W911KB-04-R-0022
Construct Type III Hydrant Fueling System
Expand/Repair Aircraft Ramp

Summary of Scope Changes

The following is intended to highlight changes to the scope of this project since the most recent solicitation. Offerors are advised to review the plans and specifications thoroughly when preparing their proposal.

Changes to the Hydrant Fueling System scope:

- Adjusted hydrant piping to reduced Apron size (piping 5 feet longer to reach new hydrant location)
- Revised Pump House Roof system
- Added bracing on truck fill stand canopy
- Deleted EPDS switches, off the edge of the Apron
- Revised cover of sump in truck fill stand area.
- Incorporated Amendments

Changes to the Parking Ramp Scope:

- Reduced ramp width by 127 feet
- Reduced width of shoulder pavement from 50 feet to 25 feet
- Revised testing requirements for concrete and soils
- Revised specification requirements for fly ash
- Revised all sections and details, including hydrant pit slab details

W911KB-04-R-0022

PROPOSAL DOCUMENTS

SCHEDULE A - EXPAND/REPAIR AIRCRAFT APRON PROJECT

AND

SCHEDULE B - CONSTRUCT TYPE III HYDRANT REFUELING SYSTEM

EIELSON AFB, ALASKA

SOLICITATION, OFFER, AND AWARD
SUPPLIES OR SERVICES AND PRICE/COSTS
CONSTRUCTION SPECIFICATIONS/STATEMENT OF WORK
INSPECTION AND ACCEPTANCE
SPECIAL CONTRACT REQUIREMENTS
CONTRACT CLAUSES
LIST OF DOCUMENTS, EXHIBITS, AND OTHER ATTACHMENTS
REPRESENTATIONS, CERTIFICATIONS, AND OTHER STATEMENTS OF OFFERORS
INSTRUCTIONS, CONDITIONS, AND NOTICES TO OFFERORS
EVALUATION FACTORS FOR AWARD

MARCH 2004

U.S. ARMY ENGINEER DISTRICT, ALASKA
CORPS OF ENGINEERS
P.O. BOX 6898
ELMENDORF AFB, ALASKA 99506-6898

INCREASE PROFIT **SUBMIT VE CHANGES**

DESIGN AUTHENTICATION

Signatures affixed below indicate the drawings and specifications included in this solicitation were prepared, reviewed, and certified in accordance with ER 1110-345-100, Design Policy for Military Construction.

SOLICITATION: **W911KB-04-R-0022**
UPC: **EIE164/174**
PROJECT TITLE: **CONSTRUCT TYPE III HYDRANT REFUELING SYSTEM AND EXPAND/REPAIR AIRCRAFT APRON PROJECT**
LOCATION: **EIELSON AFB, AK**
CONTRACT TYPE: **RFP**
SUBMITTAL: **FINAL**

FOR

OLTON SWANSON, P.E.
Chief, Engineering Division

25 MARCH 2004
Date

Randall L Bowker
FOR LAURA A. WALKER, P.E.
Chief, Military Technical Engineering Branch

This project was designed by the Alaska District of the U.S. Army Corps of Engineers. The initials or signatures and registration designations of individuals appear on these project documents within the scope of their employment as required by ER 1110-1-8152.

SOLICITATION, OFFER, AND AWARD *(Construction, Alteration, or Repair)*	1. SOLICITATION NUMBER	2. TYPE OF SOLICITATION	3. DATE ISSUED	PAGE OF PAGES
	DACA85-02-R-0032	☐ SEALED BID *(IFB)* ☒ NEGOTIATED *(RFP)*	03/26/04	

IMPORTANT - The "offer" section on the reverse must be fully completed by the offeror.

4. CONTRACT NUMBER	5. REQUISITION/PURCHASE REQUEST NUMBER	6. PROJECT NUMBER

7. ISSUED BY CODE W911KB

US ARMY ENGINEER DISTRICT, ALASKA
CEPOA-CT (W911KB)
PO BOX 6898
ANCHORAGE, AK 99506-6898

8. ADDRESS OFFER TO

US Army Engineer District, Alaska
2204 3rd Street
Elmendorf AFB, Alaska 99506

Mailing: PO Box 6898
Anchorage, AK 99506-6898

9. FOR INFORMATION CALL ▶	A. NAME	B. TELEPHONE NUMBER *(Include area code) (NO COLLECT CALLS)*
	Crystal Labrecque	(907)753-5578/ email crystal.d.labrecque@usace.army.mil

SOLICITATION

NOTE: In sealed bid solicitations "offer" and "offeror" mean "bid" and "bidder".

10. THE GOVERNMENT REQUIRES PERFORMANCE OF THE WORK DESCRIBED IN THESE DOCUMENTS *(Title, identifying number, date):*

NAICS: 237120
PROJECT TITLE/LOCATION: Construct Type III Hydrant Fuel System/Expand/Repair Aircraft Ramp, Eielson AFB, Alaska
FULL AND OPEN COMPETITION
DESCRIPTION OF WORK: This will be a fully designed project with options. The solicitation will be a request for proposal. This project will include installation of a 2,400 GPM Standard Type III Aircraft Hydrant Fueling System with 16 hydrant pit/outlets, two above ground 10,000 BBL operating tanks, pump house, 2 position truck fill stand, HSV checkout facility, pantograph storage facility and an emergency generator and an Aircraft Parking Apron with 16 parking positions for C-17 aircraft with concrete parking aprons, taxi-ways, security lighting, taxi-way edge lighting, striping and miscellaneous repairs of existing taxiways. The project will include demolition of three existing Type I Hydrant Fueling Systems including 3 pump-houses, underground storage tanks, fuel piping and pits. Responders are advised that the requirements may be delayed, cancelled or revised at any time during the solicitation, selection, evaluation, negotiation, and/or final award process based on decisions related to DOD changes and disposition of the Armed Services. THIS SOLICITATION WILL BE ISSUED USING ELECTRONIC BID SETS (EBS) AND PROVIDED ON OUR WEBSITE AT NO CHARGE.
https://ebs.poa.usace.army.mil/AdvertisedSolicitations.asp

**Contract award subject to availability of funds

11. The Contractor shall begin performance within 10 calendar days and complete it within _____ calendar days after receiving ☐ award, ☒ notice to proceed. This performance period is ☒ mandatory, ☐ negotiable. *(See* SCR-1 (also calendar days) *.)*

12A. THE CONTRACTOR MUST FURNISH ANY REQUIRED PERFORMANCE PAYMENT BONDS? *(If "YES," indicate within how many calendar days after award in Item 12B.)*	12B. CALENDAR DAYS
☒ YES ☐ NO	10

13. ADDITIONAL SOLICITATION REQUIREMENTS:

A. Sealed offers in original and ** SEE SECTION 00100, Part III, General Requirements copies to perform the work required are due at the place specified in Item 8 by 2:00 PM *(hour)* local time 26 Apr 2004 *(date)*. If this is a sealed bid solicitation, offers will be publicly opened at that time. Sealed envelopes containing offers shall be marked to show the offeror's name and address, the solicitation number, and the date and time offers are due.

B. An offer guarantee ☒ is, ☐ is not required.

C. All offers are subject to the (1) work requirements, and (2) other provisions and clauses incorporated in the solicitation in full text or by reference.

D. Offers providing less than 60 calendar days for Government acceptance after the date offers are due will not be considered and will be rejected.

! ! ! C A U T I O N T O O F F E R O R S ! ! !

1. **BUSINESS HOURS:** For the Alaska District Corps of Engineers is from 7:30 A.M. to 4:00 P.M., Monday through Friday.

2. **SUBMIT PROPOSALS:** To deliver proposals to the US Army Corp of Engineers, 2204 Third St, Elmendorf AFB, AK, you will need to submit a request for a base pass 48 hours prior to proposal due date (See Section 00100 for additional instructions). Proposals will be delivered to security desk and Contracting personnel notified to pick-up. Please be sure to submit proposals by the time specified on Standard Form 1442, Block 13-A. Any proposals received after the specified time may not be considered.

3. **VISITORS TO ELMENDORF AFB: ***NOTE: BE ADVISED THAT DUE TO BASE SECURITY MEASURES, YOU WILL NEED EXTRA TIME TO PROCESS THROUGH BONIFACE GATE.** You are required to have the following to obtain a base pass: current Anchorage emissions control inspection certificate, driver's license, DOD ID card (if applicable), proof of insurance, Alaska vehicle registration and Contracting Division point of contact/telephone number.

4. **AMENDMENTS:** Have you acknowledge receipt of **ALL** amendments? If in doubt as to the number of amendments issued, please contact our office, (907)753-2545 or (907)753-2553. SEE SECTION 00100 FOR ADDITIONAL INFORMATION REGARDING AMENDMENTS.

5. **AMENDED PROPOSAL PAGES:** If **any** of the amendments furnished amended proposal pages, **the amended pages must be used** in submitting your proposals.

6. **OFFER GUARANTEE:** Sufficient offer guarantee in proper form (SF 24) must be furnished **with your proposal**. (FOR JOBS EXCEEDING $25,000)

7. **MISTAKE IN PROPOSAL:** Have you reviewed your proposal price for possible errors in calculation or work left out?

8. **TELEGRAPHIC MODIFICATIONS:** THE ALASKA DISTRICT DOES NOT HAVE THE CAPABILITY OF RECEIVING COMMERCIAL TELEGRAMS DIRECTLY. Offerors who wish to modify their offer by telegram are urged to ensure that telegrams are submitted within enough time to arrive at the offer depository room prior to the time specified for bid opening. (SEE STANDARD FORM 1442, BLOCK 13-A FOR SPECIFIC PROPOSAL DUE TIME). Any doubt as to time should be resolved in favor of **EXTRA TIME**. Transmission by Fax to this office is **NOT ACCEPTABLE**.

9. **OFFER ACCEPTANCE PERIOD:** The minimum OFFER acceptance period is specified in Block 13D of the Standard Form 1442, Solicitation, Offer and Award. Please ensure that you allow at least the stated number of calendar days for the Government to accept your proposal.

10. **WEB-SITE:** If you have access to the Internet, updated project listing and planholder lists are available at https://ebs.poa.usace.army.mil/AdvertisedSolicitations.asp

TABLE OF CONTENTS

SECTION 00010 Solicitation/Contract Forms (SF1442)
Supplies or Services and Price/Costs

SECTION 00100 Schedule/Instruction to Bidders/Offerors
SECTION 00120 Evaluation Factors for Award

SECTION 00600 Representations and Certifications

SECTION 00700 Contract Clauses
00700a Wage Rates

SECTION 00800 Special Contract Requirements

SECTION 01000 Division I, General Requirements

SECTION 16999 Divisions 2 - 16, Technical Provisions (if applicable)

RETURN THE FOLLOWING WITH YOUR BID:

Section 00010 - Completed
Section 00600 - Completed
20% Bid Bond

PROPOSAL SCHEDULE

"SCHEDULE A" - EXPAND/REPAIR AIRCRAFT APRON PROJECT

EIELSON AFB, ALASKA

Item No.	Description of Item	Estimated Quantity	Unit	Unit Price	Amount
	BASE ITEMS				
0001AA.	Construct Expand/Repair Aircraft Apron (for 16 Aircraft), complete.	1	JOB	L.S.	$_____
0001AB.	Construct 15-inch PCC (concrete) pavement for airfield, complete.	1	JOB	L.S.	$_____
0001AC.	Construct 4-inch thick AC (Asphalt) for airfield, complete.	1	JOB	L.S.	$_____
0001AD.	Construct 2-inch thick AC (Asphalt) for airfield, complete.	1	JOB	L.S.	$_____
0001AE.	Analytical Samples of Contaminated Soil, complete.	50	EA	$_____	$_____
	TOTAL OF BASE ITEMS 0001AA THRU 0001AE - "SCHEDULE A"				$_____
	OPTIONAL ITEMS				
0001AF.	Construct additional PCC Apron in lieu of AC, complete. See sheet C-21 thru C-23.	1	JOB	L.S.	$_____
0001AG.	Furnish and Install Filter fabric, complete.	1	JOB	L.S.	$_____
	TOTAL OF OPTIONAL ITEMS 0001AF AND 0001AG - "SCHEDULE A"				$_____
	TOTAL OF BASE & OPTIONAL ITEMS 0001AA THRU 0001AG - "SCHEDULE A"				$_____

"SCHEDULE B" - CONSTRUCT TYPE III HYDRANT REFUELING SYSTEM

EIELSON AFB, ALASKA

Item No.	Description of Item	Estimated Quantity	Unit	Unit Price	Amount
	BASE ITEMS				
0002AA.	Construct Hydrant Fueling System (for 16 Aircraft with 4 pantographs/2 high-reach complete) and Demolish Buildings 1315 & 1321 (Only Buildings/No Tank Removal), excluding Item 0002AB and 0002AC below and options noted below, complete.	1	JOB	L.S.	$_____
0002AB.	Analytical Samples of Contaminated Soil, complete.	35	EA	$_____	$_____
0002AC.	Provide and Install Fuel Tank Foundation piles, complete.	5,700	LF	$_____	$_____

TOTAL OF BASE ITEMS 0002AA THRU 0002AC - "SCHEDULE B" $_____

OPTIONAL ITEMS

Item No.	Description of Item	Estimated Quantity	Unit	Unit Price	Amount
0002AD.	Truck Fill Stand Canopy	1	JOB	L.S.	$_____
0002AE.	Pig Launcher/Receiver	1	JOB	L.S.	$_____
0002AF.	Furnish & Install 5th hydrant fuel pump, complete.	1	JOB	L.S.	$_____
0002AG.	Furnish High Reach Pantographs	1	JOB	L.S.	$_____

TOTAL OF OPTIONAL ITEMS 0002AD THRU 0002AG - "SCHEDULE B" $_____

TOTAL OF BASE & OPTIONAL ITEMS 0002AA THRU 0002AG - "SCHEDULE B" $_____

TOTAL OF BASE ITEMS - "SCHEDULE A" AND "SCHEDULE B" $_____

TOTAL OF BASE ITEMS AND ALL OPTIONAL ITEMS OF "SCHEDULE A" AND "SCHEDULE B" $_____

NOTES:

1. All quantities are estimated except where unit is given as "job."

2. Prices must be entered for all items of the schedule. Additions and multiplications will be subject to verification by the Government.

3. In case of variation between the lump-sum prices and the total amount, the lump-sum prices will be considered the amount proposed. In case of variation between the unit prices and the extensions, the unit prices will be considered the proposed unit price.

4. Award of Options: Award of items 0001AF, 0001AG, 0002AD thru 0002AG can be awarded independently (in any order) and do not require any option to be awarded first.

5. Schedule A and B will be awarded conjunctively to the same contractor.

-- End of Proposal Schedule --

PROPOSAL NO. W911KB-04-R-0022

If the offer is submitted by a corporation, partnership, Joint Venture or an LLC, the applicable form listed must be completed. In the alternative, other evidence must be submitted to substantiate the authority of the person signing the offer. If a corporation, the same officer shall not execute both the offer and the certificate.

LLC

I, _____, certify that I am the _____ Secretary of the LLC named as Offeror/Contractor herein; that _____ who signed this offer/contract on behalf of the Offeror/Contractor was then _____of said LLC; that said offer/contract was duly signed for and on behalf of said LLC by authority of its governing body, and is within the scope of its corporate powers.

_____(CORPORATE SEAL)
(Secretary)

CORPORATE CERTIFICATE

I, _____, certify that I am the _____ Secretary of the corporation named as Offeror/Contractor herein; that _____ who signed this offer/contract on behalf of the Offeror/Contractor was then _____of said corporation; that said offer/contract was duly signed for and on behalf of said corporation by authority of its governing body, and is within the scope of its corporate powers.

_____(CORPORATE SEAL)
(Secretary)

AUTHORITY TO BIND PARTNERSHIP

This is to certify that the names and signatures of all partners are listed below and that the person signing the offer had authority to actually bind the partnership pursuant to its partnership agreement. Each of the partners individually has full authority to enter into and execute contractual instruments, on behalf of said partnership, with the United States of America, except as follows: (State "none" or describe limitations, if any.)

This authority shall remain in full force and effect until such time as the revocation of authority by any cause whatsoever has been furnished in writing to, and acknowledged by, the Contracting Officer.

_____
(Type or Print Name) (Signature)

PROPOSAL NO. W911KB-04-R-0022

JOINT VENTURE

I, _____ , certify that I am the Secretary of the Corporation named as Offeror/Contractor Herein, that who signed this offer/contract on behalf of the Offeror/Contractor was then _____ of said corporation by authority of its governing body and is within the scope of its corporate powers. IN WITNESS WHEREOF, I have hereunto affixed my hand and the seal of said corporation this _____ day of

AFFIX CORPORATE SEAL

_____
(Secretary)

JOINT VENTURE

I, _____ , certify that I am the Secretary of the corporation names as Offeror/Contractor herein, that who signed this offer/contract on behalf of the Offeror/Contractor was then _____ of said corporation; that said offer/contract was duly signed for and on behalf of said corporation by authority of its governing body and is within the scope of its corporate powers.

IN WITNESS WHEREOF, I have hereunto affixed my hand and the seal of said corporation this _____ day of _____.

AFFIX CORPORATE SEAL

_____
(Secretary)

PROPOSAL NO. W911KB-04-R-0022

PRE-AWARD QUESTIONNAIRE

Following offer opening, the apparent low offeror will be contacted and requested to submit the data referenced below. This will expedite our pre-award process. Prior to awarding any contract, it is required for this office to have on record specific information concerning the apparent low, responsible, responsive offeror. Accordingly it is requested that you complete the following form and return to this office, ATTN: Contracting Division, CEPOA-CT-SP.

Name of Contractor _____ X Proper Block

Business Address _____ Corporation

City/State/Zip _____ Partnership

Telephone No. _____ Individual

Operating Office Address, (This Area): J/V

LLC

Name of Contractor

Business Address _____ inc. in State of:
City/State/Zip
Telephone No.

Year inc.

LIST OF CORPORATION OFFICERS/PARTNERS BY NAME AND TITLE

_____ Small Business

_____ Large Business

_____ Minority Business

YEARS EXPERIENCE in the field of proposed work (_____).
Also indicate similarity between work currently being produced and work required under subject invitation:

Financial Institution Ratings. Is your firm listed in:
a. Dun & Bradstreet: ____No ____Yes: If yes, what is the rating?
b. Thomas Register: ____No ____Yes: If yes, what is the rating?

CERTIFIED CURRENT BALANCE SHEET and latest PROFIT AND LOSS STATEMENT signed by an officer of the company. The name of your banking firm and telephone number and the name of the individual to contact for a line-of-credit reference. The last financial statements will be acceptable if they are less than 6 months old.

PROPOSAL NO. W911KB-04-R-0022

List all pending lawsuits or unsatisfied judgments against you; the nature of same and Court where filed or adjudicated. Lawsuits or judgments where full payment will be made, or are covered by your insurance are not to be included.

_____

_____

_____

List all your contract claims pending; state nature and amount of each claim and approximate date filed.

_____

_____

_____

Name(s) of Bonding Company(ies)_____

Business Address(es)_____

Your bonding capacity as established by your surety $_____

PLEASE ATTACH with Pre-Award Questionnaire a list of tools, equipment and facilities, with year, date and value which will be used for this project.

By my signature hereon, I certify that the offer price of $
on
subject project has been reviewed and is without error.

Signature_____

Title_____

Date_____

SECTION 00100

PROPOSAL SUBMISSION REQUIREMENTS

PRICE RANGE:

The estimated price range for each part of this conjunctive project is as follows:

- FY 04 Expand/Repair Aircraft Ramp is between $15,000,000 and $19,000,000.
- FY 04 Hydrant Fuel System is between $13,000,000 and $17,000,000..

PRELIMINARY INFORMATION

1. **REQUEST FOR PROPOSAL.** The Request for Proposal (RFP) for this solicitation, including plans and specifications (if any), will be issued on CD-ROM or other electronic format at no charge. Traditional paper copies will not be available.

2. **OFFEROR GUARANTEE. A proposal bond shall be submitted with the proposal in accordance with Section 00700, 52.228-1, Bid Guarantee (Sep 1996).**

3. SURETY REQUIREMENTS

a. Corporate Sureties - Corporate sureties for bid, performance, and payment bonds must appear on the list contained in the Department of the Treasury Circular 570, "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and Acceptable Reinsuring Companies". Other requirements for corporate sureties are contained in FAR 28.202-1.

b. Individual Sureties - If individual sureties are used for bond obligations, they must meet the requirements under FAR 28.203.

5. INQUIRIES

Prospective offerors may submit inquiries concerning administrative and technical matters in writing to June Wohlbach, Contract Specialist, (907) 753-5624, or Crystal Labrecque, Contract Specialist, 907/753-5578, Fax (907) 753-2544. All written inquiries should be addressed to U.S. Army Engineer District, Alaska, ATTN: June Wohlbach/Crystal Labrecque, CEPOA-CT-CM, P.O. Box 6898, Elmendorf AFB, AK 99506-6898. (e-mail: june.l.wohlbach@poa02.usace.army.mil or crystal.d.labrecque@poa02.usace.army.mil)

COLLECT CALLS WILL NOT BE ACCEPTED.

6. VISITORS TO ARMY AND AIR FORCE BASES

All vehicle operators are required to wear seatbelts. Violators will lose their driving privileges for 10 days on their first offense, 30 days on the second offense, and 6 months or longer on the third offense.

If a firm does not have a current pass to obtain entry to Elmendorf AFB, the firm may request a day pass using the following procedures:

Forty-eight (48) hours prior to your meeting or delivery of proposal, the firm must contact Ms. Wohlbach at the above e-mail and request a day pass. The firm must provide:

a. The solicitation number

b. The names of all person(s) in the vehicle

c. Their social security number(s)

d. The name of their employer(s)

State that this is a request for a day pass. On the DAY OF entry, the driver must go to the main gate at Elmendorf and provide:

a. Valid driver's license

b. Proof of current insurance

c. Proof of current IM certification

d. Current vehicle registration.

e. Please inform the security police that you are on the list for a DAY PASS.

7. FACSIMILE PROPOSALS

Facsimile proposals or modifications will not be accepted.

8. PICK-UP SERVICE FOR TELEGRAPHIC AMENDMENTS

The US Army Engineers District, Alaska, does not provide pick-up service for telegraphic amendments.

9. PERFORMANCE OF WORK BY CONTRACTOR

Your attention is invited to Section 00700, 52.236-1, PERFORMANCE OF WORK BY CONTRACTOR. Unless submitted with the proposal, the successful contractor must furnish the Contracting Officer within 30 days after award a description of the work, which he intends to perform with his own organization (e.g. earthwork, paving, brickwork, or roofing), the percentage of the total work this represents and the estimated cost thereof.

10. EXCLUSION OF DEBARRED AND SUSPENDED CONTRACTORS

By entering into this contract, the Contractor certifies that neither it, nor any person or firm who has an interest in the Contractor's firm, is a person, or firm ineligible to be awarded Government contracts by virtue of being suspended or debarred in accordance with FAR subpart 9.4.

11. PRE-PROPOSAL CONFERENCE / SITE VISIT: Will not be conducted.

12. PRE-AWARD SURVEYS. The Government reserves the right to conduct a pre-award survey of any firm under consideration to confirm any part of the information furnished by the offeror, or to require other

evidence of managerial, financial, technical, and other capabilities, the positive establishment of which is determined by the Government to be necessary for the successful performance of the contract.

PART I. WHO MAY SUBMIT:

A. Construction contractors that have associated specifically for this project, or any other joint venture or sub-contractor.

B. Joint ventures are encouraged to apply. However, they must complete the following:

1. Obtain a Tax Identification Number (TIN) as a joint venture.
2. Prepare the Reps/Certs as a joint venture (For example, provide the TIN of the joint venture. Do not use a TIN from one of the parties of the joint venture.)
3. Register in the Central Contractor Registration (CCR) database as a joint venture to obtain a new DUNS and CAGE codes. See additional information below.
3. All parties to the joint venture must sign the proposal.

Joint ventures are advised that if they are the successful proposal, they must be registered in CCR as a joint venture. We advise the they begin this process when they prepare their proposal in order to ensure this registration is in place should they be selected for the award. "Lack of registration in the CCR database will make an offeror ineligible for award." (Reference Solicitation Clause 252.204-7004, Required Central Contractor Registration)

PART II. REQUEST FOR PROPOSAL (RFP) PROCESS

a. The U.S. Army Engineer District, Alaska, intends to solicit this requirement using the source selection procedures in accordance with the provisions set forth in this solicitation. A firm fixed price construction contract will be awarded to the offeror who submits a proposal determined to be the best value and is most advantageous to the Government, with price and non-price factors considered.

b. For this contract, the Government intends to award without discussions. However, the Government reserves its right to conduct discussions with those offerors in the competitive range if it is deemed necessary.

c. Limited exchanges with offerors may be conducted for clarifications. A competitive range may be established for conducting discussions.

d. The process used for this solicitation will be a best value process prescribed by the Federal Acquisition Regulation (FAR), 15.101 Best value continuum wherein offerors will be evaluated and selected from the following criteria:

Experience and Past Performance
Organization
Proposed Schedule
Proposed Equipment
Subcontracting Plan and Small Business Participation
Price

e. Each criterion will be evaluated as a discrete factor. The final determination as to the overall value of any proposal will reflect the combined effect of having considered all criteria as a whole. Your attention is invited to Section 00700, 52.215-1 Instruction to Offerors—Competitive Acquisition (2/2000) which contains additional information regarding proposal submission requirements, selection procedures, and other information pertinent to this acquisition.

PART III. GENERAL REQUIREMENTS

a. The intent of this RFP is to solicit proposals for the construction requirements needed to construct the Aircraft Ramp Expansion and Hydrant Fuel System at Eielson AFB as outlined in this RFP. See section 00800 for additional information on Special Contract Requirements.

b. Submit your proposal packages to the U.S. Army Engineer District, Alaska at the address shown in Block 8 of Standard Form 1442.

c. The Government must receive your proposal no later than the time and date specified in Block 13 of Standard Form 1442.

d. Submit your proposal in two volumes. Volume 1 contains your organization's experience and past performance, organization, proposed schedule and proposed equipment. Volume 2 contains SF 1442, Solicitation, Offer, and Award; Price Schedule; completed Section 00600; Representations and Certifications; Pre-Award Survey information; and your small business subcontracting plan.

e. All contractors will receive written notice if they were or were not selected for contract award.

f. Proposal clarity, organization and cross-referencing is mandatory. The offerors shall sufficiently detail and clearly define all items addressed in this Section (00100) Proposal Submission Requirements.

g. Written portions shall be type written using not more than 6 vertical lines per inch in 8-1/2" x 11" format with three holes punched, in three ring binders. Schedules may be presented as appropriate to convey the required information. The offeror shall label and tab their proposal consistent with the solicitation format index herein. Each page of the proposal shall have the page number on the bottom of the page starting with the first page to the last.

h. Number of Copies:

1. Volume 1: Provide one (1) original and three (3) copies.
2. Volume 2: Provide one (1) original and one (1) copy.

i. Page limitations:

1. Volume 1 - None
2. Volume 2 - None

PART IV. SPECIFIC PROPOSAL REQUIREMENTS

VOLUME ONE – ORGANIZATIONAL AND APPROACH CHARACTERISTICS

Volume one is an opportunity for you to provide information on the qualifications of your team and your approach to construction. Present the material sequentially under the following Tabs, A thru E, to facilitate evaluation.

TAB A: EXPERIENCE/PAST PERFORMANCE

Note: Highly relevant experience includes: construction, and start-up of military hydrant fueling systems (storage tanks, pumping facilities, distribution piping and control pits) and military airfield paving/lighting systems of a similar magnitude. Commercial airfield paving and hydrant systems experience is considered

relevant but not "highly" relevant. The government will also consider how recently the project was completed to determine relevance. Use the format specified in Part V, items 1 and 2 for all (prime and subcontractor) experience and past performance.

a. Contractor Experience: Provide up to three (3) examples of projects, demonstrating relevant experience. Provide an explanation of how these projects are similar in scope and magnitude to the work required in this RFP. The example projects submitted should clearly demonstrate the Offeror's ability to provide quality construction, to coordinate critical interfaces of complex systems with other entities, to meet critical time constraints, and to satisfy the customer/owner.

b. Sub-contractor Experience: For key subcontractors, provide up to three (3) examples of projects, demonstrating relevant experience, that are similar in scope to this project. Include Hydrant Fuel System Systems subcontractor.

c. Team Experience: Provide up to three (3) examples of projects of recent and relevant experience in which the contractor, and subcontractors have worked together. Identify any projects that are similar to this project. Provide an explanation of how these projects are similar in scope to the work required in this RFP.

d. Past Performance: Provide past performance information for each project listed under this Tab. Include this information for Prime Contractor, and any key sub-contractors. The offeror may use the Past Performance Evaluation Questionnaire included at the end of this section (00100) as a means to supplement the Past Performance requirement. This is especially useful if one or both parties has limited experience with government projects or wishes to highlight specific civilian projects. The government will review all available recent and relevant past performance data in its possession. The Offeror will be responsible for submitting the Past Performance Questionnaire to its customers in a timely manner for inclusion in the proposal.

TAB B: ORGANIZATION

a. Organization Chart: The Offeror shall submit an organization chart and a narrative describing how the organization will function in relation to this contract with emphasis on roles and responsibilities of each individual. The Offeror should include major subcontractors in the organization chart and provide in the narrative a description of the role of major subcontractors in the organization. Narrative should describe the Offeror's plan for resolving problems, coordinating major issues within the organization, and role of team members throughout construction. Include the Type III Hydrant Systems Subcontractor.

b. Key Personnel: Submit a resume for key personnel identified in the organization chart that clearly indicates their related experience. Emphasize qualifications and experience in military fuel hydrant systems and airfield paving. A resume form is provided at the end of this section but the format is not mandatory. The form may be reproduced and additional lines added if more space is required. The following individuals shall be identified:

1. Project Manager
2. Construction Superintendent
3. Safety Officer
4. Contractor Quality Control Systems Manager (CQCSM)
5. On-site managers for primary sub-contractor (s)
6. Fuel system commissioning superintendent

TAB C: PROPOSED SCHEDULE and CONSTRUCTION NARRATIVE

a. Provide a narrative to support your schedule that explains your general approach to construction, quality control and commissioning activities. Describe in words or sketch specific phases of work and associated impacts/downtime to aircraft traffic in the loop taxiway area.

b. Schedule: Submit a proposed preliminary schedule for construction. This schedule shall clearly state how it compares to the number of days stated in SCR-1. For consistency in proposals, offerors shall use an NTP date of 28 May 2004 for this schedule (the actual NTP to the successful offeror may or may not coincide with this date). **The Offeror shall state in this section acknowledgement that he understands that the total contract duration proposed in this schedule will become contractually binding should that offeror receive the award.** In addition, the proposed schedule shall be used as the basis for development of the initial NAS as defined by Section 01320 - PROJECT SCHEDULE. Schedules or diagrams may be provided separately in a size that is easily read, but shall be bound and clearly labeled. The schedules shall be task oriented, indicating the number of calendar days, after notice to proceed, by which milestones are to be achieved. Offeror may use the method of his choice; however, schedules shall be graphically represented. Give special attention to the following features when preparing your construction narrative.

1. Show the construction phase for each major feature of construction. The schedule shall indicate the offeror's understanding of loop taxiway availability within the allowable construction period.
2. Show closures and openings of all taxiways
2. Show Start-up and Commissioning
3. Show O&M manual submission and required operator training.
4. Show turnover of the project. Identify any proposed phased Turnovers. Show turnover Inspections.
5. Show as-built submissions.
6. Constraints: Offeror must demonstrate the capability and flexibility to plan and schedule the complete project to meet the proposed contract completion date. Clearly identify any constraints on the schedules presented (e.g., labor or material availability, weather, interfaces with base utilities, etc.) indicate the anticipated critical path on the schedule.

TAB D: PROPOSED EQUIPMENT

Furnish manufacturers catalog data on major materials and equipment to indicate type of equipment, size or capacities, manufacturer, and model number to be installed in this project. Originals of manufacturer's catalog or quality laser copies should be submitted where photocopies may not be legible. The proposed equipment will be evaluated for durability, operability, maintainability and any warranty periods which exceed the specifications. Provide equipment that has a minimum of two years of successful service. Data shall include: electronic controls, double block and bleed valves, control valves, filter separators, fuel pumps, loading arms, and hydrant pits.

TAB E: SUBCONTRACTING PLAN AND SMALL BUSINESS PARTICIPATION

Prepare a small business utilization plan in accordance with Section 00700, 252.219-7003. Subcontracting may be submitted within two (2) business days after the proposal due date. Proposals shall address the anticipated utilization of small businesses. List each group and goals for each small disadvantaged businesses, woman owned, hub-zone, veteran owned, and disabled veteran owned. (Use forms at the end of this section.). Small businesses are not required to submit a subcontracting plan.

VOLUME TWO –PRICING

Organize the material sequentially under the following Tabs.

TAB A: SECTION 00600

Provide requirements of 00600 of this request for proposal. (Reps and Cert.)

TAB B: PRE-AWARD SURVEY BANK REFERENCE

Submit the Pre-Award Survey form along with a letter from your financial institution confirming your firm's business and financial reputation, integrity, and ability to execute this contract. This letter must include information regarding any outstanding loans, past performance on loan payments, and general account information (for example, XYZ Corporation routinely maintains a checking balance in the six figures.).

TAB C: PRICE INFORMATION

The price information supporting the Technical Proposal shall be in the form of the proposal schedule contained in the front of this solicitation and include a signed SF1442. The initial review of the Price Proposal will result in a determination as to reasonableness and affordability compared to the independent government estimate.

TAB D. JOINT VENTURES

Joint ventures must provide a copy of their Joint Venture Agreement. LLCs must provide a copy of their Articles of Organization. JVs and LLCs must provide evidence that the person(s) signing the offer has the authority to bind the organization.

TAB E. POINTS OF CONTACT

Provide a primary and secondary point of contact should any questions arise from review of this offer. Information shall include: Name; Title; Address; Phone; Fax number; and E-mail address

PART V. FORMAT REQUIREMENTS FOR VOLUME ONE TABS

1. <u>TEAM EXPERIENCE</u>. Use separate sheets.

A. Name of Project:

B. Location of Project:

C. Owner with Point of Contact and telephone number:

D. General Scope of Construction Project:

E. Construction Cost:

F. Project Team members: Identify key construction team members and positions. Refer to Qualifications provided under Part V, Items 1 and 2.

G. Dates Construction Began / Completed:

H. Extent and Type of Work Subcontracted:

I. Were You Terminated or Assessed Liquidated Damages? (If either is "Yes," attach explanation)

2. <u>CONSTRUCTION PRIME CONTRACTOR EXPERIENCE</u>. Use separate sheets.

Use 'Project Experience Form' in this section.

3. <u>SUB-CONTRACTOR EXPERIENCE</u>. Use separate sheets.

Use 'Project Experience Form' in this section.

4. <u>CONSTRUCTION KEY PERSONNEL</u>. Use separate sheets.

Provide the information listed below on separate sheets for each person showing qualifications of: Project Manager, Construction Superintendent, Safety Officer, Contractor Quality Control Systems Manager (CQCSM), On-site managers for primary sub-contractor(s) and Fuel system commissioning superintendent. Use continuation sheets, if needed..

A. Name and Title:

B. Assignment on this Project:

C. Name of Firm:

D. Number of Years: With this Firm/ With other Firms:

E. Education and/or special credentials and training:

F. Specific Experience and Qualifications Relevant to this Project:

PAST PERFORMANCE INTERVIEW FORM

The U.S. Army Corps of Engineer, Alaska District is conducting a past performance survey for an upcoming award. Please take the time to answer the Past Performance Interview Questions below. If you have any questions, please do not hesitate to contact this office. When Filled In This Document Is Source Selection Sensitive Information IAW FAR 3.104

Name of Respondent: _____
Contract Number: _____

A. **GENERAL INFORMATION**: Please correct any information below known to be inaccurate:

Contractor's Name: _____
Address: _____Telephone Number: _____
Point of Contact: _____
Project Title or Brief Description of Work:
_____*
Contract Number Provided by Offeror: _____ *
Dollar Amount: _____*
Contract Period or Dates of Performance Provided by Offeror: _____*

Note: If information is incorrect, please provide correct number. Also, if offeror holds or has held other relevant contracts with your agency/organization in the last 3 years, please complete separate evaluation forms for those contracts as well.

Contractor Performed as the ? **Prime** Contractor ? **Sub**-Contractor.

B. **RESPONDENT INFORMATION:**

Name of Respondent: _____

Title: _____

Address: _____

_____

Telephone Number: _____

Fax Number: _____

Email Address: _____

C. **FAX OR EMAIL COMPLETED QUESTIONNAIRE FORM TO**:

U.S. Army Engineer District, Alaska District
Attn: Contracting Division (June Wohlbach/Crystal Labrecque)
P.O. Box 6898,
Elmendorf AFB, AK 99506-6898.
(907) 753-5624 or FAX (907) 753-2544
E-mail: june.l.Wohlbach@usace.army.mil
E-mail: crystal.d.labrecque@usace.army.mil

D. **PERFORMANCE INFORMATION**: Choose the number on the scale of 1 to 6 that most accurately describes the contractor's performance or situation. ***PLEASE PROVIDE A NARRATIVE EXPLANATION FOR ANY RATINGS OF 1 OR 2***.

1	2	3	4	5	6
Unsatisfactory	**Marginal**	**None**	**Satisfactory**	**Very Good**	**Exceptional**
Performance did not meet most contractual requirements. There were serious problems and the contractor's corrective actions were ineffective.	Performance did not meet some contractual requirements. There were problems, some of a serious nature, for which corrective action was only marginally effective.	No record of past performance or the record is inconclusive	Performance met contract requirements. There were some minor problems and corrective actions taken by the contractor were satisfactory.	Performance met all contract requirements and exceeded **some** to the government's benefit. There were a few minor problems, which the contractor resolved in a timely, effective manner.	Performance met all contract requirements and exceeded **many** to the government's benefit. **Problems**, if any, **were negligible** and were resolved in a timely, highly effective manner

	The contractor:							
1.	Provided experienced managers and supervisors with the technical and administrative abilities needed to meet contract requirements.	1	2	3	4	5	6	N/A
2.	Demonstrated ability to hire, maintain, and replace, if necessary, qualified personnel during the contract period.	1	2	3	4	5	6	N/A
3.	Delegated authority to project managers and supervisors	1	2	3	4	5	6	N/A
4.	Home office participated in solving significant local problems.	1	2	3	4	5	6	N/A
5.	Followed approved quality control plan.	1	2	3	4	5	6	N/A
6.	Provided effective quality control and/or inspection procedures to meet contract requirements.	1	2	3	4	5	6	N/A
7.	Corrected deficiencies in timely manner and pursuant to their quality control procedures.	1	2	3	4	5	6	N/A
8.	Provided timely resolution of contract discrepancies	1	2	3	4	5	6	N/A
9.	Identified risks/problems as they occurred.	1	2	3	4	5	6	N/A
10.	Suggested alternative approaches to problems.	1	2	3	4	5	6	N/A
11.	Displayed initiative to solve problems.	1	2	3	4	5	6	N/A
12.	Developed realistic progress schedules.	1	2	3	4	5	6	N/A
13.	Met established project schedules.	1	2	3	4	5	6	N/A
14.	Provided timely resolution of warranty defects.	1	2	3	4	5	6	N/A
15.	Was responsive to contract changes.	1	2	3	4	5	6	N/A
16.	Provided adequate project supervision.	1	2	3	4	5	6	N/A
17.	Obtained consent of surety for increases in bonding as work-in-progress increased.	1	2	3	4	5	6	N/A
18.	Paid subcontractors/suppliers in a timely manner.	1	2	3	4	5	6	N/A
19.	Provided accurate and complete line item cost proposals including all aspects of work required for each task.	1	2	3	4	5	6	N/A
20.	Demonstrated ability to deploy equipment and materials in a timely manner	1	2	3	4	5	6	N/A
21.	Provided experienced managers and supervisors with technical and administrative abilities to meet contract requirements	1	2	3	4	5	6	N/A
22.	Management of subcontracts	1	2	3	4	5	6	N/A
23.	Compliance with labor standards	1	2	3	4	5	6	N/A
24.	Compliance with safety standards	1	2	3	4	5	6	N/A
25.	Cooperated with contracting agency personnel after award.	1	2	3	4	5	6	N/A
26.	Selected appropriate methods & materials for arctic/sub-arctic construction	1	2	3	4	5	6	N/A

27.	Planned for mob, demob, execution in light of constraints and hardships encountered in arctic/sub-arctic construction	1	2	3	4	5	6	N/A
28.	Performed work in arctic/sub-arctic condition	1	2	3	4	5	6	N/A
29.	Build and managed cohesive team for design-build efforts	1	2	3	4	5	6	N/A
30.	Adhered to codes and regulations	1	2	3	4	5	6	N/A
31.	Met needs of and addressed concerns of future facility occupants	1	2	3	4	5	6	N/A
32.	Provided functional and operable facilities	1	2	3	4	5	6	N/A
33.	Quality Control: Followed approved quality control plan; provided effective quality control and/or inspection procedures to meet contract requirements; corrected deficiencies in timely manner and pursuant to their quality control procedures	1	2	3	4	5	6	N/A
34.	Provide timely resolution of contract discrepancies	1	2	3	4	5	6	N/A
35.	Identified risks/problems as they occurred	1	2	3	4	5	6	N/A
36.	Suggested alternative approaches to problems	1	2	3	4	5	6	N/A
37.	Displayed initiative to solve problems	1	2	3	4	5	6	N/A
38.	Was the contractor ever issued a cure or show cause notice under the referenced contract? If yes, explain outcome in “remarks.”					Yes		No
39.	Would you award another contract to this contractor? If not, explain in “remarks.”					Yes		No

Remarks: _____

THANK YOU FOR YOUR ASSISTANCE

PROJECT EXPERIENCE FORM

Provide a completed form for each project for which experience is being claimed.

Name of offeror_____
_____

Work performed by Offeror [ ]and [ ] or by key subcontractor _____ and [ ] or [ ] design firm _____ (enter firm name and check "and" or "or" as applicable)

Name of Project:_____
_____

Location of Project:_____
_____

Was Project a firm fixed price contract (Y/N)?_____If No, what type was it_____

Brief Description of Project

_____
_____
_____
_____
_____
_____

Contract Amount at Award: _____Final Contract Amount or Estimated Cost at Completion: _____ Amount added by Modification: _____

Explanation of any Cost Growth

_____
_____
_____

Multiple Interim Schedule Milestones (to include scheduled start date):

_____
_____
_____

Original Contract Completion Date: _____Final Contract Completion Date: _____

Actual Completion Date : _____Time added by Modification: _____

Explanation of any Late Finish:

_____
_____

_____
_____

Was the project terminated early or were cure/show cause letters received? ___Yes___No

Explain early termination (default/convenience) or cure/show cause letters_____
_____
_____
_____

Safety record: ____Accidents, _____Incidents, ____Violations

List and explain any customer concerns or dissatisfaction. Explain how you responded.
_____
_____

What were the SDB, WOB and small business percent goals in the original contract?

SDB:_____ WOB:_____ Small Business:_____ HBCU:_____HUBZONE:_____MI:_____

What was the actual percent achieved at contract completion?

SDB:_____ WOB:_____ Small Business:_____ HBCU:_____HUBZONE:_____MI:_____

Extent and Types of Work Subcontracted.
_____
_____

Was the project owner an agency of the federal government?_____Yes_____No

Name, address, FAX and telephone number of the owner:
_____

Name and telephone number of a representative of your firm who is knowledgeable of this project and can readily be contacted:
_____
_____

Name, address, FAX and telephone number of a representative of the owner who is knowledgeable of this project and can be readily contacted:
_____
_____

Name, address, FAX and telephone number of the Contracting Officer if project was for federal government:
_____
_____

SUBCONTRACTING GOALS FY 2004
for the Alaska District Contracts
(THIS PLAN MAY BE SUBMITTED WITHIN
TWO (2) BUSINESS DAYS AFTER THE PROPOSAL DUE DATE)

Small Business	57.2 %
Small Disadvantaged	8.9%
Woman-Owned Small Business	8.1%
Veteran-Owned Small Business	3.0%
Service Disabled Veteran-Owned Small Business	3.0%
HUBZone Small Business	3.0%

1. SUBMIT YOUR PLAN IN THE ATTACHED FORMAT

2. Subcontracting Plans will be evaluated in accordance with FAR Clause 52.219-9 Alternate II and AFARS AppendixDD.

SUBCONTRACTING PLAN

FIRM:_____Sol. No. W911KB-04-R-0022

_____Contract No. _____

_____

PROJECT TITLE _____

CONTRACT SPECIALIST RESPONSIBLE FOR PRE-AWARD __Ms. June Wohlbach (907) 753-5624

NAME OF OFFICE ADMINISTERING CONTRACT TO INCLUDE SUBCONTRACTING PLAN: (If more than one office, name all offices/responsible parties): _____

I. Dollar Amounts (If possible, DO NOT include indirect costs):

SEE ATTACHED TABLE 1

II. Percentage goals (expressed in terms of percentage of total planned subcontracting dollars).

SEE ATTACHED TABLE 2

1. State your firms policy statement or evidence of internal guidance to company buyers recognizing commitment to Pub. L. 99-661, Section 1207, and Pub.L. 100-180, Section 806. Describe special emphasis placed on subcontracting with SDBs. Describe corporate and management commitment to meeting your subcontracting plan. (HBCUs & MI are excluded from evaluation).

2. Describe your firm's efforts to broaden SB, SDB, WOSB , HUBZone SB, Service Disabled Veteran-Owned SB, and Veteran-Owned small business active vendor base. Specifically describe your efforts in increasing subcontracts to SBs and SDBs for non-complex and general housekeeping supplies or services normally awarded to firms already in your firm's vendor base. Describe established plans to use competition restricted to SDBs and give details about how your firm will accomplish this. (HBCUs & MI are excluded from evaluation).

3. Describe your firm's "Outreach Efforts" to work with organizations to identify potential sources for items not traditionally awarded to SB, SDB, WOSB, HUBZone SB, Service Disabled Veteran Owned SB, and Veteran-Owned SB firms. And, your proposed plan to conduct reviews to determine the competence, ability, experience and capacity available in SB, SDB, WOSB, HUBZone SB, Service Disabled Veteran-Owned SB, and Veteran-Owned SB firms and to provide them technical assistance. (HBCUs & MIs are excluded from evaluation).

4. Describe supplies and services to be subcontracted and planned for subcontracting to SBs, SDBs, WOSBs , HUBZone SB, Service Disable Veteran-Owned SB, and Veteran-Owned SB firms. Indicate intent to review major product/system components and key project elements of R&D, construction, service and spare parts contracts for subcontracting to each of the above elements. Specifically describe how your plan targets specific SBs, SDBs, WOSBs, HUBZone SB, Service Disabled Veteran-Owned SB, and Veteran-Owned SB for review to determine their competence, ability, experience and capacity and identifies specific components or major portions

of the acquisition for consideration of the above elements. Describe your firm's intent to work with large business subcontractors for major subsystems or key project elements to ensure "flowdown" of this philosophy. (HBCUs & MIs are excluded from evaluation).

5. Describe your firm's efforts, based on results of efforts described in No. 3 and No. 4 above to ensure that opportunity to participate in acquisitions. Specifically, describe how the firm intends to evaluate its own SB, SDB, WOSB, HUBZone SB, Service Disabled Veteran-Owned SB and Veteran-Owned SB award performance and program effectiveness against the established goals, both company-wide and for individual plan being negotiated. Include SBs, SDBs, WOSBs, HUBZone SBs, Service Disabled Veteran-Owned SB and Veteran-Owned SB by name as members of original team for providing major service or performing a significant portion of the effort. Additionally, how does your firm plan to establish long-range relationships with the above elements? (HBCUs & MIs are excluded from evaluation).

6. Your firm's plan (in section I and II) will be evaluated on the development of percentage goals based on planned subcontracting which is challenging, yet realistic as stated in item # 6 of Appendix CC of the AFARS. (HBCUs & MIs are excluded from evaluation).

7. Past performance to the extent your firm has historically been successful in establishing realistic, yet challenging, goals and achieving them will be evaluated. In cases where there has been no previous defense contract history, your firm will not be penalized. (HBCUs & MIs are excluded from evaluation).

8. Regulatory and statutory requirements described in # 8 of Appendix CC must be included in your firms subcontracting plan and will be evaluated accordingly. If any of the subject elements are not complied with, your plan will not be approved and will be returned to your office for revision before the contract can be awarded. Included in the appendix are the following elements to include WOSBs, HUBZone SBs, Service Disabled Veteran-Owned SB, and Veteran-Owned SB. (HBCUs & MIs are excluded from evaluation).

a) A separate goal for SB, SDB, WOSBs, HUBZone SB, Service Disabled Veteran-Owned SB and Veteran-Owned SB .

b) A separate goal for the basic contract and, if applicable, each option.

c) The name of the company employee responsible for administration of plan and employee's duties as follows:

The individual who will administer this firm's subcontracting program:

NAME_____ ADDRESS _____

_____

TELEPHONE _____ _____

_____

Describe Description of duties:

d) A statement affirming intent to comply with subcontracting "flowdown" provisions as follows:

This firm will include Clause 52.219-8 entitled, "Utilization of Small Business Concerns, Small Disadvantaged, Women-Owned Small Business Concerns," in all subcontracts which offer further subcontracting opportunities and will require all subcontractors (except small business concerns) who receive subcontracts in excess of $500,0000.00 to adopt and comply with a plan similar to the plan required by the clause at 52.219-9 Alternate II, "Small Business Subcontracting Plan." (HBCUs & MIs are excluded from evaluation).

e) A statement affirming willingness to cooperate in studies and to provide reports as follows:

This firm will submit such periodic reports and cooperate in any studies or surveys as may be required by the Corps of Engineers, Alaska District or the Small Business Administration in order to determine the extent of compliance by the company with the subcontracting plan as follows:

This firm will submit Standard Form (SF) 294, Subcontracting Report for Individual Contract, and SF 295, Summary Subcontract in accordance with the instructions on the forms. The name, address, and telephone number of the office responsible for preparation and submission of the reports is:

I, the undersigned, a designated officer of do hereby state that this firm agrees to carry out the Government's policy to provide the maximum practicable opportunity for small business concerns and small business concerns owned and controlled by socially and economically disadvantaged individuals to participate in the performance of this contract consistent with its efficient performance.

f) A statement that indirect costs are either included or excluded from the proposed goals and, and if included, how they will be prorated.

g) Description of efforts to ensure that SBs, SDBs, WOSBs, HUBZone SB, Service Disabled Veteran-Owned SB, and Veteran-Owned SBs have an equitable opportunity to participate in the acquisition: (HBCUs & MIs are excluded from evaluation).

h) A recitation of the types of records maintained to demonstrate procedures adopted to comply with the requirements and goals in the plan as follows:

This firm will maintain the following types of records to demonstrate procedures which have been adopted to comply with the requirements and goals set forth in the plan. (Set forth here are the records to be maintained. In order to be considered acceptable, the records shall include at the minimum the following:)

(1) SB, SDB, WOSB, HUBZone SB, Service Disabled Veteran-Owned SB, and Veteran-Owned SB lists, guides, and other data identifying vendors.

(2) Organizations contacted or to be contacted for SB, SDB, WOSB , HUBZone SB, Service Disabled Veteran-Owned SB, and Veteran-Owned SB sources.

(3) Record of all subcontract solicitations indicating on each solicitation (i) whether SB, SDB, WOSB, HUBZone SB and Veteran-Owned SBs were solicited, and if not, why not.

(4) Records to support other outreach efforts, to include the following: contact with minority and small business trade associations, contact with business development organizations, and attendance at small and minority business procurement conferences and trade fairs.

(5) Records to support internal activities to guide and encourage buyers to include the following: workshops, seminars, training programs, and monitoring activities to evaluate compliance.

(6) Records to support award data on a contract-by-contract basis submitted to the Government to include name, address, and business size of subcontractor.

FIRM'S REPRESENTATIVE:

SIGNATURE: _____

PRINTED/TYPED NAME: _____

TITLE: _____

GOVERNMENT REVIEW

CONTRACT SPECIALIST_____

DEPUTY FOR SMALL BUSINESS (DSB) REVIEW:

1. Received Date:_____ 2. Returned Date: _____

3. Recommendation Date: _____

CONTRACTING OFFICER _____ _____
Signature

NAME & TITLE _____ _____

DATE _____

TABLE 1: Subcontracting dollars
TABLE 2: Subcontracting goals

Solicitation No. W911KB-04-R-0022, Construct Type III Hydrant Fuel System & Ramp Upgrades, Eielson AFB, AK

TABLE 1: Subcontracting dollars

	Base Sched A (CLINS 1AA-1AE)	Option (CLIN 1AF)	Option (CLIN 1AG)	Base Sched B (CLINS 2AA-2AC)	Option (CLIN 2AD)	Option (CLIN 2AE)	Option (CLIN 2AF)	Option (CLIN 2AG)
a. Total amount of contract								
b. Total estimated amount of planned subcontracted dollars								
TOTAL DOLLARS PLANNED TO BE SUBCONTRACTED								
c. Small business (including d, e, f, & g below)								
d. Small disadvantaged businesses								
e. Woman-owned small businesses								
f. Veteran-owned small businesses								
g. Service disabled veteran-owned small businesses								
h. HUB-zone small businesses								

TABLE 2: Subcontracting goals

	Base Sched A (CLINS 1AA-1AE)	Option (CLIN 1AF)	Option (CLIN 1AG)	Base Sched B (CLINS 2AA-2AC)	Option (CLIN 2AD)	Option (CLIN 2AE)	Option (CLIN 2AF)	Option (CLIN 2AG)
a. Percentage of contract to be subcontracted (1b divided by 1a)								
PERCENTAGE OF SUBCONTRACTING DOLLARS TO BE SUBCONTRACT TO								
b. Small business (1c divided by 1b)								
c. Small disadvantaged businesses (1d divided by 1b)								
d. Women-owned small businesses (1e divided by 1b)								
f. Veteran-owned small businesses (1f divided by 1b)								
g. Service disabled veteran-owned small businesses (1g divided by 1b)								
h. HUB-zone small businesses (1h divided by 1b)								

Section 00100 - Bidding Schedule/Instructions to Bidders

CLAUSES INCORPORATED BY FULL TEXT

52.211-14 NOTICE OF PRIORITY RATING FOR NATIONAL DEFENSE USE (SEP 1990)

Any contract awarded as a result of this solicitation will be DX rated order; c02 DO rated order certified for national defense use under the Defense Priorities and Allocations System (DPAS) (15 CFR 700), and the Contractor will be required to follow all of the requirements of this regulation. [Contracting Officer check appropriate box.]

(End of provision)

52.215-1 INSTRUCTIONS TO OFFERORS--COMPETITIVE ACQUISITION (JAN 2004)

(a) Definitions. As used in this provision--

“Discussions” are negotiations that occur after establishment of the competitive range that may, at the Contracting Officer's discretion, result in the offeror being allowed to revise its proposal.

“In writing or written” means any worded or numbered expression which can be read, reproduced, and later communicated, and includes electronically transmitted and stored information.

“Proposal modification” is a change made to a proposal before the solicitation's closing date and time, or made in response to an amendment, or made to correct a mistake at any time before award.

“Proposal revision” is a change to a proposal made after the solicitation closing date, at the request of or as allowed by a Contracting Officer as the result of negotiations.

“Time”, if stated as a number of days, is calculated using calendar days, unless otherwise specified, and will include Saturdays, Sundays, and legal holidays. However, if the last day falls on a Saturday, Sunday, or legal holiday, then the period shall include the next working day.

(b) Amendments to solicitations. If this solicitation is amended, all terms and conditions that are not amended remain unchanged. Offerors shall acknowledge receipt of any amendment to this solicitation by the date and time specified in the amendment(s).

(c) Submission, modification, revision, and withdrawal of proposals. (1) Unless other methods (e.g., electronic commerce or facsimile) are permitted in the solicitation, proposals and modifications to proposals shall be submitted in paper media in sealed envelopes or packages (i) addressed to the office specified in the solicitation, and (ii) showing the time and date specified for receipt, the solicitation number, and the name and address of the offeror. Offerors using commercial carriers should ensure that the proposal is marked on the outermost wrapper with the information in paragraphs (c)(1)(i) and (c)(1)(ii) of this provision.

(2) The first page of the proposal must show--

(i) The solicitation number;

(ii) The name, address, and telephone and facsimile numbers of the offeror (and electronic address if available);

(iii) A statement specifying the extent of agreement with all terms, conditions, and provisions included in the

solicitation and agreement to furnish any or all items upon which prices are offered at the price set opposite each item;

(iv) Names, titles, and telephone and facsimile numbers (and electronic addresses if available) of persons authorized to negotiate on the offeror's behalf with the Government in connection with this solicitation; and

(v) Name, title, and signature of person authorized to sign the proposal. Proposals signed by an agent shall be accompanied by evidence of that agent's authority, unless that evidence has been previously furnished to the issuing office.

(3) Submission, modification, or revision, of proposals.

(i) Offerors are responsible for submitting proposals, and any modifications, or revisions, so as to reach the Government office designated in the solicitation by the time specified in the solicitation. If no time is specified in the solicitation, the time for receipt is 4:30 p.m., local time, for the designated Government office on the date that proposal or revision is due.

(ii)(A) Any proposal, modification, or revision received at the Government office designated in the solicitation after the exact time specified for receipt of offers is “late” and will not be considered unless it is received before award is made, the Contracting Officer determines that accepting the late offer would not unduly delay the acquisition; and--

(1) If it was transmitted through an electronic commerce method authorized by the solicitation, it was received at the initial point of entry to the Government infrastructure not later than 5:00 p.m. one working day prior to the date specified for receipt of proposals; or

(2) There is acceptable evidence to establish that it was received at the Government installation designated for receipt of offers and was under the Government's control prior to the time set for receipt of offers; or

(3) It is the only proposal received.

(B) However, a late modification of an otherwise successful proposal that makes its terms more favorable to the Government, will be considered at any time it is received and may be accepted.

(iii) Acceptable evidence to establish the time of receipt at the Government installation includes the time/date stamp of that installation on the proposal wrapper, other documentary evidence of receipt maintained by the installation, or oral testimony or statements of Government personnel.

(iv) If an emergency or unanticipated event interrupts normal Government processes so that proposals cannot be received at the office designated for receipt of proposals by the exact time specified in the solicitation, and urgent Government requirements preclude amendment of the solicitation, the time specified for receipt of proposals will be deemed to be extended to the same time of day specified in the solicitation on the first work day on which normal Government processes resume.

(v) Proposals may be withdrawn by written notice received at any time before award. Oral proposals in response to oral solicitations may be withdrawn orally. If the solicitation authorizes facsimile proposals, proposals may be withdrawn via facsimile received at any time before award, subject to the conditions specified in the provision at 52.215-5, Facsimile Proposals. Proposals may be withdrawn in person by an offeror or an authorized representative, if the identity of the person requesting withdrawal is established and the person signs a receipt for the proposal before award.

(4) Unless otherwise specified in the solicitation, the offeror may propose to provide any item or combination of items.

(5) Offerors shall submit proposals in response to this solicitation in English, unless otherwise permitted by the solicitation, and in U.S. dollars, unless the provision at FAR 52.225-17, Evaluation of Foreign Currency Offers, is included in the solicitation.

(6) Offerors may submit modifications to their proposals at any time before the solicitation closing date and time, and may submit modifications in response to an amendment, or to correct a mistake at any time before award.

(7) Offerors may submit revised proposals only if requested or allowed by the Contracting Officer.

(8) Proposals may be withdrawn at any time before award. Withdrawals are effective upon receipt of notice by the Contracting Officer.

(d) Offer expiration date. Proposals in response to this solicitation will be valid for the number of days specified on the solicitation cover sheet (unless a different period is proposed by the offeror).

(e) Restriction on disclosure and use of data. Offerors that include in their proposals data that they do not want disclosed to the public for any purpose, or used by the Government except for evaluation purposes, shall--

(1) Mark the title page with the following legend: This proposal includes data that shall not be disclosed outside the Government and shall not be duplicated, used, or disclosed--in whole or in part--for any purpose other than to evaluate this proposal. If, however, a contract is awarded to this offeror as a result of--or in connection with-- the submission of this data, the Government shall have the right to duplicate, use, or disclose the data to the extent provided in the resulting contract. This restriction does not limit the Government's right to use information contained in this data if it is obtained from another source without restriction. The data subject to this restriction are contained in sheets [insert numbers or other identification of sheets]; and

(2) Mark each sheet of data it wishes to restrict with the following legend: Use or disclosure of data contained on this sheet is subject to the restriction on the title page of this proposal.

(f) Contract award. (1) The Government intends to award a contract or contracts resulting from this solicitation to the responsible offeror(s) whose proposal(s) represents the best value after evaluation in accordance with the factors and subfactors in the solicitation.

(2) The Government may reject any or all proposals if such action is in the Government's interest.

(3) The Government may waive informalities and minor irregularities in proposals received.

(4) The Government intends to evaluate proposals and award a contract without discussions with offerors (except clarifications as described in FAR 15.306(a)). Therefore, the offeror's initial proposal should contain the offeror's best terms from a cost or price and technical standpoint. The Government reserves the right to conduct discussions if the Contracting Officer later determines them to be necessary. If the Contracting Officer determines that the number of proposals that would otherwise be in the competitive range exceeds the number at which an efficient competition can be conducted, the Contracting Officer may limit the number of proposals in the competitive range to the greatest number that will permit an efficient competition among the most highly rated proposals.

(5) The Government reserves the right to make an award on any item for a quantity less than the quantity offered, at the unit cost or prices offered, unless the offeror specifies otherwise in the proposal.

(6) The Government reserves the right to make multiple awards if, after considering the additional administrative costs, it is in the Government's best interest to do so.

(7) Exchanges with offerors after receipt of a proposal do not constitute a rejection or counteroffer by the

Government.

(8) The Government may determine that a proposal is unacceptable if the prices proposed are materially unbalanced between line items or subline items. Unbalanced pricing exists when, despite an acceptable total evaluated price, the price of one or more contract line items is significantly overstated or understated as indicated by the application of cost or price analysis techniques. A proposal may be rejected if the Contracting Officer determines that the lack of balance poses an unacceptable risk to the Government.

(9) If a cost realism analysis is performed, cost realism may be considered by the source selection authority in evaluating performance or schedule risk.

(10) A written award or acceptance of proposal mailed or otherwise furnished to the successful offeror within the time specified in the proposal shall result in a binding contract without further action by either party.

(11) If a post-award debriefing is given to requesting offerors, the Government shall disclose the following information, if applicable:

(i) The agency's evaluation of the significant weak or deficient factors in the debriefed offeror's offer.

(ii) The overall evaluated cost or price and technical rating of the successful and the debriefed offeror and past performance information on the debriefed offeror.

(iii) The overall ranking of all offerors, when any ranking was developed by the agency during source selection.

(iv) A summary of the rationale for award.

(v) For acquisitions of commercial items, the make and model of the item to be delivered by the successful offeror.

(vi) Reasonable responses to relevant questions posed by the debriefed offeror as to whether source-selection procedures set forth in the solicitation, applicable regulations, and other applicable authorities were followed by the agency.

(End of provision)

52.217-5 EVALUATION OF OPTIONS (JUL 1990)

Except when it is determined in accordance with FAR 17.206(b) not to be in the Government's best interests, the Government will evaluate offers for award purposes by adding the total price for all options to the total price for the basic requirement. Evaluation of options will not obligate the Government to exercise the option(s).

(End of provision)

52.222-24 PREAWARD ON-SITE EQUAL OPPORTUNITY COMPLIANCE EVALUATION (FEB 1999)

If a contract in the amount of $10 million or more will result from this solicitation, the prospective Contractor and its known first-tier subcontractors with anticipated subcontracts of $10 million or more shall be subject to a preaward compliance evaluation by the Office of Federal Contract Compliance Programs (OFCCP), unless, within the preceding 24 months, OFCCP has conducted an evaluation and found the prospective Contractor and subcontractors to be in compliance with Executive Order 11246.

(End of provision)

52.225-12 NOTICE OF BUY AMERICAN ACT REQUIREMENT-- CONSTRUCTION MATERIALS UNDER TRADE AGREEMENTS (JAN 2004)

(a) Definitions. Construction material, designated country construction material, domestic construction material, foreign construction material, and FTA country construction material, as used in this provision, are defined in the clause of this solicitation entitled “Buy American Act --Construction Materials under Trade Agreements” (Federal Acquisition Regulation (FAR) clause 52.225-11).

(b) Requests for determination of inapplicability. An offeror requesting a determination regarding the inapplicability of the Buy American Act should submit the request to the Contracting Officer in time to allow a determination before submission of offers. The offeror shall include the information and applicable supporting data required by paragraphs (c) and (d) of FAR clause 52.225-11 in the request. If an offeror has not requested a determination regarding the inapplicability of the Buy American Act before submitting its offer, or has not received a response to a previous request, the offeror shall include the information and supporting data in the offer.

(c) Evaluation of offers. (1) The Government will evaluate an offer requesting exception to the requirements of the Buy American Act, based on claimed unreasonable cost of domestic construction materials, by adding to the offered price the appropriate percentage of the cost of such foreign construction material, as specified in paragraph (b)(4)(i) of FAR clause 52.225-11.

(2) If evaluation results in a tie between an offeror that requested the substitution of foreign construction material based on unreasonable cost and an offeror that did not request an exception, the Contracting Officer will award to the offeror that did not request an exception based on unreasonable cost.

(d) Alternate offers. (1) When an offer includes foreign construction material, other than designated country or FTA country construction material, that is not listed by the Government in this solicitation in paragraph (b)(3) of FAR clause 52.225-11, the offeror also may submit an alternate offer based on use of equivalent domestic, designated country, or FTA country construction material.

(2) If an alternate offer is submitted, the offeror shall submit a separate Standard Form 1442 for the alternate offer, and a separate price comparison table prepared in accordance with paragraphs (c) and (d) of FAR clause 52.225-11 for the offer that is based on the use of any foreign construction material for which the Government has not yet determined an exception applies.

(3) If the Government determines that a particular exception requested in accordance with paragraph (c) of FAR clause 52.225-11 does not apply, the Government will evaluate only those offers based on use of the equivalent domestic, designated country, or FTA country construction material, and the offeror shall be required to furnish such domestic, designated country, or FTA country construction material. An offer based on use of the foreign construction material for which an exception was requested--

(i) Will be rejected as nonresponsive if this acquisition is conducted by sealed bidding; or

(ii) May be accepted if revised during negotiations.

(End of provision)

52.228-11 PLEDGES OF ASSETS (FEB 1992)

(a) Offerors shall obtain from each person acting as an individual surety on a bid guarantee, a performance bond, or a payment bond--

(1) Pledge of assets; and

(2) Standard Form 28, Affidavit of Individual Surety.

(b) Pledges of assets from each person acting as an individual surety shall be in the form of--

(1) Evidence of an escrow account containing cash, certificates of deposit, commercial or Government securities, or other assets described in FAR 28.203-2 (except see 28.203-2(b)(2) with respect to Government securities held in book entry form) and/or;

(2) A recorded lien on real estate. The offeror will be required to provide--

(i) Evidence of title in the form of a certificate of title prepared by a title insurance company approved by the United States Department of Justice. This title evidence must show fee simple title vested in the surety along with any concurrent owners; whether any real estate taxes are due and payable; and any recorded encumbrances against the property, including the lien filed in favor of the Government as required by FAR 28.203-3(d);

(ii) Evidence of the amount due under any encumbrance shown in the evidence of title;

(iii) A copy of the current real estate tax assessment of the property or a current appraisal dated no earlier than 6 months prior to the date of the bond, prepared by a professional appraiser who certifies that the appraisal has been conducted in accordance with the generally accepted appraisal standards as reflected in the Uniform Standards of Professional Appraisal Practice, as promulgated by the Appraisal Foundation.

(End of clause)

52.233-2 SERVICE OF PROTEST (AUG 1996)

(a) Protests, as defined in section 33.101 of the Federal Acquisition Regulation, that are filed directly with an agency, and copies of any protests that are filed with the General Accounting Office (GAO), shall be served on the Contracting Officer (addressed as follows) by obtaining written and dated acknowledgment of receipt from Chief, Contracting Division, US Army Corps of Engineers-Alaska District, 2204 Third St, Elmendorf AFB, Alaska.

(b) The copy of any protest shall be received in the office designated above within one day of filing a protest with the GAO.

(End of provision)

SECTION 00120

EVALUATION FACTORS FOR AWARD

I. Initial Proposal Acceptability

The Government will award the contract to the offeror of the proposal that represents the best overall value to the Government. Before a proposal will be considered for evaluation and subsequent award of contract, the offeror must assent to the terms and conditions in RFP Sections 00100 through 00800 without exception. The Government will exclude a proposal from further consideration if the offeror takes exception to any of the terms and conditions in RFP Sections 00100 through 00800.

II. Proposal Evaluation

The Government will evaluate the proposals of each offeror based on how well their proposal addresses each of the Factors listed below and described under the various Tabs (A, B, C, etc.) in Section 00100. The evaluation will determine the offeror's overall cohesive approach in assimilating these various elements for each Factor into a comprehensive, consistent, and concise proposal that meets or exceeds the Government's minimum requirements.

The Government intends to award the contract without entering into discussion. The proposal is therefore expected to be self-explanatory in addressing all of the required criteria.

III. Factors For Evaluation

Volume One:

- Experience/Past Performance (Tab A)
- Organization (Tab B)
- Proposed Schedule and Construction Narrative (TAB C)
- Proposed Equipment (TAB D)
- Subcontracting Plan (TAB E)

Volume Two:

- Pricing information

Volume One Factors

EXPERIENCE/PAST PERFORMANCE

The Government will evaluate the relevance, depth and breadth of an offeror's experience in conjunction with how well that work was performed. The Government will evaluate how recent and relevant the information is, the source of the information, and general trends in performance.

The Government will consider information submitted by the offeror, as well as any other relevant and reliable information obtained from any other source (including information from Government personnel and databases such as the Construction Contract Appraisal Support System – CCASS).

Offerors shall be given an opportunity to address unfavorable reports of past performances if no opportunity to rebut the unfavorable report had previously been provided.

Offerors who demonstrate highly relevant experience as defined in section 00100 with excellent performance will receive the most favorable rating for this factor.

ORGANIZATION

(1) ORGANIZATION CHART: The Government will evaluate the offeror's organization chart and narrative for clarity of management structure proposed and plan to work with other members of the construction team (the owner, subcontractors, and agencies where required). The extent that the organization chart and narrative demonstrates how the proposed resources will get the specified work done. The offeror's proposal should clearly identify the structure of the management organization, authorities and responsibilities, and demonstrate the effectiveness of management system to be utilized to provide a safe jobsite, a quality product, schedule control, a functioning business partnership, and a satisfied customer. The government will also evaluate your approach to support during and after project turnover.

(2) KEY PERSONNEL: The Government will evaluate the resumes submitted for Key Personnel for a clear description and demonstration of the roles, responsibilities, and related experience of the key personnel in the organization and major subcontractors organizations.

Offerors who demonstrate a well-organized team with a preponderance of highly qualified key personnel will receive the most favorable rating for this factor.

SCHEDULE AND CONSTRUCTION NARRATIVE:

The Government will evaluate the Schedule and supporting narrative to ensure that the project can be completed within the specified time stated in SCR-1. The schedule shall be complete, reasonable, and realistic in order to evaluate the contractor's understanding of all construction requirements and shall reflect all the elements listed in Section 0100 for this factor. The narrative shall include an in-depth discussion on commissioning procedures. Offerors that demonstrate innovative and reasonable strategies for completing the schedule on or ahead of time with the least disruption to loop area access will receive the most favorable rating for this factor.

PROPOSED EQUIPMENT

The government will evaluate the overall level of quality that can be expected based on the salient features of proposed equipment. Offerors who meet or exceed the quality established in the RFP will receive the most favorable ratings.

SUBCONTRACTING PLAN AND SMALL BUSINESS PARTICIPATION

Sub-factors, which are of equal value, are:

(a) Proposed usage - Will be evaluated using the submitted subcontracting plan and in terms of whether the goals and commodities proposed are realistic and obtainable, as well as how closely they conform to the specified goals established in section 00100. In the event that offerors are unable to meet the specified goals, the difficulty in meeting the goal should be explained in their proposal and will be considered during proposal evaluation.

(b) Usage on past contracts - Will be evaluated on how well the offeror was able to meet established subcontracting goals on past projects.

If the offeror is a small business no submission of Volume II, Small Business Subcontracting Plan will be required and the offeror will be rated, "Satisfactory."

The Government will evaluate and rate each large business offeror's proposed small business subcontracting plan for the utilization of small businesses in accordance with AFARS Appendix DD.

Volume Two

PRICE

Volume II, Tab C, Price, will not be rated but will be quantitatively evaluated to determine: reasonableness when compared to the government estimate and other price proposals, affordability and completeness. The Government will perform a price analysis by comparing the proposed prices to that of other offerors and to the Government Estimate.

IV. Relative Importance of Individual Evaluation Factors

Volume One. For Volume One, the Government considers each of the Factors to be in descending order of importance.

Volume Two. The Government will perform a price analysis comparing the proposed price to the independent government estimate and prices of other offerors. Price shall be evaluated for reasonableness and affordability.

EVALUATION PREFERENCE: All HUBzone businesses submitting as a prime contractor will be provided a price evaluation adjustment by adding 10 percent adjustment to all Offerors except from other HUBzone that have not waived the evaluation adjustment or otherwise successful offers from small businesses. HUBzones businesses must complete the Price Evaluation Preference form included previously and insert in Volume III of their offer.

VI. Relative Importance of Volumes. The Government considers Volume One to be more important than Volume Two. The offeror should note that, under this scenario, price is not the most important factor for award. However, the government cannot award to an offeror whose price exceeds funds available regardless of non-price rating.

VII. The Determination of Best Overall Value

See Section 00100, 52.217-5, Evaluation of Options. In order to determine which proposal represents the best overall value, the Government will compare proposals to one another in a series of paired comparisons, trading off offerors' values based on their overall performance on the non-price factors. In comparing two proposals, if one member of a pair has both the better overall non-price value and the lower price, then the Government will consider that proposal to be a better value.

If two of the highest rated proposals have the same non-price rating, the lower priced proposal shall be considered the better value.

If one member of a pair has the better overall non-price value, but a higher price than the other proposal, then the Government's source selection authority will determine if the difference in non-price value is worth the difference in price.

If the source selection authority decides that the overall non-price value is worth the higher price, then the Government will consider the proposal with the better non-price value and the higher price to be the better overall value.

If the Source Selection Authority decides that the overall value is not worth the higher price, then the Source Selection Authority will continue to make paired comparisons in this fashion until he or she has identified the proposal that represents the best overall value. The contract will be awarded to the offeror with the best overall value.

END OF SECTION 00120

Section 00600 - Representations & Certifications

CLAUSES INCORPORATED BY FULL TEXT

52.203-2 CERTIFICATE OF INDEPENDENT PRICE DETERMINATION (APR 1985)

(a) The offeror certifies that --

(1) The prices in this offer have been arrived at independently, without, for the purpose of restricting competition, any consultation, communication, or agreement with any other offeror or competitor relating to –

(i) Those prices,

(ii) The intention to submit an offer, or

(iii) The methods of factors used to calculate the prices offered:

(2) The prices in this offer have not been and will not be knowingly disclosed by the offeror, directly or indirectly, to any other offeror or competitor before bid opening (in the case of a sealed bid solicitation) or contract award (in the case of a negotiated solicitation) unless otherwise required by law; and

(3) No attempt has been made or will be made by the offeror to induce any other concern to submit or not to submit an offer for the purpose of restricting competition.

(b) Each signature on the offer is considered to be a certification by the signatory that the signatory --

(1) Is the person in the offeror's organization responsible for determining the prices offered in this bid or proposal, and that the signatory has not participated and will not participate in any action contrary to subparagraphs (a)(1) through (a)(3) of this provision; or

(2) (i) Has been authorized, in writing, to act as agent for the following principals in certifying that those principals have not participated, and will not participate in any action contrary to subparagraphs (a)(1) through (a)(3) of this provison _____ (insert full name of person(s) in the offeror's organization responsible for determining the prices offered in this bid or proposal, and the title of his or her position in the offeror's organization);

(ii) As an authorized agent, does certify that the principals named in subdivision (b)(2)(i) above have not participated, and will not participate, in any action contrary to subparagraphs (a)(1) through (a)(3) above; and

(iii) As an agent, has not personally participated, and will not participate, in any action contrary to subparagraphs (a)(1) through (a)(3) of this provision.

(c) If the offeror deletes or modifies subparagraph (a)(2) of this provision, the offeror must furnish with its offer a signed statement setting forth in detail the circumstances of the disclosure.

(End of clause)

52.203-11 CERTIFICATION AND DISCLOSURE REGARDING PAYMENTS TO INFLUENCE CERTAIN FEDERAL TRANSACTIONS (APR 1991)

(a) The definitions and prohibitions contained in the clause, at FAR 52.203-12, Limitation on Payments to Influence Certain Federal Transactions, included in this solicitation, are hereby incorporated by reference in paragraph (b) of this Certification.

(b) The offeror, by signing its offer, hereby certifies to the best of his or her knowledge and belief that on or after December 23, 1989,--

(1) No Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress on his or her behalf in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment or modification of any Federal contract, grant, loan, or cooperative agreement;

(2) If any funds other than Federal appropriated funds (including profit or fee received under a covered Federal transaction) have been paid, or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress or an employee of a Member of Congress on his or her behalf in connection with this solicitation, the offeror shall complete and submit, with its offer, OMB standard form LLL, Disclosure of Lobbying Activities, to the Contracting Officer; and

(3) He or she will include the language of this certification in all subcontract awards at any tier and require that all recipients of subcontract awards in excess of $100,000 shall certify and disclose accordingly.

(1) Submission of this certification and disclosure is a prerequisite for making or entering into this contract imposed by section 1352, title 31, United States Code. Any person who makes an expenditure prohibited under this provision, shall be subject to a civil penalty of not less than $10,000, and not more than $100,000, for each such failure.

(End of provision)

52.204-3 TAXPAYER IDENTIFICATION (OCT 1998)

(a) Definitions.

“Common parent,” as used in this provision, means that corporate entity that owns or controls an affiliated group of corporations that files its Federal income tax returns on a consolidated basis, and of which the offeror is a member.

“Taxpayer Identification Number (TIN),” as used in this provision, means the number required by the Internal Revenue Service (IRS) to be used by the offeror in reporting income tax and other returns. The TIN may be either a Social Security Number or an Employer Identification Number.

(b) All offerors must submit the information required in paragraphs (d) through (f) of this provision to comply with debt collection requirements of 31 U.S.C. 7701(c) and 3325(d), reporting requirements of 26 U.S.C. 6041, 6041A, and 6050M, and implementing regulations issued by the IRS. If the resulting contract is subject to the payment reporting requirements described in Federal Acquisition Regulation (FAR) 4.904, the failure or refusal by the offeror to furnish the information may result in a 31 percent reduction of payments otherwise due under the contract.

(c) The TIN may be used by the Government to collect and report on any delinquent amounts arising out of the offeror's relationship with the Government (31 U.S.C. 7701(c)(3)). If the resulting contract is subject to the payment reporting requirements described in FAR 4.904, the TIN provided hereunder may be matched with IRS records to verify the accuracy of the offeror's TIN.

(d) Taxpayer Identification Number (TIN).

___ TIN:._____

___ TIN has been applied for.

___ TIN is not required because:

___ Offeror is a nonresident alien, foreign corporation, or foreign partnership that does not have income effectively connected with the conduct of a trade or business in the United States and does not have an office or place of business or a fiscal paying agent in the United States;

___ Offeror is an agency or instrumentality of a foreign government;

___ Offeror is an agency or instrumentality of the Federal Government.

(e) Type of organization.

___ Sole proprietorship;

___ Partnership;

___ Corporate entity (not tax-exempt);

___ Corporate entity (tax-exempt);

___ Government entity (Federal, State, or local);

___ Foreign government;

___ International organization per 26 CFR 1.6049-4;

___ Other _____

(f) Common parent.

___ Offeror is not owned or controlled by a common parent as defined in paragraph (a) of this provision.

___ Name and TIN of common parent:

Name _____

TIN _____

(End of provision)

52.204-5 WOMEN-OWNED BUSINESS (OTHER THAN SMALL BUSINESS) (MAY 1999)

(a) Definition. Women-owned business concern, as used in this provision, means a concern that is at least 51 percent owned by one or more women; or in the case of any publicly owned business, at least 51 percent of its stock is owned by one or more women; and whose management and daily business operations are controlled by one or more women.

(b) Representation. [Complete only if the offeror is a women-owned business concern and has not represented itself as a small business concern in paragraph (b)(1) of FAR 52.219-1, Small Business Program Representations, of this solicitation.] The offeror represents that it ( ) is a women-owned business concern.

(End of provision)

52.209-5 CERTIFICATION REGARDING DEBARMENT, SUSPENSION, PROPOSED DEBARMENT, AND OTHER RESPONSIBILITY MATTERS (DEC 2001)

(a)(1) The Offeror certifies, to the best of its knowledge and belief, that-

(i) The Offeror and/or any of its Principals -

(A) Are ( ) are not ( ) presently debarred, suspended, proposed for debarment, or declared ineligible for the award of contracts by any Federal agency;

(B) Have ( ) have not ( ), within a three-year period preceding this offer, been convicted of or had a civil judgment rendered against them for: commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, state, or local) contract or subcontract; violation of Federal or state antitrust statutes relating to the submission of offers; or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, tax evasion, or receiving stolen property; and

(C) Are ( ) are not ( ) presently indicted for, or otherwise criminally or civilly charged by a governmental entity with, commission of any of the offenses enumerated in paragraph (a)(1)(i)(B) of this provision.

(ii) The Offeror has ( ) has not ( ), within a three-year period preceding this offer, had one or more contracts terminated for default by any Federal agency.

(2) "Principals," for the purposes of this certification, means officers; directors; owners; partners; and, persons having primary management or supervisory responsibilities within a business entity (e.g., general manager; plant manager; head of a subsidiary, division, or business segment, and similar positions).

This Certification Concerns a Matter Within the Jurisdiction of an Agency of the United States and the Making of a False, Fictitious, or Fraudulent Certification May Render the Maker Subject to Prosecution Under Section 1001, Title 18, United States Code.

(b) The Offeror shall provide immediate written notice to the Contracting Officer if, at any time prior to contract award, the Offeror learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances.

(c) A certification that any of the items in paragraph (a) of this provision exists will not necessarily result in withholding of an award under this solicitation. However, the certification will be considered in connection with a determination of the Offeror's responsibility. Failure of the Offeror to furnish a certification or provide such additional information as requested by the Contracting Officer may render the Offeror nonresponsible.

(d) Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render, in good faith, the certification required by paragraph (a) of this provision. The knowledge and information of an Offeror is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

(e) The certification in paragraph (a) of this provision is a material representation of fact upon which reliance was

placed when making award. If it is later determined that the Offeror knowingly rendered an erroneous certification, in addition to other remedies available to the Government, the Contracting Officer may terminate the contract resulting from this solicitation for default.

(End of provision)

52.219-1 SMALL BUSINESS PROGRAM REPRESENTATIONS (APR 2002) - ALTERNATE I (APR 2002)

(a)(1) The North American Industry Classification System (NAICS) code for this acquisition is 237120.

(2) The small business size standard is $28.5 million

(3) The small business size standard for a concern which submits an offer in its own name, other than on a construction or service contract, but which proposes to furnish a product which it did not itself manufacture, is 500 employees.

(b) Representations. (1) The offeror represents as part of its offer that it ( ) is, ( ) is not a small business concern.

(2) (Complete only if the offeror represented itself as a small business concern in paragraph (b)(1) of this provision.) The offeror represents, for general statistical purposes, that it ( ) is, ( ) is not a small disadvantaged business concern as defined in 13 CFR 124.1002.

(3) (Complete only if the offeror represented itself as a small business concern in paragraph (b)(1) of this provision.) The offeror represents as part of its offer that it ( ) is, ( ) is not a women-owned small business concern.

(4) (Complete only if the offeror represented itself as a small business concern in paragraph (b)(1) of this provision.) The offeror represents as part of its offer that it ( ) is, ( ) is not a veteran-owned small business concern.

(5) (Complete only if the offeror represented itself as a veteran-owned small business concern in paragraph (b)(4) of this provision.) The offeror represents as part of its offer that it ( ) is, ( ) is not a service-disabled veteran-owned small business concern.

(6) [Complete only if the offeror represented itself as a small business concern in paragraph (b)(1) of this provision.] The offeror represents, as part of its offer, that--

(i) It ( ) is, ( ) is not a HUBZone small business concern listed, on the date of this representation, on the List of Qualified HUBZone Small Business Concerns maintained by the Small Business Administration, and no material change in ownership and control, principal office, or HUBZone employee percentage has occurred since it was certified by the Small Business Administration in accordance with 13 CFR part 126; and

(ii) It ( ) is, ( ) is not a joint venture that complies with the requirements of 13 CFR part 126, and the representation in paragraph (b)(6)(i) of this provision is accurate for the HUBZone small business concern or concerns that are participating in the joint venture. (The offeror shall enter the name or names of the HUBZone small business concern or concerns that are participating in the joint venture:_____.) Each HUBZone small business concern participating in the joint venture shall submit a separate signed copy of the HUBZone representation.

(7) (Complete if offeror represented itself as disadvantaged in paragraph (b)(2) of this provision.) The offeror shall check the category in which its ownership falls:

____ Black American.

____ Hispanic American.

____ Native American (American Indians, Eskimos, Aleuts, or Native Hawaiians).

____ Asian-Pacific American (persons with origins from Burma, Thailand, Malaysia, Indonesia, Singapore, Brunei, Japan, China, Taiwan, Laos, Cambodia (Kampuchea), Vietnam, Korea, The Philippines, U.S. Trust Territory of the Pacific Islands (Republic of Palau), Republic of the Marshall Islands, Federated States of Micronesia, the Commonwealth of the Northern Mariana Islands, Guam, Samoa, Macao, Hong Kong, Fiji, Tonga, Kiribati, Tuvalu, or Nauru).

____ Subcontinent Asian (Asian-Indian) American (persons with origins from India, Pakistan, Bangladesh, Sri Lanka, Bhutan, the Maldives Islands, or Nepal).

____ Individual/concern, other than one of the preceding.

(c) Definitions. As used in this provision--

Service-disabled veteran-owned small business concern--

(1) Means a small business concern--

(i) Not less than 51 percent of which is owned by one or more service-disabled veterans or, in the case of any publicly owned business, not less than 51 percent of the stock of which is owned by one or more service-disabled veterans; and

(ii) The management and daily business operations of which are controlled by one or more service-disabled veterans or, in the case of a veteran with permanent and severe disability, the spouse or permanent caregiver of such veteran.

(2) Service-disabled veteran means a veteran, as defined in 38 U.S.C. 101(2), with a disability that is service-connected, as defined in 38 U.S.C. 101(16).

"Small business concern," means a concern, including its affiliates, that is independently owned and operated, not dominant in the field of operation in which it is bidding on Government contracts, and qualified as a small business under the criteria in 13 CFR Part 121 and the size standard in paragraph (a) of this provision.

Veteran-owned small business concern means a small business concern--

(1) Not less than 51 percent of which is owned by one or more veterans (as defined at 38 U.S.C. 101(2)) or, in the case of any publicly owned business, not less than 51 percent of the stock of which is owned by one or more veterans; and

(2) The management and daily business operations of which are controlled by one or more veterans.

"Women-owned small business concern," means a small business concern --

(1) That is at least 51 percent owned by one or more women or, in the case of any publicly owned business, at least 51 percent of the stock of which is owned by one or more women; or

(2) Whose management and daily business operations are controlled by one or more women.

(d) Notice.

(1) If this solicitation is for supplies and has been set aside, in whole or in part, for small business concerns, then the clause in this solicitation providing notice of the set-aside contains restrictions on the source of the end items to be furnished.

(2) Under 15 U.S.C. 645(d), any person who misrepresents a firm's status as a small, HUBZone small, small disadvantaged, or women-owned small business concern in order to obtain a contract to be awarded under the preference programs established pursuant to section 8(a), 8(d), 9, or 15 of the Small Business Act or any other provision of Federal law that specifically references section 8(d) for a definition of program eligibility, shall--

(i) Be punished by imposition of fine, imprisonment, or both;

(ii) Be subject to administrative remedies, including suspension and debarment; and

(iii) Be ineligible for participation in programs conducted under the authority of the Act.

(End of provision)

52.219-2 EQUAL LOW BIDS. (OCT 1995)

(a) This provision applies to small business concerns only.

(b) The bidder's status as a labor surplus area (LSA) concern may affect entitlement to award in case of tie bids. If the bidder wishes to be considered for this priority, the bidder must identify, in the following space, the LSA in which the costs to be incurred on account of manufacturing or production (by the bidder or the first-tier subcontractors) amount to more than 50 percent of the contract price.

_____
_____

(c) Failure to identify the labor surplus area as specified in paragraph (b) of this provision will preclude the bidder from receiving priority consideration. If the bidder is awarded a contract as a result of receiving priority consideration under this provision and would not have otherwise received award, the bidder shall perform the contract or cause the contract to be performed in accordance with the obligations of an LSA concern.

52.219-4 NOTICE OF PRICE EVALUATION PREFERENCE FOR HUBZONE SMALL BUSINESS CONCERNS (JAN 1999)

(a) Definition. HUBZone small business concern, as used in this clause, means a small business concern that appears on the List of Qualified HUBZone Small Business Concerns maintained by the Small Business Administration.

(b) Evaluation preference. (1) Offers will be evaluated by adding a factor of 10 percent to the price of all offers, except--

(i) Offers from HUBZone small business concerns that have not waived the evaluation preference;

(ii) Otherwise successful offers from small business concerns;

(iii) Otherwise successful offers of eligible products under the Trade Agreements Act when the dollar threshold for application of the Act is exceeded (see 25.402 of the Federal Acquisition Regulation (FAR)); and

(iv) Otherwise successful offers where application of the factor would be inconsistent with a Memorandum of Understanding or other international agreement with a foreign government.

(2) The factor of 10 percent shall be applied on a line item basis or to any group of items on which award may be made. Other evaluation factors described in the solicitation shall be applied before application of the factor.

(3) A concern that is both a HUBZone small business concern and a small disadvantaged business concern will receive the benefit of both the HUBZone small business price evaluation preference and the small disadvantaged business price evaluation adjustment (see FAR clause 52.219-23). Each applicable price evaluation preference or adjustment shall be calculated independently against an offeror's base offer.

These individual preference amounts shall be added together to arrive at the total evaluated price for that offer.

(c) Waiver of evaluation preference. A HUBZone small business concern may elect to waive the evaluation preference, in which case the factor will be added to its offer for evaluation purposes. The agreements in paragraph (d) of this clause do not apply if the offeror has waived the evaluation preference.

___ Offeror elects to waive the evaluation preference.

(d) Agreement. A HUBZone small business concern agrees that in the performance of the contract, in the case of a contract for

(1) Services (except construction), at least 50 percent of the cost of personnel for contract performance will be spent for employees of the concern or employees of other HUBZone small business concerns;

(2) Supplies (other than procurement from a nonmanufacturer of such supplies), at least 50 percent of the cost of manufacturing, excluding the cost of materials, will be performed by the concern or other HUBZone small business concerns;

(3) General construction, at least 15 percent of the cost of the contract performance incurred for personnel will be will be spent on the concern's employees or the employees of other HUBZone small business concerns; or

(4) Construction by special trade contractors, at least 25 percent of the cost of the contract performance incurred for personnel will be spent on the concern's employees or the employees of other HUBZone small business concerns.

(e) A HUBZone joint venture agrees that in the performance of the contract, the applicable percentage specified in paragraph (d) of this clause will be performed by the HUBZone small business participant or participants.

(f) A HUBZone small business concern nonmanufacturer agrees to furnish in performing this contract only end items manufactured or produced by HUBZone small business manufacturer concerns. This paragraph does not apply in connection with construction or service contracts.

(End of clause)

52.219-19 SMALL BUSINESS CONCERN REPRESENTATION FOR THE SMALL BUSINESS COMPETITIVENESS DEMONSTRATION PROGRAM (OCT 2000)

(a) Definition.

"Emerging small business" as used in this solicitation, means a small business concern whose size is no greater than 50 percent of the numerical size standard applicable to the North American Industry Classification System (NAICS) code assigned to a contracting opportunity.

(b) [Complete only if the Offeror has represented itself under the provision at 52.219-1 as a small business concern under the size standards of this solicitation.] The Offeror [ ] is, [ ] is not an emerging small business.

(c) (Complete only if the Offeror is a small business or an emerging small business, indicating its size range.)

Offeror's number of employees for the past 12 months (check this column if size standard stated in solicitation is expressed in terms of number of employees) or Offeror's average annual gross revenue for the last 3 fiscal years (check this column if size standard stated in solicitation is expressed in terms of annual receipts). (Check one of the following.)

No. of Employees Avg. Annual Gross Revenues

____ 50 or fewer ____ $1 million or less

____ 51 - 100 ____ $1,000,001 - $2 million

____ 101 - 250 ____ $2,000,001 - $3.5 million

____ 251 - 500 ____ $3,500,001 - $5 million

____ 501 - 750 ____ $5,000,001 - $10 million

____ 751 - 1,000 ____ $10,000,001 - $17 million

____ Over 1,000 ____ Over $17 million

(End of provision)

52.219-21 SMALL BUSINESS SIZE REPRESENTATION FOR TARGETED INDUSTRY CATEGORIES UNDER THE SMALL BUSINESS COMPETITIVENESS DEMONSTRATION PROGRAM (MAY 1999)

(Complete only if the Offeror has represented itself under the provision at 52.219-1 as a small business concern under the size standards of this solicitation.)

Offeror's number of employees for the past 12 months (check this column if size standard stated in solicitation is expressed in terms of number of employees) or Offeror's average annual gross revenue for the last 3 fiscal years (check this column if size standard stated in solicitation is expressed in terms of annual receipts). (Check one of the following.)

No. of Employees Avg. Annual Gross Revenues

____ 50 or fewer ____ $1 million or less

____ 51 - 100 ____ $1,000,001 - $2 million

____ 101 - 250 ____ $2,000,001 - $3.5 million

____ 251 - 500 ____ $3,500,001 - $5 million

____ 501 - 750 ____ $5,000,001 - $10 million

____ 751 - 1,000 ____ $10,000,001 - $17 million

____ Over 1,000 ____ Over $17 million

(End of provision)

52.222-21 PROHIBITION OF SEGREGATED FACILITIES (FEB 1999)

(a) Segregated facilities, as used in this clause, means any waiting rooms, work areas, rest rooms and wash rooms, restaurants and other eating areas, time clocks, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees, that are segregated by explicit directive or are in fact segregated on the basis of race, color, religion, sex, or national origin because of written or oral policies or employee custom. The term does not include separate or single-user rest rooms or necessary dressing or sleeping areas provided to assure privacy between the sexes.

(b) The Contractor agrees that it does not and will not maintain or provide for its employees any segregated facilities at any of its establishments, and that it does not and will not permit its employees to perform their services at any location under its control where segregated facilities are maintained. The Contractor agrees that a breach of this clause is a violation of the Equal Opportunity clause in this contract.

(c) The Contractor shall include this clause in every subcontract and purchase order that is subject to the Equal Opportunity clause of this contract.

(End of clause)

52.222-22 PREVIOUS CONTRACTS AND COMPLIANCE REPORTS (FEB 1999)

The offeror represents that --

(a) ( ) It has, ( ) has not participated in a previous contract or subcontract subject to the Equal Opportunity clause of this solicitation;

(b) ( ) It has, ( ) has not, filed all required compliance reports; and

(c) Representations indicating submission of required compliance reports, signed by proposed subcontractors, will be obtained before subcontract awards.

(End of provision)

52.222-25 AFFIRMATIVE ACTION COMPLIANCE (APR 1984)

The offeror represents that

(a) [ ] it has developed and has on file, [ ] has not developed and does not have on file, at each establishment, affirmative action programs required by the rules and regulations of the Secretary of Labor (41 CFR 60-1 and 60-2), or

(b) [ ] has not previously had contracts subject to the written affirmative action programs requirement of the rules and regulations of the Secretary of Labor.

(End of provision)

52.222-38 COMPLIANCE WITH VETERANS' EMPLOYMENT REPORTING REQUIREMENTS (DEC 2001)

By submission of its offer, the offeror represents that, if it is subject to the reporting requirements of 38 U.S.C. 4212(d) (i.e., if it has any contract containing Federal Acquisition Regulation clause 52.222-37, Employment Reports on Special Disabled Veterans, Veterans of the Vietnam Era, and Other Eligible Veterans), it has submitted the most recent VETS-100 Report required by that clause.

(End of provision)

52.223-13 CERTIFICATION OF TOXIC CHEMICAL RELEASE REPORTING (AUG 2003)

(a) Executive Order 13148, of April 21, 2000, Greening the Government through Leadership in Environmental Management, requires submission of this certification as a prerequisite for contract award.

(b) By signing this offer, the offeror certifies that--

(1) As the owner or operator of facilities that will be used in the performance of this contract that are subject to the filing and reporting requirements described in section 313 of the Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA) (42 U.S.C. 11023) and section 6607 of the Pollution Prevention Act of 1990 (PPA) (42 U.S.C. 13106), the offeror will file and continue to file for such facilities for the life of the contract the Toxic Chemical Release Inventory Form (Form R) as described in sections 313(a) and (g) of EPCRA and section 6607 of PPA; or

(2) None of its owned or operated facilities to be used in the performance of this contract is subject to the Form R filing and reporting requirements because each such facility is exempt for at least one of the following reasons: (Check each block that is applicable.)

( ) (i) The facility does not manufacture, process, or otherwise use any toxic chemicals listed in 40 CFR 372.65;

( ) (ii) The facility does not have 10 or more full-time employees as specified in section 313.(b)(1)(A) of EPCRA 42 U.S.C. 11023(b)(1)(A);

( ) (iii) The facility does not meet the reporting thresholds of toxic chemicals established under section 313(f) of EPCRA, 42 U.S.C. 11023(f) (including the alternate thresholds at 40 CFR 372.27, provided an appropriate certification form has been filed with EPA);

( ) (iv) The facility does not fall within the following Standard Industrial Classification (SIC) codes or their corresponding North American Industry Classification System sectors:

(A) Major group code 10 (except 1011, 1081, and 1094.

(B) Major group code 12 (except 1241).

(C) Major group codes 20 through 39.

(D) Industry code 4911, 4931, or 4939 (limited to facilities that combust coal and/or oil for the purpose of generating power for distribution in commerce).

(E) Industry code 4953 (limited to facilities regulated under the Resource Conservation and Recovery Act, Subtitle C (42 U.S.C. 6921, et seq.), 5169, 5171, or 7389 (limited to facilities primarily engaged in solvent recovery services on a contract or fee basis); or

( ) (v) The facility is not located within the United States or its outlying areas.

(End of clause)

52.236-28 PREPARATION OF PROPOSALS--CONSTRUCTION (OCT 1997)

(a) Proposals must be (1) submitted on the forms furnished by the Government or on copies of those forms, and (2) manually signed. The person signing a proposal must initial each erasure or change appearing on any proposal form.

(b) The proposal form may require offerors to submit proposed prices for one or more items on various bases, including--

(1) Lump sum price;

(2) Alternate prices;

(3) Units of construction; or

(4) Any combination of paragraphs (b)(1) through (b)(3) of this provision.

(c) If the solicitation requires submission of a proposal on all items, failure to do so may result in the proposal being rejected without further consideration. If a proposal on all items is not required, offerors should insert the words “no proposal” in the space provided for any item on which no price is submitted.

(d) Alternate proposals will not be considered unless this solicitation authorizes their submission.

(End of provision)

252.209-7001 DISCLOSURE OF OWNERSHIP OR CONTROL BY THE GOVERNMENT OF A TERRORIST COUNTRY (MAR 1998)

(a) "Definitions."

As used in this provision --

(a) "Government of a terrorist country" includes the state and the government of a terrorist country, as well as any political subdivision, agency, or instrumentality thereof.

(2) "Terrorist country" means a country determined by the Secretary of State, under section 6(j)(1)(A) of the Export Administration Act of 1979 (50 U.S.C. App. 2405(j)(i)(A)), to be a country the government of which has repeatedly provided support for such acts of international terrorism. As of the date of this provision, terrorist countries include:

Cuba, Iran, Iraq, Libya, North Korea, Sudan, and Syria.

(3) "Significant interest" means --

(i) Ownership of or beneficial interest in 5 percent or more of the firm's or subsidiary's securities. Beneficial interest includes holding 5 percent or more of any class of the firm's securities in "nominee shares," "street names," or some other method of holding securities that does not disclose the beneficial owner;

(ii) Holding a management position in the firm, such as a director or officer;

(iii) Ability to control or influence the election, appointment, or tenure of directors or officers in the firm;

(iv) Ownership of 10 percent or more of the assets of a firm such as equipment, buildings, real estate, or other tangible assets of the firm; or

(v) Holding 50 percent or more of the indebtness of a firm.

(b) "Prohibition on award."

In accordance with 10 U.S.C. 2327, no contract may be awarded to a firm or a subsidiary of a firm if the government of a terrorist country has a significant interest in the firm or subsidiary or, in the case of a subsidiary, the firm that owns the subsidiary, unless a waiver is granted by the Secretary of Defense.

(c) "Disclosure."

If the government of a terrorist country has a significant interest in the Offeror or a subsidiary of the Offeror, the Offeror shall disclosure such interest in an attachment to its offer. If the Offeror is a subsidiary, it shall also disclose any significant interest the government of a terrorist country has in any firm that owns or controls the subsidiary. The disclosure shall include --

(1) Identification of each government holding a significant interest; and

(2) A description of the significant interest held by each government.

(End of provision)

252.247-7022 REPRESENTATION OF EXTENT OF TRANSPORTATION BY SEA (AUG 1992)

(a) The Offeror shall indicate by checking the appropriate blank in paragraph (b) of this provision whether transportation of supplies by sea is anticipated under the resultant contract. The term supplies is defined in the Transportation of Supplies by Sea clause of this solicitation.

(b) Representation. The Offeror represents that it:

____ (1) Does anticipate that supplies will be transported by sea in the performance of any contract or subcontract resulting from this solicitation.

____ (2) Does not anticipate that supplies will be transported by sea in the performance of any contract or subcontract resulting from this solicitation.

(c) Any contract resulting from this solicitation will include the Transportation of Supplies by Sea clause. If the Offeror represents that it will not use ocean transportation, the resulting contract will also include the Defense FAR

Supplement clause at 252.247-7024, Notification of Transportation of Supplies by Sea.

(End of provision)

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Section 00700 - Contract Clauses

CLAUSES INCORPORATED BY FULL TEXT

52.202-1 DEFINITIONS (DEC 2001)

(a) Agency head or head of the agency means the Secretary (Attorney General, Administrator, Governor, Chairperson, or other chief official, as appropriate) of the agency, unless otherwise indicated, including any deputy or assistant chief official of the executive agency.

(b) Commercial component means any component that is a commercial item.

(c) Commercial item means--

(1) Any item, other than real property, that is of a type customarily used by the general public or by non-governmental entities for purposes other than governmental purposes, and that--

(i) Has been sold, leased, or licensed to the general public; or

(ii) Has been offered for sale, lease, or license to the general public;

(2) Any item that evolved from an item described in paragraph (c)(1) of this clause through advances in technology or performance and that is not yet available in the commercial marketplace, but will be available in the commercial marketplace in time to satisfy the delivery requirements under a Government solicitation;

(3) Any item that would satisfy a criterion expressed in paragraphs (c)(1) or (c)(2) of this clause, but for--

(i) Modifications of a type customarily available in the commercial marketplace; or

(ii) Minor modifications of a type not customarily available in the commercial marketplace made to meet Federal Government requirements. “Minor” modifications means modifications that do not significantly alter the nongovernmental function or essential physical characteristics of an item or component, or change the purpose of a process. Factors to be considered in determining whether a modification is minor include the value and size of the modification and the comparative value and size of the final product. Dollar values and percentages may be used as guideposts, but are not conclusive evidence that a modification is minor;

(4) Any combination of items meeting the requirements of paragraphs (c)(1), (2), (3), or (5) of this clause that are of a type customarily combined and sold in combination to the general public;

(5) Installation services, maintenance services, repair services, training services, and other services if--

(i) Such services are procured for support of an item referred to in paragraph (c)(1), (2), (3), or (4) of this definition, regardless of whether such services are provided by the same source or at the same time as the item; and

(ii) The source of such services provides similar services contemporaneously to the general public under terms and conditions similar to those offered to the Federal Government;

(6) Services of a type offered and sold competitively in substantial quantities in the commercial marketplace based on established catalog or market prices for specific tasks performed under standard commercial terms and conditions. This does not include services that are sold based on hourly rates without an established catalog or market price for a specific service performed. For purposes of these services--

(i) Catalog price means a price included in a catalog, price list, schedule, or other form that is regularly maintained by the manufacturer or vendor, is either published or otherwise available for inspection by customers, and states prices at which sales are currently, or were last, made to a significant number of buyers constituting the general public; and

(ii) Market prices means current prices that are established in the course of ordinary trade between buyers and sellers free to bargain and that can be substantiated through competition or from sources independent of the offerors.

(7) Any item, combination of items, or service referred to in subparagraphs (c)(1) through (c)(6), notwithstanding the fact that the item, combination of items, or service is transferred between or among separate divisions, subsidiaries, or affiliates of a Contractor; or

(8) A nondevelopmental item, if the procuring agency determines the item was developed exclusively at private expense and sold in substantial quantities, on a competitive basis, to multiple State and local Governments.

(d) Component means any item supplied to the Government as part of an end item or of another component, except that for use in 52.225-9, and 52.225-11 see the definitions in 52.225-9(a) and 52.225-11(a).

(e) Contracting Officer means a person with the authority to enter into, administer, and/or terminate contracts and make related determinations and findings. The term includes certain authorized representatives of the Contracting Officer acting within the limits of their authority as delegated by the Contracting Officer.

(f) Nondevelopmental item means--

(1) Any previously developed item of supply used exclusively for governmental purposes by a Federal agency, a State or local government, or a foreign govemment with which the United States has a mutual defense cooperation agreement;

(2) Any item described in paragraph (f)(1) of this definition that requires only minor modification or modifications of a type customarily available in the commercial marketplace in order to meet the requirements of the procuring department or agency; or

(3) Any item of supply being produced that does not meet the requirements of paragraph (f)(1) or (f)(2) solely because the item is not yet in use.

(g) "Contracting Officer" means a person with the authority to enter into, administer, and/or terminate contracts and make related determinations and findings. The term includes certain authorized representatives of the Contracting Officer acting within the limits of their authority as delegated by the Contracting Officer.

(h) Except as otherwise provided in this contract, the term "subcontracts" includes, but is not limited to, purchase orders and changes and modifications to purchase orders under this contract.

(End of clause)

52.203-3 GRATUITIES (APR 1984)

(a) The right of the Contractor to proceed may be terminated by written notice if, after notice and hearing, the agency head or a designee determines that the Contractor, its agent, or another representative--

(1) Offered or gave a gratuity (e.g., an entertainment or gift) to an officer, official, or employee of the Government; and

(2) Intended, by the gratuity, to obtain a contract or favorable treatment under a contract.

(b) The facts supporting this determination may be reviewed by any court having lawful jurisdiction.

(c) If this contract is terminated under paragraph (a) of this clause, the Government is entitled--

(1) To pursue the same remedies as in a breach of the contract; and

(2) In addition to any other damages provided by law, to exemplary damages of not less than 3 nor more than 10 times the cost incurred by the Contractor in giving gratuities to the person concerned, as determined by the agency head or a designee. (This subparagraph (c)(2) is applicable only if this contract uses money appropriated to the Department of Defense.)

(d) The rights and remedies of the Government provided in this clause shall not be exclusive and are in addition to any other rights and remedies provided by law or under this contract.

(End of clause)

52.203-5 COVENANT AGAINST CONTINGENT FEES (APR 1984)

(a) The Contractor warrants that no person or agency has been employed or retained to solicit or obtain this contract upon an agreement or understanding for a contingent fee, except a bona fide employee or agency. For breach or violation of this warranty, the Government shall have the right to annul this contract without liability or, in its discretion, to deduct from the contract price or consideration, or otherwise recover, the full amount of the contingent fee.

(b) "Bona fide agency," as used in this clause, means an established commercial or selling agency, maintained by a contractor for the purpose of securing business, that neither exerts nor proposes to exert improper influence to solicit or obtain Government contracts nor holds itself out as being able to obtain any Government contract or contracts through improper influence.

"Bona fide employee," as used in this clause, means a person, employed by a contractor and subject to the contractor's supervision and control as to time, place, and manner of performance, who neither exerts nor proposes to exert improper influence to solicit or obtain Government contracts nor holds out as being able to obtain any Government contract or contracts through improper influence.

"Contingent fee," as used in this clause, means any commission, percentage, brokerage, or other fee that is contingent upon the success that a person or concern has in securing a Government contract.

"Improper influence," as used in this clause, means any influence that induces or tends to induce a Government employee or officer to give consideration or to act regarding a Government contract on any basis other than the merits of the matter.

(End of clause)

52.203-7 ANTI-KICKBACK PROCEDURES. (JUL 1995)

(a) Definitions.

"Kickback," as used in this clause, means any money, fee, commission, credit, gift, gratuity, thing of value, or compensation of any kind which is provided, directly or indirectly, to any prime Contractor, prime Contractor employee, subcontractor, or subcontractor employee for the purpose of improperly obtaining or rewarding favorable

treatment in connection with a prime contract or in connection with a subcontract relating to a prime contract.

"Person," as used in this clause, means a corporation, partnership, business association of any kind, trust, joint-stock company, or individual.

"Prime contract," as used in this clause, means a contract or contractual action entered into by the United States for the purpose of obtaining supplies, materials, equipment, or services of any kind.

"Prime Contractor," as used in this clause, means a person who has entered into a prime contract with the United States.

"Prime Contractor employee," as used in this clause, means any officer, partner, employee, or agent of a prime Contractor.

"Subcontract," as used in this clause, means a contract or contractual action entered into by a prime Contractor or subcontractor for the purpose of obtaining supplies, materials, equipment, or services of any kind under a prime contract.

"Subcontractor," as used in this clause, (1) means any person, other than the prime Contractor, who offers to furnish or furnishes any supplies, materials, equipment, or services of any kind under a prime contract or a subcontract entered into in connection with such prime contract, and (2) includes any person who offers to furnish or furnishes general supplies to the prime Contractor or a higher tier subcontractor.

"Subcontractor employee," as used in this clause, means any officer, partner, employee, or agent of a subcontractor.

(b) The Anti-Kickback Act of 1986 (41 U.S.C. 51-58) (the Act), prohibits any person from -

(1) Providing or attempting to provide or offering to provide any kickback;

(2) Soliciting, accepting, or attempting to accept any kickback; or

(3) Including, directly or indirectly, the amount of any kickback in the contract price charged by a prime Contractor to the United States or in the contract price charged by a subcontractor to a prime Contractor or higher tier subcontractor.

(c)(1) The Contractor shall have in place and follow reasonable procedures designed to prevent and detect possible violations described in paragraph (b) of this clause in its own operations and direct business relationships.

(2) When the Contractor has reasonable grounds to believe that a violation described in paragraph (b) of this clause may have occurred, the Contractor shall promptly report in writing the possible violation. Such reports shall be made to the inspector general of the contracting agency, the head of the contracting agency if the agency does not have an inspector general, or the Department of Justice.

(3) The Contractor shall cooperate fully with any Federal agency investigating a possible violation described in paragraph (b) of this clause.

(4) The Contracting Officer may (i) offset the amount of the kickback against any monies owed by the United States under the prime contract and/or (ii) direct that the Prime Contractor withhold, from sums owed a subcontractor under the prime contract, the amount of any kickback. The Contracting Officer may order the monies withheld under subdivision (c)(4)(ii) of this clause be paid over to the Government unless the Government has already offset those monies under subdivision (c)(4)(i) of this clause. In either case, the Prime Contractor shall notify the Contracting Officer when the monies are withheld.

(5) The Contractor agrees to incorporate the substance of this clause, including this subparagraph (c)(5) but excepting subparagraph (c)(1), in all subcontracts under this contract which exceed $100,000.

52.203-8 CANCELLATION, RESCISSION, AND RECOVERY OF FUNDS FOR ILLEGAL OR IMPROPER ACTIVITY (JAN 1997)

(a) If the Government receives information that a contractor or a person has engaged in conduct constituting a violation of subsection (a), (b), (c), or (d) of Section 27 of the Office of Federal Procurement Policy Act (41 U.S.C. 423) (the Act), as amended by section 4304 of the 1996 National Defense Authorization Act for Fiscal Year 1996 (Pub. L. 104-106), the Government may--

(1) Cancel the solicitation, if the contract has not yet been awarded or issued; or

(2) Rescind the contract with respect to which--

(i) The Contractor or someone acting for the Contractor has been convicted for an offense where the conduct constitutes a violation of subsection 27(a) or (b) of the Act for the purpose of either--

(A) Exchanging the information covered by such subsections for anything of value; or

(B) Obtaining or giving anyone a competitive advantage in the award of a Federal agency procurement contract; or

(ii) The head of the contracting activity has determined, based upon a preponderance of the evidence, that the Contractor or someone acting for the Contractor has engaged in conduct constituting an offense punishable under subsections 27(e)(1) of the Act.

(b) If the Government rescinds the contract under paragraph (a) of this clause, the Government is entitled to recover, in addition to any penalty prescribed by law, the amount expended under the contract.

(c) The rights and remedies of the Government specified herein are not exclusive, and are in addition to any other rights and remedies provided by law, regulation, or under this contract.

(End of clause)

52.203-10 PRICE OR FEE ADJUSTMENT FOR ILLEGAL OR IMPROPER ACTIVITY (JAN 1997)

(a) The Government, at its election, may reduce the price of a fixed-price type contract and the total cost and fee under a cost-type contract by the amount of profit or fee determined as set forth in paragraph (b) of this clause if the head of the contracting activity or designee determines that there was a violation of subsection 27 (a), (b), or (c) of the Office of Federal Procurement Policy Act, as amended (41 U.S.C. 423), as implemented in section 3.104 of the Federal Acquisition Regulation.

(b) The price or fee reduction referred to in paragraph (a) of this clause shall be--

(1) For cost-plus-fixed-fee contracts, the amount of the fee specified in the contract at the time of award;

(2) For cost-plus-incentive-fee contracts, the target fee specified in the contract at the time of award, notwithstanding

any minimum fee or "fee floor" specified in the contract;

(3) For cost-plus-award-fee contracts--

(i) The base fee established in the contract at the time of contract award;

(ii) If no base fee is specified in the contract, 30 percent of the amount of each award fee otherwise payable to the Contractor for each award fee evaluation period or at each award fee determination point.

(4) For fixed-price-incentive contracts, the Government may--

(i) Reduce the contract target price and contract target profit both by an amount equal to the initial target profit specified in the contract at the time of contract award; or

(ii) If an immediate adjustment to the contract target price and contract target profit would have a significant adverse impact on the incentive price revision relationship under the contract, or adversely affect the contract financing provisions, the Contracting Officer may defer such adjustment until establishment of the total final price of the contract. The total final price established in accordance with the incentive price revision provisions of the contract shall be reduced by an amount equal to the initial target profit specified in the contract at the time of contract award and such reduced price shall be the total final contract price.

(5) For firm-fixed-price contracts, by 10 percent of the initial contract price or a profit amount determined by the Contracting Officer from records or documents in existence prior to the date of the contract award.

(c) The Government may, at its election, reduce a prime contractor's price or fee in accordance with the procedures of paragraph (b) of this clause for violations of the Act by its subcontractors by an amount not to exceed the amount of profit or fee reflected in the subcontract at the time the subcontract was first definitively priced.

(d) In addition to the remedies in paragraphs (a) and (c) of this clause, the Government may terminate this contract for default. The rights and remedies of the Government specified herein are not exclusive, and are in addition to any other rights and remedies provided by law or under this contract.

(End of clause)

52.203-12 LIMITATION ON PAYMENTS TO INFLUENCE CERTAIN FEDERAL TRANSACTIONS (JUN 2003)

(a) Definitions.

"Agency," as used in this clause, means executive agency as defined in 2.101.

"Covered Federal action," as used in this clause, means any of the following Federal actions:

(1) The awarding of any Federal contract.

(2) The making of any Federal grant.

(3) The making of any Federal loan.

(4) The entering into of any cooperative agreement.

(5) The extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

"Indian tribe" and "tribal organization," as used in this clause, have the meaning provided in section 4 of the Indian Self-Determination and Education Assistance Act (25 U.S.C. 450B) and include Alaskan Natives.

"Influencing or attempting to influence," as used in this clause, means making, with the intent to influence, any communication to or appearance before an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with any covered Federal action.

"Local government," as used in this clause, means a unit of government in a State and, if chartered, established, or otherwise recognized by a State for the performance of a governmental duty, including a local public authority, a special district, an intrastate district, a council of governments, a sponsor group representative organization, and any other instrumentality of a local government.

"Officer or employee of an agency," as used in this clause, includes the following individuals who are employed by an agency:

(1) An individual who is appointed to a position in the Government under Title 5, United States Code, including a position under a temporary appointment.

(2) A member of the uniformed services, as defined in subsection 101(3),Title 37, United States Code.

(3) A special Government employee, as defined in section 202, Title 18, United States Code.

(4) An individual who is a member of a Federal advisory committee, as defined by the Federal Advisory Committee Act, Title 5, United States Code, appendix 2.

"Person," as used in this clause, means an individual, corporation, company, association, authority, firm, partnership, society, State, and local government, regardless of whether such entity is operated for profit, or not for profit. This term excludes an Indian tribe, tribal organization, or any other Indian organization with respect to expenditures specifically permitted by other Federal law.

"Reasonable compensation," as used in this clause, means, with respect to a regularly employed officer or employee of any person, compensation that is consistent with the normal compensation for such officer or employee for work that is not furnished to, not funded by, or not furnished in cooperation with the Federal Government.

"Reasonable payment," as used in this clause, means, with respect to professional and other technical services, a payment in an amount that is consistent with the amount normally paid for such services in the private sector.

"Recipient," as used in this clause, includes the Contractor and all subcontractors. This term excludes an Indian tribe, tribal organization, or any other Indian organization with respect to expenditures specifically permitted by other Federal law.

"Regularly employed," as used in this clause, means, with respect to an officer or employee of a person requesting or receiving a Federal contract, an officer or employee who is employed by such person for at least 130 working days within 1 year immediately preceding the date of the submission that initiates agency consideration of such person for receipt of such contract. An officer or employee who is employed by such person for less than 130 working days within 1 year immediately preceding the date of the submission that initiates agency consideration of such person shall be considered to be regularly employed as soon as he or she is employed by such person for 130 working days.

State, as used in this clause, means a State of the United States, the District of Columbia, or an outlying area of the United States, an agency or instrumentality of a State, and multi-State, regional, or interstate entity having governmental duties and powers.

(b) Prohibitions.

(1) Section 1352 of Title 31, United States Code, among other things, prohibits a recipient of a Federal contract, grant, loan, or cooperative agreement from using appropriated funds to pay any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with any of the following covered Federal actions: the awarding of any Federal contract; the making of any Federal grant; the making of any Federal loan; the entering into of any cooperative agreement; or the modification of any Federal contract, grant, loan, or cooperative agreement.

(2) The Act also requires Contractors to furnish a disclosure if any funds other than Federal appropriated funds (including profit or fee received under a covered Federal transaction) have been paid, or will be paid, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with a Federal contract, grant, loan, or cooperative agreement.

(3) The prohibitions of the Act do not apply under the following conditions:

(i) Agency and legislative liaison by own employees.

(A) The prohibition on the use of appropriated funds, in subparagraph (b)(1) of this clause, does not apply in the case of a payment of reasonable compensation made to an officer or employee of a person requesting or receiving a covered Federal action if the payment is for agency and legislative liaison activities not directly related to a covered Federal action.

(B) For purposes of subdivision (b)(3)(i)(A) of this clause, providing any information specifically requested by an agency or Congress is permitted at any time.

(C) The following agency and legislative liaison activities are permitted at any time where they are not related to a specific solicitation for any covered Federal action:

(1) Discussing with an agency the qualities and characteristics (including individual demonstrations) of the person's products or services, conditions or terms of sale, and service capabilities.

(2) Technical discussions and other activities regarding the application or adaptation of the person's products or services for an agency's use.

(D) The following agency and legislative liaison activities are permitted where they are prior to formal solicitation of any covered Federal action--

(1) Providing any information not specifically requested but necessary for an agency to make an informed decision about initiation of a covered Federal action;

(2) Technical discussions regarding the preparation of an unsolicited proposal prior to its official submission; and

(3) Capability presentations by persons seeking awards from an agency pursuant to the provisions of the Small Business Act, as amended by Pub. L. 95-507, and subsequent amendments.

(E) Only those services expressly authorized by subdivision (b)(3)(i)(A) of this clause are permitted under this clause.

(ii) Professional and technical services.

(A) The prohibition on the use of appropriated funds, in subparagraph (b)(1) of this clause, does not apply in the case of--

(1) A payment of reasonable compensation made to an officer or employee of a person requesting or receiving a covered Federal action or an extension, continuation, renewal, amendment, or modification of a covered Federal action, if payment is for professional or technical services rendered directly in the preparation, submission, or negotiation of any bid, proposal, or application for that Federal action or for meeting requirements imposed by or pursuant to law as a condition for receiving that Federal action.

(2) Any reasonable payment to a person, other than an officer or employee of a person requesting or receiving a covered Federal action or an extension, continuation, renewal, amendment, or modification of a covered Federal action if the payment is for professional or technical services rendered directly in the preparation, submission, or negotiation of any bid, proposal, or application for that Federal action or for meeting requirements imposed by or pursuant to law as a condition for receiving that Federal action. Persons other than officers or employees of a person requesting or receiving a covered Federal action include consultants and trade associations.

(B) For purposes of subdivision (b)(3)(ii)(A) of this clause, "professional and technical services" shall be limited to advice and analysis directly applying any professional or technical discipline. For example, drafting of a legal document accompanying a bid or proposal by a lawyer is allowable. Similarly, technical advice provided by an engineer on the performance or operational capability of a piece of equipment rendered directly in the negotiation of a contract is allowable. However, communications with the intent to influence made by a professional (such as a licensed lawyer) or a technical person (such as a licensed accountant) are not allowable under this section unless they provide advice and analysis directly applying their professional or technical expertise and unless the advice or analysis is rendered directly and solely in the preparation, submission or negotiation of a covered Federal action. Thus, for example, communications with the intent to influence made by a lawyer that do not provide legal advice or analysis directly and solely related to the legal aspects of his or her client's proposal, but generally advocate one proposal over another are not allowable under this section because the lawyer is not providing professional legal services. Similarly, communications with the intent to influence made by an engineer providing an engineering analysis prior to the preparation or submission of a bid or proposal are not allowable under this section since the engineer is providing technical services but not directly in the preparation, submission or negotiation of a covered Federal action.

(C) Requirements imposed by or pursuant to law as a condition for receiving a covered Federal award include those required by law or regulation and any other requirements in the actual award documents.

(D) Only those services expressly authorized by subdivisions (b)(3)(ii)(A)(1) and (2) of this clause are permitted under this clause.

(E) The reporting requirements of FAR 3.803(a) shall not apply with respect to payments of reasonable compensation made to regularly employed officers or employees of a person.

(c) Disclosure.

(1) The Contractor who requests or receives from an agency a Federal contract shall file with that agency a disclosure form, OMB standard form LLL, Disclosure of Lobbying Activities, if such person has made or has agreed to make any payment using nonappropriated funds (to include profits from any covered Federal action), which would be prohibited under subparagraph (b)(1) of this clause, if paid for with appropriated funds.

(2) The Contractor shall file a disclosure form at the end of each calendar quarter in which there occurs any event that materially affects the accuracy of the information contained in any disclosure form previously filed by such person under subparagraph (c)(1) of this clause. An event that materially affects the accuracy of the information reported includes--

(i) A cumulative increase of $25,000 or more in the amount paid or expected to be paid for influencing or attempting to influence a covered Federal action; or

(ii) A change in the person(s) or individual(s) influencing or attempting to influence a covered Federal action; or

(iii) A change in the officer(s), employee(s), or Member(s) contacted to influence or attempt to influence a covered Federal action.

(3) The Contractor shall require the submittal of a certification, and if required, a disclosure form by any person who requests or receives any subcontract exceeding $100,000 under the Federal contract.

(4) All subcontractor disclosure forms (but not certifications) shall be forwarded from tier to tier until received by the prime Contractor. The prime Contractor shall submit all disclosures to the Contracting Officer at the end of the calendar quarter in which the disclosure form is submitted by the subcontractor. Each subcontractor certification shall be retained in the subcontract file of the awarding Contractor.

(d) Agreement. The Contractor agrees not to make any payment prohibited by this clause.

(e) Penalties.

(1) Any person who makes an expenditure prohibited under paragraph (a) of this clause or who fails to file or amend the disclosure form to be filed or amended by paragraph (b) of this clause shall be subject to civil penalties as provided for by 31 U.S.C. 1352. An imposition of a civil penalty does not prevent the Government from seeking any other remedy that may be applicable.

(2) Contractors may rely without liability on the representation made by their subcontractors in the certification and disclosure form.

(f) Cost allowability. Nothing in this clause makes allowable or reasonable any costs which would otherwise be unallowable or unreasonable. Conversely, costs made specifically unallowable by the requirements in this clause will not be made allowable under any other provision.

(End of clause)

52.204-4 PRINTED OR COPIED DOUBLE-SIDED ON RECYCLED PAPER (AUG 2000)

(a) Definitions. As used in this clause--

“Postconsumer material” means a material or finished product that has served its intended use and has been discarded for disposal or recovery, having completed its life as a consumer item. Postconsumer material is a part of the broader category of “recovered material.” For paper and paper products, postconsumer material means “postconsumer fiber” defined by the U.S. Environmental Protection Agency (EPA) as--

(1) Paper, paperboard, and fibrous materials from retail stores, office buildings, homes, and so forth, after they have passed through their end-usage as a consumer item, including: used corrugated boxes; old newspapers; old magazines; mixed waste paper; tabulating cards; and used cordage; or

(2) All paper, paperboard, and fibrous materials that enter and are collected from municipal solid waste; but not

(3) Fiber derived from printers' over-runs, converters' scrap, and over-issue publications.

“Printed or copied double-sided” means printing or reproducing a document so that information is on both sides of a sheet of paper.

“Recovered material,” for paper and paper products, is defined by EPA in its Comprehensive Procurement Guideline as “recovered fiber” and means the following materials:

(1) Postconsumer fiber; and

(2) Manufacturing wastes such as--

(i) Dry paper and paperboard waste generated after completion of the papermaking process (that is, those manufacturing operations up to and including the cutting and trimming of the paper machine reel into smaller rolls or rough sheets) including: envelope cuttings, bindery trimmings, and other paper and paperboard waste resulting from printing, cutting, forming, and other converting operations; bag, box, and carton manufacturing wastes; and butt rolls, mill wrappers, and rejected unused stock; and

(ii) Repulped finished paper and paperboard from obsolete inventories of paper and paperboard manufacturers, merchants, wholesalers, dealers, printers, converters, or others.

(b) In accordance with Section 101 of Executive Order 13101 of September 14, 1998, Greening the Government through Waste Prevention, Recycling, and Federal Acquisition, the Contractor is encouraged to submit paper documents, such as offers, letters, or reports, that are printed or copied double-sided on recycled paper that meet minimum content standards specified in Section 505 of Executive Order 13101, when not using electronic commerce methods to submit information or data to the Government.

(c) If the Contractor cannot purchase high-speed copier paper, offset paper, forms bond, computer printout paper, carbonless paper, file folders, white wove envelopes, writing and office paper, book paper, cotton fiber paper, and cover stock meeting the 30 percent postconsumer material standard for use in submitting paper documents to the Government, it should use paper containing no less than 20 percent postconsumer material. This lesser standard should be used only when paper meeting the 30 percent postconsumer material standard is not obtainable at a reasonable price or does not meet reasonable performance standards.

(End of clause)

52.204-7 CENTRAL CONTRACTOR REGISTRATION (OCT 2003)

(a) Definitions. As used in this clause--

Central Contractor Registration (CCR) database means the primary Government repository for Contractor information required for the conduct of business with the Government.

Data Universal Numbering System (DUNS) number means the 9-digit number assigned by Dun and Bradstreet, Inc. (D&B) to identify unique business entities.

Data Universal Numbering System +4 (DUNS+4) number means the DUNS number assigned by D&B plus a 4-character suffix that may be assigned by a business concern. (D&B has no affiliation with this 4-character suffix.) This 4-character suffix may be assigned at the discretion of the business concern to establish additional CCR records for identifying alternative Electronic Funds Transfer (EFT) accounts (see the FAR at Subpart 32.11) for the same parent concern.

Registered in the CCR database means that--

(1) The Contractor has entered all mandatory information, including the DUNS number or the DUNS+4 number, into the CCR database; and

(2) The Government has validated all mandatory data fields and has marked the record “Active”.

(b)(1) By submission of an offer, the offeror acknowledges the requirement that a prospective awardee shall be registered in the CCR database prior to award, during performance, and through final payment of any contract, basic agreement, basic ordering agreement, or blanket purchasing agreement resulting from this solicitation.

(2) The offeror shall enter, in the block with its name and address on the cover page of its offer, the annotation “DUNS” or “DUNS +4” followed by the DUNS or DUNS +4 number that identifies the offeror's name and address exactly as stated in the offer. The DUNS number will be used by the Contracting Officer to verify that the offeror is registered in the CCR database.

(c) If the offeror does not have a DUNS number, it should contact Dun and Bradstreet directly to obtain one.

(1) An offeror may obtain a DUNS number--

(i) If located within the United States, by calling Dun and Bradstreet at 1-866-705-5711 or via the Internet at http://www.dnb.com; or

(ii) If located outside the United States, by contacting the local Dun and Bradstreet office.

(2) The offeror should be prepared to provide the following information:

(i) Company legal business.

(ii) Tradestyle, doing business, or other name by which your entity is commonly recognized.

(iii) Company Physical Street Address, City, State, and Zip Code.

(iv) Company Mailing Address, City, State and Zip Code (if separate from physical).

(v) Company Telephone Number.

(vi) Date the company was started.

(vii) Number of employees at your location.

(viii) Chief executive officer/key manager.

(ix) Line of business (industry).

(x) Company Headquarters name and address (reporting relationship within your entity).

(d) If the Offeror does not become registered in the CCR database in the time prescribed by the Contracting Officer, the Contracting Officer will proceed to award to the next otherwise successful registered Offeror.

(e) Processing time, which normally takes 48 hours, should be taken into consideration when registering. Offerors who are not registered should consider applying for registration immediately upon receipt of this solicitation.

(f) The Contractor is responsible for the accuracy and completeness of the data within the CCR database, and for any liability resulting from the Government's reliance on inaccurate or incomplete data. To remain registered in the CCR

database after the initial registration, the Contractor is required to review and update on an annual basis from the date of initial registration or subsequent updates its information in the CCR database to ensure it is current, accurate and complete. Updating information in the CCR does not alter the terms and conditions of this contract and is not a substitute for a properly executed contractual document.

(g)(1)(i) If a Contractor has legally changed its business name, “doing business as” name, or division name (whichever is shown on the contract), or has transferred the assets used in performing the contract, but has not completed the necessary requirements regarding novation and change-of-name agreements in Subpart 42.12, the Contractor shall provide the responsible Contracting Officer a minimum of one business day's written notification of its intention to (A) change the name in the CCR database; (B) comply with the requirements of Subpart 42.12 of the FAR; and (C) agree in writing to the timeline and procedures specified by the responsible Contracting Officer. The Contractor must provide with the notification sufficient documentation to support the legally changed name.

(ii) If the Contractor fails to comply with the requirements of paragraph (g)(1)(i) of this clause, or fails to perform the agreement at paragraph (g)(1)(i)(C) of this clause, and, in the absence of a properly executed novation or change-of-name agreement, the CCR information that shows the Contractor to be other than the Contractor indicated in the contract will be considered to be incorrect information within the meaning of the “Suspension of Payment” paragraph of the electronic funds transfer (EFT) clause of this contract.

(2) The Contractor shall not change the name or address for EFT payments or manual payments, as appropriate, in the CCR record to reflect an assignee for the purpose of assignment of claims (see FAR Subpart 32.8, Assignment of Claims). Assignees shall be separately registered in the CCR database. Information provided to the Contractor's CCR record that indicates payments, including those made by EFT, to an ultimate recipient other than that Contractor will be considered to be incorrect information within the meaning of the “Suspension of payment” paragraph of the EFT clause of this contract.

(h) Offerors and Contractors may obtain information on registration and annual confirmation requirements via the internet at http://www.ccr.gov or by calling 1-888-227-2423, or 269-961-5757.

(End of clause)

52.209-6 PROTECTING THE GOVERNMENT'S INTEREST WHEN SUBCONTRACTING WITH CONTRACTORS DEBARRED, SUSPENDED, OR PROPOSED FOR DEBARMENT (JUL 1995)

(a) The Government suspends or debars Contractors to protect the Government's interests. The Contractor shall not enter into any subcontract in excess of the $25,000 with a Contractor that is debarred, suspended, or proposed for debarment unless there is a compelling reason to do so.

(b) The Contractor shall require each proposed first-tier subcontractor, whose subcontract will exceed $25,000, to disclose to the Contractor, in writing, whether as of the time of award of the subcontract, the subcontractor, or its principles, is or is not debarred, suspended, or proposed for debarment by the Federal Government.

(c) A corporate officer or a designee of the Contractor shall notify the Contracting Officer, in writing, before entering into a subcontract with a party that is debarred, suspended, or proposed for debarment (see FAR 9.404 for information on the List of Parties Excluded from Federal Procurement and Nonprocurement Programs). The notice must include the following:

(1) The name of the subcontractor.

(2) The Contractor's knowledge of the reasons for the subcontractor being on the List of Parties Excluded from Federal Procurement and Nonprocurement Programs.

(3) The compelling reason(s) for doing business with the subcontractor notwithstanding its inclusion on the List of Parties Excluded from Federal Procurement and Nonprocurement Programs.

(4) The systems and procedures the Contractor has established to ensure that it is fully protecting the Government's interests when dealing with such subcontractor in view of the specific basis for the party's debarment, suspension, or proposed debarment.

(End of clause)

52.211-12 LIQUIDATED DAMAGES--CONSTRUCTION (SEP 2000)

(a) If the Contractor fails to complete the work within the time specified in the contract, the Contractor shall pay liquidated damages to the Government in the amount of $2,021.00 for each calendar day of delay until the work is completed or accepted.

(b) If the Government terminates the Contractor's right to proceed, liquidated damages will continue to accrue until the work is completed. These liquidated damages are in addition to excess costs of repurchase under the Termination clause.

(End of clause)

52.211-15 DEFENSE PRIORITY AND ALLOCATION REQUIREMENTS (SEP 1990)

This is a rated order certified for national defense use, and the Contractor shall follow all the requirements of the Defense Priorities and Allocations System regulation (15 CFR 700).

(End of clause)

52.211-18 VARIATION IN ESTIMATED QUANTITY (APR 1984)

If the quantity of a unit-priced item in this contract is an estimated quantity and the actual quantity of the unit-priced item varies more than 15 percent above or below the estimated quantity, an equitable adjustment in the contract price shall be made upon demand of either party. The equitable adjustment shall be based upon any increase or decrease in costs due solely to the variation above 115 percent or below 85 percent of the estimated quantity. If the quantity variation is such as to cause an increase in the time necessary for completion, the Contractor may request, in writing, an extension of time, to be received by the Contracting Officer within 10 days from the beginning of the delay, or within such further period as may be granted by the Contracting Officer before the date of final settlement of the contract. Upon the receipt of a written request for an extension, the Contracting Officer shall ascertain the facts and make an adjustment for extending the completion date as, in the judgement of the Contracting Officer, is justified.

52.215-2 AUDIT AND RECORDS--NEGOTIATION (JUN 1999)

(a) As used in this clause, "records" includes books, documents, accounting procedures and practices, and other data, regardless of type and regardless of whether such items are in written form, in the form of computer data, or in any other form.

(b) Examination of costs. If this is a cost-reimbursement, incentive, time-and-materials, labor-hour, or price redeterminable contract, or any combination of these, the Contractor shall maintain and the Contracting Officer, or an authorized representative of the Contracting Officer, shall have the right to examine and audit all records and other evidence sufficient to reflect properly all costs claimed to have been incurred or anticipated to be incurred directly or indirectly in performance of this contract. This right of examination shall include inspection at all reasonable times of the Contractor's plants, or parts of them, engaged in performing the contract.

(c) Cost or pricing data. If the Contractor has been required to submit cost or pricing data in connection with any pricing action relating to this contract, the Contracting Officer, or an authorized representative of the Contracting Officer, in order to evaluate the accuracy, completeness, and currency of the cost or pricing data, shall have the right to examine and audit all of the Contractor's records, including computations and projections, related to--

(1) The proposal for the contract, subcontract, or modification;

(2) The discussions conducted on the proposal(s), including those related to negotiating;

(3) Pricing of the contract, subcontract, or modification; or

(4) Performance of the contract, subcontract or modification.

(d) Comptroller General--(1) The Comptroller General of the United States, or an authorized representative, shall have access to and the right to examine any of the Contractor's directly pertinent records involving transactions related to this contract or a subcontract hereunder.

(2) This paragraph may not be construed to require the Contractor or subcontractor to create or maintain any record that the Contractor or subcontractor does not maintain in the ordinary course of business or pursuant to a provision of law.

(e) Reports. If the Contractor is required to furnish cost, funding, or performance reports, the Contracting Officer or an authorized representative of the Contracting Officer shall have the right to examine and audit the supporting records and materials, for the purpose of evaluating (1) the effectiveness of the Contractor's policies and procedures to produce data compatible with the objectives of these reports and (2) the data reported.

(f) Availability. The Contractor shall make available at its office at all reasonable times the records, materials, and other evidence described in paragraphs (a), (b), (c), (d), and (e) of this clause, for examination, audit, or reproduction, until 3 years after final payment under this contract or for any shorter period specified in Subpart 4.7, Contractor Records Retention, of the Federal Acquisition Regulation (FAR), or for any longer period required by statute or by other clauses of this contract. In addition--

(1) If this contract is completely or partially terminated, the Contractor shall make available the records relating to the work terminated until 3 years after any resulting final termination settlement; and

(2) The Contractor shall make available records relating to appeals under the Disputes clause or to litigation or the settlement of claims arising under or relating to this contract until such appeals, litigation, or claims are finally resolved.

(g) The Contractor shall insert a clause containing all the terms of this clause, including this paragraph (g), in all subcontracts under this contract that exceed the simplified acquisition threshold, and--

(1) That are cost-reimbursement, incentive, time-and-materials, labor-hour, or price-redeterminable type or any combination of these;

(2) For which cost or pricing data are required; or

(3) That require the subcontractor to furnish reports as discussed in paragraph (e) of this clause.

The clause may be altered only as necessary to identify properly the contracting parties and the Contracting Officer under the Government prime contract.

(End of clause)

52.215-10 PRICE REDUCTION FOR DEFECTIVE COST OR PRICING DATA (OCT 1997)

(a) If any price, including profit or fee, negotiated in connection with this contract, or any cost reimbursable under this contract, was increased by any significant amount because--

(1) The Contractor or a subcontractor furnished cost or pricing data that were not complete, accurate, and current as certified in its Certificate of Current Cost or Pricing Data;

(2) A subcontractor or prospective subcontractor furnished the Contractor cost or pricing data that were not complete, accurate, and current as certified in the Contractor's Certificate of Current Cost or Pricing Data; or

(3) Any of these parties furnished data of any description that were not accurate, the price or cost shall be reduced accordingly and the contract shall be modified to reflect the reduction.

(b) Any reduction in the contract price under paragraph (a) of this clause due to defective data from a prospective subcontractor that was not subsequently awarded the subcontract shall be limited to the amount, plus applicable overhead and profit markup, by which--

(1) The actual subcontract; or

(2) The actual cost to the Contractor, if there was no subcontract, was less than the prospective subcontract cost estimate submitted by the Contractor; provided, that the actual subcontract price was not itself affected by defective cost or pricing data.

(c)(1) If the Contracting Officer determines under paragraph (a) of this clause that a price or cost reduction should be made, the Contractor agrees not to raise the following matters as a defense:

(i) The Contractor or subcontractor was a sole source supplier or otherwise was in a superior bargaining position and thus the price of the contract would not have been modified even if accurate, complete, and current cost or pricing data had been submitted.

(ii) The Contracting Officer should have known that the cost or pricing data in issue were defective even though the Contractor or subcontractor took no affirmative action to bring the character of the data to the attention of the Contracting Officer.

(iii) The contract was based on an agreement about the total cost of the contract and there was no agreement about the cost of each item procured under the contract.

(iv) The Contractor or subcontractor did not submit a Certificate of Current Cost or Pricing Data.

(2)(i) Except as prohibited by subdivision (c)(2)(ii) of this clause, an offset in an amount determined appropriate by the Contracting Officer based upon the facts shall be allowed against the amount of a contract price reduction if--

(A) The Contractor certifies to the Contracting Officer that, to the best of the Contractor's knowledge and belief, the Contractor is entitled to the offset in the amount requested; and

(B) The Contractor proves that the cost or pricing data were available before the “as of” date specified on its Certificate of Current Cost or Pricing Data, and that the data were not submitted before such date.

(ii) An offset shall not be allowed if--

(A) The understated data were known by the Contractor to be understated before the “as of” date specified on its Certificate of Current Cost or Pricing Data; or

(B) The Government proves that the facts demonstrate that the contract price would not have increased in the amount to be offset even if the available data had been submitted before the “as of” date specified on its Certificate of Current Cost or Pricing Data.

(d) If any reduction in the contract price under this clause reduces the price of items for which payment was made prior to the date of the modification reflecting the price reduction, the Contractor shall be liable to and shall pay the United States at the time such overpayment is repaid--

(1) Simple interest on the amount of such overpayment to be computed from the date(s) of overpayment to the Contractor to the date the Government is repaid by the Contractor at the applicable underpayment rate effective for each quarter prescribed by the Secretary of the Treasury under 26 U.S.C. 6621(a)(2); and

A penalty equal to the amount of the overpayment, if the Contractor or subcontractor knowingly submitted cost or pricing data that were incomplete, inaccurate, or noncurrent.

(End of clause)

52.215-11 PRICE REDUCTION FOR DEFECTIVE COST OR PRICING DATA--MODIFICATIONS (OCT 1997)

(a) This clause shall become operative only for any modification to this contract involving a pricing adjustment expected to exceed the threshold for submission of cost or pricing data at FAR 15.403-4, except that this clause does not apply to any modification if an exception under FAR 15.403-1 applies.

(b) If any price, including profit or fee, negotiated in connection with any modification under this clause, or any cost reimbursable under this contract, was increased by any significant amount because (1) the Contractor or a subcontractor furnished cost or pricing data that were not complete, accurate, and current as certified in its Certificate of Current Cost or Pricing Data, (2) a subcontractor or prospective subcontractor furnished the Contractor cost or pricing data that were not complete, accurate, and current as certified in the Contractor's Certificate of Current Cost or Pricing Data, or (3) any of these parties furnished data of any description that were not accurate, the price or cost shall be reduced accordingly and the contract shall be modified to reflect the reduction. This right to a price reduction is limited to that resulting from defects in data relating to modifications for which this clause becomes operative under paragraph (a) of this clause.

(c) Any reduction in the contract price under paragraph (b) of this clause due to defective data from a prospective subcontractor that was not subsequently awarded the subcontract shall be limited to the amount, plus applicable overhead and profit markup, by which--

(1) The actual subcontract; or

(2) The actual cost to the Contractor, if there was no subcontract, was less than the prospective subcontract cost estimate submitted by the Contractor; provided, that the actual subcontract price was not itself affected by defective cost or pricing data.

(d)(1) If the Contracting Officer determines under paragraph (b) of this clause that a price or cost reduction should be made, the Contractor agrees not to raise the following matters as a defense:

(i) The Contractor or subcontractor was a sole source supplier or otherwise was in a superior bargaining position and thus the price of the contract would not have been modified even if accurate, complete, and current cost or pricing data had been submitted.

(ii) The Contracting Officer should have known that the cost or pricing data in issue were defective even though the Contractor or subcontractor took no affirmative action to bring the character of the data to the attention of the Contracting Officer.

(iii) The contract was based on an agreement about the total cost of the contract and there was no agreement about the cost of each item procured under the contract.

(iv) The Contractor or subcontractor did not submit a Certificate of Current Cost or Pricing Data.

(2)(i) Except as prohibited by subdivision (d)(2)(ii) of this clause, an offset in an amount determined appropriate by the Contracting Officer based upon the facts shall be allowed against the amount of a contract price reduction if--

(A) The Contractor certifies to the Contracting Officer that, to the best of the Contractor's knowledge and belief, the Contractor is entitled to the offset in the amount requested; and

(B) The Contractor proves that the cost or pricing data were available before the “as of” date specified on its Certificate of Current Cost or Pricing Data, and that the data were not submitted before such date.

(ii) An offset shall not be allowed if--

(A) The understated data were known by the Contractor to be understated before the “as of” date specified on its Certificate of Current Cost or Pricing Data; or

(B) The Government proves that the facts demonstrate that the contract price would not have increased in the amount to be offset even if the available data had been submitted before the “as of” date specified on its Certificate of Current Cost or Pricing Data.

(e) If any reduction in the contract price under this clause reduces the price of items for which payment was made prior to the date of the modification reflecting the price reduction, the Contractor shall be liable to and shall pay the United States at the time such overpayment is repaid--

(1) Simple interest on the amount of such overpayment to be computed from the date(s) of overpayment to the Contractor to the date the Government is repaid by the Contractor at the applicable underpayment rate effective for each quarter prescribed by the Secretary of the Treasury under 26 U.S.C. 6621(a)(2); and

A penalty equal to the amount of the overpayment, if the Contractor or subcontractor knowingly submitted cost or pricing data that were incomplete, inaccurate, or noncurrent.

(End of clause)

52.215-12 SUBCONTRACTOR COST OR PRICING DATA (OCT 1997)

(a) Before awarding any subcontract expected to exceed the threshold for submission of cost or pricing data at FAR 15.403-4, on the date of agreement on price or the date of award, whichever is later; or before pricing any subcontract modification involving a pricing adjustment expected to exceed the threshold for submission of cost or pricing data at FAR 15.403-4, the Contractor shall require the subcontractor to submit cost or pricing data (actually or by specific identification in writing), unless an exception under FAR 15.403-1 applies.

(b) The Contractor shall require the subcontractor to certify in substantially the form prescribed in FAR 15.406-2 that, to the best of its knowledge and belief, the data submitted under paragraph (a) of this clause were accurate, complete, and current as of the date of agreement on the negotiated price of the subcontract or subcontract modification.

(c) In each subcontract that exceeds the threshold for submission of cost or pricing data at FAR 15.403-4, when entered into, the Contractor shall insert either--

(1) The substance of this clause, including this paragraph (c), if paragraph (a) of this clause requires submission of cost or pricing data for the subcontract; or

(2) The substance of the clause at FAR 52.215-13, Subcontractor Cost or Pricing Data--Modifications.

52.215-13 SUBCONTRACTOR COST OR PRICING DATA--MODIFICATIONS (OCT 1997)

(a) The requirements of paragraphs (b) and (c) of this clause shall--

(1) Become operative only for any modification to this contract involving a pricing adjustment expected to exceed the threshold for submission of cost or pricing data at FAR 15.403-4; and

(2) Be limited to such modifications.

(b) Before awarding any subcontract expected to exceed the threshold for submission of cost or pricing data at FAR 15.403-4, on the date of agreement on price or the date of award, whichever is later; or before pricing any subcontract modification involving a pricing adjustment expected to exceed the threshold for submission of cost or pricing data at FAR 15.403-4, the Contractor shall require the subcontractor to submit cost or pricing data (actually or by specific identification in writing), unless an exception under FAR 15.403-1 applies.

(c) The Contractor shall require the subcontractor to certify in substantially the form prescribed in FAR 15.406-2 that, to the best of its knowledge and belief, the data submitted under paragraph (b) of this clause were accurate, complete, and current as of the date of agreement on the negotiated price of the subcontract or subcontract modification.

The Contractor shall insert the substance of this clause, including this paragraph (d), in each subcontract that exceeds the threshold for submission of cost or pricing data at FAR 15.403-4 on the date of agreement on price or the date of award, whichever is later.

(End of clause)

52.215-14 INTEGRITY OF UNIT PRICES (OCT 1997)

(a) Any proposal submitted for the negotiation of prices for items of supplies shall distribute costs within contracts on a basis that ensures that unit prices are in proportion to the items' base cost (e.g., manufacturing or acquisition costs). Any method of distributing costs to line items that distorts unit prices shall not be used. For example,

distributing costs equally among line items is not acceptable except when there is little or no variation in base cost. Nothing in this paragraph requires submission of cost or pricing data not otherwise required by law or regulation.

(b) When requested by the Contracting Officer, the Offeror/Contractor shall also identify those supplies that it will not manufacture or to which it will not contribute significant value.

The Contractor shall insert the substance of this clause, less paragraph (b), in all subcontracts for other than: acquisitions at or below the simplified acquisition threshold in FAR Part 2; construction or architect-engineer services under FAR Part 36; utility services under FAR Part 41; services where supplies are not required; commercial items; and petroleum products.

(End of clause)

52.219-8 UTILIZATION OF SMALL BUSINESS CONCERNS (OCT 2000)

(a) It is the policy of the United States that small business concerns, veteran-owned small business concerns, service-disabled veteran-owned small business concerns, HUBZone small business concerns, small disadvantaged business concerns, and women-owned small business concerns shall have the maximum practicable opportunity to participate in performing contracts let by any Federal agency, including contracts and subcontracts for subsystems, assemblies, components, and related services for major systems. It is further the policy of the United States that its prime contractors establish procedures to ensure the timely payment of amounts due pursuant to the terms of their subcontracts with small business concerns, veteran-owned small business concerns, service-disabled veteran-owned small business concerns, HUBZone small business concerns, small disadvantaged business concerns, and women-owned small business concerns.

(b) The Contractor hereby agrees to carry out this policy in the awarding of subcontracts to the fullest extent consistent with efficient contract performance. The Contractor further agrees to cooperate in any studies or surveys as may be conducted by the United States Small Business Administration or the awarding agency of the United States as may be necessary to determine the extent of the Contractor's compliance with this clause.

Definitions. As used in this contract--

HUBZone small business concern means a small business concern that appears on the List of Qualified HUBZone Small Business Concerns maintained by the Small Business Administration.

Service-disabled veteran-owned small business concern--

(1) Means a small business concern--

(i) Not less than 51 percent of which is owned by one or more service-disabled veterans or, in the case of any publicly owned business, not less than 51 percent of the stock of which is owned by one or more service-disabled veterans; and

(ii) The management and daily business operations of which are controlled by one or more service-disabled veterans or, in the case of a veteran with permanent and severe disability, the spouse or permanent caregiver of such veteran.

(2) Service-disabled veteran means a veteran, as defined in 38 U.S.C. 101(2), with a disability that is service-connected, as defined in 38 U.S.C. 101(16).

Small business concern means a small business as defined pursuant to Section 3 of the Small Business Act and relevant regulations promulgated pursuant thereto.

Small disadvantaged business concern means a small business concern that represents, as part of its offer that--

(1) It has received certification as a small disadvantaged business concern consistent with 13 CFR part 124, subpart B;

(2) No material change in disadvantaged ownership and control has occurred since its certification;

(3) Where the concern is owned by one or more individuals, the net worth of each individual upon whom the certification is based does not exceed $750,000 after taking into account the applicable exclusions set forth at 13 CFR 124.104(c)(2); and

(4) It is identified, on the date of its representation, as a certified small disadvantaged business in the database maintained by the Small Business Administration (PRO-Net).

Veteran-owned small business concern means a small business concern--

(1) Not less than 51 percent of which is owned by one or more veterans (as defined at 38 U.S.C. 101(2)) or, in the case of any publicly owned business, not less than 51 percent of the stock of which is owned by one or more veterans; and

(2) The management and daily business operations of which are controlled by one or more veterans.

Women-owned small business concern means a small business concern--

(1) That is at least 51 percent owned by one or more women, or, in the case of any publicly owned business, at least 51 percent of the stock of which is owned by one or more women; and

(2) Whose management and daily business operations are controlled by one or more women.

(d) Contractors acting in good faith may rely on written representations by their subcontractors regarding their status as a small business concern, a veteran-owned small business concern, a service-disabled veteran-owned small business concern, a HUBZone small business concern, a small disadvantaged business concern, or a women-owned small business concern.

(End of clause)

52.219-9 SMALL BUSINESS SUBCONTRACTING PLAN (JAN 2002)

(a) This clause does not apply to small business concerns.

(b) Definitions. As used in this clause--

Commercial item means a product or service that satisfies the definition of commercial item in section 2.101 of the Federal Acquisition Regulation.

Commercial plan means a subcontracting plan (including goals) that covers the offeror's fiscal year and that applies to the entire production of commercial items sold by either the entire company or a portion thereof (e.g., division, plant, or product line).

Individual contract plan means a subcontracting plan that covers the entire contract period (including option periods), applies to a specific contract, and has goals that are based on the offeror's planned subcontracting in

support of the specific contract, except that indirect costs incurred for common or joint purposes may be allocated on a prorated basis to the contract.

Master plan means a subcontracting plan that contains all the required elements of an individual contract plan, except goals, and may be incorporated into individual contract plans, provided the master plan has been approved.

Subcontract means any agreement (other than one involving an employer-employee relationship) entered into by a Federal Government prime Contractor or subcontractor calling for supplies or services required for performance of the contract or subcontract.

(c) The offeror, upon request by the Contracting Officer, shall submit and negotiate a subcontracting plan, where applicable, that separately addresses subcontracting with small business, veteran-owned small business, HUBZone small business concerns, small disadvantaged business, and women-owned small business concerns. If the offeror is submitting an individual contract plan, the plan must separately address subcontracting with small business, veteran-owned small business, HUBZone small business, small disadvantaged business, and women-owned small business concerns, with a separate part for the basic contract and separate parts for each option (if any). The plan shall be included in and made a part of the resultant contract. The subcontracting plan shall be negotiated within the time specified by the Contracting Officer. Failure to submit and negotiate the subcontracting plan shall make the offeror ineligible for award of a contract.

(d) The offeror's subcontracting plan shall include the following:

(1) Goals, expressed in terms of percentages of total planned subcontracting dollars, for the use of small business, veteran-owned small business, HUBZone small business, small disadvantaged business, and women-owned small business concerns as subcontractors. The offeror shall include all subcontracts that contribute to contract performance, and may include a proportionate share of products and services that are normally allocated as indirect costs.

(2) A statement of--

(i) Total dollars planned to be subcontracted for an individual contract plan; or the offeror's total projected sales, expressed in dollars, and the total value of projected subcontracts to support the sales for a commercial plan;

(ii) Total dollars planned to be subcontracted to small business concerns;

(iii) Total dollars planned to be subcontracted to veteran-owned small business concerns;

(iv) Total dollars planned to be subcontracted to HUBZone small business concerns;

(v) Total dollars planned to be subcontracted to small disadvantaged business concerns; and

(vi) Total dollars planned to be subcontracted to women-owned small business concerns.

(3) A description of the principal types of supplies and services to be subcontracted, and an identification of the types planned for subcontracting to--

(i) Small business concerns;

(ii) Veteran-owned small business concerns;

(iii) HUBZone small business concerns;

(iv) Small disadvantaged business concerns; and

(v) Women-owned small business concerns.

(4) A description of the method used to develop the subcontracting goals in paragraph (d)(1) of this clause.

(5) A description of the method used to identify potential sources for solicitation purposes (e.g., existing company source lists, the Procurement Marketing and Access Network (PRO-Net) of the Small Business Administration (SBA), veterans service organizations, the National Minority Purchasing Council Vendor Information Service, the Research and Information Division of the Minority Business Development Agency in the Department of Commerce, or small, HUBZone, small disadvantaged, and women-owned small business trade associations). A firm may rely on the information contained in PRO-Net as an accurate representation of a concern's size and ownership characteristics for the purposes of maintaining a small, veteran-owned small, HUBZone small, small disadvantaged, and women-owned small business source list. Use of PRO-Net as its source list does not relieve a firm of its responsibilities (e.g., outreach, assistance, counseling, or publicizing subcontracting opportunities) in this clause.

(6) A statement as to whether or not the offeror in included indirect costs in establishing subcontracting goals, and a description of the method used to determine the proportionate share of indirect costs to be incurred with—

(i) Small business concerns;

(ii) Veteran-owned small business concerns;

(iii) HUBZone small business concerns;

(iv) Small disadvantaged business concerns; and

(v) Women-owned small business concerns.

(7) The name of the individual employed by the offeror who will administer the offeror's subcontracting program, and a description of the duties of the individual.

(8) A description of the efforts the offeror will make to assure that small business, veteran-owned small business, HUBZone small business, small disadvantaged business and women-owned small business concerns have an equitable opportunity to compete for subcontracts.

(9) Assurances that the offeror will include the clause of this contract entitled ``Utilization of Small Business Concerns'' in all subcontracts that offer further subcontracting opportunities, and that the offeror will require all subcontractors (except small business concerns) that receive subcontracts in excess of $500,000 ($1,000,000 for construction of any public facility) to adopt a subcontracting plan that complies with the requirements of this clause.

(10) Assurances that the offeror will--

(i) Cooperate in any studies or surveys as may be required;

(ii) Submit periodic reports so that the Government can determine the extent of compliance by the offeror with the subcontracting plan;

(iii) Submit Standard Form (SF) 294, Subcontracting Report for Individual Contracts, and/or SF 295, Summary Subcontract Report, in accordance with paragraph (j) of this clause. The reports shall provide information on subcontract awards to small business concerns, veteran-owned small business concerns, service-disabled veteran-owned small business concerns, small disadvantaged business concerns, women-owned small business concerns, and Historically Black Colleges and Universities and Minority Institutions. Reporting shall be in accordance with the instructions on the forms or as provided in agency regulations.

(iv) Ensure that its subcontractors agree to submit SF 294 and SF 295.

(11) A description of the types of records that will be maintained concerning procedures that have been adopted to comply with the requirements and goals in the plan, including establishing source lists; and a description of the offeror's efforts to locate small business, veteran-owned small business, HUBZone small business, small disadvantaged business, and women-owned small business concerns and award subcontracts to them. The records shall include at least the following (on a plant-wide or company-wide basis, unless otherwise indicated)

(i) Source lists (e.g., PRO-Net), guides, and other data that identify small business, veteran-owner small business, HUBZone small business, small disadvantaged business, and women-owned small business concerns.

(ii) Organizations contacted in an attempt to locate sources that are small business, veteran-owned small business, HUBZone small business, small disadvantaged business, or women-owned small business concerns.

(iii) Records on each subcontract solicitation resulting in an award of more than $100,000, indicating--

(A) Whether small business concerns were solicited and, if not, why not;

(B) Whether veteran-owned small business concerns were solicited and, if not, why not;

(C) Whether HUBZone small business concerns were solicited and, if not, why not;

(D) Whether small disadvantaged business concerns were solicited and, if not, why not;

(E) Whether women-owned small business concerns were solicited and, if not, why not; and

(F) If applicable, the reason award was not made to a small business concern.

(iv) Records of any outreach efforts to contact--

(A) Trade associations;

(B) Business development organizations;

(C) Conferences and trade fairs to locate small, HUBZone small, small disadvantaged, and women-owned small business sources; and

(D) Veterans service organizations.

(v) Records of internal guidance and encouragement provided to buyers through--

(A) Workshops, seminars, training, etc.; and

(B) Monitoring performance to evaluate compliance with the program's requirements.

(vi) On a contract-by-contract basis, records to support award data submitted by the offeror to the Government, including the name, address, and business size of each subcontractor. Contractors having commercial plans need not comply with this requirement.

(e) In order to effectively implement this plan to the extent consistent with efficient contract performance, the Contractor shall perform the following functions:

(1) Assist small business, veteran-owner small business, HUBZone small business, small disadvantaged business, and women-owned small business concerns by arranging solicitations, time for the preparation of bids, quantities, specifications, and delivery schedules so as to facilitate the participation by such concerns. Where the Contractor's lists of potential small business, veteran-owner small business, HUBZone small business, small disadvantaged business, and women-owned small business subcontractors are excessively long, reasonable effort shall be made to give all such small business concerns an opportunity to compete over a period of time.

(2) Provide adequate and timely consideration of the potentialities of small business, veteran-owner small business, HUBZone small business, small disadvantaged business, and women-owned small business concerns in all ``make-or-buy'' decisions.

(3) Counsel and discuss subcontracting opportunities with representatives of small business, veteran-owner small business, HUBZone small business, small disadvantaged business, and women-owned small business firms.

(4) Provide notice to subcontractors concerning penalties and remedies for misrepresentations of business status as small, veteran-owner small business, HUBZone small, small disadvantaged, or women-owned small business for the purpose of obtaining a subcontract that is to be included as part or all of a goal contained in the Contractor's subcontracting plan.

(f) A master plan on a plant or division-wide basis that contains all the elements required by paragraph (d) of this clause, except goals, may be incorporated by reference as a part of the subcontracting plan required of the offeror by this clause; provided--
(1) the master plan has been approved, (2) the offeror ensures that the master plan is updated as necessary and provides copies of the approved master plan, including evidence of its approval, to the Contracting Officer, and (3) goals and any deviations from the master plan deemed necessary by the Contracting Officer to satisfy the requirements of this contract are set forth in the individual subcontracting plan.

(g) A commercial plan is the preferred type of subcontracting plan for contractors furnishing commercial items. The commercial plan shall relate to the offeror's planned subcontracting generally, for both commercial and Government business, rather than solely to the Government contract. Commercial plans are also preferred for subcontractors that provide commercial items under a prime contract, whether or not the prime contractor is supplying a commercial item.

(h) Prior compliance of the offeror with other such subcontracting plans under previous contracts will be considered by the Contracting Officer in determining the responsibility of the offeror for award of the contract.

(i) The failure of the Contractor or subcontractor to comply in good faith with (1) the clause of this contract entitled "Utilization Of Small Business Concerns," or (2) an approved plan required by this clause, shall be a material breach of the contract.

(j) The Contractor shall submit the following reports:

(1) Standard Form 294, Subcontracting Report for Individual Contracts. This report shall be submitted to the Contracting Officer semiannually and at contract completion. The report covers subcontract award data related to this contract. This report is not required for commercial plans.

(2) Standard Form 295, Summary Subcontract Report. This report encompasses all of the contracts with the awarding agency. It must be submitted semi-annually for contracts with the Department of Defense and annually for contracts with civilian agencies. If the reporting activity is covered by a commercial plan, the reporting activity must report annually all subcontract awards under that plan. All reports submitted at the close of each fiscal year (both individual and commercial plans) shall include a breakout, in the Contractor's format, of subcontract awards, in whole dollars, to small disadvantaged business concerns by North American Industry Classification System (NAICS) Industry Subsector. For a commercial plan, the Contractor may obtain from each of its subcontractors a predominant NAICS Industry Subsector and report all awards to that subcontractor under its predominant NAICS Industry Subsector.

(End of clause)

52.219-16 LIQUIDATED DAMAGES-SUBCONTRACTING PLAN (JAN 1999)

(a) Failure to make a good faith effort to comply with the subcontracting plan, as used in this clause, means a willful or intentional failure to perform in accordance with the requirements of the subcontracting plan approved under the clause in this contract entitled "Small Business Subcontracting Plan," or willful or intentional action to frustrate the plan.

(b) Performance shall be measured by applying the percentage goals to the total actual subcontracting dollars or, if a commercial plan is involved, to the pro rata share of actual subcontracting dollars attributable to Government contracts covered by the commercial plan. If, at contract completion or, in the case of a commercial plan, at the close of the fiscal year for which the plan is applicable, the Contractor has failed to meet its subcontracting goals and the Contracting Officer decides in accordance with paragraph (c) of this clause that the Contractor failed to make a good faith effort to comply with its subcontracting plan, established in accordance with the clause in this contract entitled “Small Business Subcontracting Plan,” the Contractor shall pay the Government liquidated damages in an amount stated. The amount of probable damages attributable to the Contractor's failure to comply shall be an amount equal to the actual dollar amount by which the Contractor failed to achieve each subcontract goal.

(c) Before the Contracting Officer makes a final decision that the Contractor has failed to make such good faith effort, the Contracting Officer shall give the Contractor written notice specifying the failure and permitting the Contractor to demonstrate what good faith efforts have been made and to discuss the matter. Failure to respond to the notice may be taken as an admission that no valid explanation exists. If, after consideration of all the pertinent data, the Contracting Officer finds that the Contractor failed to make a good faith effort to comply with the subcontracting plan, the Contracting Officer shall issue a final decision to that effect and require that the Contractor pay the Government liquidated damages as provided in paragraph (b) of this clause.

(d) With respect to commercial plans, the Contracting Officer who approved the plan will perform the functions of the Contracting Officer under this clause on behalf of all agencies with contracts covered by the commercial plan.

(e) The Contractor shall have the right of appeal, under the clause in this contract entitled Disputes, from any final decision of the Contracting Officer.

(f) Liquidated damages shall be in addition to any other remedies that the Government may have.

(End of clause)

52.222-3 CONVICT LABOR (JUN 2003)

(a) Except as provided in paragraph (b) of this clause, the Contractor shall not employ in the performance of this contract any person undergoing a sentence of imprisonment imposed by any court of a State, the District of Columbia, Puerto Rico, the Northern Mariana Islands, American Samoa, Guam, or the U.S. Virgin Islands.

(b) The Contractor is not prohibited from employing persons--

(1) On parole or probation to work at paid employment during the term of their sentence;

(2) Who have been pardoned or who have served their terms; or

(3) Confined for violation of the laws of any of the States, the District of Columbia, Puerto Rico, the Northern Mariana Islands, American Samoa, Guam, or the U.S. Virgin Islands who are authorized to work at paid employment in the community under the laws of such jurisdiction, if--

(i) The worker is paid or is in an approved work training program on a voluntary basis;

(ii) Representatives of local union central bodies or similar labor union organizations have been consulted;

(iii) Such paid employment will not result in the displacement of employed workers, or be applied in skills, crafts, or trades in which there is a surplus of available gainful labor in the locality, or impair existing contracts for services;

(iv) The rates of pay and other conditions of emp loyment will not be less than those paid or provided for work of a similar nature in the locality in which the work is being performed; and

(v) The Attorney General of the United States has certified that the work-release laws or **regulations** of the jurisdiction involved are in conformity with the requirements of Executive Order 11755, as amended by Executive Orders 12608 and 12943.

(End of clause)

52.222-4 CONTRACT WORK HOURS AND SAFETY STANDARDS ACT - OVERTIME COMPENSATION. (SEP 2000)

(a) Overtime requirements. No Contractor or subcontractor employing laborers or mechanics (see Federal Acquisition Regulation 22.300) shall require or permit them to work over 40 hours in any workweek unless they are paid at least 1 and 1/2 times the basic rate of pay for each hour worked over 40 hours.

(b) Violation; liability for unpaid wages; liquidated damages. The responsible Contractor and subcontractor are liable for unpaid wages if they violate the terms in paragraph (a) of this clause. In addition, the Contractor and subcontractor are liable for liquidated damages payable to the Government. The Contracting Officer will assess liquidated damages at the rate of $10 per affected employee for each calendar day on which the employer required or permitted the emp loyee to work in excess of the standard workweek of 40 hours without paying overtime wages required by the Contract Work Hours and Safety Standards Act.

(c) Withholding for unpaid wages and liquidated damages. The Contracting Officer will withhold from payments due under the contract sufficient funds required to satisfy any Contractor or subcontractor liabilities for unpaid wages and liquidated damages. If amounts withheld under the contract are insufficient to satisfy Contractor or subcontractor liabilities, the Contracting Officer will withhold payments from other Federal or Federally assisted contracts held by the same Contractor that are subject to the Contract Work Hours and Safety Standards Act.

(d) Payrolls and basic records.

(1) The Contractor and its subcontractors shall maintain payrolls and basic payroll records for all laborers and mechanics working on the contract during the contract and shall make them available to the Government until 3 years after contract completion. The records shall contain the name and address of each employee, social security number, labor classifications, hourly rates of wages paid, daily and weekly number of hours worked, deductions made, and actual wages paid. The records need not duplicate those required for construction work by Department of Labor regulations at 29 CFR 5.5(a)(3) implementing the Davis-Bacon Act.

(2) The Contractor and its subcontractors shall allow authorized representatives of the Contracting Officer or the Department of Labor to inspect, copy, or transcribe records maintained under paragraph (d)(1) of this clause. The

Contractor or subcontractor also shall allow authorized representatives of the Contracting Officer or Department of Labor to interview employees in the workplace during working hours.

(e) Subcontracts. The Contractor shall insert the provisions set forth in paragraphs (a) through (d) of this clause in subcontracts exceeding $100,000 and require subcontractors to include these provisions in any lower tier subcontracts. The Contractor shall be responsible for compliance by any subcontractor or lower-tier subcontractor with the provisions set forth in paragraphs (a) through (d) of this clause.

(End of clause)

52.222-6 DAVIS-BACON ACT (FEB 1995)

(a) All laborers and mechanics employed or working upon the site of the work will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR Part 3), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the Contractor and such laborers and mechanics. Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph (d) of this clause; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such period. Such laborers and mechanics shall be paid not less than the appropriate wage rate and fringe benefits in the wage determination for the classification of work actually performed, without regard to skill, except as provided in the clause entitled Apprentices and Trainees. Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein; provided, That the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classifications and wage rates conformed under paragraph (b) of this clause) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the Contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

(b)(1) The Contracting Officer shall require that any class of laborers or mechanics which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The Contracting Officer shall approve an additional classification and wage rate and fringe benefits therefor only when all the following criteria have been met:

(i) The work to be performed by the classification requested is not performed by a classification in the wage determination.

(ii) The classification is utilized in the area by the construction industry.

(iii) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(2) If the Contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the Contracting Officer agree on the classification and wage rate (including the amount designated for fringe benefits, where appropriate), a report of the action taken shall be sent by the Contracting Officer to the Administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor, Washington, DC 20210. The Administrator or an authorized representative will approve, modify, or

disapprove every additional classification action within 30 days of receipt and so advise the Contracting Officer or will notify the Contracting Officer within the 30-day period that additional time is necessary.

(3) In the event the Contractor, the laborers or mechanics to be employed in the classification, or their representatives, and the Contracting Officer do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the Contracting Officer shall refer the questions, including the views of all interested parties and the recommendation of the Contracting Officer, to the Administrator of the Wage and Hour Division for determination. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the Contracting Officer or will notify the Contracting Officer within the 30-day period that additional time is necessary.

(4) The wage rate (including fringe benefits, where appropriate) determined pursuant to subparagraphs (b)(2) and (b)(3) of this clause shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

(c) Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the Contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

(2) If the Contractor does not make payments to a trustee or other third person, the Contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program; provided, That the Secretary of Labor has found, upon the written request of the Contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the Contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

(End of clause)

52.222-7 WITHHOLDING OF FUNDS (FEB 1988)

The Contracting Officer shall, upon his or her own action or upon written request of an authorized representative of the Department of Labor, withhold or cause to be withheld from the Contractor under this contract or any other Federal contract with the same Prime Contractor, or any other Federally assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same Prime Contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the Contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work, all or part of the wages required by the contract, the Contracting Officer may, after written notice to the Contractor, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

(End of clause)

52.222-8 PAYROLLS AND BASIC RECORDS (FEB 1988)

(a) Payrolls and basic records relating thereto shall be maintained by the Contractor during the course of the work and preserved for a period of 3 years thereafter for all laborers and mechanics working at the site of the work. Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in section 1(b)(2)(B) of the Davis-Bacon Act), daily and

weekly number of hours worked, deductions made, and actual wages paid. Whenever the Secretary of Labor has found, under paragraph (d) of the clause entitled Davis-Bacon Act, that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis-Bacon Act, the Contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

(b)(1) The Contractor shall submit weekly for each week in which any contract work is performed a copy of all payrolls to the Contracting Officer. The payrolls submitted shall set out accurately and completely all of the information required to be maintained under paragraph (a) of this clause. This information may be submitted in any form desired. Optional Form WH-347 (Federal Stock Number 029-005-00014-1) is available for this purpose and may be purchased from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. The Prime Contractor is responsible for the submission of copies of payrolls by all subcontractors.

(2) Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the Contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify--

(i) That the payroll for the payroll period contains the information required to be maintained under paragraph (a) of this clause and that such information is correct and complete;

(ii) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in the Regulations, 29 CFR Part 3; and

(iii) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(3) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance" required by subparagraph (b)(2) of this clause.

(4) The falsification of any of the certifications in this clause may subject the Contractor or subcontractor to civil or criminal prosecution under Section 1001 of Title 18 and Section 3729 of Title 31 of the United States Code.

(c) The Contractor or subcontractor shall make the records required under paragraph (a) of this clause available for inspection, copying, or transcription by the Contracting Officer or authorized representatives of the Contracting Officer or the Department of Labor. The Contractor or subcontractor shall permit the Contracting Officer or representatives of the Contracting Officer or the Department of Labor to interview employees during working hours on the job. If the Contractor or subcontractor fails to submit required records or to make them available, the Contracting Officer may, after written notice to the Contractor, take such action as may be necessary to cause the suspension of any further payment. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

(End of clause)

52.222-9 APPRENTICES AND TRAINEES (FEB 1988)

(a) Apprentices. Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Bureau of Apprenticeship and Training, or with a State Apprenticeship Agency recognized by the Bureau, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Bureau of Apprenticeship and Training or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the Contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated in this paragraph, shall be paid not less than the applicable wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the Contractor's or subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination. In the event the Bureau of Apprenticeship and Training, or a State Apprenticeship Agency recognized by the Bureau, withdraws approval of an apprenticeship program, the Contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(b) Trainees. Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed in the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate in the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate in the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate in the wage determination for the work actually performed. In the event the Employment and Training Administration withdraws approval of a training program, the Contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(c) Equal employment opportunity. The utilization of apprentices, trainees, and journeymen under this clause shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR Part 30.

(End of clause)

52.222-10 COMPLIANCE WITH COPELAND ACT REQUIREMENTS (FEB 1988)

The Contractor shall comply with the requirements of 29 CFR Part 3, which are hereby incorporated by reference in this contract.

(End of clause)

52.222-11 SUBCONTRACTS (LABOR STANDARDS (FEB 1988)

(a) The Contractor or subcontractor shall insert in any subcontracts the clauses entitled Davis-Bacon Act, Contract Work Hours and Safety Standards Act-Overtime Compensation, Apprentices and Trainees, Payrolls and Basic Records, Compliance with Copeland Act Requirements, Withholding of Funds, Subcontracts (Labor Standards), Contract Termination-Debarment, Disputes Concerning Labor Standards, Compliance with Davis-Bacon and Related Act Regulations, and Certification of Eligibility, and such other clauses as the Contracting Officer may, by appropriate instructions, require, and also a clause requiring subcontractors to include these clauses in any lower tier subcontracts. The Prime Contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with all the contract clauses cited in this paragraph.

(b)(1) Within 14 days after award of the contract, the Contractor shall deliver to the Contracting Officer a completed Statement and Acknowledgment Form (SF 1413) for each subcontract, including the subcontractor's signed and dated acknowledgment that the clauses set forth in paragraph (a) of this clause have been included in the subcontract.

(ii) Within 14 days after the award of any subsequently awarded subcontract the Contractor shall deliver to the Contracting Officer an updated completed SF 1413 for such additional subcontract.

(End of clause)

52.222-12 CONTRACT TERMINATION--DEBARMENT (FEB 1988)

A breach of the contract clauses entitled Davis-Bacon Act, Contract Work Hours and Safety Standards Act--Overtime Compensation, Apprentices and Trainees, Payrolls and Basic Records, Compliance with Copeland Act Requirements, Subcontracts (Labor Standards), Compliance with Davis-Bacon and Related Act Regulations, or Certification of Eligibility may be grounds for termination of the contract, and for debarment as a Contractor and subcontractor as provided in 29 CFR 5.12.

(End of clause)

52.222-13 COMPLIANCE WITH DAVIS-BACON AND RELATED ACT REGULATIONS (FEB 1988)

All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR Parts 1, 3, and 5 are hereby incorporated by reference in this contract.

(End of clause)

52.222-14 DISPUTES CONCERNING LABOR STANDARDS (FEB 1988)

The United States Department of Labor has set forth in 29 CFR Parts 5, 6, and 7 procedures for resolving disputes concerning labor standards requirements. Such disputes shall be resolved in accordance with those procedures and not the Disputes clause of this contract. Disputes within the meaning of this clause include disputes between the Contractor (or any of its subcontractors) and the contracting agency, the U.S. Department of Labor, or the employees or their representatives.

(End of clause)

52.222-15 CERTIFICATION OF ELIGIBILITY (FEB 1988)

(a) By entering into this contract, the Contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the Contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(b) No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(3) The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001.

(End of clause)

52.222-21 PROHIBITION OF SEGREGATED FACILITIES (FEB 1999)

(a) Segregated facilities, as used in this clause, means any waiting rooms, work areas, rest rooms and wash rooms, restaurants and other eating areas, time clocks, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees, that are segregated by explicit directive or are in fact segregated on the basis of race, color, religion, sex, or national origin because of written or oral policies or employee custom. The term does not include separate or single-user rest rooms or necessary dressing or sleeping areas provided to assure privacy between the sexes.

(b) The Contractor agrees that it does not and will not maintain or provide for its employees any segregated facilities at any of its establishments, and that it does not and will not permit its employees to perform their services at any location under its control where segregated facilities are maintained. The Contractor agrees that a breach of this clause is a violation of the Equal Opportunity clause in this contract.

(c) The Contractor shall include this clause in every subcontract and purchase order that is subject to the Equal Opportunity clause of this contract.

(End of clause)

52.222-23 NOTICE OF REQUIREMENT FOR AFFIRMATIVE ACTION TO ENSURE EQUAL EMPLOYMENT OPPORTUNITY FOR CONSTRUCTION (FEB 1999)

(a) The offeror's attention is called to the Equal Opportunity clause and the Affirmative Action Compliance Requirements for Construction clause of this solicitation.

(b) The goals for minority and female participation, expressed in percentage terms for the Contractor's aggregate workforce in each trade on all construction work in the covered area, are as follows:

Goals for minority participation for each trade	Goals for female participation for each trade
8.7% (Anchorage, AK) 15.1% (Locations Outside City of Anchorage)	6.9% (Alaska)

These goals are applicable to all the Contractor's construction work performed in the covered area. If the Contractor performs construction work in a geographical area located outside of the covered area, the Contractor shall apply the goals established for the geographical area where the work is actually performed. Goals are published periodically in the Federal Register in notice form, and these notices may be obtained from any Office of Federal Contract Compliance Programs office.

(c) The Contractor's compliance with Executive Order 11246, as amended, and the regulations in 41 CFR 60-4 shall be based on (1) its implementation of the Equal Opportunity clause, (2) specific affirmative action obligations required by the clause entitled "Affirmative Action Compliance Requirements for Construction," and (3) its efforts to meet the goals. The hours of minority and female employment and training must be substantially uniform throughout the length of the contract, and in each trade. The Contractor shall make a good faith effort to employ minorities and women evenly on each of its projects. The transfer of minority or female employees or trainees from Contractor to Contractor, or from project to project, for the sole purpose of meeting the Contractor's goals shall be a violation of the contract, Executive Order 11246, as amended, and the regulations in 41 CFR 60-4. Compliance with the goals will be measured against the total work hours performed.

(d) The Contractor shall provide written notification to the Deputy Assistant Secretary for Federal Contract Compliance, U.S. Department of Labor, within 10 working days following award of any construction subcontract in excess of $10,000 at any tier for construction work under the contract resulting from this solicitation. The notification shall list the --

(1) Name, address, and telephone number of the subcontractor;

(2) Employer's identification number of the subcontractor;

(3) Estimated dollar amount of the subcontract;

(4) Estimated starting and completion dates of the subcontract; and

(5) Geographical area in which the subcontract is to be performed.

(e) As used in this Notice, and in any contract resulting from this solicitation, the "covered area" is SEE ABOVE

(End of provision)

52.222-26 EQUAL OPPORTUNITY (APR 2002)

(a) Definition. United States, as used in this clause, means the 50 States, the District of Columbia, Puerto Rico, the Northern Mariana Islands, American Samoa, Guam, the U.S. Virgin Islands, and Wake Island.

(b) If, during any 12-month period (including the 12 months preceding the award of this contract), the Contractor has been or is awarded nonexempt Federal contracts and/or subcontracts that have an aggregate value in excess of $10,000, the Contractor shall comply with paragraphs (b)(1) through (b)(11) of this clause, except for work performed outside the United States by employees who were not recruited within the United States. Upon request, the Contractor shall provide information necessary to determine the applicability of this clause.

(1) The Contractor shall not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin. However, it shall not be a violation of this clause for the Contractor to extend a publicly announced preference in employment to Indians living on or near an Indian reservation, in connection with employment opportunities on or near an Indian reservation, as permitted by 41 CFR 60-1.5.

(2) The Contractor shall take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, religion, sex, or national origin. This shall include, but not be limited to, (i) employment, (ii) upgrading, (iii) demotion, (iv) transfer, (v) recruitment or recruitment advertising, (vi) layoff or termination, (vii) rates of pay or other forms of compensation, and (viii) selection for training, including apprenticeship.

(3) The Contractor shall post in conspicuous places available to employees and applicants for employment the notices to be provided by the Contracting Officer that explain this clause.

(4) The Contractor shall, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, or national origin.

(5) The Contractor shall send, to each labor union or representative of workers with which it has a collective bargaining agreement or other contract or understanding, the notice to be provided by the Contracting Officer advising the labor union or workers' representative of the Contractor's commitments under this clause, and post copies of the notice in conspicuous places available to employees and applicants for employment.

(6) The Contractor shall comply with Executive Order 11246, as amended, and the rules, regulations, and orders of the Secretary of Labor.

(7) The Contractor shall furnish to the contracting agency all information required by Executive Order 11246, as amended, and by the rules, regulations, and orders of the Secretary of Labor. The Contractor shall also file Standard Form 100 (EEO-1), or any successor form, as prescribed in 41 CFR part 60-1. Unless the Contractor has filed within the 12 months preceding the date of contract award, the Contractor shall, within 30 days after contract award, apply to either the regional Office of Federal Contract Compliance Programs (OFCCP) or the local office of the Equal Employment Opportunity Commission for the necessary forms.

(8) The Contractor shall permit access to its premises, during normal business hours, by the contracting agency or the OFCCP for the purpose of conducting on-site compliance evaluations and complaint investigations. The Contractor shall permit the Government to inspect and copy any books, accounts, records (including computerized records), and other material that may be relevant to the matter under investigation and pertinent to compliance with Executive Order 11246, as amended, and rules and regulations that implement the Executive Order.

(9) If the OFCCP determines that the Contractor is not in compliance with this clause or any rule, regulation, or order of the Secretary of Labor, this contract may be canceled, terminated, or suspended in whole or in part and the Contractor may be declared ineligible for further Government contracts, under the procedures authorized in Executive Order 11246, as amended. In addition, sanctions may be imposed and remedies invoked against the Contractor as

provided in Executive Order 11246, as amended; in the rules, regulations, and orders of the Secretary of Labor; or as otherwise provided by law.

(10) The Contractor shall include the terms and conditions of subparagraphs (b)(1) through (11) of this clause in every subcontract or purchase order that is not exempted by the rules, regulations, or orders of the Secretary of Labor issued under Executive Order 11246, as amended, so that these terms and conditions will be binding upon each subcontractor or vendor.

(11) The Contractor shall take such action with respect to any subcontract or purchase order as the contracting officer may direct as a means of enforcing these terms and conditions, including sanctions for noncompliance; provided, that if the Contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of any direction, the Contractor may request the United States to enter into the litigation to protect the interests of the United States.

(c) Notwithstanding any other clause in this contract, disputes relative to this clause will be governed by the procedures in 41 CFR 60-1.1.

(End of clause)

52.222-27 AFFIRMATIVE ACTION COMPLIANCE REQUIREMENTS FOR CONSTRUCTION (FEB 1999)

(a) Definitions. "Covered area," as used in this clause, means the geographical area described in the solicitation for this contract.

"Deputy Assistant Secretary," as used in this clause, means Deputy Assistant Secretary for Federal Contract Compliance, U.S. Department of Labor, or a designee.

"Employer's identification number," as used in this clause, means the Federal Social Security number used on the employer's quarterly federal tax return, U.S. Treasury Department Form 941.

"Minority," as used in this clause, means--

(1) American Indian or Alaskan Native (all persons having origins in any of the original peoples of North America and maintaining identifiable tribal affiliations through membership and participation or community identification).

(2) Asian and Pacific Islander (all persons having origins in any of the original peoples of the Far East, Southeast Asia, the Indian Subcontinent, or the Pacific Islands);

(3) Black (all persons having origins in any of the black African racial groups not of Hispanic origin); and

(4) Hispanic (all persons of Mexican, Puerto Rican, Cuban, Central or South American, or other Spanish culture or origin, regardless of race).

(b) If the Contractor, or a subcontractor at any tier, subcontracts a portion of the work involving any construction trade, each such subcontract in excess of $10,000 shall include this clause and the Notice containing the goals for minority and female participation stated in the solicitation for this contract.

(c) If the Contractor is participating in a Hometown Plan (41 CFR 60-4) approved by the U.S. Department of Labor in a covered area, either individually or through an association, its affirmative action obligations on all work in the plan area (including goals) shall comply with the plan for those trades that have unions participating in the plan. Contractors must be able to demonstrate participation in, and compliance with, the provisions of the plan. Each

Contractor or subcontractor participating in an approved plan is also required to comply with its obligations under the Equal Opportunity clause, and to make a good faith effort to achieve each goal under the plan in each trade in which it has employees. The overall good-faith performance by other Contractors or subcontractors toward a goal in an approved plan does not excuse any Contractor's or subcontractor's failure to make good-faith efforts to achieve the plan's goals.

(d) The Contractor shall implement the affirmative action procedures in subparagraphs (g)(1) through (16) of this clause. The goals stated in the solicitation for this contract are expressed as percentages of the total hours of employment and training of minority and female utilization that the Contractor should reasonably be able to achieve in each construction trade in which it has employees in the covered area. If the Contractor performs construction work in a geographical area located outside of the covered area, it shall apply the goals established for the geographical area where that work is actually performed. The Contractor is expected to make substantially uniform progress toward its goals in each craft.

(e) Neither the terms and conditions of any collective bargaining agreement, nor the failure by a union with which the Contractor has a collective bargaining agreement, to refer minorities or women shall excuse the Contractor's obligations under this clause, Executive Order 11246, as amended, or the regulations thereunder.

(f) In order for the nonworking training hours of apprentices and trainees to be counted in meeting the goals, apprentices and trainees must be employed by the Contractor during the training period, and the Contractor must have made a commitment to employ the apprentices and trainees at the completion of their training, subject to the availability of employment opportunities. Trainees must be trained pursuant to training programs approved by the U.S. Department of Labor.

(g) The Contractor shall take affirmative action to ensure equal employment opportunity. The evaluation of the Contractor's compliance with this clause shall be based upon its effort to achieve maximum results from its actions. The Contractor shall document these efforts fully and implement affirmative action steps at least as extensive as the following:

(1) Ensure a working environment free of harassment, intimidation, and coercion at all sites and in all facilities where the Contractor's employees are assigned to work. The Contractor, if possible, will assign two or more women to each construction project. The Contractor shall ensure that foremen, superintendents, and other onsite supervisory personnel are aware of and carry out the Contractor's obligation to maintain such a working environment, with specific attention to minority or female individuals working at these sites or facilities.

(2) Establish and maintain a current list of sources for minority and female recruitment. Provide written notification to minority and female recruitment sources and community organizations when the Contractor or its unions have employment opportunities available, and maintain a record of the organizations' responses.

(3) Establish and maintain a current file of the names, addresses, and telephone numbers of each minority and female off-the-street applicant, referrals of minorities or females from unions, recruitment sources, or community organizations, and the action taken with respect to each individual. If an individual was sent to the union hiring hall for referral and not referred back to the Contractor by the union or, if referred back, not employed by the Contractor, this shall be documented in the file, along with whatever additional actions the Contractor may have taken.

(4) Immediately notify the Deputy Assistant Secretary when the union or unions with which the Contractor has a collective bargaining agreement has not referred back to the Contractor a minority or woman sent by the Contractor, or when the Contractor has other information that the union referral process has impeded the Contractor's efforts to meet its obligations.

(5) Develop on-the-job training opportunities and/or participate in training programs for the area that expressly include minorities and women, including upgrading programs and apprenticeship and trainee programs relevant to

the Contractor's employment needs, especially those programs funded or approved by the Department of Labor. The Contractor shall provide notice of these programs to the sources compiled under subparagraph (g)(2) of this clause.

(6) Disseminate the Contractor's equal employment policy by--

(i) Providing notice of the policy to unions and to training, recruitment, and outreach programs, and requesting their cooperation in assisting the Contractor in meeting its contract obligations;

(ii) Including the policy in any policy manual and in collective bargaining agreements;

(iii) Publicizing the policy in the company newspaper, annual report, etc.;

(iv) Reviewing the policy with all management personnel and with all minority and female employees at least once a year; and

(v) Posting the policy on bulletin boards accessible to employees at each location where construction work is performed.

(7) Review, at least annually, the Contractor's equal employment policy and affirmative action obligations with all employees having responsibility for hiring, assignment, layoff, termination, or other employment decisions. Conduct review of this policy with all on-site supervisory personnel before initiating construction work at a job site. A written record shall be made and maintained identifying the time and place of these meetings, persons attending, subject matter discussed, and disposition of the subject matter.

(8) Disseminate the Contractor's equal employment policy externally by including it in any advertising in the news media, specifically including minority and female news media. Provide written notification to, and discuss this policy with, other Contractors and subcontractors with which the Contractor does or anticipates doing business.

(9) Direct recruitment efforts, both oral and written, to minority, female, and community organizations, to schools with minority and female students, and to minority and female recruitment and training organizations serving the Contractor's recruitment area and employment needs. Not later than 1 month before the date for acceptance of applications for apprenticeship or training by any recruitment source, send written notification to organizations such as the above, describing the openings, screening procedures, and tests to be used in the selection process.

(10) Encourage present minority and female employees to recruit minority persons and women. Where reasonable, provide after-school, summer, and vacation employment to minority and female youth both on the site and in other areas of the Contractor's workforce.

(11) Validate all tests and other selection requirements where required under 41 CFR 60-3.

(12) Conduct, at least annually, an inventory and evaluation at least of all minority and female personnel for promotional opportunities. Encourage these employees to seek or to prepare for, through appropriate training, etc., opportunities for promotion.

(13) Ensure that seniority practices, job classifications, work assignments, and other personnel practices do not have a discriminatory effect by continually monitoring all personnel and employment-related activities to ensure that the Contractor's obligations under this contract are being carried out.

(14) Ensure that all facilities and company activities are nonsegregated except that separate or single-user rest rooms and necessary dressing or sleeping areas shall be provided to assure privacy between the sexes.

(15) Maintain a record of solicitations for subcontracts for minority and female construction contractors and suppliers, including circulation of solicitations to minority and female contractor associations and other business

associations.

(16) Conduct a review, at least annually, of all supervisors' adherence to and performance under the Contractor's equal employment policy and affirmative action obligations.

(h) The Contractor is encouraged to participate in voluntary associations that may assist in fulfilling one or more of the affirmative action obligations contained in subparagraphs (g)(1) through (16) of this clause. The efforts of a contractor association, joint contractor-union, contractor-community, or similar group of which the contractor is a member and participant may be asserted as fulfilling one or more of its obligations under subparagraphs (g)(1) through (16) of this clause, provided the Contractor--

(1) Actively participates in the group;

(2) Makes every effort to ensure that the group has a positive impact on the employment of minorities and women in the industry;

(3) Ensures that concrete benefits of the program are reflected in the Contractor's minority and female workforce participation;

(4) Makes a good-faith effort to meet its individual goals and timetables; and

(5) Can provide access to documentation that demonstrates the effectiveness of actions taken on behalf of the Contractor. The obligation to comply is the Contractor's, and failure of such a group to fulfill an obligation shall not be a defense for the Contractor's noncompliance.

(i) A single goal for minorities and a separate single goal for women shall be established. The Contractor is required to provide equal employment opportunity and to take affirmative action for all minority groups, both male and female, and all women, both minority and nonminority. Consequently, the Contractor may be in violation of Executive Order 11246, as amended, if a particular group is employed in a substantially disparate manner.

(j) The Contractor shall not use goals or affirmative action standards to discriminate against any person because of race, color, religion, sex, or national origin.

(k) The Contractor shall not enter into any subcontract with any person or firm debarred from Government contracts under Executive Order 11246, as amended.

(l) The Contractor shall carry out such sanctions and penalties for violation of this clause and of the Equal Opportunity clause, including suspension, termination, and cancellation of existing subcontracts, as may be imposed or ordered under Executive Order 11246, as amended, and its implementing regulations, by the OFCCP. Any failure to carry out these sanctions and penalties as ordered shall be a violation of this clause and Executive Order 11246, as amended.

(m) The Contractor in fulfilling its obligations under this clause shall implement affirmative action procedures at least as extensive as those prescribed in paragraph (g) of this clause, so as to achieve maximum results from its efforts to ensure equal employment opportunity. If the Contractor fails to comply with the requirements of Executive Order 11246, as amended, the implementing regulations, or this clause, the Deputy Assistant Secretary shall take action as prescribed in 41 CFR 60-4.8.

(n) The Contractor shall designate a responsible official to--

(1) Monitor all employment-related activity to ensure that the Contractor's equal employment policy is being carried out;

(2) Submit reports as may be required by the Government; and

(3) Keep records that shall at least include for each employee the name, address, telephone number, construction trade, union affiliation (if any), employee identification number, social security number, race, sex, status (e.g., mechanic, apprentice, trainee, helper, or laborer), dates of changes in status, hours worked per week in the indicated trade, rate of pay, and locations at which the work was performed. Records shall be maintained in an easily understandable and retrievable form; however, to the degree that existing records satisfy this requirement, separate records are not required to be maintained.

Nothing contained herein shall be construed as a limitation upon the application of other laws that establish different standards of compliance or upon the requirements for the hiring of local or other area residents (e.g., those under the Public Works Employment Act of 1977 and the Community Development Block Grant Program).

(End of clause)

52.222-35 EQUAL OPPORTUNITY FOR SPECIAL DISABLED VETERANS, VETERANS OF THE VIETNAM ERA, AND OTHER ELIGIBLE VETERANS (DEC 2001)

(a) Definitions. As used in this clause--

All employment openings means all positions except executive and top management, those positions that will be filled from within the Contractor's organization, and positions lasting 3 days or less. This term includes full-time employment, temporary employment of more than 3 days duration, and part-time employment.

Executive and top management means any employee--

(1) Whose primary duty consists of the management of the enterprise in which the individual is employed or of a customarily recognized department or subdivision thereof;

(2) Who customarily and regularly directs the work of two or more other employees;

(3) Who has the authority to hire or fire other employees or whose suggestions and recommendations as to the hiring or firing and as to the advancement and promotion or any other change of status of other employees will be given particular weight;

(4) Who customarily and regularly exercises discretionary powers; and

(5) Who does not devote more than 20 percent or, in the case of an employee of a retail or service establishment, who does not devote more than 40 percent of total hours of work in the work week to activities that are not directly and closely related to the performance of the work described in paragraphs (1) through (4) of this definition. This paragraph (5) does not apply in the case of an employee who is in sole charge of an establishment or a physically separated branch establishment, or who owns at least a 20 percent interest in the enterprise in which the individual is employed.

Other eligible veteran means any other veteran who served on active duty during a war or in a campaign or expedition for which a campaign badge has been authorized.

Positions that will be filled from within the Contractor's organization means employment openings for which the Contractor will give no consideration to persons outside the Contractor's organization (including any affiliates, subsidiaries, and parent companies) and includes any openings the Contractor proposes to fill from regularly

established “recall” lists. The exception does not apply to a particular opening once an employer decides to consider applicants outside of its organization.

Qualified special disabled veteran means a special disabled veteran who satisfies the requisite skill, experience, education, and other job-related requirements of the employment position such veteran holds or desires, and who, with or without reasonable accommodation, can perform the essential functions of such position.

Special disabled veteran means--

(1) A veteran who is entitled to compensation (or who but for the receipt of military retired pay would be entitled to compensation) under laws administered by the Department of Veterans Affairs for a disability--

(i) Rated at 30 percent or more; or

(ii) Rated at 10 or 20 percent in the case of a veteran who has been determined under 38 U.S.C. 3106 to have a serious employment handicap (i.e., a significant impairment of the veteran's ability to prepare for, obtain, or retain employment consistent with the veteran's abilities, aptitudes, and interests); or

(2) A person who was discharged or released from active duty because of a service-connected disability.

Veteran of the Vietnam era means a person who--

(1) Served on active duty for a period of more than 180 days and was discharged or released from active duty with other than a dishonorable discharge, if any part of such active duty occurred--

(i) In the Republic of Vietnam between February 28, 1961, and May 7, 1975; or

(ii) Between August 5, 1964, and May 7, 1975, in all other cases; or

(2) Was discharged or released from active duty for a service-connected disability if any part of the active duty was performed--

(i) In the Republic of Vietnam between February 28, 1961, and May 7, 1975; or

(ii) Between August 5, 1964, and May 7, 1975, in all other cases.
(b) General. (1) The Contractor shall not discriminate against the individual because the individual is a special disabled veteran, a veteran of the Vietnam era, or other eligible veteran, regarding any position for which the employee or applicant for employment is qualified. The Contractor shall take affirmative action to employ, advance in employment, and otherwise treat qualified special disabled veterans, veterans of the Vietnam era, and other eligible veterans without discrimination based upon their disability or veterans' status in all employment practices such as--

(i) Recruitment, advertising, and job application procedures;

(ii) Hiring, upgrading, promotion, award of tenure, demotion, transfer, layoff, termination, right of return from layoff and rehiring;

(iii) Rate of pay or any other form of compensation and changes in compensation;

(iv) Job assignments, job classifications, organizational structures, position descriptions, lines of progression, and seniority lists;

(v) Leaves of absence, sick leave, or any other leave;

(vi) Fringe benefits available by virtue of employment, whether or not administered by the Contractor;

(vii) Selection and financial support for training, including apprenticeship, and on-the-job training under 38 U.S.C. 3687, professional meetings, conferences, and other related activities, and selection for leaves of absence to pursue training;

(viii) Activities sponsored by the Contractor including social or recreational programs; and

(ix) Any other term, condition, or privilege of employment.

(2) The Contractor shall comply with the rules, regulations, and relevant orders of the Secretary of Labor issued under the Vietnam Era Veterans' Readjustment Assistance Act of 1972 (the Act), as amended (38 U.S.C. 4211 and 4212).

(c) Listing openings. (1) The Contractor shall immediately list all employment openings that exist at the time of the execution of this contract and those which occur during the performance of this contract, including those not generated by this contract, and including those occurring at an establishment of the Contractor other than the one where the contract is being performed, but excluding those of independently operated corporate affiliates, at an appropriate local public employment service office of the State wherein the opening occurs. Listing employment openings with the U.S. Department of Labor's America's Job Bank shall satisfy the requirement to list jobs with the local employment service office.

(2) The Contractor shall make the listing of employment openings with the local employment service office at least concurrently with using any other recruitment source or effort and shall involve the normal obligations of placing a bona fide job order, including accepting referrals of veterans and nonveterans. This listing of employment openings does not require hiring any particular job applicant or hiring from any particular group of job applicants and is not intended to relieve the Contractor from any requirements of Executive orders or regulations concerning nondiscrimination in employment.

(3) Whenever the Contractor becomes contractually bound to the listing terms of this clause, it shall advise the State public employment agency in each State where it has establishments of the name and location of each hiring location in the State. As long as the Contractor is contractually bound to these terms and has so advised the State agency, it need not advise the State agency of subsequent contracts. The Contractor may advise the State agency when it is no longer bound by this contract clause.

(d) Applicability. This clause does not apply to the listing of employment openings that occur and are filled outside the 50 States, the District of Columbia, the Commonwealth of Puerto Rico, the Commonwealth of the Northern Mariana Islands, American Samoa, Guam, the Virgin Islands of the United States, and Wake Island.

(e) Postings. (1) The Contractor shall post employment notices in conspicuous places that are available to employees and applicants for employment.

(2) The employment notices shall--

(i) State the rights of applicants and employees as well as the Contractor's obligation under the law to take affirmative action to employ and advance in employment qualified employees and applicants who are special disabled veterans, veterans of the Vietnam era, and other eligible veterans; and

(ii) Be in a form prescribed by the Deputy Assistant Secretary for Federal Contract Compliance Programs, Department of Labor (Deputy Assistant Secretary of Labor), and provided by or through the Contracting Officer.

(3) The Contractor shall ensure that applicants or employees who are special disabled veterans are informed of the contents of the notice (e.g., the Contractor may have the notice read to a visually disabled veteran, or may lower the posted notice so that it can be read by a person in a wheelchair).

(4) The Contractor shall notify each labor union or representative of workers with which it has a collective bargaining agreement, or other contract understanding, that the Contractor is bound by the terms of the Act and is committed to take affirmative action to employ, and advance in employment, qualified special disabled veterans, veterans of the Vietnam era, and other eligible veterans.

(f) Noncompliance. If the Contractor does not comply with the requirements of this clause, the Government may take appropriate actions under the rules, regulations, and relevant orders of the Secretary of Labor issued pursuant to the Act.

(g) Subcontracts. The Contractor shall insert the terms of this clause in all subcontracts or purchase orders of $25,000 or more unless exempted by rules, regulations, or orders of the Secretary of Labor. The Contractor shall act as specified by the Deputy Assistant Secretary of Labor to enforce the terms, including action for noncompliance.

(End of clause)

52.222-36 AFFIRMATIVE ACTION FOR WORKERS WITH DISABILITIES (JUN 1998)

(a) General. (1) Regarding any position for which the employee or applicant for employment is qualified, the Contractor shall not discriminate against any employee or applicant because of physical or mental disability. The Contractor agrees to take affirmative action to employ, advance in employment, and otherwise treat qualified individuals with disabilities without discrimination based upon their physical or mental disability in all employment practices such as--

(i) Recruitment, advertising, and job application procedures;

(ii) Hiring, upgrading, promotion, award of tenure, demotion, transfer, layoff, termination, right of return from layoff, and rehiring;

(iii) Rates of pay or any other form of compensation and changes in compensation;

(iv) Job assignments, job classifications, organizational structures, position descriptions, lines of progression, and seniority lists;

(v) Leaves of absence, sick leave, or any other leave;

(vi) Fringe benefits available by virtue of employment, whether or not administered by the Contractor;

(vii) Selection and financial support for training, including apprenticeships, professional meetings, conferences, and other related activities, and selection for leaves of absence to pursue training;

(viii) Activities sponsored by the Contractor, including social or recreational programs; and

(ix) Any other term, condition, or privilege of employment.

(2) The Contractor agrees to comply with the rules, regulations, and relevant orders of the Secretary of Labor (Secretary) issued under the Rehabilitation Act of 1973 (29 U.S.C. 793) (the Act), as amended.

(b) Postings. (1) The Contractor agrees to post employment notices stating--

(i) The Contractor's obligation under the law to take affirmative action to employ and advance in employment qualified individuals with disabilities; and

(ii) The rights of applicants and employees.

(2) These notices shall be posted in conspicuous places that are available to employees and applicants for employment. The Contractor shall ensure that applicants and employees with disabilities are informed of the contents of the notice (e.g., the Contractor may have the notice read to a visually disabled individual, or may lower the posted notice so that it might be read by a person in a wheelchair). The notices shall be in a form prescribed by the Deputy Assistant Secretary for Federal Contract Compliance of the U.S. Department of Labor (Deputy Assistant Secretary) and shall be provided by or through the Contracting Officer.

(3) The Contractor shall notify each labor union or representative of workers with which it has a collective bargaining agreement or other contract understanding, that the Contractor is bound by the terms of Section 503 of the Act and is committed to take affirmative action to employ, and advance in employment, qualified individuals with physical or mental disabilities.

(c) Noncompliance. If the Contractor does not comply with the requirements of this clause, appropriate actions may be taken under the rules, regulations, and relevant orders of the Secretary issued pursuant to the Act.

(d) Subcontracts. The Contractor shall include the terms of this clause in every subcontract or purchase order in excess of $10,000 unless exempted by rules, regulations, or orders of the Secretary. The Contractor shall act as specified by the Deputy Assistant Secretary to enforce the terms, including action for noncompliance.

(End of clause)

52.222-37 EMPLOYMENT REPORTS ON SPECIAL DISABLED VETERANS, VETERANS OF THE VIETNAM ERA, AND OTHER ELIGIBLE VETERANS (DEC 2001)

(a) Unless the Contractor is a State or local government agency, the Contractor shall report at least annually, as required by the Secretary of Labor, on--

(1) The number of disabled veterans and the number of veterans of the Vietnam era in the workforce of the contractor by job category and hiring location; and

(2) The total number of new employees hired during the period covered by the report, and of that total, the number of disabled veterans, and the number of veterans of the Vietnam era.

(b) The above items shall be reported by completing the form entitled "Federal Contractor Veterans' Employment Report VETS-100."

(c) Reports shall be submitted no later than September 30 of each year beginning September 30, 1988.

(d) The employment activity report required by paragraph (a)(2) of this clause shall reflect total hires during the most recent 12-month period as of the ending date selected for the employment profile report required by paragraph (a)(1) of this clause. Contractors may select an ending date: (1) As of the end of any pay period during the period January through March 1st of the year the report is due, or (2) as of December 31, if the contractor has previous written approval from the Equal Employment Opportunity Commission to do so for purposes of submitting the Employer Information Report EEO-1 (Standard Form 100).

(e) The count of veterans reported according to paragraph (a) of this clause shall be based on voluntary disclosure. Each Contractor subject to the reporting requirements at 38 U.S.C. 4212 shall invite all disabled veterans and veterans of the Vietnam era who wish to benefit under the affirmative action program at 38 U.S.C. 4212 to identify themselves to the Contractor. The invitation shall state that the information is voluntarily provided; that the information will be kept confidential; that disclosure or refusal to provide the information will not subject the applicant or employee to any adverse treatment; and that the information will be used only in accordance with the regulations promulgated under 38 U.S.C. 4212.

(f) Subcontracts. The Contractor shall include the terms of this clause in every subcontract or purchase order of $10,000 or more unless exempted by rules, regulations, or orders of the Secretary.

(End of clause)

52.222-38 COMPLIANCE WITH VETERANS' EMPLOYMENT REPORTING REQUIREMENTS (DEC 2001)

By submission of its offer, the offeror represents that, if it is subject to the reporting requirements of 38 U.S.C. 4212(d) (i.e., if it has any contract containing Federal Acquisition Regulation clause 52.222-37, Employment Reports on Special Disabled Veterans, Veterans of the Vietnam Era, and Other Eligible Veterans), it has submitted the most recent VETS-100 Report required by that clause.

(End of provision)

52.223-3 HAZARDOUS MATERIAL IDENTIFICATION AND MATERIAL SAFETY DATA (JAN 1997)

(a) "Hazardous material", as used in this clause, includes any material defined as hazardous under the latest version of Federal Standard No. 313 (including revisions adopted during the term of the contract).

(b) The offeror must list any hazardous material, as defined in paragraph (a) of this clause, to be delivered under this contract. The hazardous material shall be properly identified and include any applicable identification number, such as National Stock Number or Special Item Number. This information shall also be included on the Material Safety Data Sheet submitted under this contract.

Material (If none, insert "None")	Identification No.
_____	_____
_____	_____
_____	_____

(c) This list must be updated during performance of the contract whenever the Contractor determines that any other material to be delivered under this contract is hazardous.

(d) The apparently successful offeror agrees to submit, for each item as required prior to award, a Material Safety Data Sheet, meeting the requirements of 29 CFR 1910.1200(g) and the latest version of Federal Standard No. 313, for all hazardous material identified in paragraph (b) of this clause. Data shall be submitted in accordance with Federal

Standard No. 313, whether or not the apparently successful offeror is the actual manufacturer of these items. Failure to submit the Material Safety Data Sheet prior to award may result in the apparently successful offeror being considered nonresponsible and ineligible for award.

(e) If, after award, there is a change in the composition of the item(s) or a revision to Federal Standard No. 313, which renders incomplete or inaccurate the data submitted under paragraph (d) of this clause, the Contractor shall promptly notify the Contracting Officer and resubmit the data.

(f) Neither the requirements of this clause nor any act or failure to act by the Government shall relieve the Contractor of any responsibility or liability for the safety of Government, Contractor, or subcontractor personnel or property.

(g) Nothing contained in this clause shall relieve the Contractor from complying with applicable Federal, State, and local laws, codes, ordinances, and regulations (including the obtaining of licenses and permits) in connection with hazardous material.

(h) The Government's rights in data furnished under this contract with respect to hazardous material are as follows:

(1) To use, duplicate and disclose any data to which this clause is applicable. The purposes of this right are to--

(i) Apprise personnel of the hazards to which they may be exposed in using, handling, packaging, transporting, or disposing of hazardous materials;

(ii) Obtain medical treatment for those affected by the material; and

(iii) Have others use, duplicate, and disclose the data for the Government for these purposes.

(2) To use, duplicate, and disclose data furnished under this clause, in accordance with subparagraph (h)(1) of this clause, in precedence over any other clause of this contract providing for rights in data.

(3) The Government is not precluded from using similar or identical data acquired from other sources.

(End of clause)

52.223-5 POLLUTION PREVENTION AND RIGHT-TO-KNOW INFORMATION (AUG 2003)

(a) Definitions. As used in this clause--

Priority chemical means a chemical identified by the Interagency Environmental Leadership Workgroup or, alternatively, by an agency pursuant to section 503 of Executive Order 13148 of April 21, 2000, Greening the Government through Leadership in Environmental Management.

“Toxic chemical means a chemical or chemical category listed in 40 CFR 372.65.”

(b) Executive Order 13148 requires Federal facilities to comply with the provisions of the Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA) (42 U.S.C. 11001-11050) and the Pollution Prevention Act of 1990 (PPA) (42 U.S.C. 13101-13109).

(c) The Contractor shall provide all information needed by the Federal facility to comply with the following:

(1) The emergency planning reporting requirements of section 302 of EPCRA.

(2) The emergency notice requirements of section 304 of EPCRA.

(3) The list of Material Safety Data Sheets, required by section 311 of EPCRA.

(4) The emergency and hazardous chemical inventory forms of section 312 of EPCRA.

(5) The toxic chemical release inventory of section 313 of EPCRA, which includes the reduction and recycling information required by section 6607 of PPA.

(6) The toxic chemical, priority chemical, and hazardous substance release and use reduction goals of sections 502 and 503 of Executive Order 13148.

(End of clause)

52.223-6 DRUG-FREE WORKPLACE (MAY 2001)

(a) Definitions. As used in this clause --

"Controlled substance" means a controlled substance in schedules I through V of section 202 of the Controlled Substances Act (21 U.S.C. 812) and as further defined in regulation at 21 CFR 1308.11 - 1308.15.

"Conviction" means a finding of guilt (including a plea of nolo contendere) or imposition of sentence, or both, by any judicial body charged with the responsibility to deter- mine violations of the Federal or State criminal drug statutes.

"Criminal drug statute" means a Federal or non-Federal criminal statute involving the manufacture, distribution, dispensing, possession, or use of any controlled substance.

"Drug-free workplace" means the site(s) for the performance of work done by the Contractor in connection with a specific contract at which employees of the Contractor are prohibited from engaging in the unlawful manufacture, distribution, dispensing, possession, or use of a controlled substance.

"Employee" means an employee of a Contractor directly engaged in the performance of work under a Government contract. "Directly engaged" is defined to include all direct cost employees and any other Contractor employee who has other than a minimal impact or involvement in contract performance.

"Individual" means an offeror/contractor that has no more than one employee including the offeror/contractor.

(b) The Contractor, if other than an individual, shall-- within 30 days after award (unless a longer period is agreed to in writing for contracts of 30 days or more performance duration), or as soon as possible for contracts of less than 30 days performance duration--

(1) Publish a statement notifying its employees that the unlawful manufacture, distribution, dispensing, possession, or use of a controlled substance is prohibited in the Contractor's workplace and specifying the actions that will be taken against employees for violations of such prohibition;

(2) Establish an ongoing drug-free awareness program to inform such employees about--

(i) The dangers of drug abuse in the workplace;

(ii) The Contractor's policy of maintaining a drug-free workplace;

(iii) Any available drug counseling, rehabilitation, and employee assistance programs; and

(iv) The penalties that may be imposed upon employees for drug abuse violations occurring in the workplace;

(3) Provide all employees engaged in performance of the contract with a copy of the statement required by subparagraph (b)(1) of this clause;

(4) Notify such employees in writing in the statement required by subparagraph (b)(1) of this clause that, as a condition of continued employment on this contract, the employee will--

(i) Abide by the terms of the statement; and

(ii) Notify the employer in writing of the employee's conviction under a criminal drug statute for a violation occurring in the workplace no later than 5 days after such conviction.

(5) Notify the Contracting Officer in writing within 10 days after receiving notice under subdivision (b)(4)(ii) of this clause, from an employee or otherwise receiving actual notice of such conviction. The notice shall include the position title of the employee;

(6) Within 30 days after receiving notice under subdivision (b)(4)(ii) of this clause of a conviction, take one of the following actions with respect to any employee who is convicted of a drug abuse violation occurring in the workplace:

(i) Taking appropriate personnel action against such employee, up to and including termination; or

(ii) Require such employee to satisfactorily participate in a drug abuse assistance or rehabilitation program approved for such purposes by a Federal, State, or local health, law enforcement, or other appropriate agency; and

(7) Make a good faith effort to maintain a drug-free workplace through implementation of subparagraphs (b)(1) though (b)(6) of this clause.

(c) The Contractor, if an individual, agrees by award of the contract or acceptance of a purchase order, not to engage in the unlawful manufacture, distribution, dispensing, possession, or use of a controlled substance while performing this contract.

(d) In addition to other remedies available to the Government, the Contractor's failure to comply with the requirements of paragraph (b) or (c) of this clause may, pursuant to FAR 23.506, render the Contractor subject to suspension of contract payments, termination of the contract for default, and suspension or debarment.

(End of clause)

52.223-14 TOXIC CHEMICAL RELEASE REPORTING (AUG 2003)

(a) Unless otherwise exempt, the Contractor, as owner or operator of a facility used in the performance of this contract, shall file by July 1 for the prior calendar year an annual Toxic Chemical Release Inventory Form (Form R) as described in sections 313(a) and (g) of the Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA) (42 U.S.C. 11023(a) and (g)), and section 6607 of the Pollution Prevention Act of 1990 (PPA) (42 U.S.C. 13106). The Contractor shall file, for each facility subject to the Form R filing and reporting requirements, the annual Form R throughout the life of the contract.

(b) A Contractor-owned or -operated facility used in the performance of this contract is exempt from the requirement to file an annual Form R if--

(1) The facility does not manufacture, process, or otherwise use any toxic chemicals listed in 40 CFR 372.65;

(2) The facility does not have 10 or more full-time employees as specified in section 313(b)(1)(A) of EPCRA, 42 U.S.C. 11023(b)(1)(A);

(3) The facility does not meet the reporting thresholds of toxic chemicals established under of EPCRA, 42 U.S.C. 11023(f) (including the alternate thresholds at 40 CFR 372.27, provided an appropriate certification form has been filed with EPA);

(4) The facility does not fall within the following Standard Industrial Classification (SIC) codes or their corresponding North American Industry Classification System sectors:

(i) Major group code 10 (except 1011, 1081, and 1094.

(ii) Major group code 12 (except 1241).

(iii) Major group codes 20 through 39.

(iv) Industry code 4911, 4931, or 4939 (limited to facilities that combust coal and/or oil for the purpose of generating power for distribution in commerce).

(v) Industry code 4953 (limited to facilities regulated under the Resource Conservation and Recovery Act, Subtitle C (42 U.S.C. 6921, et seq.)), 5169, 5171, or 7389 (limited to facilities primarily engaged in solvent recovery services on a contract or fee basis); or

(5) The facility is not located in the United States or its outlying areas.

(c) If the Contractor has certified to an exemption in accordance with one or more of the criteria in paragraph (b) of this clause, and after award of the contract circumstances change so that any of its owned or operated facilities used in the performance of this contract is no longer exempt--

(1) The Contractor shall notify the Contracting Officer; and

(2) The Contractor, as owner or operator of a facility used in the performance of this contract that is no longer exempt, shall (i) submit a Toxic Chemical Release Inventory Form (Form R) on or before July 1 for the prior calendar year during which the facility becomes eligible; and (ii) continue to file the annual Form R for the life of the contract for such facility.

(d) The Contracting Officer may terminate this contract or take other action as appropriate, if the Contractor fails to comply accurately and fully with the EPCRA and PPA toxic chemical release filing and reporting requirements.

(e) Except for acquisitions of commercial items, as defined in FAR Part 2, the Contractor shall--

(1) For competitive subcontracts expected to exceed $100,000 (including all options), include a solicitation provision substantially the same as the provision at FAR 52.223-13, Certification of Toxic Chemical Release Reporting; and

(2) Include in any resultant subcontract exceeding $100,000 (including all options), the substance of this clause, except this paragraph (e).

(End of clause)

52.225-11 BUY AMERICAN ACT--CONSTRUCTION MATERIALS UNDER TRADE AGREEMENTS (JAN 2004)

(a) Definitions. As used in this clause--

Component means an article, material, or supply incorporated directly into a construction material.

Construction material means an article, material, or supply brought to the construction site by the Contractor or subcontractor for incorporation into the building or work. The term also includes an item brought to the site preassembled from articles, materials, or supplies. However, emergency life safety systems, such as emergency lighting, fire alarm, and audio evacuation systems, that are discrete systems incorporated into a public building or work and that are produced as complete systems, are evaluated as a single and distinct construction material regardless of when or how the individual parts or components of those systems are delivered to the construction site. Materials purchased directly by the Government are supplies, not construction material.

Cost of components means--

(1) For components purchased by the Contractor, the acquisition cost, including transportation costs to the place of incorporation into the construction material (whether or not such costs are paid to a domestic firm), and any applicable duty (whether or not a duty-free entry certificate is issued); or

(2) For components manufactured by the Contractor, all costs associated with the manufacture of the component, including transportation costs as described in paragraph (1) of this definition, plus allocable overhead costs, but excluding profit. Cost of components does not include any costs associated with the manufacture of the end product.

Designated country means any of the following countries: Aruba, Austria, Bangladesh, Belgium, Benin, Bhutan, Botswana, Burkina Faso, Burundi, Canada, Cape Verde, Central African Republic, Chad, Comoros, Denmark.

Djibouti, Equatorial Guinea, Finland, France, Gambia, Germany, Greece, Guinea, Guinea-Bissau, Haiti, Hong Kong, Ireland, Israel, Italy, Japan.

Kiribati, Korea, Republic of, Lesotho, Liechtenstein, Luxembourg, Malawi, Maldives, Mali, Mozambique, Nepal, Netherlands, Niger, Norway, Portugal, Rwanda.

Sao Tome and Principe, Sierra Leone, Singapore, Somalia, Spain, Sweden, Switzerland, Tanzania U.R., Togo, Tuvalu, Uganda, United Kingdom, Vanuatu, Western Samoa, Yemen.

Designated country construction material means a construction material that--

(1) Is wholly the growth, product, or manufacture of a designated country; or

(2) In the case of a construction material that consists in whole or in part of materials from another country, has been substantially transformed in a designated country into a new and different construction material distinct from the materials from which it was transformed.

Domestic construction material means--

(1) An unmanufactured construction material mined or produced in the United States; or

(2) A construction material manufactured in the United States, if the cost of its components mined, produced, or manufactured in the United States exceeds 50 percent of the cost of all its components. Components of foreign origin of the same class or kind for which nonavailability determinations have been made are treated as domestic.

Foreign construction material means a construction material other than a domestic construction material.

Free Trade Agreement country means Canada, Chile, Mexico, or Singapore.

Free Trade Agreement country construction material means a construction material that--

(1) Is wholly the growth, product, or manufacture of a Free Trade Agreement (FTA) country; or

(2) In the case of a construction material that consists in whole or in part of materials from another country, has been substantially transformed in a FTA country into a new and different construction material distinct from the materials from which it was transformed.

United States means the 50 States, the District of Columbia, and outlying areas.

(b) Construction materials. (1) This clause implements the Buy American Act (41 U.S.C. 10a-10d) by providing a preference for domestic construction material. In addition, the Contracting Officer has determined that the Trade Agreements Act and Free Trade Agreements (FTAs) apply to this acquisition. Therefore, the Buy American Act restrictions are waived for designated country and FTA country construction materials.

(2) The Contractor shall use only domestic, designated country, or NAFTA country construction material in performing this contract, except as provided in paragraphs (b)(3) and (b)(4) of this clause.

(3) The requirement in paragraph (b)(2) of this clause does not apply to the construction materials or components listed by the Government as follows: None

(4) The Contracting Officer may add other foreign construction material to the list in paragraph (b)(3) of this clause if the Government determines that--

(i) The cost of domestic construction material would be unreasonable. The cost of a particular domestic construction material subject to the restrictions of the Buy American Act is unreasonable when the cost of such material exceeds the cost of foreign material by more than 6 percent;

(ii) The application of the restriction of the Buy American Act to a particular construction material would be impracticable or inconsistent with the public interest; or

(iii) The construction material is not mined, produced, or manufactured in the United States in sufficient and reasonably available commercial quantities of a satisfactory quality.

(c) Request for determination of inapplicability of the Buy American Act.

(1)(i) Any Contractor request to use foreign construction material in accordance with paragraph (b)(4) of this clause shall include adequate information for Government evaluation of the request, including--

(A) A description of the foreign and domestic construction materials;

(B) Unit of measure;

(C) Quantity;

(D) Price;

(E) Time of delivery or availability;

(F) Location of the construction project;

(G) Name and address of the proposed supplier; and

(H) A detailed justification of the reason for use of foreign construction materials cited in accordance with paragraph (b)(3) of this clause.

(ii) A request based on unreasonable cost shall include a reasonable survey of the market and a completed price comparison table in the format in paragraph (d) of this clause.

(iii) The price of construction material shall include all delivery costs to the construction site and any applicable duty (whether or not a duty-free certificate may be issued).

(iv) Any Contractor request for a determination submitted after contract award shall explain why the Contractor could not reasonably foresee the need for such determination and could not have requested the determination before contract award. If the Contractor does not submit a satisfactory explanation, the Contracting Officer need not make a determination.

(2) If the Government determines after contract award that an exception to the Buy American Act applies and the Contracting Officer and the Contractor negotiate adequate consideration, the Contracting Officer will modify the contract to allow use of the foreign construction material. However, when the basis for the exception is the unreasonable price of a domestic construction material, adequate consideration is not less than the differential established in paragraph (b)(4)(i) of this clause.

(3) Unless the Government determines that an exception to the Buy American Act applies, use of foreign construction material is noncompliant with the Buy American Act.

(d) Data. To permit evaluation of requests under paragraph (c) of this clause based on unreasonable cost, the Contractor shall include the following information and any applicable supporting data based on the survey of suppliers:

Foreign and Domestic Construction Materials Price Comparison

Construction material description	Unit of measure	Quantity	Price (dollars) \1\
Item 1:			
Foreign construction material....	.....	.....	.....
Domestic construction material...	.....	.....	.....
Item 2:			
Foreign construction material....	.....	.....	.....
Domestic construction material...	.....	.....	.....

\1\ Include all delivery costs to the construction site and any applicable duty (whether or not a duty-free entry certificate is issued).

List name, address, telephone number, and contact for suppliers surveyed. Attach copy of response; if oral, attach summary.

Include other applicable supporting information.

(e) United States law will apply to resolve any claim of breach of this contract.

(End of clause)

52.225-12 NOTICE OF BUY AMERICAN ACT REQUIREMENT-- CONSTRUCTION MATERIALS UNDER TRADE AGREEMENTS (JAN 2004)

(a) Definitions. Construction material, designated country construction material, domestic construction material, foreign construction material, and FTA country construction material, as used in this provision, are defined in the clause of this solicitation entitled "Buy American Act --Construction Materials under Trade Agreements" (Federal Acquisition Regulation (FAR) clause 52.225-11).

(b) Requests for determination of inapplicability. An offeror requesting a determination regarding the inapplicability of the Buy American Act should submit the request to the Contracting Officer in time to allow a determination before submission of offers. The offeror shall include the information and applicable supporting data required by paragraphs (c) and (d) of FAR clause 52.225-11 in the request. If an offeror has not requested a determination regarding the inapplicability of the Buy American Act before submitting its offer, or has not received a response to a previous request, the offeror shall include the information and supporting data in the offer.

(c) Evaluation of offers. (1) The Government will evaluate an offer requesting exception to the requirements of the Buy American Act, based on claimed unreasonable cost of domestic construction materials, by adding to the offered price the appropriate percentage of the cost of such foreign construction material, as specified in paragraph (b)(4)(i) of FAR clause 52.225-11.

(2) If evaluation results in a tie between an offeror that requested the substitution of foreign construction material based on unreasonable cost and an offeror that did not request an exception, the Contracting Officer will award to the offeror that did not request an exception based on unreasonable cost.

(d) Alternate offers. (1) When an offer includes foreign construction material, other than designated country or FTA country construction material, that is not listed by the Government in this solicitation in paragraph (b)(3) of FAR clause 52.225-11, the offeror also may submit an alternate offer based on use of equivalent domestic, designated country, or FTA country construction material.

(2) If an alternate offer is submitted, the offeror shall submit a separate Standard Form 1442 for the alternate offer, and a separate price comparison table prepared in accordance with paragraphs (c) and (d) of FAR clause 52.225-11 for the offer that is based on the use of any foreign construction material for which the Government has not yet determined an exception applies.

(3) If the Government determines that a particular exception requested in accordance with paragraph (c) of FAR clause 52.225-11 does not apply, the Government will evaluate only those offers based on use of the equivalent domestic, designated country, or FTA country construction material, and the offeror shall be required to furnish such domestic, designated country, or FTA country construction material. An offer based on use of the foreign construction material for which an exception was requested--

(i) Will be rejected as nonresponsive if this acquisition is conducted by sealed bidding; or

(ii) May be accepted if revised during negotiations.

(End of provision)

52.225-13 RESTRICTIONS ON CERTAIN FOREIGN PURCHASES (JAN 2004)

(a) Except as authorized by the Office of Foreign Assets Control (OFAC) in the Department of the Treasury, the Contractor shall not acquire, for use in the performance of this contract, any supplies or services if any proclamation,

Executive order, or statute administered by OFAC, or if OFAC's implementing regulations at 31 CFR chapter V, would prohibit such a transaction by a person subject to the jurisdiction of the United States.

(b) Except as authorized by OFAC, most transactions involving Cuba, Iran, Libya, and Sudan are prohibited, as are most imports from North Korea, into the United States or its outlying areas. Lists of entities and individuals subject to economic sanctions are included in OFAC's List of Specially Designated Nationals and Blocked Persons at TerList1.html. More information about these restrictions, as well as updates, is available in the OFAC's regulations at 31 CFR chapter V and/or on OFAC's Web site at http://www.treas.gov/ofac.

(c) The Contractor shall insert this clause, including this paragraph (c), in all subcontracts.

(End of clause)

52.227-1 AUTHORIZATION AND CONSENT (JUL 1995)

(a) The Government authorizes and consents to all use and manufacture, in performing this contract or any subcontract at any tier, of any invention described in and covered by a United States patent (1) embodied in the structure or composition of any article the delivery of which is accepted by the Government under this contract or (2) used in machinery, tools, or methods whose use necessarily results from compliance by the Contractor or a subcontractor with (i) specifications or written provisions forming a part of this contract or (ii) specific written instructions given by the Contracting Officer directing the manner of performance. The entire liability to the Government for infringement of a patent of the United States shall be determined solely by the provisions of the indemnity clause, if any, included in this contract or any subcontract hereunder (including any lower-tier subcontract), and the Government assumes liability for all other infringement to the extent of the authorization and consent hereinabove granted.

(b) The Contractor agrees to include, and require inclusion of, this clause, suitably modified to identify the parties, in all subcontracts at any tier for supplies or services (including construction, architect-engineer services, and materials, supplies, models, samples, and design or testing services expected to exceed the simplified acquisition threshold (however, omission of this clause from any subcontract, including those at or below the simplified acquisition threshold, does not affect this authorization and consent.)

(End of clause)

52.227-2 NOTICE AND ASSISTANCE REGARDING PATENT AND COPYRIGHT INFRINGEMENT (AUG 1996)

(a) The Contractor shall report to the Contracting Officer, promptly and in reasonable written detail, each notice or claim of patent or copyright infringement based on the performance of this contract of which the Contractor has knowledge.

(b) In the event of any claim or suit against the Government on account of any alleged patent or copyright infringement arising out of the performance of this contract or out of the use of any supplies furnished or work or services performed under this contract, the Contractor shall furnish to the Government, when requested by the Contracting Officer, all evidence and information in possession of the Contractor pertaining to such suit or claim. Such evidence and information shall be furnished at the expense of the Government except where the Contractor has agreed to indemnify the Government.

(4) The Contractor agrees to include, and require inclusion of, this clause in all subcontracts at any tier for supplies or services (including construction and architect-engineer subcontracts and those for material, supplies, models, samples, or design or testing services) expected to exceed the simplified acquisition threshold at (FAR) 2.101.to exceed the dollar amount set forth in 13.000 of the Federal Acquisition Regulation (FAR).

(End of clause)

52.227-4 PATENT INDEMNITY--CONSTRUCTION CONTRACTS (APR 1984)

Except as otherwise provided, the Contractor agrees to indemnify the Government and its officers, agents, and employees against liability, including costs and expenses, for infringement upon any United States patent (except a patent issued upon an application that is now or may hereafter be withheld from issue pursuant to a Secrecy Order under 35 U.S.C. 181) arising out of performing this contract or out of the use or disposal by or for the account of the Government of supplies furnished or work performed under this contract.

(End of clause)

52.228-1 BID GUARANTEE (SEP 1996)

(a) Failure to furnish a bid guarantee in the proper form and amount, by the time set for opening of bids, may be cause for rejection of the bid.

(b) The bidder shall furnish a bid guarantee in the form of a firm commitment, e.g., bid bond supported by good and sufficient surety or sureties acceptable to the Government, postal money order, certified check, cashier's check, irrevocable letter of credit, or, under Treasury Department regulations, certain bonds or notes of the United States. The Contracting Officer will return bid guarantees, other than bid bonds, (1) to unsuccessful bidders as soon as practicable after the opening of bids, and (2) to the successful bidder upon execution of contractual documents and bonds (including any necessary coinsurance or reinsurance agreements), as required by the bid as accepted.-

(c) The amount of the bid guarantee shall be _20_ percent of the bid price or $3,000,000, whichever is less.-

(d) If the successful bidder, upon acceptance of its bid by the Government within the period specified for acceptance, fails to execute all contractual documents or furnish executed bond(s) within 10 days after receipt of the forms by the bidder, the Contracting Officer may terminate the contract for default.-

(e) In the event the contract is terminated for default, the bidder is liable for any cost of acquiring the work that exceeds the amount of its bid, and the bid guarantee is available to offset the difference.

(End of clause)

52.228-2 ADDITIONAL BOND SECURITY (OCT 1997)

The Contractor shall promptly furnish additional security required to protect the Government and persons supplying labor or materials under this contract if--

(a) Any surety upon any bond, or issuing financial institution for other security, furnished with this contract becomes unacceptable to the Government.

(b) Any surety fails to furnish reports on its financial condition as required by the Government;

(c) The contract price is increased so that the penal sum of any bond becomes inadequate in the opinion of the Contracting Officer; or

(d) An irrevocable letter of credit (ILC) used as security will expire before the end of the period of required security. If the Contractor does not furnish an acceptable extension or replacement ILC, or other acceptable substitute, at least 30 days before an ILC's scheduled expiration, the Contracting officer has the right to immediately draw on the ILC.

(End of clause)

52.228-11 PLEDGES OF ASSETS (FEB 1992)

(a) Offerors shall obtain from each person acting as an individual surety on a bid guarantee, a performance bond, or a payment bond--

(1) Pledge of assets; and

(2) Standard Form 28, Affidavit of Individual Surety.

(b) Pledges of assets from each person acting as an individual surety shall be in the form of--

(1) Evidence of an escrow account containing cash, certificates of deposit, commercial or Government securities, or other assets described in FAR 28.203-2 (except see 28.203-2(b)(2) with respect to Government securities held in book entry form) and/or;

(2) A recorded lien on real estate. The offeror will be required to provide--

(i) Evidence of title in the form of a certificate of title prepared by a title insurance company approved by the United States Department of Justice. This title evidence must show fee simple title vested in the surety along with any concurrent owners; whether any real estate taxes are due and payable; and any recorded encumbrances against the property, including the lien filed in favor of the Government as required by FAR 28.203-3(d);

(ii) Evidence of the amount due under any encumbrance shown in the evidence of title;

(iii) A copy of the current real estate tax assessment of the property or a current appraisal dated no earlier than 6 months prior to the date of the bond, prepared by a professional appraiser who certifies that the appraisal has been conducted in accordance with the generally accepted appraisal standards as reflected in the Uniform Standards of Professional Appraisal Practice, as promulgated by the Appraisal Foundation.

(End of clause)

52.228-14 IRREVOCABLE LETTER OF CREDIT (DEC 1999)

(a) “Irrevocable letter of credit” (ILC), as used in this clause, means a written commitment by a federally insured financial institution to pay all or part of a stated amount of money, until the expiration date of the letter, upon presentation by the Government (the beneficiary) of a written demand therefor. Neither the financial institution nor the offeror/Contractor can revoke or condition the letter of credit.

(b) If the offeror intends to use an ILC in lieu of a bid bond, or to secure other types of bonds such as performance and payment bonds, the letter of credit and letter of confirmation formats in paragraphs (e) and (f) of this clause shall be used.

(c) The letter of credit shall be irrevocable, shall require presentation of no document other than a written demand and the ILC (including confirming letter, if any), shall be issued/confirmed by an acceptable federally insured financial institution as provided in paragraph (d) of this clause, and--

(1) If used as a bid guarantee, the ILC shall expire no earlier than 60 days after the close of the bid acceptance period;

(2) If used as an alternative to corporate or individual sureties as security for a performance or payment bond, the offeror/Contractor may submit an ILC with an initial expiration date estimated to cover the entire period for which financial security is required or may submit an ILC with an initial expiration date that is a minimum period of one year from the date of issuance. The ILC shall provide that, unless the issuer provides the beneficiary written notice of non-renewal at least 60 days in advance of the current expiration date, the ILC is automatically extended without amendment for one year from the expiration date, or any future expiration date, until the period of required coverage is completed and the Contracting Officer provides the financial institution with a written statement waiving the right to payment. The period of required coverage shall be:

(i) For contracts subject to the Miller Act, the later of--

(A) One year following the expected date of final payment;

(B) For performance bonds only, until completion of any warranty period; or

(C) For payment bonds only, until resolution of all claims filed against the payment bond during the one-year period following final payment.

(ii) For contracts not subject to the Miller Act, the later of--

(A) 90 days following final payment; or

(B) For performance bonds only, until completion of any warranty period.

(d) Only federally insured financial institutions rated investment grade or higher shall issue or confirm the ILC. The offeror/Contractor shall provide the Contracting Officer a credit rating that indicates the financial institution has the required rating(s) as of the date of issuance of the ILC. Unless the financial institution issuing the ILC had letter of credit business of less than $25 million in the past year, ILCs over $5 million must be confirmed by another acceptable financial institution that had letter of credit business of less than $25 million in the past year.

(e) The following format shall be used by the issuing financial institution to create an ILC:

_____

[Issuing Financial Institution's Letterhead or Name and Address]

Issue Date _____

IRREVOCABLE LETTER OF CREDIT NO. _____

Account party's name _____

Account party's address _____

For Solicitation No. _____(for reference only)

TO: [U.S. Government agency]

[U.S. Government agency's address]

1. We hereby establish this irrevocable and transferable Letter of Credit in your favor for one or more drawings up to United States $_____. This Letter of Credit is payable at [issuing financial institution's and, if any, confirming financial institution's] office at [issuing financial institution's address and, if any, confirming financial institution's address] and expires with our close of business on _____, or any automatically extended expiration date.

2. We hereby undertake to honor your or the transferee's sight draft(s) drawn on the issuing or, if any, the confirming financial institution, for all or any part of this credit if presented with this Letter of Credit and confirmation, if any, at the office specified in paragraph 1 of this Letter of Credit on or before the expiration date or any automatically extended expiration date.

3. [This paragraph is omitted if used as a bid guarantee, and subsequent paragraphs are renumbered.] It is a condition of this Letter of Credit that it is deemed to be automatically extended without amendment for one year from the expiration date hereof, or any future expiration date, unless at least 60 days prior to any expiration date, we notify you or the transferee by registered mail, or other receipted means of delivery, that we elect not to consider this Letter of Credit renewed for any such additional period. At the time we notify you, we also agree to notify the account party (and confirming financial institution, if any) by the same means of delivery.

4. This Letter of Credit is transferable. Transfers and assignments of proceeds are to be effected without charge to either the beneficiary or the transferee/assignee of proceeds. Such transfer or assignment shall be only at the written direction of the Government (the beneficiary) in a form satisfactory to the issuing financial institution and the confirming financial institution, if any.

5. This Letter of Credit is subject to the Uniform Customs and Practice (UCP) for Documentary Credits, 1993 Revision, International Chamber of Commerce Publication No. 500, and to the extent not inconsistent therewith, to the laws of _____ [state of confirming financial institution, if any, otherwise state of issuing financial institution].

6. If this credit expires during an interruption of business of this financial institution as described in Article 17 of the UCP, the financial institution specifically agrees to effect payment if this credit is drawn against within 30 days after the resumption of our business.

Sincerely,

_____

[Issuing financial institution]

(f) The following format shall be used by the financial institution to confirm an ILC:

_____
[Confirming Financial Institution's Letterhead or Name and Address]

(Date) _____

Our Letter of Credit Advice Number _____

Beneficiary: _____ [U.S. Government agency]

Issuing Financial Institution: _____

Issuing Financial Institution's LC No.: _____

Gentlemen:

1. We hereby confirm the above indicated Letter of Credit, the original of which is attached, issued by _____ [name of issuing financial institution] for drawings of up to United States dollars _____/U.S. $_____ and expiring with our close of business on _____ [the expiration date], or any automatically extended expiration date.

2. Draft(s) drawn under the Letter of Credit and this Confirmation are payable at our office located at _____.

3. We hereby undertake to honor sight draft(s) drawn under and presented with the Letter of Credit and this Confirmation at our offices as specified herein.

4. [This paragraph is omitted if used as a bid guarantee, and subsequent paragraphs are renumbered.] It is a condition of this confirmation that it be deemed automatically extended without amendment for one year from the expiration date hereof, or any automatically extended expiration date, unless:

(a) At least 60 days prior to any such expiration date, we shall notify the Contracting Officer, or the transferee and the issuing financial institution, by registered mail or other receipted means of delivery, that we elect not to consider this confirmation extended for any such additional period; or

(b) The issuing financial institution shall have exercised its right to notify you or the transferee, the account party, and ourselves, of its election not to extend the expiration date of the Letter of Credit.

5. This confirmation is subject to the Uniform Customs and Practice (UCP) for Documentary Credits, 1993 Revision, International Chamber of Commerce Publication No. 500, and to the extent not inconsistent therewith, to the laws of _____ [state of confirming financial institution].

6. If this confirmation expires during an interruption of business of this financial institution as described in Article 17 of the UCP, we specifically agree to effect payment if this credit is drawn against within 30 days after the resumption of our business.

Sincerely,

_____

[Confirming financial institution]

(g) The following format shall be used by the Contracting Officer for a sight draft to draw on the Letter of Credit:

SIGHT DRAFT

_____

[City, State]

(Date) _____

[Name and address of financial institution]

Pay to the order of _____ [Beneficiary Agency] _____ the sum of United States $_____. This draft is drawn under Irrevocable Letter of Credit No. _____.

_____

[Beneficiary Agency]

By: _____

(End of clause)

52.228-15 PERFORMANCE AND PAYMENT BONDS--CONSTRUCTION (JUL 2000)-

(a) Definitions. As used in this clause--

Original contract price means the award price of the contract; or, for requirements contracts, the price payable for the estimated total quantity; or, for indefinite-quantity contracts, the price payable for the specified minimum quantity. Original contract price does not include the price of any options, except those options exercised at the time of contract award.

(b) Amount of required bonds. Unless the resulting contract price is $100,000 or less, the successful offeror shall furnish performance and payment bonds to the Contracting Officer as follows:

(1) Performance bonds (Standard Form 25). The penal amount of performance bonds at the time of contract award shall be 100 percent of the original contract price.

(2) Payment Bonds (Standard Form 25-A). The penal amount of payment bonds at the time of contract award shall be 100 percent of the original contract price.

(3) Additional bond protection. (i) The Government may require additional performance and payment bond protection if the contract price is increased. The increase in protection generally will equal 100 percent of the increase in contract price.

(ii) The Government may secure the additional protection by directing the Contractor to increase the penal amount of the existing bond or to obtain an additional bond.

(c) Furnishing executed bonds. The Contractor shall furnish all executed bonds, including any necessary reinsurance agreements, to the Contracting Officer, within the time period specified in the Bid Guarantee provision of the solicitation, or otherwise specified by the Contracting Officer, but in any event, before starting work.

(d) Surety or other security for bonds. The bonds shall be in the form of firm commitment, supported by corporate sureties whose names appear on the list contained in Treasury Department Circular 570, individual sureties, or by other acceptable security such as postal money order, certified check, cashier's check, irrevocable letter of credit, or, in accordance with Treasury Department regulations, certain bonds or notes of the United States. Treasury Circular 570 is published in the Federal Register or may be obtained from the U.S. Department of Treasury, Financial Management Service, Surety Bond Branch, 401 14th Street, NW, 2nd Floor, West Wing, Washington, DC 20227.

(e) Notice of subcontractor waiver of protection (40 U.S.C. 270b(c). Any waiver of the right to sue on the payment bond is void unless it is in writing, signed by the person whose right is waived, and executed after such person has first furnished labor or material for use in the performance of the contract.

(End of clause)

52.229-3 FEDERAL, STATE, AND LOCAL TAXES (APR 2003)

(a) As used in this clause--

"Contract date" means the date set for bid opening or, if this is a negotiated contract or a modification, the effective date of this contract or modification.

"All applicable Federal, State, and local taxes and duties" means all taxes and duties, in effect on the contract date, that the taxing authority is imposing and collecting on the transactions or property covered by this contract.

"After-imposed Federal tax" means any new or increased Federal excise tax or duty, or tax that was exempted or excluded on the contract date but whose exemption was later revoked or reduced during the contract period, on the transactions or property covered by this contract that the Contractor is required to pay or bear as the result of legislative, judicial, or administrative action taking effect after the contract date. It does not include social security tax or other employment taxes.

"After-relieved Federal tax" means any amount of Federal excise tax or duty, except social security or other employment taxes, that would otherwise have been payable on the transactions or property covered by this contract, but which the Contractor is not required to pay or bear, or for which the Contractor obtains a refund or drawback, as the result of legislative, judicial, or administrative action taking effect after the contract date.

Local taxes includes taxes imposed by a possession or territory of the United States, Puerto Rico, or the Northern Mariana Islands, if the contract is performed wholly or partly in any of those areas.

(b) The contract price includes all applicable Federal, State, and local taxes and duties.

(c) The contract price shall be increased by the amount of any after-imposed Federal tax, provided the Contractor warrants in writing that no amount for such newly imposed Federal excise tax or duty or rate increase was included in the contract price, as a contingency reserve or otherwise.

(d) The contract price shall be decreased by the amount of any after-relieved Federal tax.

(e) The contract price shall be decreased by the amount of any Federal excise tax or duty, except social security or other employment taxes, that the Contractor is required to pay or bear, or does not obtain a refund of, through the Contractor's fault, negligence, or failure to follow instructions of the Contracting Officer.

(f) No adjustment shall be made in the contract price under this clause unless the amount of the adjustment exceeds $250.

(g) The Contractor shall promptly notify the Contracting Officer of all matters relating to any Federal excise tax or duty that reasonably may be expected to result in either an increase or decrease in the contract price and shall take appropriate action as the Contracting Officer directs.

(h) The Government shall, without liability, furnish evidence appropriate to establish exemption from any Federal, State, or local tax when the Contractor requests such evidence and a reasonable basis exists to sustain the exemption.

(End of clause)

52.231-5000 EQUIPMENT OWNERSHIP AND OPERATING EXPENSE SCHEDULE
MAR 1995)--EFARS

(a) This clause does not apply to terminations. See 52.249-5000, Basis for Settlement of Proposals and FAR Part 49.

(b) Allowable cost for construction and marine plant and equipment in sound workable condition owned or controlled and furnished by a contractor or subcontractor at any tier shall be based on actual cost data for each piece of equipment or groups of similar serial and series for which the Government can determine both ownership and operating costs from the contractor's accounting records. When both ownership and operating costs cannot be determined for any piece of equipment or groups of similar serial or series equipment from the contractor's accounting records, costs for that equipment shall be based upon the applicable provisions of EP 1110-1-8, Construction Equipment Ownership and Operating Expense Schedule, Region __IX__. Working conditions shall be considered to be average for determining equipment rates using the schedule unless specified otherwise by the contracting officer. For equipment not included in the schedule, rates for comparable pieces of equipment may be used or a rate may be developed using the formula provided in the schedule. For forward pricing, the schedule in effect at the time of negotiations shall apply. For retroactive pricing, the schedule in effect at the time the work was performed shall apply.

(c) Equipment rental costs are allowable, subject to the provisions of FAR 31.105(d)(ii) and FAR 31.205-36. Rates for equipment rented from an organization under common control, lease-purchase arrangements, and sale-leaseback arrangements, will be determined using the schedule, except that actual rates will be used for equipment leased from an organization under common control that has an established practice of leasing the same or similar equipment to unaffiliated lessees.

(d) When actual equipment costs are proposed and the total amount of the pricing action exceeds the small purchase threshold, the contracting officer shall request the contractor to submit either certified cost or pricing data, or partial/limited data, as appropriate. The data shall be submitted on Standard Form 1411, Contract Pricing Proposal Cover Sheet.

(End of clause)

52.232-5 PAYMENTS UNDER FIXED-PRICE CONSTRUCTION CONTRACTS (SEP 2002)

(a) Payment of price. The Government shall pay the Contractor the contract price as provided in this contract.

(b) Progress payments. The Government shall make progress payments monthly as the work proceeds, or at more frequent intervals as determined by the Contracting Officer, on estimates of work accomplished which meets the standards of quality established under the contract, as approved by the Contracting Officer.

(1) The Contractor's request for progress payments shall include the following substantiation:

(i) An itemization of the amounts requested, related to the various elements of work required by the contract covered

by the payment requested.

(ii) A listing of the amount included for work performed by each subcontractor under the contract.

(iii) A listing of the total amount of each subcontract under the contract.

(iv) A listing of the amounts previously paid to each such subcontractor under the contract.

(v) Additional supporting data in a form and detail required by the Contracting Officer.

(2) In the preparation of estimates, the Contracting Officer may authorize material delivered on the site and preparatory work done to be taken into consideration. Material delivered to the Contractor at locations other than the site also may be taken into consideration if--

(i) Consideration is specifically authorized by this contract; and

(ii) The Contractor furnishes satisfactory evidence that it has acquired title to such material and that the material will be used to perform this contract.

(c) Contractor certification. Along with each request for progress payments, the Contractor shall furnish the following certification, or payment shall not be made: (However, if the Contractor elects to delete paragraph (c)(4) from the certification, the certification is still acceptable.)

I hereby certify, to the best of my knowledge and belief, that--

(1) The amounts requested are only for performance in accordance with the specifications, terms, and conditions of the contract;

(2) All payments due to subcontractors and suppliers from previous payments received under the contract have been made, and timely payments will be made from the proceeds of the payment covered by this certification, in accordance with subcontract agreements and the requirements of chapter 39 of Title 31, United States Code;

(3) This request for progress payments does not include any amounts which the prime contractor intends to withhold or retain from a subcontractor or supplier in accordance with the terms and conditions of the subcontract; and

(4) This certification is not to be construed as final acceptance of a subcontractor's performance.

_____

(Name)

_____

(Title)

_____

(Date)

(d) Refund of unearned amounts. If the Contractor, after making a certified request for progress payments, discovers that a portion or all of such request constitutes a payment for performance by the Contractor that fails to conform to the specifications, terms, and conditions of this contract (hereinafter referred to as the "unearned amount"), the Contractor shall--

(1) Notify the Contracting Officer of such performance deficiency; and

(2) Be obligated to pay the Government an amount (computed by the Contracting Officer in the manner provided in paragraph (j) of this clause) equal to interest on the unearned amount from the 8th day after the date of receipt of the unearned amount until--

(i) The date the Contractor notifies the Contracting Officer that the performance deficiency has been corrected; or

(ii) The date the Contractor reduces the amount of any subsequent certified request for progress payments by an amount equal to the unearned amount.

(e) Retainage. If the Contracting Officer finds that satisfactory progress was achieved during any period for which a progress payment is to be made, the Contracting Officer shall authorize payment to be made in full. However, if satisfactory progress has not been made, the Contracting Officer may retain a maximum of 10 percent of the amount of the payment until satisfactory progress is achieved. When the work is substantially complete, the Contracting Officer may retain from previously withheld funds and future progress payments that amount the Contracting Officer considers adequate for protection of the Government and shall release to the Contractor all the remaining withheld funds. Also, on completion and acceptance of each separate building, public work, or other division of the contract, for which the price is stated separately in the contract, payment shall be made for the completed work without retention of a percentage.

(f) Title, liability, and reservation of rights. All material and work covered by progress payments made shall, at the time of payment, become the sole property of the Government, but this shall not be construed as--

(1) Relieving the Contractor from the sole responsibility for all material and work upon which payments have been made or the restoration of any damaged work; or

(2) Waiving the right of the Government to require the fulfillment of all of the terms of the contract.

(g) Reimbursement for bond premiums. In making these progress payments, the Government shall, upon request, reimburse the Contractor for the amount of premiums paid for performance and payment bonds (including coinsurance and reinsurance agreements, when applicable) after the Contractor has furnished evidence of full payment to the surety. The retainage provisions in paragraph (e) of this clause shall not apply to that portion of progress payments attributable to bond premiums.

(h) Final payment. The Government shall pay the amount due the Contractor under this contract after--

(1) Completion and acceptance of all work;

(2) Presentation of a properly executed voucher; and

(3) Presentation of release of all claims against
the Government arising by virtue of this contract, other than claims, in stated amounts, that the Contractor has specifically excepted from the operation of the release. A release may also be required of the assignee if the Contractor's claim to amounts payable under this contract has been assigned under the Assignment of Claims Act of 1940 (31 U.S.C. 3727 and 41 U.S.C. 15).

(i) Limitation because of undefinitized work. Notwithstanding any provision of this contract, progress payments shall not exceed 80 percent on work accomplished on undefinitized contract actions. A "contract action" is any action resulting in a contract, as defined in FAR Subpart 2.1, including contract modifications for additional supplies or services, but not including contract modifications that are within the scope and under the terms of the contract, such as contract modifications issued pursuant to the Changes clause, or funding and other administrative changes.

(j) Interest computation on unearned amounts. In accordance with 31 U.S.C. 3903(c)(1), the amount payable under subparagraph (d)(2) of this clause shall be--

(1) Computed at the rate of average bond equivalent rates of 91-day Treasury bills auctioned at the most recent auction of such bills prior to the date the Contractor receives the unearned amount; and

(2) Deducted from the next available payment to the Contractor.

(End of clause)

52.232-17 INTEREST (JUNE 1996)

(a) Except as otherwise provided in this contract under a Price Reduction for Defective Cost or Pricing Data clause or a Cost Accounting Standards clause, all amounts that become payable by the Contractor to the Government under this contract (net of any applicable tax credit under the Internal Revenue Code (26 U.S.C. 1481)) shall bear simple interest from the date due until paid unless paid within 30 days of becoming due. The interest rate shall be the interest rate established by the Secretary of the Treasury as provided in Section 12 of the Contract Disputes Act of 1978 (Public Law 95-563), which is applicable to the period in which the amount becomes due, as provided in paragraph (b) of this clause, and then at the rate applicable for each six-month period as fixed by the Secretary until the amount is paid. reproduce, prepare derivative works, distribute copies to the public, and (b) Amounts shall be due at the earliest of the following dates:

(1) The date fixed under this contract.

(2) The date of the first written demand for payment consistent with this contract, including any demand resulting from a default termination.

(3) The date the Government transmits to the Contractor a proposed supplemental agreement to confirm completed negotiations establishing the amount of debt.

(4) If this contract provides for revision of prices, the date of written notice to the Contractor stating the amount of refund payable in connection with a pricing proposal or a negotiated pricing agreement not confirmed by contract modification.

(c) The interest charge made under this clause may be reduced under the procedures prescribed in 32.614-2 of the Federal Acquisition Regulation in effect on the date of this contract.

(End of clause)

52.232-18 AVAILABILITY OF FUNDS (APR 1984)

Funds are not presently available for this contract. The Government's obligation under this contract is contingent upon the availability of appropriated funds from which payment for contract purposes can be made. No legal liability on the part of the Government for any payment may arise until funds are made available to the Contracting Officer for this contract and until the Contractor receives notice of such availability, to be confirmed in writing by the Contracting Officer.

(End of clause)

52.232-23 ASSIGNMENT OF CLAIMS (JAN 1986)

(a) The Contractor, under the Assignment of Claims Act, as amended, 31 U.S.C. 3727, 41 U.S.C. 15 (hereafter referred to as "the Act"), may assign its rights to be paid amounts due or to become due as a result of the performance of this contract to a bank, trust company, or other financing institution, including any Federal lending agency. The assignee under such an assignment may thereafter further assign or reassign its right under the original assignment to any type of financing institution described in the preceding sentence.

(b) Any assignment or reassignment authorized under the Act and this clause shall cover all unpaid amounts payable under this contract, and shall not be made to more than one party, except that an assignment or reassignment may be made to one party as agent or trustee for two or more parties participating in the financing of this contract.

(c) The Contractor shall not furnish or disclose to any assignee under this contract any classified document (including this contract) or information related to work under this contract until the Contracting Officer authorizes such action in writing.

(End of clause)

52.232-27 PROMPT PAYMENT FOR CONSTRUCTION CONTRACTS (OCT 2003)

Notwithstanding any other payment terms in this contract, the Government will make invoice payments under the terms and conditions specified in this clause. The Government considers payment as being made on the day a check is dated or the date of an electronic funds transfer. Definitions of pertinent terms are set forth in sections 2.101, 32.001, and 32.902 of the Federal Acquisition Regulation. All days referred to in this clause are calendar days, unless otherwise specified. (However, see paragraph (a)(3) concerning payments due on Saturdays, Sundays, and legal holidays.)

(a) Invoice payments--(1) Types of invoice payments. For purposes of this clause, there are several types of invoice payments that may occur under this contract, as follows:

(i) Progress payments, if provided for elsewhere in this contract, based on Contracting Officer approval of the estimated amount and value of work or services performed, including payments for reaching milestones in any project.

(A) The due date for making such payments is 14 days after the designated billing office receives a proper payment request. If the designated billing office fails to annotate the payment request with the actual date of receipt at the time of receipt, the payment due date is the 14th day after the date of the Contractor's payment request, provided the designated billing office receives a proper payment request and there is no disagreement over quantity, quality, or Contractor compliance with contract requirements.

(B) The due date for payment of any amounts retained by the Contracting Officer in accordance with the clause at 52.232-5, Payments Under Fixed-Price Construction Contracts, is as specified in the contract or, if not specified, 30 days after approval by the Contracting Officer for release to the Contractor.

(ii) Final payments based on completion and acceptance of all work and presentation of release of all claims against the Government arising by virtue of the contract, and payments for partial deliveries that have been accepted by the Government (e.g., each separate building, public work, or other division of the contract for which the price is stated separately in the contract).

(A) The due date for making such payments is the later of the following two events:

(1) The 30th day after the designated billing office receives a proper invoice from the Contractor.

(2) The 30th day after Government acceptance of the work or services completed by the Contractor. For a final invoice when the payment amount is subject to contract settlement actions (e.g., release of claims), acceptance is deemed to occur on the effective date of the contract settlement.

(B) If the designated billing office fails to annotate the invoice with the date of actual receipt at the time of receipt, the invoice payment due date is the 30th day after the date of the Contractor's invoice, provided the designated billing office receives a proper invoice and there is no disagreement over quantity, quality, or Contractor compliance with contract requirements.

(2) Contractor's invoice. The Contractor shall prepare and submit invoices to the designated billing office specified in the contract. A proper invoice must include the items listed in paragraphs (a)(2)(i) through (a)(2)(xi) of this clause. If the invoice does not comply with these requirements, the designated billing office must return it within 7 days after receipt, with the reasons why it is not a proper invoice. When computing any interest penalty owed the Contractor, the Government will take into account if the Government notifies the Contractor of an improper invoice in an untimely manner.

(i) Name and address of the Contractor.

(ii) Invoice date and invoice number. (The Contractor should date invoices as close as possible to the date of mailing or transmission.)

(iii) Contract number or other authorization for work or services performed (including order number and contract line item number).

(iv) Description of work or services performed.

(v) Delivery and payment terms (e.g., discount for prompt payment terms).

(vi) Name and address of Contractor official to whom payment is to be sent (must be the same as that in the contract or in a proper notice of assignment).

(vii) Name (where practicable), title, phone number, and mailing address of person to notify in the event of a defective invoice.

(viii) For payments described in paragraph (a)(1)(i) of this clause, substantiation of the amounts requested and certification in accordance with the requirements of the clause at 52.232-5, Payments Under Fixed-Price Construction Contracts.

(ix) Taxpayer Identification Number (TIN). The Contractor shall include its TIN on the invoice only if required elsewhere in this contract.

(x) Electronic funds transfer (EFT) banking information.

(A) The Contractor shall include EFT banking information on the invoice only if required elsewhere in this contract.

(B) If EFT banking information is not required to be on the invoice, in order for the invoice to be a proper invoice, the Contractor shall have submitted correct EFT banking information in accordance with the applicable solicitation provision (e.g., 52.232-38, Submission of Electronic Funds Transfer Information with Offer), contract clause (e.g.,

52.232-33, Payment by Electronic Funds Transfer--Central Contractor Registration, or 52.232-34, Payment by Electronic Funds Transfer--Other Than Central Contractor Registration), or applicable agency procedures.

(C) EFT banking information is not required if the Government waived the requirement to pay by EFT.

(xi) Any other information or documentation required by the contract.

(3) Interest penalty. The designated payment office will pay an interest penalty automatically, without request from the Contractor, if payment is not made by the due date and the conditions listed in paragraphs (a)(3)(i) through (a)(3)(iii) of this clause are met, if applicable. However, when the due date falls on a Saturday, Sunday, or legal holiday, the designated payment office may make payment on the following working day without incurring a late payment interest penalty.

(i) The designated billing office received a proper invoice.

(ii) The Government processed a receiving report or other Government documentation authorizing payment and there was no disagreement over quantity, quality, Contractor compliance with any contract term or condition, or requested progress payment amount.

(iii) In the case of a final invoice for any balance of funds due the Contractor for work or services performed, the amount was not subject to further contract settlement actions between the Government and the Contractor.

(4) Computing penalty amount. The Government will compute the interest penalty in accordance with the Office of Management and Budget prompt payment regulations at 5 CFR part 1315.

(i) For the sole purpose of computing an interest penalty that might be due the Contractor for payments described in paragraph (a)(1)(ii) of this clause, Government acceptance or approval is deemed to occur constructively on the 7th day after the Contractor has completed the work or services in accordance with the terms and conditions of the contract. If actual acceptance or approval occurs within the constructive acceptance or approval period, the Government will base the determination of an interest penalty on the actual date of acceptance or approval. Constructive acceptance or constructive approval requirements do not apply if there is a disagreement over quantity, quality, or Contractor compliance with a contract provision. These requirements also do not compel Government officials to accept work or services, approve Contractor estimates, perform contract administration functions, or make payment prior to fulfilling their responsibilities.

(ii) The prompt payment regulations at 5 CFR 1315.10(c) do not require the Government to pay interest penalties if payment delays are due to disagreement between the Government and the Contractor over the payment amount or other issues involving contract compliance, or on amounts temporarily withheld or retained in accordance with the terms of the contract. The Government and the Contractor shall resolve claims involving disputes, and any interest that may be payable in accordance with the clause at FAR 52.233-1, Disputes.

(5) Discounts for prompt payment. The designated payment office will pay an interest penalty automatically, without request from the Contractor, if the Government takes a discount for prompt payment improperly. The Government will calculate the interest penalty in accordance with the prompt payment regulations at 5 CFR part 1315.

(6) Additional interest penalty. (i) The designated payment office will pay a penalty amount, calculated in accordance with the prompt payment regulations at 5 CFR part 1315 in addition to the interest penalty amount only if--

(A) The Government owes an interest penalty of $1 or more;

(B) The designated payment office does not pay the interest penalty within 10 days after the date the invoice amount is paid; and

(C) The Contractor makes a written demand to the designated payment office for additional penalty payment, in accordance with paragraph (a)(6)(ii) of this clause, postmarked not later than 40 days after the date the invoice amount is paid.

(ii)(A) The Contractor shall support written demands for additional penalty payments with the following data. The Government will not request any additional data. The Contractor shall--

(1) Specifically assert that late payment interest is due under a specific invoice, and request payment of all overdue late payment interest penalty and such additional penalty as may be required;

(2) Attach a copy of the invoice on which the unpaid late payment interest was due; and

(3) State that payment of the principal has been received, including the date of receipt.

(B) If there is no postmark or the postmark is illegible--

(1) The designated payment office that receives the demand will annotate it with the date of receipt provided the demand is received on or before the 40th day after payment was made; or

(2) If the designated payment office fails to make the required annotation, the Government will determine the demand's validity based on the date the Contractor has placed on the demand, provided such date is no later than the 40th day after payment was made.

(b) Contract financing payments. If this contract provides for contract financing, the Government will make contract financing payments in accordance with the applicable contract financing clause.

(c) Subcontract clause requirements. The Contractor shall include in each subcontract for property or services (including a material supplier) for the purpose of performing this contract the following:

(1) Prompt payment for subcontractors. A payment clause that obligates the Contractor to pay the subcontractor for satisfactory performance under its subcontract not later than 7 days from receipt of payment out of such amounts as are paid to the Contractor under this contract.

(2) Interest for subcontractors. An interest penalty clause that obligates the Contractor to pay to the subcontractor an interest penalty for each payment not made in accordance with the payment clause--

(i) For the period beginning on the day after the required payment date and ending on the date on which payment of the amount due is made; and

(ii) Computed at the rate of interest established by the Secretary of the Treasury, and published in the Federal Register, for interest payments under section 12 of the Contract Disputes Act of 1978 (41 U.S.C. 611) in effect at the time the Contractor accrues the obligation to pay an interest penalty.

(3) Subcontractor clause flowdown. A clause requiring each subcontractor to use:

(i) Include a payment clause and an interest penalty clause conforming to the standards set forth in paragraphs (c)(1) and (c)(2) of this clause in each of its subcontracts; and

(ii) Require each of its subcontractors to include such clauses in their subcontracts with each lower-tier subcontractor or supplier.

(d) Subcontract clause interpretation. The clauses required by paragraph (c) of this clause shall not be construed to impair the right of the Contractor or a subcontractor at any tier to negotiate, and to include in their subcontract, provisions that--

(1) Retainage permitted. Permit the Contractor or a subcontractor to retain (without cause) a specified percentage of each progress payment otherwise due to a subcontractor for satisfactory performance under the subcontract without incurring any obligation to pay a late payment interest penalty, in accordance with terms and conditions agreed to by the parties to the subcontract, giving such recognition as the parties deem appropriate to the ability of a subcontractor to furnish a performance bond and a payment bond;

(2) Withholding permitted. Permit the Contractor or subcontractor to make a determination that part or all of the subcontractor's request for payment may be withheld in accordance with the subcontract agreement; and

(3) Withholding requirements. Permit such withholding without incurring any obligation to pay a late payment penalty if--

(i) A notice conforming to the standards of paragraph (g) of this clause previously has been furnished to the subcontractor; and

(ii) The Contractor furnishes to the Contracting Officer a copy of any notice issued by a Contractor pursuant to paragraph (d)(3)(i) of this clause.

(e) Subcontractor withholding procedures. If a Contractor, after making a request for payment to the Government but before making a payment to a subcontractor for the subcontractor's performance covered by the payment request, discovers that all or a portion of the payment otherwise due such subcontractor is subject to withholding from the subcontractor in accordance with the subcontract agreement, then the Contractor shall--

(1) Subcontractor notice. Furnish to the subcontractor a notice conforming to the standards of paragraph (g) of this clause as soon as practicable upon ascertaining the cause giving rise to a withholding, but prior to the due date for subcontractor payment;

(2) Contracting Officer notice. Furnish to the Contracting Officer, as soon as practicable, a copy of the notice furnished to the subcontractor pursuant to paragraph (e)(1) of this clause;

(3) Subcontractor progress payment reduction. Reduce the subcontractor's progress payment by an amount not to exceed the amount specified in the notice of withholding furnished under paragraph (e)(1) of this clause;

(4) Subsequent subcontractor payment. Pay the subcontractor as soon as practicable after the correction of the identified subcontract performance deficiency, and--

(i) Make such payment within--

(A) Seven days after correction of the identified subcontract performance deficiency (unless the funds therefor must be recovered from the Government because of a reduction under paragraph
(e)(5)(i)) of this clause; or

(B) Seven days after the Contractor recovers such funds from the Government; or

(ii) Incur an obligation to pay a late payment interest penalty computed at the rate of interest established by the Secretary of the Treasury, and published in the Federal Register, for interest payments under section 12 of the Contracts Disputes Act of 1978 (41 U.S.C. 611) in effect at the time the Contractor accrues the obligation to pay an interest penalty;

(5) Notice to Contracting Officer. Notify the Contracting Officer upon--

(i) Reduction of the amount of any subsequent certified application for payment; or

(ii) Payment to the subcontractor of any withheld amounts of a progress payment, specifying--

(A) The amounts withheld under paragraph (e)(1) of this clause; and

(B) The dates that such withholding began and ended; and

(6) Interest to Government. Be obligated to pay to the Government an amount equal to interest on the withheld payments (computed in the manner provided in 31 U.S.C. 3903(c)(1)), from the 8th day after receipt of the withheld amounts from the Government until--

(i) The day the identified subcontractor performance deficiency is corrected; or

(ii) The date that any subsequent payment is reduced under paragraph (e)(5)(i) of this clause.

(f) Third-party deficiency reports--(1) Withholding from subcontractor. If a Contractor, after making payment to a first-tier subcontractor, receives from a supplier or subcontractor of the first-tier subcontractor (hereafter referred to as a “second-tier subcontractor”) a written notice in accordance with section 2 of the Act of August 24, 1935 (40 U.S.C. 270b, Miller Act), asserting a deficiency in such first-tier subcontractor's performance under the contract for which the Contractor may be ultimately liable, and the Contractor determines that all or a portion of future payments otherwise due such first-tier subcontractor is subject to withholding in accordance with the subcontract agreement, the Contractor may, without incurring an obligation to pay an interest penalty under paragraph (e)(6) of this clause--

(i) Furnish to the first-tier subcontractor a notice conforming to the standards of paragraph (g) of this clause as soon as practicable upon making such determination; and

(ii) Withhold from the first-tier subcontractor's next available progress payment or payments an amount not to exceed the amount specified in the notice of withholding furnished under paragraph (f)(1)(i) of this clause.

(2) Subsequent payment or interest charge. As soon as practicable, but not later than 7 days after receipt of satisfactory written notification that the identified subcontract performance deficiency has been corrected, the Contractor shall--

(i) Pay the amount withheld under paragraph (f)(1)(ii) of this clause to such first-tier subcontractor; or

(ii) Incur an obligation to pay a late payment interest penalty to such first-tier subcontractor computed at the rate of interest established by the Secretary of the Treasury, and published in the Federal Register, for interest payments under section 12 of the Contracts DisputesAct of 1978 (41 U.S.C. 611) in effect at the time the Contractor accrues the obligation to pay an interest penalty.

(g) Written notice of subcontractor withholding. The Contractor shall issue a written notice of any withholding to a subcontractor (with a copy furnished to the Contracting Officer), specifying--

(1) The amount to be withheld;

(2) The specific causes for the withholding under the terms of the subcontract; and

(3) The remedial actions to be taken by the subcontractor in order to receive payment of the amounts withheld.

(h) Subcontractor payment entitlement. The Contractor may not request payment from the Government of any amount withheld or retained in accordance with paragraph (d) of this clause until such time as the Contractor has determined and certified to the Contracting Officer that the subcontractor is entitled to the payment of such amount.

(i) Prime-subcontractor disputes. A dispute between the Contractor and subcontractor relating to the amount or entitlement of a subcontractor to a payment or a late payment interest penalty under a clause included in the subcontract pursuant to paragraph (c) of this clause does not constitute a dispute to which the Government is a party. The Government may not be interpleaded in any judicial or administrative proceeding involving such a dispute.

(j) Preservation of prime-subcontractor rights. Except as provided in paragraph (i) of this clause, this clause shall not limit or impair any contractual, administrative, or judicial remedies otherwise available to the Contractor or a subcontractor in the event of a dispute involving late payment or nonpayment by the Contractor or deficient subcontract performance or nonperformance by a subcontractor.

(k) Non-recourse for prime contractor interest penalty. The Contractor's obligation to pay an interest penalty to a subcontractor pursuant to the clauses included in a subcontract under paragraph (c) of this clause shall not be construed to be an obligation of the Government for such interest penalty. A cost-reimbursement claim may not include any amount for reimbursement of such interest penalty.

(l) Overpayments. If the Contractor becomes aware of a duplicate contract financing or invoice payment or that the Government has otherwise overpaid on a contract financing or invoice payment, the Contractor shall immediately notify the Contracting Officer and request instructions for disposition of the overpayment.

(End of clause)

52.232-33 PAYMENT BY ELECTRONIC FUNDS TRANSFER—CENTRAL CONTRACTOR REGISTRATION (OCT 2003)

(a) Method of payment. (1) All payments by the Government under this contract shall be made by electronic funds transfer (EFT), except as provided in paragraph (a)(2) of this clause. As used in this clause, the term “EFT” refers to the funds transfer and may also include the payment information transfer.

(2) In the event the Government is unable to release one or more payments by EFT, the Contractor agrees to either--

(i) Accept payment by check or some other mutually agreeable method of payment; or

(ii) Request the Government to extend the payment due date until such time as the Government can make payment by EFT (but see paragraph (d) of this clause).

(b) Contractor's EFT information. The Government shall make payment to the Contractor using the EFT information contained in the Central Contractor Registration (CCR) database. In the event that the EFT information changes, the Contractor shall be responsible for providing the updated information to the CCR database.

(c) Mechanisms for EFT payment. The Government may make payment by EFT through either the Automated Clearing House (ACH) network, subject to the rules of the National Automated Clearing House Association, or the Fedwire Transfer System. The rules governing Federal payments through the ACH are contained in 31 CFR part 210.

(d) Suspension of payment. If the Contractor's EFT information in the CCR database is incorrect, then the Government need not make payment to the Contractor under this contract until correct EFT information is entered into the CCR database; and any invoice or contract financing request shall be deemed not to be a proper invoice for

the purpose of prompt payment under this contract. The prompt payment terms of the contract regarding notice of an improper invoice and delays in accrual of interest penalties apply.

(e) Liability for uncompleted or erroneous transfers. (1) If an uncompleted or erroneous transfer occurs because the Government used the Contractor's EFT information incorrectly, the Government remains responsible for--

(i) Making a correct payment;

(ii) Paying any prompt payment penalty due; and

(iii) Recovering any erroneously directed funds.

(2) If an uncompleted or erroneous transfer occurs because the Contractor's EFT information was incorrect, or was revised within 30 days of Government release of the EFT payment transaction instruction to the Federal Reserve System, and--

(i) If the funds are no longer under the control of the payment office, the Government is deemed to have made payment and the Contractor is responsible for recovery of any erroneously directed funds; or

(ii) If the funds remain under the control of the payment office, the Government shall not make payment, and the provisions of paragraph (d) of this clause shall apply.

(f) EFT and prompt payment. A payment shall be deemed to have been made in a timely manner in accordance with the prompt payment terms of this contract if, in the EFT payment transaction instruction released to the Federal Reserve System, the date specified for settlement of the payment is on or before the prompt payment due date, provided the specified payment date is a valid date under the rules of the Federal Reserve System.

(g) EFT and assignment of claims. If the Contractor assigns the proceeds of this contract as provided for in the assignment of claims terms of this contract, the Contractor shall require as a condition of any such assignment, that the assignee shall register separately in the CCR database and shall be paid by EFT in accordance with the terms of this clause. Notwithstanding any other requirement of this contract, payment to an ultimate recipient other than the Contractor, or a financial institution properly recognized under an assignment of claims pursuant to subpart 32.8, is not permitted. In all respects, the requirements of this clause shall apply to the assignee as if it were the Contractor. EFT information that shows the ultimate recipient of the transfer to be other than the Contractor, in the absence of a proper assignment of claims acceptable to the Government, is incorrect EFT information within the meaning of paragraph (d) of this clause.

(h) Liability for change of EFT information by financial agent. The Government is not liable for errors resulting from changes to EFT information made by the Contractor's financial agent.

(i) Payment information. The payment or disbursing office shall forward to the Contractor available payment information that is suitable for transmission as of the date of release of the EFT instruction to the Federal Reserve System. The Government may request the Contractor to designate a desired format and method(s) for delivery of payment information from a list of formats and methods the payment office is capable of executing. However, the Government does not guarantee that any particular format or method of delivery is available at any particular payment office and retains the latitude to use the format and delivery method most convenient to the Government. If the Government makes payment by check in accordance with paragraph (a) of this clause, the Government shall mail the payment information to the remittance address contained in the CCR database.

(End of Clause)

52.233-1 DISPUTES. (JUL 2002)

(a) This contract is subject to the Contract Disputes Act of 1978, as amended (41 U.S.C. 601-613).

(b) Except as provided in the Act, all disputes arising under or relating to this contract shall be resolved under this clause.

(c) Claim, as used in this clause, means a written demand or written assertion by one of the contracting parties seeking, as a matter of right, the payment of money in a sum certain, the adjustment or interpretation of contract terms, or other relief arising under or relating to this contract. However, a written demand or written assertion by the Contractor seeking the payment of money exceeding $100,000 is not a claim under the Act until certified. A voucher, invoice, or other routine request for payment that is not in dispute when submitted is not a claim under the Act. The submission may be converted to a claim under the Act, by complying with the submission and certification requirements of this clause, if it is disputed either as to liability or amount or is not acted upon in a reasonable time.

(d)(1) A claim by the Contractor shall be made in writing and, unless otherwise stated in this contract, submitted within 6 years after accrual of the claim to the Contracting Officer for a written decision. A claim by the Government against the Contractor shall be subject to a written decision by the Contracting Officer.

(2)(i) The contractors shall provide the certification specified in subparagraph (d)(2)(iii) of this clause when submitting any claim -

(A) Exceeding $100,000; or

(B) Regardless of the amount claimed, when using -

(1) Arbitration conducted pursuant to 5 U.S.C. 575-580; or

(2) Any other alternative means of dispute resolution (ADR) technique that the agency elects to handle in accordance with the Administrative Dispute Resolution Act (ADRA).

(ii) The certification requirement does not apply to issues in controversy that have not been submitted as all or part of a claim.

(iii) The certification shall state as follows: "I certify that the claim is made in good faith; that the supporting data are accurate and complete to the best of my knowledge and belief; that the amount requested accurately reflects the contract adjustment for which the Contractor believes the Government is liable; and that I am duly authorized to certify the claim on behalf of the Contractor.

(3) The certification may be executed by any person duly authorized to bind the Contractor with respect to the claim.

(e) For Contractor claims of $100,000 or less, the Contracting Officer must, if requested in writing by the Contractor, render a decision within 60 days of the request. For Contractor-certified claims over $100,000, the Contracting Officer must, within 60 days, decide the claim or notify the Contractor of the date by which the decision will be made.

(f) The Contracting Officer's decision shall be final unless the Contractor appeals or files a suit as provided in the Act.

(g) If the claim by the Contractor is submitted to the Contracting Officer or a claim by the Government is presented to the Contractor, the parties, by mutual consent, may agree to use alternative disput resolution (ADR). If the Contractor refuses an offer for ADR, the Contractor shall inform the Contracting Officer, in writing, of the Contractor's specific reasons for rejecting the request.

(h) The Government shall pay interest on the amount found due and unpaid from (1) the date the Contracting Officer receives the claim (certified, if required); or (2) the date that payment otherwise would be due, if that date is later, until the date of payment. With regard to claims having defective certifications, as defined in (FAR) 48 CFR 33.201, interest shall be paid from the date that the Contracting Officer initially receives the claim. Simple interest on claims shall be paid at the rate, fixed by the Secretary of the Treasury as provided in the Act, which is applicable to the period during which the Contracting Officer receives the claim and then at the rate applicable for each 6-month period as fixed by the Treasury Secretary during the pendency of the claim.

(i) The Contractor shall proceed diligently with performance of this contract, pending final resolution of any request for relief, claim, appeal, or action arising under the contract, and comply with any decision of the Contracting Officer.

(End of clause)

52.233-3 PROTEST AFTER AWARD (AUG. 1996)

(a) Upon receipt of a notice of protest (as defined in FAR 33.101) or a determination that a protest is likely (see FAR 33.102(d)), the Contracting Officer may, by written order to the Contractor, direct the Contractor to stop performance of the work called for by this contract. The order shall be specifically identified as a stop-work order issued under this clause. Upon receipt of the order, the Contractor shall immediately comply with its terms and take all reasonable steps to minimize the incurrence of costs allocable to the work covered by the order during the period of work stoppage. Upon receipt of the final decision in the protest, the Contracting Officer shall either--

(1) Cancel the stop-work order; or

(2) Terminate the work covered by the order as provided in the Default, or the Termination for Convenience of the Government, clause of this contract.

(b) If a stop-work order issued under this clause is canceled either before or after a final decision in the protest, the Contractor shall resume work. The Contracting Officer shall make an equitable adjustment in the delivery schedule or contract price, or both, and the contract shall be modified, in writing, accordingly, if--

(1) The stop-work order results in an increase in the time required for, or in the Contractor's cost properly allocable to, the performance of any part of this contract; and

(2) The Contractor asserts its right to an adjustment within 30 days after the end of the period of work stoppage; provided, that if the Contracting Officer decides the facts justify the action, the Contracting Officer may receive and act upon a proposal at any time before final payment under this contract.

(c) If a stop-work order is not canceled and the work covered by the order is terminated for the convenience of the Government, the Contracting Officer shall allow reasonable costs resulting from the stop-work order in arriving at the termination settlement.

(d) If a stop-work order is not canceled and the work covered by the order is terminated for default, the Contracting Officer shall allow, by equitable adjustment or otherwise, reasonable costs resulting from the stop-work order.

(e) The Government's rights to terminate this contract at any time are not affected by action taken under this clause.

(f) If, as the result of the Contractor's intentional or negligent misstatement, misrepresentation, or miscertification, a protest related to this contract is sustained, and the Government pays costs, as provided in FAR 33.102(b)(2) or 33.104(h)(1), the Government may require the Contractor to reimburse the Government the amount of such costs. In addition to any other remedy available, and pursuant to the requirements of Subpart 32.6, the Government may collect

this debt by offsetting the amount against any payment due the Contractor under any contract between the Contractor and the Government.

(End of clause)

52.236-2 DIFFERING SITE CONDITIONS (APR 1984)

As prescribed in 36.502, insert the following clause in solicitations and contracts when a fixed-price construction contract or a fixed-price dismantling, demolition, or removal of improvements contract is contemplated and the contract amount is expected to exceed the small purchase limitation. The Contracting Officer may insert the clause in solicitations and contracts when a fixed-price construction or a fixed-price contract for dismantling, demolition, or removal of improvements is contemplated and the contract amount is expected to be within the small purchase limitation.

(a) The Contractor shall promptly, and before the conditions are disturbed, give a written notice to the Contracting Officer of

(1) subsurface or latent physical conditions at the site which differ materially from those indicated in this contract, or

(2) unknown physical conditions at the site, of an unusual nature, which differ materially from those ordinarily encountered and generally recognized as inhering in work of the character provided for in the contract.

(b) The Contracting Officer shall investigate the site conditions promptly after receiving the notice. If the conditions do materially so differ and cause an increase or decrease in the Contractor's cost of, or the time required for, performing any part of the work under this contract, whether or not changed as a result of the conditions, an equitable adjustment shall be made under this clause and the contract modified in writing accordingly.

(c) No request by the Contractor for an equitable adjustment to the contract under this clause shall be allowed, unless the Contractor has given the written notice required; provided, that the time prescribed in (a) above for giving written notice may be extended by the Contracting Officer.

(d) No request by the Contractor for an equitable adjustment to the contract for differing site conditions shall be allowed if made after final payment under this contract.

(End of clause)

52.236-3 SITE INVESTIGATION AND CONDITIONS AFFECTING THE WORK (APR 1984)

(a) The Contractor acknowledges that it has taken steps reasonably necessary to ascertain the nature and location of the work, and that it has investigated and satisfied itself as to the general and local conditions which can affect the work or its cost, including but not limited to

(1) conditions bearing upon transportation, disposal, handling, and storage of materials;

(2) the availability of labor, water, electric power, and roads;

(3) uncertainties of weather, river stages, tides, or similar physical conditions at the site;

(4) the conformation and conditions of the ground; and (5) the character of equipment and facilities needed

preliminary to and during work performance. The Contractor also acknowledges that it has satisfied itself as to the character, quality, and quantity of surface and subsurface materials or obstacles to be encountered insofar as this information is reasonably ascertainable from an inspection of the site, including all exploratory work done by the Government, as well as from the drawings and specifications made a part of this contract. Any failure of the Contractor to take the actions described and acknowledged in this paragraph will not relieve the Contractor from responsibility for estimating properly the difficulty and cost of successfully performing the work, or for proceeding to successfully perform the work without additional expense to the Government.

(b) The Government assumes no responsibility for any conclusions or interpretations made by the Contractor based on the information made available by the Government. Nor does the Government assume responsibility for any understanding reached or representation made concerning conditions which can affect the work by any of its officers or agents before the execution of this contract, unless that understanding or representation is expressly stated in this contract.

(End of clause)

52.236-5 MATERIAL AND WORKMANSHIP (APR 1984)

(a) All equipment, material, and articles incorporated into the work covered by this contract shall be new and of the most suitable grade for the purpose intended, unless otherwise specifically provided in this contract. References in the specifications to equipment, material, articles, or patented processes by trade name, make, or catalog number, shall be regarded as establishing a standard of quality and shall not be construed as limiting competition. The Contractor may, at its option, use any equipment, material, article, or process that, in the judgment of the Contracting Officer, is equal to that named in the specifications, unless otherwise specifically provided in this contract.

(b) The Contractor shall obtain the Contracting Officer's approval of the machinery and mechanical and other equipment to be incorporated into the work. When requesting approval, the Contractor shall furnish to the Contracting Officer the name of the manufacturer, the model number, and other information concerning the performance, capacity, nature, and rating of the machinery and mechanical and other equipment. When required by this contract or by the Contracting Officer, the Contractor shall also obtain the Contracting Officer's approval of the material or articles which the Contractor contemplates incorporating into the work. When requesting approval, the Contractor shall provide full information concerning the material or articles. When directed to do so, the Contractor shall submit samples for approval at the Contractor's expense, with all shipping charges prepaid. Machinery, equipment, material, and articles that do not have the required approval shall be installed or used at the risk of subsequent rejection.

(c) All work under this contract shall be performed in a skillful and workmanlike manner. The Contracting Officer may require, in writing, that the Contractor remove from the work any employee the Contracting Officer deems incompetent, careless, or otherwise objectionable.

(End of clause)

52.236-6 SUPERINTENDENCE BY THE CONTRACTOR (APR 1984)

At all times during performance of this contract and until the work is completed and accepted, the Contractor shall directly superintend the work or assign and have on the worksite a competent superintendent who is satisfactory to the Contracting Officer and has authority to act for the Contractor.

(End of clause)

52.236-7 PERMITS AND RESPONSIBILITIES (NOV 1991)

The Contractor shall, without additional expense to the Government, be responsible for obtaining any necessary licenses and permits, and for complying with any Federal, State, and municipal laws, codes, and regulations applicable to the performance of the work. The Contractor shall also be responsible for all damages to persons or property that occur as a result of the Contractor's fault or negligence. The Contractor shall also be responsible for all materials delivered and work performed until completion and acceptance of the entire work, except for any completed unit of work which may have been accepted under the contract.

(End of clause)

52.236-8 OTHER CONTRACTS (APR 1984)

The Government may undertake or award other contracts for additional work at or near the site of the work under this contract. The Contractor shall fully cooperate with the other contractors and with Government employees and shall carefully adapt scheduling and performing the work under this contract to accommodate the additional work, heeding any direction that may be provided by the Contracting Officer. The Contractor shall not commit or permit any act that will interfere with the performance of work by any other contractor or by Government employees.

(End of clause)

52.236-9 PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES, AND IMPROVEMENTS (APR 1984)

(a) The Contractor shall preserve and protect all structures, equipment, and vegetation (such as trees, shrubs, and grass) on or adjacent to the work site, which are not to be removed and which do not unreasonably interfere with the work required under this contract. The Contractor shall only remove trees when specifically authorized to do so, and shall avoid damaging vegetation that will remain in place. If any limbs or branches of trees are broken during contract performance, or by the careless operation of equipment, or by workmen, the Contractor shall trim those limbs or branches with a clean cut and paint the cut with a tree-pruning compound as directed by the Contracting Officer.

(b) The Contractor shall protect from damage all existing improvements and utilities

(1) at or near the work site, and

(2) on adjacent property of a third party, the locations of which are made known to or should be known by the Contractor. The Contractor shall repair any damage to those facilities, including those that are the property of a third party, resulting from failure to comply with the requirements of this contract or failure to exercise reasonable care in performing the work. If the Contractor fails or refuses to repair the damage promptly, the Contracting Officer may have the necessary work performed and charge the cost to the Contractor.

(End of clause)

52.236-10 OPERATIONS AND STORAGE AREAS (APR 1984)

(a) The Contractor shall confine all operations (including storage of materials) on Government premises to areas authorized or approved by the Contracting Officer. The Contractor shall hold and save the Government, its officers and agents, free and harmless from liability of any nature occasioned by the Contractor's performance.

(b) Temporary buildings (e.g., storage sheds, shops, offices) and utilities may be erected by the Contractor only with the approval of the Contracting Officer and shall be built with labor and materials furnished by the Contractor without expense to the Government. The temporary buildings and utilities shall remain the property of the Contractor and shall be removed by the Contractor at its expense upon completion of the work. With the written consent of the Contracting Officer, the buildings and utilities may be abandoned and need not be removed.

(c) The Contractor shall, under regulations prescribed by the Contracting Officer, use only established roadways, or use temporary roadways constructed by the Contractor when and as authorized by the Contracting Officer. When materials are transported in prosecuting the work, vehicles shall not be loaded beyond the loading capacity recommended by the manufacturer of the vehicle or prescribed by any Federal, State, or local law or regulation. When it is necessary to cross curbs or sidewalks, the Contractor shall protect them from damage. The Contractor shall repair or pay for the repair of any damaged curbs, sidewalks, or roads.

(End of clause)

52.236-11 USE AND POSSESSION PRIOR TO COMPLETION (APR 1984)

(a) The Government shall have the right to take possession of or use any completed or partially completed part of the work. Before taking possession of or using any work, the Contracting Officer shall furnish the Contractor a list of items of work remaining to be performed or corrected on those portions of the work that the Government intends to take possession of or use. However, failure of the Contracting Officer to list any item of work shall not relieve the Contractor of responsibility for complying with the terms of the contract. The Government's possession or use shall not be deemed an acceptance of any work under the contract.

(b) While the Government has such possession or use, the Contractor shall be relieved of the responsibility for the loss of or damage to the work resulting from the Government's possession or use, notwithstanding the terms of the clause in this contract entitled "Permits and Responsibilities." If prior possession or use by the Government delays the progress of the work or causes additional expense to the Contractor, an equitable adjustment shall be made in the contract price or the time of completion, and the contract shall be modified in writing accordingly.

(End of clause)

52.236-12 CLEANING UP (APR 1984)

The Contractor shall at all times keep the work area, including storage areas, free from accumulations of waste materials. Before completing the work, the Contractor shall remove from the work and premises any rubbish, tools, scaffolding, equipment, and materials that are not the property of the Government. Upon completing the work, the Contractor shall leave the work area in a clean, neat, and orderly condition satisfactory to the Contracting Officer.

(End of clause)

52.236-13 ACCIDENT PREVENTION (NOV 1991)

(a) The Contractor shall provide and maintain work environments and procedures which will

(1) safeguard the public and Government personnel, property, materials, supplies, and equipment exposed to Contractor operations and activities;

(2) avoid interruptions of Government operations and delays in project completion dates; and

(3) control costs in the performance of this contract.

(b) For these purposes on contracts for construction or dismantling, demolition, or removal of improvements, the Contractor shall-

(1) Provide appropriate safety barricades, signs, and signal lights;

(2) Comply with the standards issued by the Secretary of Labor at 29 CFR Part 1926 and 29 CFR Part 1910; and

(3) Ensure that any additional measures the Contracting Officer determines to be reasonably necessary for the purposes are taken.

(c) If this contract is for construction or dismantling, demolition or removal of improvements with any Department of Defense agency or component, the Contractor shall comply with all pertinent provisions of the latest version of U.S. Army Corps of Engineers Safety and Health Requirements Manual, EM 385-1-1, in effect on the date of the solicitation.

(d) Whenever the Contracting Officer becomes aware of any noncompliance with these requirements or any condition which poses a serious or imminent danger to the health or safety of the public or Government personnel, the Contracting Officer shall notify the Contractor orally, with written confirmation, and request immediate initiation of corrective action. This notice, when delivered to the Contractor or the Contractor's representative at the work site, shall be deemed sufficient notice of the noncompliance and that corrective action is required. After receiving the notice, the Contractor shall immediately take corrective action. If the Contractor fails or refuses to promptly take corrective action, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. The Contractor shall not be entitled to any equitable adjustment of the contract price or extension of the performance schedule on any stop work order issued under this clause.

(5) The Contractor shall insert this clause, including this paragraph (e), with appropriate changes in the designation of the parties, in subcontracts.

(End of clause)

52.236-14 AVAILABILITY AND USE OF UTILITY SERVICES (APR 1984)

(a) The Government shall make all reasonably required amounts of utilities available to the Contractor from existing outlets and supplies, as specified in the contract. Unless otherwise provided in the contract, the amount of each utility service consumed shall be charged to or paid for by the Contractor at prevailing rates charged to the Government or, where the utility is produced by the Government, at reasonable rates determined by the Contracting Officer. The Contractor shall carefully conserve any utilities furnished without charge.

(b) The Contractor, at its expense and in a workmanlike manner satisfactory to the Contracting Officer, shall install and maintain all necessary temporary connections and distribution lines, and all meters required to measure the amount of each utility used for the purpose of determining charges. Before final acceptance of the work by the

Government, the Contractor shall remove all the temporary connections, distribution lines, meters, and associated paraphernalia.

(End of clause)

52.236-15 SCHEDULES FOR CONSTRUCTION CONTRACTS (APR 1984)

(a) The Contractor shall, within five days after the work commences on the contract or another period of time determined by the Contracting Officer, prepare and submit to the Contracting Officer for approval three copies of a practicable schedule showing the order in which the Contractor proposes to perform the work, and the dates on which the Contractor contemplates starting and completing the several salient features of the work (including acquiring materials, plant, and equipment). The schedule shall be in the form of a progress chart of suitable scale to indicate appropriately the percentage of work scheduled for completion by any given date during the period. If the Contractor fails to submit a schedule within the time prescribed, the Contracting Officer may withhold approval of progress payments until the Contractor submits the required schedule.

(b) The Contractor shall enter the actual progress on the chart as directed by the Contracting Officer, and upon doing so shall immediately deliver three copies of the annotated schedule to the Contracting Officer. If, in the opinion of the Contracting Officer, the Contractor falls behind the approved schedule, the Contractor shall take steps necessary to improve its progress, including those that may be required by the Contracting Officer, without additional cost to the Government. In this circumstance, the Contracting Officer may require the Contractor to increase the number of shifts, overtime operations, days of work, and/or the amount of construction plant, and to submit for approval any supplementary schedule or schedules in chart form as the Contracting Officer deems necessary to demonstrate how the approved rate of progress will be regained.

(c) Failure of the Contractor to comply with the requirements of the Contracting Officer under this clause shall be grounds for a determination by the Contracting Officer that the Contractor is not prosecuting the work with sufficient diligence to ensure completion within the time specified in the contract. Upon making this determination, the Contracting Officer may terminate the Contractor's right to proceed with the work, or any separable part of it, in accordance with the default terms of this contract.

(End of clause)

52.236-21 SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION (FEB 1997)

(a) The Contractor shall keep on the work site a copy of the drawings and specifications and shall at all times give the Contracting Officer access thereto. Anything mentioned in the specifications and not shown on the drawings, or shown on the drawings and not mentioned in the specifications, shall be of like effect as if shown or mentioned in both. In case of difference between drawings and specifications, the specifications shall govern. In case of discrepancy in the figures, in the drawings, or in the specifications, the matter shall be promptly submitted to the Contracting Officer, who shall promptly make a determination in writing. Any adjustment by the Contractor without such a determination shall be at its own risk and expense. The Contracting Officer shall furnish from time to time such detailed drawings and other information as considered necessary, unless otherwise provided.

(b) Wherever in the specifications or upon the drawings the words "directed", "required", "ordered", "designated", "prescribed", or words of like import are used, it shall be understood that the "direction", "requirement", "order", "designation", or "prescription", of the Contracting Officer is intended and similarly the words "approved", "acceptable", "satisfactory", or words of like import shall mean "approved by," or "acceptable to", or "satisfactory to" the Contracting Officer, unless otherwise expressly stated.

(c) Where "as shown," as indicated", "as detailed", or words of similar import are used, it shall be understood that the reference is made to the drawings accompanying this contract unless stated otherwise. The word "provided" as used herein shall be understood to mean "provide complete in place," that is "furnished and installed".

(d) Shop drawings means drawings, submitted to the Government by the Contractor, subcontractor, or any lower tier subcontractor pursuant to a construction contract, showing in detail (1) the proposed fabrication and assembly of structural elements, and (2) the installation (i.e., fit, and attachment details) of materials or equipment. It includes drawings, diagrams, layouts, schematics, descriptive literature, illustrations, schedules, performance and test data, and similar materials furnished by the contractor to explain in detail specific portions of the work required by the contract. The Government may duplicate, use, and disclose in any manner and for any purpose shop drawings delivered under this contract.

(e) If this contract requires shop drawings, the Contractor shall coordinate all such drawings, and review them for accuracy, completeness, and compliance with contract requirements and shall indicate its approval thereon as evidence of such coordination and review. Shop drawings submitted to the Contracting Officer without evidence of the Contractor's approval may be returned for resubmission. The Contracting Officer will indicate an approval or disapproval of the shop drawings and if not approved as submitted shall indicate the Government's reasons therefor. Any work done before such approval shall be at the Contractor's risk. Approval by the Contracting Officer shall not relieve the Contractor from responsibility for any errors or omissions in such drawings, nor from responsibility for complying with the requirements of this contract, except with respect to variations described and approved in accordance with (f) below.

(f) If shop drawings show variations from the contract requirements, the Contractor shall describe such variations in writing, separate from the drawings, at the time of submission. If the Contracting Officer approves any such variation, the Contracting Officer shall issue an appropriate contract modification, except that, if the variation is minor or does not involve a change in price or in time of performance, a modification need not be issued.

(g) The Contractor shall submit to the Contracting Officer for approval four copies (unless otherwise indicated) of all shop drawings as called for under the various headings of these specifications. Three sets (unless otherwise indicated) of all shop drawings, will be retained by the Contracting Officer and one set will be returned to the Contractor.

(End of clause)

52.236-26 PRECONSTRUCTION CONFERENCE (FEB 1995)

If the Contracting Officer decides to conduct a preconstruction conference, the successful offeror will be notified and will be required to attend. The Contracting Officer's notification will include specific details regarding the date, time, and location of the conference, any need for attendance by subcontractors, and information regarding the items to be discussed.

(End of clause)

52.242-13 BANKRUPTCY (JUL 1995)

In the event the Contractor enters into proceedings relating to bankruptcy, whether voluntary or involuntary, the Contractor agrees to furnish, by certified mail or electronic commerce method authorized by the contract, written notification of the bankruptcy to the Contracting Officer responsible for administering the contract. This notification

shall be furnished within five days of the initiation of the proceedings relating to bankruptcy filing. This notification shall include the date on which the bankruptcy petition was filed, the identity of the court in which the bankruptcy petition was filed, and a listing of Government contract numbers and contracting offices for all Government contracts against which final payment has not been made. This obligation remains in effect until final payment under this contract.

(End of clause)

52.242-14 SUSPENSION OF WORK (APR 1984)

(a) The Contracting Officer may order the Contractor, in writing, to suspend, delay, or interrupt all or any part of the work of this contract for the period of time that the Contracting Officer determines appropriate for the convenience of the Government.

(b) If the performance of all or any part of the work is, for an unreasonable period of time, suspended, delayed, or interrupted (1) by an act of the Contracting Officer in the administration of this contract, or (2) by the Contracting Officer's failure to act within the time specified in this contract (or within a reasonable time if not specified), an adjustment shall be made for any increase in the cost of performance of this contract (excluding profit) necessarily caused by the unreasonable suspension, delay, or interruption, and the contract modified in writing accordingly. However, no adjustment shall be made under this clause for any suspension, delay, or interruption to the extent that performance would have been so suspended, delayed, or interrupted by any other cause, including the fault or negligence of the Contractor, or for which an equitable adjustment is provided for or excluded under any other term or condition of this contract. (c) A claim under this clause shall not be allowed (1) for any costs incurred more than 20 days before the Contractor shall have notified the Contracting Officer in writing of the act or failure to act involved (but this requirement shall not apply as to a claim resulting from a suspension order), and (2) unless the claim, in an amount stated, is asserted in writing as soon as practicable after the termination of the suspension, delay, or interruption, but not later than the date of final payment under the contract.

(End of clause)

52.243-4 CHANGES (AUG 1987)

(a) The Contracting Officer may, at any time, without notice to the sureties, if any, by written order designated or indicated to be a change order, make changes in the work within the general scope of the contract, including changes--

(1) In the specifications (including drawings and designs);

(2) In the method or manner of performance of the work;

(3) In the Government-furnished facilities, equipment, materials, services, or site; or

(4) Directing acceleration in the performance of the work.

(b) Any other written or oral order (which, as used in this paragraph (b), includes direction, instruction, interpretation, or determination) from the Contracting Officer that causes a change shall be treated as a change order under this clause; provided, that the Contractor gives the Contracting Officer written notice stating

(1) the date, circumstances, and source of the order and

(2) that the Contractor regards the order as a change order.

(c) Except as provided in this clause, no order, statement, or conduct of the Contracting Officer shall be treated as a change under this clause or entitle the Contractor to an equitable adjustment.

(d) If any change under this clause causes an increase or decrease in the Contractor's cost of, or the time required for, the performance of any part of the work under this contract, whether or not changed by any such order, the Contracting Officer shall make an equitable adjustment and modify the contract in writing. However, except for an adjustment based on defective specifications, no adjustment for any change under paragraph (b) of this clause shall be made for any costs incurred more than 20 days before the Contractor gives written notice as required. In the case of defective specifications for which the Government is responsible, the equitable adjustment shall include any increased cost reasonably incurred by the Contractor in attempting to comply with the defective specifications.

(e) The Contractor must assert its right to an adjustment under this clause within 30 days after

(1) receipt of a written change order under paragraph (a) of this clause or (2) the furnishing of a written notice under paragraph (b) of this clause, by submitting to the Contracting Officer a written statement describing the general nature and amount of the proposal, unless this period is extended by the Government. The statement of proposal for adjustment may be included in the notice under paragraph (b) above.

(f) No proposal by the Contractor for an equitable adjustment shall be allowed if asserted after final payment under this contract.

(End of clause)

52.244-6 SUBCONTRACTS FOR COMMERCIAL ITEMS (APR 2003)

(a) Definitions.

"Commercial item", has the meaning contained in the clause at 52.202-1, Definitions.

"Subcontract", includes a transfer of commercial items between divisions, subsidiaries, or affiliates of the Contractor or subcontractor at any tier.

(b) To the maximum extent practicable, the Contractor shall incorporate, and require its subcontractors at all tiers to incorporate, commercial items or nondevelopmental items as components of items to be supplied under this contract.

(c) (1) The Contractor shall insert the following clauses in subcontracts for commercial items:

(i) 52.219-8, Utilization of Small Business Concerns (OCT 2000) (15 U.S.C. 637(d)(2) and (3)), in all subcontracts that offer further subcontracting opportunities. If the subcontract (except subcontracts to small business concerns) exceeds $500,000 ($1,000,000 for construction of any public facility), the subcontractor must include 52.219-8 in lower tier subcontracts that offer subcontracting opportunities.

(ii) 52.222-26, Equal Opportunity (Apr 2002) (E.O. 11246).

(iii) 52.222-35, Equal Opportunity for Special Disabled Veterans, Veterans of the Vietnam Era and Other Eligible Veterans (DEC 2001) (38 U.S.C. 4212(a)).

(iv) 52.222-36, Affirmative Action for Workers with Disabilities (JUN 1998) (29 U.S.C. 793).

(v) 52.247-64, Preference for Privately Owned U.S.-Flag Commercial Vessels (APR 2003) (46 U.S.C. Appx 1241 and 10 U.S.C. 2631) (flow down required in accordance with paragraph (d) of FAR clause 52.247-64).

(2) While not required, the Contractor may flow down to subcontracts for commercial items a minimal number of additional clauses necessary to satisfy its contractual obligations.

(d) The Contractor shall include the terms of this clause, including this paragraph (d), in subcontracts awarded under this contract.

(End of clause)

52.245-2 GOVERNMENT PROPERTY (FIXED-PRICE CONTRACTS) (JUN 2003)

(a) Government-furnished property.

(1) Overseas contracts. If this contract is to be performed outside of the United States and its outlying areas, the words ``Government'' and ``Government-furnished'' (wherever they appear in this clause) shall be construed as ``United States Government'' and ``United States Government-furnished,'' respectively.

(2) The delivery or performance dates for this contract are based upon the expectation that Government-furnished property suitable for use (except for property furnished "as is") will be delivered to the Contractor at the times stated in the Schedule or, if not so stated, in sufficient time to enable the Contractor to meet the contract's delivery or performance dates.

(3) If Government-furnished property is received by the Contractor in a condition not suitable for the intended use, the Contractor shall, upon receipt of it, notify the Contracting Officer, detailing the facts, and, as directed by the Contracting Officer and at Government expense, either repair, modify, return, or otherwise dispose of the property. After completing the directed action and upon written request of the Contractor, the Contracting Officer shall make an equitable adjustment as provided in paragraph (h) of this clause.

(4) If Government-furnished property is not delivered to the Contractor by the required time, the Contracting Officer shall, upon the Contractor's timely written request, make a determination of the delay, if any, caused the Contractor and shall make an equitable adjustment in accordance with paragraph (h) of this clause.

(b) Changes in Government-furnished property. (1) The Contracting Officer may, by written notice, (i) decrease the Government-furnished property provided or to be provided under this contract, or (ii) substitute other Government-furnished property for the property to be provided by the Government, or to be acquired by the Contractor for the Government, under this contract. The Contractor shall promptly take such action as the Contracting Officer may direct regarding the removal, shipment, or disposal of the property covered by such notice.

(2) Upon the Contractor's written request, the Contracting Officer shall make an equitable adjustment to the contract in accordance with paragraph (h) of this clause, if the Government has agreed in the Schedule to make the property available for performing this contract and there is any--

(i) Decrease or substitution in this property pursuant to subparagraph (b)(1) of this clause; or

(ii) Withdrawal of authority to use this property, if provided under any other contract or lease.

(c) Title in Government property. (1) The Government shall retain title to all Government-furnished property.

(2) All Government-furnished property and all property acquired by the Contractor, title to which vests in the Government under this paragraph (collectively referred to as "Government property"), are subject to the provisions of this clause. However, special tooling accountable to this contract is subject to the provisions of the Special Tooling clause and is not subject to the provisions of this clause. Title to Government property shall not be affected by its incorporation into or attachment to any property not owned by the Government, nor shall Government property become a fixture or lose its identity as personal property by being attached to any real property.

(3) Title to each item of facilities and special test equipment acquired by the Contractor for the Government under this contract shall pass to and vest in the Government when its use in performing this contract commences or when the Government has paid for it, whichever is earlier, whether or not title previously vested in the Government.

(4) If this contract contains a provision directing the Contractor to purchase material for which the Government will reimburse the Contractor as a direct item of cost under this contract--

(i) Title to material purchased from a vendor shall pass to and vest in the Government upon the vendor's delivery of such material; and

(ii) Title to all other material shall pass to and vest in the Government upon--

(A) Issuance of the material for use in contract performance;

(B) Commencement of processing of the material or its use in contract performance; or

(C) Reimbursement of the cost of the material by the Government, whichever occurs first.

(d) Use of Government property. The Government property shall be used only for performing this contract, unless otherwise provided in this contract or approved by the Contracting Officer.

(e) Property administration. (1) The Contractor shall be responsible and accountable for all Government property provided under this contract and shall comply with Federal Acquisition Regulation (FAR) Subpart 45.5, as in effect on the date of this contract.

(2) The Contractor shall establish and maintain a program for the use, maintenance, repair, protection, and preservation of Government property in accordance with sound industrial practice and the applicable provisions of Subpart 45.5 of the FAR.

(3) If damage occurs to Government property, the risk of which has been assumed by the Government under this contract, the Government shall replace the items or the Contractor shall make such repairs as the Government directs. However, if the Contractor cannot effect such repairs within the time required, the Contractor shall dispose of the property as directed by the Contracting Officer. When any property for which the Government is responsible is replaced or repaired, the Contracting Officer shall make an equitable adjustment in accordance with paragraph (h) of this clause.

(4) The Contractor represents that the contract price does not include any amount for repairs or replacement for which the Government is responsible. Repair or replacement of property for which the Contractor is responsible shall be accomplished by the Contractor at its own expense.

(f) Access. The Government and all its designees shall have access at all reasonable times to the premises in which any Government property is located for the purpose of inspecting the Government property.

(g) Risk of loss. Unless otherwise provided in this contract, the Contractor assumes the risk of, and shall be responsible for, any loss or destruction of, or damage to, Government property upon its delivery to the Contractor or upon passage of title to the Government under paragraph (c) of this clause. However, the Contractor is not

responsible for reasonable wear and tear to Government property or for Government property properly consumed in performing this contract.

(h) Equitable adjustment. When this clause specifies an equitable adjustment, it shall be made to any affected contract provision in accordance with the procedures of the Changes clause. When appropriate, the Contracting Officer may initiate an equitable adjustment in favor of the Government. The right to an equitable adjustment shall be the Contractor's exclusive remedy. The Government shall not be liable to suit for breach of contract for--

(1) Any delay in delivery of Government-furnished property;

(2) Delivery of Government-furnished property in a condition not suitable for its intended use;

(3) A decrease in or substitution of Government-furnished property; or

(4) Failure to repair or replace Government property for which the Government is responsible.

(i) Final accounting and disposition of Government property. Upon completing this contract, or at such earlier dates as may be fixed by the Contracting Officer, the Contractor shall submit, in a form acceptable to the Contracting Officer, inventory schedules covering all items of Government property (including any resulting scrap) not consumed in performing this contract or delivered to the Government. The Contractor shall prepare for shipment, deliver f.o.b. origin, or dispose of the Government property as may be directed or authorized by the Contracting Officer. The net proceeds of any such disposal shall be credited to the contract price or shall be paid to the Government as the Contracting Officer directs.

(j) Abandonment and restoration of Contractor's premises. Unless otherwise provided herein, the Government--

(1) May abandon any Government property in place, at which time all obligations of the Government regarding such abandoned property shall cease; and

(2) Has no obligation to restore or rehabilitate the Contractor's premises under any circumstances (e.g., abandonment, disposition upon completion of need, or upon contract completion). However, if the Government-furnished property (listed in the Schedule or specifications) is withdrawn or is unsuitable for the intended use, or if other Government property is substituted, then the equitable adjustment under paragraph (h) of this clause may properly include restoration or rehabilitation costs.

(k) Communications. All communications under this clause shall be in writing.

(l) Overseas contracts. If this contract is to be performed outside of the United States of America, its territories, or possessions, the words "Government" and "Government-furnished" (wherever they appear in this clause) shall be construed as "United States Government" and "United States Government-furnished," respectively.

(End of clause)

52.246-12 INSPECTION OF CONSTRUCTION (AUG 1996)

(a) Definition. "Work" includes, but is not limited to, materials, workmanship, and manufacture and fabrication of components.

(b) The Contractor shall maintain an adequate inspection system and perform such inspections as will ensure that the work performed under the contract conforms to contract requirements. The Contractor shall maintain complete

inspection records and make them available to the Government. All work shall be conducted under the general direction of the Contracting Officer and is subject to Government inspection and test at all places and at all reasonable times before acceptance to ensure strict compliance with the terms of the contract.

(c) Government inspections and tests are for the sole benefit of the Government and do not--

(1) Relieve the Contractor of responsibility for providing adequate quality control measures;

(2) Relieve the Contractor of responsibility for damage to or loss of the material before acceptance;

(3) Constitute or imply acceptance; or

(4) Affect the continuing rights of the Government after acceptance of the completed work under paragraph (i) of this section.

(d) The presence or absence of a Government inspector does not relieve the Contractor from any contract requirement, nor is the inspector authorized to change any term or condition of the specification without the Contracting Officer's written authorization.

(e) The Contractor shall promptly furnish, at no increase in contract price, all facilities, labor, and material reasonably needed for performing such safe and convenient inspections and tests as may be required by the Contracting Officer. The Government may charge to the Contractor any additional cost of inspection or test when work is not ready at the time specified by the Contractor for inspection or test, or when prior rejection makes reinspection or retest necessary. The Government shall perform all inspections and tests in a manner that will not unnecessarily delay the work. Special, full size, and performance tests shall be performed as described in the contract.

(f) The Contractor shall, without charge, replace or correct work found by the Government not to conform to contract requirements, unless in the public interest the Government consents to accept the work with an appropriate adjustment in contract price. The Contractor shall promptly segregate and remove rejected material from the premises.

(g) If the Contractor does not promptly replace or correct rejected work, the Government may (1) by contract or otherwise, replace or correct the work and charge the cost to the Contractor or (2) terminate for default the Contractor's right to proceed.

(h) If, before acceptance of the entire work, the Government decides to examine already completed work by removing it or tearing it out, the Contractor, on request, shall promptly furnish all necessary facilities, labor, and material. If the work is found to be defective or nonconforming in any material respect due to the fault of the Contractor or its subcontractors, the Contractor shall defray the expenses of the examination and of satisfactory reconstruction. However, if the work is found to meet contract requirements, the Contracting Officer shall make an equitable adjustment for the additional services involved in the examination and reconstruction, including, if completion of the work was thereby delayed, an extension of time.

(i) Unless otherwise specified in the contract, the Government shall accept, as promptly as practicable after completion and inspection, all work required by the contract or that portion of the work the Contracting Officer determines can be accepted separately. Acceptance shall be final and conclusive except for latent defects, fraud, gross mistakes amounting to fraud, or the Government's rights under any warranty or guarantee.

(End of clause)

52.248-3 VALUE ENGINEERING--CONSTRUCTION (FEB 2000)

(a) General. The Contractor is encouraged to develop, prepare, and submit value engineering change proposals (VECP's) voluntarily. The Contractor shall share in any instant contract savings realized from accepted VECP's, in accordance with paragraph (f) below.

(b) Definitions. "Collateral costs," as used in this clause, means agency costs of operation, maintenance, logistic support, or Government-furnished property.

"Collateral savings," as used in this clause, means those measurable net reductions resulting from a VECP in the agency's overall projected collateral costs, exclusive of acquisition savings, whether or not the acquisition cost changes.

"Contractor's development and implementation costs," as used in this clause, means those costs the Contractor incurs on a VECP specifically in developing, testing, preparing, and submitting the VECP, as well as those costs the Contractor incurs to make the contractual changes required by Government acceptance of a VECP.

"Government costs," as used in this clause, means those agency costs that result directly from developing and implementing the VECP, such as any net increases in the cost of testing, operations, maintenance, and logistic support. The term does not include the normal administrative costs of processing the VECP.

"Instant contract savings," as used in this clause, means the estimated reduction in Contractor cost of performance resulting from acceptance of the VECP, minus allowable Contractor's development and implementation costs, including subcontractors' development and implementation costs (see paragraph (h) below).

"Value engineering change proposal (VECP)" means a proposal that--

(1) Requires a change to this, the instant contract, to implement; and

(2) Results in reducing the contract price or estimated cost without impairing essential functions or characteristics; provided, that it does not involve a change--

(i) In deliverable end item quantities only; or

(ii) To the contract type only.

(c) VECP preparation. As a minimum, the Contractor shall include in each VECP the information described in subparagraphs (1) through (7) below. If the proposed change is affected by contractually required configuration management or similar procedures, the instructions in those procedures relating to format, identification, and priority assignment shall govern VECP preparation. The VECP shall include the following:

(1) A description of the difference between the existing contract requirement and that proposed, the comparative advantages and disadvantages of each, a justification when an item's function or characteristics are being altered, and the effect of the change on the end item's performance.

(2) A list and analysis of the contract requirements that must be changed if the VECP is accepted, including any suggested specification revisions.

(3) A separate, detailed cost estimate for

(i) the affected portions of the existing contract requirement and

(ii) the VECP. The cost reduction associated with the VECP shall take into account the Contractor's allowable development and implementation costs, including any amount attributable to subcontracts under paragraph (h) below.

(4) A description and estimate of costs the Government may incur in implementing the VECP, such as test and evaluation and operating and support costs.

(5) A prediction of any effects the proposed change would have on collateral costs to the agency.

(6) A statement of the time by which a contract modification accepting the VECP must be issued in order to achieve the maximum cost reduction, noting any effect on the contract completion time or delivery schedule.

(7) Identification of any previous submissions of the VECP, including the dates submitted, the agencies and contract numbers involved, and previous Government actions, if known.

(d) Submission. The Contractor shall submit VECP's to the Resident Engineer at the worksite, with a copy to the Contracting Officer.

(e) Government action.

(1) The Contracting Officer will notify the Contractor of the status of the VECP within 45 calendar days after the contracting office receives it. If additional time is required, the Contracting Officer will notify the Contractor within the 45-day period and provide the reason for the delay and the expected date of the decision. The Government will process VECP's expeditiously; however, it shall not be liable for any delay in acting upon a VECP.

If the VECP is not accepted, the Contracting Officer will notify the Contractor in writing, explaining the reasons for rejection. The Contractor may withdraw any VECP, in whole or in part, at any time before it is accepted by the Government. The Contracting Officer may require that the Contractor provide written notification before undertaking significant expenditures for VECP effort.

Any VECP may be accepted, in whole or in part, by the Contracting Officer's award of a modification to this contract citing this clause. The Contracting Officer may accept the VECP, even though an agreement on price reduction has not been reached, by issuing the Contractor a notice to proceed with the change. Until a notice to proceed is issued or a contract modification applies a VECP to this contract, the Contractor shall perform in accordance with the existing contract. The decision to accept or reject all or part of any VECP is a unilateral decision made solely at the discretion of the Contracting Officer.

(f) Sharing.

(1) Rates. The Government's share of savings is determined by subtracting Government costs from instant contract savings and multiplying the result by

(i) 45 percent for fixed-price contracts or

(ii) 75 percent for cost-reimbursement contracts.

(2) Payment. Payment of any share due the Contractor for use of a VECP on this contract shall be authorized by a modification to this contract to--

(i) Accept the VECP;

(ii) Reduce the contract price or estimated cost by the amount of instant contract savings; and

(iii) Provide the Contractor's share of savings by adding the amount calculated to the contract price or fee.

(g) Collateral savings. If a VECP is accepted, the Contracting Officer will increase the instant contract amount by 20 percent of any projected collateral savings determined to be realized in a typical year of use after subtracting any Government costs not previously offset. However, the Contractor's share of collateral savings will not exceed the contract's firm-fixed-price or estimated cost, at the time the VECP is accepted, or $100,000, whichever is greater. The Contracting Officer is the sole determiner of the amount of collateral savings.

(h) Subcontracts. The Contractor shall include an appropriate value engineering clause in any subcontract of $50,000 or more and may include one in subcontracts of lesser value. In computing any adjustment in this contract's price under paragraph (f) above, the Contractor's allowable development and implementation costs shall include any subcontractor's allowable development and implementation costs clearly resulting from a VECP accepted by the Government under this contract, but shall exclude any value engineering incentive payments to a subcontractor. The Contractor may choose any arrangement for subcontractor value engineering incentive payments; provided, that these payments shall not reduce the Government's share of the savings resulting from the VECP.

(i) Data. The Contractor may restrict the Government's right to use any part of a VECP or the supporting data by marking the following legend on the affected parts:

"These data, furnished under the Value Engineering-- Construction clause of contract . . . . . , shall not be disclosed outside the Government or duplicated, used, or disclosed, in whole or in part, for any purpose other than to evaluate a value engineering change proposal submitted under the clause. This restriction does not limit the Government's right to use information contained in these data if it has been obtained or is otherwise available from the Contractor or from another source without limitations." If a VECP is accepted, the Contractor hereby grants the Government unlimited rights in the VECP and supporting data, except that, with respect to data qualifying and submitted as limited rights technical data, the Government shall have the rights specified in the contract modification implementing the VECP and shall appropriately mark the data. (The terms "unlimited rights" and "limited rights" are defined in Part 27 of the Federal Acquisition Regulation.)

(End of clause)

52.249-2 TERMINATION FOR CONVENIENCE OF THE GOVERNMENT (FIXED-PRICE) (SEP 1996)

(a) The Government may terminate performance of work under this contract in whole or, from time to time, in part if the Contracting Officer determines that a termination is in the Government's interest. The Contracting Officer shall terminate by delivering to the Contractor a Notice of Termination specifying the extent of termination and the effective date.

(b) After receipt of a Notice of Termination, and except as directed by the Contracting Officer, the Contractor shall immediately proceed with the following obligations, regardless of any delay in determining or adjusting any amounts due under this clause:

(1) Stop work as specified in the notice.

(2) Place no further subcontracts or orders (referred to as subcontracts in this clause) for materials, services, or facilities, except as necessary to complete the continued portion of the contract.

(3) Terminate all subcontracts to the extent they relate to the work terminated.

(4) Assign to the Government, as directed by the Contracting Officer, all right, title, and interest of the Contractor under the subcontracts terminated, in which case the Government shall have the right to settle or to pay any termination settlement proposal arising out of those terminations.

(5) With approval or ratification to the extent required by the Contracting Officer, settle all outstanding liabilities and termination settlement proposals arising from the termination of subcontracts; the approval or ratification will be final for purposes of this clause.

(6) As directed by the Contracting Officer, transfer title and deliver to the Government (i) the fabricated or unfabricated parts, work in process, completed work, supplies, and other material produced or acquired for the work terminated, and (ii) the completed or partially completed plans, drawings, information, and other property that, if the contract had been completed, would be required to be furnished to the Government.

(7) Complete performance of the work not terminated.

(8) Take any action that may be necessary, or that the Contracting Officer may direct, for the protection and preservation of the property related to this contract that is in the possession of the Contractor and in which the Government has or may acquire an interest.

(9) Use its best efforts to sell, as directed or authorized by the Contracting Officer, any property of the types referred to in subparagraph (b)(6) of this clause; provided, however, that the Contractor (i) is not required to extend credit to any purchaser and (ii) may acquire the property under the conditions prescribed by, and at prices approved by, the Contracting Officer. The proceeds of any transfer or disposition will be applied to reduce any payments to be made by the Government under this contract, credited to the price or cost of the work, or paid in any other manner directed by the Contracting Officer.

(c) The Contractor shall submit complete termination inventory schedules no later than 120 days from the effective date of termination, unless extended in writing by the Contracting Officer upon written request of the Contractor within this 120-day period.

(d) After expiration of the plant clearance period as defined in Subpart 45.6 of the Federal Acquisition Regulation, the Contractor may submit to the Contracting Officer a list, certified as to quantity and quality, of termination inventory not previously disposed of, excluding items authorized for disposition by the Contracting Officer. The Contractor may request the Government to remove those items or enter into an agreement for their storage. Within 15 days, the Government will accept title to those items and remove them or enter into a storage agreement. The Contracting Officer may verify the list upon removal of the items, or if stored, within 45 days from submission of the list, and shall correct the list, as necessary, before final settlement.

(e) After termination, the Contractor shall submit a final termination settlement proposal to the Contracting Officer in the form and with the certification prescribed by the Contracting Officer. The Contractor shall submit the proposal promptly, but no later than 1 year from the effective date of termination, unless extended in writing by the Contracting Officer upon written request of the Contractor within this 1-year period. However, if the Contracting Officer determines that the facts justify it, a termination settlement proposal may be received and acted on after 1 year or any extension. If the Contractor fails to submit the proposal within the time allowed, the Contracting Officer may determine, on the basis of information available, the amount, if any, due the Contractor because of the termination and shall pay the amount determined.

(f) Subject to paragraph (e) of this clause, the Contractor and the Contracting Officer may agree upon the whole or any part of the amount to be paid or remaining to be paid because of the termination. The amount may include a reasonable allowance for profit on work done. However, the agreed amount, whether under this paragraph (g) or paragraph (g) of this clause, exclusive of costs shown in subparagraph (g)(3) of this clause, may not exceed the total contract price as reduced by (1) the amount of payments previously made and (2) the contract price of work not terminated. The contract shall be modified, and the Contractor paid the agreed amount. Paragraph (g) of this clause shall not limit, restrict, or affect the amount that may be agreed upon to be paid under this paragraph.

(g) If the Contractor and the Contracting Officer fail to agree on the whole amount to be paid because of the termination of work, the Contracting Officer shall pay the Contractor the amounts determined by the Contracting Officer as follows, but without duplication of any amounts agreed on under paragraph (f) of this clause:

(1) The contract price for completed supplies or services accepted by the Government (or sold or acquired under subparagraph (b)(9) of this clause) not previously paid for, adjusted for any saving of freight and other charges.

(2) The total of--

(i) The costs incurred in the performance of the work terminated, including initial costs and preparatory expense allocable thereto, but excluding any costs attributable to supplies or services paid or to be paid under subparagraph (f)(1) of this clause;

(ii) The cost of settling and paying termination settlement proposals under terminated subcontracts that are properly chargeable to the terminated portion of the contract if not included in subdivision (g)(2)(i) of this clause; and

(iii) A sum, as profit on subdivision (g)(2)(i) of this clause, determined by the Contracting Officer under 49.202 of the Federal Acquisition Regulation, in effect on the date of this contract, to be fair and reasonable; however, if it appears that the Contractor would have sustained a loss on the entire contract had it been completed, the Contracting Officer shall allow no profit under this subdivision (iii) and shall reduce the settlement to reflect the indicated rate of loss.

(3) The reasonable costs of settlement of the work terminated, including--

(i) Accounting, legal, clerical, and other expenses reasonably necessary for the preparation of termination settlement proposals and supporting data;

(ii) The termination and settlement of subcontracts (excluding the amounts of such settlements); and

(iii) Storage, transportation, and other costs incurred, reasonably necessary for the preservation, protection, or disposition of the termination inventory.

(h) Except for normal spoilage, and except to the extent that the Government expressly assumed the risk of loss, the Contracting Officer shall exclude from the amounts payable to the Contractor under paragraph (g) of this clause, the fair value, as determined by the Contracting Officer, of property that is destroyed, lost, stolen, or damaged so as to become undeliverable to the Government or to a buyer.

(i) The cost principles and procedures of Part 31 of the Federal Acquisition Regulation, in effect on the date of this contract, shall govern all costs claimed, agreed to, or determined under this clause.

(j) The Contractor shall have the right of appeal, under the Disputes clause, from any determination made by the Contracting Officer under paragraph (e), (g), or (l) of this clause, except that if the Contractor failed to submit the termination settlement proposal or request for equitable adjustment within the time provided in paragraph (e) or (l), respectively, and failed to request a time extension, there is no right of appeal.

(k) In arriving at the amount due the Contractor under this clause, there shall be deducted--

(1) All unliquidated advance or other payments to the Contractor under the terminated portion of this contract;

(2) Any claim which the Government has against the Contractor under this contract; and

(3) The agreed price for, or the proceeds of sale of, materials, supplies, or other things acquired by the Contractor or sold under the provisions of this clause and not recovered by or credited to the Government.

(l) If the termination is partial, the Contractor may file a proposal with the Contracting Officer for an equitable adjustment of the price(s) of the continued portion of the contract. The Contracting Officer shall make any equitable adjustment agreed upon. Any proposal by the Contractor for an equitable adjustment under this clause shall be requested within 90 days from the effective date of termination unless extended in writing by the Contracting Officer.

(m)(1) The Government may, under the terms and conditions it prescribes, make partial payments and payments against costs incurred by the Contractor for the terminated portion of the contract, if the Contracting Officer believes the total of these payments will not exceed the amount to which the Contractor will be entitled.

(2) If the total payments exceed the amount finally determined to be due, the Contractor shall repay the excess to the Government upon demand, together with interest computed at the rate established by the Secretary of the Treasury under 50 U.S.C. App. 1215(b)(2). Interest shall be computed for the period from the date the excess payment is received by the Contractor to the date the excess is repaid. Interest shall not be charged on any excess payment due to a reduction in the Contractor's termination settlement proposal because of retention or other disposition of termination inventory until 10 days after the date of the retention or disposition, or a later date determined by the Contracting Officer because of the circumstances.

(n) Unless otherwise provided in this contract or by statute, the Contractor shall maintain all records and documents relating to the terminated portion of this contract for 3 years after final settlement. This includes all books and other evidence bearing on the Contractor's costs and expenses under this contract. The Contractor shall make these records and documents available to the Government, at the Contractor's office, at all reasonable times, without any direct charge. If approved by the Contracting Officer, photographs, microphotographs, or other authentic reproductions may be maintained instead of original records and documents.

(End of clause)

52.249-10 DEFAULT (FIXED-PRICE CONSTRUCTION) (APR 1984)

(a) If the Contractor refuses or fails to prosecute the work or any separable part, with the diligence that will insure its completion within the time specified in this contract including any extension, or fails to complete the work within this time, the Government may, by written notice to the Contractor, terminate the right to proceed with the work (or the separable part of the work) that has been delayed. In this event, the Government may take over the work and complete it by contract or otherwise, and may take possession of and use any materials, appliances, and plant on the work site necessary for completing the work. The Contractor and its sureties shall be liable for any damage to the Government resulting from the Contractor's refusal or failure to complete the work within the specified time, whether or not the Contractor's right to proceed with the work is terminated. This liability includes any increased costs incurred by the Government in completing the work.

(b) The Contractor's right to proceed shall not be terminated nor the Contractor charged with damages under this clause, if--

(1) The delay in completing the work arises from unforeseeable causes beyond the control and without the fault or negligence of the Contractor. Examples of such causes include

(i) acts of God or of the public enemy,

(ii) acts of the Government in either its sovereign or contractual capacity,

(iii) acts of another Contractor in the performance of a contract with the Government,

(iv) fires,

(v) floods,

(vi) epidemics,

(vii) quarantine restrictions,

(viii) strikes,

(ix) freight embargoes,

(x) unusually severe weather, or delays of subcontractors or suppliers at any tier arising from unforeseeable causes beyond the control and without the fault or negligence of both the Contractor and the subcontractors or suppliers; and

(2) The Contractor, within 10 days from the beginning of any delay (unless extended by the Contracting Officer), notifies the Contracting Officer in writing of the causes of delay. The Contracting Officer shall ascertain the facts and the extent of delay. If, in the judgment of the Contracting Officer, the findings of fact warrant such action, the time for completing the work shall be extended. The findings of the Contracting Officer shall be final and conclusive on the parties, but subject to appeal under the Disputes clause.

(c) If, after termination of the Contractor's right to proceed, it is determined that the Contractor was not in default, or that the delay was excusable, the rights and obligations of the parties will be the same as if the termination had been issued for the convenience of the Government.

The rights and remedies of the Government in this clause are in addition to any other rights and remedies provided by law or under this contract.

(End of clause)

52.253-1 COMPUTER GENERATED FORMS (JAN 1991)

(a) Any data required to be submitted on a Standard or Optional Form prescribed by the Federal Acquisition Regulation (FAR) may be submitted on a computer generated version of the form, provided there is no change to the name, content, or sequence of the data elements on the form, and provided the form carries the Standard or Optional Form number and edition date.

(b) Unless prohibited by agency regulations, any data required to be submitted on an agency unique form prescribed by an agency supplement to the FAR may be submitted on a computer generated version of the form provided there is no change to the name, content, or sequence of the data elements on the form and provided the form carries the agency form number and edition date.

(6) If the Contractor submits a computer generated version of a form that is different than the required form, then the rights and obligations of the parties will be determined based on the content of the required form.

(End of clause)

252.201-7000 CONTRACTING OFFICER'S REPRESENTATIVE (DEC 1991)

(a) "Definition. Contracting officer's representative" means an individual designated in accordance with subsection 201.602-2 of the Defense Federal Acquisition Regulation Supplement and authorized in writing by the contracting officer to perform specific technical or administrative functions.

(b) If the Contracting Officer designates a contracting officer's representative (COR), the Contractor will receive a copy of the written designation. It will specify the extent of the COR's authority to act on behalf of the contracting officer. The COR is not authorized to make any commitments or changes that will affect price, quality, quantity, delivery, or any other term or condition of the contract.

(End of clause)

252.203-7001 PROHIBITION ON PERSONS CONVICTED OF FRAUD OR OTHER DEFENSE-CONTRACT-RELATED FELONIES (MAR 1999)

(a) Definitions. As used in this clause—

(1) "Arising out of a contract with the DoD" means any act in connection with—

(i) Attempting to obtain;

(ii) Obtaining, or

(iii) Performing a contract or first-tier subcontract of any agency, department, or component of the Department of Defense (DoD).

(2) "Conviction of fraud or any other felony" means any conviction for fraud or a felony in violation of state or Federal criminal statutes, whether entered on a verdict or plea, including a plea of *nolo contendere*, for which sentence has been imposed.

(3) "Date of conviction" means the date judgment was entered against the individual.

(b) Any individual who is convicted after September 29, 1988, of fraud or any other felony arising out of a contract with the DoD is prohibited from serving--

(1) In a management or supervisory capacity on any DoD contract or first-tier subcontract;

(2) On the board of directors of any DoD contractor or first-tier subcontractor;

(3) As a consultant, agent, or representative for any DoD contractor or first-tier subcontractor; or

(4) In any other capacity with the authority to influence, advise, or control the decisions of any DoD contractor or subcontractor with regard to any DoD contract or first-tier subcontract.

(c) Unless waived, the prohibition in paragraph (b) of this clause applies for not less than 5 years from the date of conviction.

(d) 10 U.S.C. 2408 provides that a defense contractor or first-tier subcontractor shall be subject to a criminal penalty of not more than $500,000 if convicted of knowingly—

(1) Employing a person under a prohibition specified in paragraph (b) of this clause; or

(2) Allowing such a person to serve on the board of directors of the contractor or first-tier subcontractor.

(e) In addition to the criminal penalties contained in 10 U.S.C. 2408, the Government may consider other available remedies, such as—

(1) Suspension or debarment;

(2) Cancellation of the contract at no cost to the Government; or

(3) Termination of the contract for default.

(f) The Contractor may submit written requests for waiver of the prohibition in paragraph (b) of this clause to the Contracting Officer. Requests shall clearly identify—

(1) The person involved;

(2) The nature of the conviction and resultant sentence or punishment imposed;

(3) The reasons for the requested waiver; and

(4) An explanation of why a waiver is in the interest of national security.

(g) The Contractor agrees to include the substance of this clause, appropriately modified to reflect the identity and relationship of the parties, in all first-tier subcontracts exceeding the simplified acquisition threshold in Part 2 of the Federal Acquisition Regulation, except those for commercial items or components.

(h) Pursuant to 10 U.S.C. 2408(c), defense contractors and subcontractors may obtain information as to whether a particular person has been convicted of fraud or any other felony arising out of a contract with the DoD by contacting The Office of Justice Programs, The Denial of Federal Benefits Office, U.S. Department of Justice, telephone (202) 616-3507.

(End of clause)

252.203-7002 DISPLAY OF DOD HOTLINE POSTER (DEC 1991)

(a) The Contractor shall display prominently in common work areas within business segments performing work under Department of Defense (DoD) contracts, DoD Hotline Posters prepared by the DoD Office of the Inspector General.

(b) DoD Hotline Posters may be obtained from the DoD Inspector General, ATTN: Defense Hotline, 400 Army Navy Drive, Washington, DC 22202-2884.

(7) The Contractor need not comply with paragraph (a) of this clause if it has established a mechanism, such as a hotline, by which employees may report suspected instances of improper conduct, and instructions that encourage employees to make such reports.

(End of clause)

252.215-7000 PRICING ADJUSTMENTS (DEC 1991)

The term "pricing adjustment," as used in paragraph (a) of the clauses entitled "Price Reduction for Defective Cost or Pricing Data - Modifications," "Subcontractor Cost or Pricing Data," and "Subcontractor Cost or Pricing Data -

Modifications," means the aggregate increases and/or decreases in cost plus applicable profits.

(End of clause)

252.219-7003 SMALL, SMALL DISADVANTAGED AND WOMEN-OWNED SMALL BUSINESS SUBCONTRACTING PLAN (DOD CONTRACTS) (APR. 1996)

This clause supplements the Federal Acquisition Regulation 52.219-9, Small, Small Disadvantaged and Women-Owned Small Business Subcontracting Plan, clause of this contract.

(a) *Definitions. Historically black colleges and universities,* as used in this clause, means institutions determined by the Secretary of Education to meet the requirements of 34 CFR 608.2. The term also means any nonprofit research institution that was an integral part of such a college or university before November 14, 1986.

Minority institutions, as used in this clause, means institutions meeting the requirements of section 1046(3) of the Higher Education Act of 1965 (20 U.S.C. 1135d-5(3)). The term also includes Hispanic-serving institutions as defined in section 316(b)(1) of such Act (20 U.S.C. 1059c(b)(1)).

(b) Except for company or division-wide commercial items subcontracting plans, the term *small disadvantaged business,* when used in the FAR 52.219-9 clause, includes historically black colleges and universities and minority institutions, in addition to small disadvantaged business concerns.

(c) Work under the contract or its subcontracts shall be credited toward meeting the small disadvantaged business concern goal required by paragraph (d) of the FAR 52.219-9 clause when:

(1) It is performed on Indian lands or in joint venture with an Indian tribe or a tribally-owned corporation, and

(2) It meets the requirements of 10 U.S.C. 2323a.

(d) Subcontracts awarded to workshops approved by the Committee for Purchase from People Who are Blind or Severely Disabled (41 U.S.C. 46-48), may be counted toward the Contractor's small business subcontracting goal.

(e) A mentor firm, under the Pilot Mentor-Protege Program established under Section 831 of Pub. L. 101-510, as amended, may count toward its small disadvantaged business goal, subcontracts awarded--

(f) The master plan approval referred to in paragraph (f) of the FAR 52.219-9 clause is approval by the Contractor's cognizant contract administration activity.

(g) In those subcontracting plans which specifically identify small, small disadvantaged, and women-owned small businesses, the Contractor shall notify the Administrative Contracting Officer of any substitutions of firms that are not small, small disadvantaged, or women-owned small businesses for the firms listed in the subcontracting plan. Notifications shall be in writing and shall occur within a reasonable period of time after award of the subcontract. Contractor-specified formats shall be acceptable.

(End of clause)

252.222-7000 RESTRICTIONS ON EMPLOYMENT OF PERSONNEL (MAR 2000)

(a) The Contractor shall employ, for the purpose of performing that portion of the contract work in Alaska, individuals who are residents thereof and who, in the case of any craft or trade, possess or would be able to acquire promptly the necessary skills to perform the contract.

(b) The Contractor shall insert the substance of this clause, including this paragraph (b), in each subcontract awarded under this contract.

(End of clause)

252.223-7001 HAZARD WARNING LABELS (DEC 1991)

(a) "Hazardous material," as used in this clause, is defined in the Hazardous Material Identification and Material Safety Data clause of this contract.

(b) The Contractor shall label the item package (unit container) of any hazardous material to be delivered under this contract in accordance with the Hazard Communication Standard (29 CFR 1910.1200 et seq). The Standard requires that the hazard warning label conform to the requirements of the standard unless the material is otherwise subject to the labeling requirements of one of the following statutes:

(1) Federal Insecticide, Fungicide and Rodenticide Act;

(2) Federal Food, Drug and Cosmetics Act;

(3) Consumer Product Safety Act;

(4) Federal Hazardous Substances Act; or

(5) Federal Alcohol Administration Act.

(c) The Offeror shall list which hazardous material listed in the Hazardous Material Identification and Material Safety Data clause of this contract will be labeled in accordance with one of the Acts in paragraphs (b)(1) through (5) of this clause instead of the Hazard Communication Standard. Any hazardous material not listed will be interpreted to mean that a label is required in accordance with the Hazard Communication Standard.

MATERIAL (If None, Insert "None.")	ACT
_____	_____
_____	_____

(d) The apparently successful Offeror agrees to submit, before award, a copy of the hazard warning label for all hazardous materials not listed in paragraph (c) of this clause. The Offeror shall submit the label with the Material Safety Data Sheet being furnished under the Hazardous Material Identification and Material Safety Data clause of this contract.

(e) The Contractor shall also comply with MIL-STD-129, Marking for Shipment and Storage (including revisions adopted during the term of this contract).

(End of clause)

252.223-7006 PROHIBITION ON STORAGE AND DISPOSAL OF TOXIC AND HAZARDOUS MATERIALS (APR 1993)

(a) "Definitions".

As used in this clause --

(1) "Storage" means a non-transitory, semi-permanent or permanent holding, placement, or leaving of material. It does not include a temporary accumulation of a limited quantity of a material used in or a waste generated or resulting from authorized activities, such as servicing, maintenance, or repair of Department of Defense (DoD) items, equipment, or facilities.

(2) "Toxic or hazardous materials" means:

(i) Materials referred to in section 101(14) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 (42 U.S.C. 9601(14)) and materials designated under section 102 of CERCLA (42 U.S.C. 9602) (40 CFR part 302);

(ii) Materials that are of an explosive, flammable, or pyrotechnic nature; or

(iii) Materials otherwise identified by the Secretary of Defense as specified in DoD regulations.

(b) In accordance with 10 U.S.C. 2692, the Contractor is prohibited from storing or disposing of non-DoD-owned toxic or hazardous materials on a DoD installation, except to the extent authorized by a statutory exception to 10 U.S.C. 2692 or as authorized by the Secretary of Defense or his designee.

(End of clause)

252.226-7001 UTILIZATION OF INDIAN ORGANIZATIONS AND INDIAN-OWNED ECONOMIC ENTERPRISES, AND HAWAIIAN SMALL BUSINESS CONCERNS (OCT 2003)

(a) Definitions. As used in this clause--

Indian means any person who is a member of any Indian tribe, band, group, pueblo, or community that is recognized by the Federal Government as eligible for services from the Bureau of Indian Affairs (BIA) in accordance with 25 U.S.C. 1452(c) and any ``Native" as defined in the Alaska Native Claims Settlement Act (43 U.S.C. 1601).

Indian organization means the governing body of any Indian tribe or entity established or recognized by the governing body of an Indian tribe for the purposes of 25 U.S.C. chapter 17.

Indian-owned economic enterprise means any Indian-owned (as determined by the Secretary of the Interior) commercial, industrial, or business activity established or organized for the purpose of profit, provided that Indian ownership constitutes not less than 51 percent of the enterprise.

Indian tribe means any Indian tribe, band, group, pueblo, or community, including native villages and native groups (including corporations organized by Kenai, Juneau, Sitka, and Kodiak) as defined in the Alaska Native Claims Settlement Act, that is recognized by the Federal Government as eligible for services from BIA in accordance with 25 U.S.C. 1452(c).

Interested party means a contractor or an actual or prospective offeror whose direct economic interest would be affected by the award of a subcontract or by the failure to award a subcontract.

Native Hawaiian small business concern means an entity that is --

(1) A small business concern as defined in section 3 of the Small Business Act (15 U.S.C. 632) and relevant implementing regulations; and

(2) Owned and controlled by a Native Hawaiian as defined in 25 U.S.C. 4221(9).

(b) The Contractor shall use its best efforts to give Indian organizations, Indian-owned economic enterprises, and Native Hawaiian small business concerns the maximum practicable opportunity to participate in the subcontracts it awards, to the fullest extent consistent with efficient performance of the contract.

(c) The Contracting Officer and the Contractor, acting in good faith, may rely on the representation of an Indian organization, Indian-owned economic enterprise, or Native Hawaiian small business concern as to its eligibility, unless an interested party challenges its status or the Contracting Officer has independent reason to question that status.

(d) In the event of a challenge to the representation of a subcontractor, the Contracting Officer will refer the matter to--

(1) For matters relating to Indian organizations or Indian-owned economic enterprises: U.S. Department of the Interior, Bureau of Indian Affairs, Attn: Chief, Division of Contracting and Grants Administration, 1849 C Street NW, MS-2626-MIB, Washington, DC 20240-4000. The BIA will determine the eligibility and will notify the Contracting Officer.

(2) For matters relating to Native Hawaiian small business concerns: Department of Hawaiian Home Lands, PO Box 1879, Honolulu, HI 96805. The Department of Hawaiian Home Lands will determine the eligibility and will notify the Contracting Officer.

(e) No incentive payment will be made--

(1) While a challenge is pending; or

(2) If a subcontractor is determined to be an ineligible participant.

(f)(1) The Contractor, on its own behalf or on behalf of a subcontractor at any tier, may request an incentive payment in accordance with this clause.

(2) The incentive amount that may be requested is 5 percent of the estimated cost, target cost, or fixed price included in the subcontract at the time of award to the Indian organization, Indian-owned economic enterprise, or Native Hawaiian small business concern.

(3) In the case of a subcontract for commercial items, the Contractor may receive an incentive payment only if the subcontracted items are produced or manufactured in whole or in part by an Indian organization, Indian-owned economic enterprise, or Native Hawaiian small business concern.

(4) The Contractor has the burden of proving the amount claimed and shall assert its request for an incentive payment prior to completion of contract performance.

(5) The Contracting Officer, subject to the terms and conditions of the contract and the availability of funds, will authorize an incentive payment of 5 percent of the estimated cost, target cost, or fixed price included in the subcontract awarded to the Indian organization, Indian-owned economic enterprise, or Native Hawaiian small business concern.

(6) If the Contractor requests and receives an incentive payment on behalf of a subcontractor, the Contractor is obligated to pay the subcontractor the incentive amount.

(g) The Contractor shall insert the substance of this clause, including this paragraph (g), in all subcontracts exceeding $500,000 for which further subcontracting opportunities may exist.

(End of clause)

252.227-7022 GOVERNMENT RIGHTS (UNLIMITED) (MAR 1979)

The Government shall have unlimited rights, in all drawings, designs, specifications, notes and other works developed in the performance of this contract, including the right to use same on any other Government design or construction without additional compensation to the Contractor. The Contractor hereby grants to the Government a paid-up license throughout the world to all such works to which he may assert or establish any claim under design patent or copyright laws. The Contractor for a period of three (3) years after completion of the project agrees to furnish the original or copies of all such works on the request of the Contracting Officer.

(End of clause)

252.227-7024 NOTICE AND APPROVAL OF RESTRICTED DESIGNS (APR 1984)

In the performance of this contract, the Contractor shall, to the extent practicable, make maximum use of structures, machines, products, materials, construction methods, and equipment that are readily available through Government or competitive commercial channels, or through standard or proven production techniques, methods, and processes. Unless approved by the Contracting Officer, the Contractor shall not produce a design or specification that requires in this construction work the use of structures, products, materials, construction equipment, or processes that are known by the Contractor to be available only from a sole source. The Contractor shall promptly report any such design or specification to the Contracting Officer and give the reason why it is considered necessary to so restrict the design or specification.

(End of clause)

252.227-7033 RIGHTS IN SHOP DRAWINGS (APR 1966)

(a) Shop drawings for construction means drawings, submitted to the Government by the Construction Contractor, subcontractor or any lower-tier subcontractor pursuant to a construction contract, showing in detail (i) the proposed fabrication and assembly of structural elements and (ii) the installation (i.e., form, fit, and attachment details) of materials or equipment. The Government may duplicate, use, and disclose in any manner and for any purpose shop drawings delivered under this contract.

(b) This clause, including this paragraph (b), shall be included in all subcontracts hereunder at any tier.

252.231-7000 SUPPLEMENTAL COST PRINCIPLES (DEC 1991)

When the allowability of costs under this contract is determined in accordance with part 31 of the Federal Acquisition Regulation (FAR), allowability shall also be determined in accordance with part 231 of the Defense FAR Supplement, in effect on the date of this contract.

(End of clause)

252.236-7000 MODIFICATION PROPOSALS - PRICE BREAKDOWN. (DEC 1991)

(a) The Contractor shall furnish a price breakdown, itemized as required and within the time specified by the Contracting Officer, with any proposal for a contract modification.

(b) The price breakdown --

(1) Must include sufficient detail to permit an analysis of profit, and of all costs for --

(i) Material;

(ii) Labor;

(iii) Equipment;

(iv) Subcontracts; and

(v) Overhead; and

(2) Must cover all work involved in the modification, whether the work was deleted, added, or changed.

(c) The Contractor shall provide similar price breakdowns to support any amounts claimed for subcontracts.

(d) The Contractor's proposal shall include a justification for any time extension proposed.

252.243-7001 PRICING OF CONTRACT MODIFICATIONS (DEC 1991)

When costs are a factor in any price adjustment under this contract, the contract cost principles and procedures in FAR part 31 and DFARS part 231, in effect on the date of this contract, apply.

252.243-7002 REQUESTS FOR EQUITABLE ADJUSTMENT (MAR 1998)

(a) The amount of any request for equitable adjustment to contract terms shall accurately reflect the contract adjustment for which the Contractor believes the Government is liable. The request shall include only costs for performing the change, and shall not include any costs that already have been reimbursed or that have been separately claimed. All indirect costs included in the request shall be properly allocable to the change in accordance with applicable acquisition regulations.

(b) In accordance with 10 U.S.C. 2410(a), any request for equitable adjustment to contract terms that exceeds the simplified acquisition threshold shall bear, at the time of submission, the following certificate executed by an individual authorized to certify the request on behalf of the Contractor:

I certify that the request is made in good faith, and that the supporting data are accurate and complete to the best of my knowledge and belief.

(Official's Name)

(Title)

(c) The certification in paragraph (b) of this clause requires full disclosure of all relevant facts, including--

(1) Cost or pricing data if required in accordance with subsection 15.403-4 of the Federal Acquisition Regulation (FAR); and

(2) Information other than cost or pricing data, in accordance with subsection 15.403-3 of the FAR, including actual cost data and data to support any estimated costs, even if cost or pricing data are not required.

(d) The certification requirement in paragraph (b) of this clause does not apply to----

(1) Requests for routine contract payments; for example, requests for payment for accepted supplies and services, routine vouchers under a cost-reimbursement type contract, or progress payment invoices; or

(2) Final adjustment under an incentive provision of the contract.

252.247-7023 TRANSPORTATION OF SUPPLIES BY SEA (MAY 2002) ALTERNATE II (MAR 2000)

(a) Definitions. As used in this clause—

(1) "Components" means articles, materials, and supplies incorporated directly into end products at any level of manufacture, fabrication, or assembly by the Contractor or any subcontractor.

(2) "Department of Defense" (DoD) means the Army, Navy, Air Force, Marine Corps, and defense agencies.

(3) "Foreign flag vessel" means any vessel that is not a U.S.-flag vessel.

(4) "Ocean transportation" means any transportation aboard a ship, vessel, boat, barge, or ferry through international waters.

(5) "Subcontractor" means a supplier, materialman, distributor, or vendor at any level below the prime contractor whose contractual obligation to perform results from, or is conditioned upon, award of the prime contract and who is performing any part of the work or other requirement of the prime contract.

(6) "Supplies" means all property, except land and interests in land, that is clearly identifiable for eventual use by or owned by the DoD at the time of transportation by sea.

(i) An item is clearly identifiable for eventual use by the DoD if, for example, the contract documentation contains a reference to a DoD contract number or a military destination.

(ii) "Supplies" includes (but is not limited to) public works; buildings and facilities; ships; floating equipment and vessels of every character, type, and description, with parts, subassemblies, accessories, and equipment; machine tools; material; equipment; stores of all kinds; end items; construction materials; and components of the foregoing.

(7) "U.S.-flag vessel" means a vessel of the United States or belonging to the United States, including any vessel registered or having national status under the laws of the United States.

(b)(1) The Contractor shall use U.S.-flag vessels when transporting any supplies by sea under this contract.

(2) A subcontractor transporting supplies by sea under this contract shall use U.S.-flag vessels if the supplies being transported are--

(i) Noncommercial items; or

(ii) Commercial items that--

(A) The Contractor is reselling or distributing to the Government without adding value (generally, the Contractor does not add value to items that it subcontracts for f.o.b. destination shipment),

(B) Are shipped in direct support of U.S. military contingency operations, exercises, or forces deployed in humanitarian or peacekeeping operations; or

(C) Are commissary or exchange cargoes transported outside of the Defense Transportation System in accordance with 10 U.S.C. 2643 (Note: This contract requires transportation of commissary or exchange cargoes outside of the Defense Transportation System in accordance with 10 U.S.C. 2643).

(c) The Contractor and its subcontractors may request that the Contracting Officer authorize shipment in foreign-flag vessels, or designate available U.S.-flag vessels, if the Contractor or a subcontractor believes that—

(1) U.S.-flag vessels are not available for timely shipment;

(2) The freight charges are inordinately excessive or unreasonable; or

(3) Freight charges are higher than charges to private persons for transportation of like goods.

(d) The Contractor must submit any request for use of other than U.S.-flag vessels in writing to the Contracting Officer at least 45 days prior to the sailing date necessary to meet its delivery schedules. The Contracting Officer will process requests submitted after such date(s) as expeditiously as possible, but the Contracting Officer's failure to grant approvals to meet the shipper's sailing date will not of itself constitute a compensable delay under this or any other clause of this contract. Requests shall contain at a minimum—

(1) Type, weight, and cube of cargo;

(2) Required shipping date;

(3) Special handling and discharge requirements;

(4) Loading and discharge points;

(5) Name of shipper and consignee;

(6) Prime contract number; and

(7) A documented description of efforts made to secure U.S.-flag vessels, including points of contact (with names and telephone numbers) with at least two U.S.-flag carriers contacted. Copies of telephone notes, telegraphic and facsimile message or letters will be sufficient for this purpose.

(e) The Contractor shall, within 30 days after each shipment covered by this clause, provide the Contracting Officer and the Maritime Administration, Office of Cargo Preference, U.S. Department of Transportation, 400 Seventh Street SW., Washington, DC 20590, one copy of the rated on board vessel operating carrier's ocean bill of lading, which shall contain the following information:

(1) Prime contract number;

(2) Name of vessel;

(3) Vessel flag of registry;

(4) Date of loading;

(5) Port of loading;

(6) Port of final discharge;

(7) Description of commodity;

(8) Gross weight in pounds and cubic feet if available;

(9) Total ocean freight in U.S. dollars; and

(10) Name of steamship company.

(f) The Contractor shall provide with its final invoice under this contract a representation that to the best of its knowledge and belief--

(1) No ocean transportation was used in the performance of this contract;

(2) Ocean transportation was used and only U.S.-flag vessels were used for all ocean shipments under the contract;

(3) Ocean transportation was used, and the Contractor had the written consent of the Contracting Officer for all non-U.S.-flag ocean transportation; or

(4) Ocean transportation was used and some or all of the shipments were made on non-U.S.-flag vessels without the written consent of the Contracting Officer. The Contractor shall describe these shipments in the following format:

	ITEM DESCRIPTION	CONTRACT LINE ITEMS	QUANTITY
TOTAL			

(g) If the final invoice does not include the required representation, the Government will reject and return it to the Contractor as an improper invoice for the purposes of the Prompt Payment clause of this contract. In the event there has been unauthorized use of non-U.S.-flag vessels in the performance of this contract, the Contracting Officer is entitled to equitably adjust the contract, based on the unauthorized use.

(h) In the award of subcontracts for the types of supplies described in paragraph (b)(2) of this clause, the Contractor shall flow down the requirements of this clause as follows:

(1) The Contractor shall insert the substance of this clause, including this paragraph (h), in subcontracts that exceed the simplified acquisition threshold in part 2 of the Federal Acquisition Regulation.

(2) The Contractor shall insert the substance of paragraphs (a) through (e) of this clause, and this paragraph (h), in subcontracts that are at or below the simplified acquisition threshold in part 2 of the Federal Acquisition Regulation.

(End of clause)

252.247-7024 NOTIFICATION OF TRANSPORTATION OF SUPPLIES BY SEA (MAR 2000)

(a) The Contractor has indicated by the response to the solicitation provision, Representation of Extent of Transportation by Sea, that it did not anticipate transporting by sea any supplies. If, however, after the award of this contract, the Contractor learns that supplies, as defined in the Transportation of Supplies by Sea clause of this contract, will be transported by sea, the Contractor --

(1) Shall notify the Contracting Officer of that fact; and

(2) Hereby agrees to comply with all the terms and conditions of the Transportation of Supplies by Sea clause of this contract.

(b) The Contractor shall include this clause; including this paragraph (b), revised as necessary to reflect the relationship of the contracting parties--

(1) In all subcontracts under this contract, if this contract is a construction contract; or

(2) If this contract is not a construction contract, in all subcontracts under this contract that are for--

(i) Noncommercial items; or

(ii) Commercial items that--

(A) The Contractor is reselling or distributing to the Government without adding value (generally, the Contractor does not add value to items that it subcontracts for f.o.b. destination shipment);

(B) Are shipped in direct support of U.S. military contingency operations, exercises, or forces deployed in humanitarian or peacekeeping operations; or

(C) Are commissary or exchange cargoes transported outside of the Defense Transportation System in accordance with 10 U.S.C. 2643.

(End of clause)

SECTION 00700a

General Wage Decision AK030001
(Dated (06/13/2003)
Modification Record:

No.	Publication Date
0	06/13/2003
1	11/28/2003
2	02/06/2004
3	03/05/2004

General Wage Decision AK030006
(Dated (06/13/2003)
Modification Record:

No.	Publication Date
0	06/13/2003
1	11/28/2003
2	02/13/2004
3	03/05/2004

General Decision Number: AK030001 03/05/2004
Superseded General Decision Number: AK020001
State: Alaska
Construction Types: Building and Heavy
Counties: Alaska Statewide.
BUILDING AND HEAVY CONSTRUCTION PROJECTS (does not include residential construction consisting of single family homes and apartments up to and including 4 stories)

Modification Number	Publication Date
0	06/13/2003
1	11/28/2003
2	02/06/2004
3	03/05/2004

* ASBE0097-001 01/01/2004

	Rates	Fringes
Asbestos Workers/Insulator (includes application of all insulating materials protective coverings, coatings and finishings to all types of mechanical systems)	$ 29.63	9.42

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* ASBE0097-002 01/01/2004

	Rates	Fringes
Hazardous Material Handler (includes preparation, wetting, stripping, removal scrapping, vacuming, bagging, and disposing of all insulation materials, whether they contain asbestos or not, from mechanical systems)	$ 26.45	9.42

BOIL0502-002 01/01/2004

	Rates	Fringes
Boilermaker	$ 35.23	15.37

BRAK0001-002 07/01/2003

	Rates	Fringes
Bricklayer, Blocklayer, Stonemason, Marble Mason, Tile Setter, Terrazzo Worker	$ 30.13	11.80
Tile & Terrazzo Finisher	$ 24.70	11.80

CARP1243-003 07/01/2003
North of the 63rd Parallel

	Rates	Fringes
Carpenter/Lather/Drywall Applicator	$ 31.40	12.20
Carpenter: Fire or Flood		

Repair Work	$ 31.99	12.20
Millwright	$ 32.38	12.20

CARP1281-004 07/01/2003
SOUTH OF 63RD PARALLEL

	Rates	Fringes
Acoustical Applicator and Lather	$ 28.10	12.70
Carpenters & Drywallers	$ 28.10	12.70
Millwright	$ 28.80	12.70

CARP2520-003 08/01/2003

	Rates	Fringes
Diver		
Stand-by	$ 32.66	12.20
Tender	$ 31.66	12.20
Working	$ 65.32	12.20
Piledriver		
Carpenter	$ 29.30	12.20
Piledriver; Skiff Operator and Rigger	$ 28.14	12.20
Sheet Pile Stabber	$ 29.14	12.20
Welder	$ 29.90	12.20

ELEC1547-004 05/05/2003

	Rates	Fringes
Cable splicer	$ 34.17	3%+11.35
Electrician;Technician	$ 32.42	3%+11.35

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* ELEC1547-005 01/01/2004

	Rates	Fringes
Cable splicer	$ 35.90	3%+16.00
Linemen (Including Equipment Operators, Technician)	$ 34.15	3%+16.00
Powderman	$ 32.15	3%+16.00
Tree Trimmer	$ 22.95	3%+16.00

ELEV0019-002 01/01/2004

	Rates	Fringes
Elevator Mechanic	$ 37.695	10.765+a

FOOTNOTE: a. Employer contributes 8% of the basic hourly rate for over 5 year's service and 6% of the basic hourly rate for 6 months to 5 years' of service as vacation paid credit. Seven paid holidays: New Year's Day; Memorial Day; Independence Day; Labor Day, Thanksgiving Day; Friday after Thanksgiving and Christmas Day

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ENGI0302-002 09/01/2003

	Rates	Fringes
Power equipment operators:		
GROUP 1	$ 32.08	10.89
GROUP 1A	$ 33.62	10.89
GROUP 2	$ 31.41	10.89
GROUP 3	$ 30.78	10.89
GROUP 4	$ 25.36	10.89

POWER EQUIPMENT OPERATOR CLASSIFICATIONS

GROUP 1: Asphalt Roller; Back Filler; Barrier Machine (Zipper); Batch Plant Operator: Batch and Mixer over 200 yds.; Beltcrete with power pack and similar conveyors; Bending Machine; Boat Coxwains; Bulldozers; Cableways, Highlines and Cablecars; Cleaning Machine; Coating Machine; Concrete Hydro Blaster; Cranes-45 tons and under or 150 foot boom and under (including jib and attachments): (a) Shovels, Backhoes, Draglines, Clamshells; Gradalls-3 yards and under; (b) Hydralifts or Transporters, all track or truck type,(c) Derricks; Crushers; Deck Winches-Double Drum; Ditching or Trenching Machine (16 inch or over); Drilling Machines, core, cable, rotary and exploration; Finishing Machine Operator, concrete paving, Laser Screed, sidewalk, curb and gutter machine; Helicopters; Hover Craft, Flex Craft, Loadmaster, Air Cushion, All Terrain Vehicle, Rollagon, Bargecable, Nodwell Sno Cat; Hydro Ax: Feller Buncher and similar; Loaders: Forklifts with power boom and swing attachment, Overhead and front end, 2 1/2 yards through 5 yards, Loaders with forks or pipe clamps, Loaders, elevating belt type, Euclid and similar types; Mechanics, Bodyman; Micro Tunneling Machine; Mixers: Mobile type w/hoist combination; Motor Patrol Grader; Mucking Machines: Mole, Tunnel Drill, Horizontal/Directional Drill Operator, and/or Shield; Operator on Dredges; Piledriver Engineers, L. B. Foster, Puller or similar Paving Breaker; Power Plant, Turbine Operator, 200 k.w. and over (power plants or combination of power units over 300 k.w.); Sauerman-Bagley; Scrapers-through 40 yards; Service Oiler/Service Engineer; Sidebooms-under 45 tons; Shot Blast Machine; Spreaders, Blaw Knox, Cedarapids, Barber Greene, Slurry Machine; Sub-grader (Gurries, C.M.I. and C.M.I. Roto Mills and similar types); Tack tractor; Truck mounted Concrete Pumps, Conveyor, Creter; Water Kote Machine; Unlicensed off road hauler

GROUP 1A: Cranes-over 45 tons or 150 foot (including jib and attachments): (a) Shovels, backhoes, draglines, clamshells-over 3 yards, (b) Tower cranes; Loaders over 5 yds.; Motor Patrol Grader (finish: when finishing to final graders and/or to hubs, or for asphalt); Power Plants: 1000 k.w. and over; Quad; Screed; Sidebooms over 45 tons; Slip Form Paver C.M.I. and similar types; Scrapers over 40 yards

GROUP 2: Batch Plant Operators: Batch and Mixer 200 yds. per hour and under; Boiler-fireman; Cement Hog and Concrete Pump Operator; Conveyors (except as listed in group 1); Hoist on steel erection; Towermobiles and Air Tuggers; Horizontal/Directional Drill Locator; Loaders, Elevating Grader, Dumor and similar; Locomotives: rod and geared engines; Mixers; Screening, Washing Plant; Sideboom (cradling rock drill regardless of size); Skidder; Trencing Machine under 16 inches.

GROUP 3: "A" Frame Trucks, Deck Winches: single power drum; Bombardier (tack or tow rig); Boring Machine; Brooms-power; Bump Cutter; Compressor; Farm tractor; Forklift, industrial type; Gin Truck or Winch Truck with poles when used for hoisting; Grade Checker and Stake Hopper; Hoist, Air Tuggers, Elevators; Loaders: (a) Elevating-Athey, Barber Green and similar types (b) Forklifts or Lumber Carrier (on

construction job site) (c) Forklifts with Tower (d) Overhead and Front-end, under 2 1/2 yds. Locomotives:Dinkey (air, steam, gas and electric) Speeders; Mechanics (light duty); Mixers: Concrete Mixers and Batch 200 yds. per hour and under; Oil, Blower Distribution; Post Hole Diggers, mechanical; Pot Fireman (power agitated); Power Plant, Turbine Operator, under 300 k.w.; Pumps-water; Rig oiler/assistant engineer, over 45 ton, over 3 yards or over 150 foot boom; Roller-other than Plantmix; Saws, concrete; Straightening Machine; Tow Tractor

GROUP 4: Rig Oiler/Assistant Engineer (Advances to Group III if over 45 tons or 3 yards or 150 ft. boom); Swamper (on trenching machines or shovel type equipment); Spotter; Steam Cleaner

FOOTNOTE: Groups 1-4 receive 10% premium while performing tunnel or underground work.

IRON0751-003 08/01/2003

	Rates	Fringes
Ironworkers:		
BRIDGE, STRUCTURAL, ORNAMENTAL, REINFORCING MACHINERY MOVER, RIGGER, SHEETER, STAGE		
RIGGER, BENDER OPERATOR.....	$ 27.50	14.10
FENCE, BARRIER AND GUARDRAIL INSTALLERS.....	$ 24.00	13.85
GUARDRAIL LAYOUT MAN.....	$ 24.74	13.85
HELICOPTER, TOWER.....	$ 28.50	14.10

LABO0341-005 09/01/2003

	Rates	Fringes
Laborers:		
GROUP 1.....	$ 24.49	11.50
GROUP 2.....	$ 25.24	11.50
GROUP 3.....	$ 25.89	11.50
GROUP 3A.....	$ 28.29	11.50
GROUP 4.....	$ 16.84	11.50
TUNNELS, SHAFTS, AND RAISES		
GROUP 1.....	$ 26.94	11.50
GROUP 2.....	$ 27.76	11.50
GROUP 3.....	$ 28.48	11.50
GROUP 3A.....	$ 31.12	11.50

LABORERS CLASSIFICATIONS

GROUP 1: Asphalt Workers (shovelman, plant crew); Brush Cutters; Camp Maintenance Laborer; Carpenter Tenders; Choke Setters, Hook Tender, Rigger, Signalman; Concrete Laborer(curb and gutter, chute handler, grouting, curing, screeding); Crusher Plant Laborer; Demolition Laborer; Ditch Diggers; Dump Man; Environmental Laborer (asbestos (limited to nonmechanical systems), hazardous and toxic waste, oil spill); Fence Installer; Fire Watch Laborer; Flagman; Form Strippers; General Laborer; Guardrail Laborer, Bridge Rail Installers; Hydro-Seeder Nozzleman; Laborers (building); Landscape or Planter; Material Handlers; Pneumatic or Power Tools; Portable or Chemical Toilet Serviceman; Pump Man or

Mixer Man; Railroad Track Laborer; Sandblast, Pot Tender; Saw Tenders; Scaffold Building and Erecting; Slurry Work; Stake Hopper; Steam Point or Water Jet Operator; Steam Cleaner Operator; Tank Cleaning; Utiliwalk and Utilidor Laborer; Watchman (construction projects); Window Cleaner

GROUP 2: Burning and Cutting Torch; Cement or Lime Dumper or Handler (sack or bulk); Choker Splicer; Chucktender (wagon, airtrack and hydraulic drills); Concrete Laborers (power buggy, concrete saws, pumpcrete nozzleman, vibratorman); Environmental Laborer (marine work); Foam Gun or Foam Machine Operator; Green Cutter (dam work); Guardrail Machine Operator; Gunnite Operator; Hod Carriers; Jackhammer or Pavement Breakers (more than 45 pounds); Mason Tender and Mud Mixer (sewer work); Plasterer, Bricklayer and Cement Finisher Tenders; Power Saw Operator; Railroad Switch Layout Laborer; Sandblaster; Sewer Caulkers; Sewer Plant Maintenance Man; Thermal Plastic Applicator; Timber Faller, chain saw operator, filer; Timberman

GROUP 3: Bit Grinder; Drill Doctor (in the field); Drillers (including, but not limited to, wagon drills, air track drills; hydraulic drills); High Rigger and tree topper; Higher Scaler; Pioneer Drilling and Drilling Off Tugger (all type drills); Powderman; Slurry Seal Squeegee Man

GROUP 3A: Asphalt Raker, Asphalt Belly dump lay down; Grade checker (setting or transfering of grade marks, line and grade); Pipelayers

GROUP 4: Final Building Cleanup

TUNNELS, SHAFTS, AND RAISES CLASSIFICATIONS

GROUP 1: Brakeman; Muckers; Nippers; Topman and Bull Gang; Tunnel Track Laborer

GROUP 2: Burning and Cutting Torch; Concrete Laborers; Jackhammers; Laser Instrument Operators; Nozzleman, Pumpcrete or Shotcrete; Pipelayers.

GROUP 3: Miner; Miner; Retimberman

GROUP 3A: Powderman

Tunnel shaft and raise rates only apply to workers regularly employed inside a tunnel portal or shaft collar.

PAIN1140-004 07/01/2003
SOUTH OF THE 63RD PARALLEL

	Rates	Fringes
Painters:		
Brush, Roller, Sign, Paper and Vinyl, Swing Stage, Hand Taper/Drywall, Structural Steel, and Commercial Spray	$ 23.79	11.39
Machine Taper/Drywall	$ 23.99	11.39
Spray-Sand/Blast, Epoxy and Tar Applicator	$ 24.59	11.39
Steeple Jack & Tower	$ 25.59	11.39

PAIN1140-005 09/01/2003

	Rates	Fringes
Soft Floor Layer	$ 25.40	8.87

PAIN1140-006 01/01/2004
SOUTH OF THE 63RD PARALLEL

	Rates	Fringes
Glazier	$ 27.00	11.60

PAIN1555-004 09/01/2003
NORTH OF THE 63RD PARALLEL

	Rates	Fringes
Hazardous Material Applicator		
LEAD BASED PAINT ABATEMENT, RADON MITIGATION, SANDBLAST, STRUCTURAL STEEL, TAPING, TEXTURING	$ 28.00	11.97
Painters:		
BRUSH, BUFFER OPERATOR, FLOOR-COVERER, POT TENDER, ROLL SPRAY, WALLCOVERER	$ 27.50	11.97

PAIN1555-005 01/01/2004
NORTH OF THE 63RD PARALLEL

	Rates	Fringes
Glazier	$ 26.60	12.07

PLAS0867-003 02/01/2003

	Rates	Fringes
Cement Mason		
NORTH OF THE 63RD PARALLEL	$ 28.51	10.70
SOUTH OF THE 63RD PARALLEL	$ 28.26	10.70
Plasterer		
NORTH OF THE 63RD PARALLEL	$ 29.99	10.70
SOUTH OF THE 63RD PARALLEL	$ 29.74	10.70

PLUM0262-002 07/01/2003
East of the 141st Meridian

	Rates	Fringes
Plumber; Steamfitter	$ 29.09	10.55

PLUM0367-002 07/20/2003
South of the 63rd Parallel

	Rates	Fringes
Plumber; Steamfitter	$ 30.80	12.50

PLUM0375-002 07/01/2003
North of the 63rd Parallel

	Rates	Fringes
Plumber; Steamfitter	$ 34.26	13.15

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* PLUM0669-002 01/01/2004

	Rates	Fringes
Sprinkler Fitter	$ 33.30	11.95

ROOF0190-002 09/01/2003

	Rates	Fringes
Roofer		
North of the 63rd Parallel	$ 30.20	10.92
South of the 63rd Parallel	$ 28.20	10.92

SHEE0023-003 07/01/2003
South of the 63rd Parallel

	Rates	Fringes
Sheet Metal Worker	$ 30.80	12.44

SHEE0023-004 09/01/2003
North of the 63rd Parallel

	Rates	Fringes
Sheet Metal Worker	$ 33.36	12.89

TEAM0959-003 09/01/2003

	Rates	Fringes
Truck Driver		
GROUP 1	$ 32.10	10.07
GROUP 1A	$ 33.15	10.07
GROUP 2	$ 31.05	10.07
GROUP 3	$ 30.37	10.07
GROUP 4	$ 29.90	10.07
GROUP 5	$ 29.26	10.07

GROUP 1: Semi with Double Box Mixer; Dump Trucks (including rockbuggy and trucks with pups) over 40 yards up to and including 60 yards; Deltas, Commanders, Rollogans and similar equipment when pulling sleds, trailers or similar equipment; Boat Coxswain; Lowboys including attached trailers and jeeps, up to and including 12 axles; Ready-mix over 12 yards up to and including 15 yards)

GROUP 1A: Dump Trucks (including Rockbuggy and Trucks with pups) over 60 yards up to and including 100 yards

GROUP 2: Turn-O-Wagon or DW-10 not self-loading; All Deltas, Commanders, Rollogans, and similar equipment; Mechanics; Tireman, heavy duty; Dump Trucks (including Rockbuggy and Trucks with pups) over 20 yards up to and including 40 yards; Lowboys including attached trailers and jeeps up to and including 8 axles; Super vac truck/cacasco truck/heat stress truck; Ready-mix over 7 yards up to and including 12 yards

GROUP 3: Dump Trucks (including Rockbuggy and Trucks with pups) over 10 yards up to and including 20 yards; batch trucks 8 yards and up; Oil distributor drivers; Greaser;Water Wagon (when pulled by Euclid or similar type equipment);Partsman

GROUP 4: Buggymobile; Semi or Truck and trailer; Dumpster; Tireman (light duty); Dump Trucks (including Rockbuggy and Truck with pups) up to and including 10 yards; Track Truck Equipment; Stringing Truck; Fuel Truck; Fuel Handler with truck; Grease Truck; Flat Beds, dual rear axle; Hyster Operators (handling bulk aggregate); Lumber Carrier; Water Wagon, semi; Water Wagon, dual axle; Gin Pole Truck, Winch Truck, Wrecker, Truck Mounted "A" Frame manufactured rating

over 5 tons; Bull Lifts and Fork Lifts with Power Boom and Swing attachments, over 5 tons; Front End Loader with Forks; Bus Operator over 30 passengers; All Terrain Vehicles; Boom Truck/Knuckle Truck over 5 tons; Foam Distributor Truck/dual axle; Hydro-seeders, dual axle; Vacuum Trucks, Truck Vacuum Sweepers; Vacuum Trucks, Truck Vacuum Sweepers; Loadmaster (air and water); Air Cushion or similar type vehicle; Fire Truck; Combination Truck-fuel and grease; Compactor (when pulled by rubber tired equipment); Rigger (air/water/oilfield); Ready Mix, up to and including 7 yards
GROUP 5: Gravel Spreader Box Operator on Truck; Flat Beds, single rear axle; Boom Truck/Knuckle Truck up to and including 5 tons; Pickups (Pilot Cars and all light duty vehicles); Water Wagon, single axle; Gin Pole Truck, Winch Truck, Wrecker, Truck Mounted "A" Frame, manufactured rating 5 tons and under; Bull Lifts and Fork Lifts (fork lifts with power broom and swing attachments up to and including 5 tons); Buffer Truck; Tack Truck; Bus Operators (up to 30 passengers); Farm type Rubber Tired Tractor (when material handling or pulling wagons on a construction project); Foam Distributor, single axle; Hydro-Seeders, single axle; Team Drivers (horses, mules and similar equipment); Rigger (warehouse operation); Fuel Handler (station/bulk attendant); Batch Truck, up to and including 7 yards

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WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29 CFR 5.5 (a) (1) (ii)).

In the listing above, the "SU" designation means that rates listed under the identifier do not reflect collectively bargained wage and fringe benefit rates. Other designations indicate unions whose rates have been determined to be prevailing.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

* an existing published wage determination
* a survey underlying a wage determination
* a Wage and Hour Division letter setting forth a position on a wage determination matter
* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

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END OF GENERAL DECISION

General Decision Number: AK030006 03/05/2004
State: Alaska
Construction Types: Highway
Counties: Aleutians East, Aleutians West, Anchorage, Bethel, Bristol Bay, Dillingham, Fairbanks North Star, Kenai Peninsula, Kodiak Island, Matanuska-Susitna, Nome, North Slope, Northwest Artic, Southeast Fairbanks, Valdez-Cordova, Wade Hampton and Yukon-Koyukuk Counties in Alaska.
Highway Construction Projects

Modification Number	Publication Date
0	06/13/2003
1	11/28/2003
2	02/13/2004
3	03/05/2004

CARP1243-004 07/01/2003
North of the 63rd Parallel

	Rates	Fringes
Carpenter	$ 31.40	12.20

CARP1281-006 07/01/2003
South of the 63rd Parallel

	Rates	Fringes
Carpenter	$ 28.10	12.70

CARP2520-004 08/01/2003

	Rates	Fringes
Piledriver		
Carpenter	$ 29.30	12.20
Piledriver, Skiff operator, Rigger	$ 28.14	12.20
Sheet Stabber	$ 29.14	12.20
Welder	$ 29.90	12.20

ELEC1547-004 05/05/2003

	Rates	Fringes
Cable splicer	$ 34.17	3%+11.35
Electrician;Technician	$ 32.42	3%+11.35

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* ELEC1547-005 01/01/2004

	Rates	Fringes
Cable splicer	$ 35.90	3%+16.00
Linemen (Including Equipment Operators, Technician)	$ 34.15	3%+16.00
Powderman	$ 32.15	3%+16.00
Tree Trimmer	$ 22.95	3%+16.00

ENGI0302-002 09/01/2003

	Rates	Fringes
Power equipment operators:		
GROUP 1	$ 32.08	10.89
GROUP 1A	$ 33.62	10.89

GROUP 2.....$ 31.41 10.89
GROUP 3.....$ 30.78 10.89
GROUP 4.....$ 25.36 10.89

POWER EQUIPMENT OPERATOR CLASSIFICATIONS

GROUP 1: Asphalt Roller; Back Filler; Barrier Machine (Zipper); Batch Plant Operator: Batch and Mixer over 200 yds.; Beltcrete with power pack and similar conveyors; Bending Machine; Boat Coxwains; Bulldozers; Cableways, Highlines and Cablecars; Cleaning Machine; Coating Machine; Concrete Hydro Blaster; Cranes-45 tons and under or 150 foot boom and under (including jib and attachments): (a) Shovels, Backhoes, Draglines, Clamshells; Gradalls-3 yards and under; (b) Hydralifts or Transporters, all track or truck type,(c) Derricks; Crushers; Deck Winches-Double Drum; Ditching or Trenching Machine (16 inch or over); Drilling Machines, core, cable, rotary and exploration; Finishing Machine Operator, concrete paving, Laser Screed, sidewalk, curb and gutter machine; Helicopters; Hover Craft, Flex Craft, Loadmaster, Air Cushion, All Terrain Vehicle, Rollagon, Bargecable, Nodwell Sno Cat; Hydro Ax: Feller Buncher and similar; Loaders: Forklifts with power boom and swing attachment, Overhead and front end, 2 1/2 yards through 5 yards, Loaders with forks or pipe clamps, Loaders, elevating belt type, Euclid and similar types; Mechanics, Bodyman; Micro Tunneling Machine; Mixers: Mobile type w/hoist combination; Motor Patrol Grader; Mucking Machines: Mole, Tunnel Drill, Horizontal/Directional Drill Operator, and/or Shield; Operator on Dredges; Piledriver Engineers, L. B. Foster, Puller or similar Paving Breaker; Power Plant, Turbine Operator, 200 k.w. and over (power plants or combination of power units over 300 k.w.); Sauerman-Bagley; Scrapers-through 40 yards; Service Oiler/Service Engineer; Sidebooms-under 45 tons; Shot Blast Machine; Spreaders, Blaw Knox, Cedarapids, Barber Greene, Slurry Machine; Sub-grader (Gurries, C.M.I. and C.M.I. Roto Mills and similar types); Tack tractor; Truck mounted Concrete Pumps, Conveyor, Creter; Water Kote Machine; Unlicensed off road hauler

GROUP 1A: Cranes-over 45 tons or 150 foot (including jib and attachments): (a) Shovels, backhoes, draglines, clamshells-over 3 yards, (b) Tower cranes; Loaders over 5 yds.; Motor Patrol Grader (finish: when finishing to final graders and/or to hubs, or for asphalt); Power Plants: 1000 k.w. and over; Quad; Screed; Sidebooms over 45 tons; Slip Form Paver C.M.I. and similar types; Scrapers over 40 yards

GROUP 2: Batch Plant Operators: Batch and Mixer 200 yds. per hour and under; Boiler-fireman; Cement Hog and Concrete Pump Operator; Conveyors (except as listed in group 1); Hoist on steel erection; Towermobiles and Air Tuggers; Horizontal/Directional Drill Locator; Loaders, Elevating Grader, Dumor and similar; Locomotives: rod and geared engines; Mixers; Screening, Washing Plant; Sideboom (cradling rock drill regardless of size); Skidder; Trencing Machine under 16 inches.

GROUP 3: "A" Frame Trucks, Deck Winches: single power drum; Bombardier (tack or tow rig); Boring Machine; Brooms-power; Bump Cutter; Compressor; Farm tractor; Forklift, industrial type; Gin Truck or Winch Truck with poles when used for

hoisting; Grade Checker and Stake Hopper; Hoist, Air Tuggers, Elevators; Loaders: (a) Elevating-Athey, Barber Green and similar types (b) Forklifts or Lumber Carrier (on construction job site) (c) Forklifts with Tower (d) Overhead and Front-end, under 2 1/2 yds. Locomotives:Dinkey (air, steam, gas and electric) Speeders; Mechanics (light duty); Mixers: Concrete Mixers and Batch 200 yds. per hour and under; Oil, Blower Distribution; Post Hole Diggers, mechanical; Pot Fireman (power agitated); Power Plant, Turbine Operator, under 300 k.w.; Pumps-water; Rig oiler/assistant engineer, over 45 ton, over 3 yards or over 150 foot boom; Roller-other than Plantmix; Saws, concrete; Straightening Machine; Tow Tractor

GROUP 4: Rig Oiler/Assistant Engineer (Advances to Group III if over 45 tons or 3 yards or 150 ft. boom); Swamper (on trenching machines or shovel type equipment); Spotter; Steam Cleaner

FOOTNOTE: Groups 1-4 receive 10% premium while performing tunnel or underground work.

IRON0751-003 08/01/2003

	Rates	Fringes
Ironworkers:		
BRIDGE, STRUCTURAL, ORNAMENTAL, REINFORCING MACHINERY MOVER, RIGGER, SHEETER, STAGE		
RIGGER, BENDER OPERATOR.....	$ 27.50	14.10
FENCE, BARRIER AND GUARDRAIL INSTALLERS.....	$ 24.00	13.85
GUARDRAIL LAYOUT MAN.....	$ 24.74	13.85
HELICOPTER, TOWER.....	$ 28.50	14.10

LABO0341-007 09/01/2003

	Rates	Fringes
Laborers:		
GROUP 1.....	$ 24.49	11.50
GROUP 2.....	$ 25.24	11.50
GROUP 3.....	$ 25.89	11.50
GROUP 3A.....	$ 28.29	11.50
GROUP 4.....	$ 16.84	11.50
Tunnels, Shafts, and Raises		
GROUP 1.....	$ 26.94	11.50
GROUP 2.....	$ 27.76	11.50
GROUP 3.....	$ 28.48	11.50
GROUP 3A.....	$ 31.12	11.50

LABORERS CLASSIFICATIONS

GROUP 1: Asphalt Workers (shovelman, plant crew); Brush Cutters; Camp Maintenance Laborer; Carpenter Tenders; Choke Setters, Hook Tender, Rigger, Signalman; Concrete Laborer(curb and gutter, chute handler, grouting, curing, screeding); Crusher Plant Laborer; Demolition Laborer; Ditch Diggers; Dump Man; Environmental Laborer (asbestos (limited to nonmechanical systems), hazardous and toxic waste, oil spill); Fence Installer; Fire Watch Laborer; Flagman; Form Strippers; General Laborer; Guardrail Laborer, Bridge Rail

Installers; Hydro-Seeder Nozzleman; Laborers (building); Landscape or Planter; Material Handlers; Pneumatic or Power Tools; Portable or Chemical Toilet Serviceman; Pump Man or Mixer Man; Railroad Track Laborer; Sandblast, Pot Tender; Saw Tenders; Scaffold Building and Erecting; Slurry Work; Stake Hopper; Steam Point or Water Jet Operator; Steam Cleaner Operator; Tank Cleaning; Utiliwalk and Utilidor Laborer; Watchman (construction projects); Window Cleaner

GROUP 2: Burning and Cutting Torch; Cement or Lime Dumper or Handler (sack or bulk); Choker Splicer; Chucktender (wagon, airtrack and hydraulic drills); Concrete Laborers (power buggy, concrete saws, pumpcrete nozzleman, vibratorman); Environmental Laborer (marine work); Foam Gun or Foam Machine Operator; Green Cutter (dam work); Guardrail Machine Operator; Gunnite Operator; Hod Carriers; Jackhammer or Pavement Breakers (more than 45 pounds); Mason Tender and Mud Mixer (sewer work); Plasterer, Bricklayer and Cement Finisher Tenders; Power Saw Operator; Railroad Switch Layout Laborer; Sandblaster; Sewer Caulkers; Sewer Plant Maintenance Man; Thermal Plastic Applicator; Timber Faller, chain saw operator, filer; Timberman

GROUP 3: Bit Grinder; Drill Doctor (in the field); Drillers (including, but not limited to, wagon drills, air track drills; hydraulic drills); High Rigger and tree topper; Higher Scaler; Pioneer Drilling and Drilling Off Tugger (all type drills); Powderman; Slurry Seal Squeegee Man

GROUP 3A: Asphalt Raker, Asphalt Belly dump lay down; Grade checker (setting or transfering of grade marks, line and grade); Pipelayers

GROUP 4: Final Building Cleanup

TUNNELS, SHAFTS, AND RAISES CLASSIFICATIONS

GROUP 1: Brakeman; Muckers; Nippers; Topman and Bull Gang; Tunnel Track Laborer

GROUP 2: Burning and Cutting Torch; Concrete Laborers; Jackhammers; Laser Instrument Operators; Nozzleman, Pumpcrete or Shotcrete; Pipelayers.

GROUP 3: Miner; Retimberman

GROUP 3A: Powderman

Tunnel shaft and raise rates only apply to workers regularly employed inside a tunnel portal or shaft collar.

PLAS0867-004 02/01/2003

	Rates	Fringes
Cement Mason		
North of the 63rd Parallel	$ 28.51	10.70
South of the 63rd Parallel	$ 28.26	10.70

TEAM0959-003 09/01/2003

	Rates	Fringes
Truck Driver		
GROUP 1	$ 32.10	10.07
GROUP 1A	$ 33.15	10.07
GROUP 2	$ 31.05	10.07
GROUP 3	$ 30.37	10.07
GROUP 4	$ 29.90	10.07

GROUP 5.....$ 29.26 10.07

GROUP 1: Semi with Double Box Mixer; Dump Trucks (including rockbuggy and trucks with pups) over 40 yards up to and including 60 yards; Deltas, Commanders, Rollogans and similar equipment when pulling sleds, trailers or similar equipment; Boat Coxswain; Lowboys including attached trailers and jeeps, up to and including 12 axles; Ready-mix over 12 yards up to and including 15 yards)

GROUP 1A: Dump Trucks (including Rockbuggy and Trucks with pups) over 60 yards up to and including 100 yards

GROUP 2: Turn-O-Wagon or DW-10 not self-loading; All Deltas, Commanders, Rollogans, and similar equipment; Mechanics; Tireman, heavy duty; Dump Trucks (including Rockbuggy and Trucks with pups) over 20 yards up to and including 40 yards; Lowboys including attached trailers and jeeps up to and including 8 axles; Super vac truck/cacasco truck/heat stress truck; Ready-mix over 7 yards up to and including 12 yards

GROUP 3: Dump Trucks (including Rockbuggy and Trucks with pups) over 10 yards up to and including 20 yards; batch trucks 8 yards and up; Oil distributor drivers; Greaser;Water Wagon (when pulled by Euclid or similar type equipment);Partsman

GROUP 4: Buggymobile; Semi or Truck and trailer; Dumpster; Tireman (light duty); Dump Trucks (including Rockbuggy and Truck with pups) up to and including 10 yards; Track Truck Equipment; Stringing Truck; Fuel Truck; Fuel Handler with truck; Grease Truck; Flat Beds, dual rear axle; Hyster Operators (handling bulk aggregate); Lumber Carrier; Water Wagon, semi; Water Wagon, dual axle; Gin Pole Truck, Winch Truck, Wrecker, Truck Mounted "A" Frame manufactured rating over 5 tons; Bull Lifts and Fork Lifts with Power Boom and Swing attachments, over 5 tons; Front End Loader with Forks; Bus Operator over 30 passengers; All Terrain Vehicles; Boom Truck/Knuckle Truck over 5 tons; Foam Distributor Truck/dual axle; Hydro-seeders, dual axle; Vacuum Trucks, Truck Vacuum Sweepers; Vacuum Trucks, Truck Vacuum Sweepers; Loadmaster (air and water); Air Cushion or similar type vehicle; Fire Truck; Combination Truck-fuel and grease; Compactor (when pulled by rubber tired equipment); Rigger (air/water/oilfield); Ready Mix, up to and including 7 yards

GROUP 5: Gravel Spreader Box Operator on Truck; Flat Beds, single rear axle; Boom Truck/Knuckle Truck up to and including 5 tons; Pickups (Pilot Cars and all light duty vehicles); Water Wagon, single axle; Gin Pole Truck, Winch Truck, Wrecker, Truck Mounted "A" Frame, manufactured rating 5 tons and under; Bull Lifts and Fork Lifts (fork lifts with power broom and swing attachments up to and including 5 tons); Buffer Truck; Tack Truck; Bus Operators (up to 30 passengers); Farm type Rubber Tired Tractor (when material handling or pulling wagons on a construction project); Foam Distributor, single axle; Hydro-Seeders, single axle; Team Drivers (horses, mules and similar equipment); Rigger (warehouse operation); Fuel Handler (station/bulk attendant); Batch Truck, up to and including 7 yards

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WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29 CFR 5.5 (a) (1) (ii)).

In the listing above, the "SU" designation means that rates listed under the identifier do not reflect collectively bargained wage and fringe benefit rates. Other designations indicate unions whose rates have been determined to be prevailing.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

* an existing published wage determination
* a survey underlying a wage determination
* a Wage and Hour Division letter setting forth a position on a wage determination matter
* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.
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END OF GENERAL DECISION

SECTION 00800
SPECIAL CONTRACT REQUIREMENTS

W911KB-04-R-0022
CONSTRUCT TYPE III HYDRANT REFUELING SYSTEM
EXPAND/REPAIR AIRCRAFT APRON PROJECT

EIELSON AFB, ALASKA

I-N-D-E-X

CLAUSE	TITLE		PAGE
SCR-1	COMMENCEMENT, PROSECUTION, AND COMPLETION OF WORK		00800-1
SCR-2	EXCLUSION OF PERIODS IN COMPUTING COMPLETION SCHEDULES	NOT USED	00800-1
SCR-3	LIQUIDATED DAMAGES-CONSTRUCTION	NOT USED	00800-1
SCR-4	TIME EXTENSIONS	NOT USED	00800-1
SCR-5	CONTRACT DRAWINGS AND SPECIFICATIONS		00800-1
SCR-6	BRAND NAME OR EQUAL	NOT USED	00800-14
SCR-7	CERTIFICATES OF COMPLIANCE		00800-14
SCR-8	SUBMITTALS		00800-15
SCR-9	IDENTIFICATION OF GOVERNMENT-FURNISHED PROPERTY	NOT USED	00800-15
SCR-10	PHYSICAL DATA		00800-15
SCR-11	AVAILABILITY AND USE OF UTILITY SERVICES	NOT USED	00800-16
SCR-12	IDENTIFICATION OF EMPLOYEES AND MILITARY REGULATIONS		00800-16
SCR-13	INSURANCE - WORK ON A GOVERNMENT INSTALLATION	NOT USED	00800-16
SCR-14	SPECIAL SAFETY REQUIREMENTS	NOT USED	00800-16
SCR-15	AIRFIELD SAFETY PRECAUTIONS		00800-16
SCR-16	LAYOUT OF WORK	NOT USED	00800-19
SCR-17	QUANTITY SURVEYS	NOT USED	00800-19
SCR-18	AGGREGATE SOURCES		00800-19
SCR-19	HAUL ROADS	NOT USED	00800-20
SCR-20	CONTRACTOR-PREPARED NETWORK ANALYSIS SYSTEM	NOT USED	00800-20
SCR-21	PERFORMANCE OF WORK BY THE CONTRACTOR	NOT USED	00800-20
SCR-22	SALVAGE MATERIALS AND EQUIPMENT	NOT USED	00800-20
SCR-23	OBSTRUCTION OF NAVIGABLE WATERWAYS	NOT USED	00800-20
SCR-24	SIGNAL LIGHTS	NOT USED	00800-20
SCR-25	COMMUNICATION SECURITY		00800-20
SCR-26	PERMITS AND RESPONSIBILITIES	NOT USED	00800-20
SCR-27	SUPERINTENDENCE OF SUBCONTRACTORS	NOT USED	00800-20

CLAUSE	TITLE		PAGE
SCR-28	PAYMENT FOR MOBILIZATION AND DEMOBILIZATION	NOT USED	00800-20
SCR-29	EQUIPMENT OWNERSHIP AND OPERATING EXPENSE SCHEDULE	NOT USED	00800-20
SCR-30	OPTIONS		00800-20
SCR-31	WORK IN QUARANTINED AREA	NOT USED	00800-20
SCR-32	PRESERVATION OF HISTORICAL, ARCHEOLOGICAL AND CULTURAL RESOURCES	NOT USED	00800-20
SCR-33	PAYMENT FOR MATERIALS DELIVERED OFF-SITE	NOT USED	00800-20
SCR-34	RESERVED	NOT USED	00800-20
SCR-35	RESERVED	NOT USED	00800-20
SCR-36	TIME EXTENSIONS FOR UNUSUALLY SEVERE WEATHER		00800-20
SCR-37	NONDOMESTIC CONSTRUCTION MATERIALS	NOT USED	00800-21
SCR-38	YEAR 2000 COMPLIANCE		00800-21
SCR-39	RESERVED	NOT USED	00800-21
SCR-40	KEY PERSONNEL		00800-21
SCR-41	DESIGN-BUILD CONTRACT - ORDER OF PRECEDENCE	NOT USED	00800-22
SCR-42	PROPOSED BETTERMENTS	NOT USED	00800-22
SCR-43	SEQUENCE OF DESIGN-CONSTRUCTION	NOT USED	00800-22
SCR-44	RESPONSIBILITY OF THE CONTRACTOR FOR DESIGN	NOT USED	00800-22
SCR-45	SAFETY AND HEALTH REQUIREMENTS MANUAL, EM 385-1-1, U.S. ARMY CORPS OF ENGINEERS		00800-22
SCR-46 THRU SCR-111		NOT USED	00800-22
SCR-112	NOTICE OF REQUIREMENT FOR AFFIRMATIVE ACTION TO ENSURE EQUAL EMPLOYMENT OPPORTUNITY	NOT USED	00800-22

ATTACHMENT: CLIMATOLOGICAL SUMMARY

--End of Special Contract Requirements Index--

SECTION 00800

SPECIAL CONTRACT REQUIREMENTS

SCR-1 COMMENCEMENT, PROSECUTION, AND COMPLETION OF WORK:

The Contractor will be required to (a) commence work under this contract within 10 calendar days after the date the Contractor receives the Notice to Proceed (NTP), (b) prosecute the work diligently, and (c) complete the entire work ready for use not later than 670 calendar days after the date the Contractor receiving Notice to Proceed. This time stated for completion shall include final cleanup of the premises.

SCR-2 THRU SCR-4 NOT USED

SCR-5 CONTRACT DRAWINGS AND SPECIFICATIONS (Aug 2000) (DFARS 252.236-7001):

(a) The Government will provide the Contractor, without charge, one set of contract drawings and specifications, except publications incorporated into the technical provisions by reference, in electronic or paper media as chosen by the Contracting Officer.

(b) The Contractor shall --

(1) Check all the drawings furnished immediately upon receipt;

(2) Compare all drawings and verify the figures before laying out the work;

(3) Promptly notify the Contracting Officer of any discrepancies;

(4) Be responsible for any errors that might have been avoided by complying with this paragraph (b); and

(5) Reproduce and print contract drawings and specifications as needed.

(c) In general –

(1) Large-scale drawings shall govern small-scale drawings; and

(2) The Contractor shall follow figures marked on drawings in preference to scale measurements.

(d) Omissions from the drawings or specifications or the mis-description of details of work that are manifestly necessary to carry out the intent of the drawings and specifications, or that are customarily performed, shall not relieve the Contractor from performing such omitted or mis-described details of the work. The Contractor shall perform such details as if fully and correctly set forth and described in the drawings and specifications.

(e) Some of the Drawings are carryover from a previous solicitation, and if un-changed from that solicitation will bear the INV.NO.DACA 85-03-R-0032. Drawings that have been modified from the previous solicitation will bear the INV.NO.W911KB-04-R-0022.

(f) The work shall conform to the specifications and the contract drawings identified on the following index of drawings:

SCHEDULE "B" DRAWINGS FOR EIE164

Drawing No.	Sheet No.	Title	Rev. No.	Date
		GENERAL		
NONE	NONE	COVER	NONE	NONE
AF 121-122-01	NONE	INDEX	"	"
AF 16-06-4300	1	LOCATION PLAN	"	"
AF 121-122-01	2	LEGEND	"	"
"	3	ELECTRICAL LEGEND SYMBOLS	"	"
"	4	SUPPLEMENT ELECTRICAL LEGEND	"	"
"	5	ABBREVIATIONS	"	"
		SITEWORK		
"	6	DEMOLITION KEY PLAN	"	"
"	7	BLDG # 1305 AND LOX BLDG DEMOLITION PLAN	"	"
"	8	BLDG # 1315 DEMOLITION PLAN	"	"
"	9	BLDG # 1321 DEMOLITION PLAN	"	"
"	10	E9 HYDRANT FUELS PITS DEMOLITION PLAN AND DETAILS	"	"
"	11	MISC. DEMOLITION DETAILS 1	"	"
"	12	MISC. DEMOLITON DETAILS 2		"
"	13	PUMPHOUSE SALVAGE ITEMS 1	"	"
"	14	PUMPHOUSE SALVAGE ITEMS 2	"	"
"	15	CIVIL NOTES LEGEND & ABBREVIATIONS	"	"

Drawing No.	Sheet No.	Title	Rev. No.	Date
AF 121-122-01	16	PUMPHOUSE SITE PLAN	NONE	NONE
"	17	PUMPHOUSE GRADING PLAN	"	"
"	18	SITE SECTIONS 1	"	"
"	19	FUELIDOR SECTIONS AND DETAILS 1	"	"
"	20	FUELIDOR SECTIONS AND DETAILS 2	"	"
"	21	SITE DETAILS 1	"	"
"	22	SITE DETAILS 2	"	"
"	23	LINER DETAILS	"	"
"	24	STAIR DETAILS	"	"
"	25	UTILIDOR PLAN & PROFILE 1	"	"
"	26	UTILIDOR PLAN & PROFILE 2	"	"
"	27	UTILIDOR PLAN & PROFILE 3	"	"
"	28	MANHOLE PLANS AND SECTIONS 1	"	"
"	29	MANHOLE PLANS AND SECTIONS 2	"	"
"	30	MANHOLE PLANS AND SECTIONS 3	"	"
"	31	PIPING DETAILS 1	"	"
"	32	PIPING DETAILS 2	"	"
"	33	UTILIDOR STRUCTURAL DETAILS 1	"	"
"	34	UTILIDOR STRUCTURAL DETAILS 2	"	"
"	35	MANHOLE DETAILS 1	"	"
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Drawing No.	Sheet No.	Title	Rev. No.	Date
AF 121-122-01	37	FUEL PIPE SITE PLAN AREA 2	NONE	NONE
"	38	FUEL PIPE SITE PLAN AREA 3	"	"
"	39	FUEL PIPE SITE PLAN AREA 4	"	"
"	40	FUEL PIPE SITE PLAN AREA 5	"	"
"	41	FUEL PIPE SITE PLAN AREA 6	"	"
"	42	FUEL PIPE SITE PLAN AREA 7	"	"
"	43	PROFILE SHEET	"	"
"	44	PROFILE SHEET	"	"
"	45	APRON PROFILE SHEET	"	"
"	46	APRON PROFILE SHEET	"	"
"	47	APRON PROFILE SHEET	"	"
"	48	PROFILE SHEET	"	"
"	49	FUEL PIT DETAILS	"	"
"	50	TRUCK FILL STAND DETAILS	"	"
"	51	PANTOGRAPH FLUSH STATION	"	"
"	52	FUEL SYSTEM DETAILS	"	"
"	53	PANTOGRAPH DETAILS	"	"
"	54	PANTOGRAPH HIGH REACH. UNDERWING UNIT	"	"
"	55	PIPELINE PIG TRAP PLANS SECTIONS AND DETAILS	"	"
"	56	FUEL PIPE SITE PLAN ENLARGED AREA 2	"	"
"	57	ELECTRICAL SITE PLAN AREA 1	"	"
"	58	ELECTRICAL SITE PLAN AREA 2	"	"

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AF 121-122-01	59	ELECTRICAL SITE PLAN AREA 3	NONE	NONE
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"	61	ELECTRICAL SITE PLAN AREA 5	"	"
"	62	ELECTRICAL SITE PLAN AREA 6	"	"
"	63	ELECTRICAL SITE PLAN AREA 7	"	"
"	64	ELECTRICAL SITE PLAN AREA 8	"	"
"	65	ELECTRICAL SITE PLAN AREA 9	"	"
"	66	CATHODIC PROTECTION DETAILS	"	"
"	67	CATHODIC PROTECTION DETAILS	"	"
"	68	CATHODIC PROTECTION DETAILS	"	"
"	69	MISCELLANEOUS DETAILS	"	"
"	70	TANK DETAILS	"	"
"	71	GROUNDING DETAILS	"	"
"	72	ELECTRICAL MISC. DETAILS	"	"
"	73	UTILIDOR ELECTRICAL DETAILS	"	"
		ARCHITECTURAL		
"	74	COMPOSITE FLOOR PLAN	"	"
"	75	FLOOR PLAN AREA - A	"	"
"	76	FLOOR PLAN AREA - B	"	"
"	77	MEZZANINE PLAN AND DETAILS	"	"
"	78	REFLECTED CEILING PLAN AND DETAILS	"	"

Drawing No.	Sheet No.	Title	Rev. No.	Date
AF 121-122-01	79	ROOF PLAN	NONE	NONE
"	80	ROOF DETAILS	"	"
"	81	ROOF EDGE DETAILS	"	"
"	82	BUILDING ELEVATIONS	"	"
"	83	WALL SECTIONS	"	"
"	84	WALL SECTIONS AND DETAILS	"	"
"	85	WALL SECTIONS	"	"
"	86	WALL SECTIONS	"	"
"	87	ROOM AND DOOR SCHEDULES	"	"
"	88	DOOR DETAILS	"	"
"	89	DOOR DETAILS	"	"
"	90	MISCELLANEOUS DETAILS	"	"
"	91	DOOR AND WINDOW DETAILS	"	"
"	92	TYPICAL SEALANT DETAILS	"	"
		STRUCTURAL		
"	93	DECISION & GENERAL NOTES	"	"
"	94	TYPICAL CONCRETE DETAILS	"	"
"	95	FOUNDATION PLAN	"	"
"	96	PIPE SUPPORT PLAN & SCHEDULE	"	"
"	97	FOUNDATION DETAILS	"	"
"	98	FOUNDATION DETAILS	"	"
"	99	PIPE SUPPORT SECTIONS AND DETAILS	"	"
"	100	PIPE SUPPORT SECTIONS AND DETAILS	"	"
"	101	MEZZANINE PLAN & DETAILS	"	"
"	102	BRIDGE CRANE GIRDER PLAN & DETAILS	"	"

Drawing No.	Sheet No.	Title	Rev. No.	Date
AF 121-122-01	103	CMU DETAILS	NONE	NONE
"	104	STEAM ENTRANCE VAULT	"	"
"	105	FUEL PIT PLAN & DETAILS	"	"
"	106	PRODUCT RECOVERY TANK VAULT DETAILS	"	"
"	107	PIPE SUPPORT DETAILS	"	"
		10,000 BBL FUEL TANK		
"	108	10,000 BBL FUEL STORAGE TANK PLAN AND PAN LAYOUT	"	"
"	109	10,000 BBL FUEL STORAGE TANK ROOF PLAN & DETAILS	"	"
"	110	10,000 BBL FUEL STORAGE TANK DETAILS	"	"
"	111	10,000 BBL FUEL STORAGE TANK TANK FOUNDATION	"	"
"	112	10,000 BBL FUEL STORAGE TANK TANK STAIRS	"	"
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	115	10,000 BBL FUEL STORAGE TANK APPURTENANCES & FITTINGS	"	"
"	116	10,000 BBL FUEL STORAGE TANK FLOATING PAN DETAILS	"	"
"	117	10,000 BBL FUEL STORAGE TANK WATER DRAW-OFF & MISCELLANEOUS DETAILS	"	"
		MECHANICAL		
"	118	PIPING PLAN	"	"
"	119	MECHANICAL PLAN	"	"

Drawing No.	Sheet No.	Title	Rev. No.	Date
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"	121	ISOMETRIC DIAGRAM	"	"
"	122	SECTIONS	"	"
"	123	SECTIONS	"	"
"	124	SEQUENCE OF OPERATIONS	"	"
"	125	DETAILS	"	"
"	126	PRODUCT RECOVERY TANK DETAILS	"	"
"	127	DETAILS	"	"
"	128	ENLARGED MECHANICAL ROOM AND TOILET ROOM PLAN	"	"
"	129	STEAM SYSTEM DETAILS	"	"
"	130	MECHANICAL SCHEDULES	"	"
"	131	INSTALLATION SIMPLEX GRINDER PUMP RAIL SYSTEM IN FIBERGLASS SUMP	"	"
"	132	HVAC CONTROLS LEGEND SHEET	"	"
"	133	AHU-1 HVAC CONTROLS	"	"
"	134	PUMP & PANTOGRAPH RM HVAC CONTROLS	"	"
"	135	GLYCOL HOT WATER SYSTEM HVAC CONTROLS	"	"
"	136	MISC HVAC CONTROLS	"	"
		ELECTRICAL		
"	137	LIGHTING PLAN	"	"
"	138	LIGHTING FIXTURE DETAILS	"	"
"	139	POWER PLAN	"	"
"	140	MEZZANNE POWER & LIGHTING PLANS	"	"
"	141	FIRE ALARM PLAN	"	"

Drawing No.	Sheet No.	Title	Rev. No.	Date
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"	143	GROUNDING & LIGHTNING PROTECTION PLAN	"	"
"	144	ONE-LINE DIAGRAM	"	"
"	145	WIRING DIAGRAMS	"	"
"	146	SCHEDULE SHEET	"	"
"	147	ELECTRICAL DETAILS	"	"
"	148	EPDS CONTROL AT FCC	"	"
"	149	PUMP CONTROL PANEL ELEVATION	"	"
"	150	GRAPHIC DISPLAY	"	"
"	151	CONTROL SYSTEM DIAGRAMS	"	"
"	152	CONTROL SYSTEM I/O SHEET 1	"	"
"	153	CONTROL SYSTEM I/O SHEET 2	"	"
"	154	CONTROL SYSTEM I/O SHEET 3	"	"
"	155	TERMINAL BLOCK CONNECTIONS (FOR FIELD DEVICES)	"	"
		FILLSTAND CANOPY		
"	156	FLOOR PLAN, ROOF PLAN, AND DETAILS	"	"
"	157	BUILDING ELEVATIONS AND WALL SECTION	"	"
"	158	LIGHTING & LIGHTNING PROTECTION PLANS OPTION	"	"
"	159	DESIGN AND GENERAL NOTES	"	"
"	160	FOUNDATION & ROOF FRAMING PLANS	"	"
"	161	FOUNDATION DETAILS	"	"
"	162	STEEL DETAILS OPTION	"	"

Drawing No.	Sheet No.	Title	Rev. No.	Date
		PIG TRAP FACILITY		
AF 121-122-01	163	FLOOR PLAN, ELEVATIONS, AND SECTIONS OPTION	NONE	NONE
"	164	LIGHTING & LIGHTING PROTECTION PLANS OPTION	"	"
"	165	FOUNDATION PLAN & DETAILS OPTION	"	"

SCHEDULE "A" DRAWINGS FOR EIE174

Drawing No.	Sheet No.	Title	Rev. No.	Date
		GENERAL		
NONE	NONE	INDEX SHEET	NONE	NONE
AF 16-06-4295	1	LOCATION AND VICINITY MAP	"	"
		DEMOLITON		
AF 113-321-01	1	DEMOLITION KEY PLAN	"	"
"	2	DEMOLITION PLAN	"	"
"	3	DEMOLITION PLAN	"	"
"	4	DEMOLITION PLAN	"	"
"	5	DEMOLITION PLAN	"	"
		CIVIL		
"	6	CONTRACTOR STAGING AND CONSTRUCTION PHASING PLAN	"	"
"	7	OVERALL SITE AND SHEET KEY PLAN	"	"
"	8	CROSS SECTIONS & DETAILS	"	"
"	9	SITE PLAN AREAS A AND B	"	"
"	10	SITE PLAN AIRCRAFT RAMP	"	"
"	11	SITE PLAN AIRCRAFT RAMP	"	"

Drawing No.	Sheet No.	Title	Rev. No.	Date
AF 113-321-01	12	SITE PLAN RAMP AND AREAS C AND D	NONE	NONE
"	13	PLAN AND PROFILE TAXIWAY H	"	"
"	14	PLAN AND PROFILE TAXIWAY J	"	"
"	15	PLAN AND PROFILE TAXIWAY H	"	"
"	16	PLAN AND PROFILE TAXIWAY J	"	"
"	17	BORING LOCATION & GEOTEXTILE LOCATION PLAN - NOT USED	"	"
"	18	BORING LOCATION & GEOTEXTILE LOCATION PLAN	"	"
"	19	BORING LOCATION & GEOTEXTILE LOCATION PLAN	"	"
"	20	BORING LOCATION PLAN	"	"
"	21	BORING LOCATION PLAN	"	"
"	22	BORING LOCATION & GEOTEXTILE LOCATION PLAN	"	"
"	23	BORING LOCATION & GEOTEXTILE LOCATION PLAN	"	"
"	24	PLAN VIEW AIRFIELD PAVEMENTS - NOT USED	"	"
"	25	PLAN VIEW AIRFIELD PAVEMENTS & PCC JOINT LAYOUT	"	"
"	26	PLAN VIEW AIRFIELD PAVEMENTS & PCC JOINT LAYOUT	"	"
"	27	PLAN VIEW AIRFIELD PAVEMENTS & PCC JOINT LAYOUT	"	"
"	28	PLAN VIEW AIRFIELD PAVEMENTS & PCC JOINT LAYOUT	"	"

Drawing No.	Sheet No.	Title	Rev. No.	Date
AF 113-321-01	29	AIRFIELD PAVEMENT SECTIONS	NONE	NONE
"	30	AIRFIELD PAVEMENT SECTIONS & DETAILS	"	"
"	31	AIRFIELD PAVEMENT SECTIONS	"	"
"	32	AIRFIELD PAVEMENT SECTIONS - NOT USED	"	"
"	33	AIRFIELD PAVEMENT SECTIONS & DETAILS	"	"
"	34	AIRFIELD PAVEMENT PIT SECTIONS & DETAILS	"	"
"	35	BORING LOGS	"	"
"	36	BORING LOGS	"	"
"	37	BORING LOGS	"	"
"	38	BORING LOGS	"	"
"	39	BORING LOGS	"	"
"	40	BORING LOGS	"	"
"	41	BORING LOGS	"	"
"	42	BORING LOGS	"	"
"	43	BORING LOGS	"	"
"	44	BORING LOGS	"	"
"	45	BORING LOGS	"	"
"	46	BORING LOGS	"	"
"	47	BORING LOGS	"	"
"	48	BORING LOGS	"	"
"	49	BORING LOGS	"	"
"	50	AIRCRAFT RAMP MARKING PLAN	"	"
		ELECTRICAL		
"	51	ELECTRICAL LEGEND	"	"

Drawing No.	Sheet No.	Title	Rev. No.	Date
AF 113-321-01	52	ELECTRICAL KEY PLAN DEMOLITION WORK	NONE	NONE
"	53	ELECTRICAL SITE PLAN DEMOLITION WORK	"	"
"	54	ELECTRICAL SITE PLAN DEMOLITION WORK	"	"
"	55	ELECTRICAL SITE PLAN DEMOLITION WORK	"	"
"	56	ELECTRICAL SITE PLAN DEMOLITION WORK	"	"
"	57	ELECTRICAL SITE PLAN DEMOLITION WORK	"	"
"	58	ELECTRICAL KEY PLAN NEW WORK	"	"
"	59	ELECTRICAL SITE PLAN NEW WORK	"	"
"	60	ELECTRICAL SITE PLAN NEW WORK	"	"
"	61	ELECTRICAL SITE PLAN NEW WORK	"	"
"	62	ELECTRICAL SITE PLAN NEW WORK	"	"
"	63	ELECTRICAL SITE PLAN NEW WORK	"	"
"	64	SITE LIGHTING DIAGRAM & ONE-LINE DIAGRAM	"	"
"	65	PRIMARY POWER ONE-LINE DEMOLITION WORK	"	"
"	66	PRIMARY POWER ONE-LINE NEW WORK	"	"
"	67	POWER POLE & TRENCH DETAILS	"	"
"	68	ELECTRICAL DETAILS	"	"
"	69	HIGH MAST LIGHTING DETAILS	"	"
"	70	TAXIWAY GUIDANCE SIGN DETAILS	"	"

Drawing No.	Sheet No.	Title	Rev. No.	Date
		FIRE PROTECTION		
AF 113-321-01	71	FIRE PROTECTION KEY MAP	NONE	NONE
"	72	FIRE PROTECTION WATER PLAN AND PROFILE 1 OF 5	"	"
"	73	FIRE PROTECTION WATER PLAN AND PROFILE 2 OF 5	"	"
"	74	FIRE PROTECTION WATER PLAN AND PROFILE 3 OF 5	"	"
"	75	FIRE PROTECTION WATER PLAN AND PROFILE 4 OF 5	"	"
"	76	FIRE PROTECTION WATER PLAN AND PROFILE 5 OF 5	"	"
"	77	FIRE PROTECTION MANHOLE 19C PLAN & SECTIONS	"	"
"	78	FIRE PROTECTION MANHOLE 19C DETAILS	"	"

SCR-6 BRAND NAME OR EQUAL NOT USED

SCR-7 CERTIFICATES OF COMPLIANCE:

Any certificates required for demonstrating proof of compliance of materials with specification requirements shall be executed in 3 copies. Each certificate shall be signed by an official authorized to certify in behalf of the manufacturing company and shall contain the name and address of the Contractor, the project name and location, and the quantity and date or dates of shipment or delivery to which the certificates apply. Copies of laboratory test reports submitted with certificates shall contain the name and address of the testing laboratory and the date or dates of the tests to which the report applies. Certification shall not be construed as relieving the Contractor from furnishing satisfactory material, if, after tests are performed on selected samples, the material is found not to meet the specific requirements.

SCR-8 SUBMITTALS (ER 415-1-10, 30 May 1995):

Within 30 days after receipt of Notice to Proceed, the Contractor shall complete and submit to the Contracting Officer, in triplicate, submittal register ENG Form 4288 listing all submittals and dates. In addition to those items listed on ENG Form 4288, the Contractor shall furnish submittals for any deviation from the plans or specifications. The scheduled need dates must be recorded on the document for each item for control purposes. In preparing the document, adequate time (minimum of 30 days) shall be allowed for review and, only when stipulated, approval and possible re-submittal. Scheduling shall be coordinated with the approved progress schedule. The

Contractor's Quality Control representative shall review the listing at least every 30 days and take appropriate action to maintain an effective system. Copies of updated or corrected listing shall be submitted to the Contracting Officer at least every 60 days in the quantity specified. Payment will not be made for any material or equipment which does not comply with contract requirements.

Section 01330 includes an ENG Form 4288 listing technical items the Contractor shall submit to the Contracting Officer, as indicated in the contract requirements.

SCR-9 NOT USED

SCR-10 EIELSON AFB PHYSICAL DATA (APR 1984): Data and information furnished or referred to below are furnished for the Contractor's information. The Government shall not be responsible for any interpretation of or conclusion drawn from the data or information by the Contractor.

a. The indications of physical conditions on the drawings and in the specifications are the result of site investigation.

b. Location: Eielson AFB is located on the Richardson Highway approximately 26 miles southeast of Fairbanks, Alaska.

c. Transportation:

(1) Water: Commercial docking facilities are available at Anchorage, Alaska.

(2) Highway: Eielson AFB is connected to the State of Alaska Highway System.

(3) Railroad: The Alaska Railroad offers freight service from the 48 contiguous states and Canada via rail barge and train ship through Whittier, and from Seward, to Anchorage and Fairbanks. In addition to the freight service, scheduled passenger service and express service between Anchorage and Fairbanks, and passenger service between Anchorage and Whittier are also available. Fairbanks (including Eielson AFB and Ft. Wainwright) is the northern terminus, and Seward and Whittier are the southern terminals of the Alaska Railroad.

d. Communications: Telephone communications and services are under the jurisdiction of the Communications Officer. The Contractor shall make all arrangements for required communication service directly with the Communications Office. The Government does not guarantee the adequacy or efficiency of the service or the number of telephones that can be assigned to the Contractor.

e. Weather Data: A Climatological Summary for Eielson AFB is attached to the end of this section.

SCR-11 NOT USED

SCR-12 IDENTIFICATION OF EMPLOYEES AND MILITARY REGULATIONS:

(a) The Contractor shall be responsible for compliance with all regulations and orders of the Commanding Officer of the Military Installation, respecting identification of employees, movements on

installation, parking, truck entry, and all other military regulations which may affect the work.

(b) The work under this contract is to be performed at an operating Military Installation with consequent restrictions on entry and movement of non-military personnel and equipment.

SCR-13 AND SCR-14 NOT USED

SCR-15 AIRFIELD SAFETY PRECAUTIONS (DEC 1991) (DFARS 252.236-7005):

(a) Definitions.
As used in this clause--

(1) "Landing Areas" means--

(i) The primary surfaces, compromising the surface of the runway, runway shoulders, and lateral safety zones. The length of each primary surface is the same as the runway length. The width of each primary surface is 2,000 feet (1,000 feet on each side of the runway centerline);

(ii) The "clear zone" beyond the ends of each runway, i.e., the extension of the primary surface for a distance of 3,000 feet beyond each end of each runway, and 3,000 feet wide;

(iii) All taxiways, plus the lateral clearance zones along each side for the length of the taxiways (is laterally 200 feet from the far or opposite edge of the taxiway for a total of 400 feet); and

(iv) All aircraft parking aprons, plus the area 125 feet in width extending beyond each edge all around the aprons.

(2) "Safety precaution areas" means those portions of approach-departure clearance zones and transitional zones where placement of objects incident to contract performance might result in vertical projections at or above the approach-departure clearance, or the transitional surface.

(i) The "approach-departure clearance surface" is an extension of the primary surface and the clear zone at each end of each runway, for a distance of 50,000 feet, first along an inclined (glide angle) and then along a horizontal plane, both flaring symmetrically about the runway centerline extended.

(A) The inclined plane (glide angle) begins in the clear zone 200 feet past the end of the runway (and primary surface) at the same elevation as the end of the runway. It continues upward at a slope of 50:1 (1 foot vertically for each 50 feet horizontally) to an elevation of 500 feet above the established airfield elevation. At that point the plane becomes horizontal, continuing at that same uniform elevation to a point 50,000 feet longitudinally from the beginning of the inclined plane (glide angle) and ending there.

(B) The width of the surface at the beginning of the inclined plane (glide angle) is the same as the width of the primary surface. It then flares uniformly, reaching the maximum width of 16,000 feet at the end.

(ii) The "approach-departure clearance zone" is the ground area under the approach-departure clearance surface.

(iii) The "transitional surface" is a sideways extension of all primary surfaces, clear zones, and approach-departure clearance surfaces along the inclined planes.

(A) The inclined plane in each case begins at the edge of the surface.

(B) The slope of the inclined plane is 7:1 (1 foot vertically for each 7 feet horizontally). It continues to the point of intersection with the--

(1) Inner horizontal surface (which is the horizontal plane 150 feet above the established airfield elevation); or

(2) Outer horizontal surface (which is the horizontal plane 500 feet above the established airfield elevation), whichever is applicable.

(iv) The "transitional zone" is the ground area under the transitional surface. (It adjoins the primary surface, clear zone and approach-departure clearance zone.)

(b) General.

(1) The Contractor shall comply with the requirements of this clause while--

(i) Operating all ground equipment (mobile or stationary);

(ii) Placing all materials; and

(iii) Performing all work, upon and around all airfields.

(2) The requirements of this clause are in addition to any other safety requirements of this contract.

(c) The Contractor shall--

(1) Report to the Contracting Officer before initiating any work;

(2) Notify the Contracting Officer of proposed changes to locations and operations;

(3) Not permit either its equipment or personnel to use any runway for purposes other than aircraft operation without permission of the Contracting Officer, unless the runway is--

(i) Closed by order of the Contracting Officer; and

(ii) Marked as provided in paragraph (d)(2) of this clause;

(4) Keep all paved surfaces, such as runways, taxiways, and hardstands, clean at all times and, specifically, free from small stones which might damage aircraft propellers or jet aircraft;

(5) Operate mobile equipment according to the safety provisions of this clause, while actually performing work on the airfield. At all other times, the Contractor shall remove all mobile equipment to locations--

(i) Approved by the Contracting Officer;

(ii) At a distance of at least 1,000 feet from the runway centerline, plus any additional distance; and

(iii) Necessary to ensure compliance with the other provisions of this clause; and

(6) Not open a trench unless material is on hand and ready for placing in the trench. As soon as practicable after material has been placed and work approved, the Contractor shall backfill and compact trenches as required by the contract. Meanwhile, all hazardous conditions shall be marked and lighted in accordance with the other provisions of this clause.

(d) Landing areas.

The Contractor shall--

(1) Place nothing upon the landing areas without the authorization of the Contracting Officer;

(2) Outline those landing areas hazardous to aircraft, using (unless otherwise authorized by the Contracting Officer) red flags by day, and electric, battery-operated low-intensity red flasher lights by night;

(3) Obtain, at an airfield where flying is controlled, additional permission from the control tower operator each time before entering any landing area, unless the landing area is marked as hazardous in accordance with paragraph (d)(2) of this clause;

(4) Identify all vehicles it operates in landing areas by means of flag on a staff attached to, and flying above, the vehicle. The flag shall be 3 feet square, and consist of a checkered pattern of international orange and white squares of 1 foot on each side (except that the flag may vary up to ten percent from each of these dimensions);

(5) Mark all other equipment and materials in the landing areas, using the same marking devices as in paragraph (d)(2) of this clause; and

(6) Perform work so as to leave that portion of the landing area which is available to aircraft free from hazards, holes, piles of material, and projecting shoulders that might damage an aircraft tire.

(e) Safety precaution areas.

The Contractor shall--

(1) Place nothing upon the safety precaution areas without authorization of the Contracting Officer;

(2) Mark all equipment and materials in safety precaution areas, using (unless otherwise authorized by the Contracting Officer) red flags by day, and electric, battery-operated, low-intensity red flasher lights by night; and

(3) Provide all objects placed in safety precaution areas with a red light or red lantern at night, if the objects project above the approach-departure clearance surface or above the transitional surface.

SCR-16 AND SCR-17 NOT USED

SCR-18 AGGREGATE SOURCES:

(a) Asphalt, base course, and select fill aggregates can be produced from the approved sources listed below:

(1) Sources of fine aggregate. Mullins Pit

(2) Sources of course aggregate. Mullins Pit

(b) Asphalt, base course, and select fill aggregates may be furnished from any of the above listed sources or at the option of the Contractor may be furnished from any other source designated by the Contractor and approved by the Contracting Officer, subject to the conditions hereinafter stated. The Contractor is advised that additional processing (washing, screening, and crushing) may be required in order for this material to meet requirements listed in sub-paragraph (c) below.

(c) After the award of the contract, the Contractor shall designate in writing only one source or combination of sources from which it proposes to furnish aggregates. If the Contractor proposes to furnish aggregates from a source or from sources not listed above it may designate only a single source or single combination of sources for aggregates. Samples for acceptance testing shall be provided as required by the following Technical Specifications:

(1) SECTION 02319 EARTHWORK FOR VEHICLE TRAFFIC AREAS, STRUCTURES, SIDEWALKS, CURBS AND GUTTERS, AND AREA GRADING;

(2) SECTION 02320 EARTHWORK FOR AIRFIELD PAVEMENTS AND AREA GRADING;

(3) SECTION 02722 GRADED-CRUSHED AGGREGATE BASE COURSE; and

(4) SECTION 02749 HOT-MIX ASPHALT (HMA) FOR AIRFIELDS

If a source for coarse or fine aggregate so designated by the Contractor is not approved for use by the Contracting Officer, the Contractor may not submit for approval other sources but shall furnish the coarse or fine aggregate, as the case may be, from an approved source listed above at no additional cost to the Government.

(d) Concrete aggregate for this project shall not be obtained from the Mullins Pit. The contractor shall obtain concrete aggregate that meet the requirements for SECTION 02753 CONCRETE PAVEMENT FOR AIRFIELDS AND OTHER HEAVY DUTY PAVEMENTS and SECTION 03300 CAST-IN PLACE STRUCTURAL CONCRETE from an off base location. The material source must be approved by the Contracting Officer, and the materials shall meet the requirements specified in this Technical Specification.

(e) Listing of a concrete aggregate source is not to be construed as approval of all material from the source. The right is reserved to reject materials from certain localized areas, zones, strata, or channels, when such materials are unsuitable for concrete aggregate as determined by the Contracting Officer. Materials produced from an approved source shall meet

all the requirements of SECTION 02753 CONCRETE PAVEMENT FOR AIRFIELDS AND OTHER HEAVY DUTY PAVEMENTS and SECTION 03300 CAST-IN-PLACE STRUCTURAL CONCRETE of the Technical Specifications of these specifications.

SCR-19 AND SCR-24 NOT USED

SCR-25 COMMUNICATION SECURITY:

All communications with DOD organizations are subject to COMSEC review. Contractor personnel shall be aware that telecommunications networks are continually subject to intercept by unfriendly intelligence organizations. The DOD has authorized the military departments to conduct COMSEC monitoring and recording of telephone calls originating from or terminating at DOD organizations. Therefore, civilian Contractor personnel are advised that any time they place a call to or receive a call from Alaska District offices or Resident Engineer offices located on military installations, they are subject to COMSEC procedures. The Contractor will assume the responsibility for ensuring wide and frequent dissemination of the above information to all employees dealing with official DOD information.

SCR-26 THRU SCR-29 NOT USED

SCR-30 OPTIONS

a. The Government may increase the quantity of work awarded by exercising Optional Items listed on both the Proposal Schedule "A" and "B" at any time, or not at all, but no later than 90 calendar days after Contract Award date. Notice to Proceed on work added by exercise of the option will be given upon execution of consent of surety.

b. The parties hereto further agree that any options herein shall be considered as having been exercised at the time the Government deposits written notification to the Contractor in the mails.

c. Optional items awarded shall be completed within the time period for completion of the base items, as stated in SCR-1.

SCR-31 THRU SCR-35 NOT USED

SCR-36 TIME EXTENSIONS FOR UNUSUALLY SEVERE WEATHER (ER 415-1-15, 31 Oct 1989):

1. This provision specifies the procedure for determination of time extensions for unusually severe weather in accordance with the Contract Clause entitled "DEFAULT (FIXED PRICE CONSTRUCTION)". In order for the Contracting Officer to award a time extension under this clause, the following conditions must be satisfied:

a. The weather experienced at the project site during the contract period must be found to be unusually severe; that is, more severe than the adverse weather anticipated for the project location during any given month.

b. The unusually severe weather must actually cause a delay to the completion of the project. The delay must be beyond the control and without the fault or negligence of the Contractor.

2. The following schedule of monthly anticipated adverse weather delays is based on National Oceanic and Atmospheric Administration (NOAA) or similar data for the project location and will constitute the base line for monthly

weather time evaluations. The Contractor's progress schedule must reflect these anticipated adverse weather delays in all weather dependent activities.

Monthly Anticipated Adverse Weather Delay Work Days Based on a 5-Day Work Week

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
22	20	21	0	0	1	6	1	0	10	21	22

3. Upon acknowledgement of the Notice to Proceed and continuing throughout the contract, the Contractor shall record on the daily CQC report, the occurrence of adverse weather and the resultant impact to normally scheduled work. Actual adverse weather delays days must prevent work on critical activities for 50 percent or more of the Contractor's scheduled workday. The number of actual adverse weather days shall include days impacted by actual adverse weather (even if adverse weather occurred in previous month), be calculated chronologically from the first to the last day in each month, and be recorded as full days. If the number of actual adverse weather days exceeds the number of days anticipated in Paragraph 2, above, the Contracting Officer will convert any qualifying delays to calendar days, giving full consideration for equivalent fair weather workdays, and issue a modification in accordance with the Contract Clause entitled "DEFAULT (FIXED-PRICE CONSTRUCTION)".

SCR-37 NOT USED

SCR-38 YEAR 2000 COMPLIANCE (OCT 1997) (FAR 39.106):

In accordance with FAR 39.106, the Contractor shall ensure that with respect to any design, construction, goods, or services under this contract as well as any subsequent task/delivery orders issued under this contract (if applicable), all information technology contained therein shall be Year 2000 compliant. Specifically, the Contractor shall:

(1) Perform, maintain, and provide an inventory of all major components to include structures, equipment, items, parts, and furnishings under this contract and each task/delivery order which may be affected by the Year 2000 compliance requirement.

(2) Indicate whether each component is currently Year 2000 compliant or requires an upgrade for compliance prior to Government acceptance.

SCR-39 NOT USED

SCR-40 KEY PERSONNEL:

During the performance of this contract, no substitutions shall be made for individuals specifically identified in the Contractor's accepted proposal to perform key functions in the work, unless determined necessary by the Contracting Officer and approved in writing. Proposed substitutes shall have qualifications comparable to those of the persons being replaced.

SCR-41 THRU SCR-44 NOT USED

SCR-45 SAFETY AND HEALTH REQUIREMENTS MANUAL, EM 385-1-1, U.S. ARMY CORPS OF ENGINEERS:

EM 385-1-1 and its changes are available at http://www.hq.usace.army.mil (at the HQ homepage, select Safety and Occupational Health).

The Contractor shall be responsible for complying with the current edition and all changes posted on the web (see web address above) as of the effective date of this solicitation and shall comply with the version in effect on the contract award date. This EM 385-1-1 shall remain in effect throughout the life of the contract.

SCR-46 THRU SCR-111 NOT USED

SCR-112 NOTICE OF REQUIREMENT FOR AFFIRMATIVE ACTION TO ENSURE EQUAL EMPLOYMENT OPPORTUNITY FOR CONSTRUCTION (FEB 1999) (FAR 52.222-23): NOT USED

ATTACHMENT: CLIMATOLOGICAL SUMMARY

CLIMATOLOGICAL SUMMARY

EIELSON (Period of record exceeds 25 years)

MEANS AND EXTREMES FOR PERIOD OF RECORD

Temperature		Mean Annual	25.2° F
		Highest Recorded	93° F
		Lowest Recorded	-64° F
		Maximum Freezing Index	6724° Days (1955-56)
		Maximum Thawing Index	3848° Days 1951
Precipitation		Mean Annual	13.6"
		Mean Annual Snowfall	74.6"
		Maximum Monthly	7.47"
		Maximum Monthly Mean	2.51" July
		Maximum Rainfall During 24 hr Period	3.61" July 1967
		Maximum Snowfall During 24 hr Period	14.2" Feb 1966
		Maximum Monthly Snowfall	47.1" Dec 1949
		Greatest Depth Snow on Ground	54.0" Feb
Wind		Mean Hourly Speed	3.5 mph
		Prevailing Direction	W
		Maximum Velocity	74 mph
		Direction Maximum Velocity	SW
Annual Mean Number of Days	Sunrise to Sunset	Clear	83
		Partly Cloudy	71
		Cloudy	211
		Precipitation 0.01 inch or more	106
		Snow, Sleet, or Hail 1.0 inch or more	55
		Heavy Fog	12
		Thunderstorms	2 per year
	Max Temp	≥ 70°	43
		≤ 32°	154
	Min Temp	≤ 32°	229
		≤ Zero	124

NPA Form 3
AUG 1958

-- END OF SPECIAL CONTRACT REQUIREMENTS--

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SECTION 01015

SPECIAL ITEMS

PART 1 GENERAL

1.1 SCOPE

Items included in this section cover special features and/or requirements which are not otherwise specified or indicated.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

U.S. AIR FORCE (USAF)

AFOSHSTD91-5	(1997) Welding, Cutting, and Brazing

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM E 1527	(2003) Practice for Environmental Site Assessments: Phase 1 Environmental Site Assessment Process

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910	Occupational Safety and Health Standards
29 CFR 1926	Safety and Health Regulations for Construction
40 CFR 61	National Emission Standards for Hazardous Air Pollutants

U.S. ARMY CORPS OF ENGINEERS (USACE)

TI 809-04	(1998) Seismic Design for Buildings

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 241	(2000) Safeguarding Construction, Alteration, and Demolition Operations

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with SECTION 01330 SUBMITTAL PROCEDURES:

SD-06 Test Reports

Videotapes

1.4 ACCIDENT PREVENTION PLAN

The Contractor shall obtain the Contracting Officer's approval of the Accident Prevention Plan required by the Safety and Health Requirements Manual referenced in paragraph Accident Prevention of the Contract Clauses prior to start of any work at the project site.

1.5 FIRE SAFETY

The Contractor shall obtain a permit from the organization having jurisdiction over the job site for any welding or open flame work.

1.5.1 Fire Protection

The Contractor shall comply with local Air Force fire protection requirements and NFPA 241.

1.5.2 Welding Permit

The Contractor shall obtain AF Form 592 "USAF Welding, Cutting, and Brazing Permit" (copy attached to this section) from the Installation Fire Chief prior to any welding operations. Welding shall conform to AFOSHSTD91-5 and requires inspection and approval by the Installation Fire Department.

1.6 WORK CLEARANCE AND UTILITY OUTAGES

The Contractor shall limit the number of utility outages to the minimum necessary to complete the work. All outages shall be scheduled to occur between 0800 and 1500 hours, Tuesdays through Thursdays. A written request for each outage shall be submitted to the Utilities Distribution Foreman, through the Contracting Officer, with the maximum lead time possible, but not less than 14 working days prior to the requested outage. The request shall identify the utility, exact location, affected facilities, the duration of the outage, and a brief explanation of the work to be performed. For commercial telephone and cable outages, the request shall be made directly with the provider. The Contractor shall post outage notices at each entrance of each affected building and notify each building manager by phone or in person a minimum of 24 hours before the outage begins. No outage shall be effected until the Contractor has received approval from the Contracting Officer. If the outage cannot be completed within the time requested, a new request shall be submitted and approval obtained in advance for the additional time required. The Contractor will be required to pay overtime costs of Government utilities personnel required to work beyond 01500, or on holidays or weekends, due to outages. Shutdown and startup of utility systems will be done by Base utility personnel unless otherwise specified. Emergency, unscheduled outages shall be reported immediately to the Utilities Distribution Foreman.

1.6.1 Clearance Request

The Contractor shall have a properly executed AF Form 103, Base Civil Engineering Work Clearance Request (copy attached to this section), coordinated through the Contracting Officer and signed by the Base Civil Engineer prior to any work at the project site.

1.6.2 Utility Outages

Utility outages shall be coordinated with the Base Civil Engineer through the Contracting Officer at least 14 days prior to the planned utility interruption. Outage periods shall exclude Saturdays, Sundays and holidays.

1.7 DISPOSITION OF MATERIALS

Combustible and noncombustible waste material shall be disposed of off-site at an authorized solid waste disposal facility, except as otherwise specified. No burning will be permitted. The Contractor shall comply with all Federal, State and local regulations. Covered vehicles shall be used for hauling to prevent spillage. Clean (uncontaminated) soil, gravel, and rock; concrete, recyclable asphalt, and asbestos may be disposed of at various designated sites, generally within a five mile radius of the project site. The Contractor shall include a plan covering waste disposal, borrow pit operations and project site operations as part of the Environmental Protection Plan specified in SECTION 01355 ENVIRONMENTAL PROTECTION.

1.7.1 Salvageable Material

Salvageable material, if not otherwise indicated, shall become the property of the Contractor. The value of such salvage shall be reflected in the contract price.

1.8 WARRANTY OF CONSTRUCTION

a. In addition to any other warranties in this contract, the Contractor warrants, except as provided in subparagraph "i" herein, that the work performed under this contract conforms to the contract requirements and is free of any defect of equipment, material, or design furnished, or workmanship performed by the Contractor or any subcontractor or supplier at any tier.

b. This warranty shall continue for a period of 1 year from the date of final acceptance of the work. If the Government takes possession of any part of the work before final acceptance, this warranty shall continue for a period of 1 year from the date the Government takes possession.

c. The Contractor shall remedy at the Contractor's expense any failure to conform, or any defect. In addition, the Contractor shall remedy at the Contractor's expense any damage to Government-owned or -controlled real or personal property, when that damage is the result of:

1. The Contractor's failure to conform to contract requirements; or

2. Any defect of equipment, material, workmanship, or design furnished.

d. The Contractor shall restore any work damaged in fulfilling the terms and conditions of this clause. The Contractor's warranty with respect to work repaired or replaced will run for 1 year from the date of repair or replacement.

e. The Contracting Officer will notify the Contractor, in writing, within a reasonable time after the discovery of any failure, defect, or

damage.

f. If the Contractor fails to remedy any failure, defect, or damage within a reasonable time after receipt of notice, the Government shall have the right to replace, repair, or otherwise remedy the failure, defect, or damage at the Contractor's expense.

g. With respect to all warranties, expressed or implied, from subcontractors, manufacturers, or suppliers for work performed and materials furnished under this contract, the Contractor shall:

1. Obtain all warranties that would be given in normal commercial practice;

2. Require all warranties to be executed, in writing, for the benefit of the Government, if directed by the Contracting Officer; and

3. Enforce all warranties for the benefit of the Government, if directed by the Contracting Officer.

h. In the event the Contractor's warranty under subparagraph "b" herein has expired, the Government may bring suit at its expense to enforce a subcontractor's, manufacturer's, or supplier's warranty.

i. Unless a defect is caused by the negligence of the Contractor or subcontractor or supplier at any tier, the Contractor shall not be liable for the repair of any defects of material or design furnished by the Government nor for the repair of any damage which results from any defect in Government-furnished material or design.

j. This warranty shall not limit the Government's rights under the Inspection of Construction clause of this contract with respect to latent defects, gross mistakes, or fraud.

k. Defects in design or manufacture of equipment, specified by the Government on a "brand name and model" basis, shall not be included in this warranty. In this event, the Contractor shall require any subcontractors, manufacturers, or suppliers thereof to execute their warranties, in writing, directly to the Government.

1.8.1 Failures

Upon receipt of notice from the Government of failure of any part of warranted items during the warranty period, the affected part or parts shall be promptly replaced. Such replacement shall include furnishing and installing the necessary new part or parts, making all necessary repairs, restoring the affected item to the operating condition specified in this contract and making all such tests as are necessary to ensure that there are no remaining defects. Such tests shall be performed in the presence of representatives of the Using Agency indicated below. Upon final acceptance of the work or transfer of responsibility to the Government for operation and maintenance of the items covered, whichever is earlier, the Contractor shall be responsible to the Using Agency for the warranty provisions of this contract. A letter stating the applicable warranty provisions shall be furnished to the Contracting Officer in duplicate, in the format and text shown in the sample letter attached to this section.

354th Civil Engineering Squadron

1.8.2 Warranty Tag

The Contractor shall provide the following information typed or printed in ink on tag stock or card stock which shall be affixed in easy view location on the warranted installed equipment:

"This equipment was installed by contract W911KB-04-C-00__ and is under warranty by the (Construction Company Name) at (Phone Number) until (Day Month Year).

All maintenance by installation personnel is to be performed in accordance with maintenance manual provided at time of acceptance to avoid possible negation of the warranty.

In case of requirements for major adjustments, repairs or replacements, call the Base Civil Engineer's Contract Manager at (907) 377-5128."

1.8.3 System Warranty Check

The System Supplier, for the fuel system and the Sub-Contractor responsible for the heating system, will be required to accomplish a supplemental cold weather system operational check (validation) sometime between late January and early February, if the Facility project start-up is accomplish outside of this time period.

1.9 CAMP FACILITIES

There are no Government owned camp facilities at the jobsite for the Contractor's use.

1.10 FURNISHINGS FOR GOVERNMENT FIELD OFFICE

The Government field office specified in SECTION 01500 TEMPORARY CONSTRUCTION FACILITIES shall be furnished with the following:

a. Two (2) desks,

b. One (1) drawing layout table,

c. Six (6) chairs,

d. Two (2) four-drawer vertical or two-drawer lateral file cabinet,

e. Plain paper FAX machine,

f. Two (2) business telephones with answering machines, and

g. Portable copier with automatic document feed.

The telephones and FAX machine shall have single party lines, different from each other, and separate from the Contractor's phone line(s). All costs shall be borne by the Contractor and included in the contract price, except that long distance charges incurred by the Government representative(s) will be paid for by the Government upon arrangement with the Contracting Officer.

1.11 PARTNERING

The Government intends to encourage the foundation of a cohesive partnership with the Contractor and its subcontractors. This partnership will be structured to draw on the strengths of each organization to identify and achieve reciprocal goals. The objectives are effective and efficient contract performance, intended to achieve completion within budget, on schedule, and in accordance with plans and specifications.

This partnership will be bilateral in makeup, and participation will be totally voluntary. Any costs associated with effectuating this partnership will be agreed to by both parties and will be shared equally with no change in contract price. To implement this partnership initiative, it is anticipated that within 90 days of Notice to Proceed the Contractor's on-site project manager and the Government's on-site representative will attend a partnership development seminar followed by a team-building workshop to be attended by the Contractor's key on-site staff and Government's personnel. Follow-up workshops will be held periodically throughout the duration of the contract as agreed to by the Contractor and the Government.

1.12 OPERATION AND MAINTENANCE (O & M) MANUALS

Six copies shall be submitted to the Contracting Officer not later than 30 days prior to scheduled contract completion. Failure to submit manuals by this date will be considered cause to withhold any payments due the Contractor. All equipment manual materials shall be durable, clearly printed or reproduced copies, not more than 8-1/2 x 11 inches in size, or neatly folded to that size without overlapping into the binding. Materials shall be indexed and bound in stiff covers with tab separators. Approval of manuals shall be obtained prior to scheduling operating tests and field training courses.

1.13 VIDEOTAPING OF TESTS AND O & M TRAINING

The Contractor shall videotape tests and operation and maintenance training sessions required in the technical specifications for mechanical and electrical features. Videotapes shall be produced in the VHS format and of professional quality. Approval of applicable O & M manuals shall be obtained and manuals provided on site at least 3 days prior to tests and training as specified. Each system or piece of equipment shall be covered in a single tape or set of tapes which shall be correlated with the approved O & M manuals. Videotapes shall be categorized and indexed by equipment and item of repair, with a typed or printed label showing the project, equipment or system and contract number; this same information shall be provided as an introduction on each video tape. One copy of the videotaped material shall be submitted to the Contracting Officer, for review, within ten (10) days after completion of the videotaped training session. Coverage shall include, as applicable:

a. Testing, trouble-shooting, repair of heating, ventilation, diesel-generator and boiler controls.

b. Demonstration of common maintenance items, i.e. system tests (efficiency and operability), cleaning, adjustment, replacement of high failure items, scheduled maintenance, tear down and repair of specific items, etc.

c. Testing of fire suppression and detection systems. Resetting of

systems after activation. Trouble-shooting, actual maintenance and repair of specific components, etc.

d. How to verify system performance and operating parameters (i.e. flows, temperatures, pressures, amperage draw, etc.).

1.14 HEALTH HAZARD ASBESTOS

Minor amounts of asbestos may be present within building materials encountered while working with existing insulation, piping and equipment. The Contractor shall determine the presence of asbestos and, if present, notify the Contracting Officer immediately and provide safeguards and disposal methods, including work practices, respiratory protection and industrial hygiene measures, that satisfy 29 CFR 1910 and 29 CFR 1926.58. An equitable adjustment will be made to the contract for additional work required if asbestos is present. Removal and disposal shall also satisfy 40 CFR 61.140 through 61.156, with disposal satisfying 61.146(c)(1).

1.15 EARTHQUAKE-RESISTANT EQUIPMENT SUPPORTS

All items of electrical, mechanical, and other installed equipment shall be mounted to prevent damage from lateral motion caused by earthquake. Restraints for seismic loading shall comply with requirements in TI 809-04. Any hooks from which light fixtures or other equipment are suspended shall be closed. Light fixtures in suspended ceilings shall have secondary support from main structural framing of ceiling or roof system. Items of suspended or supported equipment subject to causing damage by swaying or tipping shall be cross-braced or laterally secured to the building structure. Any items of equipment mounted without rigid restraint of lateral motion shall have sufficient clearances and flexibility of associated wiring, piping, or other connections to accommodate the full range of such motion as might occur.

1.16 NPDES

Work shall comply with EPA National Pollutant Discharge Elimination System. See SECTION 01356 STORMWATER POLLUTION PREVENTION MEASURES for additional specific requirements.

1.17 NON-GOVERNMENT BORROW SOURCES

The Contractor shall check any non-Government, proposed borrow sources for the presence of hazardous substances and petroleum products as defined in ASTM E 1527. The publication includes guidance on previously examined sites. A Phase I Environmental Site Assessment, also as defined therein, shall be submitted for each proposed borrow site as a supplement to the Environmental Protection Plan specified in SECTION 01355 ENVIRONMENTAL PROTECTION. The report shall identify any previous or current presence of hazardous substances at the site, regardless of whether they have been, or can be, released to the environment. The Assessment shall be performed under the direct supervision of an independent, registered professional engineer, currently licensed by the State in which the borrow source is located, and within such time frame as will ensure reports are valid when submitted. The engineer shall have a minimum of 3 years experience in performing satisfactory Environmental Site Assessments. All reports shall be certified in writing by the engineer and submitted in the standard format specified in the referenced publication, through the Contracting Officer, to the Base Environmental Office for review. Reports shall be submitted at least 30 days prior to needing borrow materials in the work.

The qualifications of the engineer performing the Assessment shall be included with the report. Where hazardous materials are indicated, use of the source will not be allowed. No borrow materials shall be brought onto Government property without approval of the Contracting Officer. The Government reserves the right to sample and test any borrow materials delivered to the project for conformance with this specification.

1.18 BIRDS' PROTECTION

Federal and State law protects the Cliff Swallows that build mud nests on Base/Post facilities. Once the Cliff Swallow establishes nest and lays eggs, then the nest cannot be removed or annoyed until the nests are no longer occupied. Forcing or annoying the birds to abandon an occupied nest is a violation of State and Federal law. Any work including demolition of known Cliff Swallows nesting areas (i.e., eaves, porches, entranceways, tanks, etc.) shall be done prior to 10 May or after 1 August to avoid project delays.

The Contractor shall initiate a program to remove the partially completed nests daily from 10 May to 21 July to avoid work stoppage. The Contractor is responsible for all or any delays and charges filed by U.S. Fish and Wildlife Service and the State of Alaska Department of Public Safety due to his/her negligence in removing and/or annoying such established nests.

1.19 PROJECT COORDINATION

The Contractor shall ensure that the taxiway edge lighting, not scheduled for demolition, shall remain operational at all times. The Contractor shall provide all necessary temporary wiring, terminations, excavation, etc. to ensure that the taxiway lighting remains fully operational.

1.20 SPECIAL AIRFIELD SAFETY ISSUES

1.20.1 General

The Contractor is reminded that access to the job site and construction storage areas will be in close proximity to, and across active taxiways, or thru active airfield clear zones.

The Contractor shall provide to the Airfield Manager, a list of all personnel that will be driving onto the job site. This list shall include the following information:

a. Name of driver

b. Social Security Number

c. Drivers License number

d. Make, model, color, and vehicle type to be driven. If it is anticipated that a given person may drive multiple vehicles, then the vehicle information shall be indicated under the name of that driver.

The Contractor shall provide the Airfield Manager a revised updated copy when new personnel are added, or are no longer assigned to the project.

1.20.2 Airfield Safety Briefing

An airfield briefing/safety meeting will be arranged at the preconstruction

conference for any and all persons that will be driving any type of vehicle onto the job site for this project. A representative of the Base Airfield Managers office will present this briefing. This meeting is mandatory and no person will be allowed to drive onto the job site until this briefing has been attended.

1.20.3 Airfield Access

Access to the job site via South Gate or T/W "Lima" shall be controlled by personnel permanently assigned by Contractor. These persons shall have the authority to deny access to the job site to any and all construction vehicles and personnel at any time any for any duration when directed to by any of the following personnel or their representatives:

a. Airfield Control Tower,

b. Airfield Manager,

c. Base Operations Manager, or

d. Airfield/Base Security Forces personnel

Requests for denied access by Air Force personnel may include emergency aircraft recovery, mission exercises and other security issues. In the event that a request to deny access is made by Air Force personnel, the Contractor's personnel shall take immediate steps close off access and to inform all drivers that access is denied and that they will be contacted again when access has been resumed. The Contractor's personnel shall not resume access to the job site until instructed to by the appropriate Air Force personnel.

1.20.4 Communication Requirements

All Contractor personnel manning construction equipment of any type shall remain in constant communication via radio with the Project Superintendent, person manning the South Gate entrance, and the person manning the T/W "Lima" crossing. The actual radio frequency to be used by all Contractor personnel shall be coordinated with the Airfield Manager prior to use.

In addition to the radio communication requirement listed above the Project Superintendent, person manning the South Gate entrance, and the person manning the T/W "Lima" crossing shall be in cell phone communication with the airfield control tower at all times. The persons manning T/W Lima crossing shall maintain contact with "Thunder Ops" since Eielson AFB control tower does not control the loop area. The contractor shall provide to the Airfield Manager, Thunder Ops, and the control tower representative those phone numbers. The phone numbers shall not be changed by the Contractor without prior written notification and subsequent approval from the control tower personnel and the Airfield Manager.

1.20.5 Crossing T/W "Lima" South of F-16 Parking Apron

1.20.5.1 Traffic Control

The Contractor shall be required to install lighted aircraft safety barricades and FOD fencing on both sides of the access crossing of the taxiway. Exact location of this crossing is shown on the project plans.

1.20.5.1 Lighted Barricades

The lighted barricades shall be placed end-to-end across the taxiway itself and both taxiway shoulders. The lighted barricades shall be placed 5 feet outside of the FOD fence.

1.20.5.1.2 FOD Fencing

The FOD fencing shall not be erected integrally with the lighted aircraft safety barricades. Spacing between the rows of FOD fencing shall be kept at a minimum, but in no case shall it be less than what is normally required two-way truck traffic. Spacing between FOD fencing and the lighted barricades shall be coordinated with the Airfield Manager.

The FOD fencing shall be erected to catch any wind driven debris that may cause damage to nearby aircraft. Fencing shall be a minimum of 42 inches high, fastened to vertical uprights that are spaced no more than 10 feet on center and securely fastened to the ground to prevent the fencing from being blown over and to catch any remaining surface FOD. The material employed by the Contractor shall be suitable for the application intended.

1.20.5.2 Vehicle FOD Checks - T/W "Lima"

The access crossing at T/W "Lima" shall remain "FOD free" at all times. Contractor personnel shall be required to perform a FOD check prior to the start of any crossing of T/W "Lima". Any FOD found on the vehicles frame or located in between the tire treads shall be removed prior to crossing. Immediately after crossing, a back-view FOD check shall be performed. Any FOD that is spotted on the T/W and within the FOD fences shall be immediately cleaned up before proceeding further into the job site. These FOD checks are mandatory. Any vehicle and driver identified as violating this requirement will not be allowed back onto the job site.

1.21 DAILY NOTIFICATION OF CONSTRUCTION EQUIPMENT LOCATION

The Contractor shall provide daily notification, in writing to the Airfield Manager, a list of equipment on the job site that exceed 15 feet in height. The list shall include the following information:

a. Equipment type
b. Manufacturer
c. Maximum height of the equipment
d. Location of the equipment for that day

1.22 ATTACHMENTS

AF Form 592
AF Form 103

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

S A M P L E L E T T E R

Contracting Officer
Date_____
Address (as stated in Notice of Award)

SUBJECT: Warranty Provisions, Contract

GENTLEMEN:

This is to acknowledge our responsibility in connection with the warranty provisions of this contract as set forth in the contract specifications.

The following items, equipment or systems furnished or installed under this contract are hereby warranted against defective design, material and workmanship for a period as indicated:

Warranted Item, Equipment or System	Identification Serial Number, Etc.	Warranty Expires at 11:59 PM Std. Time
_____	_____	_____
_____	_____	_____
_____	_____	_____

Upon receipt of notice from the Government of failure of any part or parts of the warranted item, equipment, or system during the warranty period, the affected part or parts will be replaced promptly with new parts. Such replacement will include furnishing and installing the new part or parts, making all necessary repairs, restoring the item, equipment, or system to the operating condition specified in this contract and making all such tests as are necessary to ensure that there are no remaining defects. Such tests will be performed in the presence of the Representative of the Using Agency indicated below.

We are responsible to _____ for the warranty provisions of this contract. Correspondence regarding the failure of any of the preceding items, equipment or systems covered by the warranty provisions of this contract should be addressed to:

	Telephone Number:
_____	
_____	_____
_____	_____

Very truly yours,

Signed: _____
Title: _____
Organization: _____

USAF WELDING, CUTTING AND BRAZING PERMIT (AF FORM 592)

THIS PERMIT WILL BE RETAINED AT THE WORKSITE UNTIL THE JOB IS COMPLETED WITH A COPY RETAINED BY THE FIRE DEPARTMENT. PERMITS ARE NOT REQUIRED FOR WELDING SHOPS OR OTHER AREAS APPROVED BY THE FIRE DEPARTMENT.

USAF WELDING, CUTTING AND BRAZING PERMIT
(See instructions and checklist on reverse)

1. CONTROL NUMBER: FC-109
2. DATE PERMIT ISSUED: 21 OCT 1980
3. TIME PERMIT ISSUED: 1515
4. EXPIRATION (Date and time): 21 OCT 80 - 1700
5. ☒ AIRCRAFT TAIL NO. 751
6. ☐ FACILITY NO.
INSIDE ☐ OUTSIDE ☒
FLOOR NO
7. ☐ OPEN AREA (Specify)
8. OPERATION TO BE PERFORMED: WELD AFTERBURNER
9. ☑ FIRE WATCH IS REQUIRED DURING OPERATION AND 30 MINUTES THEREAFTER
10. ☒ AN AFTER OPERATION INSPECTION IS REQUIRED CALL 6144 AFTER COMPLETION OF OPERATION AND REMAIN UNTIL ARRIVAL OF FIRE INSPECTOR.
11. ☐ CALL _____ UPON COMPLETION OF OPERATION
12. SPECIAL PRECAUTIONS
WATCH FOR FUEL VENTING
ROPE OFF AIRCRAFT
REMOVE UNNECESSARY METTLE FROM AREA
STOP IMMEDIATELY IF A FUEL LEAK OCCURS
13. THE LOCATION WHERE THIS WORK IS TO BE DONE HAS BEEN EXAMINED, NECESSARY PRECAUTIONS TAKEN TO PROVIDE A FIRE SAFE ENVIRONMENT, AND PERMISSION IS GRANTED FOR THIS WORK
SIGNATURE OF FIRE INSPECTOR ISSUING THE PERMIT: [illegible]
14. I AM FULLY QUALIFIED TO PERFORM THIS OPERATION AND UNDERSTAND MY RESPONSIBILITIES AS OUTLINED IN AFOSH STANDARD 127-5
SIGNATURE OF OPERATOR OR ON-SCENE SUPERVISOR: [illegible]
15. ☒ AN AFTER OPERATION INSPECTION HAS BEEN PERFORMED AND THE AREA IS DECLARED SAFE
SIGNATURE OF FIRE INSPECTOR: [illegible] DATE: 21 OCT 80 TIME: 1645
16. ☐ OPERATOR/FIRE WATCH HAS DECLARED THE AREA SAFE
NAME AND ORGANIZATION OF CALLER | DATE | TIME

AF FORM 592, OCT 80

CONTROL NUMBER (OPTIONAL)

DATE AND TIME PERMIT EXPIRES

DATE AND TIME PERMIT ISSUED

IDENTIFY AIRCRAFT TAIL NUMBER OR BUILDING NUMBER AND FLOOR NUMBER.

IDENTIFY LOCATION IF WELDING IN AN OPEN AREA.

BRIEF DESCRIPTION OF WORK

CHECK IF FIRE WATCH REQUIRED.

CHECK IF FOLLOW-UP INSPECTION NEEDED AND ENTER FIRE INSPECTOR'S PHONE NUMBER

CHECK IF ONLY NOTIFICATION OF COMPLETION IS NEEDED. ENTER FIRE INSPECTOR'S PHONE NUMBER.

FILLED OUT BY FIRE INSPECTOR

FIRE INSPECTOR'S SIGNATURE

OPERATOR OR ON-SCENE SUPERVISOR SIGNS HERE.

AFTER COMPLETION INSPECTION AND SIGNATURE OF FIRE INSPECTOR

CHECK IF OPERATOR OR FIRE WATCH CALLS TO INDICATE JOB IS COMPLETE AND THE AREA IS SAFE. FILL IN CALLER'S NAME, DATE AND TIME.

GOVERNMENT PRINTING OFFICE 1981 - 340 974 1012

BASE CIVIL ENGINEERING WORK CLEARANCE REQUEST

DATE PREPARED

1. Clearance is requested to proceed with work at _____ on Work Order/Job No. _____, Contract No. _____, involving excavation or utility disturbance per attached sketch. The area involved ☐ Has ☐ Has not been staked or clearly marked.

2. TYPE OF FACILITY/WORK INVOLVED

	A. PAVEMENTS		B. DRAINAGE SYSTEMS		C. RAILROAD TRACKS		D. FIRE DETECTION AND PROTECTION SYSTEMS		E. UTILITY ☐ OVERHEAD ☐ UNDERGROUND
	F. COMM. ☐ OVERHEAD ☐ UNDERGROUND		G. AIRCRAFT OR VEHICULAR TRAFFIC FLOW		H. SECURITY		I. OTHER *(Specify)*		

3. INSTRUCTIONS: The BCE work clearance request is used for any work (contract or in house) that may disrupt aircraft or vehicular traffic flow, base utility services, protection provided by fire and intrusion alarm system, or routine activities of the installation. This form is used to coordinate the required work with key base activities and keep customer inconvenience to a minimum. It is also used to identify potentially hazardous work conditions in an attempt to prevent accidents. The work clearance request is processed just prior to the start of work. If delays are encountered and the conditions at the job site change (or may have changed) this work clearance request must be reprocessed.

4. DATE CLEARANCE REQUIRED	5. DATE CLEARANCE TERMINATED

6. REQUESTING OFFICIAL *(Signature)*	7. PHONE NO.	8. ORGANIZATION

CLEARANCE REVIEW

	ORGANIZATION	REMARKS	REVIEWER'S NAME AND INITIALS
9. BASE CIVIL ENGINEERING	A. ELECTRICAL DISTRIBUTION		
	B. STEAM DISTRIBUTION		
	C. WATER DISTRIBUTION		
	D. POL DISTRIBUTION		
	E. SEWER LINES		
	F. DRAINAGE SYSTEMS		
	G. PAVEMENTS, GROUNDS, RAILROADS		
	H. FIRE DEPARTMENT		
	I. ENGINEERING & ENVIRONMENTAL PLANNING		
	J. CATHODIC PROTECTION		
	K. OTHER		
10. SECURITY POLICE			
11. SAFETY			
12. COMMUNICATIONS			
13. BASE OPERATIONS			
14. COMMERCIAL UTILITY COMPANY *(Telephone, Gas, Electrical, etc.)*			
15. OTHER *(Specify)*			

AF FORM JUL 82 103 PREVIOUS EDITION WILL BE US

6. **REMARKS** *(This section must describe specific precautionary measures to be taken before and during work accomplishment. Specific comments concerning the approved method of excavation, hand or powered equipment should be included.)*

REQUESTED CLEARANCE

☐ APPROVED ☐ DISAPPROVED

DATE	SIGNATURE OF APPROVING OFFICER *(Chief of Operations or Chief of Engineering and Environmental Planning)*

--END OF SECTION--

GPO : 1984 O - 428-544

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SECTION 01180

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SECTION 01180

RADIOACTIVE MATERIALS PROCEDURES

PART 1 GENERAL

1.1 SCOPE

This section covers the use of items containing radioactive substances, such as soil density measuring devices, on military property or installations.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

U.S. AIR FORCE (USAF)

AFI 40-201	Managing Radioactive Material in the Air Force

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

10 CFR 0-199	Code of Federal Regulations, Title 10, Chapter I, Nuclear Regulatory Commission (NRC)

1.3 REQUIREMENTS

Use of radioactive material on military property or installations shall conform to the following requirements.

1.3.1 Standards

The Contractor shall comply with 10 CFR 0-199 and AFI 40-201.

1.3.2 Usage Request

The Contractor shall submit a temporary radioactive material usage request, through the Contracting Officer, to the Base Radiation Safety Officer (RSO), Bioenvironmental Engineering Services. Submittal shall be made at least 60 days prior to the desired start date or date of arrival of the material, whichever is sooner, for NRC licensed items, and at least 120 days prior to such date for items which do not require an NRC license, such as certain density gages. The request shall include the following information:

a. A detailed description of the proposed activities or usage, to include safety precautions to be enforced.

b. A copy of the written procedures established by the Contractor to ensure the radiological health and safety of Air Force personnel and the public while the material is on an Air Force installation.

c. A copy of the applicable NRC or Agreement State License possessed by the Contractor, if available. If the material is not controlled by the NRC, the Contractor shall provide a complete and accurate NRC Form 313 for each type of unit to be used, with all necessary supporting documentation, for review and subsequent forwarding to the USAF Radioisotope Committee (RIC), requesting an Air Force Radioactive Materials Use Permit be granted the Contractor for the specified period of use.

NOTE: The RIC may temporarily deny the request until additional information they require for evaluation is provided, or may totally deny the request if the Contractor's proposal does not meet 10 CFR 0-199, AFI 40-201, or other Air Force requirements. An additional 90 day period will be required for review of each additional submittal to the RIC. A decision of the RIC to totally deny a permit will be considered final.

d. A copy of the NRC Form 241 or a similar document for each specific licensable item the Contractor wishes to use.

e. A copy of the contract section(s) describing the work to be performed, and the inclusive dates during which the work will be conducted.

f. The Contractor shall also provide documentation of the names and qualifications of all personnel who will handle, store, transport and/or use the radioactive material proving that they are properly trained to perform these functions. Specific documentation (such as course completion certificates and in-house training certifications and plans) shall be included to show that these personnel are properly trained in accordance with the stipulations of the license(s) or the proposed permit.

1.4 INITIAL NOTIFICATION

Once the Contractor has received written approval for use of the radioactive material through the Contracting Officer, the radioactive material may be brought onto the installation. The Contractor shall notify the RSO immediately upon bringing the material onto the installation, and again 3 working days prior to the initial use of the materials.

1.5 COMPLETE NOTIFICATION

The Contractor shall notify the RSO immediately upon completion of use, and when the material is removed from the installation.

1.6 VIOLATIONS

The Contractor will be subject to inspection by the Contracting Officer, the RSO, and Federal and State agencies or their designated representatives at all times when the materials are on the installation. Any violations of the conditions of the approval, or of applicable regulations, will require immediate cessation of work until the cause is corrected, and written approval for re-start of work is received by the Contracting Officer from the RSO. All delays, down time, etc. incurred as a result of such cessation of work shall be at the Contractor's expense.

1.7 ACCIDENTS

Accidents or incidents involving the radioactive material, and any known or potential exposure of Contractor or non-Contractor personnel to radiation, shall be reported immediately to the RSO and the Contracting Officer, and operations suspended until the circumstances have been evaluated by the RSO, and approval for the re-start has been received by the Contracting Officer.

1.8 ATTACHMENTS

CONRAS Permit

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

Application For Eielson AFB CONRAS Permit

Application for Eielson AFB CONRAS Permit

Company's Local Representative:

Local Address:

Local Phone:

RSO Name:

RSO Address (If Different From Above):

RSO Phone (If Different From Above):

Eielson AFB Contract/Project Number (Attach Copy Of Applicable Pages):

Description Of Work:

Dates Of Work:

Where/How Will You Secure The Source/Device At Eielson?

Describe/Attach The Procedures You Will Use To Prevent Exposure To AF Personnel and the General Public During This Project:

We acknowledge that the Eielson RSO can make periodic checks to ensure our personnel are following radiation safety practices to prevent exposures to Air Force personnel and avoid contamination of government property. In addition, the installation RSO has the authority to suspend our operations if he/she believes them to be unsafe

We have attached the required documents (listed below).

Signature and Typed/Printed Name of Local Representative

Attach the following documents

1. **Copy of NRC/agreement state license <u>OR</u>**
   State Registration for NORM & Generally-Licensed Sources
2. **Proof of Training for Users Working the Eielson Project**
3. **Copy of Latest Leak Test**
4. **Copy of Project Radiation Safety Plan (if not described above)**
5. **Copy of Applicable Pages From Contract**

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3.1 CONTRACT COST BREAKDOWN

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SECTION 01271

MEASUREMENT, PAYMENT, AND CONTRACT COST BREAKDOWN

PART 1 GENERAL

1.1 MEASUREMENT

1.1.1 Lump Sum

Each lump sum item will be measured for payment as a complete item.

1.1.2 Linear Foot (L.F.)

Unless otherwise specified, measurement of items by length will be based on horizontal or vertical measurements, as applicable, taken after the item of work or portion thereof is completed.

1.2 PAYMENT

Payment will be made at the contract unit price. The price for each item shall constitute full compensation for furnishing all labor, equipment, and materials, and performing all operations necessary to construct and complete the work in accordance with the specifications and drawings. Payment shall be considered as full compensation, notwithstanding that minor features of the work to complete the item may not be mentioned.

1.2.1 Items 0001AB, 0001AC & 0001AD AC and PCC Pavement

Payment shall be made for satisfactory AC and PCC pavement in-place. Following layout of the work in accordance with the Special Contract Requirements, and prior to beginning paving operations, the Contractor shall field measure the total area to be paved as indicated on the drawings for each of items 0001AB, 0001AC & 0001AD. A price per square yard shall then be computed for each item by dividing the lump sum bid price for the item by the actual number of square yards to be placed. Certified copies of measurements and computations shall be provided to the contracting officer for verification. Payment for each item will be reduced from the lump sum bid price, in accordance with SECTIONS 02749 HOT-MIX ASPHALT (HMA) FOR AIRFIELDS and 02753 CONCRETE PAVEMENT FOR AIRFIELDS AND OTHER HEAVY-DUTY PAVEMENTS for variations from specified quality. The computed price per square yard will be multiplied by the square yards placed in each lot to determine the portion of the bid price to be reduced. For each item, the total amount paid will not exceed the amount listed in the proposal schedule.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 CONTRACT COST BREAKDOWN

The Contractor shall furnish within 30 days after the date of Notice to Proceed, and prior to the submission of its first partial payment estimate, a breakdown of its lump-sum pay item or items which will be reviewed by the

Contracting Officer as to propriety of distribution of the total cost to the various accounts. Any unbalanced items as between early and late payment items or other discrepancies will be revised by the Contracting Officer to agree with a reasonable cost of the work included in the various items. This contract cost breakdown will then be utilized as the basis for progress payments to the Contractor.

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PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

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SECTION 01312

QUALITY CONTROL SYSTEM (QCS)

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

The Government will use the Resident Management System for Windows (RMS) to assist in its monitoring and administration of this contract. The Contractor shall use the Government-furnished Construction Contractor Module of RMS, referred to as QCS, to record, maintain, and submit various information throughout the contract period. This joint Government-Contractor use of RMS and QCS will facilitate electronic exchange of information and overall management of the contract. QCS provides the means for the Contractor to input, track, and electronically share information with the Government in the following areas:

Administration

Finances

Quality Control

Submittal Monitoring

Scheduling

Import/Export of Data

1.1.1 Correspondence and Electronic Communications

For ease and speed of communications, both Government and Contractor will, to the maximum extent feasible, exchange correspondence and other documents in electronic format. Correspondence, pay requests and other documents comprising the official contract record shall also be provided in paper format, with signatures and dates where necessary. Paper documents will govern, in the event of discrepancy with the electronic version.

1.1.2 Other Factors

Particular attention is directed to Contract Clause, "Schedules for Construction Contracts", Contract Clause, "Payments", SECTION 01320, PROJECT SCHEDULE, SECTION 01330, SUBMITTAL PROCEDURES, and SECTION 01451, CONTRACTOR QUALITY CONTROL, which have a direct relationship to the reporting to be accomplished through QCS. Also, there is no separate payment for establishing and maintaining the QCS database; all costs associated therewith shall be included in the contract pricing for the work.

1.2 QCS SOFTWARE

QCS is a Windows-based program that can be run on a stand-alone personal computer or on a network. The Government will make available the QCS software to the Contractor after award of the construction contract. Prior to the Pre-Construction Conference, the Contractor shall be responsible to

download, install and use the latest version of the QCS software from the Government's RMS Internet Website. Upon specific justification and request by the Contractor, the Government can provide QCS on 3-1/2 inch high-density diskettes or CD-ROM. Any program updates of QCS will be made available to the Contractor via the Government RMS Website as they become available.

1.3 SYSTEM REQUIREMENTS

The following listed hardware and software is the minimum system configuration that the Contractor shall have to run QCS:

Hardware

IBM-compatible PC with 500 MHz Pentium or higher processor

128+ MB RAM for workstation / 256+ MB RAM for server

1 GB hard drive disk space for sole use by the QCS system

3-1/2 inch high-density floppy drive

Compact disk (CD) Reader, 8x speed or higher

SVGA or higher resolution monitor (1024 x 768, 256 colors)

Mouse or other pointing device

Windows compatible printer (Laser printer must have 4+ MB of RAM)

Connection to the Internet, minimum 56 Kbps

Software

MS Windows 98, ME, NT, or 2000

Word Processing software compatible with MS Word 97 or newer

Latest version of: Netscape Navigator, Microsoft Internet Explorer, or other browser that supports HTML 4.0 or higher

Virus protection software that is regularly upgraded with all issued manufacturer's updates

Electronic mail (E-mail), MAPI compatible

1.4 RELATED INFORMATION

1.4.1 QCS User Guide

After contract award, the Contractor shall download instructions for the installation and use of QCS from the Government RMS Internet Website; the Contractor can obtain the current address from the Government. In case of justifiable difficulties, the Government will provide the Contractor with a CD-ROM containing these instructions.

1.4.2 Contractor Quality Control (CQC) Training

The use of QCS will be discussed with the Contractor's QC System Manager

during the mandatory CQC Training class.

1.5 CONTRACT DATABASE

Prior to the pre-construction conference, the Government shall provide the Contractor with basic contract award data to use for QCS. The Government will provide data updates to the Contractor as needed, generally by files attached to E-mail. These updates will generally consist of submittal reviews, correspondence status, QA comments, and other administrative and QA data.

1.6 DATABASE MAINTENANCE

The Contractor shall establish, maintain, and update data for the contract in the QCS database throughout the duration of the contract. The Contractor shall establish and maintain the QCS database at the Contractor's site office. Data updates to the Government shall be submitted by E-mail with file attachments, e.g., daily reports, schedule updates, payment requests. If permitted by the Contracting Officer, a data diskette or CD-ROM may be used instead of E-mail (see paragraph DATA SUBMISSION VIA COMPUTER DISKETTE OR CD-ROM). The QCS database typically shall include current data on the following items:

1.6.1 Administration

1.6.1.1 Contractor Information

The database shall contain the Contractor's name, address, telephone numbers, management staff, and other required items. Within 14 calendar days of receipt of QCS software from the Government, the Contractor shall deliver Contractor administrative data in electronic format via E-mail.

1.6.1.2 Subcontractor Information

The database shall contain the name, trade, address, phone numbers, and other required information for all subcontractors. A subcontractor must be listed separately for each trade to be performed. Each subcontractor/trade shall be assigned a unique Responsibility Code, provided in QCS. Within 14 calendar days of receipt of QCS software from the Government, the Contractor shall deliver subcontractor administrative data in electronic format via E-mail.

1.6.1.3 Correspondence

All Contractor correspondence to the Government shall be identified with a serial number. Correspondence initiated by the Contractor's site office shall be prefixed with "S". Letters initiated by the Contractor's home (main) office shall be prefixed with "H". Letters shall be numbered starting from 0001 (e.g., H-0001 or S-0001). The Government's letters to the Contractor will be prefixed with "C".

1.6.1.4 Equipment

The Contractor's QCS database shall contain a current list of equipment planned for use or being used on the jobsite, including the most recent and planned equipment inspection dates.

1.6.1.5 Management Reporting

QCS includes a number of reports that Contractor management can use to track the status of the project. The value of these reports is reflective of the quality of the data input, and is maintained in the various sections of QCS. Among these reports are: Progress Payment Request worksheet, QA/QC comments, Submittal Register Status, Three-Phase Inspection checklists.

1.6.2 Finances

1.6.2.1 Pay Activity Data

The QCS database shall include a list of pay activities that the Contractor shall develop in conjunction with the construction schedule. The sum of all pay activities shall be equal to the total contract amount, including modifications. Pay activities shall be grouped by Contract Line Item Number (CLIN), and the sum of the activities shall equal the amount of each CLIN. The total of all CLINs equals the Contract Amount.

1.6.2.2 Payment Requests

All progress payment requests shall be prepared using QCS. The Contractor shall complete the payment request worksheet and include it with the payment request. The work completed under the contract, measured as percent or as specific quantities, shall be updated at least monthly. After the update, the Contractor shall generate a payment request report using QCS. The Contractor shall submit the payment requests with supporting data by E-mail with file attachment(s). If permitted by the Contracting Officer, a data diskette may be used instead of E-mail. A signed paper copy of the approved payment request is also required, which shall govern in the event of discrepancy with the electronic version.

1.6.3 Quality Control (QC)

QCS provides a means to track implementation of the 3-phase QC Control System, prepare daily reports, identify and track deficiencies, document progress of work, and support other Contractor QC requirements. The Contractor shall maintain this data on a daily basis. Entered data shall automatically output to the QCS generated daily report. The Contractor shall provide the Government a Contractor Quality Control (CQC) Plan within the time required in SECTION 01451, CONTRACTOR QUALITY CONTROL. Within seven calendar days of Government acceptance, the Contractor shall submit a data diskette or CD-ROM reflecting the information contained in the accepted CQC Plan: schedule, pay activities, features of work, submittal register, QC requirements, and equipment list.

1.6.3.1 Daily Contractor Quality Control (CQC) Reports.

QCS includes the means to produce the Daily CQC Report. The Contractor may use other formats to record basic QC data. However, the Daily CQC Report generated by QCS shall be the Contractor's official report. Data from any supplemental reports by the Contractor shall be summarized and consolidated onto the QCS-generated Daily CQC Report. Daily CQC Reports shall be submitted as required by SECTION 01451, CONTRACTOR QUALITY CONTROL. Reports shall be submitted electronically to the Government using E-mail or diskette within 24 hours after the date covered by the report. Use of either mode of submittal shall be coordinated with the Government representative. The Contractor shall also provide the Government a signed, printed copy of the daily CQC report.

1.6.3.2 Deficiency Tracking.

The Contractor shall use QCS to track deficiencies. Deficiencies identified by the Contractor shall be numerically tracked using QC punch list items. The Contractor shall maintain a current log of its QC punch list items in the QCS database. The Government will log the deficiencies it has identified using its QA punch list items. The Government's QA punch list items will be included in its export file to the Contractor. The Contractor shall regularly update the correction status of both QC and QA punch list items.

1.6.3.3 Three-Phase Control Meetings

The Contractor shall maintain scheduled and actual dates and times of preparatory and initial control meetings in QCS.

1.6.3.4 Accident/Safety Tracking.

The Government will issue safety comments, directions, or guidance whenever safety deficiencies are observed. The Government's safety comments will be included in its export file to the Contractor. The Contractor shall regularly update the correction status of the safety comments. In addition, the Contractor shall utilize QCS to advise the Government of any accidents occurring on the jobsite. This brief supplemental entry is not to be considered as a substitute for completion of mandatory reports, e.g., ENG Form 3394 and OSHA Form 200.

1.6.3.5 Features of Work

The Contractor shall include a complete list of the features of work in the QCS database. A feature of work may be associated with multiple pay activities. However, each pay activity (see subparagraph "Pay Activity Data" of paragraph "Finances") will only be linked to a single feature of work.

1.6.3.6 QC Requirements

The Contractor shall develop and maintain a complete list of QC testing, transferred and installed property, and user training requirements in QCS. The Contractor shall update all data on these QC requirements as work progresses, and shall promptly provide this information to the Government via QCS.

1.6.4 Submittal Management

The Government will provide the initial submittal register, ENG Form 4288, SUBMITTAL REGISTER, in electronic format. Thereafter, the Contractor shall maintain a complete list of all submittals, including completion of all data columns. Dates on which submittals are received and returned by the Government will be included in its export file to the Contractor. The Contractor shall use QCS to track and transmit all submittals. ENG Form 4025, submittal transmittal form, and the submittal register update, ENG Form 4288, shall be produced using QCS. RMS will be used to update, store and exchange submittal registers and transmittals, but will not be used for storage of actual submittals.

1.6.5 Schedule

The Contractor shall develop a construction schedule consisting of pay activities, in accordance with Contract Clause "Schedules for Construction Contracts", or SECTION 01320, PROJECT SCHEDULE, as applicable. This schedule shall be input and maintained in the QCS database either manually or by using the Standard Data Exchange Format (SDEF) (see SECTION 01320 PROJECT SCHEDULE). The updated schedule data shall be included with each pay request submitted by the Contractor.

1.6.6 Import/Export of Data

QCS includes the ability to export Contractor data to the Government and to import submittal register and other Government-provided data, and schedule data using SDEF.

1.7 IMPLEMENTATION

Contractor use of QCS as described in the preceding paragraphs is mandatory. The Contractor shall ensure that sufficient resources are available to maintain its QCS database, and to provide the Government with regular database updates. QCS shall be an integral part of the Contractor's management of quality control.

1.8 DATA SUBMISSION VIA COMPUTER DISKETTE OR CD-ROM

The Government-preferred method for Contractor's submission of updates, payment requests, correspondence and other data is by E-mail with file attachment(s). For locations where this is not feasible, the Contracting Officer may permit use of computer diskettes or CD-ROM for data transfer. Data on the disks or CDs shall be exported using the QCS built-in export function. If used, diskettes and CD-ROMs shall be submitted in accordance with the following:

1.8.1 File Medium

The Contractor shall submit required data on 3-1/2 inch double-sided high-density diskettes formatted to hold 1.44 MB of data, capable of running under Microsoft Windows 95 or newer. Alternatively, CD-ROMs may be used. They shall conform to industry standards used in the United States. All data shall be provided in English.

1.8.2 Disk or CD-ROM Labels

The Contractor shall affix a permanent exterior label to each diskette and CD-ROM submitted. The label shall indicate, in English, the QCS file name, full contract number, contract name, project location, data date, name and telephone number of person responsible for the data.

1.8.3 File Names

The Government will provide the file names to be used by the Contractor with the QCS software.

1.9 MONTHLY COORDINATION MEETING

The Contractor shall update the QCS database each workday. At least monthly, the Contractor shall generate and submit an export file to the Government with schedule update and progress payment request. As required

in Contract Clause "Payments", at least one week prior to submittal, the Contractor shall meet with the Government representative to review the planned progress payment data submission for errors and omissions. The Contractor shall make all required corrections prior to Government acceptance of the export file and progress payment request. Payment requests accompanied by incomplete or incorrect data submittals will be returned. The Government will not process progress payments until an acceptable QCS export file is received.

1.10 NOTIFICATION OF NONCOMPLIANCE

The Contracting Officer will notify the Contractor of any detected noncompliance with the requirements of this specification. The Contractor shall take immediate corrective action after receipt of such notice. Such notice, when delivered to the Contractor at the work site, shall be deemed sufficient for the purpose of notification.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

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SECTION 01320

PROJECT SCHEDULE

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of the specification to the extent referenced. The publications are referenced in the text by basic designation only.

U.S. ARMY CORPS OF ENGINEERS (USACE)

ER 1-1-11	(1995) Progress, Schedules, and Network Analysis Systems

1.2 QUALIFICATIONS

The Contractor shall designate an authorized representative who shall be responsible for the preparation of all required project schedule reports.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

Pursuant to the Contract Clause, SCHEDULE FOR CONSTRUCTION CONTRACTS, a Project Schedule as described below shall be prepared. The scheduling of construction shall be the responsibility of the Contractor. Contractor management personnel shall actively participate in its development. Subcontractors and suppliers working on the project shall also contribute in developing and maintaining an accurate Project Schedule. The approved Project Schedule shall be used to measure the progress of the work, to aid in evaluating time extensions, and to provide the basis of all progress payments.

3.2 BASIS FOR PAYMENT

The schedule shall be the basis for measuring Contractor progress. Lack of an approved schedule or scheduling personnel will result in an inability of the Contracting Officer to evaluate Contractor's progress for the purposes of payment. Failure of the Contractor to provide all information, as specified below, shall result in the disapproval of the entire Project Schedule submission and the inability of the Contracting Officer to evaluate Contractor progress for payment purposes. In the case where Project Schedule revisions have been directed by the Contracting Officer and those revisions have not been included in the Project Schedule, the Contracting Officer may hold retainage up to the maximum allowed by contract, each payment period, until revisions to the Project Schedule have been made.

3.3 PROJECT SCHEDULE

The computer software system utilized by the Contractor to produce the Project Schedule shall be capable of providing all requirements of this specification. Failure of the Contractor to meet the requirements of this specification shall result in the disapproval of the schedule. Manual methods used to produce any required information shall require approval by the Contracting Officer.

3.3.1 Use of the Critical Path Method

The Critical Path Method (CPM) of network calculation shall be used to generate the Project Schedule. The Contractor shall provide the Project Schedule in the Precedence Diagram Method (PDM).

3.3.2 Level of Detail Required

The Project Schedule shall include an appropriate level of detail. Failure to develop or update the Project Schedule or provide data to the Contracting Officer at the appropriate level of detail, as specified by the Contracting Officer, shall result in the disapproval of the schedule. The Contracting Officer will use, but is not limited to, the following conditions to determine the appropriate level of detail to be used in the Project Schedule:

3.3.2.1 Activity Durations

Contractor submissions shall follow the direction of the Contracting Officer regarding reasonable activity durations. Reasonable durations are those that allow the progress of activities to be accurately determined between payment periods (usually less than 2 percent of all non-procurement activities' Original Durations are greater than 20 days).

3.3.2.2 Procurement Activities

Tasks related to the procurement of long lead materials or equipment shall be included as separate activities in the project schedule. Long lead materials and equipment are those materials that have a procurement cycle of over 90 days. Examples of procurement process activities include, but are not limited to: submittals, approvals, procurement, fabrication, and delivery.

3.3.2.3 Critical Activities

The following activities shall be listed as separate line activities on the Contractor's project schedule:

a. Submission and approval of mechanical/electrical layout drawings.

b. Submission and approval of O & M manuals.

c. Submission and approval of as-built drawings.

d. Submission and approval of 1354 data and installed equipment lists.

e. Submission and approval of testing and air balance (TAB).

f. Submission of TAB specialist design review report.

g. Submission and approval of fire protection specialist.

h. Submission and approval of testing and balancing of HVAC plus commissioning plans and data.

i. Air and water balance dates.

j. HVAC commissioning dates.

k. Controls testing plan.

l. Controls testing.

m. Performance Verification testing.

n. Other systems testing, if required.

o. Prefinal inspection.

p. Correction of punchlist from prefinal inspection.

q. Final inspection.

3.3.2.4 Government Activities

Government and other agency activities that could impact progress shall be shown. These activities include, but are not limited to: approvals, inspections, utility tie-in, Government Furnished Equipment (GFE) and Notice to Proceed (NTP) for phasing requirements.

3.3.2.5 Responsibility

All activities shall be identified in the project schedule by the party responsible to perform the work. Responsibility includes, but is not limited to, the subcontracting firm, Contractor work force, or Government agency performing a given task. Activities shall not belong to more than one responsible party. The responsible party for each activity shall be identified by the Responsibility Code.

3.3.2.6 Work Areas

All activities shall be identified in the project schedule by the work area in which the activity occurs. Activities shall not be allowed to cover more than one work area. The work area of each activity shall be identified by the Work Area Code.

3.3.2.7 Modification or Claim Number

Any activity that is added or changed by contract modification or used to justify claimed time shall be identified by a mod or claim code that changed the activity. Activities shall not belong to more than one modification or claim item. The modification or claim number of each activity shall be identified by the Mod or Claim Number. Whenever possible, changes shall be added to the schedule by adding new activities. Existing activities shall not normally be changed to reflect modifications.

3.3.2.8 Offer Item

All activities shall be identified in the project schedule by the Offer

Item to which the activity belongs. An activity shall not contain work in more than one offer item. The offer item for each appropriate activity shall be identified by the Offer Item Code.

3.3.2.9 Phase of Work

All activities shall be identified in the project schedule by the phases of work in which the activity occurs. Activities shall not contain work in more than one phase of work. The project phase of each activity shall be by the unique Phase of Work Code.

3.3.2.10 Category of Work

All Activities shall be identified in the project schedule according to the category of work which best describes the activity. Category of work refers, but is not limited, to the procurement chain of activities including such items as submittals, approvals, procurement, fabrication, delivery, installation, start-up, and testing. The category of work for each activity shall be identified by the Category of Work Code.

3.3.2.11 Feature of Work

All activities shall be identified in the project schedule according to the feature of work to which the activity belongs. Feature of work refers, but is not limited to, a work breakdown structure for the project. The feature of work for each activity shall be identified by the Feature of Work Code.

3.3.3 Scheduled Project Completion

The schedule interval shall extend from NTP to the contract completion date.

3.3.3.1 Project Start Date

The schedule shall start no earlier than the date on which the NTP was acknowledged. The Contractor shall include as the first activity in the project schedule an activity called "Start Project". The "Start Project" activity shall have an "ES" constraint date equal to the date that the NTP was acknowledged, and a zero day duration.

3.3.3.2 Constraint of Last Activity

Completion of the last activity in the schedule shall be constrained by the contract completion date. Calculation on project updates shall be such that if the early finish of the last activity falls after the contract completion date, then the float calculation shall reflect a negative float on the critical path. The Contractor shall include as the last activity in the project schedule an activity called "End Project". The "End Project" activity shall have an "LF" constraint date equal to the completion date for the project, and a zero day duration.

3.3.3.3 Early Project Completion

In the event the project schedule shows completion of the project prior to the contract completion date, the Contractor shall identify those activities that have been accelerated and/or those activities that are scheduled in parallel to support the Contractor's "early" completion. Contractor shall specifically address each of the activities noted in the narrative report at every project schedule update period to assist the Contracting Officer in evaluating the Contractor's ability to actually

complete prior to the contract period.

3.3.4 Interim Completion Dates

Contractually specified interim completion dates shall also be constrained to show negative float if the early finish date of the last activity in that phase falls after the interim completion date.

3.3.4.1 Start Phase

The Contractor shall include as the first activity for a project phase an activity called "Start Phase X" where "X" refers to the phase of work. The "Start Phase X" activity shall have an "ES" constraint date equal to the date on which the NTP was acknowledged, and a zero day duration.

3.3.4.2 End Phase

The Contractor shall include as the last activity in a project phase an activity called "End Phase X" where "X" refers to the phase of work. The "End Phase X" activity shall have an "LF" constraint date equal to the completion date for the project, and a zero day duration.

3.3.4.3 Phase X

The Contractor shall include a hammock type activity for each project phase called "Phase X" where "X" refers to the phase of work. The "Phase X" activity shall be logically tied to the earliest and latest activities in the phase.

3.3.5 Default Progress Data Disallowed

Actual Start and Finish dates shall not be automatically updated by default mechanisms that may be included in CPM scheduling software systems. Actual Start and Finish dates on the CPM schedule shall match those dates provided from Contractor Quality Control Reports. Failure of the Contractor to document the Actual Start and Finish dates on the Daily Quality Control report for every in-progress or completed activity, and failure to ensure that the data contained on the Daily Quality Control reports is the sole basis for schedule updating, shall result in the disapproval of the Contractor's schedule and the inability of the Contracting Officer to evaluate Contractor progress for payment purposes. Updating of the percent complete and the remaining duration of any activity shall be independent functions. Program features which calculate one of these parameters from the other shall be disabled.

3.3.6 Out-of-Sequence Progress

Activities that have posted progress without all preceding logic being satisfied (Out-of-Sequence Progress) will be allowed only on a case-by-case approval of the Contracting Officer. The Contractor shall propose logic corrections to eliminate all out of sequence progress or justify not changing the sequencing for approval prior to submitting an updated project schedule.

3.3.7 Negative Lags

Lag durations contained in the project schedule shall not have a negative value.

3.4 PROJECT SCHEDULE SUBMISSIONS

The Contractor shall provide the submissions as described below. The data disk, reports, and network diagrams required for each submission are contained in paragraph SUBMISSION REQUIREMENTS.

3.4.1 Preliminary Project Schedule Submission

The Preliminary Project Schedule, defining the Contractor's planned operations for the first 60 calendar days shall be submitted for approval within 20 calendar days after the NTP is acknowledged. The approved preliminary schedule shall be used for payment purposes not to exceed 60 calendar days after NTP.

3.4.2 Initial Project Schedule Submission

The Initial Project Schedule shall be submitted for approval within 40 calendar days after NTP. The schedule shall provide a reasonable sequence of activities which represent work through the entire project and shall be at a reasonable level of detail.

3.4.3 Periodic Schedule Updates

Based on the result of progress meetings, specified in "Periodic Progress Meetings", the Contractor shall submit periodic schedule updates. These submissions shall enable the Contracting Officer to assess Contractor's progress. If the Contractor fails or refuses to furnish the information and project schedule data, which in the judgement of the Contracting Officer or authorized representative is necessary for verifying the Contractor's progress, the Contractor shall be deemed not to have provided an estimate upon which progress payment may be made.

3.4.4 Standard Activity Coding Dictionary

The Contractor shall use the activity coding structure defined in the Standard Data Exchange Format (SDEF) in ER 1-1-11, Appendix A. This exact structure is mandatory, even if some fields are not used.

3.5 SUBMISSION REQUIREMENTS

The following items shall be submitted by the Contractor for the preliminary submission, initial submission, and every periodic project schedule update throughout the life of the project:

3.5.1 Data Disks

Two data disks containing the project schedule shall be provided. Data on the disks shall adhere to the SDEF format specified in ER 1-1-11, Appendix A.

3.5.1.1 File Medium

Required data shall be submitted on 3.5 in. disks, formatted to hold 1.44 MB of data, under the MS-DOS Version 5. or 6.x, unless otherwise approved by the Contracting Officer.

3.5.1.2 Disk Label

A permanent exterior label shall be affixed to each disk submitted. The

label shall indicate the type of schedule (Preliminary, Initial, Update, or Change), full contract number, project name, project location, data date, name and telephone number of the person responsible for the schedule, and the MS-DOS version used to format the disk.

3.5.1.3 File Name

Each file submitted shall have a name related to either the schedule data date, project name, or contract number. The Contractor shall develop a naming convention that will ensure that the names of the files submitted are unique. The Contractor shall submit the file naming convention to the Contracting Officer for approval.

3.5.2 Narrative Report

A Narrative Report shall be provided with the preliminary, initial, and each update of the project schedule. This report shall be provided as the basis of the Contractor's progress payment request. The Narrative Report shall include: a description of activities along the 2 most critical paths, a description of current and anticipated problem areas or delaying factors and their impact, and an explanation of corrective actions taken or required to be taken. The narrative report is expected to relay to the Government, the Contractor's thorough analysis of the schedule output and its plans to compensate for any problems, either current or potential, which are revealed through that analysis.

3.5.3 Approved Changes Verification

Only project schedule changes that have been previously approved by the Contracting Officer shall be included in the schedule submission. The Narrative Report shall specifically reference, on an activity by activity basis, all changes made since the previous period and relate each change to documented, approved schedule changes.

3.5.4 Schedule Reports

The format for each activity for the schedule reports listed below shall contain: Activity Numbers, Activity Description, Original Duration, Remaining Duration, Early Start Date, Early Finish Date, Late Start Date, Late Finish Date, Total Float. Actual Start and Actual Finish Dates shall be printed for those activities in progress or completed.

3.5.4.1 Activity Report

A list of all activities sorted according to activity number.

3.5.4.2 Logic Report

A list of Preceding and Succeeding activities for every activity in ascending order by activity number. Preceeding and succeeding activities shall include all information listed above in paragraph Schedule Reports. A blank line shall be left between each activity grouping.

3.5.4.3 Total Float Report

A list of all incomplete activities sorted in ascending order of total float. Activities which have the same amount of total float shall be listed in ascending order of Early Start Dates. Completed activities shall not be shown on this report.

3.5.4.4 Earnings Report

A compilation of the Contractor's Total Earnings on the project from the NTP until the most recent Monthly Progress Meeting. This report shall reflect the Earnings of specific activities based on the agreements made in the field and approved between the Contractor and Contracting Officer at the most recent Monthly Progress Meeting. Provided that the Contractor has provided a complete schedule update, this report shall serve as the basis of determining Contractor Payment. Activities shall be grouped by offer item and sorted by activity numbers. This report shall: sum all activities in an offer item and provide an offer item percent; and complete and sum all offer items to provide a total project percent complete. The printed report shall contain, for each activity: the Activity Number, Activity Description, Original Budgeted Amount, Total Quantity, Quantity to Date, Percent Complete (based on cost), and Earnings to Date.

3.5.5 Network Diagram

The network diagram shall be required on the initial schedule submission and on monthly schedule update submissions. The network diagram shall depict and display the order and interdependence of activities and the sequence in which the work is to be accomplished. The Contracting Officer will use, but is not limited to, the following conditions to review compliance with this paragraph:

3.5.5.1 Continuous Flow

Diagrams shall show a continuous flow from left to right with no arrows from right to left. The activity number, description, duration, and estimated earned value shall be shown on the diagram.

3.5.5.2 Project Milestone Dates

Dates shall be shown on the diagram for start of project, any contract required interim completion dates, and contract completion date(s).

3.5.5.3 Critical Path

The critical path shall be clearly shown.

3.5.5.4 Banding

Activities shall be grouped to assist in the understanding of the activity sequence. Typically, this flow will group activities by category of work, work area and/or responsibility.

3.5.5.5 S-Curves

Earnings curves showing projected early and late earnings and earnings to date.

3.6 PERIODIC PROGRESS MEETINGS

Progress meetings to discuss payment shall include a monthly onsite meeting or other regular intervals mutually agreed to at the preconstruction conference. During this meeting the Contractor shall describe, on an activity by activity basis, all proposed revisions and adjustments to the project schedule required to reflect the current status of the project.

The Contracting Officer will need to approve activity progress, proposed revisions, and adjustments as appropriate.

3.6.1 Meeting Attendance

The Contractor's Project Manager and Scheduler shall attend the regular progress meeting.

3.6.2 Update Submission Following Progress Meeting

A complete update of the project schedule containing all approved progress, revisions, and adjustments, based on the regular progress meeting, shall be submitted not later than 4 working days after the monthly progress meeting.

3.6.3 Progress Meeting Contents

Update information, including Actual Start Dates, Actual Finish Dates, Remaining Durations, and Cost-to-Date shall be subject to the approval of the Contracting Officer. As a minimum, the Contractor shall address the following items on an activity by activity basis during each progress meeting.

3.6.3.1 Start and Finish Dates

The Actual Start and Actual Finish dates for each activity currently in-progress or completed.

3.6.3.2 Time Completion

The estimated Remaining Duration for each activity in-progress. Time-based progress calculations shall be based on Remaining Duration for each activity.

3.6.3.3 Cost Completion

The earnings for each activity started. Payment will be based on earnings for each in-progress or completed activity. Payment for individual activities will not be made for work that contains quality defects. A portion of the overall project amount may be retained based on delays of activities.

3.6.3.4 Logic Changes

All logic changes pertaining to NTP on change orders, change orders to be incorporated into the schedule, Contractor proposed changes in work sequence, corrections to schedule logic for out-of-sequence progress, lag durations, and other changes that have been made pursuant to contract provisions shall be specifically identified and discussed.

3.6.3.5 Other Changes

Other changes required due to delays in completion of any activity or group of activities include: 1) delays beyond the Contractor's control, such as strikes and unusual weather; 2) delays encountered due to submittals, Government Activities, deliveries or work stoppages which make re-planning the work necessary; 3) changes required to correct a schedule which does not represent the actual or planned prosecution and progress of the work.

3.7 REQUESTS FOR TIME EXTENSIONS

In the event the Contractor requests an extension of the contract completion date, or any interim milestone date, the Contractor shall furnish the following for a determination as to whether or not the Contractor is entitled to an extension of time under the provisions of the contract: justification, project schedule data, and supporting evidence as the Contracting Officer may deem necessary. Submission of proof of delay, based on revised activity logic, duration, and costs (updated to the specific date that the delay occurred) is obligatory to any approvals.

3.7.1 Justification of Delay

The project schedule shall clearly display that the Contractor has used, in full, all the float time available for the work involved with this request. The Contracting Officer's determination as to the number of allowable days of contract extension shall be based upon the project schedule updates in effect for the time period in question, and other factual information. Actual delays that are found to be caused by the Contractor's own actions, which result in the extension of the schedule, will not be a cause for a time extension to the contract completion date.

3.7.2 Submission Requirements

The Contractor shall submit a justification for each request for a change in the contract completion date of under 2 weeks based upon the most recent schedule update at the time of the NTP or constructive direction issued for the change. Such a request shall be in accordance with the requirements of other appropriate Contract Clauses and shall include, as a minimum:

a. A list of affected activities, with their associated project schedule activity number.

b. A brief explanation of the causes of the change.

c. An analysis of the overall impact of the changes proposed.

d. A sub-network of the affected area.

Activities impacted in each justification for change shall be identified by a unique activity code contained in the required data file.

3.7.3 Additional Submission Requirements

For any requested time extension of over 2 weeks, the Contracting Officer may request an interim update with revised activities for a specific change request. The Contractor shall provide this disk within 4 days of the Contracting Officer's request.

3.8 DIRECTED CHANGES

If the NTP is issued for changes prior to settlement of price and/or time, the Contractor shall submit proposed schedule revisions to the Contracting Officer within 2 weeks of the NTP being issued. The proposed revisions to the schedule will need to be approved by the Contracting Officer prior to inclusion of those changes within the project schedule. If the Contractor fails to submit the proposed revisions, the Contracting Officer may furnish the Contractor with suggested revisions to the project schedule. The Contractor shall include these revisions in the project schedule until

revisions are submitted, and final changes and impacts have been negotiated. If the Contractor has any objections to the revisions furnished by the Contracting Officer, the Contractor shall advise the Contracting Officer within 2 weeks of receipt of the revisions. Regardless of the objections, the Contractor shall continue to update the schedule with the Contracting Officer's revisions until a mutual agreement in the revisions is reached. If the Contractor fails to submit alternative revisions within 2 weeks of receipt of the Contracting Officer's proposed revisions, the Contractor will be deemed to have concurred with the Contracting Officer's proposed revisions. The proposed revisions will then be the basis for an equitable adjustment for performance of the work.

3.9 OWNERSHIP OF FLOAT

Float available in the schedule, at any time, shall not be considered for the exclusive use of either the Government or the Contractor.

3.10 ATTACHMENT

Standard Data Exchange Format Specification (Appendix A)

APPENDIX A

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STANDARD DATA EXCHANGE FORMAT SPECIFICATION

PART 1- GENERAL

1. Application of This Provision: The Standard Data Exchange Format (SDEF) provides a non-proprietary protocol to exchange project planning and progress data between scheduling systems.

2. File Type and Format: The data file shall consist of a 132 character, freed format, "ASCII" file. Text shall be left-justified and numbers shall be right-justified in each field. Data records must conform, exactly, to the sequence, column position, maximum length, mandatory values, and field definitions described below to comply with the SDEF. Unless specifically stated, all numbers shall be whole numbers. Fields containing numbers shall not be zero filled. All data columns shall be separated by a single blank column. The file shall not contain blank lines.

3. Usage Notes: Where appropriate, notes regarding proper usage of systems to support the SDEF have been included in brackets ([ ]). These notes are included to assist users in creating SDEF-compatible files, given the variety of software systems that support the SDEF.

4. Recommended Systems: Several systems have been tested to determine the accuracy of importing and exporting SDEF files. For information on the current list of recommended systems, please contact Mr. Stan Green at HQUSACE, (202) 761-0206. Although the currently listed system have been tested other systems may also be acceptable provided those systems correctly import and export SDEF files.

5. SDEF Checker Program: A program that checks whether a file meets the SDEF is available free of charge. A copy of this program may be obtained by written request to: U.S. Army Corps of Engineers, ATTN: Mr. Bill East (CECER-FFA), P.O. Box 9005, Champaign, IL 61826-90005. A description of the SDEF Checker is also available on the Internet and CivilNet.

PART 2- SDEF SPECIFICATION

6. SDEF Organization: The SDEF shall consist of the following records provided in the exact sequence shown below:

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Paragraph Reference	Record Description	Remarks
6.a	Volume Record	Mandatory First Line of File
6.b	Project Record	Mandatory Second Line of File
6.c	Calendar Record(s)	Mandatory One Record Minimum
6.d	Holiday Record(s)	Mandatory if Holidays Used
6.e	Activity Record(s)	Mandatory Records
6.f	Precedence Record(s)	Mandatory for Precedence
6.g	Unit Cost Record(s)	Mandatory for Unit Costs
6.h	Progress Record(s)	Mandatory Records
6.i	File End Record	Mandatory Last Line of Disk/File

6.a. Volume Record: The Volume Record shall be used to control the transfer of data that may not fit on a single disk. The first line in every file used to store SDEF data shall be the Volume Record. The Volume Record shall sequentially identify the number of the data transfer disk(s). The Volume Record shall have the following format:

Description	Column Position	Max. Len.	Req. Value	Type	Notes
RECORD IDENTIFIER	1 - 4	4	VOLM	Fixed	Filled
DISK NUMBER	6 - 7	2	√	Number	Right Justified

6.a.(l) The RECORD IDENTIFIER is the first four characters of this record. The required value for this field shall be "VOLM". The VOLM record must appear on the first line of the SDEF data file.

6.a.(2) The DISK NUMBER field shall identify the number of the data disk used to store the data exchange information. If all data may be contained on a single disk, this field shall contain the value of "l". If more disks are required, then the second disk shall contain the value "2", the third disk shall be designated with a "3", and so on. Identifcation of the last data disk is accomplished in the Reject End Record.

6.b. Project Record: The Project Identifier Record shall contain general project information. Because more than one SDEF file may be required for data transfer between large projects, the PROJ record shall be the second line of the first SDEF file transferred. The PROJ record shall contain information in the following format:

Description	Column Position	Max. Len.	Req. Value	Type	Notes
RECORD IDENTIFIER	1- 4	4	PROJ	Fixed	Filled
DATA DATE	6- 12	7	√	ddmmmyy	Filled
PROJECT IDENTIFIER	14-17	4	√	Alpha.	Left Justified
PROJECT NAME	19-66	48	√	Alpha.	Left Justified
CONTRACTOR NAME	68-103	36	√	Alpha.	Left Justified
ARROW OR PRECEDENCE	105-105	1	A,P	Fixed	Filled
CONTRACT NUMBER	107-112	6	√	Alpha.	Left Justified
PROJECT START	114-120	7	√	ddmmmyy	Filled
PROJECT END	122-128	7	√	ddmmmyy	Filled

6.b.(1) The RECORD IDENTIFIER is the first four characters of this record. The required value for this field shall be "PROJ". This record shall contain the general project information and indicates which scheduling method shall be used.

6.b.(2) The DATA DATE is the date of the schedule calculation. The abbreviation "ddmmmyy" refers to a date format that shall translate a date into two numbers for the day, three letters for the month, and two numbers for the year. For example, March 1, 1999 shall be translated into OlMar99. This same convention for date formats shall be used throughout the entire data format. To ensure that dates are translated consistently, the following abbreviations shall be used for the three character month code:

Abbreviation	Month
JAN	January
FEB	February
MAR	March
APR	April
MAY	May
JUN	June
JUL	July
AUG	August
SEP	September
OCT	October
NOV	November
DEC	December

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6.b.(3) The PROJECT IDENTIFIER is a maximum four character abbreviation for the schedule. These four characters shall be used to uniquely identify the project and specific update as agreed upon by Contractor and Contracting Officer. When utilizing scheduling software these four characters shall be used to select the project. Software manufacturers shall provide information to users to ensure that data importing programs do not automatically overwrite other schedules with the same PROJECT IDENTIFIER.

6.b.(4) The PROJECT NAME field shall contain the name and location of the project edited to fit the space provided. The data appearing here shall appear on scheduling software reports. The abbreviation "Alpha." refers to an "Alphanumeric" field value and shall be used throughout the remainder of this specification.

6.b.(5) The CONTRACTOR NAME field shall contain the Construction Contractor's name, edited to fit the space provided.

6.b.(6) The ARROW OR PRECEDENCE field shall indicate which method shall be used for calculation of the schedule. The value "A" shall signify the Arrow Diagramming Method. The value "P" shall signify the Precedence Diagramming Method. The ACTIVITY ID field of the Activity Record shall be interpreted differently depending on the value of this field. The Precedence Record shall be required if the value of this field is "P". [Usage note: software systems may not support both arrow and precedence diagramming. It is recommended that the selection of the type of network be based on the capabilities of the software used by project partners.]

6.b.(7) The CONTRACT NUMBER field shall contain the contract number for the project. For example, the construction contract number DACA85-89-C-0001 shall be entered into this field as "890001".

6.b.(8) The PROJECT START field shall contain the date that the Contractor acknowledges the Notice to Proceed (NTP). [Usage note: Software systems may use a project start date to constrain the first activity of a network. To ensure consistent scheduling calculations across products, it is recommended that the first activity in the schedule contain an EARLY START constraint and a software system's PROJECT START date only be used to report on the project's start date.]

6.b.(9) The PROJECT END field shall contain the date that the Contractor plans to complete the work as approved by the Contracting Officer. [Usage note: software systems may use a project end date to constrain the last activity of a network. To ensure consistent scheduling calculations across products, it is recommended that the last activity in the schedule contain an EARLY START constraint and a software system's PROJECT END date only be used to report on the project's end date.]

6.c. Calendar Record: The Calendar Record(s) shall follow the Project Identifier Record in the first disk of data transferred. A minimum of one Calendar Record shall be required for all data exchange activity files. The format for the Calendar Record shall be as follows:

Description	Column Position	Max. Len.	Req. Value	Type	Notes
RECORD IDENTIFIER	1 - 4	4	CLDR	FixedFilled	
CALENDAR CODE	6 - 6	1	√	Alpha.	Filled
WORKDAYS	8 - 14		SMTWTFS	Fixed	Filled
CALENDAR DESCRIPTION	16-45	30	√	Alpha.	Left Justified

6.c.(1) The RECORD IDENTIFIER shall always begin with "CLDR" to identify it as a Calendar Record. Each Calendar Record used shall have this identification in the first four columns. [Usage note: Systems contain a variety of calendar options. It is recommended that the least common denominator of calendar features between the systems be used as the basis for creating the SDEF file for a given project.]

6.c.(2) The CALENDAR CODE shall be used in the activity records to signify that this calendar is associated with the activity. [Usage note: Some systems do not allow for alphanumeric CALENDAR CODES, but only allow positive integers from 1 to 9. It is recommended that only positive integers be used for the CALENDAR CODE field to support the widest variety of scheduling systems.]

6.c.(3) The WORKDAYS field shall contain the work-week pattern selected with "Y", for Yes, and "N", for No. The first character shall be Sunday and the last character Saturday. An example of a typical five (5) day work-week would be NYYYYYN. A seven (7) day work-week would be YYYYYYY.

6.c.(4) The CALENDAR DESCRIPTION shall be used to briefly describe the calendar used.

6.d. Holiday Record: The Holiday Record(s) shall follow the Calendar Record(s) in the first disk of data transferred. There may be calendars without any holidays designated or several Holiday Records for each Calendar Record(s). The format for the Holiday Record shall be as follows:

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Description	Column Position	Max. Len.	Req. Value	Type	Notes
RECORD IDENTIFIER	1 - 4	4	HOLI	Fixed	Filled
CALENDAR CODE	6 - 6	1	√	Alpha.	Filled
HOLIDAY DATE	8 - 14	7	√	ddmmmyy	Filled
HOLIDAY DATE	16-22		-	ddmmmyy	May be Filled
HOLIDAY DATE	24-30		-	ddmmmyy	May be Filled
HOLIDAY DATE	32-38		-	ddmmmyy	May be Filled
HOLIDAY DATE	40-46		-	ddmmmyy	May be Filled
HOLIDAY DATE	48-54		-	ddmmmyy	May be Filled
HOLIDAY DATE	56-62		-	ddmmmyy	May be Filled
HOLIDAY DATE	64-70		-	ddmmmyy	May be Filled
HOLIDAY DATE	72-78		-	ddmmmyy	May be Filled
HOLIDAY DATE	80-86		-	ddmmmyy	May be Filled
HOLIDAY DATE	88-94		-	ddmmmyy	May be Filled
HOLIDAY DATE	96-102		-	ddmmmyy	May be Filled
HOLIDAY DATE	104-110		-	ddmmmyy	May be Filled
HOLIDAY DATE	112-118		-	ddmmmyy	May be Filled
HOLIDAY DATE	120-126		-	ddmmmyy	May be Filled

6.d.(1) The RECORD IDENTIFIER shall always begin with "HOLI". Each Holiday Record used shall have this identification in the first four columns.

6.d.(2) The CALENDAR CODE indicates which work-week calendar the holidays shall be applied to. More than one HOLI record may be used for a given CALENDAR CODE.

6.d.(3) The HOLIDAY DATE shall contain the date of each individual non-work day.

6.e. Activity Records: Activity Records shall follow any Holiday Record(s). If there are no Holiday Record(s), then the Activity Records shall follow the Calendar Record(s). There shall be one Activity Record for every activity in the network. Each activity shall have one record in the following format:

Description	Column Position	Max. Len.	Req. Value	Type	Notes
RECORD IDENTIFIER	1-4	4	ACTV	Fixed	Filled
ACTIVITY ID	6-15	10	√	Integer	See Comment Below
ACTIVITY DESCR.	17-46	30	√	Alpha.	Left Justified
ACTIVITY DURATION	48-50	3	√	Integer	Right Justified
CONSTRAINT DATE	52-58	7		ddmmmyy	May be Filled
CONSTRAINT TYPE	60-61	2		ES or LF	May be Filled
CALENDAR CODE	63-63	1		Alpha.	Filled
HAMMOCK CODE	65-65	1	Y, blank	Fixed	May be Filled
WORKERS PER DAY	67-69	3		Integer	Right Justified
RESPONSIBILITY CODE	71-74	4		Alpha.	Left Justified
WORK AREA CODE	76-79	4		Alpha.	Left Justified
MOD OR CLAIM NO.	81-86	6		Alpha.	Left Justified
BID ITEM	88-93	6		Alpha.	Left Justified
PHASE OF WORK	95-96	2		Alpha.	Left Justified
CATEGORY OF WORK	98-98	1		Alpha.	May be Filled
FEATURE OF WORK	100-128	30		Alpha.	Left Justified

6.e.(1) The RECORD IDENTIFIER for each activity description record must begin with the four character "ACTV" code. This field shall be used for both the Arrow Diagram Method (ADM) and Precedence Diagram Method (PDM),

6.e.(2) The ACTIVITY ID consists of coding that shall differ, depending on whether the ADM or PDM method was selected in the Project Record. If the ADM method was selected then the field shall be interpreted as two right-justified fields of five (5) integers each. If the PDM method was selected the field shall be interpreted as one (1) right-justified field of ten (10) integers each. The maximum activity number allowed under this arrangement is 99999 for ADM and 9999999999 for the PDM method. [Usage note: Many systems allow alphanumeric ACTIVITY IDs. While the SDEF does not strictly, allow the use of alphanumeric values, users may agree to use the ACTIVITY ID field to exchange alphanumeric data. It is recommended that the ACTIVITY ID be restricted to integers when one or more of the systems being used for scheduling allows only integer ACTIVITY ID values.]

6.e.(3) The ACTIVITY DESCRIPTION shall be a maximum of 30 characters. Descriptions must be limited to the space provided.

6.e.(4) The ACTIVITY DURATION contains the estimated original duration for the activity on the schedule. The duration shall be based upon the work-week designated by the activity's related calendar.

6.e.(5) The CONSTRAINT DATE field shall be used to identify a date that the scheduling system may use to modify float calculations. If there is a date in this field, then there must be a valid entry in the CONSTRAINT TYPE field.

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6.e.(6) The CONSTRAINT TYPE field shall be used to identify the way that the scheduling system shall use the CONSTRAINT DATE to modify schedule float calculations. If there is a value in this field, then there must be a valid entry in the CONSTRAINT DATE field. The valid values for the CONSTRAINT TYPE are as follows:

Definition

The CONSTRAINT DATE shall replace an activity's early start date, if the early start date is prior to the CONSTRAINT DATE.
The CONSTRAINT DATE shall replace an activity's late finish date, if the late finish date is after the CONSTRAINT DATE.

[Usage note: Systems provide a wide variety of constraint types that may not be supported by other systems. It is recommended that constraint types be restricted to the values above regardless of the capabilities of the various systems being used for scheduling.]

6.e.(7) The CALENDAR CODE relates this activity to an appropriate work-week calendar. The ACTIVITY DURATION must be based on the valid work-week referenced by this CALENDAR CODE field.

6.e.(8) The HAMMOCK CODE indicates that a particular activity does not have its own independent duration, but takes its start dates from the start date of the preceding activity (or node) and takes its finish dates from the finish dates of its succeeding activity (or node). If the value of the HAMMOCK CODE field is "Y", then the activity is a hammmock activity.

6.e.(9) The WORKERS PER DAY shall contain the average number of workers expected to work on the activity each day the activity is in progress. If this code is required by project scheduling specifications, values for this data will be right justified. Activities without workers per day shall have a value of "0".

6.e.(10) The RESPONSIBILITY CODE shall identify the subcontractors or major trade involved with completing the work for the activity. If this code is required by project scheduling specifications, value for this data will be left justified.

6.e.(11) The WORK AREA CODE shall identify the location of the activity within the project. If this code is required by project scheduling specifications, value for this data will be left justified.

6.e.(12) The MOD OR CLAIM NUMBER shall uniquely identify activities that are added or changed on a construction contract modification, or activities that justify any claimed time extensions. If this code is required by project scheduling specifications, value for this data will be left justified.

6.e.(13) The BID ITEM shall identify the bid item number associated with each activity. If this code is required by project scheduling specifications, value for this data will be left justified.

6.e.(14) The PHASE OF WORK shall identify the timing of a specific activity within the entire project. If this code is required by project scheduling specifications, value for this data will be left justified.

6.e.(15) The CATEGORY OF WORK shall identify the general type of work performed by every activity. If this code is required by project scheduling specifications, value for this data will be placed in the field.

6.e.(16) The FEATURE OF WORK shalI identify a very broad designation of the general type of work that is being accomplished by the activity. If this code is required by project scheduling specifications, value for this data will be left justified. [Usage note: Many systems require that FEATURE OF WORK values be placed in several activity code fields. It is recommended that users review SDEF documentation to determine the correct way to use a given software system to produce the FEATURE OF WORK code.]

6.f. Precedence Record: The Precedence Record(s) shall follow the Activity Records if a Precedence Diagram Method schedule (PDM) is identified in the ARROW OR PRECEDENCE field of the Project Record. The Precedence Record has the following format:

Description	Column Position	Max. Len.	Req. Value	Type	Notes
RECORD IDENTIFIER	1 - 4	4	PRED	Fixed	Filled
ACTIVITY ID	6-15	10	√	Integer	See Comment Below
PRECEDING ACTIVITY	17 -26	10	√	Integer	See Comment Below
PREDECESSOR TYPE	28-28		√	S, F, C	Filled
LAG DURATION	30-33	4	√	Integer	Right Justified

6.f.(1) The RECORD IDENTIFIER shall begin with the four characters "PRED" in the first four columns of the record.

6.f.(2) The ACTIVITY ID identifies the activity whose predecessor shall be specified in this record.

6.f.(3) The PRECEDING ACTIVITY number is the number of an activity that precedes the activity noted in the ACTIVITY ID field.

6.f.(4) The PREDECESSOR TYPE field indicates the type of relation that exists between the chosen pair of activities. Valid PREDECESSOR TYPE fields areas follows:

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Code	Definition
S	Start-to-Start relation
F	Finish-to-Finish relation
C	Finish-to-Start relation

[Usage note: Some systems provide additional predecessor types that may not be supported by all other systems. It is recommended that predecessor types be restricted to the values above regardless of the capabilities of the various systems being used for scheduling.]

6.f.(5) The LAG DURATION field contains the number of days delay between the preceding and current activity. [Usage note: Some systems allow negative values for the LAG DURATION. Because these values are not supported by all other systems, it is recommended that values be restricted to zero and positive integers.]

6.g. Unit Cost Record: The Unit Cost Record shall follow all Precedence Records. If the schedule utilizes the Arrow Diagram Method, then the Unit Cost Record shall follow any Activity records. There shall be one Unit Cost Record for every activity that is not a lump sum activity. [Usage note: (1) It is recommended that users who wish to exchange unit cost data contact SDEF vendor representatives to determine the ability of the software system to import/export unit cost information. (2) If the software being used by each member of the project team supports unit cost data then users may wish to conduct a trial run of the SDEF data exchange with a two or three-activity network to ensure that unit cost data transfers as expected. If problems are found please consult vendor representatives for resolution prior to exchange of full project schedules. (3) Unit cost record data does not, in most systems, result in the correct values being placed in the ACTIVITY COST and COST TO DATE fields of the Progress (PROG) Record. Users must, at this time, manually transfer the data from the Unit Cost Record to the Progress Record.

The fields for this record shall take the following format:

Description	Column Position	Max. Len.	Req. Value	Type	Notes
RECORD IDENTIFIER	1 - 4	4	UNIT	Fixed	Filled
ACTIVITY ID	6-15	10	√	Integer	See Comment Below
TOTAL QTY	17-29	13	√	Format 8.4	Right Justified
COST PER UNIT	31-43	13	√	Format 8.4	Right Justified
QTY TO DATE	45-57	13	√	Format 8.4	Right Justified
UNIT OF MEASURE	59-61	3	√	Alpha.	Left Justified

6.g.(1) The RECORD IDENTIFIER shall be identified with the four characters 'UNIT" placed in the first four columns of the record.

6.g.(2) The ACTIVITY ID for each activity shall match the format described in the activity record. Each activity may have only one Unit Cost Record.

6.g.(3) The TOTAL QTY is the total amount of material to be used in this activity. This number consists of eight digits, one decimal point and four more digits. An example of a number in this format is "11111111.1111". If decimal places are not needed this field shall still contain a ".0000" in columns 25-29. [Usage note: Many systems support a different format for this value that does not include as many decimal places. It is recommended that users determine their requirements for significant digits based on the lowest common denominator of the software systems being used for a given project.]

6.g.(4) The COST PER UNIT is the cost, in dollars and cents, for each unit to be used in this activity. This number consists of eight digits, one decimal point, and four more digits. An example of a number in this format is "11111111.1111". If decimal places are not needed this field shall still contain a ".0000" in columns 39-43. [Usage note: Many systems support a different format for this value that does not include as many decimal places. It is recommended that users determine their requirements for significant digits based on the lowest common denominator of the software systems being used for a given project.]

6.g.(5) The QTY TO DATE is the quantity of material installed in this activity up to the data date. This number consists of eight digits, one decimal point, and four more digits. An example of a number in this format is "11111111.1111". If decimal places are not needed this field shall still contain a ".0000" in columns 53-57. [Usage note: Many systems support a different format for this value that does not include as many decimal places. It is recommended that users determine their requirements for significant digits based on the lowest common denominator of the software systems being used for a given project.]

6.g.(6) The UNIT OF MEASURE is an abbreviation that may be used to describe the units being measured for this activity. Valid values for this field are any meaningful English or metric unit, except "LS" for Lump Sum. Lump Sum activities are not to have Unit Cost Records.

6.h. Progress Record: Progress Record(s) shall follow all Unit Cost Record(s). If there are no Unit Cost Record(s), then the Progress Record(s) shall follow all Precedence Records. If the schedule utilizes the Arrow Diagram Method, then the Progress Record shall follow any Activity Records. One Progress Record is required for every activity in the Activity Record. The fields for this Record shall be provided in the following format:

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Description	Column Position	Max. Len.	Req. Value	Type	Notes
RECORD IDENTIFIER	1-4	4	PROG	Fixed	Filled
ACTIVITY ID	6-5	10	√	Integer	See Comment Below
ACTUAL START DATE	17-23	7	√	ddmmmyy	Filled if Started
ACTUAL FINISH DATE	25-31	7	√	ddmmmyy	Filled if Finished
REMAINING DURATION	33-35	3	√	Integer	Right Justified
ACTIVITY COST	37-48	12	√	Format 9.2	Right Justified
COST TO DATE	50-61	12	√	Format 9.2	Right Justitied
STORED MATERIAL	63-74	12	√	Format 9.2	Right Justified
EARLY START DATE	76-82	7	√	ddmmmyy	Filled if Not Started
EARLY FINISH DATE	84-90	7	√	ddmmmyy	Filled if Not Finished
LATE START DATE	92-98	7	√	ddmmmyy	Filled if Not Started
LATE FINISH DATE	100-1067		√	ddmmmyy	Filled if Not Finished
FLOAT SIGN	108-1081		+, -	Fixed	Filled if Not Finished
TOTAL FLOAT	110-1123		√	Integer	R. Just. if Not Finished

6.h.(1) The RECORD IDENTIFIER shall begin with the four characters "PROG" in the first four columns of the record.

6.h.(2) The ACTIVITY ID for each activity for which progress has been posted shall match the format described in the Activity Record.

6.h.(3) An ACTUAL START DATE is required for alI in-progress activities. The ACTUAL START DATE shall be the same as, or later than, the PROJECT START date contained in the Project Record. The ACTUAL START DATE shall also be the same as, or prior to, the DATA DATE contained in the Project Record. If there is an ACTUAL START DATE for an activity that there must also be a REMAINING DURATION, and the values for the EARLY START DATE and LATE START DATE are blank. [Usage note: Some systems allow default values for ACTUAL START DATE if the date is not entered by the user. Because the failure to include a start date for activities may result in different schedule calculations, it is recommended that the ACTUAL START DATE be required for all activities in progress.]

6.h.(4) An ACTUAL FINISH DATE is required for all completed activities. If the REMAINING DURATION of an activity is zero, then there must be an ACTUAL FINISH DATE. If there is an ACTUAL FINISH DATE, then values for the EARLY START DATE, LATE START DATE, EARLY FINISH DATE, LATE FINISH DATE, FLOAT SIGN, and TOTAL FLOAT shall be blank. [Usage note: Some systems allow default values for ACTUAL FINISH DATE if the date is not entered by the user. Because the failure to include a finish date for activities may result in different schedule calculations, it is recommended that the ACTUAL FINISH DATE be required for all activities in progress.]

6.h.(5)AREMAININ G DURATION is required for all activities. Activities that have not started shall have a remaining duration equal to their original duration. Activities completed based on time, shall have a zero (0) REMAINING DURATION. [Usage note: Systems have a variety of "short-cut" methods to determine the REMAINING DURATION value. It is recommended that users actually consider the time required to complete the remaining work on a given task, rather than allow a system to calculate the remaining duration based on the amount of work that has already been accomplished.]

6.h.(6) The ACTIVITY COST contains the estimated earned value of the work to be accomplished in the activity. An example of a number in this format is "1111111 11.11". If decimal places are not needed this field shall still contain a ".00" in the last three columns of this field. [Usage note: Users should inquire of software vendors if the user needs to add a zero in the data field to produce the default value "0.00".]

6.h.(7) The COST TO DATE contains the earned value for the activity. If there is an ACTUAL START DATE, then there must also be some value for COST TO DATE. An example of a number in this format is "111111111.11". If decimal places are not needed, this field shall still contain a ".00" in the last three columns of this field. The COST TO DATE is not tied to REMAINING DURATION. For example, if the REMAINING DURATION is "0", the COST TO DATE may only be 95% of the ACTIVITY COST. This difference may be used to reflect 5% retainage for punch list items. [Usage note: Systems implement cost information in different ways. It is recommended that users carefully review SDEF documentation and test results to determine how to ensure that SDEF data is exported correctly.]

6.h.(8) The STORED MATERIAL field contains the value of the material that the Contractor has paid for and is on site or in secure storage areas that is a portion of the COST TO DATE. An example of a number in this format is "111111111.11". If decimal places are not needed, this field shall still contain a ".00" in the last three columns of this field. [Usage note: Systems implement the stored materials field in a variety of ways. Many systems do not enforce STORED MATERIAL + COST TO DATE < ACTIVITY COST. To avoid potential confusion between systems, it is recommended that new activities be added to a schedule to reflect the cost of large equipment procurement rather than use the STORED MATERIALS field.]

6.h.(9) The EARLY START DATE indicates the earliest date possible that an activity can start as calculated by a CPM scheduling system or other Contracting Officer approved planning method. If the progress record for an activity contains an ACTUAL START DATE, then this field shall be blank.

6.h.(10) The EARLY FINISH DATE indicates the earliest date possible that an activity can finish as calculated by a CPM scheduling system or other Contracting Officer approved planning method. If the progress record for an activity contains an ACTUAL FINISH DATE, then this field shall be blank.

6.h.(11) The LATE START DATE indicates the latest date that an activity can begin as calculated by a CPM scheduling system or other Contracting Officer approved planning method. If the progress record for an activity contains an ACTUAL START DATE, then this field shall be blank.

6.h.(12) The LATE FINISH DATE indicates the latest date that an activity can finish as calculated by a CPM scheduling system or other Contracting Officer approved planning method. If the progress record for an activity contains an ACTUAL FINISH DATE, then this field shall be blank.

6.h.(13) The FLOAT SIGN indicates whether the float time calculated using a CPM scheduling system or other Contracting Officer approved planning method, is positive or negative in nature. If the progress record for an activity contains an ACTUAL FINISH DATE, then this field shall be blank. In the case of zero float this field shall be blank.

6.h.(14) The TOTAL FLOAT indicates the total float time. In the Precedence Diagram Method (PDM), the total float is the difference between the early and late start or finish dates. In the Arrow Diagram Method (ADM), the total float is equal to the late event time at the end of the activity, minus the sum of the early event time at the start of the activity plus the duration of the activity.

6.i. Project End Record: The Project End Record shall be used to identify that the data file is completed. If the ASCII End of File character is encountered, then data import programs shall use that character to infer that the data continues on the next disk. The user shall then be prompted for the next disk number, based on the VOLM record data. The Project End Record shall be the last record of the entire data file, and shall have the following format:

Description	Column Position	Max. Len.	Req. Value	Type	Notes
RECORD IDENTIFIER	1-3	3	END	Fixed	Filled

6.i.(1) The RECORD IDENTIFIER for the Project End Record shall be "END". Data contained in the data exchange file that occurs after this record shall not be used.

--END OF SECTION--

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SECTION 01330

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SECTION 01330

SUBMITTAL PROCEDURES

PART 1 GENERAL

1.1 SUBMITTAL IDENTIFICATION (SD)

Submittals required are identified by SD numbers and titles as follows:

SD-01 Preconstruction Submittals

SD-02 Shop Drawings

SD-03 Product Data

SD-04 Samples

SD-05 Design Data

SD-06 Test Reports

SD-07 Certificates

SD-08 Manufacturer's Instructions

SD-09 Manufacturer's Field Reports

SD-10 Operation and Maintenance Data

SD-11 Closeout Submittals

1.2 SUBMITTAL CLASSIFICATION

Submittals are classified as follows:

1.2.1 Government Approved

Government approval is required for extensions of design, critical materials, deviations, equipment whose compatibility with the entire system must be checked, and other items as designated by the Contracting Officer. Within the terms of the Contract Clause entitled "Specifications and Drawings for Construction," they are considered to be "shop drawings."

1.2.2 Information Only

All submittals not requiring Government approval will be for information only. They are not considered to be "shop drawings" within the terms of the Contract Clause referred to above.

1.3 APPROVED SUBMITTALS

The Contracting Officer's approval of submittals shall not be construed as a complete check, but will indicate only that the general method of construction, materials, detailing and other information are satisfactory.

Approval will not relieve the Contractor of the responsibility for any error which may exist, as the Contractor under the Contractor Quality Control (CQC) requirements of this contract is responsible for dimensions, the design of adequate connections and details, and the satisfactory construction of all work. After submittals have been approved by the Contracting Officer, no resubmittal for the purpose of substituting materials or equipment will be considered unless accompanied by an explanation of why a substitution is necessary.

1.4 DISAPPROVED SUBMITTALS

The Contractor shall make all corrections required by the Contracting Officer and promptly furnish a corrected submittal in the form and number of copies specified for the initial submittal. If the Contractor considers any correction indicated on the submittals to constitute a change to the contract, a notice in accordance with the Contract Clause "Changes" shall be given promptly to the Contracting Officer.

1.5 WITHHOLDING OF PAYMENT

Payment for materials incorporated in the work will not be made if required approvals have not been obtained.

1.6 GENERAL

The Contractor shall make submittals as required by the specifications. The Contracting Officer may request submittals in addition to those specified when deemed necessary to adequately describe the work covered in the respective sections. Units of weights and measures used on all submittals shall be the same as those used in the contract drawings. Each submittal shall be complete and in sufficient detail to allow ready determination of compliance with contract requirements. Prior to submittal, all items shall be checked and approved by the Contractor's Quality Control (CQC) System Manager and each item shall be stamped, signed, and dated by the CQC System Manager indicating action taken. Proposed deviations from the contract requirements shall be clearly identified. Submittals shall include items such as: Contractor's, manufacturer's, or fabricator's drawings; descriptive literature including (but not limited to) catalog cuts, diagrams, operating charts or curves; test reports; test cylinders; samples; O&M manuals (including parts list); certifications; warranties; and other such required submittals. Submittals requiring Government approval shall be scheduled and made prior to the acquisition of the material or equipment covered thereby. Samples remaining upon completion of the work shall be picked up and disposed of in accordance with manufacturer's Material Safety Data Sheets (MSDS) and in compliance with existing laws and regulations.

1.7 SUBMITTAL REGISTER

At the end of this section is a submittal register showing items of equipment and materials for which submittals are required by the specifications; this list may not be all inclusive and additional submittals may be required. The Contractor shall maintain a submittal register for the project in accordance with SECTION 01312 QUALITY CONTROL SYSTEM (QCS).

1.8 SCHEDULING

Submittals covering component items forming a system or items that are

interrelated shall be scheduled to be coordinated and submitted concurrently. Certifications to be submitted with the pertinent drawings shall be so scheduled. Adequate time (a minimum of 30 calendar days exclusive of mailing time) shall be allowed and shown on the register for review and approval. No delay damages or time extensions will be allowed for time lost in late submittals.

1.9 TRANSMITTAL FORM (ENG FORM 4025)

The sample transmittal form (ENG Form 4025) attached to this section shall be used for submitting both Government approved and information only submittals in accordance with the instructions on the reverse side of the form. These forms will be furnished to the Contractor. This form shall be properly completed by filling out all the heading blank spaces and identifying each item submitted. Special care shall be exercised to ensure proper listing of the specification paragraph and/or sheet number of the contract drawings pertinent to the data submitted for each item.

1.10 SUBMITTAL PROCEDURES

Submittals shall be made as follows:

1.10.1 Procedures

a. Government Approved and Information Only submittals shall be listed on separate ENG Form 4025's.

b. Sample for testing shall be delivered in accordance with SECTION 01451 CONTRACTOR QUALITY CONTROL. All other submittals shall be delivered to the Contracting Officer.

1.10.2 Deviations

For submittals which include proposed deviations requested by the Contractor, the column "variation" of ENG Form 4025 shall be checked. The Contractor shall set forth in writing the reason for any deviations and annotate such deviations on the submittal. The Government reserves the right to rescind inadvertent approval of submittals containing unnoted deviations.

1.11 CONTROL OF SUBMITTALS

The Contractor shall carefully control his procurement operations to ensure that each individual submittal is made on or before the Contractor scheduled submittal date shown on the approved "Submittal Register."

1.12 GOVERNMENT APPROVED SUBMITTALS

Upon completion of review of submittals requiring Government approval, the submittals will be identified as having received approval by being so stamped and dated. Four copies of the submittal will be retained by the Contracting Officer and one copies of the submittal will be returned to the Contractor.

1.13 INFORMATION ONLY SUBMITTALS

Normally submittals for information only will not be returned. Approval of the Contracting Officer is not required on information only submittals. The Government reserves the right to require the Contractor to resubmit any

item found not to comply with the contract. This does not relieve the Contractor from the obligation to furnish material conforming to the plans and specifications; will not prevent the Contracting Officer from requiring removal and replacement of nonconforming material incorporated in the work; and does not relieve the Contractor of the requirement to furnish samples for testing by the Government laboratory or for check testing by the Government in those instances where the technical specifications so prescribe.

1.14 STAMPS

Stamps used by the Contractor on the submittal data to certify that the submittal meets contract requirements shall be similar to the following:

CONTRACTOR
(Firm Name)
_____ Approved
_____ Approved with corrections as noted on submittal data and/or attached sheets(s).
SIGNATURE: _____
TITLE: _____
DATE: _____

1.15 ATTACHMENTS

Submittal Registers

ENG Form 4025

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

SUBMITTAL REGISTER

CONTRACT NO.
W911KB-04-R-0022

TITLE AND LOCATION
CONSTRUCT TYPE III HYDRANT REFUELING SYSTEM

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH #	CLASSIFICATION	GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION			APPROVING AUTHORITY					REMARKS
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		01015	SD-06 Test Reports															
			Videotapes	1.13														
		01351	SD-02 Shop Drawings															
			Work Zones	1.38.1	G	AO												
			Decontamination Facilities	1.39.1	G	AO												
			SD-03 Product Data															
			Exposure Monitoring/Air Sampling	1.14	G	AO												
			Program															
			Site Control Log	1.38.2	G	AO												
		01355	SD-01 Preconstruction Submittals															
			Environmental Protection Plan	1.7	G	AO												
		01356	SD-05 Design Data															
			Storm Water Pollution Prevention	1.5.1	G	AE												
			Plan (SWPPP)															
			Notice of Intent for Storm Water	1.5.2	G	AE												
			Discharge (NOI)															
			Description of the Project	1.5.2	G	AE												
			Notice of Termination of	1.5.4	G	AE												
			Coverage (NOT)															
			SD-07 Certificates															
			Mill Certificate or Affidavit	2.1.3														
		01400	SD-01 Preconstruction Submittals															
			Accident Prevention Plan	1.11	G	AO												
			Accident Prevention Plan	1.11	G	AO												
			Respiratory Protection	1.6.7.2	G	AO												
			SD-03 Product Data															

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		01400	Airborne	1.6.7.2	G	AO												
			Medical	1.7	G	AO												
			Confined Space	1.6.6.1	G	AO												
			Protection	1.6.7	G	AO												
			Containment	1.9.1	G	AO												
			SD-06 Test Reports															
			Air Monitoring	1.9.2.1	G	AO												
			Airborne	1.6.7.2	G	AO												
			PM-10 Monitoring	1.9.2.1	G	AO												
			Inspection	1.10	G	AO												
			SD-07 Certificates															
			Qualifications	1.11.3	G	AO												
			Qualifications	1.11.3	G	AO												
			Medical Requirements	1.7														
		01450	SD-03 Product Data															
			Sampling and Analysis Plan	3.3	G													
			SD-06 Test Reports															
			Chemistry Data Package	3.4														
			Chemical Data Final Report	3.7	G	EN-E												
		01525	SD-01 Preconstruction Submittals															
			Accident Prevention Plan (APP)	1.8	G													
			Activity Hazard Analysis (AHA)	1.9	G													
			Crane Critical Lift Plan	1.8.1	G													
			SD-06 Test Reports															
			Reports	1.13														
			Accident Reports	1.13.1														

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		01525	Monthly Exposure Reports	1.13.3														
			Regulatory Citations and	1.13.4														
			Violations															
			Crane Reports	1.13.5														
			Certificate of Compliance	1.13.6														
			SD-07 Certificates															
			Confined Space Entry Permit	1.10														
		01730	SD-10 Operation and Maintenance															
			Data															
			Manuals	2.1	G	AE												
		01780	SD-02 Shop Drawings															
			As-Built Drawings	1.3.1	G	RE												
			SD-03 Product Data															
			Warranty Management Plan	1.4.1														
			Warranty Tags	1.4.5														
			Final Cleaning	1.7	G	RE												
			SD-11 Closeout Submittals															
			As-Built Record of Equipment and	1.3.2														
			Materials															
		02111	SD-02 Shop Drawings															
			Surveys	1.3	G	RE												
			SD-03 Product Data															
			Excavation	3.3.1	G	RE &												
			Closure Report	3.8	G	RE &												
			SD-06 Test Reports															
			Backfill	2.1	G	RE &												

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		02111	Surveys	1.3	G RE &													
			Confirmation Sampling and	3.4	G RE &													
			Analysis															
			Sampling of Stored Material	3.6.1	G RE &													
			Sampling	3.6	G RE &													
			Compaction	3.8	G RE &													
		02115	SD-01 Preconstruction Submittals															
			Excavation and material handling	1.7.1	G AO													
			plan															
			Site safety and health plan	3.2	G AO													
			Work plan	1.7.3	G AO													
			SD-06 Test Reports															
			Laboratory Testing	3.18														
			SD-07 Certificates															
			Qualification	1.5	G AO													
			SD-11 Closeout Submittals															
			Closure report	3.23	G AO													
		02218	SD-01 Preconstruction Submittals															
			Tests	3.4														
			Inspections	3.5														
			SD-02 Shop Drawings															
			FML	2.4	G AO													
			SD-03 Product Data															
			Catalog	2.1	G AE													
			SD-04 Samples															
			FML Samples	2.4.2														

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		02218	SD-06 Test Reports															
			FML Factory Test	2.4.3														
			Tests	3.4														
			Inspections	3.5														
			SD-07 Certificates															
			Equipment	1.6.2														
			Qualifications	1.4														
			Verification of Dimensions	1.6.1														
			FML Manufacturer's	3.3.2														
			SD-09 Manufacturer’s Field															
			Reports															
			Instructions	3.3.2														
		02220	SD-03 Product Data															
			Work Plan	3.1	G AO													
			SD-07 Certificates															
			Demolition plan	1.10	G AO													
			SD-11 Closeout Submittals															
			Receipts	1.4.1														
		02230	SD-01 Preconstruction Submittals															
			Disposal of Materials	3.4														
		02276	SD-02 Shop Drawings															
			Geomembrane layout drawing	1.3.1														
			Repair location drawing	1.3.2														
			SD-03 Product Data															
			Geomembrane liner	2.2	G AO													
			Geocushion	2.3														

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		02276	Boot assemblies	2.2.1														
			Attachment hardware	2.2.2														
			SD-06 Test Reports															
			Shop fabrication seam test reports	3.1														
			vacuum box test	3.4.2.2														
			air lance tests	3.4.2.3														
			seam strength tests	3.4.2.1														
			SD-07 Certificates															
			Geomembrane liner installation	1.3.3														
			plan															
			Qualifications	1.3.4														
			Field quality control plan	1.3.5														
			Manufacturer's material warranty	1.3.6														
			Installer's workmanship warranty	1.3.7														
			Subgrade acceptance certificate	1.3.8														
			Geomembrane liner certificate	1.3.9														
			SD-08 Manufacturer’s Instructions															
			Field seaming	1.3.10														
		02300	SD-08 Manufacturer’s Instructions															
			Earthwork	3.5.1														
			SD-09 Manufacturer’s Field															
			Reports															
			Testing	3.6														
			SD-07 Certificates															
			Testing	3.6														
		02314	SD-03 Product Data															

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		02314	Compaction Test Plan	3.11														
			SD-06 Test Reports															
			Compaction Test Report	1.5.1														
		02319	SD-06 Test Reports															
			Testing	3.11														
			Non-Government Borrow Sources	3.5														
			SD-07 Certificates															
			Compaction Test Plan	3.11														
			Heating and Monitoring Plan	3.2.4.3														
			Non-Government Borrow Sources	3.5														
		02320	SD-01 Preconstruction Submittals															
			Compaction Test Plan	3.5														
			SD-06 Test Reports															
			Compaction Test	3.5														
		02373	SD-06 Test Reports															
			Manufacturing Quality Control	2.2														
			Sampling and Testing															
			SD-07 Certificates															
			Geotextile	2.1.1														
			SD-04 Samples															
			Samples	3.1														
		02390	SD-02 Shop Drawings															
			Drawings	2.2														
			SD-09 Manufacturer's Field															
			Reports															
			Tests	3.3														

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		02390	SD-07 Certificates															
			Tiedowns	2.2														
			Grounding Connectors	2.4														
			Copper Conductors	2.3														
		02456	SD-02 Shop Drawings															
			Fabricated	3.1.4	G	AE												
			Pile Driving	3.1.1	G	AE												
			SD-03 Product Data															
			Equipment	2.2	G	AO												
			SD-06 Test Reports															
			Field Tests and Inspections	3.2	G	AO												
			SD-07 Certificates															
			Materials	2.1	G	AO												
		02457	SD-11 Closeout Submittals															
			Pile Driving	3.1.1														
		02510	SD-03 Product Data															
			Disposal Method of Waste Water	3.2														
			SD-06 Test Reports															
			Pressure Test	3.2.2														
		02511	SD-03 Product Data															
			Materials	1.4.1														
			Materials	2.1														
			SD-08 Manufacturer’s Instructions															
			Manufacturer's Recommendations	1.2														
			Manufacturer's Recommendations	1.4.2														
			SD-06 Test Reports															

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		02511	Hydrostatic tests	1.4.3	G	AO												
			Hydrostatic tests	3.16	G	AO												
			Disinfection	1.4.4	G	AO												
			Disinfection	3.17	G	AO												
		02533	SD-03 Product Data															
			Materials	1.4.1	G	AO												
			SD-06 Test Reports															
			Hydrostatic tests	1.4.2	G	AO												
			SD-08 Manufacturer’s Instructions															
			Manufacturer's Recommendations	1.4.3														
		02559	SD-03 Product Data															
			Materials	1.3.1														
			Materials	2.1.1														
			Spare Parts	1.3.2														
			SD-04 Samples															
			Insulation	1.3.3														
			SD-06 Test Reports															
			Tests	3.10														
			Tests	3.10.2.2														
			SD-07 Certificates															
			Flange Gaskets	2.2.1.3														
			SD-10 Operation and Maintenance															
			Data															
			Steam Distribution System	1.6.1	G	AO												
		02560	SD-01 Preconstruction Submittals															

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		02560	Utilidor Heating and Temperature	3.7.3	G AO													
			Monitoring Plan															
			SD-02 Shop Drawings															
			Detail Drawings	1.4.1	G AO													
			Fabrication and Erection	1.4.2	G AO													
			Drawings															
			SD-03 Product Data															
			Schedules of Work and Tests	1.4.3														
			Required for Installation															
			Manufacturer's Catalog Data	1.4.4														
			SD-04 Samples															
			Materials	1.4.5														
			SD-08 Manufacturer’s Instructions															
			Waterproofing Material	1.4.6														
			Waterstops	1.5.2														
		02630	SD-07 Certificates															
			Pipeline Testing	3.6														
		02722	SD-01 Preconstruction Submittals															
			Plant, Equipment, and Tools	1.6														
			SD-09 Manufacturer’s Field															
			Reports															
			Sampling and testing	1.4														
			Field Density Tests	1.4.2.3														
		02740	SD-09 Manufacturer’s Field															
			Reports															
			Job Mix	3.3														

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		02740	Base Course	2.1														
			Pavement	3.3														
			SD-07 Certificates															
			Prime Coat	2.2														
			Asphalt	3.3														
			Tack Coat	2.4														
		02748	SD-09 Manufacturer's Field															
			Reports															
			Field	3.6														
		02749	SD-01 Preconstruction Submittals															
			Mix Design	2.3	G	ED												
			JMF	2.3.2														
			Contractor Quality Control	3.10	G	RE												
			SD-03 Product Data															
			Mix Design	2.3	G	ED												
			Contractor Quality Control	3.10	G	RE												
			SD-06 Test Reports															
			Aggregates	2.1	G	ED												
			QC Monitoring	3.10.3.10	G	RE												
			SD-07 Certificates															
			Asphalt Cement Binder	2.2	G	ED												
			Testing Laboratory	3.6	G	RE												
			Asphalt Cement Binder	2.2														
			Testing Laboratory	3.6														
		02753	SD-03 Product Data															
			Equipment	1.12														

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		02753	Proposed Techniques	1.10	G ED													
			SD-06 Test Reports															
			Sampling and Testing	1.4.10.1	G RE													
		02762	SD-01 Preconstruction Submittals															
			Test	1.3														
			Equipment	1.4														
			Manufacturer	1.6														
			SD-04 Samples															
			Compression Seals	2.1	G													
		02763	SD-03 Product Data															
			Equipment	1.5														
			Equipment	1.5														
			Requirements	1.5.1														
			SD-06 Test Reports															
			Sampling and Testing	2.3														
			SD-07 Certificates															
			Marking	2.1														
		02921	SD-01 Preconstruction Submittals															
			Equipment	3.1.3														
			SD-04 Samples															
			Delivered Topsoil	1.4.1.1														
			Delivered Topsoil	2.2														
			Delivered Topsoil	3.1.4														
			Soil Amendments	1.4.1.2														
			Soil Amendments	2.3														
			Mulch	2.4														

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ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAG# RAPH	CLASSIFICATION	GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION			APPROVING AUTHORITY					
							SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION	MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
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		02921	SD-06 Test Reports															
			Soil Test	2.3.2														
			Soil Test	3.1.4														
			SD-07 Certificates															
			Delivery	1.4.1														
			Topsoil	2.2														
			Seed	2.1.2														
			Fertilizer	2.3.2														
			SD-11 Closeout Submittals															
			Quantity Check	3.5														
			Seed Establishment Period	3.8.1														
			Maintenance Record	3.8.3.4														
		02975	SD-06 Test Reports															
			Installation of Sealant	3.3														
			SD-09 Manufacturer's Field															
			Reports															
			Test Requirements	1.4	G													
			SD-04 Samples															
			Materials	1.4														
		03150	SD-02 Shop Drawings															
			Waterstops	2.4														
			SD-03 Product Data															
			Preformed Expansion Joint Filler	2.2														
			Sealant	2.3														
			Waterstops	2.4														
			SD-04 Samples															

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		03150	Field-Molded Type	2.3.1														
			Non-metallic Materials	2.4.1														
			SD-07 Certificates															
			Preformed Expansion Joint Filler	2.2														
			Sealant	2.3														
			Waterstops	2.4														
		03200	SD-02 Shop Drawings															
			Reinforcement	3.1	G	AE												
			SD-07 Certificates															
			Reinforcing Steel	2.3														
		03300	SD-03 Product Data															
			Mixture Proportions	1.5	G	AE												
			SD-06 Test Reports															
			Testing and Inspection for	3.13														
			Contractor Quality Control															
			SD-07 Certificates															
			Qualifications	1.3														
		04200	SD-02 Shop Drawings															
			Masonry Work	1.3.4	G	AE												
			SD-03 Product Data															
			Insulation	2.9														
			Cold Weather Installation	3.1.2	G	AO												
			SD-04 Samples															
			Concrete Masonry Units (CMU)	2.2	G	AO												
			Ties and Bar Positioners	2.6	G	AO												
			Insulation	2.9	G	AO												

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		04200	Joint Reinforcement	2.7	G AO													
			SD-06 Test Reports															
			Field Testing of Mortar	3.17.1	G AO													
			Field Testing of Grout	3.17.2	G AO													
			Masonry Cement	2.4	G AO													
			Fire-rated CMU	2.2.2	G AO													
			Special Inspection	1.3.4	G AO													
			SD-07 Certificates															
			Concrete Masonry Units (CMU)	2.2														
			Ties and Bar Positioners	2.6														
			Joint Reinforcement	2.7														
			Reinforcing Steel Bars and Rods	2.8														
			Masonry Cement	2.4														
			Precast Concrete Items	2.3														
			Admixtures	2.4.1														
			Admixtures	2.4.1														
			Insulation	2.9														
			Insulation	2.9														
		05120	SD-02 Shop Drawings															
			Erection plan	1.5.2.1	G AE													
			Fabrication drawings	1.5.1	G AE													
			SD-03 Product Data															
			Shop primer	2.4														
			SD-06 Test Reports															
			Bolts, nuts, and washers	2.2														
			SD-07 Certificates															

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		05120	Steel	2.1														
			Bolts, nuts, and washers	2.2														
			Shop primer	2.4														
			Welding electrodes and rods	2.3.1														
			Welding procedures and	1.5.2.2														
			qualifications															
		05210	SD-02 Shop Drawings															
			Steel Joists	1.3	G	AE												
			SD-07 Certificates															
			Steel Joists	1.3	G	AE												
		05300	SD-02 Shop Drawings															
			Deck Units	2.1	G	AE												
			Accessories	2.5	G	AE												
			Attachments	3.3	G	AE												
			Holes and Openings	3.4	G	AE												
			SD-03 Product Data															
			Deck Units	2.1	G	AE												
			Attachments	3.3	G	AO												
			SD-07 Certificates															
			Deck Units	2.1														
			Attachments	3.3														
		05500	SD-02 Shop Drawings															
			Miscellaneous Metal Items	1.6	G	AE												
			SD-04 Samples															
			Miscellaneous Metal Items	1.6														
		07416	SD-02 Shop Drawings															

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		07416	Structural Standing Seam Metal	1.7.1	G	AE												
			Roof															
			SD-03 Product Data															
			Design	1.7.1	G	AE												
			Manufacturer	1.7.2	G	AO												
			SD-04 Samples															
			Roof Panels	2.1	G	AE												
			Factory Color Finish	2.6	G	AE												
			Insulation	2.7	G	AE												
			EPDM Rubber Boots	2.11														
			SD-06 Test Reports															
			Uplift Resistance	2.1.1	G	AE												
			SD-07 Certificates															
			Structural Standing Seam Metal	1.7.1	G	AO												
			Roof															
			Insulation	2.7														
		07600	SD-02 Shop Drawings															
			Materials	2.1	G	AO												
		07840	SD-02 Shop Drawings															
			Firestopping Materials	2.1														
			SD-07 Certificates															
			Firestopping Materials	2.1														
			Installer Qualifications	1.5														
			Inspection	3.3														
		07900	SD-03 Product Data															
			Backing	2.1	G	AO												

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		07900	Bond-Breaker	2.2	G	AO												
			Sealant	2.5	G	AO												
			SD-07 Certificates															
			Sealant	2.5														
		08110	SD-02 Shop Drawings															
			Doors	2.1	G	G												
			Doors	2.1	G	G												
			Frames	2.5	G	G												
			Frames	2.5	G	G												
			Accessories	2.3														
			Weatherstripping	2.6														
			SD-03 Product Data															
			Doors	2.1	G	AE												
			Frames	2.5	G	AE												
			Accessories	2.3														
			Weatherstripping	2.6														
		08331	SD-02 Shop Drawings															
			Approved Detail Drawings	3.1	G	AE												
			SD-03 Product Data															
			Rolling Counter Doors	1.4	G	AE												
			Installation	3.1														
			Cleaning	3.3														
			SD-10 Operation and Maintenance															
			Data															
			Operation	2.4														
		08361	SD-02 Shop Drawings															

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		08361	Doors	2.2	G AO													
			SD-03 Product Data															
			Doors	2.2	G AE													
			SD-08 Manufacturer's Instructions															
			Doors	2.2														
			SD-10 Operation and Maintenance															
			Data															
			Doors	2.2	G AO													
		08520	SD-02 Shop Drawings															
			Aluminum Windows	2.1	G AE													
			SD-03 Product Data															
			Aluminum Windows	2.1	G AE													
			SD-04 Samples															
			Aluminum Windows	2.1	G AE													
			SD-06 Test Reports															
			Aluminum Windows	2.1	G AE													
			SD-07 Certificates															
			Aluminum Windows	2.1														
		08710	SD-02 Shop Drawings															
			Hardware schedule	1.3	G AE													
			Keying system	2.2.5														
			SD-03 Product Data															
			Hardware items	2.2	G AE													
			SD-08 Manufacturer's Instructions															
			Installation	3.1														

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		08710	SD-10 Operation and Maintenance															
			Data															
			Hardware Schedule	1.3	G AE													
			SD-11 Closeout Submittals															
			Key bitting	1.4														
		08810	SD-02 Shop Drawings															
			Installation	3.2	G AO													
			SD-03 Product Data															
			Insulating Glass	2.2	G AO													
			Glazing Accessories	2.4	G AO													
			SD-04 Samples															
			Insulating Glass	2.2	G AO													
			SD-07 Certificates															
			Insulating Glass	2.2														
		09250	SD-02 Shop Drawings															
			Steel Framing	3.1	G AO													
			Control Joints	2.3.5	G AO													
			Resistant	3.4	G AO													
			SD-07 Certificates															
			Gypsum Board	1.6														
			Gypsum Board	1.6														
			Gypsum Board	2.2														
			Gypsum Board	2.2														
			Steel Framing	3.1														
		09510	SD-02 Shop Drawings															
			Approved Detail Drawings	1.3	G AE													

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		09510	SD-03 Product Data															
			Acoustical Ceiling	1.3	G AE													
			SD-04 Samples															
			Acoustical Units	2.1	G AE													
			SD-06 Test Reports															
			Ceiling Attenuation Class and	2.5														
			Test															
			SD-07 Certificates															
			Acoustical Units	2.1														
		09650	SD-03 Product Data															
			Adhesive for Wall Base	2.1	G AO													
			SD-04 Samples															
			Flooring	1.5	G AE													
			Wall Base	2.2	G AE													
			SD-06 Test Reports															
			Moisture	1.5														
			SD-08 Manufacturer’s Instructions															
			Flooring	1.5														
			SD-10 Operation and Maintenance															
			Data															
			Package	3.1														
		09900	SD-02 Shop Drawings															
			Piping identification	3.8	G AO													
			stencil	3.8														
			SD-03 Product Data															
			Coating	2.1	G AO													

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		09900	Manufacturer's Technical Data	2.1														
			Sheets															
			SD-04 Samples															
			Color	1.8	G AO													
			SD-07 Certificates															
			Applicator's qualifications	1.3														
			SD-08 Manufacturer’s Instructions															
			Application	3.5.1														
			Mixing	3.5.2														
			Manufacturer's Material Safety	1.6.2														
			Data Sheets															
			SD-10 Operation and Maintenance															
			Data															
			Coatings:	2.1	G AO													
		09971	SD-04 Samples															
			Color	2.2	G AO													
			Specification	2.1	G AO													
			SD-05 Design Data															
			Containment System	1.4.1.1	G AE													
			SD-06 Test Reports															
			Coatings Qualification Test	1.4.2.1	G AO													
			Reports															
			Coating Sample Test Reports	3.2.3	G AO													
			Abrasive Sample Test Reports	3.2.4	G AO													
			Daily Inspection Reports	3.8.2.2	G AO													

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		09971	Recycled Metallic Abrasive Field	1.4.2.2	G	AO												
			Test Reports (Daily and Weekly)															
			SD-07 Certificates															
			Work Plan	1.4.3.1	G	AE												
			Qualifications of Certified	1.4.3.2	G	AE												
			Industrial Hygienist (CIH)															
			Qualifications of Testing	1.4.3.3	G	AE												
			Laboratory for Coatings															
			Qualifications of Testing	1.4.3.4	G	AE												
			Laboratory for Abrasive															
			Qualifications of Coating	1.4.3.5	G	AE												
			Contractors															
			Contractor	3.1	G	AE												
			Removal	3.1	G	AO												
			Coating Inspection Company	1.4.3.7	G	AE												
			Coating Inspector	1.4.3.8	G	AO												
			NACE	3.2.1	G	AO												
			Qualifications of Coating	1.4.3.6	G	AE												
			Manufacturer's Representative															
			Coating Materials	1.4.3.9	G	AE												
			Coating System Component	1.4.3.10	G	AE												
			Compatibility															
			Non-metallic Abrasive	1.4.3.11	G	AO												
			Metallic Abrasive	1.4.3.12	G	AO												
			SD-08 Manufacturer’s Instructions															
			Coating System Instructions	1.4.4.1	G	AE												

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		09971	SD-11 Closeout Submittals															
			Disposal of Used Abrasive	3.6.5	G	AO												
			Inspection Logbook	3.8.2.3	G	AO												
		09973	SD-04 Samples															
			Specification	2.1.1	G	AO												
			SD-05 Design Data															
			Environmental Control System	1.4.1.1	G	AE												
			SD-06 Test Reports															
			Coating Sample Test Reports	3.2.3	G	AO												
			Abrasive Sample Test Reports	3.2.4	G	AO												
			Daily Inspection Reports	3.9.2.2	G	AO												
			Recycled Metallic Abrasive Field	1.4.2.1	G	AO												
			Test Reports (Daily and Weekly)															
			SD-07 Certificates															
			Work Plan	1.4.3.1	G	AE												
			Qualifications of Certified	1.4.3.2	G	AE												
			Industrial Hygienist (CIH)															
			Qualifications of Testing	1.4.3.3	G	AE												
			Laboratory for Coatings															
			Qualifications of Testing	1.4.3.4	G	AE												
			Laboratory for Abrasive															
			Qualifications of Coating	1.4.3.5	G	AE												
			Contractors															
			Painting Contractor	1.4.3.5	G	AE												
			Removal	3.1	G	AE												
			Coating Inspection Company	1.4.3.7	G	AE												

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CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAG# RAPH	CLASSIFICATION	GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION			APPROVING AUTHORITY					
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		09973	Coating Inspector	1.4.3.8	G	AE												
			NACE Certified	1.4.3.9														
			Qualifications of Coating	1.4.3.6	G	AE												
			Manufacturer's Representative															
			Epoxy Coating Materials	1.4.3.10	G	AE												
			Non-metallic Abrasive	1.4.3.11	G	AO												
			Metallic Abrasive	1.4.3.12	G	AO												
			SD-08 Manufacturer’s Instructions															
			Coating System Instructions	1.4.4.1	G	AE												
			SD-11 Closeout Submittals															
			Disposal of Used Abrasive	3.7.5	G	AO												
			Inspection Logbook	3.9.2.3	G	AO												
		10800	SD-03 Product Data															
			Finishes	2.1.2	G	AO												
			Accessory Items	2.2	G	AO												
			SD-04 Samples															
			Finishes	2.1.2														
			Accessory Items	2.2														
			SD-07 Certificates															
			Accessory Items	2.2														
		12320	SD-02 Shop Drawings															
			Installation	3.1	G	AO												
			SD-03 Product Data															
			Cabinets	2.1	G	AO												
			Countertops and Backsplash	2.2	G	AO												
		13080	SD-02 Shop Drawings															

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		13080	Bracing	3.1	G	AE												
		13100	SD-02 Shop Drawings															
			Installation	2.1.5	G	AE												
			SD-07 Certificates															
			Materials	2.1	G	AO												
		13110	SD-02 Shop Drawings															
			Drawings	1.3.7	G	AO												
			Contractor's Modifications	1.3.2	G	AO												
			SD-03 Product Data															
			Equipment	2.2.12.2	G	A0												
			Spare Parts	3.9														
			SD-06 Test Reports															
			Tests and Measurements	3.5	G	AO												
			Contractor's Modifications	1.3.2	G	AO												
			SD-07 Certificates															
			Cathodic Protection System	3.1.1	G	AO												
			Services of 'Corrosion Expert'	1.3.1	G	AO												
			SD-10 Operation and Maintenance															
			Data															
			Cathodic Protection System	3.1.1														
			Training Course	3.6														
		13120	SD-02 Shop Drawings															
			Drawings	1.4.8	G	AE												
			SD-03 Product Data															
			Design Analysis	1.5	G	AE												
			Instruction	1.3.2.2	G	AE												

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		13120	Erection	3.1	G	AE												
			Qualifications	1.3.2														
			SD-04 Samples															
			Accessories	2.3.7	G	AO												
			Siding	1.5	G	AO												
			Insulation	2.3.5	G	AO												
			SD-07 Certificates															
			Metal Building System	1.3														
		13280	SD-03 Product Data															
			Respiratory Protection Program	1.12	G													
			Cleanup and Disposal	3.9														
			Asbestos Hazard Abatement Plan	1.5.2	G													
			Materials and Equipment	1.2														
			Qualifications	1.5	G													
			Training Program	1.11	G													
			Medical Requirements	1.10	G													
			SD-06 Test Reports															
			Exposure Assessment and Air	3.7	G													
			Monitoring															
			Local Exhaust Ventilation	1.20														
			Licenses, Permits and	1.14	G													
			Notifications															
			SD-07 Certificates															
			Ventilation	1.20														
		13281	SD-03 Product Data															
			Materials and Equipment	1.18														

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		13281	Expendable Supplies	1.19														
			Qualifications	1.5	G EN-E													
			SD-06 Test Reports															
			Pressure	3.4.1.2														
			Licences, Permits, and	1.11	G EN-E													
			Notifications															
			Accident Prevention Plan (APP)	1.7	G EN-E													
			Sampling and Analysis	1.13	G EN-E													
			Clearance Report	3.7	G EN-E													
		13851	SD-02 Shop Drawings															
			Fire Alarm Reporting System	1.4.1	G AE													
			SD-03 Product Data															
			Storage Batteries	2.2	G AE													
			Voltage	1.3.2	G AE													
			Special Tools and Spare Parts	2.7.3	G AO													
			Technical Data and Computer	1.5	G AO													
			Software															
			Training	3.6	G AO													
			Testing	3.5	G AO													
			SD-06 Test Reports															
			Testing	3.5	G AO													
			SD-07 Certificates															
			Equipment	1.3.1	G AO													
			Qualifications	1.3.7	G AO													
			SD-10 Operation and Maintenance															
			Data															

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		13851	Technical Data and Computer	1.5	G	AO												
			Software															
		14602	SD-02 Shop Drawings															
			Bridge Crane	2.4.7	G	AE												
			SD-03 Product Data															
			Hoist Hook Assembly	2.1.2														
			Heat	2.1.1.2														
			Bridge Crane	2.4.7	G	AE												
			Bridge Crane	2.4.7	G	AE												
			Hoist	2.2.5	G	AE												
			Parts	2.1.5														
			SD-06 Test Reports															
			Acceptance Testing	3.2														
			SD-07 Certificates															
			Hoist	2.2.5														
			Design	2.1.1.3														
			Trolleys	2.2														
			SD-10 Operation and Maintenance															
			Data															
			Operation	2.1.1.3														
			Maintenance	3.3														
		15050	SD-02 Shop Drawings															
			Meter	2.9	G	AE												
			Venturi Tubes	2.8.3	G	AE												
			Water Draw-off System	2.16	G	AE												

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		15050	Hydrant Outlet Pits and Isolation	2.12	G	AE												
			Valve Pits															
			High Point Vent and Low Point	2.13	G	AE												
			Drain Pits															
			Bowser Pump	2.17	G	AE												
			Vault	2.11.1	G	AE												
			SD-03 Product Data															
			Pressure Gages	2.5	G	AE												
			Automatic Pump Controls	2.8	G	AE												
			Meters	2.9	G	G												
			Meters	2.9	G	G												
			Product Recovery Tank and	2.11	G	AE												
			Accessories															
			Hydrant Outlet Pits and Isolation	2.12	G	AE												
			Valve Pits															
			High Point Vent and Low Point	2.13	G	AE												
			Drain Pits															
			Operating Tank Level Indicator	2.14	G	AE												
			Water Draw-Off System	2.16	G	AE												
			Venturi Tubes	2.8.3	G	AE												
			Bowser Pump	2.17	G	AE												
			SD-06 Test Reports															
			Leak Detection	2.11.1.2	G	AE												
			SD-07 Certificates															
			Coating	3.2.1	G	AE												
			UL	2.8.1	G	AE												

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		15050	STI-P3	2.11.1.1	G	AE												
			Pits	2.11.1.2	G	AE												
			System Supplier	2.4.1	G	AE												
			SD-10 Operation and Maintenance															
			Data															
			Gauges	2.5	G	AE												
			Automatic Pump Controls	2.8	G	AE												
			Product Recovery Tank and	2.11	G	AE												
			Accessories															
			Operating Tank Level Indicator	2.14	G	AE												
			Water Draw-off System	2.16	G	AE												
			Bowser Pump	2.17	G	AE												
		15051	SD-02 Shop Drawings															
			assembly	2.2	G	AE												
			SD-03 Product Data															
			Flow meter	2.2	G	AE												
			Hydrant coupler	2.2	G	AE												
			Shut-off valve	2.4	G	AE												
			Automatic pressure equalizing	2.2	G	AE												
			system															
			Pressure fueling nozzle	2.2	G	AE												
			Venturi	2.6.11	G	AO												
			Swivel joints	2.2	G	AE												
			Sampling and drain assembly	2.2	G	AE												
			Pressure gage assembly	2.4	G	AE												
			Venting assembly	2.4	G	AE												

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		15051	SD-07 Certificates															
			construction	2.4	G	AE												
			SD-10 Operation and Maintenance															
			Data															
			Flow meter	2.2	G	AE												
			Hydrant coupler	2.2	G	AE												
			Shut-off valve	2.4	G	AE												
			Automatic pressure equalizing	2.2	G	AE												
			system															
			Pressure fueling nozzle	2.2	G	AE												
			Venturi	2.6.11	G	AE												
			Swivel joints	2.2	G	AE												
			Sampling and drain assembly	2.2	G	AE												
			Pressure gage assembly	2.4	G	AE												
			Venting	2.2	G	AE												
		15060	SD-03 Product Data															
			Piping	2.5	G	AE												
			Fittings	2.2.1	G	AE												
			Fittings	2.2.6	G	AE												
			Valves	2.2.1	G	AE												
			Valves	2.3	G	AE												
			Strainers	2.5.2	G	AE												
			Flexible Hoses	2.6	G	AE												
			Lightning Surge Arrester	2.2.6.4	G	AE												
			Protective Coatings	2.2.11	G	AE												
			Sample Connections	2.5.4	G	AE												

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		15060	Isolating Gasket Kits	2.2.6.4	G	AE												
			Gaskets	2.2.8	G	AE												
			Purge Blocks	3.1.1	G	AE												
			Pigging Accessories	2.5.8	G	AE												
			SD-06 Test Reports															
			Pneumatic Test	3.8.1														
			Hydrostatic Test	3.8.1.2														
			SD-07 Certificates															
			Welding Procedures and	3.1.2	G	AE												
			Qualifications of Welders															
			Pipe	3.6.1														
			Fittings	2.2.1														
			Fittings	2.2.6														
			Valves	2.2.1														
			Valves	2.3														
			Inspector	2.2.3														
			Inspector	2.2.3														
			Isolating Gasket Kits	2.2.6.4														
			fuel pipe	2.5.4														
			Survey	3.9.3.6														
			Pipeline Pigging Verification	3.9														
			SD-10 Operation and Maintenance															
			Data															
			Operation	3.1.1	G	AE												
		15070	SD-02 Shop Drawings															
			Coupling and Bracing	3.1	G	AE												

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		15070	Flexible Couplings or Joints	3.2	G	AE												
			Equipment Requirements	1.3	G	AE												
			Contractor Designed Bracing	1.2.4	G	AE												
			SD-03 Product Data															
			Coupling and Bracing	3.1	G	AE												
			Equipment Requirements	1.3	G	AE												
			Contractor Designed Bracing	1.2.4	G	AE												
		15080	SD-02 Shop Drawings															
			Mica Plates	3.2.2.4	G	AO												
			SD-03 Product Data															
			General Materials	2.1	G	AO												
			SD-04 Samples															
			Thermal Insulation	2.1.1.2	G	AO												
		15101	SD-02 Shop Drawings															
			Control Valves	2.2.1	G	AE												
			SD-03 Product Data															
			Control Valves	2.2.1	G	AE												
			SD-06 Test Reports															
			Control Valves	2.2.1														
			SD-07 Certificates															
			Proof	2.2.1.8	G	AE												
			Engineer	3.1	G	AE												
			Field	2.2.5.6	G	AE												
			SD-10 Operation and Maintenance															
			Data															
			Manual	2.4.1.5	G	AE												

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		15140	SD-02 Shop Drawings															
			Fueling Pump (FP-1 through	2.2	G	AE												
			FP-5)															
			Fuel Transfer Pump (FTP-1)	2.3	G	AE												
			SD-03 Product Data															
			Fueling Pump (FP-1 through	2.2	G	AE												
			FP-5)															
			Fuel Transfer Pump (FTP-1)	2.3	G	AE												
			SD-06 Test Reports															
			Test	3.1.1														
			SD-07 Certificates															
			Fueling Pump (FP-1 through	2.2	G	AE												
			FP-5)															
			Fuel Transfer Pump (FTP-1)	2.3	G	AE												
			SD-10 Operation and Maintenance															
			Data															
			Operation and Maintenance	3.2.5	G	AE												
		15176	SD-01 Preconstruction Submittals															
			Welding	1.4.2	G	AO												
			Tests	3.2	G	AO												
			Inspections	3.3	G	AO												
			SD-02 Shop Drawings															
			Storage	2.4	G	AE												
			SD-03 Product Data															
			Storage	2.4	G	AE												
			Gauge Table	3.4.2.2	G	AO												

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		15176	SD-04 Samples															
			Special	3.1.2.1	G AO													
			SD-05 Design Data															
			Tank	1.4.1	G AE													
			SD-06 Test Reports															
			Steel	2.5.2.9	G AE													
			Fire Test	2.5.2.11	G AE													
			Tests	3.2	G AO													
			Inspections	3.3	G AO													
			SD-07 Certificates															
			Welding	1.4.2	G AO													
			Verification of Dimensions	1.8.1														
			Floating Pan	2.5.2														
			Radiographic Inspections	1.4.3	G AO													
			Experience	1.4.1	G AO													
			SD-08 Manufacturer’s Instructions															
			Installation	3.1														
		15177	SD-07 Certificates															
			Contractor's Qualification	1.11	G AO													
			Statement															
		15400	SD-02 Shop Drawings															
			Plumbing System	3.7.1	G AO													
			Electrical	2.8.1	G AO													
			SD-05 Design Data															
			Welding	1.3.1	G AO													
			Absorb	2.4	G AO													

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		15400	SD-06 Test Reports															
			Tests, Flushing and Disinfection	3.7	G	AO												
			Backflow Prevention Assembly	3.7.1.1	G	AO												
			SD-07 Certificates															
			Materials and Equipment	1.2														
			Bolts	2.1.1	G	AO												
			SD-08 Manufacturer's Instructions															
			Plumbing System	3.7.1	G	AO												
			SD-10 Operation and Maintenance															
			Data															
			Plumbing System	3.7.1														
		15556	SD-02 Shop Drawings															
			Heating System	2.16	G	AE												
			SD-03 Product Data															
			Parts	2.1.3	G	AO												
			Welding	3.3	G	AO												
			Framed Instructions	3.17	G	AO												
			SD-06 Test Reports															
			Testing and Cleaning	3.14	G	AO												
			SD-07 Certificates															
			Bolts	3.9.2														
			SD-10 Operation and Maintenance															
			Data															
			Heating System	2.16	G	AO												
		15653	SD-02 Shop Drawings															
			Drawings	1.5.2	G	AE												

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		15653	SD-03 Product Data															
			Air-Conditioning	2.5	G	AE												
			Part	2.11.1	G	AO												
			Framed Instructions	3.1.14	G	AO												
			Qualifications	1.3	G	AO												
			Verification of Dimensions	1.5.1	G	AO												
			Tests	3.2														
			Demonstrations	3.5	G	AO												
			SD-06 Test Reports															
			Tests	3.2	G	AO												
			System Performance Tests	3.2.1	G	AO												
			SD-07 Certificates															
			Air-Conditioning	2.5														
			Service	3.2														
			SD-10 Operation and Maintenance															
			Data															
			Operation	2.3	G	AO												
			Operation	3.5	G	AO												
			Maintenance Manuals	3.5	G	AO												
		15880	SD-02 Shop Drawings															
			Filter Separator	2.6	G	AE												
			SD-07 Certificates															
			Filter Separator	2.6														
			SD-10 Operation and Maintenance															
			Data															
			Filter Separator	2.6	G	AE												

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		15895	SD-02 Shop Drawings															
			Drawings	3.1.9	G	AE												
			Installation	3.1	G	AO												
			SD-03 Product Data															
			Components and Equipment	2.1	G	AE												
			Procedures	3.1.1.1	G	AO												
			Welding Procedures	3.1.1.1	G	AO												
			System	2.5.5	G	AO												
			Similar	2.1	G	AO												
			Welding	3.1.1.1														
			Testing, Adjusting and Balancing	3.6	G	AO												
			Field Training	3.8														
			SD-06 Test Reports															
			Performance Tests	3.7	G	AO												
			SD-07 Certificates															
			Bolts	2.5.2.2														
			SD-10 Operation and Maintenance															
			Data															
			Operating and Maintenance	3.8	G	AO												
			Instructions															
		15899	SD-01 Preconstruction Submittals															
			Start-up	2.2.1	G	AE												
			SD-06 Test Reports															
			Test	3.5	G	AE												
			Final	3.5														
			SD-11 Closeout Submittals															

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		15899	System	2.2.1	G	AO												
		15951	SD-02 Shop Drawings															
			HVAC Control System	3.1.1	G	AE												
			SD-03 Product Data															
			Service Organization	1.6	G	AO												
			Equipment Compliance Booklet	1.6	G	AE												
			Commissioning Procedures	3.4	G	AO												
			Performance Verification Test	1.6	G	AO												
			Procedures															
			Training	3.6	G	AO												
			SD-06 Test Reports															
			Commissioning Report	3.6.2	G	AO												
			Performance Verification Test	3.5.3	G	AO												
			SD-10 Operation and Maintenance															
			Data															
			Operation Manual	1.5	G	AO												
			Maintenance and Repair Manual	1.6	G	AO												
		15970	SD-02 Shop Drawings															
			Shop Drawing	3.4.1	G	AE												
			SD-03 Product Data															
			Pump Control Panel (PCP) and	2.1	G	AE												
			Components															
			Pump Control Panel (PCP) and	3.1	G	AE												
			Components															
			Programmable Logical Controller	2.2	G	AE												
			(PLC) Hardware and Software															

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		15970	Programmable Logical Controller	3.2	G	AE												
			(PLC) Hardware and Software															
			PC	2.1.15.2	G	AE												
			Tools and Spare Parts	3.5														
			SD-06 Test Reports															
			Certified Pump Control Panel	3.1.2														
			(PCP) Shop Test Report															
			Record of Test	3.4.2														
			SD-07 Certificates															
			Experience and Qualifications	1.5	G	AE												
			Plan for Instructing Personnel	3.4.3	G	AO												
			Testing Plan	3.4.2	G	AE												
			SD-10 Operation and Maintenance															
			Data															
			Operation and Maintenance	3.4.3	G	AO												
			Manuals															
		15990	SD-02 Shop Drawings															
			TAB Schematic Drawings and	3.3	G	AO												
			Report Forms															
			SD-03 Product Data															
			TAB Related HVAC Submittals	3.2	G	AO												
			TAB Procedures	3.5.1	G	AO												
			Calibration	1.4	G	AO												
			Systems Readiness Check	3.5.2	G	AO												
			TAB Execution	3.5.1	G	AO												
			TAB Verification	3.5.4	G	AO												

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		15990	SD-06 Test Reports															
			Design Review Report	3.1	G	AO												
			Systems Readiness Check	3.5.2	G	AO												
			TAB Report	3.5.3	G	AO												
			TAB Verification Report	3.5.4	G	AO												
			SD-07 Certificates															
			Ductwork Leak Testing	3.4	G	AO												
			TAB Firm	1.5.1	G	AO												
			TAB Specialist	1.5.2	G	AO												
		15995	SD-03 Product Data															
			Commissioning Team	3.1	G	AO												
			Test	1.2	G	G												
			Test	1.2	G	G												
			SD-06 Test Reports															
			Test	1.2	G	AO												
		16070	SD-02 Shop Drawings															
			Lighting Fixtures in Buildings	3.2	G	AE												
			Equipment Requirements	1.4	G	AE												
			SD-03 Product Data															
			Lighting Fixtures in Buildings	3.2	G	AE												
			Equipment Requirements	1.4	G	AE												
			Contractor Designed Bracing	1.3.3	G	AE												
		16264	SD-02 Shop Drawings															
			Layout	3.8	G	AE												
			Drawings	1.6.1	G	AE												
			Acceptance	3.9	G	AO												

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		16264	SD-03 Product Data															
			Performance Tests	3.5.5	G	AO												
			Sound Limitations	2.6	G	AO												
			Generator	2.12	G	AE												
			Integral Main Fuel Storage Tank	2.3.4	G	AE												
			Power Factor	3.5.1.2	G	AE												
			Time-Delay on Alarms	2.16.5	G	AO												
			Cooling System	2.5	G	AE												
			Manufacturer's Catalog	2.2	G	AE												
			Vibration Isolation	1.4.8	G	AE												
			Instructions	3.8	G	AO												
			Experience	1.4.9	G	AO												
			Field Engineer	1.4.10	G	AO												
			Site Welding	1.4.6	G	AO												
			General Installation	3.1	G	AO												
			Site	1.4.6	G	AO												
			SD-06 Test Reports															
			Onsite Inspection and Tests	3.5	G	AO												
			SD-07 Certificates															
			Vibration Isolation	1.4.8	G	AO												
			Tests	1.4.6	G	AO												
			Durability	3.5.5.1	G	AO												
			Emissions	2.9	G	AO												
			Sound limitations	2.6	G	AO												
			Balance	2.12.1	G	AO												
			Materials and Equipment	2.1	G	AO												

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		16264	Factory Inspection and Tests	2.23	G AO													
			Inspections	3.5.3	G AO													
			Cooling System	2.5	G AO													
		16370	SD-02 Shop Drawings															
			Electrical Distribution System	3.11.3	G AE													
			Construction	2.8.1	G AO													
			SD-03 Product Data															
			Nameplates	2.3	G AO													
			Material and Equipment	2.2	G AO													
			General Installation Requirements	3.1	G AO													
			SD-06 Test Reports															
			Factory Tests	2.16	G AO													
			Field Testing	3.11	G AO													
			Operating Tests	3.11.5	G AO													
			SD-07 Certificates															
			Material and Equipment	2.2	G AO													
			SD-10 Operation and Maintenance															
			Data															
			Electrical Distribution System	3.11.3	G AO													
		16375	SD-02 Shop Drawings															
			Electrical Distribution System	3.11.3	G AE													
			Drawings	2.4.1.6	G AO													
			SD-03 Product Data															
			Nameplates	2.2	G AO													
			Material and Equipment	2.1	G AE													
			General Installation Requirements	3.1	G AO													

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		16375	SD-06 Test Reports															
			Factory Tests	2.17	G AO													
			Field Testing	3.11	G AO													
			Operating Tests	3.11.8	G AO													
			Cable Install	3.2.1	G AO													
			Cable Install	3.2.1.4	G AO													
			SD-07 Certificates															
			Material and Equipment	2.1	G AO													
			Cable Joints	3.3	G AO													
			Cable Install	3.2.1	G AO													
			Cable Install	3.2.1.4	G AO													
			SD-10 Operation and Maintenance															
			Data															
			Electrical Distribution System	3.11.3	G AO													
		16415	SD-02 Shop Drawings															
			Electrical Equipment	3.16	G AE													
			SD-03 Product Data															
			Protective Device Coordination	2.27	G AE													
			Study															
			Manufacturer	2.1.1	G AE													
			Fixture	2.1.3	G AO													
			Installation	2.11	G AO													
			As-Built Drawings	1.2.6	G AO													
			Onsite Tests	3.22.2	G AO													
			SD-06 Test Reports															
			Factory	2.3.1.1	G AO													

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		16415	Field Test	3.20	G AO													
			Field Test Reports	3.20	G AO													
			SD-07 Certificates															
			Materials and Equipment	1.4	G AO													
		16526	SD-03 Product Data															
			Materials and Equipment	2.1	G ED													
			Parts	3.2														
			Parts	3.3														
			Parts	3.3.1														
			Parts	3.4														
			SD-06 Test Reports															
			Field Quality Control	3.14	G RE													
			Inspection	3.14.3														
			SD-07 Certificates															
			Cables, General Requirements	3.2														
			Materials and Equipment	2.1														
			SD-10 Operation and Maintenance															
			Data															
			Equipment	2.1.2	G RE													
		16528	SD-02 Shop Drawings															
			Lighting System	1.3.1	G AO													
			Drawings	2.2.1	G AO													
			As-Built Drawings	3.12.2	G AO													
			SD-03 Product Data															
			Equipment	1.3.2	G AO													
			Parts	2.1	G AO													

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		16528	SD-06 Test Reports															
			Operating Test	3.12.1	G	AO												
			Ground Resistance	3.12.2	G	AO												
			Measurements															
			SD-10 Operation and Maintenance															
			Data															
			Lighting System	1.3.1	G	AO												
		16710	SD-02 Shop Drawings															
			Premises Distribution System	1.7	G	AO												
			Installation	3.1	G	AO												
			SD-03 Product Data															
			Record Keeping and	1.8	G	AO												
			Documentation															
			Spare Parts	3.1.8	G	AO												
			Manufacturer's	3.1	G	AO												
			Test Plan	3.6	G	AO												
			Qualifications	1.5	G	AO												
			SD-06 Test Reports															
			Test Reports	3.6														
			SD-07 Certificates															
			Premises Distribution System	1.7														
			Materials and Equipment	2.1														
			Installers	1.5.1	G	AO												
		16711	SD-02 Shop Drawings															
			Telephone	3.1.2.3	G	AO												
			Installation	3.1	G	AO												

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ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAG# RAPH	CLASSIFICATION	GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION			APPROVING AUTHORITY					
							SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION	MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		16711	Drawings	2.5.1	G AO													
			SD-03 Product Data															
			Parts	3.3	G AO													
			Equipment	1.5.2														
			Installation	3.1	G AO													
			Acceptance Tests	3.5	G AO													
			Cutover and Records	3.4	G AO													
			SD-06 Test Reports															
			Acceptance Tests	3.5	G AO													
			SD-07 Certificates															
			Telephone	3.1.2.3	G AO													
			Qualifications	1.4	G AO													

TRANSMITTAL OF SHOP DRAWINGS, EQUIPMENT DATA, MATERIAL SAMPLES, OR MANUFACTURER'S CERTIFICATES OF COMPLIANCE

(Read instructions on the reverse side prior to initiating this form)

DATE

TRANSMITTAL NO.

SECTION I - REQUEST FOR APPROVAL OF THE FOLLOWING ITEMS *(This section will be initiated by the contractor)*

TO:

FROM:

CONTRACT NO.

CHECK ONE:
☐ THIS IS A NEW TRANSMITTAL
☐ THIS IS A RESUBMITTAL OF TRANSMITTAL _____

SPECIFICATION SEC. NO. *(Cover only one section with each transmittal)*

PROJECT TITLE AND LOCATION

CHECK ONE: THIS TRANSMITTAL IS FOR GOV'T. APPROVAL ☐ FIO

ITEM NO. *a.*	DESCRIPTION OF ITEM SUBMITTED *(Type size, model number/etc.)* *b.*	MFG OR CONTR. CAT., CURVE DRAWING OR BROCHURE NO. *(See instruction no. 8)* *c.*	NO. OF COPIES *d.*	CONTRACT REFERENCE DOCUMENT		FOR CONTRACTOR USE CODE *g.*	VARIATION *(See instruction No. 6)* *h.*	FOR CE USE CODE *i.*
				SPEC. PARA. NO. *e.*	DRAWING SHEET NO. *f.*			

REMARKS

I certify that the above submitted items have been reviewed in detail and are correct and in strict conformance with the contract drawings and specifications except as other wise stated.

NAME AND SIGNATURE OF CONTRACTOR

SECTION II - APPROVAL ACTION

ENCLOSURES RETURNED *(List by Item No.)*

NAME, TITLE AND SIGNATURE OF APPROVING AUTHORITY

DATE

INSTRUCTIONS

1. Section I will be initiated by the Contractor in the required number of copies.

2. Each transmittal shall be numbered consecutively in the space provided for "Transmittal No.". This number, in addition to the contract number, will form a serial number for identifying each submittal. For new submittals or resubmittals mark the appropriate box; on resubmittals, insert transmittal number of last submission as well as the new submittal number.

3. The "Item No." will be the same "Item No." as indicated on ENG FORM 4288-R for each entry on this form.

4. Submittals requiring expeditious handling will be submitted on a separate form.

5. Separate transmittal form will be used for submittals under separate sections of the specifications.

6. A check shall be placed in the "Variation" column when a submittal is not in accordance with the plans and specifications--also, a written statement to that effect shall be included in the space provided for "Remarks".

7. Form is self-transmittal, letter of transmittal is not required.

8. When a sample of material or Manufacturer's Certificate of Compliance is transmitted, indicate "Sample" or "Certificate" in column c, Section I.

9. U.S. Army Corps of Engineers approving authority will assign action codes as indicated below in space provided in Section I, column i to each item submitted. In addition they will ensure enclosures are indicated and attached to the form prior to return to the contractor. The Contractor will assign action codes as indicated below in Section I, column g, to each item submitted.

THE FOLLOWING ACTION CODES ARE GIVEN TO ITEMS SUBMITTED

A	--	Approved as submitted.	E	--	Disapproved (See attached).
B	--	Approved, except as noted on drawings.	F	--	Receipt acknowledged.
C	--	Approved, except as noted on drawings. Refer to attached sheet resubmission required.	FX	--	Receipt acknowledged, does not comply as noted with contract requirements.
D	--	Will be returned by separate correspondence.	G	--	Other *(Specify)*

10. Approval of items does not relieve the contractor from complying with all the requirements of the contract plans and specifications.

(Reverse of ENG Form 4025-R)

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PART 3 EXECUTION (Not Applicable)

-- End of Section Table of Contents --

SECTION 01351

SAFETY, HEALTH, AND EMERGENCY RESPONSE (HTRW/UST)

PART 1 GENERAL1.1 REFERENCES

Health and Safety requirements in this specification section apply to workers excavating, removing and disposing of soils contaminated with petroleum hydrocarbons. See SECTIONS 01450 CHEMICAL DATA QUALITY CONTROL, 02319 EARTHWORK FOR VEHICLE TRAFFIC AREAS, STRUCTURES, SIDEWALKS, CURBS AND GUTTERS, AND AREA GRADING, and 02314 EARTHWORK FOR UTILITIES for additional information. See SECTION 01400 SPECIAL SAFETY REQUIREMENTS for general safety information.

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS (ACGIH)

ACGIH Limit Values	(2004) Chemical Substances TLVs and BEIs

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z358.1	(1998) Emergency Eyewash and Shower Equipment

AMERICAN PETROLEUM INSTITUTE (API)

API Pub 2219	(1999) Safe Operation of Vacuum Trucks in Petroleum Service, 2nd Edition
API RP 1604	(1996) Closure of Underground Petroleum Storage Tanks
API Std 2015	(1994) Safe Entry and Cleaning of Petroleum Storage Tanks

NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH (NIOSH)

NIOSH 85-115	(1985) Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2003) U.S. Army Corps of Engineers Safety and Health Requirements Manual
ER 385-1-92	(2000) Safety and Occupational Document Requirements for Hazardous, Toxic, and Radioactive Waste (HTRW) Activities

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1904	Recording and Reporting Occupational Injuries and Illnesses
29 CFR 1910	Occupational Safety and Health Standards
29 CFR 1926	Safety and Health Regulations for Construction
49 CFR 171	General Information, Regulations, and Definitions
49 CFR 172	Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements

1.2 DESCRIPTION OF WORK

Three pumphouses (Bldgs 1305, 1315, and 1321), associated fuel piping and hydrant pits comprising the existing Type I systems at E7, E8, and E9 Complexes will be demolished.. Each pumphouse also has one 25,000 gallon UST and three 50,000 USTs that must be removed. The new facility will house two 10,000 bbl JP-8 storage tanks, a new pumphouse, a heated pantograph storage area, an emergency generator, and two truck fillstands. Petroleum contaminated soil may also be encountered during removal of USTs adjacent to Bldgs 1305, 1315, and 1321.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with SECTION 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Work Zones; G-AO

Drawings including initial work zone boundaries: Exclusion Zone (EZ), including restricted and regulated areas; Contamination Reduction Zone (CRZ); and Support Zone (SZ).

Decontamination Facilities; G-AO

Drawings showing the layout of the personnel and equipment decontamination areas.

SD-03 Product Data

Exposure Monitoring/Air Sampling Program; G-AO

Personnel exposure monitoring/sampling results.

Site Control Log; G-AO

Record of each entry and exit into the site, as specified.

HAZWOPER Qualifications Certificates.

A certificate for each worker performing cleanup operations with potential for unacceptable occupational exposure signed by the safety and health manager and the occupational physician indicating the workers meet the training and medical surveillance requirements of this contract.

1.4 REGULATORY REQUIREMENTS

Work performed under this contract shall comply with EM 385-1-1, OSHA requirements in 29 CFR 1910 and 29 CFR 1926, especially OSHA's Hazardous Waste Operations and Emergency Response Standard 29 CFR 1926, SECTION .65/ 29 CFR 1910, SECTION .120 and state specific OSHA requirements where applicable. Matters of interpretation of standards shall be submitted to the appropriate administrative agency for resolution before starting work. Where the requirements of this specification, applicable laws, criteria, ordinances, regulations, and referenced documents vary, the most stringent requirements shall apply.

1.5 PRECONSTRUCTION SAFETY CONFERENCE

A preconstruction conference will be scheduled prior to beginning of site work at which time representatives of the Contracting Officer will review and discuss requirements relative to planning and administration of the overall safety program. The following documents will be reviewed with the Contractor's Site Safety and Health Manager at that time: Safety and Health Program; Site Safety and Health Plan; Confined Space Entry Program; Hazard Communication Program; Respiratory Protection Program; and Spill Prevention and Containment Plan..

1.6 SAFETY AND HEALTH PROGRAM

The Contractor shall develop and implement a Safety and Health Program (SHP) which incorporates requirements in OSHA standards 29 CFR 1910, SECTION .120 (b) and 29 CFR 1926, SECTION .65 (b) and SECTION 01.A.07 of EM 385-1-1. The Safety and Health Program shall address the items in paragraph (b) of 29 CFR 1910, SECTION .120/29 CFR 1926, SECTION .65 and Appendix A of EM 385-1-1 in specific detail. These items are: Signature Sheet; Background Information; Statement of Safety and Health Policy; Responsibilities and Lines of Authority; Subcontractors and Suppliers; Training; Safety and Health Inspections; Safety and Health Expectations, Incentives programs and Compliance; Accident Reporting; Medical Surveillance/Medical Support; Personal Protective Equipment; Standard Operating Procedures and Corporate Plans supporting occupational safety and health.

1.7 SITE SAFETY AND HEALTH PLAN

The Contractor shall develop and implement a Site Safety and Health Plan (SSHP) meeting the requirements of SECTION 01.A.10 of EM 385-1-1 and 29 CFR 1910, SECTION .120/29 CFR 1926, SECTION .65 (b)(4). At a minimum, the SSHP shall address each element in Appendix C of ER 385-1-92 and shall incorporate an Activity Hazard Analysis meeting the requirements of 01.A.10 and Figure 1-1 of EM 385-1-1.

a. The SSHP shall be considered a living document and shall be updated as occupational safety and health conditions change during project

execution and improved as occupational safety and health lessons are learned during the course of the project.

b. SSHP elements in Appendix C of ER 385-1-92 are: 1. Site Description and Contamination Characterization; 2. Activity Hazard Analysis; 3. Health and Safety Staff Organization, Qualifications and Responsibilities for the project; 4. Health and Safety Training requirements for the project; 5. Personal Protective Equipment; 6. Medical Surveillance requirements for the project; 7. Radiation Dosimetry, if applicable; 8. Exposure Monitoring/Air Sampling; 9. Heat Stress/Cold Stress Prevention; 10. Applicable elements of the Safety and Health Program edited to meet site specific conditions and site specific standard operating safety procedures, engineering controls and work practices used to reduce exposure to contaminants and prevent accidents; 11. Site Control Measures; 12. Personal Hygiene and Decontamination; 13. Equipment Decontamination; 14. Emergency Equipment and First Aid Requirements; 15. Emergency Response and Contingency Procedures. 16. Accident Prevention; 17. Logs, Reports and Record-keeping.

1.7.1 Acceptance and Modifications

Prior to submittal, the SSHP shall be signed and dated by the Safety and Health Manager and the Site Superintendent. The SSHP shall be submitted for review 10 days prior to the Preconstruction Safety Conference. Deficiencies in the SSHP will be discussed at the preconstruction safety conference, and the SSHP shall be revised to correct the deficiencies and resubmitted for acceptance. Onsite work shall not begin until the plan has been accepted. A copy of the written SSHP shall be maintained onsite. Changes and modifications to the accepted SSHP shall be made with the knowledge and concurrence of the Safety and Health Manager, the Site Superintendent, and the Contracting Officer. Should any unforeseen hazard become evident during the performance of the work, the Site Safety and Health Officer (SSHO) shall bring such hazard to the attention of the Safety and Health Manager, the Site Superintendent, and the Contracting Officer, both verbally and in writing, for resolution as soon as possible. In the interim, necessary action shall be taken to re-establish and maintain safe working conditions in order to safeguard onsite personnel, visitors, the public, and the environment. Disregard for the provisions of this specification or the accepted SSHP shall be cause for stopping of work until the matter has been rectified.

1.7.2 Availability

The SSHP shall be made available in accordance with 29 CFR 1910, SECTION .120 (b)(1)(v) and 29 CFR 1926, SECTION .65 (b)(1)(v).

1.8 SITE DESCRIPTION AND CONTAMINATION CHARACTERIZATION

1.8.1 Project/Site Conditions

The Contractor shall refer to Base Environmental Restoration Program documents for specific levels and types of contamination at this site. All soils in the areas of excavation are to be considered contaminated with petroleum hydrocarbons. Soils shall be removed and disposed or returned to the excavation site.

1.9 TASK SPECIFIC HAZARDS, INITIAL PPE, HAZWOPER MEDICAL SURVEILLANCE AND TRAINING APPLICABILITY

The SSHP shall include a safety and health hazard/risk analysis for each site task and operation to be performed. The hazard/risk analysis shall provide information necessary for determining safety and health procedures, equipment, and training to protect onsite personnel, the environment, and the public. It is the Contractor's responsibility to reevaluate occupational safety and health hazards as the work progresses and to adjust the PPE and onsite operations, if necessary, so that the work is performed safely.

1.10 STAFF ORGANIZATION, QUALIFICATION AND RESPONSIBILITIES

1.10.1 Safety and Health Manager

Safety and Health Manager shall be an Industrial Hygienist certified by the American Board of Industrial Hygiene or a safety professional certified by the Board of Certified Safety Professionals.

1. The Safety and Health Manager shall have the following additional qualifications:

    a. A minimum of 2 years experience in developing and implementing safety and health programs at hazardous waste sites, in the petroleum processing industry, or at underground storage tank removal projects.

    b. Documented experience in supervising professional and technician level personnel.

    c. Documented experience in developing worker exposure assessment programs and air monitoring programs and techniques.

    d. Documented experience in the development of personal protective equipment programs, including programs for working in and around potentially toxic, flammable and combustible atmospheres and confined spaces.

    e. Working knowledge of state and Federal occupational safety and health regulations.

2. The Safety and Health Manager shall:

    a. Be responsible for the development, implementation, oversight, and enforcement of the SSHP.

    b. Sign and date the SSHP prior to submittal.

    c. Conduct initial site-specific training.

    d. Be present onsite during the first 3 days of site activities and at the startup of each new major phase.

    e. Visit the site as needed for the duration of activities, to audit the effectiveness of the SSHP.

    f. Be available for emergencies.

g. Provide onsite consultation as needed to ensure the SSHP is fully implemented.

h. Coordinate any modifications to the SSHP with the Site Superintendent, the SSHO, and the Contracting Officer.

i. Provide continued support for upgrading/downgrading of the level of personal protection.

j. Be responsible for evaluating air monitoring data and recommending changes to engineering controls, work practices, and PPE.

k. Review accident reports and results of daily inspections.

l. Serve as a member of the Contractor's quality control staff.

1.10.2 Additional Certified Health and Safety Support Personnel

The Contractor shall retain either safety support from a safety professional certified by the Board of Certified Safety professionals to develop written occupational safety procedures for the SSHP and when necessary visit the site to help implement SSHP requirements or industrial hygiene support from an industrial hygienist certified by the American Board of Industrial Hygiene to develop occupational health practices for the SSHP and if necessary visit the site to help implement SSHP requirements.

1.10.3 Site Safety and Health Officer

An individual and one alternate shall be designated the Site Safety and Health Officer (SSHO). The name, qualifications (education and training summary and documentation), and work experience of the Site Safety and Health Officer and alternate shall be included in the SSHP.

1. The SSHO shall have the following qualifications:

a. A minimum of 1 year experience in implementing safety and health programs at hazardous waste sites, at underground storage tank removal projects, in the chemical or petroleum processing industry or sites involving petroleum contamination where Level C personal protective equipment was required.

b. Documented experience in construction techniques and construction safety procedures.

c. Working knowledge of Federal and state occupational safety and health regulations.

d. Specific training in personal and respiratory protective equipment program implementation, confined space program oversight, and in the proper use of air monitoring instruments, and air sampling methods.

2. The Site Safety and Health Officer shall:

a. Assist and represent the Safety and Health Manager in onsite training and the day to day onsite implementation and enforcement of the accepted SSHP.

b. Be assigned to the site on a full time basis for the duration of field activities. If operations are performed during more than 1 work shift per day, a site Safety and Health Officer shall be present for each shift.

c. Have authority to ensure site compliance with specified safety and health requirements, Federal, state and OSHA regulations and all aspects of the SSHP including, but not limited to, activity hazard analyses, air monitoring, use of PPE, decontamination, site control, standard operating procedures used to minimize hazards, safe use of engineering controls, the emergency response plan, confined space entry procedures, spill containment program, and preparation of records by performing a daily safety and health inspection and documenting results on the Daily Safety Inspection Log in accordance with 29 CFR 1904.

d. Have authority to stop work if unacceptable health or safety conditions exist, and take necessary action to re-establish and maintain safe working conditions.

e. Consult with and coordinate any modifications to the SSHP with the Safety and Health Manager, the Site Superintendent, and the Contracting Officer.

f. Serve as a member of the Contractor's quality control staff on matters relating to safety and health.

g. Conduct accident investigations and prepare accident reports.

h. Review results of daily quality control inspections and document safety and health findings into the Daily Safety Inspection Log.

i. In coordination with site management and the Safety and Health Manager, recommend corrective actions for identified deficiencies and oversee the corrective actions.

1.10.4 Occupational Physician

The services of a licensed physician, who is certified in occupational medicine by the American Board of Preventative Medicine, or who, by necessary training and experience is Board eligible, shall be utilized. The medical consultant's name and qualifications shall be included in the SSHP. The physician shall be responsible for the determination of medical surveillance protocols and for review of examination/test results performed in compliance with 29 CFR 1910, SECTION .120 (f) and 29 CFR 1926, SECTION .65 (f) and paragraph MEDICAL SURVEILLANCE. The occupational physician is not required to visit the site.

1.10.5 Persons Certified in First Aid and CPR

At least two persons who are currently certified in first aid and CPR by the American Red Cross or other approved agency shall be onsite at all times during site operations. They shall be trained in universal precautions and the use of PPE as described in the Bloodborne Pathogens Standard of 29 CFR 1910, SECTION .1030. These persons may perform other duties but shall be immediately available to render first aid when needed.

1.10.6 Safety and Health Technicians

For each work crew in the work area, one person, designated as a Safety and Health technician, shall perform activities such as air monitoring, decontamination, and safety oversight on behalf of the SSHO. They shall have appropriate training equivalent to the SSHO in each specific area for which they have responsibility and shall report to and be under the supervision of the SSHO.

1.11 TRAINING

The Contractor's training program for workers performing cleanup operations and who will be exposed to contaminants shall meet the following requirements.

1.11.1 General Hazardous Waste Operations Training

All Personnel performing duties with potential for exposure to on-site contaminants shall meet and maintain the following 29 CFR 1910, SECTION .120/ 29 CFR 1926, SECTION .65 (e) training requirements:

a. 40 hours of off site hazardous waste instruction.

b. 3 days actual field experience under the direct supervision of a trained, experienced supervisor.

c. 8 hours refresher training annually.

Onsite supervisors shall have an additional 8 hours management and supervisor training specified in 29 CFR 1910, SECTION .120/29 CFR 1926, SECTION .65 (e) (4).

1.11.2 Initial Session (Pre-entry Briefing)

Prior to commencement of onsite field activities, all site employees, including those assigned only to the Support Zone, shall attend a site-specific safety and health training session. This session shall be conducted by the Safety and Health Manager and/or the Site Safety and Health Officer to ensure that all personnel are familiar with requirements and responsibilities for maintaining a safe and healthful work environment. Procedures and contents of the accepted SSHP and Sections 01.B.02 and 28.D.03 of EM 385-1-1 shall be thoroughly discussed.
The Contracting Officer shall be notified at least 5 days prior to the initial site-specific training session so government personnel involved in the project may attend.

1.11.3 Periodic Sessions

Periodic onsite training shall be conducted by the SSHO for personnel assigned to work at the siteweek. The training shall address safety and health procedures, work practices, any changes in the SSHP, activity hazard analyses, work tasks, or schedule; results of air monitoring, review of safety discrepancies and accidents. Should an operational change affecting onsite field work be made, a meeting prior to implementation of the change shall be convened to explain safety and health procedures. Site-specific training sessions for new personnel, visitors, and suppliers shall be conducted by the SSHO using the training curriculum outlines developed by the Safety and Health Manager.

1.11.4 Other Training

Workers performing cleaning or surface preparation of the interior of the tank(s) shall be trained in Confined Space Entry. All Contractor personnel shall be trained according to the Contractor's Respiratory Protection Program.

1.12 PERSONAL PROTECTIVE EQUIPMENT

1.12.1 Site Specific PPE Program

Onsite personnel exposed to contaminants shall be provided with appropriate personal protective equipment. Components of levels of protection (B, C, D and modifications) must be relevant to site-specific conditions, including heat and cold stress potential and safety hazards. Only respirators approved by NIOSH shall be used. Protective equipment and clothing shall be kept clean and well maintained. The PPE section of the SSHP shall include site-specific procedures to determine PPE program effectiveness and for onsite fit-testing of respirators, cleaning, maintenance, inspection, and storage of PPE.

1.12.2 Levels of Protection

The Safety and Health Manager shall establish and evaluate as the work progresses the levels of protection for each work activity. The Safety and Health Manager shall also establish action levels for upgrade or downgrade in levels of PPE. Protocols and the communication network for changing the level of protection shall be described in the SSHP. The PPE evaluation protocol shall address air monitoring results, potential for exposure, changes in site conditions, work phases, job tasks, weather, temperature extremes, individual medical considerations, etc.

1.12.2.1 Initial PPE Components

The following items constitute minimum protective clothing and equipment ensembles to be utilized during this project:

Level D.

Appropriate work clothing
- Steel-toed work boots
- Hearing protection (if necessary)
- Hard hat
- Gloves appropriate to protect against task-specific hazards

Modified Level D

Appropriate work clothing
- Coveralls to protect against dermal exposure to contaminated soil or groundwater
- Steel-toed work boots
- Hearing protection (if necessary)
- Hard hat
- Gloves appropriate to protect against task-specific chemical and physical hazards

Level C

Air purifying respirator with organic vapor or OV/combination cartridges

Appropriate work clothing and coveralls
Gloves appropriate to protect against task-specific chemical and physical hazards
Steel-toed work boots
Hearing protection (if necessary)
Hard hat

1.12.3 PPE for Government Personnel

Two clean sets of personal protective equipment and clothing (excluding air-purifying negative-pressure respirators and safety shoes, which will be provided by individual visitors), as required for entry into the Exclusion Zone and/or Contamination Reduction Zone, shall be available for use by the Contracting Officer or official visitors. The items shall be cleaned and maintained by the Contractor and stored in a clean area and clearly marked: "FOR USE BY GOVERNMENT ONLY." The Contractor shall provide basic training in the use and limitations of the PPE provided.

1.13 MEDICAL SURVEILLANCE PROGRAM

The Contractor's medical surveillance program for workers performing cleanup operations and who will be exposed to contaminants shall meet 29 CFR 1910, SECTION .120/29 CFR 1926, SECTION .65 (f) and the following requirements. The Contractor shall assure the Occupational Physician or the physician's designee performs the physical examinations and reviews examination results. Participation in the medical surveillance program shall be without cost to the employee, without loss of pay and at a reasonable time and place.

1.13.1 Physician's Written Opinion

Before work begins a copy of the physician's written opinion for each employee shall be obtained and furnished to the Safety and Health Manager; and the employee. The opinion shall address the employee's ability to perform anticipated tasks and shall contain the following:

a. The physician's recommended limitations upon the employee's assigned work and/or PPE usage.

b. The physician's opinion about increased risk to the employee's health resulting from work; and

c. A statement that the employee has been informed and advised about the results of the examination.

1.13.2 Medical Records

Documentation of medical exams shall be provided as part of the Certificate of Worker or Visitor Acknowledgment. Medical records shall be maintained in accordance with 29 CFR 1910 SECTION .120, and 29 CFR 1926 SECTION .65.

1.14 EXPOSURE MONITORING/AIR SAMPLING PROGRAM

The Safety and Health Manager shall prepare and implement an exposure monitoring/air sampling program to identify and quantify safety and health hazards and airborne levels of hazardous substances in order to assure proper selection of engineering controls, work practices and personal protective equipment for affected site personnel.

1.15 HEAT STRESS MANAGEMENT

The Contractor shall establish a heat stress management program and implement it when the ambient temperature exceeds 70 Degrees F. The heat stress management program shall consist of the following procedures and practices.

1.15.1 Physiological Monitoring

The Contractor shall train or otherwise assure workers heart rates and body core temperatures are monitored and assure that threshold levels in Table 4 of ACGIH Limit Values are not exceeded.

1.15.2 ACGIH General Controls for Heat Stress

The Contractor shall implement general heat stress control procedures in Table 5 of ACGIH Limit Values as part of his heat stress management program.

1.15.3 ACGIH Job Specific Controls for Heat Stress

The Contractor shall implement job specific heat stress controls in Table 5 of ACGIH Limit Values when site specific conditions warrant.

1.16 SPILL AND DISCHARGE CONTROL

Written spill and discharge containment/control procedures shall be developed and implemented. These procedures shall describe prevention measures, such as building berms or dikes; spill control measures and material to be used (e.g. booms, vermiculite); location of the spill control material; personal protective equipment required to cleanup spills; disposal of contaminated material; and who is responsible to report the spill. Storage of contaminated material or hazardous materials shall be appropriately bermed, diked and/or contained to prevent any spillage of material on uncontaminated soil. If the spill or discharge is reportable, and/or human health or the environment are threatened, the National Response Center, the state, and the Contracting Officer shall be notified as soon as possible. Reporting requirements shall be in accordance with SECTION 02115 UNDERGROUND STORAGE TANK REMOVAL.

1.17 MATERIALS TRANSFER SAFETY

Liquids and residues shall be removed from the tanks using explosion-proof or air-driven pumps. Pump motors and suction hoses shall be bonded to the tank and grounded to prevent electrostatic ignition hazards. Use of a hand pump will be permitted to remove the last of the liquid from the bottom of the tanks. If a vacuum truck is used for removal of liquids or residues, the area of operation for the vacuum truck shall be vapor free. The truck shall be located upwind from the tank and outside the path of probable vapor travel. The vacuum pump exhaust gases shall be discharged through a hose of adequate size and length downwind of the truck and tank area. Vacuum truck operating and safety practices shall conform to API Pub 2219. Fuel residues shall be collected in drums, tanks, or tank trucks labeled according to 49 CFR 171 and 49 CFR 172 and disposed of as specified. After the materials have been transferred and the tanks have been exposed, fittings and lines shall be disconnected and drained of their contents. The contents of the lines shall not spill to the environment during cutting or disconnecting of fittings. Materials drained shall be transferred into DOT-approved drums for storage and/or transportation. Only non-sparking or non-heat producing tools shall be used to disconnect and drain or to cut

through tank fittings. Electrical equipment (e.g., pumps, portable hand tools, etc.) used for tank preparation shall be explosion-proof. Following cutting or disconnecting of the fittings, openings leading to the tanks shall be plugged.

1.18 CONFINED SPACE ENTRY PROCEDURES

If appropriate, the Contractor shall prepare a confined space entry procedure (that complies with the provisions of 29 CFR 1910, SECTION .146) and a lock-out-tag-out LOTO) procedure prior to beginning tank cleaning operations.

1.19 HOT WORK

Hot work will not be permitted except as outlined herein. Prior to conducting hot work, a hot work permit shall be prepared and submitted. An example format for a hot work permit shall be included in the SSHP. The permit shall describe compliance with the following procedures. After tank interiors, piping and equipment have been decontaminated, hot work may be conducted only when the tank, piping and equipment is inerted, and to the extent necessary to begin dismantling the tanks. After decontamination of tank interiors, hot work shall not be performed unless monitoring indicates atmospheres within and immediately surrounding the tanks are less than 8% oxygen inside the tank and less than 10% of the LFL outside the tank; continuous monitoring shall continue until the hot work is completed. The hot work prohibition includes welding, cutting, grinding, sawing, or other similar operations which could be expected to potentially generate combustion-producing temperatures or sparks, or which could produce potentially hazardous fumes or vapors. An individual at each hot work site shall be designated as a fire watch. This person's sole responsibility shall be to monitor the hot work and have immediate access to the fire extinguisher located at each hot work site. A new permit shall be obtained at the start of each work shift during which hot work will be conducted.

1.20 FIRE PROTECTION AND PREVENTION

Comply with all applicable provisions of 29 CFR 1926 Subpart F.

1.21 ELECTRICAL SAFETY

If temporary electrical power is used for this project, it shall conform to the National Electrical Code, the National Electrical Safety Code, and EM 385-1-1. Air monitoring and sampling equipment shall be rated intrinsically safe. All portable electrical equipment shall be protected by Ground Fault Circuit Interrupters (GFCI). Clearances to adjacent overhead transmission and distribution electrical lines shall be sufficient for the safe movement of vehicles and operation of construction equipment.

1.22 EXCAVATION AND TRENCH SAFETY

The Contractor shall comply with the requirements of 29 CFR 1926, SECTION .650-652 when workers are exposed to the potential of excavation cave-ins. The designated competent person shall determine the excavation to be safe prior to worker entrance, regardless of the depth of excavation.

1.23 GUARDING OF MACHINERY AND EQUIPMENT

Comply with the requirements of EM 385-1-1, SECTION 16.B.

1.24 LOCKOUT/TAGOUT

The Contractor shall comply with all applicable requirements of 29 CFR 1910, SECTION .147, 29 CFR 1910, SECTION .301-305, and EM 385-1-1, SECTION 12.

1.25 FALL PROTECTION

Where applicable, the Contractor shall comply with all applicable requirements of 29 CFR 1926, SECTION .500-503.

1.26 HAZARD COMMUNICATION

A hazard communication program shall be established and implemented in accordance with 29 CFR 1926, SECTION .59. This shall include the development of a written Hazard Communication Plan which shall be included as part of the SSHP and kept on site, as required by 29 CFR 1926, SECTION .59(e)(1).

1.27 ILLUMINATION

The Contractor shall comply with the requirements of 29 CFR 1926, SECTION .26.

1.28 SANITATION

Comply with EM 385-1-1, SECTION 2.

1.29 ENGINEERING CONTROLS

The Contractor shall implement feasible engineering and work practice controls to reduce and maintain employee exposure at or below the OSHA PELs and ACGIH TLVs (the more restrictive shall apply) for hazardous substances that may be encountered.

1.30 SIGNS AND LABELS

Before site operations begin, mark the perimeter of contaminated excavation areas with warning tape or other appropriate visual means. Post signs that direct visitors to the authorized entrance to the site.

1.31 WASTE DISPOSAL

Waste shall be handled, transported, and disposed in accordance with all Federal, state, and local regulations.

1.32 TANK PURGING FOR PERMIT-REQUIRED CONFINED SPACE ENTRIES

Tanks shall be purged for confined space entry. The flammable vapors shall be reduced to less than 10% of the LFL and the oxygen content shall be between 19.5% and 23.5%. Confined space entry into the tanks shall not be attempted unless absolutely necessary, as for example, to remove sludge from the tank. Flammable vapors may be exhausted from the tank by any of the methods from API RP 1604 listed below, or any method approved by the Contracting Officer. The SSHP shall specify the purging method to be used.

a. Ventilation by Eductor-Type Air Movers: The eductor-type air mover shall be properly bonded and grounded to prevent the generation and discharge of static electricity. When using this method, the fill (drop) tube shall remain in place to ensure ventilation at the bottom of the tank. Tanks equipped with fill (drop) tubes that are not removable shall be purged by this method. An eductor extension shall

be used to discharge vapors a minimum of 12 feet above grade or 3 feet above adjacent roof lines, whichever is greater. If this is not possible, alternative methods shall be proposed and approved prior to purging. Noise levels generated by these devices as a result of high airflow may exceed OSHA PELs. Noise levels shall be evaluated and appropriate hearing protection shall be provided.

b. Ventilation by Diffused Air Blowers: When using this purging method, the air-diffusing pipe is properly bonded and grounded to prevent the discharge of a spark. Fill (drop) tubes shall be removed to allow proper diffusion of the air in the tank. Air supply shall be from a compressor that has been checked to ensure that Grade D breathing air is being supplied. Air pressure in the tank shall not exceed 5 psi gauge to avoid tank failure.

c. Commercial Emulsifiers and Volatile Fuel Encapsulators: These products are completely miscible in water, aid in the elimination of flammable vapors, and are biodegradable. Regulatory requirements for treatment and disposal of the water shall be determined prior to using this method. Standing outside the tank, the operator shall rinse the tank with a 3-to-6 percent solution of the product using a pressure sprayer through a tank opening. Explosive concentrations shall be measured at several levels (top, middle, and bottom) within the tank. If readings are greater than 10% of the LFL, the tank shall be rinsed again. When LFL readings are acceptable, the water in the tank shall be pumped out for disposal.

1.33 TANK INERTING (NO ENTRY)

Following the removal of tank contents but prior to excavation of the tanks and tank preparation activities, the tanks shall be inerted only by introducing an inert gas, carbon dioxide (CO_2) or liquid nitrogen (N_2), to remove flammable vapors. Before inerting, all openings in the tanks shall be plugged with threaded or expansion type plugs except the vent tube and the opening to be used for introducing the inert gas. Within 30 minutes prior to initiating any activities (e.g., excavating, preparation, removal, opening, demolition, transportation, or other similar activities) involving a tank which has been inerted, the inerted nature of the tank (oxygen levels less than 8%) shall be verified.

a. CO_2 fire extinguishers shall not be used for inerting the tank interiors. If a compressed gas (e.g., CO_2 or N_2) is introduced into the tank the following requirements shall be met to prevent the buildup of static electricity:

1. The UST and the compressed gas supply tank shall be bonded together and grounded.

2. The compressed gas shall be supplied only at low flows.

3. The liquid or gas shall be released at the tank bottom so that static electricity is not generated by liquid falling to the bottom of the tank. The tank shall be slowly filled from the bottom up.

b. Dry ice, which evolves CO_2 gas as it evaporates, if used, shall be introduced in the amount of at least 3 lbs per 100 gallons of tank capacity. Skin contact with dry ice shall be prevented by wearing heavy cloth gloves.

c. Sufficient quantities of inert gas (CO_2 or N_2) shall be introduced into the tanks to lower the oxygen content to less than 8%. Pressure inside the tank shall not exceed 5 psi. Prior to proceeding with additional activities on the tank (e.g., excavating), the oxygen content of the tanks shall be monitored to confirm that it is less than 8%. Additional oxygen level monitoring shall be conducted at least hourly while activities involving the tanks are underway but prior to decontamination of tank interiors; at least daily during periods in which the tanks are not being disturbed but prior to decontamination of their interiors; or as directed by the Contracting Officer. If monitoring of tank interiors indicates that oxygen levels are not remaining below 8%, additional inert gas shall be introduced and more frequent oxygen monitoring shall be initiated.

d. During inerting procedures, an extension vent tube a minimum of 12 feet above grade or 3 feet above any adjacent (within 75 feet) roof lines, whichever is greater shall be used to discharge tank vapors. If this is not possible, alternative methods shall be proposed and approved prior to inerting. Continuous combustible gas/oxygen monitoring shall be conducted at the vent and inert gas introduction holes.

1.34 TANK ATMOSPHERE TESTING

The air within the storage tanks shall be monitored to ensure the space is either adequately purged and safe for personnel entry, or to ensure the tank has been adequately inerted and the oxygen content is less than 8%. In both instances, monitoring shall be performed at the top, bottom, and middle areas of the tanks to ensure stratification has not occurred. Monitoring results shall be reported to project personnel to ensure safe operations. Data shall be recorded as specified in paragraph EXPOSURE MONITORING/AIR SAMPLING PROGRAM.

1.34.1 Monitoring to Ensure Purging

When monitoring to ensure purging, both oxygen content and LFL readings are required. Prior to obtaining LFL readings, the Contractor shall monitor the oxygen content of the space and verify that the combustible gas indicators are operating within the oxygen limits identified by the CGI manufacturer. Personnel shall not be permitted to enter spaces with oxygen levels less than 19.5%, except in emergencies, and then only when equipped with the proper PPE and when following permit-required confined space entry procedures. Toxic air contaminants shall be monitored as specified in paragraph EXPOSURE MONITORING/AIR SAMPLING PROGRAM.

1.34.2 Monitoring to Ensure Inerting

Inerted tanks shall be monitored to ensure oxygen readings remain below a maximum allowable percentage of 8% by volume.

1.35 TANK LIFTING

Tanks shall be lifted using equipment with a rated capacity greater than the load to be lifted. Tanks shall be lifted by lifting eyes or by straps under the ends of the tanks. Tanks shall not be lifted by the manhole flange or by removing the bungs. Personnel shall be directed to remain away from the ends of the tanks and tanks shall be positioned, whenever possible, with the ends oriented away from occupied or traveled areas, due

to potential for rupture. During transportation, the tanks shall be secured to prevent movement.

1.36 TANK DEMOLITION

The tanks excavated as part of this project shall be demolished before being removed from the site unless they are transported directly to a state certified tank destruction facility. Demolition will not be permitted until a decontamination of the interiors and exteriors is complete. Demolition shall involve opening the tanks sufficiently to permanently prohibit further use as containers of liquids. Tanks shall be inerted and tested before they are opened. Plans and procedures, including a list of materials and supplies, for safely and effectively demolishing the tanks shall be submitted in the SSHP.

1.37 TANK CLEANING

Safety practices and procedures for the cleaning of the storage tanks shall conform to API Std 2015. Opening of the tanks to permit decontamination shall be conducted utilizing only methods approved in the SSHP. The interior and exterior of the tank shall be decontaminated prior to removing it from the work site unless the tank is being transported directly to a state certified tank destruction facility. Plans and procedures, including materials and supplies, for safely and effectively opening the tanks, cleaning surfaces of the interior and exterior of the tanks, and disposing of the decontamination fluids shall be submitted in the SSHP. Volatile organic solvents shall not be permitted to be utilized for decontamination procedures. Personnel shall not enter any of the storage tanks as a part of this project, except when following permit-required confined space entry procedures. Decontamination fluids shall be collected and disposed. Upon completion of this project, written certification shall be made that the tank was properly decontaminated prior to being removed from the site.

1.38 SITE CONTROL MEASURES

1.38.1 Work Zones

Work zone boundaries (exclusion zone, including restricted and regulated areas; contamination reduction zone; and support zone) and access points shall be established and the boundary delineations shall be described in the SSHP. Delineation of work zone boundaries shall be based on the contamination characterization and the hazard/risk analysis to be performed as described in paragraph: HAZARD/RISK ANALYSIS. As work progresses and field conditions are monitored, work zone boundaries may be modified with approval of the Contracting Officer. Work zones shall be clearly identified and marked in the field (using fences, tape, signs, etc.). A site map, showing work zone boundaries and locations of decontamination facilities, shall be posted in the onsite office. Work zones shall consist of the following:

a. Exclusion Zone (EZ): The exclusion zone is the area where hazardous contamination is either known or expected to occur and the greatest potential for exposure exists. Entry into this area shall be controlled and exit may only be made through the CRZ.

b. Contamination Reduction Zone (CRZ): The CRZ is the transition area between the Exclusion Zone and the Support Zone. The personnel and equipment decontamination areas shall be separate and unique areas located in the CRZ.

c. Support Zone (SZ): The Support Zone is defined as areas of the site, other than exclusion zones and contamination reduction zones, where workers do not have the potential to be exposed to hazardous substances or dangerous conditions resulting from hazardous waste operations. The Support Zone shall be secured against active or passive contamination. Site offices, parking areas, and other support facilities shall be located in the Support Zone.

1.38.2 Site Control Log

A log of personnel visiting, entering, or working on the site shall be maintained. The log shall include the following: date, name, agency or company, time entering and exiting site, time entering and exiting the exclusion zone (if applicable), and personal protective equipment utilized. Before visitors are allowed to enter the Contamination Reduction Zone or Exclusion Zone, they shall show proof of current training, medical surveillance and respirator fit testing (if respirators are required for the tasks to be performed) and shall fill out the Certificate of Worker or Visitor Acknowledgment. This visitor information, including date, shall be recorded in the log.

1.38.3 Communication

An employee alarm system that has adequate means of on and off site communication shall be provided and installed in accordance with 29 CFR 1910 SECTION .165. The means of communication shall be able to be perceived above ambient noise or light levels by employees in the affected portions of the workplace. The signals shall be distinctive and recognizable as messages to evacuate or to perform critical operations. This includes: the buddy system at all times. For tank cleaning, a worker shall be stationed outside the tank and provided a means of communication with workers inside the tank, such as an airhorn, in the event of an emergency requiring evacuation from the tank..

1.38.4 Site Security

Ensure employees use designated access points for movement of personnel and equipment between zones and on and off site. Close and lock any access gates on the site. Restrict site access to authorized personnel. Signs shall be printed in bold large letters on contrasting backgrounds in English and/or where appropriate, in the predominant language of workers unable to read English. Signs shall be visible from all points where entry might occur and at such distances from the restricted area that employees may read the signs and take necessary protective steps before entering.

1.39 PERSONAL HYGIENE AND DECONTAMINATION

Personnel entering the Exclusion or Contamination Reduction Zones or otherwise exposed or subject to exposure to hazardous chemical vapors, liquids, or contaminated solids shall adhere to the following personal hygiene and decontamination provisions. Decontamination shall be performed in the outside the work area to entering the Support Zone from the Exclusion Zone. Chapter 10.0 of NIOSH 85-115 shall be consulted when preparing decontamination procedures. A discussion of personal hygiene and decontamination facilities and procedures to be followed by site workers shall be submitted as part of the SSHP. Employees shall be trained in the procedures and the procedures shall be enforced throughout site operations. Persons disregarding these provisions of the SSHP shall be barred from the

site.

1.39.1 Decontamination Facilities

The Contractor shall initially set up a decontamination line outside the work area. Employees shall exit the work area and shall implement the following decontamination procedures and techniques: For the tank cleaning personnel: Scrub and rinse water proof outer garments, remove all outer garments, hand and face wash Showers if needed, must comply with 29 CFR 1910, SECTION.141 and EM 385-1-1, 02 C, Washing Facilities. Following are additional decontamination procedures contractor personnel are to follow: identified in the SSHP (i.e., removal of contaminated soil from boots, hand and face wash) For workers involved with pipes containing JP-4 or JP-8 fuels and and associated equipment, a water source must be available to wash skin that comes into contact with the fuel.. It is the site safety and health officer's responsibility to recommend techniques to improve personnel decontamination techniques and procedures, if necessary.

1.39.2 Equipment Decontamination

Vehicles and equipment used in the EZ shall be decontaminated in the CRZ prior to leaving the site.

1.39.2.1 Decontamination Facilities

The decontamination area and associated procedures shall be proposed in the SSHP.

1.40 EMERGENCY EQUIPMENT AND FIRST AID REQUIREMENTS

The following items, as a minimum, shall be maintained onsite and available for immediate use:

a. First aid equipment and supplies approved by the consulting physician.

b. Emergency eyewashes and showers which comply with ANSI Z358.1.

c. Emergency-use respirators. For escape purposes, two 5- to 15-minute emergency escape masks shall be supplied. For rescue purposes, two positive pressure self-contained breathing apparatus (SCBA) shall be supplied. These shall be dedicated for emergency use only and maintained onsite.

d. Fire extinguishers with a minimum rating for Class B fires such as carbon dioxide extinguishers of shall be provided at site facilities and in all vehicles and at any other site locations where flammable or combustible materials present a fire risk.

1.41 EMERGENCY RESPONSE AND CONTINGENCY PROCEDURES

An Emergency Response Plan, that meets the requirements of 29 CFR 1910, SECTION .120 (l) and 29 CFR 1926, SECTION .65 (l), shall be developed and implemented as a section of the SSHP. In the event of any emergency associated with remedial action, the Contractor shall, without delay, alert all onsite employees that there is an emergency situation; take action to remove or otherwise minimize the cause of the emergency; alert the Contracting Officer; and institute measures necessary to prevent repetition of the conditions or actions leading to, or resulting in, the emergency.

Employees that are required to respond to hazardous emergency situations shall be trained in how to respond to such expected emergencies. The plan shall be reviewed periodically and revised as necessary to reflect new or changing site conditions or information. Copies of the accepted SSHP and revisions shall be provided to the affected local emergency response agencies. The following elements, as a minimum, shall be addressed in the plan:

a. Pre-emergency planning. Contact the local emergency response planner during preparation of the Emergency Response Plan. The contractor shall arrange to have fire, rescue, medical and police security services provided by local emergency responders. The Contractor shall ensure the Emergency Response Plan for the site is compatible and integrated with the local fire, rescue, medical and police security services available from local emergency response planning agencies.

b. Personnel roles, lines of authority, communications for emergencies.

c. Emergency recognition and prevention.

d. Site topography, layout, and prevailing weather conditions.

e. Criteria and procedures for site evacuation (emergency alerting procedures, employee alarm system, emergency PPE and equipment, safe distances, places of refuge, evacuation routes, site security and control).

f. Specific procedures for decontamination and medical treatment of injured personnel.

g. Route maps to nearest prenotified medical facility. Site-support vehicles shall be equipped with maps. At the beginning of project operations, drivers of the support vehicles shall become familiar with the emergency route and the travel time required.

h. Emergency alerting and response procedures including posted instructions and a list of names and telephone numbers of emergency contacts (physician, nearby medical facility, fire and police departments, ambulance service, Federal, state, and local environmental agencies; as well as Safety and Health Manager, the Site Superintendent, the Contracting Officer and/or their alternates).

i. Criteria for initiating community alert program, contacts, and responsibilities.

j. Procedures for reporting incidents to appropriate government agencies. In the event that an incident such as an explosion or fire, or a spill or release of toxic materials occurs during the course of the project, the appropriate government agencies shall be immediately notified. In addition, the Contracting Officer shall be verbally notified immediately and receive a written notification within 24 hours. The report shall include the following items:

1. Name, organization, telephone number, and location of the Contractor.

2. Name and title of the person(s) reporting.

3. Date and time of the incident.

4. Location of the incident, i.e., site location, facility name.

5. Brief summary of the incident giving pertinent details including type of operation ongoing at the time of the incident.

6. Cause of the incident, if known.

7. Casualties (fatalities, disabling injuries).

8. Details of any existing chemical hazard or contamination.

9. Estimated property damage, if applicable.

10. Nature of damage, effect on contract schedule.

11. Action taken to ensure safety and security.

12. Other damage or injuries sustained, public or private.

k. Procedures for critique of emergency responses and follow-up.

1.42 CERTIFICATE OF WORKER/VISITOR ACKNOWLEDGEMENT

A copy of a Contractor-generated certificate of worker/visitor acknowledgement shall be completed and submitted for each visitor allowed to enter contamination reduction or exclusion zones, and for each employee, following the example certificate at the end of this section.

1.43 INSPECTIONS

The SSHO's Daily Inspection Logs shall be attached to and submitted with the Daily Quality Control reports. Each entry shall include the following: date, work area checked, employees present in work area, PPE and work equipment being used in each area, special safety and health issues and notes, and signature of preparer. In the event of an accident, the Contracting Officer shall be notified according to EM 385-1-1. Within 2 working days of any reportable accident, an Accident Report shall be completed on ENG Form 3394 and submitted.

1.44 SAFETY AND HEALTH PHASE-OUT REPORT

A Safety and Health Phase-Out Report shall be submitted within 10working days following completion of the work, prior to final acceptance of the work. The following minimum information shall be included:

a. Summary of the overall performance of safety and health (accidents or incidents including near misses, unusual events, lessons learned, etc.).

b. Final decontamination documentation including procedures and techniques used to decontaminate equipment, vehicles, and on site facilities.

c. Summary of exposure monitoring and air sampling accomplished during the project.

d. Signatures of Safety and Health Manager and SSHO.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

-- End of Section --

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SECTION 01355

ENVIRONMENTAL PROTECTION

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

U.S. ARMY (DA)

AR 200-5	Pest Management

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

33 CFR 328	Definitions
40 CFR 68	Chemical Accident Prevention Provisions
40 CFR 152 - 186	Pesticide Programs
40 CFR 260	Hazardous Waste Management System: General
40 CFR 261	Identification and Listing of Hazardous Waste
40 CFR 262	Standards Applicable to Generators of Hazardous Waste
40 CFR 279	Standards for the Management of Used Oil
40 CFR 302	Designation, Reportable Quantities, and Notification
40 CFR 355	Emergency Planning and Notification
49 CFR 171 - 178	Hazardous Materials Regulations

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2003) U.S. Army Corps of Engineers Safety and Health Requirements Manual
WETLAND MANUAL	Corps of Engineers Wetlands Delineation Manual Technical Report Y-87-1

1.2 DEFINITIONS

1.2.1 Environmental Pollution and Damage

Environmental pollution and damage is the presence of chemical, physical, or biological elements or agents which adversely affect human health or

welfare; unfavorably alter ecological balances of importance to human life; affect other species of importance to humankind; or degrade the environment aesthetically, culturally and/or historically.

1.2.2 Environmental Protection

Environmental protection is the prevention/control of pollution and habitat disruption that may occur to the environment during construction. The control of environmental pollution and damage requires consideration of land, water, and air; biological and cultural resources; and includes management of visual aesthetics; noise; solid, chemical, gaseous, and liquid waste; radiant energy and radioactive material as well as other pollutants.

1.2.3 Contractor Generated Hazardous Waste

Contractor generated hazardous waste means materials that, if abandoned or disposed of, may meet the definition of a hazardous waste. These waste streams would typically consist of material brought on site by the Contractor to execute work, but are not fully consumed during the course of construction. Examples include, but are not limited to, excess paint thinners (i.e. methyl ethyl ketone, toluene etc.), waste thinners,excess paints, excess solvents, waste solvents, and excess pesticides, and contaminated pesticide equipment rinse water.

1.2.4 Installation Pest Management Coordinator

Installation Pest Management Coordinator (IPMC) is the individual officially designated by the Installation Commander to oversee the Installation Pest Management Program and the Installation Pest Management Plan.

1.2.5 Land Application for Discharge Water

The term "Land Application" for discharge water implies that the Contractor shall discharge water at a rate which allows the water to percolate into the soil. No sheeting action, soil erosion, discharge into storm sewers, discharge into defined drainage areas, or discharge into the "waters of the United States" shall occur. Land Application shall be in compliance with all applicable Federal, State, and local laws and regulations.

1.2.6 Pesticide

Pesticide is defined as any substance or mixture of substances intended for preventing, destroying, repelling, or mitigating any pest, or intended for use as a plant regulator, defoliant or desiccant.

1.2.7 Pests

The term "pests" means arthropods, birds, rodents, nematodes, fungi, bacteria, viruses, algae, snails, marine borers, snakes, weeds and other organisms (except for human or animal disease-causing organisms) that adversely affect readiness, military operations, or the well-being of personnel and animals; attack or damage real property, supplies, equipment, or vegetation; or are otherwise undesirable.

1.2.8 Surface Discharge

The term "Surface Discharge" implies that the water is discharged with

possible sheeting action and subsequent soil erosion may occur. Waters that are surface discharged may terminate in drainage ditches, storm sewers,creeks, and/or "waters of the United States" and would require a permit to discharge water from the governing agency.

1.2.9 Waters of the United States

All waters which are under the jurisdiction of the Clean Water Act, as defined in 33 CFR 328.

1.2.10 Wetlands

Wetlands means those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, and bogs. Official determination of whether or not an area is classified as a wetland must be done in accordance with WETLAND MANUAL.

1.3 GENERAL REQUIREMENTS

The Contractor shall minimize environmental pollution and damage that may occur as the result of construction operations. The environmental resources within the project boundaries and those affected outside the limits of permanent work shall be protected during the entire duration of this contract. The Contractor shall comply with all applicable environmental Federal, State, and local laws and regulations. The Contractor shall be responsible for any delays resulting from failure to comply with environmental laws and regulations.

1.4 SUBCONTRACTORS

The Contractor shall ensure compliance with this section by subcontractors.

1.5 PAYMENT

No separate payment will be made for work covered under this section. The Contractor shall be responsible for payment of fees associated with environmental permits, application, and/or notices obtained by the Contractor. All costs associated with this section shall be included in the contract price. The Contractor shall be responsible for payment of all fines/fees for violation or non-compliance with Federal, State, Regional and local laws and regulations.

1.6 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with SECTION 01330 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Environmental Protection Plan; G-AO

The environmental protection plan.

1.6.1 CERTIFICATION REQUIREMENTS

An environmental agency may require design and construction documents to be certified by a Professional Engineer (PE) registered in the State of Alaska. The Contractor shall comply with the certification requirements of the environmental regulatory agencies.

1.6 ENVIRONMENTAL COORDINATION, PERMITS, NOTICES, REVIEWS AND/OR APPROVALS

The Contractor shall be responsible for contacting the appropriate Federal, State, Regional, and local environmental agencies to identify all required environmental permits (construction and operating), notices, reviews, and approvals required for the project. Once the requirements are identified, the Contractor shall be responsible for coordinating the requirements with Eielson's Environmental Flight and the Contracting Officer in regard to implementation for a Federal Facility project. The Contractor shall ensure that all coordination, permits, notices, reviews and/or approvals are completed and submitted with each applicable phase of the design. Prior to construction starting for any phase, the Contractor shall assure that all permits and/or approvals are received and copies are submitted to the Contracting Officer. The Contractor shall be responsible for any contract delays resulting from failure to obtain environmental permits, notices, reviews and/or approvals when required.

1.6.2 Applications, Supporting Documents, and Fees

The Contractor shall obtain and complete all environmental permit applications and notices including any documents required for a modification for an existing permit held by the Facility. The Contractor is responsible for preparing all supporting documents, including but not limited to engineering reports, emission surveys, diagrams, pollutant load calculations, etc. If, in lieu of permits, the governing agency requires review and approval of the design, the Contractor shall submit and obtain approval of the design and associated documents. The Contractor shall be responsible for all fees associated with the permits, applications, reviews, approvals, and notices.

1.6.3 Replace Hydrant Fuel System at Eielson AFB, Alaska Environmental Permits, Notices, Reviews, and/or Approvals

The following is a listing of permits, notices, reviews, and/or approvals which may be required for this project. This listing and requirements are not to be considered all-inclusive by the Contractor, but is provided as information that may be used in successfully accomplishing the environmental compliances. See Internet site http://www.state.ak.us/dec/dawq/dec_dawq.htm.

a. The Environmental Protection Agency (EPA) has authority for the National Pollutant Discharge Elimination System (NPDES) program. Eielson Air Force Base has been issued a EPA Resources Authorization to Discharge Under the Surface Water Discharge System. The Storm Water Pollution Prevention Plan (SWPPP) is a requirement of this permit. The SWPPP may be reviewed at the Environmental Flight Office. The Contractor shall be responsible for coordination with the Environmental Flight for possible modifications to this permit for surface drainage discharges.

b. Coverage under the Authorization to Discharge Under the EPA

Pollutant Discharge Elimination System (NPDES) Permit for storm water discharge from construction site is required. The Contractor shall be responsible for implementing the terms and requirements of the permit and shall be considered the "permittee". The Contractor shall prepare and implement a Storm Water Pollution Prevention Plan, inspections, and reporting in accordance with the Permit. The SWPPP and a copy of an unsigned Notice of Intent (NOI) shall be submitted with the 100% design submittals for review and comments by the Contracting Officer or at a minimum 7 days prior to construction commencing. The Contractor shall be responsible for all submittals to the EPA prior to construction activity beginning. The Contractor shall be responsible for assuring that their SWPPP is in accordance with Eielson AFB's SWPPP (identified in the above paragraph). The Contractor shall retain copies of the storm water pollution prevention plan and all reports in accordance with the permit. All submissions to the EPA shall be by certified mail. The Contractor shall include copies of all submittals to the EPA (NOI/NOT), a return certified mail receipt, plans, and reports in the Appendix to the Environmental Protection Plan.

c. Eielson AFB has a State of Alaska Title V Air Permit for the entire facility. The Contractor shall coordinate all air pollutant emissions with Eielson's AFB Environmental Flight for possible modifications and/or permit to construct. Eielson Air Force Base has started to obtain a Permit to Construct for Changes to their Title V permit. This permit will cover the generator and the two 10,000 barrel aboveground tanks.

e. Drinking water, new water mains including fire hydrants, back-flow preventers, lift stations, stormwater and sanitary sewer approval of plans and specifications is required by the State of Alaska prior to construction commencing. These plans and specifications shall be sent to the Alaska Department of Environmental Conservation, Division of Air and Water Quality for review and approval. The plans and specifications shall be submitted with a cover letter requesting a review and approval. The plans and specifications are required to have a stamp and signature of a registered engineer. A copy of the request shall be forwarded to the Eielson's Environmental Flight Office and the COR. The State of Alaska review period will be at least 30 days.

1.7 ENVIRONMENTAL PROTECTION PLAN

Prior to commencing construction activities or delivery of materials to the site, the Contractor shall submit an Environmental Protection Plan for review and approval by the Contracting Officer. The purpose of the Environmental Protection Plan is to present a comprehensive overview of known or potential environmental issues which the Contractor must address during construction. Issues of concern shall be defined within the Environmental Protection Plan as outlined in this section. The Contractor shall address each topic at a level of detail commensurate with the environmental issue and required construction task(s). Topics or issues which are not identified in this section, but which the Contractor considers necessary, shall be identified and discussed after those items formally identified in this section. Prior to submittal of the Environmental Protection Plan, the Contractor shall meet with the Contracting Officer for the purpose of discussing the implementation of the initial Environmental Protection Plan; possible subsequent additions and revisions to the plan including any reporting requirements; and methods for administration of the Contractor's Environmental Plans. The Environmental Protection Plan shall be current and maintained onsite by the Contractor.

1.7.1 Compliance

No requirement in this Section shall be construed as relieving the Contractor of any applicable Federal, State, and local environmental protection laws and regulations. During Construction, the Contractor shall be responsible for identifying, implementing, and submitting for approval any additional requirements to be included in the Environmental Protection Plan.

1.7.2 Contents

The environmental protection plan shall include, but shall not be limited to, the following:

a. Name(s) of person(s) within the Contractor's organization who is(are) responsible for ensuring adherence to the Environmental Protection Plan.

b. Name(s) and qualifications of person(s) responsible for manifesting hazardous waste to be removed from the site, if applicable.

c. Name(s) and qualifications of person(s) responsible for training the Contractor's environmental protection personnel.

d. Description of the Contractor's environmental protection personnel training program.

e. An erosion and sediment control plan which identifies the type and location of the erosion and sediment controls to be provided. The plan shall include monitoring and reporting requirements to assure that the control measures are in compliance with the erosion and sediment control plan, Federal, State, and local laws and regulations. A Storm Water Pollution Prevention Plan (SWPPP) may be substituted for this plan.

f. Drawings showing locations of proposed temporary excavations or embankments for haul roads, stream crossings, material storage areas, structures, sanitary facilities, and stockpiles of excess or spoil materials including methods to control runoff and to contain materials on the site.

g. Traffic control plans including measures to reduce erosion of temporary roadbeds by construction traffic, especially during wet weather. Plan shall include measures to minimize the amount of mud transported onto paved public roads by vehicles or runoff.

h. Work area plan showing the proposed activity in each portion of the area and identifying the areas of limited use or nonuse. Plan should include measures for marking the limits of use areas including methods for protection of features to be preserved within authorized work areas.

i. Drawing showing the location of borrow areas.

j. The Spill Control plan shall include the procedures, instructions, and reports to be used in the event of an unforeseen spill of a substance regulated by 40 CFR 68, 40 CFR 302, 40 CFR 355, and/or regulated under State or Local laws and regulations. The Spill Control Plan supplements the requirements of EM 385-1-1. This plan shall

include as a minimum:

1. The name of the individual who will report any spills or hazardous substance releases and who will follow up with complete documentation. This individual shall immediately notify the Contracting Officer, Facility Environmental Office, the Facility Response Personnel if a reportable quantity is released to the environment. The plan shall contain a list of the required reporting channels and telephone numbers.

2. The name and qualifications of the individual who will be responsible for implementing and supervising the containment and cleanup.

3. Training requirements for Contractor's personnel and methods of accomplishing the training.

4. A list of materials and equipment to be immediately available at the job site, tailored to cleanup work of the potential hazard(s) identified.

5. The names and locations of suppliers of containment materials and locations of additional fuel oil recovery, cleanup, restoration, and material-placement equipment available in case of an unforeseen spill emergency.

6. The methods and procedures to be used for expeditious contaminant cleanup.

k. A non-hazardous solid waste disposal plan identifying methods and locations for solid waste disposal including clearing debris. The plan shall include schedules for disposal. The Contractor shall identify any subcontractors responsible for the transportation and disposal of solid waste. Licenses or permits shall be submitted for solid waste disposal sites that are not a commercial operating facility. Evidence of the disposal facility's acceptance of the solid waste shall be attached to this plan during the construction. The Contractor shall attach a copy of each of the Non-hazardous Solid Waste Diversion Reports to the disposal plan. The report shall be submitted on the first working day after the first quarter that non-hazardous solid waste has been disposed and/or diverted and shall be for the previous quarter (e.g. the first working day of January, April, July, and October). The report shall indicate the total amount of waste generated and total amount of waste diverted in cubic metersyards or tons along with the percent that was diverted.

l. A recycling and solid waste minimization plan with a list of measures to reduce consumption of energy and natural resources. The plan shall detail the Contractor's actions to comply with and to participate in Federal, State, Regional, and local government sponsored recycling programs to reduce the volume of solid waste at the source. Eielson Air Force Base has a Waste Disposal/Borrow Pit Coordination Review Form which will need to be completed prior to construction activity commencing. A copy of this form is attached to this section and can be obtained the Eielson Environmental Flight office.

m. An air pollution control plan detailing provisions to assure that dust, debris, materials, trash, etc., do not become air borne and travel off the project site.

n. A contaminant prevention plan that: identifies potentially hazardous substances to be used on the job site; identifies the intended actions to prevent introduction of such materials into the air, water, or ground; and details provisions for compliance with Federal, State, and local laws and regulations for storage and handling of these materials. In accordance with EM 385-1-1, a copy of the Material Safety Data Sheets (MSDS) and the maximum quantity of each hazardous material to be on site at any given time shall be included in the contaminant prevention plan. As new hazardous materials are brought on site or removed from the site, the plan shall be updated.

o. A waste water management plan that identifies the methods and procedures for management and/or discharge of waste waters which are directly derived from construction activities, such as concrete curing water, clean-up water, disinfection water, hydrostatic test water, and water used in flushing of lines. If a settling/retention pond is required, the plan shall include the design of the pond including drawings, removal plan, and testing requirements for possible pollutants. If land application will be the method of disposal for the waste water, the plan shall include a sketch showing the location for land application along with a description of the pretreatment methods to be implemented. If surface discharge will be the method of disposal, a copy of the permit and associated documents shall be included as an attachment prior to discharging the waste water. If disposal is to a sanitary sewer, the plan shall include documentation that the Waste Water Treatment Plant Operator has approved the flow rate, volume, and type of discharge.

p. A historical, archaeological, cultural resources biological resources and wetlands plan that defines procedures for identifying and protecting historical, archaeological, cultural resources, biological resources and wetlands known to be on the project site: and/or identifies procedures to be followed if historical archaeological, cultural resources, biological resources and wetlands not previously known to be onsite or in the area are discovered during construction. The plan shall include methods to assure the protection of known or discovered resources and shall identify lines of communication between Contractor personnel and the Contracting Officer.

q. A pesticide treatment plan shall be included and updated, as information becomes available. The plan shall include: sequence of treatment, dates, times, locations, pesticide trade name, EPA registration numbers, authorized uses, chemical composition, formulation, original and applied concentration, application rates of active ingredient (i.e. pounds of active ingredient applied), equipment used for application and calibration of equipment. The Contractor is responsible for Federal, State, Regional and Local pest management record keeping and reporting requirements as well as any additional Installation specific requirements. The Contractor shall follow AR 200-5 Pest Management, Chapter 2, Section III "Pest Management Records and Reports" for data required to be reported to the Installation.

1.7.3 Appendix

Copies of all environmental permits, permit application packages, approvals to construct, notifications, certifications, reports, and termination documents shall be attached,as an appendix, to the Environmental Protection Plan.

1.8 PROTECTION FEATURES

This paragraph supplements the Contract Clause PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES, AND IMPROVEMENTS. Prior to start of any onsite construction activities, the Contractor and the Contracting Officer shall make a joint condition survey. Immediately following the survey, the Contractor shall prepare a brief report including a plan describing the features requiring protection under the provisions of the Contract Clauses, which are not specifically identified on the drawings as environmental features requiring protection along with the condition of trees, shrubs and grassed areas immediately adjacent to the site of work and adjacent to the Contractor's assigned storage area and access route(s), as applicable. This survey report shall be signed by both the the Contractor and the Contracting Officer upon mutual agreement as to its accuracy and completeness. The Contractor shall protect those environmental features included in the survey report and any indicated on the drawings, regardless of interference which their preservation may cause to the Contractor's work under the contract.

1.9 ENVIRONMENTAL ASSESSMENT OF CONTRACT DEVIATIONS

Any deviations, requested by the Contractor, from the drawings,plans and specifications which may have an environmental impact will be subject to approval by the Contracting Officer and may require an extended review, processing, and approval time. The Contracting Officer reserves the right to disapprove alternate methods, even if they are more cost effective, if the Contracting Officer determines that the proposed alternate method will have an adverse environmental impact.

1.10 NOTIFICATION

The Contracting Officer will notify the Contractor in writing of any observed noncompliance with Federal, State or local environmental laws or regulations, permits, and other elements of the Contractor's Environmental Protection plan. The Contractor shall, after receipt of such notice, inform the Contracting Officer of the proposed corrective action and take such action when approved by the Contracting Officer. The Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No time extensions shall be granted or equitable adjustments allowed to the Contractor for any such suspensions. This is in addition to any other actions the Contracting Officer may take under the contract, or in accordance with the Federal Acquisition Regulation or Federal Law.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 LAND RESOURCES

The Contractor shall confine all activities to areas defined by the drawings and specifications. Prior to the beginning of any construction, the Contractor shall identify any land resources to be preserved within the work area. Except in areas indicated on the drawings or specified to be cleared, the Contractor shall not remove, cut, deface, injure, or destroy land resources including trees, shrubs, vines, grasses, topsoil, and land forms without approval. No ropes, cables, or guys shall be fastened to or attached to any trees for anchorage unless specifically authorized. The

Contractor shall provide effective protection for land and vegetation resources at all times as defined in the following subparagraphs. Stone, soil, or other materials displaced into uncleared areas shall be removed by the Contractor.

3.1.1 Work Area Limits

Prior to commencing construction activities, the Contractor shall mark the areas that need not be disturbed under this contract. Isolated areas within the general work area which are not to be disturbed shall be marked or fenced. Monuments and markers shall be protected before construction operations commence. Where construction operations are to be conducted during darkness, any markers shall be visible in the dark. The Contractor's personnel shall be knowledgeable of the purpose for marking and/or protecting particular objects.

3.1.2 Landscape

Trees, shrubs, vines, grasses, land forms and other landscape features indicated and defined on the drawings to be preserved shall be clearly identified by marking, fencing, or wrapping with boards, or any other approved techniques. The Contractor shall restore landscape features damaged or destroyed during construction operations outside the limits of the approved work area.

3.1.3 Erosion and Sediment Controls

The Contractor shall be responsible for providing erosion and sediment control measures in accordance with Federal, State, and local laws and regulations. The erosion and sediment controls selected and maintained by the Contractor shall be such that water quality standards are not violated as a result of the Contractor's construction activities. The area of bare soil exposed at any one time by construction operations should be kept to a minimum. The Contractor shall construct or install temporary and permanent erosion and sediment control best management practices (BMPs) as indicated on the drawings. BMPs may include, but not be limited to, vegetation cover, stream bank stabilization, slope stabilization, silt fences, construction of terraces, interceptor channels, sediment traps, inlet and outfall protection, diversion channels, and sedimentation basins. The Contractor's best management practices shall also be in accordance with the Alaska National Pollutant Discharge Elimination System (NPDES) Storm Water Pollution Prevention Plan (SWPPP) which may be reviewed at the Eielson's Environmental Office. Any temporary measures shall be removed after the area has been stabilized.

3.1.4 Contractor Facilities and Work Areas

The Contractor's field offices, staging areas, stockpile storage, and temporary buildings shall be placed in areas designated on the drawings or as directed by the Contracting Officer. Temporary movement or relocation of Contractor facilities shall be made only when approved. Erosion and sediment controls shall be provided for on-site borrow and spoil areas to prevent sediment from entering nearby waters. Temporary excavation and embankments for plant and/or work areas shall be controlled to protect adjacent areas.

3.2 WATER RESOURCES

The Contractor shall monitor construction activities to prevent pollution

of surface and ground waters. Toxic or hazardous chemicals shall not be applied to soil or vegetation unless otherwise indicated. All water areas affected by construction activities shall be monitored by the Contractor. For construction activities immediately adjacent to impaired surface waters, the Contractor shall be capable of quantifying sediment or pollutant loading to that surface water when required by State or Federally issued Clean Water Act permits.

3.2.1 Wetlands

The Contractor shall not enter, disturb, destroy, or allow discharge of contaminants into any wetlands except as described in the contract documents. Authorization to enter specific wetlands identified shall not relieve the Contractor from any obligation to protect other wetlands within, adjacent to, or in the vicinity of the construction site and associated boundaries. Authorization to work on wetlands shall be obtained from the Eielson Environmental Flight Office.

3.3 AIR RESOURCES

Equipment operation, activities, or processes performed by the Contractor shall be in accordance with all Federal and State air emission and performance laws and standards.

3.3.1 Particulates

Dust particles; aerosols and gaseous by-products from construction activities; and processing and preparation of materials, such as from asphaltic batch plants; shall be controlled at all times, including weekends, holidays and hours when work is not in progress. The Contractor shall maintain excavations, stockpiles, haul roads, permanent and temporary access roads, plant sites, spoil areas, borrow areas, and other work areas within or outside the project boundaries free from particulates which would cause the Federal, State, and local air pollution standards to be exceeded or which would cause a hazard or a nuisance. Sprinkling, chemical treatment of an approved type, baghouse, scrubbers, electrostatic precipitators or other methods will be permitted to control particulates in the work area. Sprinkling, to be efficient, must be repeated to keep the disturbed area damp at all times. The Contractor must have sufficient, competent equipment available to accomplish these tasks. Particulate control shall be performed as the work proceeds and whenever a particulate nuisance or hazard occurs. The Contractor shall comply with all State and local visibility regulations.

3.3.2 Odors

Odors from construction activities shall be controlled at all times. The odors shall not cause a health hazard and shall be in compliance with State regulations and/or local ordinances.

3.3.3 Sound Intrusions

The Contractor shall keep construction activities under surveillance and control to minimize environment damage by noise. The Contractor shall comply with the provisions of the State of Alaska rules.

3.3.4 Burning

Burning shall be prohibited on the Government premises.

3.4 CHEMICAL MATERIALS MANAGEMENT AND WASTE DISPOSAL

Disposal of wastes shall be as directed below, unless otherwise specified in other sections and/or shown on the drawings.

3.4.1 Solid Wastes

Solid wastes (excluding clearing debris) shall be placed in containers which are emptied on a regular schedule. Handling, storage, and disposal shall be conducted to prevent contamination. Segregation measures shall be employed so that no hazardous or toxic waste will become co-mingled with solid waste. The Contractor shall transport solid waste off Government property and dispose of it in compliance with Federal, State, and local requirements for solid waste disposal. A Subtitle D RCRA permitted landfill shall be the minimum acceptable off-site solid waste disposal option. The Contractor shall verify that the selected transporters and disposal facilities have the necessary permits and licenses to operate. The Contractor shall comply with site procedures (Eielson AFB Waste Disposal/Borrow Pit Coordination Review), Federal, State, and local laws and regulations pertaining to the use of landfill areas.

3.4.2 Chemicals and Chemical Wastes

Chemicals shall be dispensed ensuring no spillage to the ground or water. Periodic inspections of dispensing areas to identify leakage and initiate corrective action shall be performed and documented. This documentation will be periodically reviewed by the Government. Chemical waste shall be collected in corrosion resistant, compatible containers. Collection drums shall be monitored and removed to a staging or storage area when contents are within 6 inches of the top. Wastes shall be classified, managed, stored, and disposed of in accordance with Federal, State, and local laws and regulations.

3.4.3 Contractor Generated Hazardous Wastes/Excess Hazardous Materials

Hazardous wastes are defined in 40 CFR 261, or are as defined by applicable State and local regulations. Hazardous materials are defined in 49 CFR 171 - 178. The Contractor shall, at a minimum, manage and store hazardous waste in compliance with 40 CFR 262 and shall manage and store hazardous waste in accordance with the Installation hazardous waste management plan. The Contractor shall take sufficient measures to prevent spillage of hazardous and toxic materials during dispensing. The Contractor shall segregate hazardous waste from other materials and wastes, shall protect it from the weather by placing it in a safe covered location, and shall take precautionary measures such as berming or other appropriate measures against accidental spillage. The Contractor shall be responsible for storage, describing, packaging, labeling, marking, and placarding of hazardous waste and hazardous material in accordance with 49 CFR 171 - 178, State, and local laws and regulations. The Contractor shall transport Contractor generated hazardous waste off Government property within 60 days in accordance with the Environmental Protection Agency and the Department of Transportation laws and regulations. The Contractor shall dispose of hazardous waste in compliance with Federal, State and local laws and regulations. Spills of hazardous or toxic materials shall be immediately reported to the Contracting Officer and the Facility Environmental Office. Cleanup and cleanup costs due to spills shall be the Contractor's responsibility. The disposition of Contractor generated hazardous waste and excess hazardous materials are the Contractor's responsibility. The

Contractor shall coordinate the disposition of hazardous waste with the Facility's Hazardous Waste Manager and the Contracting Officer.

3.4.4 Fuel and Lubricants

Storage, fueling and lubrication of equipment and motor vehicles shall be conducted in a manner that affords the maximum protection against spill and evaporation. Fuel, lubricants and oil shall be managed and stored in accordance with all Federal, State, Regional, and local laws and regulations. Used lubricants and used oil to be discarded shall be stored in marked corrosion-resistant containers and recycled or disposed in accordance with 40 CFR 279, State, and local laws and regulations. There shall be no storage of fuel on the project site. Fuel must be brought to the project site each day that work is performed.

3.4.5 Waste Water

Disposal of waste water shall be as specified below.

a. Waste water from construction activities, such as onsite material processing, concrete curing, foundation and concrete clean-up, water used in concrete trucks, forms, etc. shall not be allowed to enter water ways or to be discharged prior to being treated to remove pollutants. The Contractor shall dispose of the construction related waste water off-Government property in accordance with all Federal, State, Regional and Local laws and regulations, or by collecting and placing it in a retention pond where suspended material can be settled out and/or the water can evaporate to separate pollutants from the water. The site for the retention pond shall be coordinated and approved with the Contracting Officer. The residue left in the pond prior to completion of the project shall be removed, tested, and disposed off-Government property in accordance with Federal, State, and local laws and regulations. The area shall be backfilled to the original grade, top-soiled and seeded/sodded.

b. For discharge of ground water, the Contractor shall surface discharge in accordance with the requirements of the NPDES or State STORM WATER DISCHARGES FROM CONSTRUCTION SITES permit. Land application shall be in accordance with all Federal, State, Regional, and/or Local laws and regulations for pumping and land applying ground water.

c. Water generated from the flushing of lines after disinfection or disinfection in conjunction with hydrostatic testing shall be land applied in accordance with all Federal, State, and local laws and regulations for land application.

3.5 RECYCLING AND WASTE MINIMIZATION

The Contractor shall participate in State and local government sponsored recycling programs. The Contractor is further encouraged to minimize solid waste generation throughout the duration of the project.

3.6 NON-HAZARDOUS SOLID WASTE DIVERSION REPORT

The Contractor shall maintain an inventory of non-hazardous solid waste diversion and disposal of construction and demolition debris. The Contractor shall submit a report to Eielson Environmental Flight through the Contracting Officer on the first working day after each fiscal year

quarter, starting the first quarter that non-hazardous solid waste has been generated. The following shall be included in the report:

a. Construction and Demolition (C&D) Debris Disposed = (_____) in cubic yards or tons,, as appropriate.

b. Construction and Demolition (C&D) Debris Recycled = (_____) in cubic yards or tons,, as appropriate.

c. Total C&D Debris Generated = (_____) in cubic yards or tons,, as appropriate.

d. Waste Sent to Waste-To-Energy Incineration Plant (This amount should not be included in the recycled amount) = (_____) in cubic yards or tons,, as appropriate.

3.7 HISTORICAL, ARCHAEOLOGICAL, AND CULTURAL RESOURCES

If during excavation or other construction activities any previously unidentified or unanticipated historical, archaeological, and cultural resources are discovered or found, all activities that may damage or alter such resources shall be temporarily suspended. Resources covered by this paragraph include but are not limited to: any human skeletal remains or burials; artifacts; shell, midden, bone, charcoal, or other deposits; rock or coral alignments, pavings, wall, or other constructed features; and any indication of agricultural or other human historical activities. Upon such discovery or find, the Contractor shall immediately notify the Contracting Officer so that the appropriate authorities may be notified and a determination made as to their significance and what, if any, special disposition of the finds should be made. The Contractor shall cease all activities that may result in impact to or the destruction of these resources. The Contractor shall secure the area and prevent employees or other persons from trespassing on, removing, or otherwise disturbing such resources.

3.8 BIOLOGICAL RESOURCES

The Contractor shall minimize interference with, disturbance to, and damage to fish, wildlife, and plants including their habitat. The Contractor shall be responsible for the protection of threatened and endangered animal and plant species including their habitat in accordance with Federal, State, Regional, and local laws and regulations.

3.9 INTEGRATED PEST MANAGEMENT

In order to minimize impacts to existing fauna and flora, the Contractor, through the Contracting Officer, shall coordinate with the Installation Pest Management Coordinator (IPMC) at the earliest possible time prior to pesticide application. The Contractor shall discuss integrated pest management strategies with the IPMC and receive concurrence from the IPMC through the COR prior to the application of any pesticide associated with these specifications. Installation Pest Management personnel shall be given the opportunity to be present at all meetings concerning treatment measures for pest or disease control and during application of the pesticide. The use and management of pesticides are regulated under 40 CFR 152 - 186.

3.9.1 Pesticide Delivery and Storage

Pesticides shall be delivered to the site in the original, unopened containers bearing legible labels indicating the EPA registration number and the manufacturer's registered uses. Pesticides shall be stored according to manufacturer's instructions and under lock and key when unattended.

3.9.2 Qualifications

For the application of pesticides, the Contractor shall use the services of a subcontractor whose principal business is pest control. The subcontractor shall be licensed and certified in the state where the work is to be performed.

3.9.3 Pesticide Handling Requirements

The Contractor shall formulate, treat with, and dispose of pesticides and associated containers in accordance with label directions and shall use the clothing and personal protective equipment specified on the labeling for use during all phases of the application. Material Safety Data Sheets (MSDS)shall be available for all pesticide products.

3.9.4 Application

Pesticides shall be applied by a State Certified Pesticide Applicator in accordance with EPA label restrictions and recommendation. The Certified Applicator shall wear clothing and personal protective equipment as specified on the pesticide label. Water used for formulating shall only come from locations designated by the Contracting Officer. The Contractor shall not allow the equipment to overflow. Prior to application of pesticide, all equipment shall be inspected for leaks, clogging, wear, or damage and shall be repaired prior to being used.

3.10 AIR POLLUTION

3.10.1 General

Sprinkling or similar methods shall be employed to control dust. If sprinkling is used, the Contractor shall retain sufficient, suitable equipment at the site(s) and repeat applications at such intervals as to keep all parts of the jobsite damp as indicated below. As a minimum, one water truck shall be on-site at all times for each location except when freezing weather precludes sprinkling.

3.10.2 Dust Control - Mullins Pit

The Contractor shall keep dust generated by operations at this location from becoming a nuisance. The Contractor shall ensure that no material of any type will fall off any vehicle while in transit, and that no dust is generated by the transport vehicles.

3.10.3 Dust Control - South Gate Access Road

Dust control applications shall be at such intervals as to keep all parts of the access road, taxiways, apron areas, and storage yards damp at all times 24-hours/day, 7-days/week. There shall be no visible dust coming off any portion of these areas at any time, or off any vehicle hauling material for the Contractor. In addition, the Contractor shall ensure that no

material of any type will fall off any vehicle while in transit.

3.11 HAZARDOUS MATERIALS USE ON-SITE

All Department of Defense (DOD) Contractors in order to facilitate DOD compliance with all information collection and reporting provisions of Executive Order (E.O.) 12856 are required to collect and report information on Hazardous Materials usage. This includes, but is not limited to, the Emergency Preparedness and Community Right-To-Know Act (EPCRA) and the Pollution Prevention Act (PPA) requirements of the E.O. Each Contractor working on site shall submit projected use quantities and MSD's for all project materials containing SARA Title III chemicals to the Contracting Officer 30 days prior to on site construction start. Contractors shall use the Contractor's Hazardous Materials Usage Report as formatted below or a Contractor-generated report that contains the same information. This information will be consolidated by the project/contract number and delivered to the Hazmart by the Contracting Officer. Information will be entered into AF-EMIS under the contract information. The Contractor shall provide to the Contracting Officer a completed Contractor's Hazardous Material Usage Report (or equivalent) within 60 days of on-site construction completion. If new hazardous materials (containing SARA Title III Chemicals) are introduced during the contract period, submit the projected use quantities and the new MSDS's not later than seven days after the purchase date (copy of MSDS and invoice is acceptable.) If there is a 25 percent increase in projected use quantity of an already identified hazardous material (containing a SARA Title III chemical) over the initial revised estimate, then the Contractor must submit a revised projected use quantity estimate (no MSDS is required).

Contractor Hazardous Material Usage Report

Part Number	Product Name	Manufacturer	Initial Estimated Quantity	Quantity Used	Unit of Issue (gal, lb, qt, etc)
1.					
2.					
3.					
4.					
5.					
6.					
7.					

Air Force Contract Monitor: _____
Phone Number: _____
Contractor Point of Contact: _____
Phone Number: _____

3.12 PREVIOUSLY USED EQUIPMENT

The Contractor shall clean all previously used construction equipment prior to bringing it onto the project site. The Contractor shall ensure that the equipment is free from soil residuals, egg deposits from plant pests, noxious weeds, and plant seeds. The Contractor shall consult with the USDA jurisdictional office for additional cleaning requirements.

3.13 MAINTENANCE OF POLLUTION FACILITIES

The Contractor shall maintain permanent and temporary pollution control facilities and devices for the duration of the contract or for that length

of time construction activities create the particular pollutant.

3.14 MILITARY MUNITIONS

In the event the Contractor discovers or uncovers military munitions as defined in 40 CFR 260, the Contractor shall immediately stop work in that area and immediately inform the Contracting Officer.

3.15 TRAINING OF CONTRACTOR PERSONNEL

The Contractor's personnel shall be trained in all phases of environmental protection and pollution control. The Contractor shall conduct environmental protection/pollution control meetings for all Contractor personnel prior to commencing construction activities. Additional meetings shall be conducted for new personnel and when site conditions change. The training and meeting agenda shall include: methods of detecting and avoiding pollution; familiarization with statutory and contractual pollution standards; installation and care of devices, vegetative covers, and instruments required for monitoring purposes to ensure adequate and continuous environmental protection/pollution control; anticipated hazardous or toxic chemicals or wastes, and other regulated contaminants; recognition and protection of archaeological sites, artifacts, wetlands, and endangered species and their habitat that are known to be in the area.

3.16 POST CONSTRUCTION CLEANUP

The Contractor shall clean up all areas used for construction in accordance with Contract Clause: "Cleaning Up". The Contractor shall, unless otherwise instructed in writing by the Contracting Officer, obliterate all signs of temporary construction facilities such as haul roads, work area, structures, foundations of temporary structures, stockpiles of excess or waste materials, and other vestiges of construction prior to final acceptance of the work. The disturbed area shall be graded, filled and the entire area seeded unless otherwise indicated.

3.17 ATTACHMENT

Blank EIE AFB Waste Disposal/Borrow Pit Coordination Review document

EIELSON AFB WASTE DISPOSAL/BORROW PIT COORDINATION REVIEW (Page 1)

FTQW #/PROJECT TITLE:

Air Force Project Manager/Telephone Number:

Contractor Project Engineer/Telephone Number:

AF FORM 332 FOR PROJECT (Air Force project manager must attach to Coordination Review)

REQUIRED SURVEYS (To be completed by project engineer. For SABER, Demolition IDIQ, Pavements IDIQ, and Roofing IDIQ to be done by Air Force project manager.)

1. Lead-based paint survey (has been / will be / is not required to be – circle one) accomplished. Attach or give a brief description of the results or state why a survey is not required:

2. Asbestos survey. Attach results or state why a survey is not required:

WASTES TO BE GENERATED (Quantities are an estimate by the project engineer.):

1. Trees:_____number, square feet, or acres

2. Trees and brush or hydro-axed vegetation and soil mixture:_____cubic yards

3. Clean soil:_____cubic yards - give brief description (percent silt, sand, gravel, etc):

4. Contaminated soil:_____cubic yards. Type of contaminate(s):

5. Concrete:_____cubic yards

6. Asphalt:

   a. Chunk_____cubic yards

   b. Milled_____cubic yards

EIELSON AFB WASTE DISPOSAL/BORROW PIT COORDINATION REVIEW (Page 2)

FTQW #/PROJECT TITLE:

Air Force Project Manager/Telephone Number:

Contractor Project Engineer/Telephone Number:

WASTES TO BE GENERATED (continued)(Quantities are an estimate by the project engineer.):

7. Asbestos:_____cubic yards

8. Hazardous Wastes (Quantities as applicable)

Non-incandescent lights:_____ Smoke detectors:_____ Waste paint:_____
PCB light ballasts:_____ Exit lights:_____ Used solvents:_____
Transformers:_____
Others:_____List and give brief description):

9. Construction/Demolition Wastes (wood, glass, sheetrock, pipe, shingles, etc):

   a. Give brief description:

   b. Items to be salvaged (list):

   c. Items to be recycled (list):

BORROW PITS: Materials required (Quantities are an estimate by the project engineer. Approval of this review authorizes removal of actual quantities needed.):

1. Gravel:_____cubic yards

2. Topsoil:_____cubic yards

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DIVISION 01 - GENERAL REQUIREMENTS

SECTION 01356

STORM WATER POLLUTION PREVENTION MEASURES

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SECTION 01356

STORM WATER POLLUTION PREVENTION MEASURES

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 4439	(1997) Standard Terminology for Geosynthetics
ASTM D 4491	(1999a) Water Permeability of Geotextiles by Permittivity
ASTM D 4533	(1991; R 1996) Trapezoid Tearing Strength of Geotextiles
ASTM D 4632	(1991; R 1997) Grab Breaking Load and Elongation of Geotextiles
ASTM D 4751	(1999a) Determining Apparent Opening Size of a Geotextile
ASTM D 4873	(2001) Identification, Storage, and Handling of Geosynthetic Rolls

1.2 GENERAL

The Contractor shall implement the storm water pollution prevention measures specified in this section in a manner which will meet the requirements of SECTION 01355 ENVIRONMENTAL PROTECTION, and the requirements of the National Pollution Discharge Elimination System (NPDES) permit attached to that Section.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with SECTION 01330 SUBMITTAL PROCEDURES:

SD-05 Design Data

Storm Water Pollution Prevention Plan (SWPPP); G, AE.

Notice of Intent for Storm Water Discharge (NOI); G, AE.

Description of the Project; G, AE.

Notice of Termination of Coverage (NOT); G, AE.

SD-07 Certificates

Mill Certificate or Affidavit

Certificate attesting that the Contractor has met all specified requirements.

1.4 EROSION AND SEDIMENT CONTROLS

The controls and measures required by the Contractor are described below.

1.4.1 Stabilization Practices

The stabilization practices to be implemented shall include mulching,geotextiles,erosion control matts, preservation of mature vegetation,etc. On his daily CQC Report, the Contractor shall record the dates when the major grading activities occur, (e.g., clearing and grubbing,excavation,embankment,and grading); when construction activities temporarily or permanently cease on a portion of the site; and when stabilization practices are initiated. Except as provided in paragraphs UNSUITABLE CONDITIONS and NO ACTIVITY FOR LESS THAN 21 DAYS, stabilization practices shall be initiated as soon as practicable, but no more than 14 days, in any portion of the site where construction activities have temporarily or permanently ceased.

1.4.1.1 Unsuitable Conditions

Where the initiation of stabilization measures by the fourteenth day after construction activity temporarily or permanently ceases is precluded by unsuitable conditions caused by the weather, stabilization practices shall be initiated as soon as practicable after conditions become suitable.

1.4.1.2 No Activity for Less Than 21 Days

Where construction activity will resume on a portion of the site within 21 days from when activities ceased (e.g., the total time period that construction activity is temporarily ceased is less than 21 days), then stabilization practices do not have to be initiated on that portion of the site by the fourteenth day after construction activity temporarily ceased.

1.4.2 Structural Practices

Structural practices shall be implemented to divert flows from exposed soils, temporarily store flows, or otherwise limit runoff and the discharge of pollutants from exposed areas of the site. Structural practices shall be implemented in a timely manner during the construction process to minimize erosion and sediment runoff. Structural practices shall include the following devices.

1.4.2.1 Silt Fences

The Contractor shall provide silt fences as a temporary structural practice to minimize erosion and sediment runoff. Silt fences shall be properly installed to effectively retain sediment immediately after completing each phase of work where erosion would occur in the form of sheet and rill erosion (e.g. clearing and grubbing, excavation, embankment, and grading).

Silt fences shall be installed in the locations indicated on the drawings. Final removal of silt fence barriers shall be upon approval by the Contracting Officer.

1.4.2.2 Straw Bales

The Contractor shall provide bales of straw as a temporary structural practice to minimize erosion and sediment runoff. Bales shall be properly placed to effectively retain sediment immediately after completing each phase of work (e.g., clearing and grubbing, excavation, embankment, and grading) in each independent runoff area (e.g., after clearing and grubbing in a area between a ridge and drain, bales shall be placed as work progresses, bales shall be removed/replaced/relocated as needed for work to progress in the drainage area). Areas where straw bales are to be used are shown on the drawings. Final removal of straw bale barriers shall be upon approval by the Contracting Officer. Rows of bales of straw shall be provided as follows:

a. Along the downhill perimeter edge of all areas disturbed.

b. Along the top of the slope or top bank of drainage ditches, channels, swales, etc. that traverse disturbed areas.

c. Along the toe of all cut slopes and fill slopes of the construction areas.

d. Perpendicular to the flow in the bottom of existing drainage ditches, channels, swales, etc. that traverse disturbed areas or carry runoff from disturbed areas. Rows shall be spaced a maximum of 65 feet apart.

e. Perpendicular to the flow in the bottom of new drainage ditches, channels, and swales. Rows shall be spaced a maximum of 65 feet apart.

f. At the entrance to culverts that receive runoff from disturbed areas.

1.5 NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES)

Work shall comply with EPA NPDES General Permit. Reference website at http://cfpub.epa.gov/npdes/stormwater/cgp.cfm for permit, required forms, and guidance documents.

1.5.1 Storm Water Pollution Prevention Plan (SWPPP)

Storm Water Pollution Prevention Plan (SWPPP)in accordance with the Environmental Protection Agency's NPDES General Permits for Storm Water Discharge from Construction Activities published in the Federal Register July 1, 2003, pages 39087 - 39091. The Contractor is also responsible for compliance with any updates and changes to this permit. The Contracting Officer will retain authority assigned therein to the State. The SWPP shall be submitted to the Contracting Officer for review and approval.

1.5.2 Notice of Intent for Storm Water Discharge (NOI)

The Contractor shall complete EPA Form 3510-9, Notice of Intent for Storm Water Discharges Associated with Construction Activity Under a NPDES General Permit, in accordance with EPA instructions and requirements. The

contractor shall be responsible for determining the proper coordinates to use on Form 3510-9 and entering those coordinates in the right format. The Contractor shall complete the form, and submit it, along with the SWPPP, a one page description of the project, a copy of the Civil Drawings, and prepaid mailing envelopes for the whole package, one addressed to the NPDES Program Director and the other addressed to the Alaska Department of Environmental Conservation, to the Contracting Officer for review

1.5.3 Filing

Upon receipt of satisfactory submittal from the Contractor, the Resident Engineer will promptly complete a separate 3510-9, for the Government, and forward both the Contractor-prepared and Resident Engineer-prepared forms to the NPDES Program Director. In accordance with applicable requirements, no onsite work shall be performed until two days after the documents have been post marked, notwithstanding any other provisions of the contract.

The Government will forward copies of both Form 3510-9's, along with the SWPPP, the one-page project description, and civil drawings to the Alaska Department of Environmental Conservation (ADEC) in accordance with State of Alaska regulations. The Contractor shall pay all fees required for review in accordance with 18 AAC 72.

1.5.4 Notice of Termination of Coverage (NOT)

Upon completion of work at the project site, the Contractor shall prepare EPA Form 3510-13, Notice of Termination of Coverage Under the NPDES General Permit for Storm Water Discharges Associated with Industrial Activity, in accordance with the regulations stated on the form. The completed form and prepaid mailing envelopes shall be submitted to the Contracting Officer within 10 days after the earliest date that final site conditions meet filing requirements. The Resident Engineer will promptly complete a separate 3510-13 for the Government. The Government will forward both forms to the NPDES Program Director.

PART 2 PRODUCTS

2.1 COMPONENTS FOR SILT FENCES

2.1.1 Filter Fabric

The geotextile shall comply with the requirements of ASTM D 4439, and shall consist of polymeric filaments which are formed into a stable network such that filaments retain their relative positions. The filament shall consist of a long-chain synthetic polymer composed of at least 85 percent by weight of ester, propylene, or amide, and shall contain stabilizers and/or inhibitors added to the base plastic to make the filaments resistance to deterioration due to ultraviolet and heat exposure. Synthetic filter fabric shall contain ultraviolet ray inhibitors and stabilizers to provide a minimum of six months of expected usable construction life at a temperature range of 0 to 120 degrees F. The filter fabric shall meet the following requirements:

FILTER FABRIC FOR SILT SCREEN FENCE

PHYSICAL PROPERTY	TEST PROCEDURE	STRENGTH REQUIREMENT
Grab Tensile	ASTM D 4632	100 lbs. min.
Elongation (%)		30 % max.

FILTER FABRIC FOR SILT SCREEN FENCE

PHYSICAL PROPERTY	TEST PROCEDURE	STRENGTH REQUIREMENT
Trapezoid Tear	ASTM D 4533	55 lbs. min.
Permittivity	ASTM D 4491	0.2 sec-1
AOS (U.S. Std Sieve)	ASTM D 4751	20-100

2.1.2 Silt Fence Stakes and Posts

The Contractor may use either wooden stakes or steel posts for fence construction. Wooden stakes utilized for silt fence construction, shall have a minimum cross section of 2 inches by 2 inches when oak is used and 4 inches by 4 inches when pine is used, and shall have a minimum length of 5 feet. Steel posts (standard "U" or "T" section) utilized for silt fence construction, shall have a minimum weight of 1.33 pounds per linear foot and a minimum length of 5 feet.

2.1.3 Mill Certificate or Affidavit

A mill certificate or affidavit shall be provided attesting that the fabric and factory seams meet chemical, physical, and manufacturing requirements specified above. The mill certificate or affidavit shall specify the actual Minimum Average Roll Values and shall identify the fabric supplied by roll identification numbers. The Contractor shall submit a mill certificate or affidavit signed by a legally authorized official from the company manufacturing the filter fabric.

2.1.4 Identification Storage and Handling

Filter fabric shall be identified, stored and handled in accordance with ASTM D 4873.

2.2 COMPONENTS FOR STRAW BALES

The straw in the bales shall be stalks from oats, wheat, rye, barley, rice, or from grasses such as byhalia, bermuda, etc., furnished in air dry condition. The bales shall have a standard cross section of 14 inches by 18 inches. All bales shall be either wire-bound or string-tied. The Contractor may use either wooden stakes or steel posts to secure the straw bales to the ground. Wooden stakes utilized for this purpose, shall have a minimum dimensions of 2 inches x 2 inches in cross section and shall have a minimum length of 3 feet. Steel posts (standard "U" or "T" section) utilized for securing straw bales, shall have a minimum weight of 1.33 pounds per linear foot and a minimum length of 3 feet.

PART 3 EXECUTION

3.1 INSTALLATION OF SILT FENCES

Silt fences shall extend a minimum of 16 inches above the ground surface and shall not exceed 34 inches above the ground surface. Filter fabric shall be from a continuous roll cut to the length of the barrier to avoid the use of joints. When joints are unavoidable, filter fabric shall be spliced together at a support post, with a minimum 6 inch overlap, and securely sealed. A trench shall be excavated approximately 4 inches wide

and 4 inches deep on the upslope side of the location of the silt fence. The 4-inch by 4-inch trench shall be backfilled and the soil compacted over the filter fabric. Silt fences shall be removed upon approval by the Contracting Officer.

3.2 INSTALLATION OF STRAW BALES

Straw bales shall be placed in a single row, lengthwise on the contour, with ends of adjacent bales tightly abutting one another. Straw bales shall be installed so that bindings are oriented around the sides rather than along the tops and bottoms of the bales in order to prevent deterioration of the bindings. The barrier shall be entrenched and backfilled. A trench shall be excavated the width of a bale and the length of the proposed barrier to a minimum depth of 4 inches. After the bales are staked and chinked (gaps filled by wedging with straw), the excavated soil shall be backfilled against the barrier. Backfill soil shall conform to the ground level on the downhill side and shall be built up to 4 inches against the uphill side of the barrier. Loose straw shall be scattered over the area immediately uphill from a straw bale barrier to increase barrier efficiency. Each bale shall be securely anchored by at least two stakes driven through the bale. The first stake or steel post in each bale shall be driven toward the previously laid bale to force the bales together. Stakes or steel pickets shall be driven a minimum 18 inches deep into the ground to securely anchor the bales.

3.3 MAINTENANCE

The Contractor shall maintain the temporary and permanent vegetation, erosion and sediment control measures, and other protective measures in good and effective operating condition by performing routine inspections to determine condition and effectiveness, by restoration of destroyed vegetative cover, and by repair of erosion and sediment control measures and other protective measures. The following procedures shall be followed to maintain the protective measures.

3.3.1 Silt Fence Maintenance

Silt fences shall be inspected in accordance with paragraph INSPECTIONS. Any required repairs shall be made promptly. Close attention shall be paid to the repair of damaged silt fence resulting from end runs and undercutting. Should the fabric on a silt fence decompose or become ineffective, and the barrier is still necessary, the fabric shall be replaced promptly. Sediment deposits shall be removed when deposits reach one-third of the height of the barrier. When a silt fence is no longer required, it shall be removed. The immediate area occupied by the fence and any sediment deposits shall be shaped to an acceptable grade. The areas disturbed by this shaping shall be seeded in accordance with SECTION 02921 SEEDING.

3.3.2 Straw Bale Maintenance

Straw bale barriers shall be inspected in accordance with paragraph INSPECTIONS. Close attention shall be paid to the repair of damaged bales, end runs and undercutting beneath bales. Necessary repairs to barriers or replacement of bales shall be accomplished promptly. Sediment deposits shall be removed when deposits reach one-half of the height of the barrier. Bale rows used to retain sediment shall be turned uphill at each end of each row. When a straw bale barrier is no longer required, it shall be removed. The immediate area occupied by the bales and any sediment

deposits shall be shaped to an acceptable grade. The areas disturbed by this shaping shall be seeded in accordance with SECTION 02921SEEDING.

3.4 INSPECTIONS

3.4.1 General

The Contractor shall inspect disturbed areas of the construction site, areas used for storage of materials that are exposed to precipitation that have not been finally stabilized, stabilization practices, structural practices, other controls, and area where vehicles exit the site at least once every seven (7) calendar days and within 24 hours of the end of any storm that produces 0.5 inches or more rainfall at the site. Where sites have been finally stabilized, such inspection shall be conducted at least once every month.

3.4.2 Inspections Details

Disturbed areas and areas used for material storage that are exposed to precipitation shall be inspected for evidence of, or the potential for, pollutants entering the drainage system. Erosion and sediment control measures identified in the Storm Water Pollution Prevention Plan shall be observed to ensure that they are operating correctly. Discharge locations or points shall be inspected to ascertain whether erosion control measures are effective in preventing significant impacts to receiving waters. Locations where vehicles exit the site shall be inspected for evidence of offsite sediment tracking.

3.4.3 Inspection Reports

For each inspection conducted, the Contractor shall prepare a report summarizing the scope of the inspection, name(s) and qualifications of personnel making the inspection, the date(s) of the inspection, major observations relating to the implementation of the Storm Water Pollution Prevention Plan, maintenance performed, and actions taken. The report shall be furnished to the Contracting Officer within 24 hours of the inspection as a part of the Contractor's daily CQC REPORT. A copy of the inspection report shall be maintained on the job site.

-- End of Section --

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SECTION 01400

SPECIAL SAFETY REQUIREMENTS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

CODE OF FEDERAL REGULATIONS (CFR)

29 CFR 1910	Occupational Safety and Health Standards
29 CFR 1926	Safety and Health Regulations for Construction
29 CFR 1910.20	Access to Employee Exposure and Medical Records
29 CFR 1910.94	Ventilation
29 CFR 1910.134	Respiratory Protection
29 CFR 1910.146	Permit-required Confined Spaces
40 CFR 50.6	National Primary and Secondary Ambient Air Quality Standards for Particulate Matter
40 CFR 50.12	National Primary and Secondary Ambient Air Quality Standards for Lead
40 CFR 50	Reference Method for the Determination of Suspended Particulate Matter in the Atmosphere
40 CFR 58	Probe Siting Criteria for Ambient Air Quality Monitoring

NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH (NIOSH)

NIOSH Pub No. 98-119	(1998, 4th Ed., 2nd Supplement) NIOSH Manual of Analytical Methods

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z87.1	(1989; Errata; Z87.1a) Occupational and Educational Eye and Face Protection
ANSI Z358.1	(1998) Emergency Eyewash and Shower Equipment

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC Guide 6	(1997) Containing Debris Generated During Paint Removal Operations

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2002) National Electrical Code

STATE OF ALASKA ADMINISTRATIVE CODE (AAC)

18 AAC 50	Air Quality Control
8 AAC 60-80	Occupational Safety and Health Division

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2003) U.S. Army Corps of Engineers Safety and Health Requirements Manual

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1926.62	Lead

1.2 SUMMARY

1.2.1 General

This section provides guidelines for preparation of accident prevention plans, and to implement the accident prevention clause (this specification) and EM 385-1-1, Safety and Health Requirements Manual. This section also includes guidelines for demolition of structures that contain lead-based paint. The U.S. Army Corps of Engineers Safety and Health Requirements Manual, EM 385-1-1 is available from U.S. Government bookstores operated by the Government Printing Office Changes to EM 385-1-1 applicable to this contract include only those revisions posted at the following website (all revisions up to the time this solicitation is issued): http://www.hq.usace.army.mil/soh/hqusace_soh.htm ("Changes to EM"). U.S. Government bookstores are located in most major cities including Milwaukee, Chicago, Kansas City, Denver, and Pueblo, Colorado.

1.2.2 Description of Work

Three pumphouses (Bldgs 1305, 1315, and 1321), associated fuel piping and hydrant pits comprising the existing Type I systems at E&, E8, and E9 Complexes will be demolished. The new facility will house two 10,000 bbl JP-8 storage tanks, a new pumphouse, a heated pantograph storage area, an emergency generator, and two truck fillstands. Petroleum contaminated soil may also be encountered during removal of USTs adjacent to Bldgs 1305, 1315, and 1321.

1.3 PRECONSTRUCTION CONFERENCE

See Contract Clause "PRECONSTRUCTION CONFERENCE". A preconstruction conference will be scheduled prior to beginning of site work. Requirements relative to planning and administration of the overall safety program will be discussed.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with SECTION 01330SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Accident Prevention Plan; G-AO.

The Contractor shall submit an Accident Prevention Plan in accordance with the requirements of Section 01 of EM 385-1-1. The plan shall include, but is not limited to, each of the topic areas listed in Appendix A therein and the requirements of paragraph SAFETY AND HEALTH PROVISIONS; each topic shall be developed in a concise manner to include management and operational aspects.

Respiratory Protection Program; G-AO.

The Contractor shall submit a comprehensive written respiratory protection program in accordance with 29 CFR 1910.134, 29 CFR 1926.62, and Section 05.E of EM 385-1-1.

SD-03 Product Data

Airborne Sampling Plan; G-AO

The contractor shall submit an Airborne Sampling Plan detailing the NIOSH Pub No. 98-119, Factory Mutual, or Underwriters Laboratories approved equipment, equipment calibration procedures, sampling methods, sampling to be performed, and analytical procedures to be used based on the type of work to be performed and anticipated toxic contaminants to be generated. The contractor shall include the name of the accredited laboratory, listed by the American Industrial Hygiene Association (AIHA), to be used to conduct the analysis of any collected air samples.

Medical Surveillance Plan; G-AO.

The Contractor shall submit a Medical Surveillance Plan as required in paragraph MEDICAL STATUS and provide a statement from the examining physician indicating the name of each employee evaluated and any limitations which will preclude the employee from performing the work required. The statement shall include the date of the medical evaluation, the physician's name, signature, and telephone number.

Confined Space Procedures; G-AO.

The Contractor shall submit detailed written standard operating procedures for confined spaces in accordance with 29 CFR 1910.146 and EM 385-1-1, Section 6I, and as further described in this paragraph.

a. The procedures shall include certificates of calibration for all testing and monitoring equipment. The certificates of calibration shall include: type of equipment, model number, date

of calibration, firm conducting calibration, and signature of individual certifying calibration.

b. The procedures shall include methods of inspection of personal protective equipment prior to use.

c. The procedures shall include work practices and other engineering controls designed to reduce airborne hazardous chemical exposures to a minimum.

d. The procedures shall include specification of the design and installation of ventilation systems which shall provide adequate oxygen content and provide for the dilution of paint solvent vapor and other toxic particulates within the confined space. In addition, the contractor shall include plans to evaluate the adequacy of air flow patterns.

Worker Protection Plan; G-AO

The Contractor shall submit a Worker Protection Plan in accordance with the requirements of 29 CFR 1926.62. The plan shall address all necessary aspects of worker protection.

Containment Plan; G-AO

The Contractor shall submit a plan for containing debris generated during paint preparation operations in accordance with the requirements of paragraph Containment. The plan shall include drawings, load-bearing capacity calculations, and wind load calculations. When the design is such that the spent abrasive is allowed to accumulate in quantities greater than 1,000 pounds, and/or impart a significant wind load on the structure, the contractor shall have the drawings approved by a registered structural engineer. The drawings and calculations shall be stamped with the engineer's seal.

SD-06 Test Reports

Exposure Assessment and Air Monitoring; G-AO.

Air-monitoring results and documentation.

Airborne Sampling Report; G-AO.

The Contractor shall submit reports of airborne sampling tests as required by paragraph Airborne Sampling.

PM-10 Monitoring Report; G-AO.

The Contractor shall submit reports of the PM-10 monitoring tests as described in paragraph PM-10 Monitoring.

Inspection and Operation Records; G-AO

The Contractor shall submit records of inspections and operations performed in accordance with paragraph INSPECTION. Submittals shall be made on a daily basis.

SD-07 Certificates

Qualifications; G-AO.

A written report providing evidence of qualifications for personnel, facilities and equipment assigned to the work. Include copies of:

a. Current State and Local supervisor and worker accreditation certificates.

b. Laboratory Qualifications and Certificates

Medical Requirements.

Physician's written opinion.

1.5 QUALIFICATIONS

Qualifications and experience shall comply with the following.

1.5.1 Certified Professional

The Contractor shall utilize a qualified and competent person as defined in Section 01 of EM 385-1-1 to develop the required safety and health submittal and to provide on-site safety and health services during the contract period. The person shall be a Certified Industrial Hygienist (CIH), an Industrial Hygienist (IH), or a Certified Safety Professional (CSP) with a minimum of 3 years of demonstrated experience in similar related work. The Contractor shall certify that the Certified Industrial Hygienist (CIH) holds current and valid certification from the American Board of Industrial Hygiene (ABIH), that the IH is considered board eligible by written confirmation from the ABIH, or that the CSP holds current and valid certification from the American Board of Certified Safety Professionals. The CIH, IH, or CSP may utilize other qualified and competent persons, as defined in EM 385-1-1, to conduct on-site safety and health activities as long as these persons have a minimum of 2 years of demonstrated experience in similar related work and are under the direct supervision of the CIH, IH, or CSP.

1.5.2 Certified Laboratory

The Contractor shall provide documentation which includes the name, address, and telephone number of the laboratories to be providing services.

1.6 SAFETY AND HEALTH PROVISIONS

Work shall be performed in accordance with the requirements of 29 CFR 1910, 29 CFR 1926, EM 385-1-1, 8 AAC 60-80 and other references as listed herein. Matters of interpretation of the standards shall be submitted to the Contracting Officer for resolution before starting work. Where the regulations conflict, the most stringent requirements shall apply. Paragraph SAFETY AND HEALTH PROVISIONS supplements the requirements of EM 385-1-1, paragraph (1). In any conflict between Section 01 of EM 385-1-1 and this paragraph, the provisions herein shall govern.

1.6.1 Abrasive Blasting

The Contractor shall comply with the requirements in Section 06.H of EM 385-1-1.

1.6.1.1 Hoses And Nozzles

In addition to the requirements in Section 20 of EM 385-1-1, hoses and hose connections of a type to prevent shock from static electricity shall be used. Hose lengths shall be joined together by approved couplings of a material and type designed to prevent erosion and weakening of the couplings. The couplings and nozzle attachments shall fit on the outside of the hose and shall be designed to prevent accidental disengagement.

1.6.1.2 Workers Other Than Blasters

Workers other than blasting operators working in close proximity to abrasive blasting operations shall be protected by utilizing MSHA/NIOSH-approved half-face or full-face air purifying respirators equipped with high-efficiency particulate air (HEPA) filters, eye protection meeting or exceeding ANSI Z87.1 and hearing protectors (ear plugs and/or ear muffs) providing a noise reduction rating of at least 20 dBA or as needed to provide adequate protection.

1.6.2 Cleaning with Compressed Air

Cleaning with compressed air shall be in accordance with Section 20.B.5 of EM 385-1-1 and personnel shall be protected as specified in 29 CFR 1910.134.

1.6.3 Cleaning with Solvents

1.6.3.1 Ventilation

Ventilation shall be provided where required by 29 CFR 1910.146 or where the concentration of solvent vapors exceeds 10 percent of the Lower Explosive Limit (LEL). Ventilation shall be in accordance with 29 CFR 1910.94, paragraph (c)(5).

1.6.3.2 Personal Protective Equipment

Personal protective equipment shall be provided where required by 29 CFR 1910.146 and in accordance with 29 CFR 1910, Subpart I.

1.6.4 Pretreatment of Metals and Concrete with Acids

1.6.4.1 Personal Protective Equipment

Personnel shall be protected in accordance with 29 CFR 1910, Subpart I.

1.6.4.2 Emergency Equipment

In addition to the requirements of Section 05 of EM 385-1-1, the Contractor shall provide an eyewash in accordance with ANSI Z358.1, paragraph (6).

1.6.5 Mixing Epoxy and Polyurethane Resin Formulations

1.6.5.1 Exhaust Ventilation

Local exhaust ventilation shall be provided in the area where the curing agent and resin are mixed. This ventilation system shall be capable of providing at least 100 linear fpm of capture velocity measured at the point where the curing agent and resin contact during mixing.

1.6.5.2 Personal Protective Equipment

Exposure of skin and eyes to epoxy resin components shall be avoided by wearing appropriate chemically resistant gloves, apron, safety goggles, and face shields meeting or exceeding the requirements of ANSI Z87.1

1.6.5.3 Medical Precautions

Individuals who have a history of sensitivity to epoxy or polyurethane resin systems shall be medically evaluated before any exposure can occur. Individuals who are medically evaluated as exhibiting a sensitivity to epoxy resins shall not conduct work tasks or otherwise be exposed to such chemicals. Individuals who develop a sensitivity shall be immediately removed from further exposure and medically evaluated.

1.6.5.4 Emergency Equipment

A combination unit, comprised of an eyewash and deluge shower, within close proximity to the epoxy or polyurethane resin mixing operation shall be provided in accordance with ANSI Z358.1, paragraph (9).

1.6.6 Paint Application

1.6.6.1 Ventilation

When using solvent-based paint in confined spaces, ventilation shall be provided to exchange air in the space at a minimum rate of 5,000 cubic feet per minute per spray gun in operation. It may be necessary to install both a mechanical supply and exhaust ventilation system to effect adequate air changes within the confined space. All air-moving devices shall be located and affixed to an opening of the confined space in a manner that assures that the airflow is not restricted or short circuited and is supplied in the proper direction. Means of egress shall not be blocked. Ventilation shall be continued after completion of painting and through the drying phase of the operation. If the ventilation system fails or the concentration of volatiles exceeds 10 percent of the LEL (except in the zone immediately adjacent to the spray nozzle), painting shall be stopped and spaces evacuated until such time that adequate ventilation is provided. An audible alarm that signals system failure shall be an integral part of the ventilation system. The effectiveness of the ventilation shall be checked by using ventilation smoke tubes and making frequent oxygen and combustible gas readings during painting operations. Exhaust ducts shall discharge clear of the working areas and away from possible sources of ignition.

1.6.6.2 Explosion Proof Equipment

Electrical wiring, lights, and other equipment located in the paint spraying area shall be of the explosion proof type designed for operation in Class I, Division 1, Group D, hazardous locations as required by the NFPA 70. Electrical wiring, motors, and other equipment, outside of but within 20 feet of any spraying area, shall not spark and shall conform to the provisions for Class I, Division 2, Group D, hazardous locations. Electric motors used to drive exhaust fans shall not be placed inside spraying areas or ducts. Fan blades and portable air ducts shall be constructed of nonferrous materials. Motors and associated control equipment shall be properly maintained and grounded. The metallic parts of air-moving devices, spray guns, connecting tubing, and duct work shall be electrically bonded and the bonded assembly shall be grounded.

1.6.6.3 Further Precautions

a. Workers shall wear nonsparking safety shoes.

b. Solvent drums taken into the spraying area shall be placed on nonferrous surfaces and shall be grounded. Metallic bonding shall be maintained between containers and drums when materials are being transferred.

c. Insulation on all power and lighting cables shall be inspected to ensure that the insulation is in excellent working condition and is free of all cracks and worn spots. Cables shall be further inspected to ensure that no connections are within 50 feet of the operation, that lines are not overloaded, and that they are suspended with sufficient slack to prevent undue stress or chafing.

1.6.6.4 Ignition Sources

Ignition sources, to include lighted cigarettes, cigars, pipes, matches, or cigarette lighters shall be prohibited in area of solvent cleaning, paint storage, paint mixing, or paint application.

1.6.7 Health Protection

1.6.7.1 Air Sampling

The Contractor shall perform air sampling and testing as needed to assure that workers are not exposed to contaminants above the permissible exposure limit. In addition, the Contractor shall provide the Contracting Officer with a copy of the test results from the laboratory within five working days of the sampling date and shall provide results from direct-reading instrumentation on the same day the samples are collected.

1.6.7.2 Respirators

During all spray painting operations, spray painters shall use approved SCBA or SAR (air line) respirators, unless valid air sampling has demonstrated contaminant levels to be consistently within concentrations that are compatible with air-purifying respirator Assigned Protection Factor (APF). Persons with facial hair that interferes with the sealing surface of the facepiece to faceseal or interferes with respirator valve function shall not be allowed to perform work requiring respiratory protection. Air-purifying chemical cartridge/canister half- or full-facepiece respirators that have a particulate pre-filter and are suitable for the specific type(s) of gas/vapor and particulate contaminant(s) may be used for non-confined space painting, mixing, and cleaning (using solvents). These respirators may be used provided the measured or anticipated concentration of the contaminant(s) in the breathing zone of the exposed worker does not exceed the APF for the respirator and the gas/vapor has good warning properties or the respirator assembly is equipped with a NIOSH-approved end of service life indicator for the gas(es)/vapor anticipated or encountered. Where paint contains toxic elements such as lead, cadmium, chromium, or other toxic particulates that may become airborne during painting in non-confined spaces, air-purifying half- and full-facepiece respirators or powered air-purifying respirators equipped with appropriate gas vapor cartridges, in combination with a high-efficiency filter, or an appropriate canister incorporating a high-efficiency filter, shall be used.

1.6.7.3 Protective Clothing and Equipment

All workers shall wear safety shoes or boots, appropriate gloves to protect against the chemical to be encountered, and breathable, protective, full-body covering during spray-painting applications. Where necessary for emergencies, protective equipment such as life lines, body harnesses, or other means of personnel removal shall be used during confined-space work.

1.7 MEDICAL STATUS

Prior to the start of work and annually thereafter, all Contractor employees working with or around paint systems, thinners, blast media, those required to wear respiratory protective equipment, and those who will be exposed to high noise levels shall be medically evaluated for the particular type of exposure they may encounter. Medical records shall be maintained as required by 29 CFR 1910.20. The evaluation shall include:

a. Audiometric testing and evaluation of employees who will work in a noise environment with a time weighted average greater than or equal to 90 dBA.

b. Vision screening (employees who use full-facepiece respirators shall not wear contact lenses).

c. Medical evaluation shall include, but shall not be limited to, the following:

1. Medical history including, but not limited to, alcohol use, with emphasis on liver, kidney, and pulmonary systems, and sensitivity to chemicals to be used on the job.

2. General physical examination with emphasis on liver, kidney, and pulmonary system.

3. Determination of the employee's physical and psychological ability to wear respiratory protective equipment and to perform job-related tasks.

4. Determination of baseline values of biological indices for later comparison to changes associated with exposure to paint systems and thinners or blast media, which include: liver function tests to include SGOT, SGPT, GGPT, alkaline phosphates, bilirubin, complete urinalysis, EKG (employees over age 40), blood urea nitrogen (bun), serum creatinine, pulmonary function test, FVC, and FEV, chest x-ray (if medically indicated), blood lead and ZPP (for individuals where it is known there will be an exposure to materials containing lead), other criteria that may be deemed necessary by the Contractor's physician, and Physician's statements for individual employees that medical status would permit specific task performance.

5. For lead-based paint removal, the medical requirements of 29 CFR 1926.62 shall also be included.

1.8 CHANGE IN MEDICAL STATUS

Any employee whose medical status has changed negatively due to work related chemical and/or physical agent exposure while working with or

around paint systems and thinners, blast media, or other chemicals shall be evaluated by a physician, and the Contractor shall obtain a physicians statement as described in paragraph MEDICAL STATUS prior to allowing the employee to return to those work tasks. The Contractor shall notify the Contracting Officer in writing of any negative changes in employee medical status and the results of the physicians reevaluation statement.

1.9 ENVIRONMENTAL PROTECTION

The Contractor shall comply with the following environmental protection criteria.

1.9.1 Containment

The Contractor shall contain debris generated during paint preparation operations in accordance with the requirements of SSPC Guide 6. Where required the containment air pressure shall be verified visually. Where required the minimum air movement velocity shall be 100 fpm for cross-draft ventilation or 60 fpm for down-draft ventilation.

1.9.2 Air Quality Monitoring

1.9.2.1 PM-10 Monitoring

The Contractor shall perform PM-10 monitoring. The positioning of air monitoring equipment shall be in accordance with 40 CFR 58, App E, Subpart (8). In addition, a minimum of two PM-10 monitors shall be used at the project site, one down wind from the project and one in the area of greatest public access (e.g., playground, school yard, or homeowner's yard). When the project is in an area where there are critical receptors nearby, monitoring shall be conducted throughout the entire period that abrasive blasting and cleanup operations are performed. Otherwise, monitoring shall be performed 4 of the first 8 days and on a regular basis thereafter for a sum total of 25 percent of the time surface preparation and debris cleanup are performed. Failure to meet air quality regulatory limits per 40 CFR 50.6, 40 CFR 50.12, 40 CFR 50, App B, or 18 AAC 50 shall require air monitoring to be repeated immediately after corrective actions have been taken. The Contractor shall also conduct pre-project PM-10 monitoring. The pre-project PM-10 monitoring shall be conducted a minimum of 2 weeks prior to the beginning of the project. The monitoring shall continue for a minimum of 3 days to establish background levels. A report of the results shall be submitted to the Contracting Officer within 48 hours and shall include:

1. Name and location of jobsite.

2. Date of monitoring.

3. Time of monitoring (i.e., time monitoring begins and ends each day).

4. Identification and serial number of monitoring units.

5. Drawing showing specific location of monitoring units.

6. Drawing showing specific location of paint removal operation and the method of removal or work activity being performed.

7. Wind direction and velocity.

8. A flow chart verifying the rate of air flow across the filter throughout the sampling period.

9. Name and address of laboratory.

10. Laboratory test procedure.

11. Laboratory test results.

12. Signatures of field and laboratory technicians conducting the work.

1.10 INSPECTION

The Contractor shall inspect, document, and report all work phases and operations on a daily basis. As a minimum the daily report shall contain the following:

a. Inspections performed, including the area of the structure involved and the results of the inspection.

b. Surface preparation operations performed, including the area of the structure involved, the mode of preparation, the kinds of solvent, abrasive, or power tools employed, and whether contract requirements were met.

c. Thinning operations performed, including thinners used, batch numbers, and thinner/paint volume ratios.

d. Application operations performed, including the area of the structure involved, mode of application employed, ambient temperature, substrate temperature, dew point, relative humidity, type of paint with batch numbers, elapsed time between surface preparation and application, elapsed time for recoat, condition of underlying coat, number of coats applied, and if specified, measured dry film thickness or spreading rate of each new coating.

1.11 ACCIDENT PREVENTION PLANS

The Contractor shall submit, prior to the start of on site activity, a proposed accident prevention plan which shall be the accident prevention policy to be followed by all of the Contractor's and subcontractor's personnel and supervisory staff during performance of the work.

1.11.1 Requirements

The proposed plan shall be developed after a careful analysis of the work involved and shall be tailored specifically to the conditions of this project. The Contractor's accident prevention plan shall also contain, as a minimum, the following general information or procedures for the activity indicated. The Contractor shall submit his plan for review and acceptance prior to commencing work.

1.11.1.1 Responsible Individual(s)

The Contractor shall designate an onsite employee as the individual responsible for insuring the accident prevention plan is implemented and enforced.

1.11.1.2 Subcontractor Supervision

Explain procedures to assure that subcontractor(s) fully comply with the accident prevention plan.

1.11.1.3 Indoctrination of New Employees

The plan shall include provisions for advising workers of the purpose of the accident prevention plan, specific hazards on the job and precautions to be taken, emergency procedures, information concerning tool box safety meetings, required protective equipment, cleanup rules and location of company safety rules (posting or handout).

1.11.1.4 Tool Box Safety Meetings

Hold weekly "Tool Box" safety meetings. Timely safety subjects shall be determined by a responsible individual. Employees will be informed of time, location, who will conduct, and subject. Identify procedures for including subcontractors. The Contractor shall provide a copy of the Weekly Tool Box Meeting and Monthly Supervisor's Safety Meeting to the Contracting Officer.

1.11.1.5 Fire Prevention and Protection

Identify source of fire protection. Insure adequate fire extinguishers, water barrels, or other fire-fighting equipment is located on site. Explain prevention activities to include storage areas and special hazards such as welding and use of flammable liquids, and other special hazards.

1.11.1.6 Housekeeping

Daily cleanup of all debris and waste materials is required. Adequate disposal containers should be placed strategically around the site. Debris shall be removed on a regular basis. Explain procedures that include use of barrels, dumpsters, trash chutes, etc.

1.11.1.7 Mechanical Equipment Inspection

All mechanical equipment (trucks, cranes, forklifts, backhoes, graders, etc.) shall be inspected prior to use and at fixed intervals throughout the life of the contract. Explain how inspections will be accomplished (frequency, by whom, and records to be kept).

1.11.1.8 First Aid and Medical Facilities

First aid facilities shall be made available on the job site. Arrangements for emergency medical attention shall be made prior to start of work. All emergency numbers (doctor, hospital, ambulance, fire department) shall be posted at the project superintendent's office.

1.11.1.9 Sanitation

Include provisions for toilet facilities, drinking water and washing facilities. A sufficient number of toilet facilities as specified in EM 385-1-1 shall be provided unless permission is granted to use existing facilities (portable chemical are authorized). Insure safe drinking water and individual cups are available. For the projects where corrosive or toxic materials are used, separate washing facilities are required.

1.11.1.10 Safety Promotions

The Contractor shall promote accident prevention. Identify method (posters, awards etc.).

1.11.1.11 Accident Reporting

All accidents (employee injuries, vehicle, building, or equipment damage etc.) regardless of their severity, shall be reported to the onsite government representative or to the area engineer, who in turn will advise the Contractor of forms to be submitted and timeframes.

1.11.1.12 Job Hazard Analysis

When job situations change and it is necessary to alter safety requirements, a Job Hazard Analysis will be accomplished, documented, and added as an addendum to the Accident Prevention Plan. Each Job Hazard Analysis shall include, but not be limited to, a description of the work, probable hazards related to that work and positive precautionary measures to be taken to reduce or eliminate each hazard. An example of changing situations may be new subcontractors performing work such as earth moving, trenching, concrete work, roofing, electrical, masonry etc. The onsite government representative will determine the format and amount of detail required of the written plan.

1.11.2 Safety and Health Oversight

Work which may expose personnel to lead paint shall be supervised by a Competent Person as defined in 29 CFR 1926.62 and as required in paragraph: Qualifications of this section. The Competent Person shall be able to identify existing and predictable lead paint hazards and shall have the authority to take corrective measures to eliminate them. Personal air monitoring shall be overseen by the Competent Person.

1.11.3 Qualifications

1.11.3.1 Competent Person

The Contractor's full-time onsite Competent Person shall meet the competent person requirements of 29 CFR 1926, Section .62 and be experienced in administration and supervision of projects involving lead-based paint, including work practices, protective measures for personnel, etc. This person shall have completed a Contractor Supervisor LBP abatement course by an EPA Training Center or an equivalent certification course, and have had a minimum of 2 years on-the-job experience.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

-- End of Section --

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DIVISION 01 - GENERAL REQUIREMENTS

SECTION 01420

SOURCES FOR REFERENCE PUBLICATIONS

PART 1 GENERAL

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SECTION 01420

SOURCES FOR REFERENCE PUBLICATIONS

PART 1 GENERAL

1.1 REFERENCES

Various publications are referenced in other sections of the specifications to establish requirements for the work. These references are identified in each section by document number, date and title. The document number used in the citation is the number assigned by the standards producing organization, (e.g. ASTM B 564 Nickel Alloy Forgings). However, when the standards producing organization has not assigned a number to a document, an identifying number has been assigned for reference purposes.

1.2 ORDERING INFORMATION

The addresses of the standards publishing organizations whose documents are referenced in other sections of these specifications are listed below, and if the source of the publications is different from the address of the sponsoring organization, that information is also provided. Documents listed in the specifications with numbers which were not assigned by the standards producing organization should be ordered from the source by title rather than by number. The designations "AOK" and "LOK" are for administrative purposes and should not be used when ordering publications.

ACI INTERNATIONAL (ACI)
P.O. Box 9094
Farmington Hills, MI 48333-9094
Ph: 248-848-3700
Fax: 248-848-3701
Internet: http://www.aci-int.org

AIR CONDITIONING AND REFRIGERATION INSTITUTE (ARI)
4100 North Fairfax Drive, Suite 200
Arlington, VA 22203
Ph: 703-524-8800
Fax: 703-528-3816
E-mail: ari@ari.org
Internet: http://www.ari.org

AIR DIFFUSION COUNCIL (ADC)
1000 East Woodfield Road, Suite 102
Shaumburg, IL 60173-5921
Ph: 847-706-6750
Fax: 847-706-6751
E-mail: info@flexibleduct.org
Internet: http://www.flexibleduct.org

AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL (AMCA)
30 West University Drive
Arlington Heights, IL 60004-1893
Ph: 847-394-0150
Fax: 847-253-0088

E-mail: amca@amca.org
Internet: http://www.amca.org

ALUMINUM ASSOCIATION (AA)
900 19th Street N.W., Suite 300
Washington, DC 20006
Ph: 202-862-5100
Fax: 202-862-5164
Internet: http://www.aluminum.org

AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)
1827 Walden Office Square, Suite 550
Schaumburg, IL 60173-4268
Ph: 847-303-5664
Fax: 847-303-5774
E-mail: webmaster@aamanet.org
Internet: http://www.aamanet.org

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)
444 North Capital Street, NW, Suite 249
Washington, DC 20001
Ph: 202-624-5800
Fax: 202-624-5806
E-mail: info@aashto.org
Internet: http://www.aashto.org

AMERICAN BEARING MANUFACTURERS ASSOCIATION (ABMA)
2025 M Street, NW, Suite 800
Washington, DC 20036
Ph: 202-367-1155
Fax: 202-367-2155
E-mail: webmaster@aamanet.org
Internet: http://www.abma-dc.org

AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS (ACGIH)
1330 Kemper Meadow Drive
Cincinnati, OH 45240
Ph: 513-742-2020
Fax: 513-742-3355
E-mail: mail@acgih.org
Internet: http://www.acgih.org

AMERICAN GEAR MANUFACTURERS ASSOCIATION (AGMA)
500 Montgomery Street, Suite 300
Alexandria, VA 22314-1560
Ph: 703-684-0211
Fax: 703-684-0242
E-mail: webmaster@agma.org
Internet: http://www.agma.org

AMERICAN HARDBOARD ASSOCIATION (AHA)
c/o Composite Panel Association
18922 Premiere Court
Gaithersburg, MD 20879-1574
Ph: 301-670-0604
Fax: 301-840-1252
Internet: http://www.pbmdf.org

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)
One East Wacker Drive, Suite 3100
Chicago, IL 60601-2001
Ph: 312-670-2400
Fax: 312-670-5403
Publications: 800-644-2400
E-mail: pubs@aisc.org
Internet: http://www.aisc.org

AMERICAN IRON AND STEEL INSTITUTE (AISI)
1140 Connecticut Avenue, NW, Suite 705
Washington, DC 20036
Ph: 202-452-7100
Fax: 202-463-6573
Internet: http://www.steel.org

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)
1819 L Street, NW, 6th Floor
Washington, DC 20036
Ph: 202-293-8020
Fax: 202-293-9287
E-mail: info@ansi.org
Internet: http://www.ansi.org/

Note --- Documents beginning with the letter "S" can be ordered from:

Acoustical Society of America (ASA)
2 Huntington Quadrangle, Suite 1NO1
Melville, NY 11747-4502
Ph: 516-576-2360
Fax: 516-576-2377
E-mail: asa@aip.org
Internet: http://asa.aip.org

AMERICAN PETROLEUM INSTITUTE (API)
1220 L Street, NW
Washington, DC 20005-4070
Ph: 202-682-8000
Fax: 202-682-8223
Internet: http://www.api.org

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)
100 Barr Harbor Drive
P.O. Box C700
West Conshohocken, PA 19428-2959
Ph: 610-832-9585
Fax: 610-832-9555
E-mail: service@astm.org
Internet:

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)
1801 Alexander Bell Drive
Reston, VA 20191-4400
Ph: 703-295-6300 or 800-548-2723
Fax: 703-295-6222
E-mail: marketing@asce.org
Internet: http://www.asce.org

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)
1791 Tullie Circle, NE
Atlanta, GA 30329
Ph: 800-527-4723 or 404-636-8400
Fax: 404-321-5478
E-mail: ashrae@ashrae.org
Internet: http://www.ashrae.org

AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)
901 Canterbury, Suite A
Westlake, OH 44145
Ph: 440-835-3040
Fax: 440-835-3488
E-mail: info@asse-plumbing.org
Internet: http://www.asse-plumbing.org

AMERICAN WATER WORKS ASSOCIATION(AWWA)
6666 West Quincy Avenue
Denver, CO 80235
Ph: 303-794-7711
Fax: 303-794-3951
Internet: http://www.awwa.org

AMERICAN WELDING SOCIETY (AWS)
550 N.W. LeJeune Road
Miami, FL 33126
Ph: 800-443-9353 or 305-443-9353
Fax: 305-443-7559
E-mail: info@aws.org
Internet: http://www.aws.org

AMERICAN WOOD-PRESERVERS' ASSOCIATION (AWPA)
P.O. Box 388
Selma, AL 36702-0388
Ph: 334-874-9800
Fax: 334-874-9008
E-mail: email@awpa.com
Internet: http://www.awpa.com

ASBESTOS CEMENT PRODUCT PRODUCERS ASSOCIATION (ACPPA)
PMB114-1745 Jefferson Davis Highway
Arlington, VA 22202
Ph: 514-861-1153
Fax: 514-861-1152
Internet: www.asbestos-institute.ca

ASME INTERNATIONAL (ASME)
Three Park Avenue
New York, NY 10016-5990
Ph: 212-591-7722
Fax: 212-591-7674
E-mail: infocentral@asme.org
Internet: http://www.asme.org

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SECTION 01450

CHEMICAL DATA QUALITY CONTROL

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 200-1-1	(1994) Validation of Analytical Chemistry Laboratories
EM 200-1-3	(1994) Requirements for the Preparation of Sampling and Analysis Plans Ch 1
EM 200-1-6	(1997) Chemical Quality Assurance
ER 1110-1-263	(1996) Data Quality Management for Hazardous, Toxic, Radioactive Waste Remedial Activities

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA 540/R 94-012	(1994) Contract Laboratory Program National Functional Guidelines for Inorganic Data Review
EPA 540/R 94-013	(1994) Contract Laboratory Program National Functional Guidelines for Organic Data Review
EPA 530/F-93/004	(Rev O; updates I, II, IIA, IIB, and III) Test Methods for Evaluating Solid Waste (Vol IA, IB, IC, and II)

1.2 ACRONYMS

The definition of acronyms used by the Contractor that pertain to chemical data quality control shall be clearly defined for all contract related products and communications.

1.3 MEASUREMENT AND PAYMENT

Separate payment will not be made for providing and maintaining the chemical data quality requirements including the chemical data quality management, chemical data validation, minimum chemical data reporting requirements, and chemical data quality submittal requirements; these costs shall be included in the applicable unit prices or lump sum prices contained in the bidding schedule.

1.4 CHEMISTRY REQUIREMENTS

Chemical Data Quality Control (CDQC) shall be as defined in ER 1110-1-263; this ER, which integrates USACE guidance on the subject, shall be supplemented by EM 200-1-6 for detail technical guidance on CDQC. Tables and charts defining Design Analysis (DA), ROD, and remedial technology specific chemistry shall be according to or consistent with EM 200-1-3.

1.4.1 Site History

1.4.2 Data Quality Objectives (DQO)

Sample acquisition, chemical analysis and chemical parameter measurements shall be performed so that the resulting data meet and support data use requirements. The chemical data shall be acquired, documented, verified and reported to ensure that the specified precision, accuracy, representativeness, comparability, completeness and sensitivity requirements are achieved.

1.5 QUALITY ASSURANCE ELEMENTS

The Contractor shall be responsible for the following QA elements necessary to monitor and ensure the quality of chemical data produced.

1.5.1 Laboratory Validation Requirements

The Contractor shall propose the minimum number of laboratories that can attain or have attained U.S. Army Corps of Engineers (USACE) and Alaska Department of Environmental Conservation validation in accordance with EM 200-1-1 and consistent with contract required chemical data quality. The Contractor may propose laboratories that shall subsequently be validated by the USACE, or select currently validated USACE laboratories. The Contractor shall identify all proposed project laboratories in the sampling and analysis plan (SAP). If a proposed analytical laboratory cannot meet specified analytical requirements or achieve the required validation, the Contractor shall select another laboratory. If not currently validated, the USACE laboratory validation process requires a nominal 120 day process.

1.5.2 Review of Primary Laboratory Data

The Contractor shall be responsible for the independent data review of the entire primary data set.

1.5.3 Validation of Data

The Contractor shall be responsible for validating 10 percent of the data in accordance with EPA 540/R 94-012 and EPA 540/R 94-013. The data validation strategy shall be established at the beginning of the project to be consistent with project DQO.

1.6 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with SECTION 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Sampling and Analysis Plan; G..

The SAP including the Field Sampling Plan (FSP) and the Quality Assurance Project Plan (QAPP), no later than 30 days after receipt of notice to proceed.

SD-06 Test Reports

Chemistry Data Package.

The chemistry data package shall be provided as an attachment to the CDFR.

Chemical Data Final Report; G, EN-ES-M.

The CDFR, within 30 days of completing work at the site, before final payment. Each report shall be labeled with the contract number, project name and location.

1.7 QUALIFICATIONS

1.7.1 Chemical Quality Control Officer

As a minimum, the Contractor's Chemical Quality Control Officer shall have: a BS degree in Chemistry or related field; 2 years of experience related to investigations, studies, design and remedial actions at HTRW sites; and 2 field seasons (or one continuous calendar year experience) in calibration and operation of various field monitoring devices as well as standard analytical chemistry methods common for analyzing soil, water, air and other materials for chemical contamination assessment, including hazardous waste manifesting. The Chemical Quality Control Officer shall ensure that all chemistry related objectives including responsibilities for DQO definitions, sampling and analysis, project requirements for data documentation and validation, and final project reports are attained. The Chemical Quality Control officer need not be present onsite during routine sampling, but shall be available for consultation with Government and Contractor personnel.

1.7.2 Environmental Sampler

As a minimum, the Contractor's Environmental Sampler shall be ADEC-qualified sampler and have: a BS degree in Chemistry, Environmental Science, Engineering, Geology, Hydrology, or a related field; 2 years of experience in the development and preparation of SAP and work plans; 2 years of experience in and knowledge of EPA methods for collecting environmental and hazardous waste samples; 2 years of experience in operation of field screening equipment (e.g. PID, FID, infrared spectrometer, immunoassay, etc.); and 1 field season of experience with the particular field screening techniques for use on this project. The Environmental Sampler shall collect all onsite samples and perform all field screening tests. The Environmental Sampler shall review the sampling results, and provide recommendations for the Contractor's sampling program. The Environmental Sampler shall be onsite during excavation and stockpiling operations involving contaminated soil or soil to be checked for contamination.

1.8 COORDINATION MEETING

After the preconstruction conference, before any sampling or testing, the Contractor and the Contracting Officer will meet to discuss the CQC Plan and the SAP. The coordination meeting will be simultaneous to any CQC coordination meeting required in SECTION 01451 CONTRACTOR QUALITY CONTROL unless otherwise indicated or directed. A list of definable features that involve chemical measurements shall be agreed upon. At a minimum, each matrix (soil, water, air, containerized wastes, radioactive wastes, instrumental chemical parameter measurement, etc.) shall be a definable work feature. Management of the chemical data quality system including project DQO, project submittals, chemical data documentation, chemical data assessment, required sampling and analysis protocols, and minimum data reporting requirements shall be agreed upon. The meeting will serve to establish an interrelationship between the Contractor's chemical data quality management and Government chemical quality assurance requirements. Minutes of the meeting will be documented by the Government and shall be signed by both the Contractor and the Contracting Officer. The minutes will include any or all unresolved chemical issues along with the conditions for resolution and will become a part of the contract file.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

The Contractor shall be responsible for chemical sample acquisition, sample analysis, instrumental measurements of chemical parameters and for chemical data quality control. An effective chemical data quality control system shall be established that meets the requirements for the chemical measurement DQO applicable to the project. The system shall cover chemical measurements pertaining to and required for Contractor and subcontractor produced chemical data. The Contractor shall control field screening, sampling, and testing in conjunction with remedial activities to meet all DQO; minimize the amount of excavated material requiring temporary storage; prevent dilution of contaminated soils with clean soils; and ensure completion of work within the required time.

3.2 QUALITY CONTROL PLAN

3.2.1 Additional Requirements

In addition to the quality control requirements specified in SECTION 01451 CONTRACTOR QUALITY CONTROL, the CQC Plan shall incorporate the qualifications, authority and responsibilities of all chemical quality management and support personnel. Chemical measurements including sampling and/or chemical parameter measurement will not be permitted to begin until after production and acceptance of the CQC Plan, and Government approval of the SAP.

3.2.2 Chemistry Elements of the CQC Plan

To cover contract related chemical measurements by the Contractor and all subcontractors, the CQC Plan shall include the following as a minimum.

3.2.2.1 Qualifications

Names, education, experience qualifications, authorities, and

decision-making responsibilities of all chemical quality management and support personnel. The CQC Plan shall contain a copy of a letter from the project QC manager designating and authorizing a Chemical Quality Control Officer and chemical quality control organization staff.

3.2.2.2 Authority and Responsibility

A diagram, flow chart, or figure clearly depicting the chemical data quality management and support staff and the authority and responsibility of each for chemical sampling and analysis, procedures for corrective actions, deliverables and submittals, deviations and changes, chemical quality documentation, data validation, minimum data reporting requirements, and DQO for chemical parameter measurement by the Contractor and subcontractors. The contents of this section of the CQC Plan shall be included in the applicable "Project Organization" elements of the FSP and the QAPP.

3.3 SAMPLING AND ANALYSIS PLAN

The SAP shall be prepared in accordance with CDQC requirements and EM 200-1-3. The SAP shall be a two-part document that contains two distinct elements: FSP and QAPP. Sections of the FSP and QAPP shall not be cross referenced. The SAP shall confirm the Contractor's understanding of the contract requirements for chemical data quality control, and shall describe procedures for field sampling and sample submittal for analysis, field chemical parameter measurement, data documentation, data assessment and data reporting requirements. The SAP shall delineate the methods the Contractor intends to use to accomplish the chemical quality control items to assure accurate, precise, representative, complete, legally defensible and comparable data. The SAP shall describe all chemical parameter measurements for all matrices for all phases of the remediation contract. As a single interrelated document, the SAP shall be provided to field and laboratory personnel. The Contractor may propose original/innovative approaches to chemical parameter measurements for cost reduction and remediation efficiency by abbreviated sampling, contingency sampling and/or contingency analysis, indicator or tracer analysis, onsite analytical services, equivalency or screening methods. The SAP shall clearly identify the Contractor obtained laboratories. The Contractor shall furnish copies of the Government approved SAP to all laboratories and the Contractor's field sampling crew. The SAP shall address all levels of the investigation with enough detail to become a document which may be used as an audit guide for field and laboratory work.

3.3.1 Field Sampling Plan

The FSP shall contain necessary technical detail and direction for the field personnel to understand sampling and field measurement requirements. The FSP shall provide a comprehensive description and full detail for personnel to perform all onsite activities required to attain project DQO, including: locations of samples, sampling procedures for onsite and offsite chemical analysis, summaries of analyses to be performed on samples, shipment of samples for offsite analyses, performance of onsite and offsite instrumental parameter measurements, data documentation and reporting requirements.

3.3.2 Quality Assurance Project Plan

The QAPP shall contain necessary technical detail and direction for field and laboratory personnel to understand project sample analysis, quality

control and data reporting requirements, analytical methods, required detection limits, QC requirements, and data validation and reporting requirements.

3.4 CHEMISTRY DATA PACKAGE

The chemistry data package shall be produced and provided through USACE as an attachment to the CDFR. The chemistry data package shall contain information to demonstrate that the project's DQO have been fulfilled. The QA function will compare QA sample results to corresponding primary sample results, will assess the Contractor's compliance with the SAP, and will recommend corrective action as necessary.

3.5 CONTROL OF CHEMICAL DATA QUALITY

Contractor chemical data quality control shall ensure that a quality control program is in place that assures sampling and analytical activities and the resulting chemical parameter measurement data comply with the DQO and the requirements of the SAP. The Contractor shall utilize the three-phase control system that includes a preparatory, initial and follow-up phase for each definable feature of work. The Contractor's three-phase chemical data control process shall ensure that data reporting requirements are achieved and shall be implemented according to SECTION 01451 CONTRACTOR QUALITY CONTROL. The three-phase chemical data control process shall be combined with that under SECTION 01451 CONTRACTOR QUALITY CONTROL.

3.6 ANALYTICAL TESTING LABORATORIES

The Contractor shall propose the analytical laboratories to be used for the primary samples analyses. Laboratory validation requirements shall be in accordance with paragraph Laboratory Validation Requirements. The Contractor may utilize its own laboratory or utilize subcontract laboratories to achieve the primary required sample analyses.

3.6.1 Laboratory Analytical Requirements

The Contractor shall provide the specified chemical analyses by the Contractor's laboratory. The Contractor shall provide chemical analyses to achieve the project DQO for all parameters specified by the methods. To give the USACE programs the greatest flexibility in the execution of its projects, the EPA 530/F-93/004 methods are generally the methods employed for the analytical testing of environmental samples. These methods are flexible and shall be adapted to individual project-specific requirements.

3.6.2 Laboratory Performance

The Contractor shall provide continued acceptable analytical performance and shall establish a procedure to address data deficiencies noted by review and/or quality assurance sample results. The Contractor shall provide and implement a mechanism for providing analytical labs with the SAP or QAPP portion of the SAP, for monitoring the lab's performance and for performing corrective action procedures. The Contractor shall acquire analytical services with additional USACE and State of Alaska validated laboratories in the event a project lab loses its validation status during the project.

3.7 CHEMICAL DATA FINAL REPORT

The CDFR shall be produced including a summary of quality control practices employed and all chemical parameter measurement activities after project completion. As a minimum, the CDFR shall contain the following:

a. Summary of project scope and description.

b. Summary of any deviations from the design chemical parameter measurement specifications.

c. Summary of chemical parameter measurements performed as contingent measurements.

d. Summary discussion of resulting data including achieving data reporting requirements.

e. Summary of achieving project specific DQO.

f. Presentation and evaluation of the data to include an overall assessment on the quality of the data for each method and matrix.

g. Internal QC data generated during the project, including tabular summaries correlating sample identifiers with all blank, matrix spikes, surrogates, duplicates, laboratory control samples, and batch identifiers.

h. A list of the affected sample results for each analyte (indexed by method and matrix) including the appropriate data qualifier flag (J, B, R, etc.), where sample results are negatively impacted by adverse quality control criteria.

i. Summary of field and laboratory oversight activities, providing a discussion of the reliability of the data, QC problems encountered, and a summary of the evaluation of data quality for each analysis and matrix as indicated by the laboratory QC data and any other relevant findings.

j. Conclusions and recommendations.

k. Appendices containing: (1) Chemistry data package, and (2) Results of the Chemical Quality Assurance Report (CQAR). The CQAR is a Government produced document achieved through the inspection and analysis of QA samples and corresponding project sample data. The CQAR will include review of all QC parameters such as holding times, detection limits, method blanks, surrogate recoveries, matrix spikes and duplicates, and inter-laboratory and intra-laboratory data comparisons.

3.8 DOCUMENTATION

Documentation records shall be provided as factual evidence that required chemical data has been produced and chemical data quality has been achieved. The documentation shall comply with the requirements specified in paragraphs SAMPLING AND ANALYSIS PLAN, CHEMISTRY DATA PACKAGE, and CHEMICAL DATA FINAL REPORT.

3.9 NOTIFICATION OF NON-COMPLIANCE

The Contracting Officer will notify the Contractor of any detected noncompliance with the foregoing requirements. The Contractor shall take immediate corrective action after receipt of such notice.

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SECTION 01451

CONTRACTOR QUALITY CONTROL

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 3740	(2001) Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
ASTM E 329	(2000b) Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction

1.2 PAYMENT

Separate payment will not be made for providing and maintaining an effective Quality Control program, and all costs associated therewith shall be included in the applicable unit prices or lump-sum prices contained in the Proposal Schedule.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

The Contractor is responsible for quality control and shall establish and maintain an effective quality control system in compliance with the Contract Clause titled "Inspection of Construction". The quality control system shall consist of plans, procedures, and organization necessary to produce an end product which complies with the contract requirements. The system shall cover all construction operations, both onsite and offsite, and shall be keyed to the construction sequence. The site project superintendent will be held responsible for the quality of work on the job and is subject to removal by the Contracting Officer for non-compliance with the quality requirements specified in the contract. The site project superintendent in this context shall be the highest level manager responsible for the overall construction activities at the site, including quality and production. The site project superintendent shall maintain a physical presence at the site at all times, except as otherwise acceptable to the Contracting Officer, and shall be responsible for all construction and construction related activities at the site.

3.2 QUALITY CONTROL PLAN

The Contractor shall furnish for review by the Government, not later than 30 days after receipt of notice to proceed, the Contractor Quality Control (CQC) Plan proposed to implement the requirements of the Contract Clause titled "Inspection of Construction". The plan shall identify personnel, procedures, control, instructions, tests, records, and forms to be used. The Government will consider an interim plan for the first 30 days of operation. Construction will be permitted to begin only after acceptance of the CQC Plan or acceptance of an interim plan applicable to the particular feature of work to be started. Work outside of the features of work included in an accepted interim plan will not be permitted to begin until acceptance of a CQC Plan or another interim plan containing the additional features of work to be started.

3.2.1 Content of the CQC Plan

The CQC Plan shall include, as a minimum, the following to cover all construction operations, both onsite and offsite, including work by subcontractors, fabricators, suppliers, and purchasing agents:

a. A description of the quality control organization, including a chart showing lines of authority and acknowledgment that the CQC staff shall implement the three phase control system for all aspects of the work specified. The staff shall include a CQC System Manager who shall report to the project manager.

b. The name, qualifications (in resume format), duties, responsibilities, and authorities of each person assigned a CQC function.

c. A copy of the letter to the CQC System Manager signed by an authorized official of the firm which describes the responsibilities and delegates sufficient authorities to adequately perform the functions of the CQC System Manager, including authority to stop work which is not in compliance with the contract. The CQC System Manager shall issue letters of direction to all other various quality control representatives outlining duties, authorities, and responsibilities. Copies of these letters shall also be furnished to the Government.

d. Procedures for scheduling, reviewing, certifying, and managing submittals, including those of subcontractors, offsite fabricators, suppliers, and purchasing agents. These procedures shall be in accordance with SECTION 01330 SUBMITTAL PROCEDURES.

e. Control, verification, and acceptance testing procedures for each specific test to include the test name, specification paragraph requiring test, feature of work to be tested, test frequency, and person responsible for each test. (Laboratory facilities approved by the Contracting Officer shall be used.)

f. Procedures for tracking preparatory, initial, and follow-up control phases and control, verification, and acceptance tests including documentation.

g. Procedures for tracking construction deficiencies from identification through acceptable corrective action. These procedures shall establish verification that identified deficiencies have been corrected.

h. Reporting procedures, including proposed reporting formats.

i. A list of the definable features of work. A definable feature of work is a task which is separate and distinct from other tasks, has separate control requirements, and may be identified by different trades or disciplines, or it may be work by the same trade in a different environment. Although each section of the specifications may generally be considered as a definable feature of work, there is frequently more than one definable feature under a particular section. This list will be agreed upon during the coordination meeting.

3.2.2 Acceptance of Plan

Acceptance of the Contractor's plan is required prior to the start of construction. Acceptance is conditional and will be predicated on satisfactory performance during the construction. The Government reserves the right to require the Contractor to make changes in his CQC Plan and operations including removal of personnel, as necessary, to obtain the quality specified.

3.2.3 Notification of Changes

After acceptance of the CQC Plan, the Contractor shall notify the Contracting Officer in writing of any proposed change. Proposed changes are subject to acceptance by the Contracting Officer.

3.3 COORDINATION MEETING

After the Preconstruction Conference, before start of construction, and prior to acceptance by the Government of the CQC Plan, the Contractor shall meet with the Contracting Officer or Authorized Representative and discuss the Contractor's quality control system. The CQC Plan shall be submitted for review a minimum of 30 calendar days prior to the Coordination Meeting. During the meeting, a mutual understanding of the system details shall be developed, including the forms for recording the CQC operations, control activities, testing, administration of the system for both onsite and offsite work, and the interrelationship of Contractor's Management and control with the Government's Quality Assurance. Minutes of the meeting shall be prepared by the Government and signed by both the Contractor and the Contracting Officer. The minutes shall become a part of the contract file. There may be occasions when subsequent conferences will be called by either party to reconfirm mutual understandings and/or address deficiencies in the CQC system or procedures which may require corrective action by the Contractor.

3.4 QUALITY CONTROL ORGANIZATION

3.4.1 Personnel Requirements

The requirements for the CQC organization are a CQC System Manager and sufficient number of additional qualified personnel to ensure safety and contract compliance. The Safety and Health Manager shall receive direction and authority from the CQC System Manager and shall serve as a member of the CQC staff. Personnel identified in the technical provisions as requiring specialized skills to assure the required work is being performed properly will also be included as part of the CQC organization.The Contractor's CQC staff shall maintain a presence at the site at all times during progress of the work and have complete authority and responsibility

to take any action necessary to ensure contract compliance. The CQC staff shall be subject to acceptance by the Contracting Officer. The Contractor shall provide adequate office space, filing systems and other resources as necessary to maintain an effective and fully functional CQC organization. Complete records of all letters, material submittals, show drawing submittals, schedules and all other project documentation shall be promptly furnished to the CQC organization by the Contractor. The CQC organization shall be responsible to maintain these documents and records at the site at all times, except as otherwise acceptable to the Contracting Officer.

3.4.2 CQC System Manager

The Contractor shall identify as CQC System Manager an individual within the onsite work organization who shall be responsible for overall management of CQC and have the authority to act in all CQC matters for the Contractor. The CQC System Manager shall be a graduate licensed engineer with a minimum of 5 - 10 years in related work. This CQC System Manager shall be on the site at all times during construction and shall be employed by the prime Contractor. The CQC System Manager shall be assigned no other duties. An alternate for the CQC System Manager shall be identified in the plan to serve in the event of the System Manager's absence. The requirements for the alternate shall be the same as for the designated CQC System Manager.

3.4.3 CQC Personnel

In addition to CQC personnel specified elsewhere in the contract, the Contractor shall provide as part of the CQC organization specialized personnel to assist the CQC System Manager for the following areas:

a. Civil

b. Mechanical

These individuals shall be directly employed by the prime Contractor and may not be employed by a supplier or sub-contractor on this project; be responsible to the CQC System Manager; be physically present at the construction site during work on their areas of responsibility; have the necessary education and/or experience in accordance with the experience matrix listed herein. These individuals shall have no other duties other than quality control.

Experience Matrix

	Area	Qualifications
a.	Civil	Graduate Civil Engineer with 2 years experience in the type of work being performed on this project or technician with 5 yrs related experience
b.	Mechanical	Graduate Mechanical Engineer with 2 yrs experience or person with 5 yrs related experience

3.4.4 Additional Requirement

In addition to the above experience and/or education requirements the CQC System Manager shall have completed the course entitled "Construction Quality Management For Contractors" within the past 5-years. This course is periodically offered at the Associated General Contractors of Alaska offices in Anchorage and Fairbanks.

3.4.5 Organizational Changes

The Contractor shall maintain the CQC staff at full strength at all times. When it is necessary to make changes to the CQC staff, the Contractor shall revise the CQC Plan to reflect the changes and submit the changes to the Contracting Officer for acceptance.

3.5 SUBMITTALS AND DELIVERABLES

Submittals, if needed, shall be made as specified in SECTION 01330 SUBMITTAL PROCEDURES. The CQC organization shall be responsible for certifying that all submittals and deliverables are in compliance with the contract requirements.

3.6 CONTROL

Contractor Quality Control is the means by which the Contractor ensures that the construction, to include that of subcontractors and suppliers, complies with the requirements of the contract. At least three phases of control shall be conducted by the CQC System Manager for each definable feature of work as follows:

3.6.1 Preparatory Phase

This phase shall be performed prior to beginning work on each definable feature of work, after all required plans/documents/materials are approved/accepted, and after copies are at the work site. This phase shall include:

a. A review of each paragraph of applicable specifications, reference codes, and standards. A copy of those sections of referenced codes and standards applicable to that portion of the work to be accomplished in the field shall be made available by the Contractor at the preparatory inspection. These copies shall be maintained in the field and available for use by Government personnel until final acceptance of the work.

b. A review of the contract drawings.

c. A check to assure that all materials and/or equipment have been tested, submitted, and approved.

d. Review of provisions that have been made to provide required control inspection and testing.

e. Examination of the work area to assure that all required preliminary work has been completed and is in compliance with the contract.

f. A physical examination of required materials, equipment, and sample work to assure that they are on hand, conform to approved shop drawings

or submitted data, and are properly stored.

g. A review of the appropriate activity hazard analysis to assure safety requirements are met.

h. Discussion of procedures for controlling quality of the work including repetitive deficiencies. Document construction tolerances and workmanship standards for that feature of work.

i. A check to ensure that the portion of the plan for the work to be performed has been accepted by the Contracting Officer.

j. Discussion of the initial control phase.

k. The Government shall be notified at least 48 hours in advance of beginning the preparatory control phase. This phase shall include a meeting conducted by the CQC System Manager and attended by the superintendent, other CQC personnel (as applicable), and the foreman responsible for the definable feature. The results of the preparatory phase actions shall be documented by separate minutes prepared by the CQC System Manager and attached to the daily CQC report. The Contractor shall instruct applicable workers as to the acceptable level of workmanship required in order to meet contract specifications.

3.6.2 Initial Phase

This phase shall be accomplished at the beginning of a definable feature of work. The following shall be accomplished:

a. A check of work to ensure that it is in full compliance with contract requirements. Review minutes of the preparatory meeting.

b. Verify adequacy of controls to ensure full contract compliance. Verify required control inspection and testing.

c. Establish level of workmanship and verify that it meets minimum acceptable workmanship standards. Compare with required sample panels as appropriate.

d. Resolve all differences.

e. Check safety to include compliance with and upgrading of the safety plan and activity hazard analysis. Review the activity analysis with each worker.

f. The Government shall be notified at least 24 hours in advance of beginning the initial phase. Separate minutes of this phase shall be prepared by the CQC System Manager and attached to the daily CQC report. Exact location of initial phase shall be indicated for future reference and comparison with follow-up phases.

g. The initial phase should be repeated for each new crew to work onsite, or any time acceptable specified quality standards are not being met.

3.6.3 Follow-up Phase

Daily checks shall be performed to assure control activities, including control testing, are providing continued compliance with contract

requirements, until completion of the particular feature of work. The checks shall be made a matter of record in the CQC documentation. Final follow-up checks shall be conducted and all deficiencies corrected prior to the start of additional features of work which may be affected by the deficient work. The Contractor shall not build upon nor conceal non-conforming work.

3.6.4 Additional Preparatory and Initial Phases

Additional preparatory and initial phases shall be conducted on the same definable features of work if: the quality of on-going work is unacceptable; if there are changes in the applicable CQC staff, onsite production supervision or work crew; if work on a definable feature is resumed after a substantial period of inactivity; or if other problems develop.

3.7 TESTS

3.7.1 Testing Procedure

The Contractor shall perform specified or required tests to verify that control measures are adequate to provide a product which conforms to contract requirements. Upon request, the Contractor shall furnish to the Government duplicate samples of test specimens for possible testing by the Government. Testing includes operation and/or acceptance tests when specified. The Contractor shall procure the services of a Corps of Engineers approved testing laboratory or establish an approved testing laboratory at the project site. The Contractor shall perform the following activities and record and provide the following data:

a. Verify that testing procedures comply with contract requirements.

b. Verify that facilities and testing equipment are available and comply with testing standards.

c. Check test instrument calibration data against certified standards.

d. Verify that recording forms and test identification control number system, including all of the test documentation requirements, have been prepared.

e. Results of all tests taken, both passing and failing tests, shall be recorded on the CQC report for the date taken. Specification paragraph reference, location where tests were taken, and the sequential control number identifying the test shall be given. If approved by the Contracting Officer, actual test reports may be submitted later with a reference to the test number and date taken. An information copy of tests performed by an offsite or commercial test facility shall be provided directly to the Contracting Officer. Failure to submit timely test reports as stated may result in nonpayment for related work performed and disapproval of the test facility for this contract.

3.7.2 Testing Laboratories

3.7.2.1 Capability Check

The Government reserves the right to check laboratory equipment in the proposed laboratory for compliance with the standards set forth in the

contract specifications and to check the laboratory technician's testing procedures and techniques. Laboratories utilized for testing soils, concrete, asphalt, and steel shall meet criteria detailed in ASTM D 3740 and ASTM E 329.

3.7.2.2 Capability Recheck

If the selected laboratory fails the capability check, the Contractor will be assessed actual costs to reimburse the Government for each succeeding recheck of the laboratory or the checking of a subsequently selected laboratory. Such costs will be deducted from the contract amount due the Contractor.

3.7.3 Onsite Laboratory

The Government reserves the right to utilize the Contractor's control testing laboratory and equipment to make assurance tests, and to check the Contractor's testing procedures, techniques, and test results at no additional cost to the Government.

3.7.4 Furnishing or Transportation of Samples for Testing

Costs incidental to the transportation of samples or materials shall be borne by the Contractor. Samples of materials for test verification and acceptance testing by the Government shall be delivered to a laboratory to be designated by the Contracting Officer.

Coordination for each specific test, exact delivery location, and dates will be made through the Area Office.

3.8 COMPLETION INSPECTION

3.8.1 Punch-Out Inspection

Near the end of the work, or any increment of the work established by a time stated in the Special Contract Requirement COMMENCEMENT, PROSECUTION, AND COMPLETION OF WORK, or by the specifications, the CQC Manager shall conduct an inspection of the work. A punch list of items which do not conform to the approved drawings and specifications shall be prepared and included in the CQC documentation, as required by paragraph DOCUMENTATION. The list of deficiencies shall include the estimated date by which the deficiencies will be corrected. The CQC System Manager or staff shall make a second inspection to ascertain that all deficiencies have been corrected. Once this is accomplished, the Contractor shall notify the Government that the facility is ready for the Government Pre-Final inspection.

3.8.2 Pre-Final Inspection

The Government will perform the pre-final inspection to verify that the facility is complete and ready to be occupied. A Government Pre-Final Punch List may be developed as a result of this inspection. The Contractor's CQC System Manager shall ensure that all items on this list have been corrected before notifying the Government, so that a Final inspection with the customer can be scheduled. Any items noted on the Pre-Final inspection shall be corrected in a timely manner. These inspections and any deficiency corrections required by this paragraph shall be accomplished within the time slated for completion of the entire work or any particular increment of the work if the project is divided into increments by separate completion dates.

3.8.3 Final Acceptance Inspection

The Contractor's Quality Control Inspection personnel, plus the superintendent or other primary management person, and the Contracting Officer's Representative shall be in attendance at the final acceptance inspection. Additional Government personnel including, but not limited to, those from Base Civil Facility Engineer user groups, and major commands may also be in attendance. The final acceptance inspection will be formally scheduled by the Contracting Officer based upon results of the Pre-Final inspection. Notice shall be given to the Contracting Officer at least 14 days prior to the final acceptance inspection and shall include the Contractor's assurance that all specific items previously identified to the Contractor as being unacceptable, along with all remaining work performed under the contract, will be complete and acceptable by the date scheduled for the final acceptance inspection. Failure of the Contractor to have all contract work acceptably complete for this inspection will be cause for the Contracting Officer to bill the Contractor for the Government's additional inspection cost in accordance with the contract clause titled "Inspection of Construction".

3.9 DOCUMENTATION

The Contractor shall maintain current records providing factual evidence that required quality control activities and/or tests have been performed. These records shall include the work of subcontractors and suppliers and shall be on an acceptable form that includes, as a minimum, the following information:

a. Contractor/subcontractor and their area of responsibility.

b. Operating plant/equipment with hours worked, idle, or down for repair.

c. Work performed each day, giving location, description, and by whom. When Network Analysis (NAS) is used, identify each phase of work performed each day by NAS activity number.

d. Test and/or control activities performed with results and references to specifications/drawings requirements. The control phase shall be identified (Preparatory, Initial, Follow-up). List of deficiencies noted, along with corrective action.

e. Quantity of materials received at the site with statement as to acceptability, storage, and reference to specifications/drawings requirements.

f. Submittals and deliverables reviewed, with contract reference, by whom, and action taken.

g. Offsite surveillance activities, including actions taken.

h. Job safety evaluations stating what was checked, results, and instructions or corrective actions.

i. Instructions given/received and conflicts in plans and/or specifications.

j. Contractor's verification statement.

These records shall indicate a description of trades working on the project; the number of personnel working; weather conditions encountered; and any delays encountered. These records shall cover both conforming and deficient features and shall include a statement that equipment and materials incorporated in the work and workmanship comply with the contract. The original and one copy of these records in report form shall be furnished to the Government daily within 24 hours after the date covered by the report, except that reports need not be submitted for days on which no work is performed. As a minimum, one report shall be prepared and submitted for every 7 days of no work and on the last day of a no work period. All calendar days shall be accounted for throughout the life of the contract. The first report following a day of no work shall be for that day only. Reports shall be signed and dated by the CQC System Manager. The report from the CQC System Manager shall include copies of test reports and copies of reports prepared by all subordinate quality control personnel.

3.10 SAMPLE FORMS

Sample forms enclosed at the end of this section.

3.11 NOTIFICATION OF NONCOMPLIANCE

The Contracting Officer will notify the Contractor of any detected noncompliance with the foregoing requirements. The Contractor shall take immediate corrective action after receipt of such notice. Such notice, when delivered to the Contractor at the work site, shall be deemed sufficient for the purpose of notification. If the Contractor fails or refuses to comply promptly, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to such stop orders shall be made the subject of claim for extension of time or for excess costs or damages by the Contractor.

3.12 ATTACHMENTS

CQC Report

CONTRACTOR'S QUALITY CONTROL REPORT (CQC) (ER 1180-1-6)	DATE	REPORT NO.
CONTRACT NO. AND NAME OF CONTRACTOR:	DESCRIPTION AND LOCATION OF THE WORK:	

WEATHER CLASSIFICATION:

CLASS A No interruption of any kind from weather conditions occurring on this or previous shifts.
CLASS B Weather occurred during this shift that caused a complete stoppage of all work.
CLASS C Weather occurred during this shift that caused a partial stoppage of work.
CLASS D Weather overhead excellent or suitable during shift. Work completely stopped due to results of previous adverse weather.
CLASS E Weather overhead excellent or suitable during shift but work partially stopped due to previous adverse manner.
OTHER Explain.

CLASSIFICATION:

CLASS _____

TEMPERATURE:

MAX ____ MIN ____

PRECIPITATION:

INCHES _____

CONTRACTOR/SUBCONTRACTORS AND AREA OF RESPONSIBILITY FOR WORK PERFORMED TODAY: (Attach list of items of equipment either idle or working as appropriate.)

a. _____
b. _____
c. _____
d. _____
e. _____
f. _____

1. WORK PERFORMED TODAY: (Indicate location and description of work performed. Refer to work performed by prime and/or subcontractors by letter in Table above.)

2. TYPE AND RESULTS OF INSPECTION: (Indicate whether P-Prepatory, I-Initial, or F-Followup and include satisfactory work completed or deficiencies with action to be taken.)

3. TESTS REQUIRED BY PLANS AND/OR SPECIFICATIONS PERFORMED AND RESULTS OF TESTS:

4. VERBAL INSTRUCTIONS RECEIVED: (List any instructions given by Government personnel on construction deficiencies, retesting required, etc., with action to be taken.)

5. REMARKS: (Cover any conflicts in plans, specifications or instructions: acceptability of incoming materials; offsite surveillance activities; progress of work, delays, causes and extent thereof; days of no work with reasons for same.)

6. SAFETY: (Include any infractions of approved safety plan, safety manual, or instructions from Government personnel. Specify correctve action taken).

CONTRACTOR: _____

CONTRACTOR'S CERTIFICATION: I certify that the above report is complete and correct and that all material and equipment used, work performed and tests conducted during this reporting period were in strict compliance with the contract plans and specifications except as noted above.

_____
CONTRACTOR'S APPROVED AUTHORIZED REPRESENTATIVE

--END OF SECTION--

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SECTION 01500

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PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

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SECTION 01500

TEMPORARY CONSTRUCTION FACILITIES

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

1.1.1 Site Plan

The Contractor shall prepare a site plan indicating the proposed location and dimensions of any area to be fenced and used by the Contractor, the number of trailers to be used, avenues of ingress/egress to the fenced area and details of the fence installation. Any areas which may have to be graveled to prevent the tracking of mud shall also be identified. The Contractor shall also indicate if the use of a supplemental or other staging area is desired.

1.1.2 Identification of Employees

The Contractor shall be responsible for furnishing to each employee, and for requiring each employee engaged on the work to display, identification as approved and directed by the Contracting Officer. Prescribed identification shall immediately be delivered to the Contracting Officer for cancellation upon release of any employee. When required, the Contractor shall obtain and provide fingerprints of persons employed on the project. Contractor and subcontractor personnel shall wear identifying markings on hard hats clearly identifying the company for whom the employee works.

1.1.3 Employee Parking

Contractor employees shall park privately owned vehicles in an area designated by the Contracting Officer. This area will be within reasonable walking distance of the construction site. Contractor employee parking shall not interfere with existing and established parking requirements of the military installation.

1.2 AVAILABILITY AND USE OF UTILITY SERVICES

1.2.1 Payment for Utility Services

The Government will make all reasonably required utilities available to the Contractor from existing outlets and supplies, as specified in the contract. Unless otherwise provided in the contract, the amount of each utility service consumed shall be charged to or paid for by the Contractor at prevailing rates charged to the Government or, where the utility is produced by the Government, at reasonable rates determined by the Contracting Officer. The Contractor shall carefully conserve any utilities furnished without charge.

1.2.2 Meters and Temporary Connections

The Contractor, at its expense and in a manner satisfactory to the Contracting Officer, shall provide and maintain necessary temporary

connections, distribution lines, and meters required to measure the amount of each utility used for the purpose of determining charges. The Contractor shall notify the Contracting Officer, in writing, 5 working days before final electrical connection is desired so that a utilities contract can be established.

1.2.1.1 Advance Deposit

An advance deposit for utilities consisting of an estimated month's usage or a minimum of $50.00 will be required. The last monthly bills for the fiscal year will normally be offset by the deposit and adjustments will be billed or returned as appropriate. Services to be rendered for the next fiscal year, beginning 1 October, will require a new deposit. Notification of the due date for this deposit will be mailed to the Contractor prior to the end of the current fiscal year.

1.2.4 Final Meter Reading

Before completion of the work and final acceptance of the work by the Government, the Contractor shall notify the Contracting Officer, in writing, 5 working days before termination is desired. The Government will take a final meter reading. The Contractor shall then remove all the temporary distribution lines, meter(s), and associated paraphernalia. The Contractor shall pay all outstanding utility bills before final acceptance of the work by the Government.

1.2.2 Sanitation

The Contractor shall provide and maintain within the construction area minimum field-type sanitary facilities approved by the Contracting Officer. Government toilet facilities will not be available to Contractor's personnel.

1.2.3 Telephone

The Contractor shall make arrangements and pay all costs for telephone facilities desired.

1.3 BULLETIN BOARD

Immediately upon beginning of work, the Contractor shall provide a weatherproof glass-covered bulletin board not less than 36 by 48 inches in size for displaying the Equal Employment Opportunity poster, a copy of the wage decision contained in the contract, Wage Rate Information poster, and other information approved by the Contracting Officer. The bulletin board shall be located at the project site in a conspicuous place easily accessible to all employees, as approved by the Contracting Officer. Legible copies of the aforementioned data shall be displayed until work is completed. Upon completion of work, the bulletin board shall be removed by and remain the property of the Contractor.

1.4 PROTECTION AND MAINTENANCE OF TRAFFIC

During construction the Contractor shall provide access and temporary relocated roads as necessary to maintain traffic. The Contractor shall maintain and protect traffic on all affected roads during the construction period except as otherwise specifically directed by the Contracting Officer. Measures for the protection and diversion of traffic, including the provision of watchmen and flagmen, erection of barricades, placing of

lights around and in front of equipment and the work, and the erection and maintenance of adequate warning, danger, and direction signs, shall be as required by the State and local authorities having jurisdiction. The traveling public shall be protected from damage to person and property. The Contractor's traffic on roads selected for hauling material to and from the site shall interfere as little as possible with public traffic. The Contractor shall investigate the adequacy of existing roads and the allowable load limit on these roads. The Contractor shall be responsible for the repair of any damage to roads caused by construction operations.

1.4.1 Haul Roads

The Contractor shall, at its own expense, construct access and haul roads necessary for proper prosecution of the work under this contract. Haul roads shall be constructed with suitable grades and widths; sharp curves, blind corners, and dangerous cross traffic shall be avoided. The Contractor shall provide necessary lighting, signs, barricades, and distinctive markings for the safe movement of traffic. The method of dust control, although optional, shall be adequate to ensure safe operation at all times. Location, grade, width, and alignment of construction and hauling roads shall be subject to approval by the Contracting Officer. Lighting shall be adequate to assure full and clear visibility for full width of haul road and work areas during any night work operations. Upon completion of the work, haul roads designated by the Contracting Officer shall be removed.

1.4.2 Barricades

The Contractor shall erect and maintain temporary barricades to limit public access to hazardous areas. Such barricades shall be required whenever safe public access to paved areas such as roads, parking areas or sidewalks is prevented by construction activities or as otherwise necessary to ensure the safety of both pedestrian and vehicular traffic. Barricades shall be securely placed, and clearly visible with adequate illumination to provide sufficient visual warning of the hazard during both day and night.

1.5 CONTRACTOR'S TEMPORARY FACILITIES

1.5.1 Administrative Field Offices

The Contractor shall provide and maintain administrative field office facilities within the construction area at the designated site. Government office and warehouse facilities will not be available to the Contractor's personnel.

1.5.2 Clearance Criteria for Storage/Supplemental Storage Areas

The Contractor shall comply with the following clearance criteria when install the fence around any of the project Storage or Supplemental Storage Areas:

a. Clearance from the centerline of T/W "Lima" to the nearest edge of the fencing shall be 200 feet minimum.

b. Clearance from the edge of the F-16 parking apron to the nearest edge of the fencing shall be 50 feet minimum.

These clearances are for both aircraft safety and safety of the materials and equipment stored within the fenced boundary. Compliance with the

clearance criteria above is mandatory.

1.5.3 Storage Area

The Contractor shall construct a temporary 6 foot high chain link fence around trailers and materials. The fence shall include plastic strip inserts, colored brown, so that visibility through the fence is obstructed. Fence posts may be driven, in lieu of concrete bases, where soil conditions permit. Trailers, materials, or equipment shall not be placed or stored outside the fenced area unless such trailers, materials, or equipment are assigned a separate and distinct storage area by the Contracting Officer away from the vicinity of the construction site but within the military boundaries. Trailers, equipment, or materials shall not be open to public view with the exception of those items which are in support of ongoing work on any given day. Materials shall not be stockpiled outside the fence in preparation for the next day's work. Mobile equipment, such as tractors, wheeled lifting equipment, cranes, trucks, and like equipment, shall be parked within the fenced area at the end of each work day.

1.5.4 Supplemental Storage Area

Upon Contractor's request, the Contracting Officer will designate another or supplemental area for the Contractor's use and storage of trailers, equipment, and materials. This area may not be in close proximity of the construction site but shall be within the military boundaries. Fencing of materials or equipment will not be required at this site; however, the Contractor shall be responsible for cleanliness and orderliness of the area used and for the security of any material or equipment stored in this area. Utilities will not be provided to this area by the Government.

1.5.5 Appearance of Trailers

Trailers utilized by the Contractor for administrative or material storage purposes shall present a clean and neat exterior appearance and shall be in a state of good repair. Trailers which, in the opinion of the Contracting Officer, require exterior painting or maintenance will not be allowed on the military property.

1.5.6 Maintenance of Storage Area

Fencing shall be kept in a state of good repair and proper alignment. Should the Contractor elect to traverse, with construction equipment or other vehicles, grassed or unpaved areas which are not established roadways, such areas shall be covered with a layer of gravel as necessary to prevent rutting and the tracking of mud onto paved or established roadways; gravel gradation shall be at the Contractor's discretion. Grass located within the boundaries of the construction site shall be mowed for the duration of the project. Grass and vegetation along fences, buildings, under trailers, and in areas not accessible to mowers shall be edged or trimmed neatly.

1.5.7 New Building

In the event a new building is constructed for the temporary project field office, it shall be a minimum 12 feet in width, 16 feet in length and have a minimum of 7 feet headroom. It shall be equipped with approved electrical wiring, at least one double convenience outlet and the required switches and fuses to provide 110-120 volt power. It shall be provided

with a work table with stool, desk with chair, two additional chairs, and one legal size file cabinet that can be locked. The building shall be waterproof, shall be supplied with heater, shall have a minimum of two doors, electric lights, a telephone, a battery operated smoke detector alarm, a sufficient number of adjustable windows for adequate light and ventilation, and a supply of approved drinking water. Approved sanitary facilities shall be furnished. The windows and doors shall be screened and the doors provided with dead bolt type locking devices or a padlock and heavy duty hasp bolted to the door. Door hinge pins shall be non-removable. The windows shall be arranged to open and to be securely fastened from the inside. Glass panels in windows shall be protected by bars or heavy mesh screens to prevent easy access to the building through these panels. Any new building erected for a temporary field office shall be maintained by the Contractor during the life of the contract and upon completion and acceptance of the work shall become the property of the Contractor and shall be removed from the site. All charges for telephone service for the temporary field office shall be borne by the Contractor, including long distance charges.

1.5.8 Security Provisions

Adequate outside security lighting shall be provided at the Contractor's temporary facilities. The Contractor shall be responsible for the security of its own equipment; in addition, the Contractor shall notify the appropriate law enforcement agency requesting periodic security checks of the temporary project field office.

1.6 GOVERNMENT FIELD OFFICE

1.6.1 Resident Engineer's Office

The Contractor shall provide the Government Resident Engineer with an office, approximately 200 square feet in floor area, located where directed and providing space heat, electric light and power, and toilet facilities consisting of one lavatory and one water closet complete with connections to water and sewer mains. A mail slot in the door or a lockable mail box mounted on the surface of the door shall be provided. At completion of the project, the office shall remain the property of the Contractor and shall be removed from the site. Utilities shall be connected and disconnected in accordance with local codes and to the satisfaction of the Contracting Officer. See SECTION 01015 SPECIAL ITEMS for furnishings.

1.6.2 Trailer-Type Mobile Office

The Contractor may, at its option, furnish and maintain a trailer-type mobile office acceptable to the Contracting Officer and providing as a minimum the facilities specified above. The trailer shall be securely anchored to the ground at all four corners to guard against movement during high winds.

1.7 PLANT COMMUNICATION

Whenever the Contractor has the individual elements of its plant so located that operation by normal voice between these elements is not satisfactory, the Contractor shall install a satisfactory means of communication, such as telephone or other suitable devices. The devices shall be made available for use by Government personnel.

1.8 TEMPORARY PROJECT SAFETY FENCING

As soon as practicable, but not later than 15 days after the date established for commencement of work, the Contractor shall furnish and erect temporary project safety fencing at the work site. The safety fencing shall be a high visibility orange colored, high density polyethylene grid or approved equal, a minimum of 42 inches high, supported and tightly secured to steel posts located on maximum 10 foot centers, constructed at the approved location. The safety fencing shall be maintained by the Contractor during the life of the contract and, upon completion and acceptance of the work, shall become the property of the Contractor and shall be removed from the work site.

1.9 CLEANUP

Construction debris, waste materials, packaging material and the like shall be removed from the work site daily. Any dirt or mud which is tracked onto paved or surfaced roadways shall be cleaned away. Materials resulting from demolition activities which are salvageable shall be stored within the fenced area described above or at the supplemental storage area. Stored material not in trailers, whether new or salvaged, shall be neatly stacked when stored.

1.10 RESTORATION OF STORAGE AREA

Upon completion of the project and after removal of trailers, materials, and equipment from within the fenced area, the fence shall be removed and will become the property of the Contractor. Areas used by the Contractor for the storage of equipment or material, or other use, shall be restored to the original or better condition. Gravel used to traverse grassed areas shall be removed and the area restored to its original condition, including top soil and seeding as necessary. Seeding to be done per SECTION 02921 SEEDING.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

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SECTION 01525

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SECTION 01525

SAFETY AND OCCUPATIONAL HEALTH REQUIREMENTS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASME INTERNATIONAL (ASME)

ASME B30.5	(2000) Mobile and Locomotive Cranes
ASME B30.22	(2000) Articulating Boom Cranes

OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA)

29 CFR 1910	Occupational Safety and Health Standards
29 CFR 1910.94	Ventilation
29 CFR 1910.120	Hazardous Waste Operations and Emergency Response
29 CFR 1910.146	Permit-required Confined Spaces
29 CFR 1915	Confined and Enclosed Spaces and Other Dangerous Atmospheres in Shipyard Employment
29 CFR 1926	Safety and Health Regulations for Construction
29 CFR 1926.65	Hazardous Waste Operations and Emergency Response
29 CFR 1926.500	Fall Protection

U. S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2003) U.S. Army Corps of Engineers Safety and Health Requirements Manual

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 10	(1998; Errata 10-98-1) Portable Fire Extinguishers
NFPA 70	(2002) National Electrical Code
NFPA 241	(2000) Safeguarding Construction, Alteration, and Demolition Operations

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Accident Prevention Plan (APP); G.

Activity Hazard Analysis (AHA); G.

Crane Critical Lift Plan; G.

SD-06 Test Reports

Reports;

Submit reports as their incidence occurs, in accordance with the requirements of the paragraph entitled, "Reports."

Accident Reports;

Monthly Exposure Reports;

Regulatory Citations and Violations;

Crane Reports;

Certificate of Compliance (Crane);

SD-07 Certificates

Confined Space Entry Permit;

Submit one copy of each permit attached to each Daily Quality Control Report.

1.3 DEFINITIONS

a. High Visibility Accident. Any mishap which may generate publicity and/or high visibility.

b. Medical Treatment. Treatment administered by a physician or by registered professional personnel under the standing orders of a physician. Medical treatment does not include first aid treatment even through provided by a physician or registered personnel.

c. Multi-Employer Work Site (MEWS). A multi-employer work site, as defined by OSHA, is one in which many employers occupy the same site. The Government considers the Prime Contractor to be the "controlling authority" for all work site safety and health of the subcontractors.

d. Operating Envelope. The area surrounding any crane. Inside this "envelope" is the crane, the operator, riggers, rigging gear between the hook and the load, the load and the crane's supporting structure

(ground, rail, etc.).

e. Recordable Injuries or Illnesses. Any work-related injury or illness that results in:

(1) Death, regardless of the time between the injury and death, or the length of the illness;

(2) Days away from work;

(3) Restricted work;

(4) Transfer to another job;

(5) Medical treatment beyond first aid;

(6) Loss of consciousness; or

(7) A significant injury or illness diagnosed by a physician or other licensed health care professional, even if it did not result in (1) through (6) above.

f. Site Safety and Health Officer (SSHO). The superintendent or other qualified or competent person who is responsible for the on-site safety and health required for the project. The Contractor quality control (QC) person can be the SSHO on this project.

g. "USACE" property and equipment specified in USACE EM 385-1-1 should be interpreted as Government property and equipment.

h. Weight Handling Equipment (WHE) Accident. A WHE accident occurs when any one or more of the six elements in the operating envelope fails to perform correctly during operation, including operation during maintenance or testing resulting in personnel injury or death; material or equipment damage; dropped load; derailment; two-blocking; overload; and collision, including unplanned contact between the load, crane, and/or other objects. A dropped load, derailment, two-blocking, overload and collision are considered accidents even though no material damage or injury occurs. A component failure (e.g., motor burnout, gear tooth failure, bearing failure) is not considered an accident solely due to material or equipment damage unless the component failure results in damage to other components (e.g., dropped boom, dropped load, roll over, etc.).

1.4 REGULATORY REQUIREMENTS

In addition to the detailed requirements included in the provisions of this contract, work performed shall comply with USACE EM 385-1-1, and the following federal, state, and local, rules and regulations. Submit matters of interpretation of standards to the appropriate administrative agency for resolution before starting work. Where the requirements of this specification, applicable laws, criteria, ordinances, regulations, and referenced documents vary, the most stringent requirements shall apply.

1.5 DRUG PREVENTION PROGRAM

Conduct a proactive drug and alcohol use prevention program for all workers, prime and subcontractor, on the site. Ensure that no employee uses illegal drugs or consumes alcohol during work hours. Ensure there are

no employees under the influence of drugs or alcohol during work hours. After accidents, collect blood, urine, or saliva specimens and test the injured and involved employees for the influence of drugs and alcohol. A copy of the test shall be made available to the Contracting Officer upon request.

1.6 SITE QUALIFICATIONS, DUTIES AND MEETINGS

1.6.1 Personnel Qualifications

1.6.1.1 Site Safety and Health Officer (SSHO)

Site Safety and Health Officer (SSHO) shall be provided at the work site at all times to perform safety and occupational health management, surveillance, inspections, and safety enforcement for the Contractor. The SSHO shall meet the following requirements:

Level 2:
A minimum of 3 years safety work on similar project.
30-hour OSHA construction safety class or equivalent within last 3 years.
Competent person training as needed.

1.6.1.2 Competent Person for Confined Space Entry

Provide a competent person meeting the requirements of EM 385-1-1 who is assigned in writing by the Designated Authority to assess confined spaces and who possesses demonstrated knowledge, skill and ability to:

a. Identify the structure, location, and designation of confined and permit-required confined spaces where work is done;

b. Calibrate and use testing equipment including but not limited to, oxygen indicators, combustible gas indicators, carbon monoxide indicators, and carbon dioxide indicators, and to interpret accurately the test results of that equipment;

c. Perform all required tests and inspections specified in 29 CFR 1910.146 and 29 CFR 1915 Subpart B;

d. Assess hazardous conditions including atmospheric hazards in confined space and adjacent spaces and specify the necessary protection and precautions to be taken;

e. Determine ventilation requirements for confined space entries and operations;

f. Assess hazards associated with hot work in confined and adjacent space and determine fire watch requirements; and,

g. Maintain records required.

1.6.1.3 Competent Person for the Health Hazard Control and Respiratory Protection Program

Provide a competent person meeting the requirements of EM 385-1-1 who is:

a. Capable by education, specialized training and/or experience of anticipating, recognizing, and evaluating employee exposure to

hazardous chemical, physical and biological agents in accordance with USACE EM 385-1-1, Section 6.

b. Capable of specifying necessary controls and protective actions to ensure worker health.

1.6.1.4 Crane Operators

Crane operators shall meet the requirements in USACE EM 385-1-1, Appendix G.

1.6.2 Personnel Duties

1.6.2.1 Site Safety and Health Officer (SSHO)/Superintendent

a. Conduct daily safety and health inspections and maintain a written log which includes area/operation inspected, date of inspection, identified hazards, recommended corrective actions, estimated and actual dates of corrections. Safety inspection logs shall be attached to the Contractors' daily quality control report.

b. Conduct mishap investigations and complete required reports. Maintain the OSHA Form 300 and Daily Production reports for prime and sub-contractors.

c. Maintain applicable safety reference material on the job site.

d. Attend the pre-construction conference, pre-work meetings including preparatory inspection meeting, and periodic in-progress meetings.

e. Implement and enforce accepted APPS and AHAs.

f. Maintain a safety and health deficiency tracking system that monitors outstanding deficiencies until resolution. A list of unresolved safety and health deficiencies shall be posted on the safety bulletin board.

g. Ensure sub-contractor compliance with safety and health requirements.

Failure to perform the above duties will result in dismissal of the superintendent and/or SSHO, and a project work stoppage. The project work stoppage will remain in effect pending approval of a suitable replacement.

1.6.3 Meetings

1.6.3.1 Preconstruction Conference

a. The Contractor will be informed, in writing, of the date of the preconstruction conference. The purpose of the preconstruction conference is for the Contractor and the Contracting Officer's representatives to become acquainted and explain the functions and operating procedures of their respective organizations and to reach mutual understanding relative to the administration of the overall project's APP before the initiation of work.

b. Contractor representatives who have a responsibility or significant role in accident prevention on the project shall attend the preconstruction conference. This includes the project superintendent, site safety and health officer, quality control supervisor, or any

other assigned safety and health professionals who participated in the development of the APP (including the AHAs and special plans, program and procedures associated with it).

c. The Contractor shall discuss the details of the submitted APP to include incorporated plans, programs, procedures and a listing of anticipated activity hazard analyses (AHAs) that will be developed and implemented during the performance of the contract. This list of proposed AHAs will be reviewed at the conference and an agreement will be reached between the Contractor and the Contracting Officer's representative as to which phases will require an analysis. In addition, a schedule for the preparation, submittal, review, and acceptance of AHAs shall be established to preclude project delays.

d. Deficiencies in the submitted APP will be brought to the attention of the Contractor at the preconstruction conference, and the Contractor shall revise the plan to correct deficiencies and re-submit it for acceptance. Work shall not begin until there is an accepted APP.

1.6.3.2 Weekly Safety Meetings

Conduct weekly safety meetings at the project site for all employees. The Contracting Officer will be informed of the meeting in advance and be allowed attendance. Minutes showing contract title, signatures of attendees and a list of topics discussed shall be attached to the Contractors' daily quality control report.

1.6.3.3 Work Phase Meetings

The appropriate AHA shall be reviewed and attendance documented by the Contractor at the preparatory, initial, and follow-up phases of quality control inspection. The analysis should be used during daily inspections to ensure the implementation and effectiveness of safety and health controls.

1.7 TRAINING

1.7.1 New Employee Indoctrination

New employees (prime and sub-contractor) will be informed of specific site hazards before they begin work. Documentation of this orientation shall be kept on file at the project site.

1.7.2 Periodic Training

Provide Safety and Health Training in accordance with USACE EM 385-1-1 and the accepted APP. Ensure all required training has been accomplished for all onsite employees.

1.7.3 Training on Activity Hazard Analysis (AHA)

Prior to beginning a new phase, training will be provided to all affected employees to include a review of the AHA to be implemented.

1.8 ACCIDENT PREVENTION PLAN (APP)

The Contractor shall use a qualified person to prepare the written site-specific APP. Prepare the APP in accordance with the format and requirements of USACE EM 385-1-1 and as supplemented herein. Cover all paragraph and subparagraph elements in USACE EM 385-1-1, Appendix A,

"Minimum Basic Outline for Preparation of Accident Prevention Plan". Where a paragraph or subparagraph element is not applicable to the work to be performed indicate "Not Applicable" next to the heading. Specific requirements for some of the APP elements are described below at paragraph 1.8.1. The APP shall be job-specific and shall address any unusual or unique aspects of the project or activity for which it is written. The APP shall interface with the Contractor's overall safety and health program. Any portions of the Contractor's overall safety and health program referenced in the APP shall be included in the applicable APP element and made site-specific. The Government considers the Prime Contractor to be the "controlling authority" for all work site safety and health of the subcontractors. Contractors are responsible for informing their subcontractors of the safety provisions under the terms of the contract and the penalties for noncompliance, coordinating the work to prevent one craft from interfering with or creating hazardous working conditions for other crafts, and inspecting subcontractor operations to ensure that accident prevention responsibilities are being carried out. The APP shall be signed by the person and firm (senior person) preparing the APP, the Contractor, the on-site superintendent, the designated site safety and health officer.

Submit the APP to the Contracting Officer 15 calendar days prior to the date of the preconstruction conference for acceptance. Work cannot proceed without an accepted APP. The Contracting Officer reviews and comments on the Contractor's submitted APP and accepts it when it meets the requirements of the contract provisions.

Once accepted by the Contracting Officer, the APP and attachments will be enforced as part of the contract. Disregarding the provisions of this contract or the accepted APP will be cause for stopping of work, at the discretion of the Contracting Officer, until the matter has been rectified.

Once work begins, changes to the accepted APP shall be made with the knowledge and concurrence of the Contracting Officer, project superintendent, SSHO and quality control manager. Should any unforeseen hazard become evident during the performance of work, the project superintendent shall inform the Contracting Officer, both verbally and in writing, for resolution as soon as possible. In the interim, all necessary action shall be taken by the Contractor to restore and maintain safe working conditions in order to safeguard onsite personnel, visitors, the public, and the environment.

Copies of the accepted plan will be maintained at the resident engineer's office and at the job site. The APP shall be continuously reviewed and amended, as necessary, throughout the life of the contract. Unusual or high-hazard activities not identified in the original APP shall be incorporated in the plan as they are discovered.

1.8.1 EM 385-1-1 Contents

In addition to the requirements outlines in Appendix A of USACE EM 385-1-1, the following is required:

a. Names and qualifications (resumes including education, training, experience and certifications) of all site safety and health personnel designated to perform work on this project to include the designated site safety and health officer and other competent and qualified personnel. The duties of each position shall be specified.

b. Qualifications of competent and of qualified persons. As a

minimum, competent persons shall be designated and qualifications submitted for each of the following major areas: excavation; scaffolding; fall protection; hazardous energy; confined space; health hazard recognition, evaluation and control of chemical, physical and biological agents; personal protective equipment and clothing to include selection, use and maintenance.

c. Confined Space Entry Plan. Develop a confined space entry plan in accordance with USACE EM 385-1-1, applicable OSHA standards 29 CFR 1910, 29 CFR 1915, and 29 CFR 1926, and any other federal, state and local regulatory requirements identified in this contract. Identify the qualified person's name and qualifications, training, and experience. Delineate the qualified person's authority to direct work stoppage in the event of hazardous conditions. Include procedure for rescue by contractor personnel and the coordination with emergency responders. (If there is no confined space work, include a statement that no confined space work exists and none will be created.)

d. Health Hazard Control Program. The Contractor shall designate a competent and qualified person to establish and oversee a Health Hazard Control Program in accordance with USACE EM 385-1-1, Section 6. The program shall ensure that employees, on-site Government representatives, and others, are not adversely exposed to chemical, physical and biological agents and that necessary controls and protective actions are instituted to ensure health.

e. Crane Critical Lift Plan. Prepare and sign weight handling critical lift plans for lifts over 75 percent of crane hoist's maximum load limit; lifts involving more than one crane or hoist; lifts of personnel; and technically difficult lifts involving non-routine rigging or operation, sensitive equipment, or unusual safety risks in accordance with USACE EM 385-1-1, paragraph 16.c.18. and submit 15 calendar days prior to on-site work.

f. Alcohol and Drug Abuse Plan

(1) Describe plan for random checks and testing with pre-employment screening in accordance with the DFAR Clause subpart 252.223-7004, "Drug Free Work Force."

(2) Description of the on-site prevention program

g. Fall Protection and Prevention (FP&P) Plan. The plan shall be site specific and address all fall hazards in the work place and during different phases of construction. It shall address how to protect and prevent workers from falling to lower levels when they are exposed to fall hazards above 6 feet. A qualified person shall prepare and sign the plan. The plan shall include fall protection and prevention systems, equipment and methods employed for every phase of work, responsibilities, rescue and escape equipment and operations, training requirements, and monitoring methods. Fall Protection and Prevention Plan shall be revised for lengthy projects, reflecting any changes during the course of construction due to changes in personnel, equipment, systems or work habits. The accepted Fall Protection and Prevention Plan shall be kept and maintained at the job site for the duration of the project.

h. Lead Abatement Plan. The safety and health aspects of lead-based paint removal, prepared in accordance with Section 13281, Lead Hazard

Control Activities.

i. Asbestos Hazard Abatement Plan. The safety and health aspects of asbestos work, prepared in accordance with Section 13280, Asbestos Abatement.

j. Site Safety, Health and Emergency Response Plan. The safety and health aspects prepared in accordance with Section 01351.

k. Site Demolition Plan. The safety and health aspects prepared in accordance with Section 02220A, Demolition.

l. Training Records and Requirements. List of mandatory training and certifications which are applicable to this project (e.g. explosive actuated tools, confined space entry, fall protection, crane operation, vehicle operator, forklift operators, personal protective equipment); list of requirements for periodic retraining/certification; outline requirements for supervisory and employee safety meetings.

1.9 ACTIVITY HAZARD ANALYSIS (AHA)

The Activity Hazard Analysis (AHA) format shall be in accordance with USACE EM 385-1-1. Submit the AHA for review at least 15 calendar days prior to the start of each phase. Format subsequent AHA as amendments to the APP. An AHA will be developed by the Contractor for every operation involving a type of work presenting hazards not experienced in previous project operations or where a new work crew or subcontractor is to perform work. The analysis must identify and evaluate hazards and outline the proposed methods and techniques for the safe completion of each phase of work. At a minimum, define activity being performed, sequence of work, specific safety and health hazards anticipated, control measures (to include personal protective equipment) to eliminate or reduce each hazard to acceptable levels, equipment to be used, inspection requirements, training requirements for all involved, and the competent person in charge of that phase of work. For work with fall hazards, including fall hazards associated with scaffold erection and removal, identify the appropriate fall arrest systems. For work with materials handling equipment, address safeguarding measures related to materials handling equipment. For work requiring excavations, include requirements for safeguarding excavations. An activity requiring an AHA shall not proceed until the AHA has been accepted by the Contracting Officer's representative and a meeting has been conducted by the Contractor to discuss its contents with everyone engaged in the activity, including on-site Government representatives. The Contractor shall document meeting attendance at the preparatory, initial, and follow-up phases of quality control inspection. The AHA shall be continuously reviewed and, when appropriate, modified to address changing site conditions or operations. The analysis should be used during daily inspections to ensure the implementation and effectiveness of the activity's safety and health controls.

The AHA list will be reviewed periodically (at least monthly) at the Contractor supervisory safety meeting and updated as necessary when procedures, scheduling, or hazards change.

Activity hazard analyses shall be updated as necessary to provide an effective response to changing work conditions and activities. The on-site superintendent, site safety and health officer and competent persons used to develop the AHAs, including updates, shall sign and date the AHAs before they are implemented.

1.10 DISPLAY OF SAFETY INFORMATION

Within 7 calendar days after commencement of work, erect a safety bulletin board at the job site. The following information shall be displayed on the safety bulletin board in clear view of the on-site construction personnel, maintained current, and protected against the elements and unauthorized removal:

a. Map denoting the route to the nearest emergency care facility.

b. Emergency phone numbers.

c. Copy of the most up-to-date APP.

d. AHA(s).

e. OSHA 300A Form.

f. Confined space entry permit.

g. OSHA Safety and Health Protection-On-The-Job Poster.

h. Safety and Health Warning Posters.

1.11 SITE SAFETY REFERENCE MATERIALS

Maintain safety-related references applicable to the project, including those listed in the article "References." Maintain applicable equipment manufacturer's manuals.

1.12 EMERGENCY MEDICAL TREATMENT

Contractors will arrange for their own emergency medical treatment. Government has no responsibility to provide emergency medical treatment.

1.13 REPORTS

1.13.1 Accident Reports

a. For recordable injuries and illnesses, and property damage accidents resulting in at least $2,000 in damages, the Prime Contractor shall conduct an accident investigation to establish the root cause(s) of the accident, complete the USACE Accident Report Form 3394 and provide the report to the Contracting Officer within 1 calendar day(s) of the accident. The Contracting Officer will provide copies of any required or special forms.

b. For a weight handling equipment accident the Prime Contractor shall conduct an accident investigation to establish the root cause(s) of the accident, complete the WHE Accident Report form and provide the report to the Contracting Officer within 30 calendar days of the accident. The Contracting Officer will provide a blank copy of the accident report form.

1.13.2 Accident Notification

Notify the Contracting Officer as soon as practical, but not later than four hours, after any accident meeting the definition of Recordable

Injuries or Illnesses or High Visibility Accidents, property damage equal to or greater than $2,000, or any weight handling equipment accident involving a overturned crane, collapsed boom, or any other major damage to the crane or adjacent property. Information shall include contractor name; contract title; type of contract; name of activity, installation or location where accident occurred; date and time of accident; names of personnel injured; extent of property damage, if any; extent of injury, if known, and brief description of accident (to include type of construction equipment used, PPE used, etc.). Preserve the conditions and evidence on the accident site until the Government investigation team arrives on site and Government investigation is conducted.

1.13.3 Monthly Exposure Reports

Monthly exposure reporting to the Contracting Officer is required to be attached to the monthly billing request. This report is a compilation of employee-hours worked each month for all site workers, both prime and subcontractor. The Contracting Officer will provide copies of any special forms.

1.13.4 Regulatory Citations and Violations

Contact the Contracting Officer immediately of any OSHA or other regulatory agency inspection or visit, and provide the Contracting Officer with a copy of each citation, report, and contractor response. Correct violations and citations promptly and provide written corrective actions to the Contracting Officer.

1.13.5 Crane Reports

Submit crane inspection reports required in accordance with USACE EM 385-1-1, Appendix H and as specified herein with Daily Reports of Inspections.

1.13.6 Certificate of Compliance

The Contractor shall provide a Certificate of Compliance for each crane entering an activity under this contract (see Contracting Officer for a blank certificate). Certificate shall state that the crane and rigging gear meet applicable OSHA regulations (with the Contractor citing which OSHA regulations are applicable, e.g., cranes used in construction, demolition, or maintenance shall comply with 29 CFR 1926 and USACE EM 385-1-1 section 16 and Appendix H. Certify on the Certificate of Compliance that the crane operator(s) is qualified and trained in the operation of the crane to be used. The Contractor shall also certify that all of its crane operators working on the DOD activity have been trained in the proper use of all safety devices (e.g., anti-two block devices). These certifications shall be posted on the crane.

1.14 HOT WORK

Prior to performing "Hot Work" (welding, etc.) or operating other flame-producing devices, a written permit shall be requested from the Fire Division. CONTRACTORS ARE REQUIRED TO MEET ALL CRITERIA BEFORE A PERMIT IS ISSUED. The Contractor will provide at least two (2) twenty (20) pound 4A:20 BC rated extinguishers for normal "Hot Work". All extinguishers shall be current inspection tagged, approved safety pin and tamper resistant seal. It is also mandatory to have a designated FIRE WATCH for any "Hot Work" done at this activity.

a. Oil painting materials (paint, brushes, empty paint cans, etc.), and all flammable liquids shall be removed from the facility at quitting time. All painting materials and flammable liquids shall be stored outside in a suitable metal locker or box and will require re-submittal with non-hazardous materials.

b. Accumulation of trays, paper, shavings, sawdust, boxes and other packing materials shall be removed from the facility at the close of each workday and such material disposed of in the proper containers located away from the facility.

c. The storage of combustible supplies shall be a safe distance from structures.

d. Area outside the facility undergoing work shall be cleaned of trash, paper, or other discarded combustibles at the close of each workday.

e. All portable electric devices (saws, sanders, compressors, extension chord, lights, etc.) shall be disconnected at the close of each workday. When possible, the main electric switch in the facility shall be deactivated.

f. When starting work in the facility, Contractors shall require their personnel to familiarize themselves with the location of the nearest fire alarm boxes and place in memory the emergency Fire Division phone number. ANY FIRE, NO MATTER HOW SMALL, SHALL BE REPORTED TO THE RESPONSIBLE FIRE DIVISION IMMEDIATELY.

PART 2 PRODUCTS

2.1 CONFINED SPACE SIGNAGE

The Contractor shall provide permanent signs integral to or securely attached to access covers for new permit-required confined spaces. Signs wording: "DANGER--PERMIT-REQUIRED CONFINED SPACE - DO NOT ENTER -" in bold letters a minimum of 1 inch in height and constructed to be clearly legible with all paint removed. The signal word "DANGER" shall be red and readable from 5 feet.

PART 3 EXECUTION

3.1 CONSTRUCTION AND/OR OTHER WORK

The Contractor shall comply with USACE EM 385-1-1, NFPA 241, the APP, the AHA, and other related submittals and activity fire and safety regulations.

3.1.1 Hazardous Material Use

Each hazardous material must receive approval prior to being brought onto the job site or prior to any other use in connection with this contract. Allow a minimum of 10 working days for processing of the request for use of a hazardous material. Any work or storage involving hazardous chemicals or materials must be done in a manner that will not expose Government or Contractor employees to any unsafe or unhealthful conditions. Adequate protective measures must be taken to prevent Government or Contractor employees from being exposed to any hazardous condition that could result from the work or storage. The Prime Contractor shall keep a complete inventory of hazardous materials brought onto the work-site. Approval by

the Contracting Officer of protective measures and storage area is required prior to the start of the work.

3.1.2 Hazardous Material Exclusions

Notwithstanding any other hazardous material used in this contract, radioactive materials or instruments capable of producing ionizing/non-ionizing radiation (with the exception of radioactive material and devices used in accordance with EM 385-1-1 such as nuclear density meters for compaction testing and laboratory equipment with radioactive sources) as well as materials which contain asbestos, mercury or polychlorinated biphenyls, di-isocynates, lead-based paint are prohibited. The Contracting Officer, upon written request by the Contractor, may consider exceptions to the use of any of the above excluded materials.

3.1.3 Unforeseen Hazardous Material

The design should have identified materials such as PCB, lead paint, and friable and non-friable asbestos. If material, not indicated, that may be hazardous to human health upon disturbance during construction operations is encountered, stop that portion of work and notify the Contracting Officer immediately. Within 14 calendar days the Government will determine if the material is hazardous. If material is not hazardous or poses no danger, the Government will direct the Contractor to proceed without change. If material is hazardous and handling of the material is necessary to accomplish the work, the Government will issue a modification pursuant to "FAR 52.243-4, Changes" and "FAR 52.236-2, Differing Site Conditions."

3.2 PRE-OUTAGE COORDINATION MEETING

Contractors are required to apply for utility outages at least 15 days in advance. As a minimum, the request should include the location of the outage, utilities being affected, duration of outage and any necessary sketches. Special requirements for electrical outage requests are contained elsewhere in this specification section. Once approved, and prior to beginning work on the utility system requiring shut down, the Contractor shall attend a pre-outage coordination meeting with the Contracting Officer and the DPW Utilities Department to review the scope of work and the lock-out/tag-out procedures for worker protection. No work will be performed on energized electrical circuits unless proof is provided that no other means exist.

3.3 FALL HAZARD PROTECTION AND PREVENTION

The Contractor shall establish a fall protection and prevention program, for the protection of all employees exposed to fall hazards. The program shall include company policy, identify responsibilities, education and training requirements, fall hazard identification, prevention and control measures, inspection, storage, care and maintenance of fall protection equipment and rescue and escape procedures.

3.3.1 Training

The Contractor shall institute a fall protection training program. As part of the Fall Hazard Protection and Prevention Program, the Contractor shall provide training for each employee who might be exposed to fall hazards. Training requirements shall be in accordance with USACE EM 385-1-1, section 21.A.16.

3.4 EQUIPMENT

3.4.1 Material Handling Equipment

a. Material handling equipment such as forklifts shall not be modified with work platform attachments for supporting employees unless specifically delineated in the manufacturer's printed operating instructions.

b. The use of hooks on equipment for lifting of material must be in accordance with manufacturer's printed instructions.

c. Operators of forklifts or power industrial trucks shall be licensed in accordance with OSHA.

3.4.2 Weight Handling Equipment

a. Cranes must be equipped with:

(1) Load indicating devices (LIDs) and a boom angle or radius indicator,

(2) or load moment indicating devices (LMIs).

(3) Anti-two block prevention devices.

(4) Boom hoist hydraulic relief valve, disconnect, or shutoff (stops hoist when boom reaches a predetermined high angle).

(5) Boom length indicator (for telescoping booms).

(6) Device to prevent uncontrolled lowering of a telescoping hydraulic boom.

(7) Device to prevent uncontrolled retraction of a telescoping hydraulic boom.

b. The Contractor shall notify the Contracting Officer 15 days in advance of any cranes entering the activity so that necessary quality assurance spot checks can be coordinated. Contractor's operator shall remain with the crane during the spot check.

c. The Contractor shall comply with the crane manufacturer's specifications and limitations for erection and operation of cranes and hoists used in support of the work. Erection shall be performed under the supervision of a designated person (as defined in ASME B30.5). All testing shall be performed in accordance with the manufacturer's recommended procedures.

d. The Contractor shall comply with ASME B30.5 for mobile and locomotive cranes, ASME B30.22 for articulating boom cranes.

e. The presence of Government personnel does not relieve the Contractor of an obligation to comply with all applicable safety regulations. The Government will investigate all complaints of unsafe or unhealthful working conditions received in writing from contractor employees, federal civilian employees, or military personnel.

f. Each load shall be rigged/attached independently to the

hook/master-link in such a fashion that the load cannot slide or otherwise become detached. Christmas-tree lifting (multiple rigged materials) is not allowed.

g. Under no circumstance shall a Contractor make a lift at or above 90% of the cranes rated capacity in any configuration.

h. When operating in the vicinity of overhead transmission lines, operators and riggers shall be alert to this special hazard and shall follow the requirements of USACE EM 385-1-1 section 11 and ASME B30.5 or ASME B30.22 as applicable.

i. Crane suspended personnel work platforms (baskets) shall not be used unless the Contractor proves that using any other access to the work location would provide a greater hazard to the workers or is impossible. Personnel shall not be lifted with a line hoist or friction crane.

j. A fire extinguisher having a minimum rating of 10BC and a minimum nominal capacity of 5lb of extinguishing agent shall be available at all operator stations or crane cabs. Portable fire extinguishers shall be inspected, maintained, and recharged as specified in NFPA 10, Standard for Portable Fire Extinguishers.

k. All employees shall be kept clear of loads about to be lifted and of suspended loads.

l. A weight handling equipment operator shall not leave his position at the controls while a load is suspended.

m. Only Contractor crane operators who have met the requirements of 29 CFR 1910.94, 29 CFR 1910.120, 29 CFR 1926.65, 29 CFR 1926.500, USACE EM 385-1-1, ASME B30.5, and ASME B30.22 and other local and state requirements shall be authorized to operate the crane.

n. The Contractor shall use cribbing when performing lifts on outriggers.

o. The crane hook/block must be positioned directly over the load. Side loading of the crane is prohibited.

p. A physical barricade must be positioned to prevent personnel from entering the counterweight swing (tail swing) area of the crane.

q. A substantial and durable rating chart containing legible letters and figures shall be provided with each crane and securely mounted onto the crane cab in a location allowing easy reading by the operator while seated in the control station.

r. Certification records which include the date of inspection, signature of the person performing the inspection, and the serial number or other identifier of the crane that was inspected shall always be available for review by Contracting Officer personnel.

s. Written reports listing the load test procedures used along with any repairs or alterations performed on the crane shall be available for review by Contracting Officer personnel.

t. The Contractor shall certify that all crane operators have been

trained in proper use of all safety devices (e.g. anti-two block devices).

3.4.3 Equipment and Mechanized Equipment

a. Equipment shall be operated by designated qualified operators. Proof of qualifications shall be kept on the project site for review.

b. Manufacture specifications or owner's manual for the equipment shall be on site and reviewed for additional safety precautions or requirements that are sometimes not identified by OSHA or USACE EM 385-1-1. Such additional safety precautions or requirements shall be incorporated into the AHAs.

c. Equipment and mechanized equipment shall be inspected in accordance with manufacturer's recommendations for safe operation by a competent person prior to being placed into use.

d. Daily checks or tests shall be conducted and documented on equipment and mechanized equipment by designated competent persons.

3.5 EXCAVATIONS

The competent person for excavations performed as a result of contract work shall be on-site when excavation work is being performed, and shall inspect, and document the excavations daily prior to entry by workers. The competent person must evaluate all hazards, including atmospheric, that may be associated with the work, and shall have the resources necessary to correct hazards promptly.

3.5.1 Utility Locations

Prior to digging, the appropriate digging permit must be obtained. All underground utilities in the work area must be positively identified by a private utility locating service in addition to any station locating service and coordinated with the station utility department. Any markings made during the utility investigation must be maintained throughout the contract.

3.5.2 Utility Location Verification

The Contractor must physically verify underground utility locations by hand digging using wood or fiberglass handled tools when any adjacent construction work is expected to come within three feet of the underground system. Digging within 2 feet of a known utility must not be performed by means of mechanical equipment; hand digging shall be used. If construction is parallel to an existing utility the utility shall be exposed by hand digging every 100 feet if parallel within 5 feet of the excavation.

3.5.3 Utilities with Concrete Slabs

Utilities located within concrete slabs or pier decks, bridges, and the like are extremely difficult to identify. The location must be coordinated with station utility departments in addition to a private locating service. Outages on system utilities shall be used in circumstances where concrete chipping, saw cutting, or core drilling is required and utilities are unable to be completely identified.

3.5.4 Shoring Systems

Trench and shoring systems must be identified in the accepted safety plan and AHA. Manufacture tabulated data and specifications or registered engineer tabulated data for shoring or benching systems shall be readily available on site for review. Job-made shoring or shielding shall have the registered professional engineer stamp, specifications, and tabulated data. Extreme care must be used when excavating near direct burial electric underground cables.

3.5.5 Trenching Machinery

Trenching machines with digging chain drives shall be operated only when the spotters/laborers are in plain view of the operator. Operator and spotters/laborers shall be provided training on the hazards of the digging chain drives with emphasis on the distance that needs to be maintained when the digging chain is operating. Documentation of the training shall be kept on file at the project site.

3.6 ELECTRICAL

3.6.1 Conduct of Electrical Work

Underground electrical spaces must be certified safe for entry before entering to conduct work. Cables that will be cut must be positively identified and de-energized prior to performing each cut. Positive cable identification must be made prior to submitting any outage request for electrical systems. Arrangements are to be coordinated with the Contracting Officer and Station Utilities for identification. The Contracting Officer will not accept an outage request until the Contractor satisfactorily documents that the circuits have been clearly identified. Perform all high voltage cable cutting remotely using hydraulic cutting tool. When racking in or live switching of circuit breakers, no additional person other than the switch operator will be allowed in the space during the actual operation. Plan so that work near energized parts is minimized to the fullest extent possible. Use of electrical outages clear of any energized electrical sources is the preferred method. When working in energized substations, only qualified electrical workers shall be permitted to enter. When work requires Contractor to work near energized circuits as defined by the NFPA 70, high voltage personnel must use personal protective equipment that includes, as a minimum, electrical hard hat, safety shoes, insulating gloves with leather protective sleeves, fire retarding shirts, coveralls, face shields, and safety glasses. Insulating blankets, hearing protection, and switching suits may be required, depending on the specific job and as delineated in the Contractor's AHA.

3.6.2 Portable Extension Cords

Portable extension cords shall be sized in accordance with manufacturer ratings for the tool to be powered and protected from damage. All damaged extension cords shall be immediately removed from service. Portable extension cords shall meet the requirements of NFPA 70.

3.7 WORK IN CONFINED SPACES

The Contractor shall comply with the requirements in Section 06.I of USACE EM 385-1-1 and OSHA 29 CFR 1910.146. Any potential for a hazard in the confined space requires a permit system to be used.

a. Entry Procedures. Prohibit entry into a confined space by personnel for any purpose, including hot work, until the qualified person has conducted appropriate tests to ensure the confined or enclosed space is safe for the work intended and that all potential hazards are controlled or eliminated and documented. (See Section 06.I.05 of USACE EM 385-1-1 for entry procedures.) All hazards pertaining to the space shall be reviewed with each employee during review of the AHA.

b. Forced air ventilation is required for all confined space entry operations and the minimum air exchange requirements must be maintained to ensure exposure to any hazardous atmosphere is kept below its' action level.

c. Ensure the use of rescue and retrieval devices in confined spaces greater than 1.5 m (5 feet) in depth. Conform to Sections 06.I.09, 06.I.10 and 06.I.11 of USACE EM 385-1-1.

d. Sewer wet wells require continuous atmosphere monitoring with audible alarm for toxic gas detection.

e. Include training information for employees who will be involved as entrants and attendants for the work. Conform to Section 06.I.06 of USACE EM 385-1-1.

f. Daily Entry Permit. Post the permit in a conspicuous place close to the confined space entrance.

3.8 CRYSTALLINE SILICA

Grinding, abrasive blasting, and foundry operations of construction materials containing crystalline silica, shall comply with OSHA regulations, such as 29 CFR 1910.94, and USACE EM 385-1-1, Appendix C. The Contractor shall develop and implement effective exposure control and elimination procedures to include dust control systems, engineering controls, and establishment of work area boundaries, as well as medical surveillance, training, air monitoring, and personal protective equipment.

3.9 HOUSEKEEPING

3.9.1 Clean-Up

All debris in work areas shall be cleaned up daily or more frequently if necessary. Construction debris may be temporarily located in an approved location, however garbage accumulation must be removed each day.

3.9.2 Dust control

In addition to the dust control measures required elsewhere in the contract documents, dry cutting of brick or masonry shall be prohibited. Wet cutting must address control of water run off.

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SECTION 01572

CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT

PART 1 GENERAL

1.1 GOVERNMENT POLICY

Government policy is to apply sound environmental principles in the design, construction and use of facilities. As part of the implementation of that policy the Contractor shall: (1) practice efficient waste management when sizing, cutting, and installing products and materials and (2) use all reasonable means to divert construction and demolition waste from landfills and incinerators and to facilitate their recycling or reuse.

1.2 MANAGEMENT

The Contractor shall take a pro-active, responsible role in the management of construction and demolition waste and require all subcontractors, vendors, and suppliers to participate in the effort. Construction and demolition waste includes products of demolition or removal, excess or unusable construction materials, packaging materials for construction products, and other materials generated during the construction process but not incorporated into the work. In the management of waste consideration shall be given to the availability of viable markets, the condition of the material, the ability to provide the material in suitable condition and in a quantity acceptable to available markets, and time constraints imposed by internal project completion mandates. The Contractor shall be responsible for implementation of any special programs involving rebates or similar incentives related to recycling of waste. Revenues or other savings obtained for salvage, or recycling shall accrue to the Contractor. Firms and facilities used for recycling, reuse, and disposal shall be appropriately permitted for the intended use to the extent required by federal, state, and local regulations.

1.3 PLAN

A waste management plan shall be submitted within 15 days after notice to proceed and prior to initiating any site preparation work. The plan shall include the following:

a. Name of individuals on the Contractor's staff responsible for waste prevention and management.

b. Actions that will be taken to reduce solid waste generation.

c. Description of the specific approaches to be used in recycling/reuse of the various materials generated, including the areas and equipment to be used for processing, sorting, and temporary storage of wastes.

d. Characterization, including estimated types and quantities, of the waste to be generated.

e. Name of landfill and/or incinerator to be used and the estimated

costs for use, assuming that there would be no salvage or recycling on the project.

f. Identification of local and regional reuse programs, including non-profit organizations such as schools, local housing agencies, and organizations that accept used materials such as materials exchange networks and Habitat for Humanity.

g. List of specific waste materials that will be salvaged for resale, salvaged and reused, or recycled. Recycling facilities that will be used shall be identified.

h. Identification of materials that cannot be recycled/reused with an explanation or justification.

i. Anticipated net cost savings determined by subtracting Contractor program management costs and the cost of disposal from the revenue generated by sale of the materials and the incineration and/or landfill cost avoidance.

1.4 RECORDS

Records shall be maintained to document the quantity of waste generated; the quantity of waste diverted through sale, reuse, or recycling; and the quantity of waste disposed by landfill or incineration. The records shall be made available to the Contracting Officer during construction, and a copy of the records shall be delivered to the Contracting Officer upon completion of the construction.

1.5 COLLECTION

The necessary containers, bins and storage areas to facilitate effective waste management shall be provided and shall be clearly and appropriately identified. Recyclable materials shall be handled to prevent contamination of materials from incompatible products and materials and separated by one of the following methods:

1.5.1 Source Separated Method

Waste products and materials that are recyclable shall be separated from trash and sorted into appropriately marked separate containers and then transported to the respective recycling facility for further processing.

1.5.2 Co-Mingled Method

Waste products and recyclable materials shall be placed into a single container and then transported to a recycling facility where the recyclable materials are sorted and processed.

1.5.3 Other Methods

Other methods proposed by the Contractor may be used when approved by the Contracting Officer.

1.6 DISPOSAL

Except as otherwise specified in other sections of the specifications, disposal shall be in accordance with the following:

1.6.1 Reuse

First consideration shall be given to salvage for reuse since little or no re-processing is necessary for this method, and less pollution is created when items are reused in their original form. Sale or donation of waste suitable for reuse shall be considered. Salvaged materials, other than those specified in other sections to be salvaged and reinstalled, shall not be used in this project.

1.6.2 Recycle

Waste materials not suitable for reuse, but having value as being recyclable, shall be made available for recycling whenever economically feasible.

1.6.3 Waste

Materials with no practical use or economic benefit shall be disposed at a landfill or incinerator.

-- End of Section --

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SECTION 01582

AIR FORCE PROJECT SIGN

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1.2 PROJECT SIGNS
1.3 PAYMENT
1.4 ATTACHMENT

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PART 3 EXECUTION - NOT USED

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SECTION 01582

AIR FORCE PROJECT SIGN

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FED-STD-595	(Rev. B) Colors Used in Government Procurement

1.2 PROJECT SIGNS

Two (2) separate project signs will be required for this project. One will be a standard Air Force project sign and the other will be a Defense Logistics Agency (DLA) project sign. A copy of each sign is attached to the end of this section.

Immediately upon beginning work at project site, the Contractor shall furnish and erect the project signs in a location determined by the Contracting Officer. Details of construction shall be as shown on the attached drawings. The sign shall be constructed of 1/2-inch thick, Grade A-C, exterior-type plywood. The sign shall receive one coat of primer paint, FED-STD-595 color number 20109, semi-gloss, exterior-type enamel. The Air Force Engineering and services emblem decal, the DLA emblem decals will be furnished to the Contractor by the Government, for applying where indicated. Upon completion of work on the project, the sign shall be removed from the job site and shall remain the property of the Contractor.

1.3 PAYMENT

No separate payment will be made for the project sign. Costs shall be considered incidental to and included in the contract price.

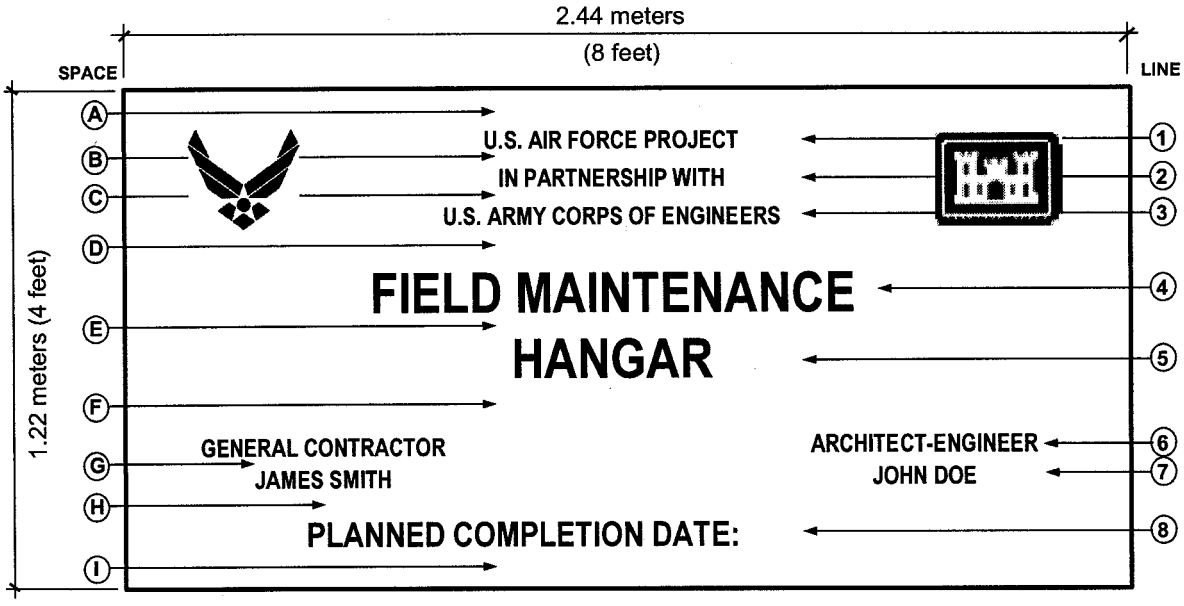
1.4 ATTACHMENT

Air Force Project Sign

DLA Project Sign

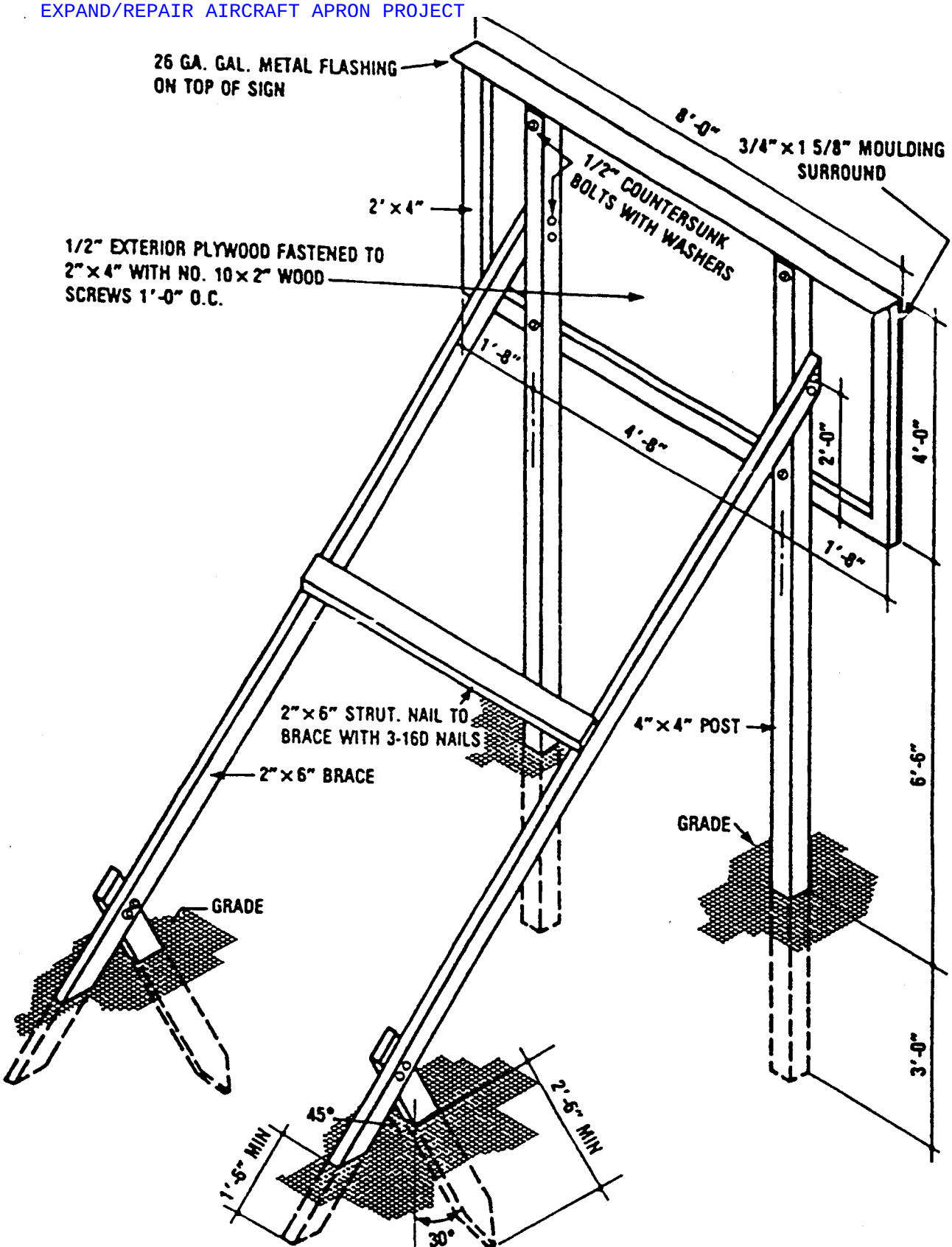
PART 2 PRODUCTS - NOT USED

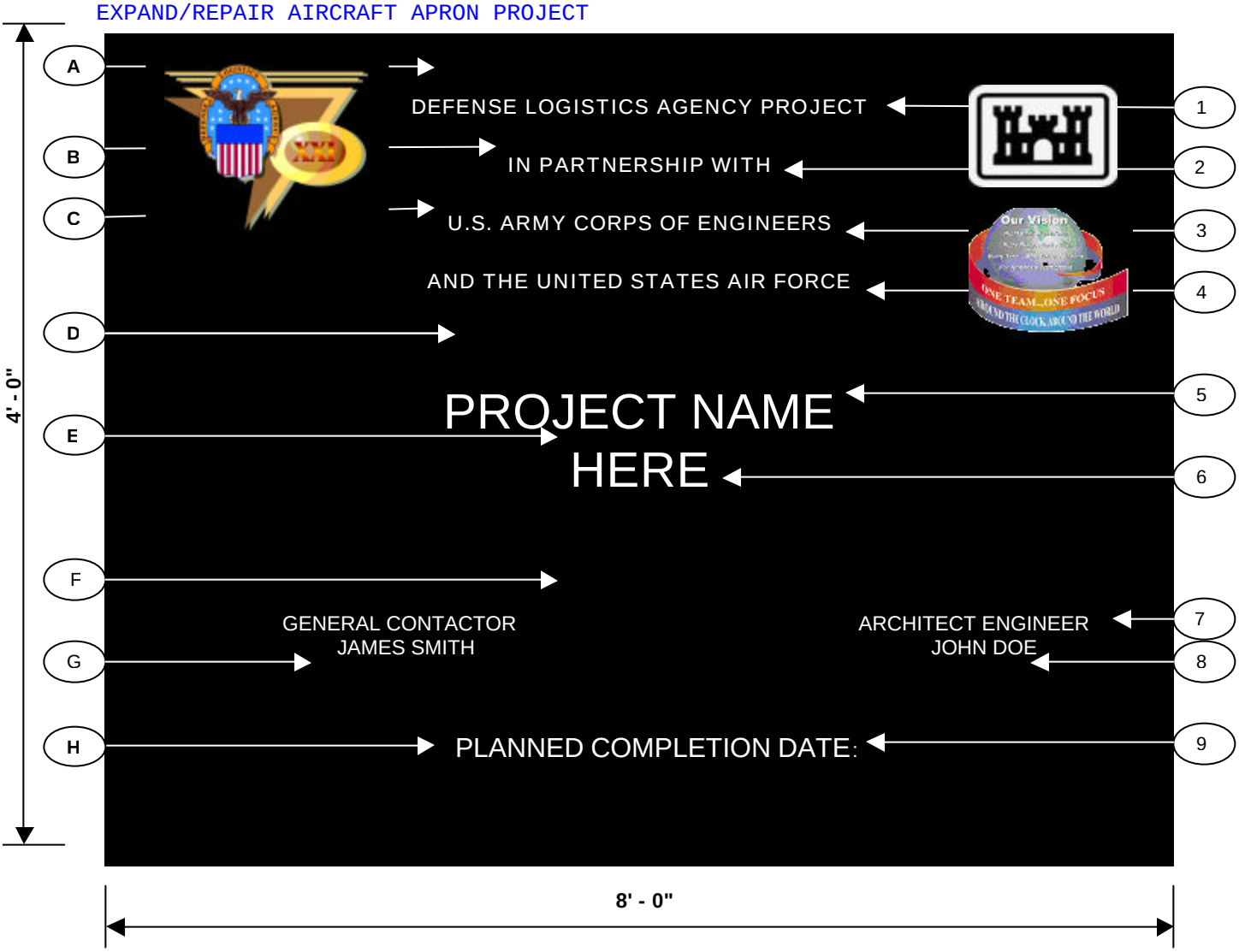
PART 3 EXECUTION - NOT USED



SAMPLE CONSTRUCTION SIGN FOR MILCON PROJECTS

Space	Height	Line	Description	Letter Height	Stroke
A	102 mm (4 in)	1	U.S. AIR FORCE PROJECT	38 mm (1.5 in)	5 mm (0.1875 in)
B	51 mm (2 in)	2	IN PARTNERSHIP WITH	38 mm (1.5 in)	5 mm (0.1875 in)
C	51 mm (2 in)	3	U.S. ARMY CORPS OF ENGINEERS	38 mm (1.5 in)	5 mm (0.1875 in)
D	127 mm (5 in)	4	PROJECT NAME	102 mm (4 in)	13 mm (0.5 in)
E	76 mm (3 in)	5	PROJECT NAME CONT'D (IF REQUIRED)	102 mm (4 in)	13 mm (0.5 in)
F	127 mm (5 in)	6	GENERAL CONTRACTOR/A-E	38 mm (1.5 in)	5 mm (0.1875 in)
G	25 mm (1 in)	7	GENERAL CONTRACTOR/A-E	38 mm (1.5 in)	5 mm (0.1875 in)
H	102 mm (4 in)	8	PLANNED COMPLETION DATE	63 mm (2.5 in)	6 mm (0.25 in)


26 GA. GAL. METAL FLASHING ON TOP OF SIGN
8'-0"
3/4" × 1 5/8" MOULDING SURROUND
1/2" COUNTERSUNK BOLTS WITH WASHERS
2' × 4"
1/2" EXTERIOR PLYWOOD FASTENED TO 2" × 4" WITH NO. 10 × 2" WOOD SCREWS 1'-0" O.C.
1'-8"
4'-8"
2'-0"
4'-0"
1'-8"
2" × 6" STRUT. NAIL TO BRACE WITH 3-16D NAILS
4" × 4" POST
2" × 6" BRACE
6'-6"
GRADE
GRADE
45°
2'-6" MIN
1'-6" MIN
30°
3'-0"



SAMPLE CONSTRUCTION SIGN FOR MILCON PROJECTS SCHEDULE

SPACE	HEIGHT	LINE	DESCRIPTION	LETTER HEIGHT	STROKE
A	3”	1	DEFENSE LOGISTICS AGENCY PROJECT	1.5”	3/16”
B	1”	2	IN PARTNERSHIP WITH	1.5”	3/16”
C	1”	3	U.S. ARMY CORPS OF ENGINEERS	1.5”	3/16”
D	1”	4	AND THE UNITED STATES AIR FORCE	1.5”	3/16”
E	5”	5	PROJECT NAME	4”	1/2"
F	3”	6	PROJECT NAME CONT’D (IF REQUIRED)	4”	1/2"
G	5”	7	GENERAL CONTRACTOR/A-E	1.5”	3/16”
H	1”	8	GENERAL CONTRACTOR/A-E	1.5”	3/16”
I	4”	9	PLANNED COMPLETION DATE	2.5”	1/4"

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SECTION 01670

RECYCLED / RECOVERED MATERIALS

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SECTION 01670

RECYCLED / RECOVERED MATERIALS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

40 CFR 247	Comprehensive Procurement Guideline for Products Containing Recovered Materials

1.2 OBJECTIVES

Government procurement policy is to acquire, in a cost effective manner, items containing the highest percentage of recycled and recovered materials practicable consistent with maintaining a satisfactory level of competition without adversely affecting performance requirements or exposing suppliers' employees to undue hazards from the recovered materials. The Environmental Protection Agency (EPA) has designated certain items which must contain a specified percent range of recovered or recycled materials. EPA designated products specified in this contract comply with the stated policy and with the EPA guidelines. The Contractor shall make all reasonable efforts to use recycled and recovered materials in providing the EPA designated products and in otherwise utilizing recycled and recovered materials in the execution of the work.

1.3 EPA DESIGNATED ITEMS INCORPORATED IN THE WORK

Various sections of the specifications contain requirements for materials that have been designated by EPA as being products which are or can be made with recovered or recycled materials. These items, when incorporated into the work under this contract, shall contain at least the specified percentage of recycled or recovered materials unless adequate justification (non-availability) for non-use is provided. When a designated item is specified as an option to a non-designated item, the designated item requirements apply only if the designated item is used in the work.

1.4 EPA PROPOSED ITEMS INCORPORATED IN THE WORK

Products other than those designated by EPA are still being researched and are being considered for future Comprehensive Procurement Guideline (CPG) designation. It is recommended that these items, when incorporated in the work under this contract, contain the highest practicable percentage of recycled or recovered materials, provided specified requirements are also met.

1.5 EPA LISTED ITEMS USED IN CONDUCT OF THE WORK BUT NOT INCORPORATED IN THE WORK

There are many products listed in 40 CFR 247 which have been designated or proposed by EPA to include recycled or recovered materials that may be used by the Contractor in performing the work but will not be incorporated into the work. These products include office products, temporary traffic control products, and pallets. It is recommended that these non-construction products, when used in the conduct of the work, contain the highest practicable percentage of recycled or recovered materials and that these products be recycled when no longer needed.

-- End of Section --

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DIVISION 01 - GENERAL REQUIREMENTS

SECTION 01730

FUEL SYSTEM OPERATION AND MAINTENANCE SUPPORT INFORMATION (OMSI)

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2.2 IDENTIFICATION

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3.5.18 Control Valves
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3.5.20 Fire Alarm and Fire Detecting System
3.5.21 Motor Control Center
3.5.22 Non-Automatic Transfer Switch
3.5.23 Pump Control Panel (PCP)

-- End of Section Table of Contents --

SECTION 01730

FUEL SYSTEM OPERATION AND MAINTENANCE SUPPORT INFORMATION (OMSI)

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

DEFENSE LOGISTICS AGENCY HANDBOOK

H4.1	(June 82) Federal Supply Code for Manufacturers; United States and Canada-name to Code

Contractor Responsibility

The Contractor is responsible for providing the technical publications specified herein for all of the components, assemblies, sub-assemblies, attachments, and accessories, required to be supplied in accordance with submittal requirements of each - specification section, regardless of whether the item was manufactured and assembled in-house or obtained from other sources.

1.2 SUBMITTALS

1.2.1 OMSI Submittal Requirements

OMSI submittals are required in order that complete documentation can be assembled to provide the Government "Activity" with the necessary information and orientation to adequately operate and maintain the new structures/facilities of this project. The Contractor shall submit the OMSI documents and information specified for the equipment listed under the OMSI submittal paragraphs in each technical section. Five (5) copies of each OMSI submittal shall be forwarded to the Contracting Officer no later than 120-days prior to contract completion. OMSI submittals are to be submitted separate from and in addition to Contractor's product approval submittals.

SD-10 Operation and Maintenance Data

Manuals; G-AE.

PART 2 PRODUCTS

2.1 DEVELOPMENT OF SUBMITTALS

Provide submittals in separate four-inch (4") folders. Manufacturer's manuals or data for the components, assemblies, subassemblies, and other operating parts which are provided shall be assembled into a loose-leaf notebook-type folder, indexed by major assembly and component in sequential order. Manuals shall be complete in all respects for all equipment,

controls, and accessories provided.

2.2 IDENTIFICATION

On each folder identify and mark as follows:

a. Inscribe on the cover, the words, "OPERATION AND MAINTENANCE MANUAL", the name and location of the building, and the contract number.

b. Equipment manufacturer and/or Contractor's address and telephone number; names, address and telephone numbers of each subcontractor installing equipment; and local representative for each item of equipment.

c. Volume number and title of the folder.

d. The manual shall have a table of contents and be assembled to conform to the table of contents with the tab sheets placed before instructions covering the subject. Sub-divide manuals or provide separate manuals for each of the following categories.

1. Operating Instructions

2. Maintenance, Service, and Repair Instructions

3. Parts Manual

PART 3 EXECUTION

3.1 OPERATING INSTRUCTIONS

The operator's instructions shall include specific instructions and illustrations of the equipment operation required or recommended by the manufacturer as follows:

3.1.1 Safety

Include manufacturer's safety precautions to be observed while operating under all conditions for which the equipment was designed. Clearly list all major hazards to personnel and equipment safety that are peculiar to systems and equipment described in the manual.

3.1.2 Operator Prestart

Include instructions for prestart checks, lubrication, and service requirements necessary for setting up or preparing each system for use, warm up procedures, and verification of normal operation. Include control diagrams with data to explain detailed operation and control of each item of the equipment.

3.1.3 Starting and Shutdown Procedures and Controls

Include a control sequence describing start up operation and provide shutdown procedures and post-shutdown requirements.

3.1.4 Normal Operating Instructions

Instructions shall be sufficient to enable the mechanic to adjust, stop and start, and operate the equipment properly. Special startup precautions

shall be noted, as well as other items requiring action before the equipment may be put into service. Include detailed drawings indicating procedure and valve numbers and status as to normally open/closed.

3.1.5 Emergency Operating Procedures

Include action to be taken in the event of a malfunction of the unit, either to permit a short period of continued operation or to prevent further damage to the unit and to the system in which it is installed.

3.1.6 Operator Service Requirements

Include instructions for operator service requirements during operation of the equipment.

3.1.7 Instruction to Government Personnel

The Contractor shall furnish the services of competent instructors who will give full instruction to the designated personnel in the adjustment, operation and maintenance, including pertinent safety requirements, of the equipment or system specified. Each instructor shall be thoroughly familiar with all parts of the installation and shall be trained in operating theory as well as practical operation and maintenance work. Instruction shall be given during the first regular work week after the equipment or system has been accepted and turned over to the Government for regular operation. A minimum of 1 man-day (8-hours) of instruction shall be furnished for each system specified in other sections. When more than 4 man-days of instruction are specified, approximately half of the time shall be used for classroom instruction. All other time shall be used for instruction with the equipment or system. When significant changes or modifications in the equipment or system are made under the terms of the contract, additional instruction shall be provided to acquaint the operating personnel with the changes or modifications. Government representatives shall be allowed to video tape all classroom and field instructions.

3.2 MAINTENANCE, SERVICE AND REPAIR INSTRUCTIONS

The shop or maintenance manual shall include manufacturer's instructions to maintain the equipment in a safe and serviceable condition. The maintenance or shop manual shall contain all necessary instructions, illustrations, charges and diagrams covering, as a minimum, the items listed below.

3.2.1 Lubrication Instructions

a. Include a table showing recommended lubricants for specific temperature ranges and applications.

b. Include chart(s) with schematic diagram of the equipment showing lubrication points, recommended types and grades of lubricants, and capacities. Provide a lubrication schedule showing service interval frequency.

3.2.2 Table of Preventative Maintenance Instructions

Include frequency in time, miles or hours covering routine servicing, lubrication, and adjustments.

3.2.3 Preventative Maintenance Inspection

Points and checklist should be clearly spelled out as part of operator-type inspection in this section. Include chart with schematic diagram and/or a separate inspection checklist - indicating what should be examined for wear or possible malfunction and what should be reported for repair.

3.2.4 Troubleshooting Guides and Diagnostic Techniques

Provide step-by-step procedures to enable prompt isolation of the cause of a malfunction with corrective maintenance instructions. Instructions shall clearly indicate why the check out is performed and what conditions are to be sought.

3.2.5 Removal and Preplacement Instructions

Provide step-by-step procedures for removal, replacement, disassembly and assembly of all components, assemblies, sub-assemblies, accessories, and attachments normally subjected to wear, damage, malfunction, and frequent replacement. These instructions should provide for a judicious combination of text and illustrations.

3.2.6 Maintenance and Repair Procedure

Provide instructions for tolerances, dimensions, settings, and adjustments normally required for performing routine maintenance servicing. Instructions shall provide the necessary information to bring equipment up to the required serviceable standard when it becomes unserviceable. Include instructions for examining equipment for needed repairs and adjustment, and any tests or inspections required to determine whether or not parts must be replaced.

3.3 PARTS MANUAL

3.3.1 Contents

The parts manual shall provide positive identification and coverage for all of the parts of components, assemblies, sub-assemblies, and accessories of the end item normally subject to wear, malfunctioning, damage, or loss. Include any special hardware requirements (eg., high-strength bolts and nuts). The parts manual may cover more than one model or series or equipments, components, assemblies, subassemblies, attachments, or accessories, such as a master parts catalog, in accordance with the manufacturer's standard commercial practice. Identification of the parts shall be such that all parts may be ordered and centrally stocked by the government without further identification to the make, model, and serial number of the equipment being provided.

3.3.2 Illustrations, Drawings, and/or Exploded Views

Provide clear and legible illustrations, drawings, and/or views to enable easy identification of all individual parts, components, assemblies, sub-assemblies, and accessories of the end item. Show part numbers and description on illustrations or list separately. When the illustrations omit the part numbers and description, both the illustrations and separate listing shall show the index, the illustrations and separate listing shall show the index, reference, or key number which will cross-reference the illustrated part to listed part. Parts shown in the listings shall be grouped by components, assemblies, and sub-assemblies with individual parts

identified to the assembly.

3.3.3 End Item Manufacturer's Part Numbers

Include parts for which the end item manufacturer has proprietary rights or has exercised design control, and for which the end item manufacturer is the logical supplier. The end item manufacturer shall also assign numbers to purchased production parts, if such parts are altered to meet the prime manufacturer's design configuration. (Repainting, marking, or other nonsignificant operations are not adequate cause for use of exclusively assigned numbers).

3.3.4 Components Assemblies/Parts

Include those components assemblies/parts purchased by the end item manufacturer for which the end item manufacturer does not have control, and shall be identified by the actual manufacturer's name and part numbers. Detail parts in the manufacturer's assembly, as well as attaching parts, for which the manufacturer does not have design control shall also be identified by the applicable actual manufacturer's parts numbers. This paragraph does not restrict the end item manufacturer from assigning part numbers as long as the actual manufacturer's part number and the Federal Supply Code for Manufacturer H4.1 (FSCM) or manufacturer is shown.

3.3.5 Appendices

End item manufacturer may add an appendix for cross-reference to implement components assemblies/parts requirements when implementation in manual form varies drastically with the style, format, and method of Contractor's standard commercial practice. Subject cross-referenced in an appendix will appear in the following format:

End Item Manufacturer's Alpha Numeric Seq.	Actual Manufacturer's Name and/or FSCM* From H4.1~	Actual Manufacturer Part No.
100001	John Doe & Co. 000000	2000002

*Federal Supply Code for Manufacturers Cataloging Handbook, Name to Code

3.4 VALIDATION

Each submittal shall be validated by the Contractor or Manufacturer as being accurate and applicable to the systems and equipment provided.

3.5 SPECIFIC EQUIPMENT SUBMITTALS

The technical sections of this specification identify the specific equipment or systems for which OMSI submittals are required. This paragraph' and its subparagraph contain a general list of various types of equipment and systems together with the OMSI information required for each type. The applicable OMSI information contained in this paragraph shall be submitted for each specific piece of equipment or system listed under the "OMSI Submittals" paragraph in the technical sections. Operating instructions; maintenance, service, and repair instructions; and parts manuals shall conform to the requirements of their -respective paragraph herein. Provide validation in accordance with Paragraph: VALIDATION for all submittals.

3.5.1 Pressure Gages

a. Manufacturer's descriptive literature, general.

b. Parts manuals and recommended spare parts list.

c. Maintenance, service and repair instructions.

d. Manufacturer's name, model number, serial number, Federal Stock Number (if any).

3.5.2 Automatic Pump Controls

Includes Pressure Indicating Transmitters, Flow Switches, Venturi Tubes, Differential Pressure Transmitters, and Level Switches.

a. Manufacturer's descriptive literature, general.

b. Parts manual.

c. Maintenance, service and repair instructions.

d. Operating Instructions.

e. Manufacturer's name, model number, serial number, Federal Stock Number (if any).

f. Performance data at specified conditions.

g. Control wiring diagrams showing all terminations of conductors (and all control devices) labeled to permit identification in the field; part numbers of all control devices; normally open or normally `closed; voltage of all control `components.

h. Name, address and telephone number of the nearest manufacturer's representative.

3.5.3 Meters

a. Manufacturer's descriptive literature, general.

b. Parts manual and recommended spare parts list.

c. Maintenance, service and repair instructions.

d. Operating Instructions.

e. Manufacturer's name, model number, serial number, Federal Stock Number (if any).

f. Performance data at specified conditions.

g. Name, address and telephone number of the nearest manufacturer's representative.

3.5.4 Product Recovery Tank and Accessories

a. Manufacturer's descriptive literature, general.

b. Parts manual and recommended spare parts list.

c. Maintenance, service and repair instructions.

d. Operating Instructions.

e. Manufacturer's name, model number, serial number, Federal Stock Number (if any).

f. Performance data at specified conditions.

g. Name, address and telephone number of the nearest manufacturer's representative.

3.5.5 Hydrant Outlet Pits, Isolation Valve Pits, High Point Vent and Low Point Drain Pits

a. Manufacturer's descriptive literature, general.

b. Parts manual and recommended spare parts list.

c. Maintenance, service and repair instructions.

d. Manufacturer's name, model number, serial number, Federal Stock Number (if any).

e. Name, address and telephone number of the nearest manufacturer's representative.

3.5.6 Operating Tank Level Indicator

a. Manufacturer's descriptive literature, general.

b. Parts manual and recommended spare parts list.

c. Maintenance, service and repair instructions.

d. Operating Instructions.

e. Manufacturer's name, model number, serial number, Federal Stock Number (if any).

f. Performance data at specified conditions.

g. Control wiring diagrams showing all terminations of conductors (and all control devices) labeled to permit identification in the field; part numbers of all control devices; normalcy open or normally closed; voltage of all control components.

h. Name, address and telephone number of the nearest manufacturer's representative.

3.5.7 Pantographs

a. Manufacturer's descriptive literature, general.

b. Parts manual and recommended spare parts list.

c. Maintenance, service and repair instructions.

d. Operating Instructions.

e. Manufacturer's name, model number, serial number, Federal Stock Number (if any).

f. Performance data at specified conditions.

g. Name, address and telephone number of the nearest manufacturer's representative.

h. SSEA approval letter.

3.5.8 Piping and Fittings

a. Certificates of Compliance.

b. Batch run numbers.

c. Manufacturer's descriptive literature, general.

d. Name address and telephone number of manufacturer.

3.5.9 Manual Valves

a. Manufacturer's descriptive literature, general.

b. Parts manual and recommended spare parts list.

c. Maintenance, service and repair instructions.

d. Operating Instructions.

e. Manufacturer's name, model number, serial number, Federal Stock Number (if any).

f. Performance data at specified conditions.

g. Where specified to have limit switches, control wiring diagram showing all terminations of conductors (and all control devices) labeled to permit identification in the field; part numbers of all control devices; normally open or normally closed; voltage of all control components.

h. Name, address and telephone number of the nearest manufacturer's representative.

3.5.10 Gaskets and Isolating Gasket Kits

a. Manufacturer's descriptive literature, general.

b. Manufacturer's name, model number, serial number, Federal Stock Number (if any).

c. Name, address and telephone number of the nearest manufacturer's representative.

3.5.11 Strainers

a. Manufacturer's descriptive literature, general.

b. Parts manual and recommended spare parts list.

c. Maintenance, service and repair instructions.

d. Manufacturer's name, model number, serial number, Federal Stock Number (if any).

e. Name, address and telephone number of the nearest manufacturer's representative.

3.5.12 Protective Coatings

a. Manufacturer's descriptive literature, general.

b. Maintenance, service and repair instructions.

c. Manufacturer's name, model number, serial number, Federal Stock Number (if any).

d. Name, address and telephone number of the nearest manufacturer's representative.

3.5.13 Sample Connections

a. Manufacturer's descriptive literature, general.

b. Parts manual and recommended spare parts list.

c. Maintenance, service and repair instructions.

d. Operating Instructions.

e. Manufacturer's name, model number, serial number, Federal Stock Number (if any).

f. Name, address and telephone number of the nearest manufacturer's representative.

3.5.14 Filter Separators and Micronic Filter

a. Manufacturer's descriptive literature, general.

b. Parts manual and recommended spare parts list.

c. Maintenance, service and repair instructions.

d. Operating Instructions.

e. Manufacturer's name, model number, serial number, Federal Stock Number (if any).

f. Performance data at specifies conditions.

g. Name, address and telephone number of the nearest manufacturer's representative.

3.5.15 Water Draw-Off System

a. Manufacturer's descriptive literature, general.

b. Maintenance, service and repair instructions.

c. Operating Instructions.

d. Manufacturer's name, model number, serial number, Federal Stock Number (if any).

e. Name, address and telephone number of the nearest manufacturer's representative.

3.5.16 Pumps - Fueling, Fuel Transfer, Product Return, and Booser Pumpdown

a. Manufacturer's descriptive literature, general.

b. Parts manual and recommended spare parts list.

c. Maintenance, service and repair instructions:

d. Manufacturer's name, model number, serial number, Federal Stock Number (if any).

e. Performance data at specified flow rates. Performance shall include:

1. Head developed, horsepower required and efficiency.

2. Pump curves, flow and power requirements, efficiency, head and operating speed. Curves to show operating points at full range of operating conditions.

f. Control wiring diagrams showing all terminations of conductors (and all control devices) labeled to permit identification in the field; part numbers of all control devices; normally open or normally closed; voltage of all control components and operational description.

g. Plan and elevation views of equipment showing clearance required for maintenance and/or replacement.

h. Name, address and telephone number of the nearest manufacturer's representative.

i. Shipping and operating weights.

j. Operating instructions.

k. Factory run test curves indicating flow, head rpm, vibration amplitude and BHP.

3.5.17 Flexible Hoses

a. Manufacturer's descriptive literature, general.

b. Maintenance service and repair instructions.

c. Manufacturer's name, model number, serial number.

d. Name, address and telephone number of the nearest manufacturer's representative.

3.5.18 Control Valves

(Submit for each type control valve specified)

a. Manufacturer's descriptive literature, general.

b. Operational description of valve and control pilots.

c. Description of valve assembly complete with parts list.

d. Recommended spare parts list for main valve and pilot control systems.

e. Instructions for trouble shooting.

f. Maintenance, service and repair instructions.

g. Manufacturer's name, model number and stock number.

h. Operational Test Data.

3.5.19 Engine-Generator

a. Internal and interconnecting wiring and control diagrams with data to explain detailed operation and control of the system or equipment.

b. A control sequence describing startup', operation, and shutdown.

c. Description of the function of each principal item of equipment.

d. Installation and maintenance instructions.

e. Safety precautions.

f. Diagrams and illustrations.

g. Testing methods.

h. Performance data.

i. Lubrication schedule including type, grade, temperature range, and frequence.

j. Parts list: The list shall indicate sources of supply, recommended spare parts, and name of servicing organization'.

k. List qualified permanent servicing organizations for support of the equipment, including addresses and certified qualifications.

3.5.20 Fire Alarm and Fire Detecting System

a. Manufacturer's descriptive literature, general.

b. Parts manual.

c. Maintenance, service and repair instructions.

d. Operating Instructions.

e. Drawing of component arrangement, schedule of components with sizes, types, and ratings, and wiring diagrams.

f. Manufacturer's name, model number, serial number, Federal Stock Number (if any).

g. Name, address and telephone number of the nearest manufacturer's representative.

3.5.21 Motor Control Center

a a. Internal and interconnecting wiring and control diagrams with data to explain detailed operation and control of the system or equipment.

b. A control sequence describing startup, operation, and shutdown.

c. Description of the function of each principal item of equipment.

d. Installation and maintenance instructions.

e. Safety precautions.

f. Diagrams and illustrations.

g. Parts list.

h. Drawing of component arrangement, schedule of components with sizes, types, and ratings.

i. Manufacturer's name, model number, serial number.

j. Name, address and telephone number of the nearest manufacturer's representative.

3.5.22 Non-Automatic Transfer Switch

a. Manufacturer's descriptive literature, general.

b. Parts list.

c. Maintenance, service and repair instructions.

d. Operating Instructions.

e. Drawing of component arrangement, schedule of components with sizes, types, and ratings, and wiring diagrams.

f. Manufacturer's name, model number, serial number, Federal Stock Number (if any).

g. Name, address and telephone number of the nearest manufacturer's representative.

3.5.23 Pump Control Panel (PCP)

a. General description and specifications.

b. Comprehensive discussion of both hardware and operating program.

c. Installation and initial checkout procedures.

d. Detailed electrical and logical description.

e. Complete troubleshooting procedures, diagrams, and guidelines.

f. Complete alignment and calibration procedures for components.

g. Preventive maintenance requirements.

h. Detailed system schematics, system field assembly drawings, and system component specifications and dimensions.

i. Complete spare parts lists.

j. Interface requirements and capabilities.

k. Signal identification and timing diagrams.

l. Complete as-built bill of materials, control drawings, schedules, and sequence of operations.

m. Safety precautions.

n. Control sequence describing start-up, operation, and shutdown. Control sequence shall be integrated with startup and operation of the motor control center.

o. Part list which-shall indicate sources of supply, recommended spare parts, and name of servicing organization.

p. Manufacturer's name, address, and telephone number.

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SECTION 01731

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SECTION 01731

GENERAL FUEL SYSTEM REQUIREMENTS

PART 1 GENERAL

1.1 SUBMITTALS

See SECTION 01330 SUBMITTAL PROCEDURES.

1.2 STANDARD PRODUCTS/SERVICE AVAILABILITY

1.2.1 Materials and Equipment

Materials and equipment shall be standard products of a manufacturer regularly engaged in the manufacturer of such products, which are of a similar material, design and workmanship. The standard products shall have been in satisfactory commercial or industrial use for two years prior to bid opening. The two-year use shall include applications of equipment and materials under similar circumstances and of similar size.

1.2.2 Experience Required

The two-year experience requirement must be satisfactorily completed for a product which has been sold or is offered for sale on the commercial market through advertisements, manufacturer's catalogs, or brochures.

1.2.3 Alternative Service Record

Products having less than a two-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturer's factory or laboratory test, can be shown.

1.2.4 Service Support

The equipment items shall be supported by service organizations. The Contractor shall submit a certified list of qualified permanent service organizations for support of the equipment which includes their addresses and qualifications. These service organizations shall be reasonably convenient to the equipment installation and able to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

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SECTION 01780

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PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

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SECTION 01780

CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

STATE OF ALASKA ADMINISTRATIVE CODE (AAC)

18 AAC 72	(1999) Wastewater Treatment and Disposal
18 AAC 80	Drinking Water

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with SECTION 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

As-Built Drawings; G, RE.

Drawings showing final as-built conditions of the project. The final CADD as-built drawings shall consist of one set of electronic CADD drawing files in the specified format, one set of mylar drawings, 2 sets of blue-line prints of the mylars, and one set of the approved working as-built drawings.

SD-03 Product Data

Warranty Management Plan.

One set of the warranty management plan containing information relevant to the warranty of materials and equipment incorporated into the construction project, including the starting date of warranty of construction. The Contractor shall furnish with each warranty the name, address, and telephone number of each of the guarantor's representatives nearest to the project location.

Warranty Tags.

Two record copies of the warranty tags showing the layout and design.

Final Cleaning; G, RE.

Two copies of the listing of completed final clean-up items.

SD-11 Closeout Submittals

As-Built Record of Equipment and Materials.

1.3 PROJECT RECORD DOCUMENTS

1.3.1 As-Built Drawings

This paragraph covers as-built drawings complete, as a requirement of the contract. The terms "drawings," "contract drawings," "drawing files," "working as-built drawings" and "final as-built drawings" refer to contract drawings which are revised to be used for final as-built drawings.

1.3.1.1 Government Furnished Materials

One set of electronic CADD files in the specified software and format revised to reflect all bid amendments will be provided by the Government at the preconstruction conference for projects requiring CADD file as-built drawings.

1.3.1.2 Working As-Built and Final As-Built Drawings

The Contractor shall revise 2 sets of paper drawings by red-line process to show the as-built conditions during the prosecution of the project. These working as-built marked drawings shall be kept current on a weekly basis and at least one set shall be available on the jobsite at all times. Changes from the contract plans which are made in the work or additional information which might be uncovered in the course of construction shall be accurately and neatly recorded as they occur by means of details and notes. Final as-built drawings shall be prepared after the completion of each definable feature of work as listed in the Contractor Quality Control Plan (Foundations, Utilities, Structural Steel, etc., as appropriate for the project). The working as-built marked prints and final as-built drawings will be jointly reviewed for accuracy and completeness by the Contracting Officer and the Contractor prior to submission of each monthly pay estimate. If the Contractor fails to maintain the working and final as-built drawings as specified herein, the Contracting Officer will deduct from the monthly progress payment an amount representing the estimated cost of maintaining the as-built drawings. This monthly deduction will continue until an agreement can be reached between the Contracting Officer and the Contractor regarding the accuracy and completeness of updated drawings. The working and final as-built drawings shall show, but shall not be limited to, the following information:

a. The actual location, kinds and sizes of all sub-surface utility lines. In order that the location of these lines and appurtenances may be determined in the event the surface openings or indicators become covered over or obscured, the as-built drawings shall show, by offset dimensions to two permanently fixed surface features, the end of each run including each change in direction. Valves, splice boxes and similar appurtenances shall be located by dimensioning along the utility run from a reference point. The average depth below the surface of each run shall also be recorded.

b. The location and dimensions of any changes within the building structure.

c. Correct grade, elevations, cross section, or alignment of roads,

earthwork, structures or utilities if any changes were made from contract plans.

d. Changes in details of design or additional information obtained from working drawings specified to be prepared and/or furnished by the Contractor; including but not limited to fabrication, erection, installation plans and placing details, pipe sizes, insulation material, dimensions of equipment foundations, etc.

e. The topography, invert elevations and grades of drainage installed or affected as part of the project construction.

f. Changes or modifications which result from the final inspection.

g. Where contract drawings or specifications present options, only the option selected for construction shall be shown on the final as-built prints.

h. If borrow material for this project is from sources on Government property, or if Government property is used as a spoil area, the Contractor shall furnish a contour map of the final borrow pit/spoil area elevations.

i. Systems designed or enhanced by the Contractor, such as HVAC controls, and fire alarm.

j. Modifications (change order price shall include the Contractor's cost to change working and final as-built drawings to reflect modifications) and compliance with the following procedures.

1. Directions in the modification for posting descriptive changes shall be followed.

2. A Modification Cloud shall be placed at the location of each deletion.

3. For new details or sections which are added to a drawing, a Modification Triangle shall be placed by the detail or section title.

4. For minor changes, a Modification Triangle shall be placed by the area changed on the drawing (each location).

5. For major changes to a drawing, a Modification Triangle shall be placed by the title of the affected plan, section, or detail at each location.

6. For changes to schedules or drawings, a Modification Triangle shall be placed either by the schedule heading or by the change in the schedule.

7. The Modification Triangle size shall be 1/2 inch diameter unless the area where the triangle is to be placed is crowded. Smaller size triangle shall be used for crowded areas.

1.3.1.3 Drawing Preparation

The as-built drawings shall be modified as may be necessary to correctly show the features of the project as it has been constructed by bringing the

contract set into agreement with approved working as-built prints, and adding such drawings as may be necessary. These working as-built marked prints shall be neat, legible and accurate. These drawings are part of the permanent records of this project and shall be returned to the Contracting Officer after approval by the Government. Any drawings damaged or lost by the Contractor shall be satisfactorily replaced by the Contractor at no expense to the Government.

1.3.1.4 Computer Aided Design and Drafting (CADD) Drawings

Only personnel proficient in the preparation of CADD drawings shall be employed to modify the contract drawings or prepare additional new drawings. Additions and corrections to the contract drawings shall be equal in quality and detail to that of the originals. Line colors, line weights, lettering, layering conventions, and symbols shall be the same as the original line colors, line weights, lettering, layering conventions, and symbols. If additional drawings are required, they shall be prepared using the specified electronic file format applying the same graphic standards specified for original drawings. The title block and drawing border to be used for any new final as-built drawings shall be identical to that used on the contract drawings. Additions and corrections to the contract drawings shall be accomplished using CADD files. The Contractor will be furnished "as-designed" drawings in AutoCad Release 2000 format compatible with a Windows NT operating system. The electronic files will be supplied on compact disc, read-only memory (CD-ROM). The Contractor shall be responsible for providing all program files and hardware necessary to prepare final as-built drawings. The Contracting Officer will review final as-built drawings for accuracy and the Contractor shall make required corrections, changes, additions, and deletions.

a. CADD colors shall be the "base" colors of red, green, and blue. Color code for changes shall be as follows:

1. Deletions (red) - Deleted graphic items (lines) shall be colored red with red lettering in notes and leaders.

2. Additions (Green) - Added items shall be drawn in green with green lettering in notes and leaders.

3. Special (Blue) - Items requiring special information, coordination, or special detailing or detailing notes shall be in blue.

b. The Contract Drawing files shall be renamed in a manner related to the contract number (i.e., 02-C-0010.DWG) as instructed in the Pre-Construction conference. Marked-up changes shall be made only to those renamed files. All changes shall be made on the layer/level as the original item. There shall be no deletions of existing lines; existing lines shall be over struck in red. Additions shall be in green with line weights the same as the drawing. Special notes shall be in blue on layer #63.

c. When final revisions have been completed, the cover sheet drawing shall show the wording "RECORD DRAWING AS-BUILT" followed by the name of the Contractor in letters at least 3/16 inch high. All other contract drawings shall be marked either "AS-Built" drawing denoting no revisions on the sheet or "Revised As-Built" denoting one or more revisions. Original contract drawings shall be dated in the revision block.

d. Within 10 days after Government approval of all of the working as-built drawings for a phase of work, the Contractor shall prepare the final CADD as-built drawings for that phase of work and submit two sets of blue-lined prints of these drawings for Government review and approval. The Government will promptly return one set of prints annotated with any necessary corrections. Within 10 days the Contractor shall revise the CADD files accordingly at no additional cost and submit one set of final prints for the completed phase of work to the Government. Within 20 days of substantial completion of all phases of work, the Contractor shall submit the final as-built drawing package for the entire project. The submittal shall consist of one set of electronic files on compact disc, read-only memory (CD-ROM), one set of mylars, two sets of blue-line prints and one set of the approved working as-built drawings. They shall be complete in all details and identical in form and function to the contract drawing files supplied by the Government. Any transactions or adjustments necessary to accomplish this is the responsibility of the Contractor. The Government reserves the right to reject any drawing files it deems incompatible with the customer's CADD system. Paper prints, drawing files and storage media submitted will become the property of the Government upon final approval. Failure to submit final as-built drawing files and marked prints as specified shall be cause for withholding any payment due the Contractor under this contract. Approval and acceptance of final as-built drawings shall be accomplished before final payment is made to the Contractor.

1.3.1.5 Payment

No separate payment will be made for as-built drawings required under this contract, and all costs accrued in connection with such drawings shall be considered a subsidiary obligation of the Contractor.

1.3.2 As-Built Record of Equipment and Materials

The Contractor shall furnish one copy of preliminary record of equipment and materials used on the project 15 days prior to final inspection. This preliminary submittal will be reviewed and returned 2 days after final inspection with Government comments. Two sets of final record of equipment and materials shall be submitted 10 days after final inspection. The designations shall be keyed to the related area depicted on the contract drawings. The record shall list the following data:

RECORD OF DESIGNATED EQUIPMENT AND MATERIALS DATA

Description	Specification Section	Manufacturer and Catalog,	Composition and Size	Where Used	Model, and Serial Number

1.3.3 Final Approved Shop Drawings

The Contractor shall furnish final approved project shop drawings 30 days after transfer of the completed facility.

1.3.4 Construction Contract Specifications

The Contractor shall furnish final as-built construction contract specifications, including modifications thereto, 30 days after transfer of the completed facility.

1.4 WARRANTY MANAGEMENT

1.4.1 Warranty Management Plan

The Contractor shall develop a warranty management plan which shall contain information relevant to the clause Warranty of Construction in technical specification SECTION 01015 SPECIAL ITEMS. At least 30 days before the planned pre-warranty conference, the Contractor shall submit the warranty management plan for Government approval. The warranty management plan shall include all required actions and documents to assure that the Government receives all warranties to which it is entitled. The plan shall be in narrative form and contain sufficient detail to render it suitable for use by future maintenance and repair personnel, whether tradesmen, or of engineering background, not necessarily familiar with this contract. The term "status" as indicated below shall include due date and whether item has been submitted or was accomplished. Warranty information made available during the construction phase shall be submitted to the Contracting Officer for approval prior to each monthly pay estimate. Approved information shall be assembled in a binder and shall be turned over to the Government upon acceptance of the work. The construction warranty period shall begin on the date of project acceptance and shall continue for the full product warranty period. A joint 4 month and 9 month warranty inspection shall be conducted, measured from time of acceptance, by the Contractor, Contracting Officer and the Customer Representative. Information contained in the warranty management plan shall include, but not be limited to, the following:

a. Roles and responsibilities of all personnel associated with the warranty process, including points of contact and telephone numbers within the organizations of the Contractors, subcontractors, manufacturers or suppliers involved.

b. Listing and status of delivery of all Certificates of Warranty for extended warranty items, to include roofs, HVAC balancing, pumps, motors, transformers, and for all commissioned systems such as fire protection and alarm systems, lightning protection systems, etc.

c. A list for each warranted equipment, item, feature of construction or system indicating:

1. Name of item.

2. Model and serial numbers.

3. Location where installed.

4. Name and phone numbers of manufacturers or suppliers.

5. Names, addresses and telephone numbers of sources of spare parts.

6. Warranties and terms of warranty. This shall include one-year overall warranty of construction. Items which have extended warranties shall be indicated with separate warranty expiration dates.

7. Cross-reference to warranty certificates as applicable.

8. Starting point and duration of warranty period.

9. Summary of maintenance procedures required to continue the warranty in force.

10. Cross-reference to specific pertinent Operation and Maintenance manuals.

11. Organization, names and phone numbers of persons to call for warranty service.

12. Typical response time and repair time expected for various warranted equipment.

d. The Contractor's plans for attendance at the 4 and 9 month post-construction warranty inspections conducted by the Government.

e. Procedure and status of tagging of all equipment covered by extended warranties.

f. Copies of instructions to be posted near selected pieces of equipment where operation is critical for warranty and/or safety reasons.

1.4.2 Performance Bond

The Contractor's Performance Bond shall remain effective throughout the construction warranty period.

a. In the event the Contractor fails to commence and diligently pursue any construction warranty work required, the Contracting Officer will have the work performed by others, and after completion of the work, will charge the remaining construction warranty funds for expenses incurred by the Government while performing the work, including, but not limited to, administrative expenses.

b. In the event sufficient funds are not available to cover the construction warranty work performed by the Government at the Contractor's expense, the Contracting Officer will have the right to recoup expenses from the bonding company.

c. Following oral or written notification of required construction warranty repair work, the Contractor shall respond in a timely manner. Written verification will follow oral instructions. Failure of the Contractor to respond will be cause for the Contracting Officer to proceed against the Contractor.

1.4.3 Pre-Warranty Conference

Prior to contract completion, and at a time designated by the Contracting Officer, the Contractor shall meet with the Contracting Officer to develop a mutual understanding with respect to the requirements of this section. Communication procedures for Contractor notification of construction warranty defects, priorities with respect to the type of defect, reasonable time required for Contractor response, and other details deemed necessary by the Contracting Officer for the execution of the construction warranty shall be established/reviewed at this meeting. In connection with these requirements and at the time of the Contractor's quality control completion inspection, the Contractor shall furnish the name, telephone number and address of a licensed and bonded company which is authorized to initiate

and pursue construction warranty work action on behalf of the Contractor. This point of contact will be located within the local service area of the warranted construction, shall be continuously available, and shall be responsive to Government inquiry on warranty work action and status. This requirement does not relieve the Contractor of any of its responsibilities in connection with other portions of this provision.

1.4.4 Contractor's Response to Construction Warranty Service Requirements

Following oral or written notification by the Contracting Officer, the Contractor shall respond to construction warranty service requirements in accordance with the "Construction Warranty Service Priority List" and the three categories of priorities listed below. The Contractor shall submit a report on any warranty item that has been repaired during the warranty period. The report shall include the cause of the problem, date reported, corrective action taken, and when the repair was completed. If the Contractor does not perform the construction warranty within the time frames specified, the Government will perform the work and backcharge the construction warranty payment item established.

a. First Priority Code 1. Perform onsite inspection to evaluate situation, and determine course of action within 4 hours, initiate work within 6 hours and work continuously to completion or relief.

b. Second Priority Code 2. Perform onsite inspection to evaluate situation, and determine course of action within 8 hours, initiate work within 24 hours and work continuously to completion or relief.

c. Third Priority Code 3. All other work to be initiated within 3 work days and work continuously to completion or relief.

d. The "Construction Warranty Service Priority List" is as follows:

Code 1-Air Conditioning Systems
(1) Air conditioning leak in part of building, if causing damage.
(2) Air conditioning system not cooling properly.

Code 1-Bulk Fuel Tanks
(1) Fuel tanks
(2) Control systems
(3) Valving
(4) Piping

Code 1-Fuel Pump House
(1) Fuel pumps
(2) Control systems
(3) Valving
(4) Piping

Code 1-Doors
(1) Overhead doors not operational, causing a security, fire, or safety problem.
(2) Interior, exterior personnel doors or hardware, not functioning properly, causing a security, fire, or safety problem.

Code 3-Doors
(1) Overhead doors not operational.
(2) Interior/exterior personnel doors or hardware not functioning properly.

Code 1-Electrical
(1) Power failure (entire area or any building operational after 1600 hours).
(2) Security lights
(3) Smoke detectors

Code 2-Electrical
(1) Power failure (no power to a room or part of building).
(2) Receptacle and lights (in a room or part of building).

Code 3-Electrical
(1) Street lights.

Code 1-Gas
(1) Leaks and breaks.
(2) No gas to family housing unit or cantonment area.

Code 1-Heat
(1) Area power failure affecting heat.
(2) Heater in unit not working.

Code 1-Plumbing
(1) Hot water heater failure.
(2) Leaking water supply pipes.

Code 2-Plumbing
(1) Flush valves not operating properly.
(2) Fixture drain, supply line to commode, or any water pipe leaking.
(3) Commode leaking at base.

Code 3-Plumbing
(1) Leaky faucets.

Code 3-Interior
(1) Floors damaged.
(2) Paint chipping or peeling.
(3) Casework.

Code 1-Roof Leaks
(1) Temporary repairs will be made where major damage to property is occurring.

Code 2-Roof Leaks
(1) Where major damage to property is not occurring, check for location of leak during rain and complete repairs on a Code 2 basis.

Code 2-Water (Exterior)
(1) No water to facility.

Code 2-Water (Hot)
(1) No hot water in portion of building listed.

Code 3-All other work not listed above.

1.4.5 Warranty Tags

At the time of installation, each warranted item shall be tagged with a durable, oil and water resistant tag approved by the Contracting Officer. Each tag shall be attached with a copper wire and shall be sprayed with a silicone waterproof coating. The date of acceptance and the QC signature shall remain blank until project is accepted for beneficial occupancy. The tag shall show the following information.

a. Type of product/material_____.

b. Model number_____.

c. Serial number_____.

d. Contract number_____.

e. Warranty period_____from_____to_____.

f. Inspector's signature_____.

g. Construction Contractor_____.

Address_____.

Telephone number_____.

h. Warranty contact_____.

Address_____.

Telephone number_____.

i. Warranty response time priority code_____.

j. WARNING - PROJECT PERSONNEL TO PERFORM ONLY OPERATIONAL MAINTENANCE DURING THE WARRANTY PERIOD.

1.5 MECHANICAL TESTING, ADJUSTING, BALANCING, AND COMMISSIONING

Prior to final inspection and transfer of the completed facility, all reports, statements, certificates, and completed checklists for testing, adjusting, balancing, and commissioning of mechanical systems shall be submitted to and approved by the Contracting Officer as specified in applicable technical specification sections.

1.6 OPERATION AND MAINTENANCE MANUALS

Operation manuals and maintenance manuals shall be submitted as specified. Operation manuals and maintenance manuals provided in a common volume shall be clearly differentiated and shall be separately indexed.

1.7 FINAL CLEANING

The premises shall be left broom clean. Stains, foreign substances, and temporary labels shall be removed from surfaces. Carpet and soft surfaces shall be vacuumed. Equipment and fixtures shall be cleaned to a sanitary condition. Filters of operating equipment shall be cleaned. Debris shall be removed from roofs, drainage systems, gutters, and downspouts. Paved

areas shall be swept and landscaped areas shall be raked clean. The site shall have waste, surplus materials, and rubbish removed. The project area shall have temporary structures, barricades, project signs, and construction facilities removed. A list of completed clean-up items shall be submitted on the day of final inspection.

1.8 WATER AND SEWER SYSTEMS

The Contractor shall have As-Built engineering plans for water and sewer systems approved and signed by a professional engineer registered in the State of Alaska, in accordance with current 18 AAC 80 and 18 AAC 72, respectively, such that the Alaska Department of Environmental Conservation will issue the required "Certificate to Operate".

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

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SECTION 01781

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PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

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SECTION 01781

OPERATION AND MAINTENANCE DATA

PART 1 GENERAL

1.1 SUBMISSION OF OPERATION AND MAINTENANCE DATA

Submit Operation and Maintenance (O&M) Data specifically applicable to this contract and a complete and concise depiction of the provided equipment, product, or system. Organize and present information in sufficient detail to clearly explain O&M requirements at the system, equipment, component, and subassembly level. Include an index preceding each submittal. Submit in accordance with this section and SECTION 01330, "Submittal Procedures."

1.1.1 Package Quality

Documents must be fully legible. Poor quality copies and material with hole punches obliterating the text or drawings will not be accepted.

1.1.2 Package Content

Data package content shall be as shown in the paragraph titled "Schedule of Operation and Maintenance Data Packages." Comply with the data package requirements specified in the individual technical sections, including the content of the packages and addressing each product, component, and system designated for data package submission.

1.1.3 Changes to Submittals

Manufacturer-originated changes or revisions to submitted data shall be furnished by the Contractor if a component of an item is so affected subsequent to acceptance of the O&M Data. Changes, additions, or revisions required by the Contracting Officer for final acceptance of submitted data, shall be submitted by the Contractor within 30 calendar days of the notification of this change requirement.

1.2 TYPES OF INFORMATION REQUIRED IN O&M DATA PACKAGES

1.2.1 Operating Instructions

Include specific instructions, procedures, and illustrations for the following phases of operation:

1.2.1.1 Safety Precautions

List personnel hazards and equipment or product safety precautions for all operating conditions.

1.2.1.2 Operator Prestart

Include procedures required to set up and prepare each system for use.

1.2.1.3 Startup, Shutdown, and Post-Shutdown Procedures

Provide narrative description for Startup, Shutdown and Post-shutdown operating procedures including the control sequence for each procedure.

1.2.1.4 Normal Operations

Provide narrative description of Normal Operating Procedures. Include Control Diagrams with data to explain operation and control of systems and specific equipment.

1.2.1.5 Emergency Operations

Include Emergency Procedures for equipment malfunctions to permit a short period of continued operation or to shut down the equipment to prevent further damage to systems and equipment. Include Emergency Shutdown Instructions for fire, explosion, spills, or other foreseeable contingencies. Provide guidance and procedures for emergency operation of all utility systems including required valve positions, valve locations and zones or portions of systems controlled.

1.2.1.6 Operator Service Requirements

Include instructions for services to be performed by the operator such as lubrication, adjustment, inspection, and recording gage readings.

1.2.1.7 Environmental Conditions

Include a list of Environmental Conditions (temperature, humidity, and other relevant data) that are best suited for the operation of each product, component or system. Describe conditions under which the item equipment should not be allowed to run.

1.2.2 Preventive Maintenance

Include the following information for preventive and scheduled maintenance to minimize corrective maintenance and repair.

1.2.2.1 Lubrication Data

Include preventative maintenance lubrication data, in addition to instructions for lubrication provided under paragraph titled "Operator Service Requirements":

a. A table showing recommended lubricants for specific temperature ranges and applications.

b. Charts with a schematic diagram of the equipment showing lubrication points, recommended types and grades of lubricants, and capacities.

c. A Lubrication Schedule showing service interval frequency.

1.2.2.2 Preventive Maintenance Plan and Schedule

Include manufacturer's schedule for routine preventive maintenance, inspections, tests and adjustments required to ensure proper and economical operation and to minimize corrective maintenance. Provide manufacturer's projection of preventive maintenance work-hours on a daily, weekly,

monthly, and annual basis including craft requirements by type of craft. For periodic calibrations, provide manufacturer's specified frequency and procedures for each separate operation.

1.2.3 Corrective Maintenance (Repair)

Include manufacturer's recommended procedures and instructions for correcting problems and making repairs.

1.2.3.1 Troubleshooting Guides and Diagnostic Techniques

Include step-by-step procedures to promptly isolate the cause of typical malfunctions. Describe clearly why the checkout is performed and what conditions are to be sought. Identify tests or inspections and test equipment required to determine whether parts and equipment may be reused or require replacement.

1.2.3.2 Wiring Diagrams and Control Diagrams

Wiring diagrams and control diagrams shall be point-to-point drawings of wiring and control circuits including factory-field interfaces. Provide a complete and accurate depiction of the actual job specific wiring and control work. On diagrams, number electrical and electronic wiring and pneumatic control tubing and the terminals for each type, identically to actual installation configuration and numbering.

1.2.3.3 Maintenance and Repair Procedures

Include instructions and a list of tools required to repair or restore the product or equipment to proper condition or operating standards.

1.2.3.4 Removal and Replacement Instructions

Include step-by-step procedures and a list required tools and supplies for removal, replacement, disassembly, and assembly of components, assemblies, subassemblies, accessories, and attachments. Provide tolerances, dimensions, settings and adjustments required. Instructions shall include a combination of text and illustrations.

1.2.3.5 Spare Parts and Supply Lists

Include lists of spare parts and supplies required for maintenance and repair to ensure continued service or operation without unreasonable delays. Special consideration is required for facilities at remote locations. List spare parts and supplies that have a long lead-time to obtain.

1.2.4 Corrective Maintenance Work-Hours

Include manufacturer's projection of corrective maintenance work-hours including requirements by type of craft. Corrective maintenance that requires completion or participation of the equipment manufacturer shall be identified and tabulated separately.

1.2.5 Appendices

Provide information required below and information not specified in the preceding paragraphs but pertinent to the maintenance or operation of the product or equipment. Include the following:

1.2.6 Parts Identification

Provide identification and coverage for all parts of each component, assembly, subassembly, and accessory of the end items subject to replacement. Include special hardware requirements, such as requirement to use high-strength bolts and nuts. Identify parts by make, model, serial number, and source of supply to allow reordering without further identification. Provide clear and legible illustrations, drawings, and exploded views to enable easy identification of the items. When illustrations omit the part numbers and description, both the illustrations and separate listing shall show the index, reference, or key number that will cross-reference the illustrated part to the listed part. Parts shown in the listings shall be grouped by components, assemblies, and subassemblies in accordance with the manufacturer's standard practice. Parts data may cover more than one model or series of equipment, components, assemblies, subassemblies, attachments, or accessories, such as typically shown in a master parts catalog

1.2.6.1 Warranty Information

List and explain the various warranties and include the servicing and technical precautions prescribed by the manufacturers or contract documents in order to keep warranties in force. Include warranty information for primary components such as the compressor of air conditioning system.

1.2.6.2 Personnel Training Requirements

Provide information available from the manufacturers that is needed for use in training designated personnel to properly operate and maintain the equipment and systems.

1.2.6.3 Testing Equipment and Special Tool Information

Include information on test equipment required to perform specified tests and on special tools needed for the operation, maintenance, and repair of components.

1.2.6.4 Contractor Information

Provide a list that includes the name, address, and telephone number of the General Contractor and each Subcontractor who installed the product or equipment, or system. For each item, also provide the name address and telephone number of the manufacturer's representative and service organization most convenient to the project site. Provide the name, address, and telephone number of the product, equipment, and system manufacturers.

1.3 SCHEDULE OF OPERATION AND MAINTENANCE DATA PACKAGES

Furnish the O&M data packages specified in individual technical sections. The required information for each O&M data package is as follows:

1.3.1 Data Package 1

a. Safety precautions

b. Maintenance and repair procedures

c. Warranty information

d. Contractor information

e. Spare parts and supply list

1.3.2 Data Package 2

a. Safety precautions

b. Normal operations

c. Environmental conditions

d. Lubrication data

e. Preventive maintenance plan and schedule

f. Maintenance and repair procedures

g. Removal and replacement instructions

h. Spare parts and supply list

i. Parts identification

j. Warranty information

k. Contractor information

1.3.3 Data Package 3

a. Safety precautions

b. Normal operations

c. Emergency operations

d. Environmental conditions

e. Lubrication data

f. Preventive maintenance plan and schedule

g. Troubleshooting guides and diagnostic techniques

h. Wiring diagrams and control diagrams

i. Maintenance and repair procedures

j. Removal and replacement instructions

k. Spare parts and supply list

l. Parts identification

m. Warranty information

n. Testing equipment and special tool information

o. Contractor information

1.3.4 Data Package 4

a. Safety precautions

b. Operator prestart

c. Startup, shutdown, and post-shutdown procedures

d. Normal operations

e. Emergency operations

f. Operator service requirements

g. Environmental conditions

h. Lubrication data

i. Preventive maintenance plan and schedule

j. Troubleshooting guides and diagnostic techniques

k. Wiring diagrams and control diagrams

l. Maintenance and repair procedures

m. Removal and replacement instructions

n. Spare parts and supply list

o. Corrective maintenance man-hours

p. Parts identification

q. Warranty information

r. Personnel training requirements

s. Testing equipment and special tool information

t. Contractor information

1.3.5 Data Package 5

a. Safety precautions

b. Operator prestart

c. Start-up, shutdown, and post-shutdown procedures

d. Normal operations

e. Environmental conditions

f. Preventive maintenance plan and schedule

g. Troubleshooting guides and diagnostic techniques

h. Wiring and control diagrams

i. Maintenance and repair procedures

j. Spare parts and supply list

k. Testing equipments and special tools

l. Warranty information

m. Contractor information

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

-- End of Section --

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DIVISION 02 - SITE CONSTRUCTION

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SECTION 02111

EXCAVATION AND HANDLING OF CONTAMINATED MATERIAL

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

STATE OF ALASKA ADMINISTRATIVE CODE (AAC)

18 AAC 75	Oil and Other Hazardous Substances Pollution Control

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 5434	(1997) Standard Guide for Field Logging of Subsurface Explorations of Soil and Rock

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

40 CFR 302	Designation, Reportable Quantities, and Notification
29 CFR 1926	Safety and Health Regulations for Construction

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2003) U.S. Army Corps of Engineers Safety and Health Requirements Manual

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with SECTION 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Surveys; G, RE.

Separate cross-sections of each area before and after excavation and after backfilling.

SD-03 Product Data

Excavation and Handling Work Plan; G, RE & EN-ES-M.

Work Plan within 30 calendar days after notice to proceed. No

work at the site, with the exception of site inspections and surveys, shall be performed until the Work Plan is approved. The Contractor shall allow 30 calendar days in the schedule for the Government's review. No adjustment for time or money will be made if resubmittals of the Work Plan are required due to deficiencies in the plan. At a minimum, the Work Plan shall include:

a. Schedule of activities.

b. Method of excavation and equipment to be used.

c. Shoring or side-wall slopes proposed.

d. Dewatering plan.

e. Storage methods and locations for liquid and solid contaminated material.

f. Borrow sources and haul routes.

g. Decontamination procedures.

h. Spill contingency plan.

Closure Report; G, RE & EN-ES-M.

3 copies of the Closure Report within 14 calendar days of work completion at the site.

SD-06 Test Reports

Backfill; G, RE & EN-ES-M.

Surveys; G, RE & EN-ES-M.

Confirmation Sampling and Analysis; G, RE & EN-ES-M.

Sampling of Stored Material; G, RE & EN-ES-M.

Sampling Liquid; G, RE & EN-ES-M

Compaction; G, RE & EN-ES-M

Test results.

1.3 SURVEYS

Surveys shall be performed immediately prior to and after excavation of contaminated material to determine the volume of contaminated material removed and not reused. The Contractor shall provide cross-sections on 25 foot intervals and at break points for all excavated areas. Locations of confirmation samples shall also be surveyed and shown on the drawings.

1.4 REGULATORY REQUIREMENTS

1.4.1 Permits and Licenses

The Contractor shall obtain required federal, state, and local permits for excavation and storage of contaminated material. Permits shall be obtained

at no additional cost to the Government.

1.4.2 Air Emissions

Air emissions shall be monitored and controlled in accordance with SECTION 01355.

1.5 DESCRIPTION OF WORK

The work shall consist of the field screening of all excavated soil and stockpiling of approximately 300 cubic yards of POL contaminated material that can not be used as backfill. Contaminated material that is excavated from known source areas, meets the physical requirements of the project and does not contain free product may be used as backfill if it is placed within the same approximate location and depth from which it was excavated. The boundaries of known source areas are shown on drawings in the attached Chemical Data Reports and are also available from CEPOA-EN-ES-M (907)753-2682.

1.6 CHEMICAL TESTING

Required sampling and chemical analysis shall be conducted in accordance with SECTION 01450 CHEMICAL DATA QUALITY CONTROL.

1.7 SCHEDULING

The Contractor shall notify the Contracting Officer 30 calendar days prior to the start of excavation. The Contractor shall be responsible for contacting regulatory agencies in accordance with the applicable reporting requirements.

PART 2 PRODUCTS

2.1 BACKFILL

Additional backfill material shall be obtained from sources approved by the Contracting Officer. A Level I Site assessment shall be conducted at each source to verify that the material is not contaminated.

2.2 SPILL RESPONSE MATERIALS

The Contractor shall provide appropriate spill response materials including, but not limited to the following: containers, adsorbents, shovels, and personal protective equipment. Spill response materials shall be available at all times when contaminated materials/wastes are being handled or transported. Spill response materials shall be compatible with the type of materials and contaminants being handled.

PART 3 EXECUTION

3.1 EXISTING STRUCTURES AND UTILITIES

No excavation shall be performed until site utilities have been field located. The Contractor shall take the necessary precautions to ensure no damage occurs to existing structures and utilities. Damage to existing structures and utilities resulting from the Contractor's operations shall be repaired at no additional cost to the Government. Utilities encountered that were not previously shown or otherwise located shall not be disturbed without approval from the Contracting Officer.

3.2 CLEARING

Clearing shall be performed to the limits shown on the drawings in accordance with SECTION 02230 CLEARING AND GRUBBING.

3.3 CONTAMINATED MATERIAL REMOVAL

3.3.1 Excavation

Areas of contamination shall be excavated to the depth and extent not to exceed the minimum requirements identified on the project drawings unless directed by the Contracting Officer. Excavation shall be performed in a manner that will limit spills and the potential for contaminated material to be mixed with uncontaminated material. An excavation log describing visible signs of contamination encountered shall be maintained for each area of excavation. Excavation logs shall be prepared in accordance with ASTM D 5434.

3.3.2 Shoring

If workers must enter the excavation, it shall be evaluated, shored, sloped or braced as required by EM 385-1-1 and 29 CFR 1926 SECTION 650.

3.3.3 Dewatering

Surface water shall be diverted to prevent entry into the excavation. No dewatering shall be performed without prior approval of the Contracting Officer.

3.4 CONFIRMATION SAMPLING AND ANALYSIS

The Contracting Officer may inspect the removal of contaminated material from each site. After material suspected of being contaminated has been removed from excavations located outside of known source areas, the excavation shall be examined for evidence of contamination. If the excavation appears to be free of contamination, field analysis shall be used to determine the presence of fuel contamination using a real time vapor monitoring instrument. Excavation of additional material is not anticipated and shall only be performed as directed by the Contracting Officer.

When contamination is encountered and suspected contaminated material is removed, samples to document remaining contamination within the excavation shall be collected and analyzed for the following contaminants using the analytical methods provided below:

Gasoline Range Organics	(AK101)
Diesel Range Organics	(AK102)
Residual Range Organics	(AK103)
Benzene	(EPA Method 8021)
Toluene	(EPA Method 8021)
Ethylbenzene	(EPA Method 8021)
Xylenes	(EPA Method 8021)
Polynuclear aromatic hydrocarbons	(EPA Method 8270)

Samples from excavations located outside known source areas shall be collected at the frequency and locations indicated by the application of the Alaska Department of Environmental Conservation's Underground Storage

Tank Procedures Manual or as directed by the Contracting Officer. Locations of samples shall be marked in the field and documented on the as-built drawings. No samples shall be collected from bottoms or sidewalls of excavations within known source areas.

3.5 CONTAMINATED MATERIAL STORAGE

Material shall be placed in temporary storage immediately after excavation. A written log shall be kept to track the source of contaminated material in each stockpile.

3.5.1 Stockpiles

Stockpiles shall be constructed to isolate stored contaminated material from the environment. Stockpiles shall be constructed in accordance with the requirements of 18 AAC 75 at locations directed by the Contracting Officer. Stockpile locations will be within one mile of a particular excavation.

3.6 SAMPLING

3.6.1 Sampling of Stored Material

Samples of stored material suspected to be contaminated shall be collected at the frequency and locations indicated by the application of the Alaska Department of Environmental Conservation's Underground Storage Tank Procedures Manual. Analytical results shall be compared to the Cleanup Levels from the migration to groundwater column of Tables B1 and B2 of 18 AAC 75.

3.7 SPILLS

In the event of a spill or release of a hazardous substance (as designated in 40 CFR 302), pollutant, contaminant, or oil (as governed by the Oil Pollution Act (OPA), 33 U.S.C. 2701 et seq.), the Contractor shall notify the Contracting Officer and the Air Force immediately. Spills shall be reported to the Air Force by calling 377-7745 during normal working hours and by notifying the Eielson AFB Fire Department outside normal working hours. Immediate containment actions shall be taken to minimize the effect of any spill or leak. Cleanup shall be in accordance with applicable federal, state, and local regulations. As directed by the Contracting Officer, additional sampling and testing shall be performed to verify spills have been cleaned up. Spill cleanup and testing shall be done at no additional cost to the Government.

3.8 CLOSURE REPORT

Five copies of a Closure Report shall be prepared and submitted within 14 calender days of completing work at the site. The report shall be labeled with the contract number, project name, location, date, name of general contractor, and the Corps of Engineers District contracting for the work. The Closure Report shall include the following information as a minimum:

a. A cover letter signed by a responsible company official who is certifying that all services involved have been performed in accordance with the terms and conditions of the contract documents and regulatory requirements.

b. A narrative report including, but not limited to, the following:

(1. site conditions, ground water elevation, and cleanup criteria;

2. excavation logs;

3. field screening readings;

4. quantity of materials removed from each area of contamination;

5. quantity of water/product removed during dewatering;

6. sampling locations and sampling methods;

7. sample collection data such as time of collection and method of preservation;

8. sample chain-of-custody forms; and

9. source of backfill.

c. Copies of all chemical and physical test results.

d. Copies of all manifests and land disposal restriction notifications.

e. Copies of all certifications of final disposal signed by the responsible disposal facility official.

f. Waste profile sheets.

g. Scale drawings showing limits of each excavation, limits of contamination, known underground utilities within 50 feet of excavation, sample locations, and sample identification numbers. On-site stockpile, storage, treatment, loading, and disposal areas shall also be shown on the drawings.

h. Progress Photographs. Color photographs shall be used to document progress of the work. A minimum of four views of the site showing the location of the area of contamination, entrance/exit road, and any other notable site conditions shall be taken before work begins. After work has been started, activities at each work location shall be photographically recorded weekly. Photographs shall be a minimum of 3 x 5 inches and shall include:

1. Soil removal and sampling.

2. Dewatering operations.

3. Unanticipated events such as spills and the discovery of additional contaminated material.

4. Contaminated material/water storage, handling, treatment, and transport.

5. Site or task-specific employee respiratory and personal protection.

6. Fill placement, grading, and compaction.

7. Post-construction photographs. After completion of work at each site, the Contractor shall take a minimum of four views of each excavation site.

A digital version of the report, chemical data in Electronic Data Format (EDF) version 1.2a and all photos shown in the report shall be included with the Closure Report. Photographs shall be a minimum of 3 inches by 5 inches and shall be mounted back-to-back in double face plastic sleeves punched to fit standard three ring binders. Each print shall have an information box attached. The box shall be typewritten and arranged as follows:

Project Name:	Direction of View:
Location:	Date/Time:
Photograph No.:	Description of View:

3.9 ATTACHMENTS

Chemical Data Reports

United States Army
Corps of Engineers

Alaska District
PO Box 898
Anchorage, AK
99506-0898

Chemical Data Report

EIE164 Hydrant Fueling System Upgrade, Eielson Air Force Base, Alaska

Prepared by
Engineering Services Branch
Materials Section

March 2003

Executive Summary

This chemical data report was prepared by the U.S. Army Corps of Engineers Alaska District Engineering Services Branch, Materials Section (CEPOA-EN-ES-M), at the request of the Alaska District Project Management Division Military Branch (CEPOA-PM-M). The primary purpose of this sampling event was to evaluate potential contamination in subsurface soils at the site under consideration for the proposed Hydrant Fueling System upgrade on Eielson AFB, Alaska.

Soil samples were collected by CEPOA-EN-ES-M personnel and analyzed for gasoline range organics (GRO), benzene, toluene, ethylbenzene, and total xylenes (BTEX), diesel range organics (DRO), residual range organics (RRO), and total lead, at the request of CEPOA-PM-M. Within the proposed project footprint, no analyte was reported above the applicable State of Alaska 18 AAC 75 regulatory limits. Historical fuel contamination has been identified to the north and east of the proposed project footprint. Contamination is the result of refueling activities at the E9 Fuel Pumphouse.

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1 Introduction

This chemical data report was prepared by the U.S. Army Corps of Engineers Alaska District Engineering Services Branch, Materials Section (CEPOA-EN-ES-M), at the request of the Alaska District Project Management Division Military Branch (CEPOA-PM-M). The primary purpose of this sampling event was to evaluate potential contamination in subsurface soils at the site under consideration for the proposed Hydrant Fueling System upgrade on Eielson AFB, Alaska.

2 Objective

The purpose of the investigation was to characterize soils in the proposed construction area in order to facilitate planning for the disposal of potential contaminated soils excavated during construction. The obtained data is intended to be used to estimate the amount, nature, and approximate extent of contamination present in soil that is expected to be disturbed during construction. Groundwater was not sampled, and this investigation was not intended to be a comprehensive environmental assessment of the site.

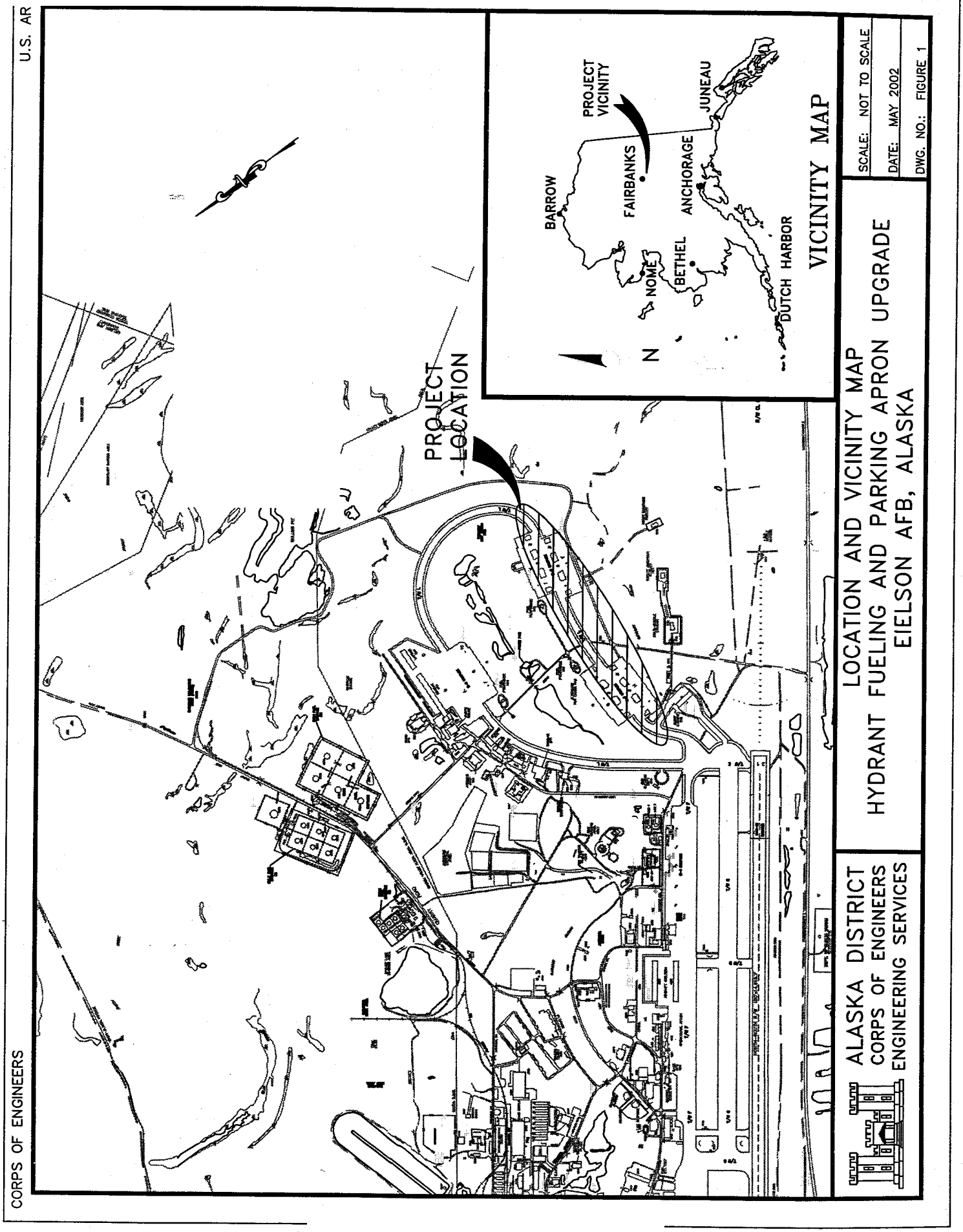
3 Site Background

3.1 Location and Project Background

The project site is on Eielson Air Force Base (AFB). Eielson AFB covers approximately 19,700 acres. It is located along the Richardson Highway within the Fairbanks North Star Borough, approximately 24 miles southeast of Fairbanks and 10 miles southeast of the city of North Pole, Alaska (Figure 1). Approximately 3,650 acres are improved or partially improved with the remaining land encompassing forest, wetlands, lakes, and ponds. Residential and occupational populations are primarily concentrated in the developed portion of the Base. Since its establishment in 1944, the mission of Eielson AFB has been to train and equip personnel for close air support of ground troops in an arctic environment.

3.2 Site Characteristics

Eielson AFB is in the broad, essentially level flood plain of the Tanana River. The site is on a higher, older portion of the flood plain removed from the active stream channels and normally is not subject to flooding. The floodplain consists of deposits of silt, sand and gravel to depths of over 100 meters overlaying bedrock. Groundwater generally is encountered a few meters below the ground surface (bgs) within the flood plain area. Groundwater was encountered between 2 and 2.5 meters bgs during field activities in September 2000. Discontinuous permafrost is present throughout the region.


U.S. AR
CORPS OF ENGINEERS
PROJECT LOCATION
PROJECT VICINITY
BARROW
FAIRBANKS
ANCHORAGE
JUNEAU
NOME
BETHEL
DUTCH HARBOR
N
VICINITY MAP
SCALE: NOT TO SCALE
DATE: MAY 2002
DWG. NO.: FIGURE 1
LOCATION AND VICINITY MAP
HYDRANT FUELING AND PARKING APRON UPGRADE
EIELSON AFB, ALASKA
ALASKA DISTRICT
CORPS OF ENGINEERS
ENGINEERING SERVICES

3.3 Site History and Known Contamination

In carrying out its defense mission, the soils and groundwater at the base have been contaminated from the storage and handling of fuels and solvents plus the operation of landfills. Initially, this contamination was evaluated under the U.S. Air Force Installation Restoration Program (IRP). The four-phase IRP was initiated in 1982 with a Phase I records search to identify past disposal sites containing contaminants that may pose a hazard to human health or the environment. Under the IRP, the U.S. Air Force identified potential areas of contamination at Eielson AFB. Potential source areas included old landfills, storage and disposal areas, fueling system leaks, and spill areas.

The EPA listed Eielson AFB on the National Priorities List (NPL) in 1989. In May 1991, the U.S. Air Force, the State of Alaska, and the EPA entered into the Federal Facility Agreement (FFA), under CERCLA. Following the FFA, the U.S. Air Force began its Superfund clean-up program.

As with many Superfund sites, the problems at Eielson AFB were complex. Thus, the FFA divided the potential source areas at Eielson AFB into six Operable Units (OUs). OU1 refers to the eight sources that have caused petroleum contamination at the base. The eight source areas with petroleum contamination designated under OU1 were: ST20 E-7, E-8, and E-9 Complexes (Refueling Loop); ST48 Power Plant; ST49 Alert Hanger; SS50 Blair Lakes Vehicle Maintenance; SS51 Blair Lakes Ditch; SS52 Blair Lakes Diesel Spill; SS53 Blair Lakes Fuel Spill; and DP54 Blair Lakes Drum Disposal Site. OU1 addresses sites contaminated by leaks and spills of fuels. Soils contaminated with petroleum products occur at or near the source of contamination. Contaminated subsurface soil and groundwater occurs in plumes on the top of a shallow groundwater table that fluctuates seasonally. Most of the contamination is in subsurface soils and the shallow groundwater. Much of the groundwater contamination is believed to migrate from the smear zone because of fluctuations in the groundwater table, rather than infiltration from precipitation. The OU1 source area directly affecting the proposed fuel hydrant/parking apron upgrade is ST-20 (Figure 2). Contaminants of concern at ST-20 are fuel constituent petroleum hydrocarbons, including benzene, toluene, ethylbenzene, and xylenes (BTEX).

Eielson AFB Liquid Fuels Department records indicate three spills at the E-9 Refueling Loop. Leak 1 was detected August 1988 and repaired June 1989. The leak was extensive; the amount of fuel lost is unknown. After the leak was repaired, a leak test was conducted on the piping. During this test, contractors noticed fuel farther out on the tarmac seeping up through cracks (Leak 2). The age of this leak is unknown. This leak was repaired in June 1989. The third leak was discovered near the refueling building in June 1992 and repaired in July 1992. It occurred in the line to the defueling tank. The amount leaked is unknown.

Soil Contamination at the E-9 Complex (EPA Superfund Record of Decision, 1994)

TPH and BTEX were detected in subsurface soils within a 60-m radius of the pump house. The highest concentrations of TPH and volatile constituents of fuel detected in subsurface soil samples (1.5 to 2.0 m) in 1988 were located at well 20M01. A number of subsurface soil samples were collected in 1989, in the vicinity of the pump house and the floating product

plume. The TPH concentrations detected were above the 100 mg/kg Alaskan cleanup level. The extent of subsurface soil contamination east of well 20M07 (south and east of the pump house) has not been defined and is likely related to the floating product associated with releases from underground pipelines. In addition to the petroleum-related contamination, vinyl chloride was detected in the soil at borehole 20M01. This may be an anomalous detection. Vinyl chloride was detected in only one of 16 soil samples, and no identified source for the vinyl chloride exists. The complex will continue to be monitored for vinyl chloride to determine if this result is representative.

Groundwater Contamination at the E-9 Complex

The source of BTEX and naphthalenes in groundwater is thought to be associated with floating product. The highest concentrations of BTEX and naphthalenes were measured in 1989. The concentrations of these contaminants were substantially lower in 1993. The benzene plume in 1989 extended up to 180 m downgradient of the E-9 pump house. The area of highest benzene concentration was near well 20M07 where floating product has been found. Also in 1989, low concentrations of BTEX were detected downgradient of well 20M23. In 1993, concentrations and extent of the plume were substantially smaller. Benzene concentrations in well 20M07)near the floating product)has decreased from 440 mg/L in 1989 to 98.4 mg/L in 1993. Also, the benzene concentrations in wells 20M22, 20M23, and 20M24)wells downgradient of the E-9 pump house)have fallen below the MCL of 5 mg/L. The only increase in concentration was in well 20M08 (from 98.4 to 440 mg/L). In general, the benzene plume and concentrations in groundwater do not appear to be moving between 1989 and 1993 and in general are decreasing. The benzene in the groundwater is concentrated around the pump house, and an order of magnitude drop in concentration occurs on the other side of the runway (between wells 20M08 and 20M23).

Floating Fuel at the E-9 Complex

The fluctuating water table and variable soil lithologies result in continuous changes in apparent product thickness. Multiple leaks in underground fueling and defueling lines and ongoing remediation efforts also affect the vertical and horizontal distribution of floating product. Thus, the data show no clear trends in measured product thickness. For instance, at product probe 20PP72 measurements taken 9 days apart in August 1992 varied by as much as 5.8 cm. One measurement of note during the 1993 sampling was product probe 20PP119 in which 98.15 cm of product were measured. This probe is adjacent to one of the underground fuel storage tanks. The source of the floating product at the E-9 Complex is believed to be subsurface leaks from JP-4 fuel pipelines and tanks. The known extent of the floating product is near the pump house at the edge of the runway. Because of the site access restrictions along the runway, however, the floating product may extend out under the tarmac. Jet fuel seeping from the tarmac during pipe integrity testing, the high concentrations of BTEX detected in recent soil gas surveys on the tarmac, and the shape of the benzene isoconcentration lines suggest at least one source emanating from the tarmac.

4 Field Activities

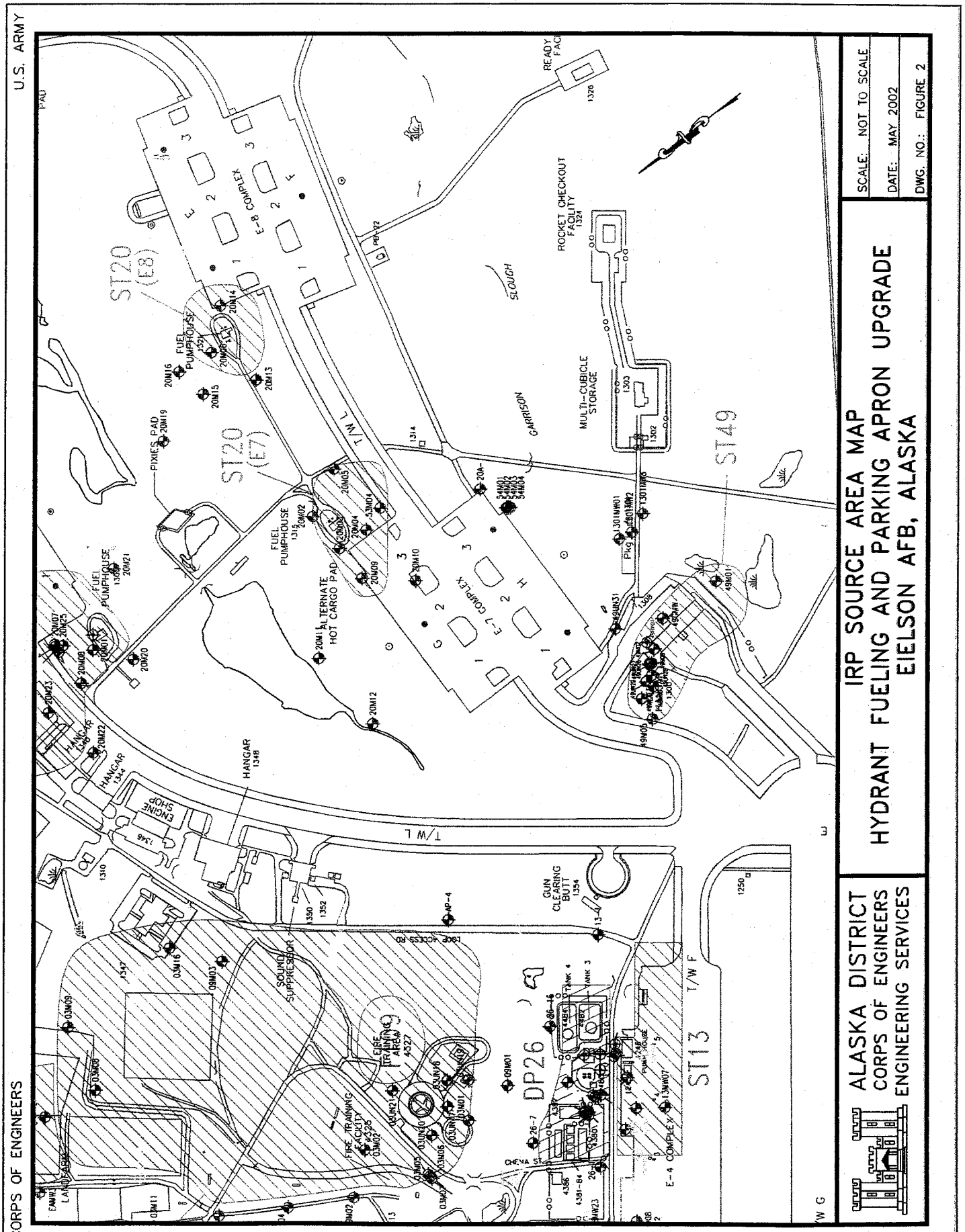
The subsurface exploration for the currently proposed project site was conducted 12-14/May/2002 and 6-8/June/2002. All work was conducted under the Sampling and Analysis Plan and the Site-Specific Health & Safety Plan for the Hydrant Fueling and Parking Apron Upgrades. These plans were finalized in May 2002 by EN-ES-M and are on file. Twenty test borings were drilled, two to a depth of 50 feet bgs, seven to 25 feet bgs, and eleven to 15 feet bgs. The test borings were drilled using a track mounted CME 850 drill rig fitted with continuous flight, 8-inch (in.) diameter hollow stem augers. The Corps of Engineers, Alaska District's drill crew, performed the drilling. An Alaska District geotechnical engineer (CEPOA-EN-ES-SG) collected samples to determine physical and engineering properties, and the results are presented separately in a geotechnical recommendations report. Doug Deters and Gerald Archibald (CEPOA-EN-ES-M chemists) conducted screening and sampling for chemical contaminants, using the methods described below. Chemist's field notes are provided in Appendix A.

Test borings AP-5277 through AP-5296 (Figure 3) were drilled during this project. Soil samples for geotechnical analysis were collected near the surface and at approximately 5-foot intervals until borehole completion or refusal. Surface samples were collected directly from the sidewalls of the borings and subsurface soil samples were collected from the split spoon, driven approximately 18-inches ahead of the auger with a 340 pound sliding hammer. Upon retrieval from the boring, a preliminary photoionization detector (PID) reading was taken from the end of the split spoon and recorded in the field log. Although there were no elevated PID readings or other indications of contamination, selected samples were collected to confirm the absence of fuel range organics and also to determine concentrations of lead. When analytical samples were collected, the split spoon was opened and the soil samples were rapidly collected with a clean stainless steel spoon and were placed in appropriate containers provided by the laboratory. Samples to be analyzed for volatile analytes were collected before samples to be analyzed for non- or semi-volatile analytes. A new pair of nitrile gloves and a new spoon were used for each sample. A final PID reading was obtained on soil collected from the split spoon and placed into a small plastic Ziploc bag that was allowed to warm on the dash of a vehicle for a minimum of 15 minutes (heated headspace method). If the split spoon retrieved from the borehole was saturated with groundwater, a heated headspace PID reading was not obtained due to the interference caused by water vapors. Groundwater was encountered at approximately 5-7 feet bgs. Observations made during sampling, such as, time, weather, and odor or sheen, were also recorded in the field log.

At the discretion of the sampler, submitted samples were tested for benzene, toluene, ethylbenzene and xylenes (BTEX), gasoline range organics (GRO), diesel range organics (DRO), residual range organics (RRO), and lead. Labeled sample containers were wrapped in paper towels (for cushioning and absorbency), sealed in individual Ziploc bags (to prevent cross-contamination), and packed in a cooler with ice-packs and enough vermiculite to fill any voids in the cooler. A Chain-of-Custody (COC) form and a temperature blank were included in each cooler. Coolers were taped shut with strapping tape in two places and two custody seals were placed on the coolers. Samples (including blind duplicates and field blanks) were shipped to STL Seattle. Samples delivered to the lab were analyzed by the following methods:

BTEX by EPA Method 8021B
GRO by State of Alaska Method AK101
DRO by State of Alaska Method AK102
RRO by State of Alaska Method AK103
Lead by EPA Method 6010B

Because no field evidence of contamination was observed, no Investigative-Derived Waste (IDW) disposal was necessary. Drill cuttings were backfilled into the auger holes and remains were spread out over the surrounding soils. Due to the current use of the facility for jet-aircraft operations, care was taken to remove cuttings and other debris from the pavement.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ST20 (E8)
ST20 (E7)
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ST13
DP26
E-8 COMPLEX
E-7 COMPLEX
E-4 COMPLEX
FUEL PUMPHOUSE
PIXIES PAD
ALTERNATE HOT CARGO PAD
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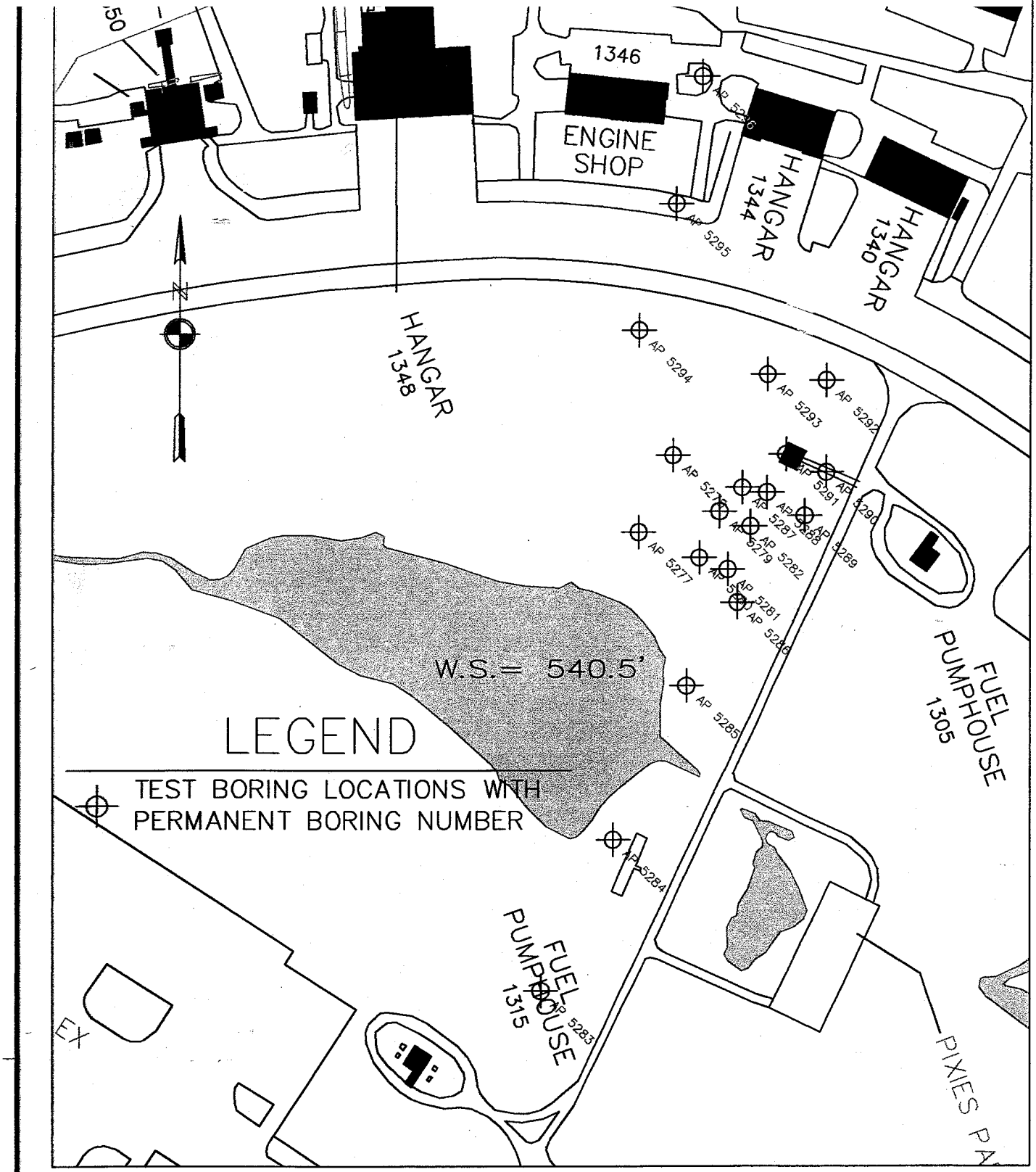
HANGAR 1344
ENGINE SHOP
SOUND SUPPRESSOR
FIRE TRAINING AREA
FIRE TRAINING FACILITY
GUN CLEARING BUTTT
ROCKET CHECKOUT FACILITY
MULTI-CUBICLE STORAGE
READY FAC
SLOUGH
GARRISON
T/W L
T/W F
LOOP ACCESS RD
CHEVA ST
SCALE: NOT TO SCALE
DATE: MAY 2002
DWG. NO.: FIGURE 2
IRP SOURCE AREA MAP
HYDRANT FUELING AND PARKING APRON UPGRADE
EIELSON AFB, ALASKA
ALASKA DISTRICT
CORPS OF ENGINEERS
ENGINEERING SERVICES



ALASKA DISTRICT
CORPS OF ENGINEERS
SOILS AND GEOLOGY

TEST BORING LOCATION MAP
CONSTRUCT TYPE III HYDRANT FUELING SYSTEM (EIE 164)
EIELSON AIR FORCE BASE, ALASKA

SCALE: 1" = 250'
DATE: 18 SEPT 2002
DRAWN/RVW: MDP/CRW
FIGURE 3

5 Analytical Results

5.1 Chemical Results

Complete data packages are on file at the Alaska District U.S. Army Corps of Engineers. The analytical methods used for this project were selected based upon the nature of the contaminants known to exist in the area, and on the expected regulatory requirements. This report identifies results that exceed the most conservative ADEC 18 AAC 75 cleanup levels. A data summary table is provided in Appendix C. Soil sample results for GRO and DRO are compared to 18 AAC 75 Method One, Category A, Soil Cleanup Levels. Soil sample results analyzed for BTEX and lead were compared to 18 AAC 75 Method Two Soil Cleanup Levels (Migration to Groundwater in the Under 40 Inch Zone). Table 1, below, summarizes the Cleanup Level (CL) that was used for each analyte and the regulation that was used to derive that value.

TABLE 1: APPLICABLE CLEANUP LEVELS

Contaminant of Concern	18 AAC 75 Soil Cleanup Levels
GRO	50 mg/kg
DRO	100 mg/kg
RRO	2000 mg/kg
Benzene	0.020 mg/kg
Toluene	5.4 mg/kg
Ethylbenzene	5.5 mg/kg
Total Xylenes	78 mg/kg
Lead	400 mg/kg

5.1.1 BTEX

Benzene results did not exceed the most stringent 18 AAC 75 regulatory limit of 0.020 mg/kg in any of the four samples submitted for analysis. The Practical Quantitation Limit (PQL) for benzene in sample 02EHFS04SL was 0.035 mg/kg; however, the Method Detection Limit (MDL) for benzene in this sample was 0.007 mg/kg. No detection was reported above the MDL in any sample for any of the BTEX compounds. Complete data tables are provided in Appendix C.

5.1.2 GRO, DRO, RRO

No GRO, DRO, or RRO results were reported in excess of the regulatory limits given above. GRO results were below MDL as well as the regulatory limits for all four samples. Of the three samples analyzed for DRO, minor detections were reported above the PQL in samples 02EHFS01SL and –04SL. Sample 02EHFS04SL was also reported to have a RRO detection above the PQL; however, this result was qualified as "not typical product" by the analyst.

5.1.3 Lead

Low levels of lead were reported in all three samples analyzed for this metal. All three results were approximately 2 orders of magnitude below the regulatory limit of 400 mg/kg.

5.2 Data Quality Review

Surrogate recovery in the BTEX analysis for sample 02EHFS04SL was low, due to a high moisture percentage in the sample. While the accuracy of these results was biased slightly low, only the resultant benzene PQL exceeded the regulatory limit. No other data qualifications were noted in a review of the laboratory report. For all other analyses, quality control results were within established limits.

6 Conclusion

No analyte was reported above 18AAC75 regulatory limits for any of the four samples submitted for analysis. With minor qualifications, all data reported is usable for the project purpose of estimating the amount, nature, and approximate extent of contamination present in soil that is expected to be disturbed during construction.

7 References

18 AAC 75. Oil and Hazardous Substances Pollution Control Regulations, effective October 1, 1999.

Eielson Air Force Base, Operable Unit 1 EPA Superfund Record of Decision, 1994.

U.S. Army Corps of Engineers. November 2000. Geotechnical Findings Report for the Joint Mobility Complex, Eielson AFB, Alaska. Prepared by CEPOA-EN-ES-SG.

Appendix A

Chemist Field Sampling Log

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Hydrant Fueling System
Doug Deters - Project Chemist
May 10 -

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PAGE	REFERENCE	DATE

Project Crew:
Doug Peters - Chemist
Rob Weakland - Engineer
Bill Tester - Driller
Ron Ngiriliad - Driller Asst.

Samples Collected will be tested for:

BTEX by 8021B
GRO by AK101
DRO by AK 102
RRO by AK 103
Lead by 6010B or 6020

HP1 (50') 12 May 2002

1080 Onsite 50°F Mostly Sunny

Background PID: 0.4

Time	Depth	Hole/Open	PID Cold	PID Warm	Sample #	Notes
1150	1'	0.4	0.5	0.4		
1202	5'	0.5	0.8	0.6		Bottom ½ saturated, No fuel odor, PID same as Background.
1216	10'	0.4	NT - GW @ 3.8' Bgs			
1226	15'	0.5	—			
1246	20'	0.4	—			Lots-o-heave
1339	25'	NT	PID not working - Dis-assembled			wiring harness - re-assembled + works better
1431	27-30'	used split spoon to grab				heave out of augers before drilling next sample.
1447	30'	0.2	— No signs of contamination.			
1514	40'	0.4	- No signs of contam.			
1553	50'	0.3	- No signs of contam.			

In any of the drill cuttings.

Backfilled cuttings and spread out the remaining drill cuttings.

Installed Pizometer

1730 Offsite

12 May 2002 HP1 (50')

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GRO by AK101
DRO by AK 102
RRO by AK 103
Lead by 6010B or 6020

HP1 (50') 12 May 2002
1080 Onsite 50°F Mostly Sunny
Background PID: 0.4

Time	Depth	Hole/Open	PID Cold	PID Warm	Sample #	Notes
1150	1'	0.4	0.5	0.4		
1202	5'	0.5	0.8	0.6		Bottom ½ saturated, No fuel odor, PID same as Background.
1216	10'	0.4	NT - GW @ 3.8' Bgs			
1226	15'	0.5	—			
1246	20'	0.4	—			Lots-o-heave
1339	25'	NT	PID not working - Dis-assembled			wiring harness - re-assembled + works better
1431	27-30'	used split spoon to grab				heave out of augers before drilling next sample.
1447	30'	0.2	— No signs of contamination.			
1514	40'	0.4	- No signs of contam.			
1553	50'	0.3	- No signs of contam.			

In any of the drill cuttings.
Backfilled cuttings and spread out the remaining drill cuttings.
Installed Pizometer
1730 Offsite

12 May 2002 HP1 (50')

4

HP2 13 May 2002

1000 Pickup flightline pass & Base Ops

1230 Onsite 55° Sunny, S. wind 5-10 mph

Calibrate PID - background : 0.5

Time	Depth:	spoon/hole	PID cold	PID warm
1423	1'	0.5	0.3	
1434	5'	0.4	Sample Saturated - DNS - No signs of contamination.	
1441	10'	0.5	NT - Sample wet	
1509	15'	0.4	—	
	20	0.5	—	
	25	0.5	—	
	30	0.4	—	
	40	0.4	—	
	50	0.4	—	

No signs of contamination in any soil cuttings.

5

13 May 2002 HP2

Sample Number	Notes
DNS	No signs of contamination
—	No signs of contamination.

Rob took remaining PID readings while I went & picked up Laptop.

1600 offsite

4

HP2 13 May 2002

1000 Pickup flightline pass & Base Ops

1230 Onsite 55° Sunny, S. wind 5-10 mph

Calibrate PID - background : 0.5

Time	Depth:	spoon/hole	PID cold	PID warm
1423	1'	0.5	0.3	
1434	5'	0.4	Sample Saturated - DNS - No signs of contamination.	
1441	10'	0.5	NT - Sample wet	
1509	15'	0.4	—	
	20	0.5	—	
	25	0.5	—	
	30	0.4	—	
	40	0.4	—	
	50	0.4	—	

No signs of contamination in any soil cuttings.

5

13 May 2002 HP2

Sample Number	Notes
DNS	No signs of contamination
—	No signs of contamination.

Rob took remaining PID readings while I went & picked up Laptop.

1600 offsite

HP-3 (25') 14 May 2002

0930 Onsite 50° Sunny

Calibrate PID - Background: 0.2

Time	Depth	Spoon/hole	PID Cold	PID Warm	Sample#	Notes
1019	1'	0.5	0.4	0.3	DNS	No signs of contamination
1031	5'	0.4	0.3	0.4	DNS	3/4 of sample wet - No signs of cont.
1040	10'	0.4	NT - Sample		Saturated - No signs of contamination	
1109	15'	0.3	"	"		"
1128	20'	0.2	"	"		"
1150	25'	0.4	No signs of			

contamination in any of the drill Cuttings. Installed pizometer in hole + backfilled + grouted.

1225 Offsite

14 May 2002 HP3 (25')

8

HP4 (25') 14 May 2002
1227 Onsite, sunny 58°
Background PID: 0.4

Time	Depth	space/hole	PID cold	PID warm
1303	1'	0.4	0.3	0.4
	5'		NT - Saturated	
	10'			
	15'			
	20'			
	25'			

1315 Went to Hecktor's Welding and dropped off water jacket for repair. Rob obtained remaining PID readings (After 1' sample)

offsite

9

14 May 2002 HP4 (25')

Sample #	Notes
DNS	- ~~Sample~~ auger flight wet at about 2' bgs, NO signs of Cont.
"	
"	
"	
"	
"	

HP5 (25') 14 May 2002
1445 Onsite 60° Sunny
Background PID: 0.2

Time	Depth	spoon/hole	PID cold	PID warm
1445	1'	0.2	0.3	0.5
1454	5'	0.3	0.1	0.5
1506	10'	0.2	NT - Saturated	
1516	15'	0.3		
1533	20'	0.4		
1542	25'	0.3		

No signs of contamination in any of the cuttings. Used as backfill.

1605 Offsite

14 May 2002 HP-5 (25')

Sample #	Notes
DNS	- No signs of contamination
DNS	- No sign of contam. Bottom ½ of spoon saturated

HP6 (25') 14 May 2002

1608 Onsite 60° Sunny

Background PID: 0.2

Time	Depth	Spoon	PID Cold	Warm
1614	1'	0.4	0.4	
1621	5'	0.2	NT -	
1637	10'	0.3	"	NT Saturated
1647	15'	0.3		
1659	20'	0.3		
1708	25'	0.2		

No signs of contamination in any of the drill cuttings. Backfill borehole.

Offsite

14 May 2002 HP6 (25')

Sample #	Notes
DNS	- No signs of contamination
Sample Saturated	- No signs of contam. DNS
DNS	No signs of contamination
	"
	"
	"

Onsite

6 June 07
on site 1515
Clear 70°F
Background 0.3
HP-7

Time	depth	PID	Cold	Hot	Sample
1520	1'	—	0.4	0.4	NS
1530	4.5-6.5	0.4	0.3	0.4	NS
1535	9.5-11.5	0.4	0.3	0.2	NS

HP-8
on site 1600
Background 0.3
Clear 70°F

Time	depth	PID	Cold	Hot	Sample
1606	1'	—	0.4	0.2	NS
1616	4.5-6.5	0.4	0.7	1.1	NS
1620	9.5-11.5	0.4	no recovery		NS
1630	14.5-16.5	0.2	0.1	0.1	

7 June 02
on site 1030
HP-9
Clear 65°F
Background 0.2

Time	depth	PID	Cold	Hot	Sample
1045	1'	—	0.3	0.4	NS
1050	4.5-6.5	0.4	0.3	0.3	NS
1055	9.5-11.5	0.3	0.4	0.4	NS

on site 1115
HP-10
Clear 70°F
Background 0.4

Time	depth	PID	Cold	Hot	Sample		
1120	1'	—	0.4	1.1		1	7
1140	4.5-6.5	0.5	0.3	0.4		2	7
1145	9.5-11.5	0.2	0.3	0.2		3	6
						4	4

18

HP. 11
On site 1225
Sunny 70°F
Background 0.2

Time	depth	PID	Cold	Hot	Sample
1235	1'	—	0.3	0.3	NS
1240	4.5-6.5	0.2	0.6	0.3	NS
1245	9.5-11.5	0.3	0.3	0.3	NS
1255	14.5-16.5	0.3	0.3	0.3	NS

HP. 12
onsite 1320
Sunny 70°F
Background 0.2

Time	depth	PID	Cold	Hot	Sample
1325	1'	—	0.3	0.3	NS
1410	4.5-6.5	0.3	0.4	0.3	-2
1425	9.5-11.5	0.3	0.3	0.4	NS
1440	14.5-16.5	0.4	0.3	0.4	NS

19

HP 13
on site 1520
Background 0.3
Clear 70°F

Time	depth	PID	Cold	Hot	Sample
1525	1'	—	0.3	0.4	
1530	4.5-6.5	0.3	0.3	0.3	
1535	9.5-11.5	0.2	0.3	0.3	
1540	14.5-16.5	0.4	1.2	0.4	
1555	19.5-21.5	0.4	0.4	0.2	
1615	24.5-26.5	0.3	0.2	0.2	

HP-14
on site 1650
Background 0.1
Cloudy 65°F

Time	depth	PID	Cold	Hot
1655	1'	—	0.2	0.2
1700	4.5-6.5	0.2	0.2	0.2
1705	9.5-11.5	0.2	0.2	0.2
1710	14.5-16.5	0.2	0.3	0.2
1725	19.5-21.5	0.2	No	recovery
1735	24.5-26.5	0.3	0.1	0.3

8 June 02
HP-15
on site 1005
Cloudy 60°F
Background 0.3

Time	depth	PID	Cold	Hot	Sample
1010	1'	–	0.4	0.4	NS
1020	5-7	0.3	0.4	0.3	↓
1030	10-12	0.3	0.3	0.4	
1045	15-17	0.3	0.3	0.3	
1135	25-27	0.2	0.2	0.3	NS

HP-16
on site 1216
Cloudy 60°F
Background 0.2

Time	depth	PID	Cold	Hot
1220	1'	–	0.3	0.3
1225	5-7	0.2	0.3	0.4
1230	10-12	0.3	0.4	0.4

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GRO by AK101
DRO by AK 102
RRO by AK 103
Lead by 6010B or 6020

HP1 (50') 12 May 2002
1080 Onsite 50°F Mostly Sunny
Background PID: 0.4

Time	Depth	Hole/Open	PID Cold	PID Warm	Sample #	Notes
1150	1'	0.4	0.5	0.4		
1202	5'	0.5	0.8	0.6		Bottom ½ saturated, No fuel odor, PID same as Background.
1216	10'	0.4	NT - GW @ 3.8' Bgs			
1226	15'	0.5	—			
1246	20'	0.4	—			Lots-o-heave
1339	25'	NT	PID not working - Dis-assembled			wiring harness - re-assembled + works better
1431	27-30'	used split spoon to grab				heave out of augers before drilling next sample.
1447	30'	0.2	— No signs of contamination.			
1514	40'	0.4	- No signs of contam.			
1553	50'	0.3	- No signs of contam.			

In any of the drill cuttings.
Backfilled cuttings and spread out the remaining drill cuttings.
Installed Pizometer
1730 Offsite

12 May 2002 HP1 (50')

4

HP2 13 May 2002

1000 Pickup flightline pass & Base Ops

1230 Onsite 55° Sunny, S. wind 5-10 mph

Calibrate PID - background : 0.5

Time	Depth:	spoon/hole	PID cold	PID warm	Sample Number	Notes
1423	1'	0.5	0.3		DNS	No signs of contamination
1434	5'	0.4	Sample Saturated - DNS - No signs of contamination.			
1441	10'	0.5	NT - Sample wet			
1509	15'	0.4	—		—	No signs of contamination.
	20	0.5	—			Rob took remaining PID readings
	25	0.5	—			while I went & picked up Laptop.
	30	0.4	—			
	40	0.4	—			
	50	0.4	—			

No signs of contamination in any soil cuttings.

5

13 May 2002 HP2

1600 offsite

HP-3 (25') 14 May 2002

0930 Onsite 50° Sunny

Calibrate PID - Background: 0.2

Time	Depth	Spoon/hole	PID Cold	PID Warm
1019	1'	0.5	0.4	0.3
1031	5'	0.4	0.3	0.4
1040	10'	0.4	NT - Sample	
1109	15'	0.3	"	"
1128	20'	0.2	"	"
1150	25'	0.4	No signs of	

14 May 2002 HP3 (25')

Sample#	Notes
DNS	No signs of contamination
DNS	3/4 of sample wet - No signs of cont.
Saturated - No signs of contamination	
	"
	"

contamination in any of the drill cuttings. Installed pizometer in hole + backfilled + grouted.

1225 Offsite

8

HP4 (25') 14 May 2002
1227 Onsite, sunny 58°
Background PID: 0.4

Time	Depth	space/hole	PID cold	PID warm
1303	1'	0.4	0.3	0.4
	5'		NT - Saturated	
	10'			
	15'			
	20'			
	25'			

1315 Went to Hecktor's Welding and dropped off water jacket for repair. Rob obtained remaining PID readings (After 1' sample)

offsite

9

14 May 2002 HP4 (25')

Sample #	Notes
DNS	- ~~Sample~~ auger flight wet at about 2' bgs, NO signs of Cont.
"	
"	
"	
"	
"	

HP5 (25') 14 May 2002
1445 Onsite 60° Sunny
Background PID: 0.2

Time	Depth	spoon/hole	PID cold	PID warm
1445	1'	0.2	0.3	0.5
1454	5'	0.3	0.1	0.5
1506	10'	0.2	NT - Saturated	
1516	15'	0.3		
1533	20'	0.4		
1542	25'	0.3		

No signs of contamination in any of the cuttings. Used as backfill.

1605 Offsite

14 May 2002 HP-5 (25')

Sample #	Notes
DNS	- No signs of contamination
DNS	- No sign of contam. Bottom ½ of spoon saturated

HP6 (25') 14 May 2002

1608 Onsite 60° Sunny

Background PID: 0.2

Time	Depth	Spoon	PID Cold	Warm
1614	1'	0.4	0.4	
1621	5'	0.2	NT -	
1637	10'	0.3	"	NT Saturated
1647	15'	0.3		
1659	20'	0.3		
1708	25'	0.2		

No signs of contamination in any of the drill cuttings. Backfill borehole.

Offsite

14 May 2002 HP6 (25')

Sample #	Notes
DNS	- No signs of contamination
Sample Saturated	- No signs of contam. DNS
DNS	No signs of contamination
	"
	"
	"

6 June 07
on site 1515
Clear 70°F
Background 0.3
HP-7

Time	depth	PID	Cold	Hot	Sample
1520	1'	—	0.4	0.4	NS
1530	4.5-6.5	0.4	0.3	0.4	NS
1535	9.5-11.5	0.4	0.3	0.2	NS

HP-8
on site 1600
Background 0.3
Clear 70°F

Time	depth	PID	Cold	Hot	Sample
1606	1'	—	0.4	0.2	NS
1616	4.5-6.5	0.4	0.7	1.1	NS
1620	9.5-11.5	0.4	no recovery		NS
1630	14.5-16.5	0.2	0.1	0.1	

7 June 02
on site 1030
HP-9
Clear 65°F
Background 0.2

Time	depth	PID	Cold	Hot	Sample
1045	1'	—	0.3	0.4	NS
1050	4.5-6.5	0.4	0.3	0.3	NS
1055	9.5-11.5	0.3	0.4	0.4	NS

on site 1115
HP-10
Clear 70°F
Background 0.4

Time	depth	PID	Cold	Hot	Sample		
1120	1'	—	0.4	1.1		1	7
1140	4.5-6.5	0.5	0.3	0.4		2	7
1145	9.5-11.5	0.2	0.3	0.2		3	6
						4	4

18

HP. 11
On site 1225
Sunny 70°F
Background 0.2

Time	depth	PID	Cold	Hot	Sample
1235	1'	—	0.3	0.3	NS
1240	4.5-6.5	0.2	0.6	0.3	NS
1245	9.5-11.5	0.3	0.3	0.3	NS
1255	14.5-16.5	0.3	0.3	0.3	NS

HP. 12
onsite 1320
Sunny 70°F
Background 0.2

Time	depth	PID	Cold	Hot	Sample
1325	1'	—	0.3	0.3	NS
1410	4.5-6.5	0.3	0.4	0.3	-2
1425	9.5-11.5	0.3	0.3	0.4	NS
1440	14.5-16.5	0.4	0.3	0.4	NS

19

HP 13
on site 1520
Background 0.3
Clear 70°F

Time	depth	PID	Cold	Hot	Sample
1525	1'	<	0.3	0.4	
1530	4.5-6.5	0.3	0.3	0.3	
1535	9.5-11.5	0.2	0.3	0.3	
1540	14.5-16.5	0.4	1.2	0.4	
1555	19.5-21.5	0.4	0.4	0.2	
1615	24.5-26.5	0.3	0.2	0.2	

HP-14
on site 1650
Background 0.1
Cloudy 65°F

Time	depth	PID	Cold	Hot
1655	1'	—	0.2	0.2
1700	4.5-6.5	0.2	0.2	0.2
1705	9.5-11.5	0.2	0.2	0.2
1710	14.5-16.5	0.2	0.3	0.2
1725	19.5-21.5	0.2	No	recovery
1735	24.5-26.5	0.3	0.1	0.3

8 June 02
HP-15
on site 1005
Cloudy 60°F
Background 0.3

Time	depth	PID	Cold	Hot	Sample
1010	1'	–	0.4	0.4	NS
1020	5-7	0.3	0.4	0.3	↓
1030	10-12	0.3	0.3	0.4	
1045	15-17	0.3	0.3	0.3	
1135	25-27	0.2	0.2	0.3	NS

HP-16
on site 1216
Cloudy 60°F
Background 0.2

Time	depth	PID	Cold	Hot
1220	1'	–	0.3	0.3
1225	5-7	0.2	0.3	0.4
1230	10-12	0.3	0.4	0.4

on site 1240
HIP 17
Cloudy 68°F
Background 0.3

Time	depth	PID	Coll	Hot	Sample
1242	1'	~~0.3~~	0.3	0.3	NS
1245	5-7	0.3	0.3	0.3	~~0~~ YSC
1255	10-12	0.3	0.3	0.3	NS

On site 1315
HIP 18
Cloudy 60°F
Background 0.3

Time	depth	PID	Coll	Hot	Sample
1316	1'	–	0.4	0.5	NS
1325	5-7	0.3	0.3	0.5	
1330	10-12	0.4	0.3	0.5	
1335	15-17	0.5	0.4	0.4	NS

on site 1500
HP 19
Cloudy 60°F
Background 0.3

Time	depth	PID	Cold	Hot	Sample
1515	1'	—	0.3	0.5	NS
1520	5-7	0.3	0.3	0.5	NS
1525	10-12	0.3	0.3	0.4	NS

HP-20
on site 1705
cloudy 60°F
Background 0.3

Time	depth	PID	Cold	Hot	Sample
1715	1'	—	0.3	0.4	NS
1720	5-7	0.3	0.3	0.4	NS
1725	10-12	0.3	0.3	0.4	NS
1735	15-17	0.3	0.3	0.3	NS

Appendix B

Soils and Geology Section

Soil Boring Logs

CORPS OF ENGINEERS
ENGINEERING SERVICES

Soils and Geology Section
EXPLORATION LOG

Eielson AFB, Alaska	Date: 12 May 2002
Drilling Agency: ☐ Alaska District ☒ Other USACE	Elevation Datum: ☒ MSL ☐ other
Location: Northing: 3,893,030 ft Easting: 1,473,946 ft	Top of Hole Elevation: 548.4 ft
Hole Number, Field: HB-1 Permanent: AP-5277	Operator: William Tester
Inspector: Robert Weakland	
Type of Hole: ☐ other ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer	Depth to Groundwater: 3.7 ft WD
Depth Drilled: 49.5 ft	Total Depth: 51.5 ft
Hammer Weight: 340 lbs	Split Spoon I.D: 2.5 in
Size and Type of Bit: 4.3 in Drag bit	Type of Equipment: CME 850 with autohammer
Type of Samples: Grab and Drive	

Depth (ft)	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	%Gravel	%Sand	%Fines	Max Size (in)	PID (ppm)	% Water	Description and Remarks
2	1		PFS	Grab	GP	Poorly graded GRAVEL with Sand	63	33	4	2.0	0.4	3	Brown, moist, subrounded to rounded gravel, medium to coarse sand, NP fines
4–6	2		PFS	26 11 5 3	GP	Poorly graded GRAVEL with Sand and Cobbles	66	29	5	>3.0	0.6		Brown, moist to wet, angular to rounded gravel, medium to coarse sand, NP fines, fractured cobbles
10	3		NFS	5 4 4 4	GP	Poorly graded GRAVEL with Sand	66	33	1	2.5			Brown, wet, subrounded to rounded gravel, fine to coarse sand, nonplastic (NP) fines
16	4		NFS	5 5 4 7	GP	Poorly graded GRAVEL with Sand	77	21	2	2.0			Brown, wet, subrounded to rounded gravel, fine to coarse sand, NP fines
20	5			12 14 15 12	GP	Poorly graded GRAVEL with Sand				2.0			Brown, wet, rounded gravel, fine to coarse sand, NP fines
24													4 ft. of heaving sand
26	6		NFS	7 4 6 6	GW	Well-graded GRAVEL with Sand	75	24	1	2.5			Gray, wet, subrounded to rounded gravel, medium to coarse sand
28													3 ft. of heaving sand
30–32	7			5 12 8 7	GW	Well-graded GRAVEL with Sand and Cobbles				>3.0			Gray, wet, angular to subrounded gravel, medium to coarse sand, drive fractured cobbles

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Project: Type III Hydrant Fueling System, FY04 (EIE164)

Hole Number: AP-5277

EXPLORATION LOG EIE164.GPJ ACE_ANC.GDT 12/31/02

ALASKA DISTRICT
CORPS OF ENGINEERS
ENGINEERING SERVICES

Soils and Geology Section

EXPLORATION LOG

Project: *Type III Hydrant Fueling System, FY04 (EIE164)*
Eielson AFB, Alaska

Page 2 of 2
Date: *12 May 2002*

Drilling Agency: ☐ Alaska District ☒ Other *USACE*

Elevation Datum: ☒ MSL ☐ other

Location: Northing: *3,893,030 ft* Easting: *1,473,946 ft*

Top of Hole Elevation: *548.4 ft*

Hole Number, Field: *HB-1* Permanent: *AP-5277*

Operator: *William Tester*

Inspector: *Robert Weakland*

Type of Hole: ☐ other ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: *3.7 ft WD*

Depth Drilled: *49.5 ft*

Total Depth: *51.5 ft*

Hammer Weight: *340 lbs*

Split Spoon I.D.: *2.5 in*

Size and Type of Bit: *4.3 in Drag bit*

Type of Equipment: *CME 850 with autohammer*

Type of Samples: *Grab and Drive*

Depth (ft)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	Grain Size %Gravel	%Sand	%Fines	Max Size (in)	PID (ppm)	% Water	Description and Remarks
34, 36, 38, 40, 42, 44		8			16 16 12 12	GW	**Well-graded GRAVEL with Sand and Cobbles**				>3.0			**7 ft. of heaving sand** **Gray, wet, subrounded to rounded gravel, medium to coarse sand, drive fractured cobbles**
46, 48, 50		9			16 22 20 24	GW-GM	**Well-graded GRAVEL with Silt and Sand**							**Gray, moist to wet, subrounded to rounded gravel, medium sand**
52, 54, 56, 58, 60, 62, 64, 66														**Bottom of Hole 51.5 ft** **Elevation 496.9 ft** **Groundwater Encountered While Drilling: at depth 3.7 ft** **PID = (Hot) Photo Ionization Detector**

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Project: *Type III Hydrant Fueling System, FY04 (EIE164)*

Hole Number: *AP-5277*

EXPLORATION LOG EIE164.GPJ ACE_ANC.GDT 12/31/02

ALASKA DISTRICT
CORPS OF ENGINEERS
ENGINEERING SERVICES

Soils and Geology Section

EXPLORATION LOG

Project: *Type III Hydrant Fueling System, FY04 (EIE164)*
Eielson AFB, Alaska

Page 1 of 2

Date: *13 May 2002*

Drilling Agency: ☐ Alaska District ☒ Other *USACE*

Elevation Datum: ☒ MSL ☐ other

Location: Northing: *3,893,168 ft* Easting: *1,474,007 ft*

Top of Hole Elevation: *548.9 ft*

Hole Number, Field: *HB-2* Permanent: *AP-5278*

Operator: *William Tester*

Inspector: *Robert Weakland*

Type of Hole: ☐ other ☐ Test Pit ☐ Auger Hole ☐ Monitoring Well ☒ Piezometer

Depth to Groundwater: *4.3 ft WD*

Depth Drilled: *49.5 ft*

Total Depth: *51.5 ft*

Hammer Weight: *340 lbs*

Split Spoon I.D: *2.5 in*

Size and Type of Bit: *4.3 in Drag bit*

Type of Equipment: *CME 850 with autohammer*

Type of Samples: *Grab and Drive*

Depth (ft)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	%Gravel	%Sand	%Fines	Max Size (in)	PID (ppm)	% Water	Description and Remarks
		1		S2	Grab	SP-SM	Poorly graded SAND with Silt					0.3		Brown to gray, moist, fine to medium sand, nonplastic (NP) fines
2														
4														
		2		S2	4 6 4 3	SP-SM	Poorly graded SAND with Silt and Gravel				2.0	0.4		Brown to gray, moist to wet, subrounded to rounded gravel, fine to medium sand, nonplastic (NP) fines
6														
8														
10		3		NFS	3 2 1 1	GP	Poorly graded GRAVEL with Sand	66	32	2	2.5			Brown to gray, wet, subrounded to rounded gravel, fine to medium sand
12														
														8 ft. of heaving sand
14														
		4		NFS	4 3 2 2	GP	Poorly graded GRAVEL with Sand				1.0			Bown, wet, rounded gravel, medium to coarse sand
16														
18														
20		5		NFS	4 3 6 9	GP	Poorly graded GRAVEL with Sand	58	40	2	2.5			Brown, wet, subrounded to rounded gravel, medium to coarse sand
22														
24														
26		6			8 44 47 22						>3.0	0.5		Shoe plugged with fractured cobble
28														
30		7			20 19 13 12	GW	Well-graded GRAVEL with Sand and Cobbles				>3.0	0.4		Gray, wet, subrounded gravel, fine to coarse sand
32														

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Project: *Type III Hydrant Fueling System, FY04 (EIE164)*

Hole Number: *AP-5278*

ALASKA DISTRICT
CORPS OF ENGINEERS
ENGINEERING SERVICES

Soils and Geology Section

EXPLORATION LOG

Project: *Type III Hydrant Fueling System, FY04 (EIE164)*
Eielson AFB, Alaska

Page 2 of 2

Date: *13 May 2002*

Drilling Agency: ☐ Alaska District ☒ Other *USACE*

Elevation Datum: ☒ MSL ☐ other

Location: Northing: *3,893,168 ft* Easting: *1,474,007 ft*

Top of Hole Elevation: *548.9 ft*

Hole Number, Field: *HB-2* Permanent: *AP-5278*

Operator: *William Tester*

Inspector: *Robert Weakland*

Type of Hole: ☐ other ☐ Test Pit ☐ Auger Hole ☐ Monitoring Well ☒ Piezometer

Depth to Groundwater: *4.3 ft WD*

Depth Drilled: *49.5 ft*

Total Depth: *51.5 ft*

Hammer Weight: *340 lbs*

Split Spoon I.D: *2.5 in*

Size and Type of Bit: *4.3 in Drag bit*

Type of Equipment: *CME 850 with autohammer*

Type of Samples: *Grab and Drive*

Depth (ft)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	Grain Size %Gravel	%Sand	%Fines	Max Size (in)	PID (ppm)	% Water	Description and Remarks
34														
36														
38														
40		8			18 36 18 12	GW-GM	**Well-graded GRAVEL with Silt and Sand**				2.0	0.4		**Gray, wet, subangular to subrounded gravel, fine to coarse sand, NP fines**
42														
44														
46														
48														**2 ft. of heaving sand**
50		9			9 12 15 15	GW-GM	**Well-graded GRAVEL with Silt and Sand**					0.4		**Gray, wet, subangular to subrounded gravel, fine to coarse sand, NP fines**
52														**Bottom of Hole 51.5 ft Elevation 497.4 ft Groundwater Encountered While Drilling: at depth 4.3 ft PID = (Hot) Photo Ionization Detector**
54														
56														
58														
60														
62														
64														
66														

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Project: *Type III Hydrant Fueling System, FY04 (EIE164)*

Hole Number: *AP-5278*

EXPLORATION LOG EIE164.GPJ ACE_ANC.GDT 12/31/02

ALASKA DISTRICT
CORPS OF ENGINEERS
ENGINEERING SERVICES

Soils and Geology Section
EXPLORATION LOG

Project: *Type III Hydrant Fueling System, FY04 (EIE164)*
Eielson AFB, Alaska

Page 1 of 1
Date: *14 May 2002*

Drilling Agency: ☐ Alaska District ☒ Other *USACE*

Elevation Datum: ☒ MSL ☐ other

Location: Northing: *3,893,067 ft* Easting: *1,474,091 ft*

Top of Hole Elevation: *549.0 ft*

Hole Number, Field: *HB-3* Permanent: *AP-5279*

Operator: *William Tester*

Inspector: *Robert Weakland*

Type of Hole: ☐ other ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: *3.3 ft WD*

Depth Drilled: *24.5 ft*

Total Depth: *26.5 ft*

Hammer Weight: *340 lbs*

Split Spoon I.D: *2.5 in*

Size and Type of Bit: *4.3 in Drag bit*

Type of Equipment: *CME 850 with autohammer*

Type of Samples: *Grab and Drive*

Depth (ft)	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	%Gravel	%Sand	%Fines	Max Size (in)	PID (ppm)	% Water	Description and Remarks
2	1		F2	Grab	SM	Silty SAND with Gravel				2.0	0.3		Brown, moist, subrounded gravel, fine to medium sand, nonplastic (NP) fines
4–6	2		PFS	52 42 26 8	GW	Well-graded GRAVEL with Sand	57	38	5	2.0	0.4		Brown, wet, subrounded to rounded gravel, fine to coarse sand, NP fines
8													7 ft. of heaving sand
10–12	3		NFS	7 5 4 4	GW	Well-graded GRAVEL with Sand	63	34	3	1.3			Brown to gray, wet, subrounded to rounded gravel, fine to coarse sand, NP fines
14													2 ft. of heaving sand
16	4		NFS	7 4 6 6	GP	Poorly graded GRAVEL with Sand	50	47	3	1.5			Gray, wet, subrounded to rounded gravel, fine to coarse sand, NP fines
18													3 ft. of heaving sand
20–22	5			5 8 5 4	SP-SM	Poorly graded SAND with Silt and Gravel				1.5			Gray, wet, subrounded to rounded gravel, fine to coarse sand, NP fines
24–26	6			11 9 11 11	GW-GM	Well-graded GRAVEL with Silt, Sand, and Cobbles				>3.0			Gray, wet, subrounded to rounded gravel, fine to coarse sand, NP fines
28–32													Bottom of Hole 26.5 ft Elevation 522.5 ft Groundwater Encountered While Drilling: at depth 3.3 ft PID = (Hot) Photo Ionization Detector

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Project: *Type III Hydrant Fueling System, FY04 (EIE164)*

Hole Number: *AP-5279*

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EXPLORATION LOG

Project: *Type III Hydrant Fueling System, FY04 (EIE164)*
Eielson AFB, Alaska

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Date: *14 May 2002*

Drilling Agency: ☐ Alaska District ☒ Other *USACE*

Elevation Datum: ☒ MSL ☐ other

Location: Northing: *3,892,984 ft* Easting: *1,474,054 ft*

Top of Hole Elevation: *548.6 ft*

Hole Number, Field: *HB-4* Permanent: *AP-5280*

Operator: *William Tester*

Inspector: *Robert Weakland*

Type of Hole: ☐ other ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: *2.3 ft WD*

Depth Drilled: *24.5 ft*

Total Depth: *26.5 ft*

Hammer Weight: *340 lbs*

Split Spoon I.D: *2.5 in*

Size and Type of Bit: *4.3 in Drag bit*

Type of Equipment: *CME 850 with autohammer*

Type of Samples: *Grab and Drive*

Depth (ft)	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	%Gravel	%Sand	%Fines	Max Size (in)	PID (ppm)	% Water	Description and Remarks
	1		NFS	Grab	GW	Well-graded GRAVEL with Sand				2.5	0.3		Brown, moist, subrounded to rounded gravel, medium sand, nonplastic (NP) fines
2													
4	2		NFS	34 16 10 8	GW	Well-graded GRAVEL with Sand				1.8	0.2		Brown to gray, wet, subrounded to rounded gravel, fine to medium sand, nonplastic (NP) fines
6													
8													1.5 ft. of heaving sand
10	3		NFS	5 6 5 6	GW	Well-graded GRAVEL with Sand	63	35	2	2.0	0.2		Brown to gray, wet, subrounded to rounded gravel, fine to coarse sand, NP fines
12													
14													2 ft. of heaving sand
16	4		NFS	9 5 2 4	GW	Well-graded GRAVEL with Sand				2.0	0.3		Brown to gray, wet, subangular to subrounded gravel, fine to coarse sand, NP fines
18													1.5 ft. of heaving sand
20	5		NFS	5 6 7 9	GP	Poorly graded GRAVEL with Sand	66	31	3	2.5	0.3		Brown to gray, wet, subangular to subrounded gravel, fine to coarse sand, NP fines
22													
24													2 ft. of heaving sand
26	6			5 7 13 14	GW	Well-graded GRAVEL with Sand and Cobbles				>3.0	0.2		Brown to gray, wet, subangular to subrounded gravel, fine to coarse sand, NP fines, drive fractured cobbles
28													Bottom of Hole 26.5 ft Elevation 522.1 ft Groundwater Encountered While Drilling: at depth 2.3 ft PID = (Hot) Photo Ionization Detector
30													
32													

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Project: *Type III Hydrant Fueling System, FY04 (EIE164)*

Hole Number: *AP-5280*

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Soils and Geology Section

EXPLORATION LOG

Project: Type III Hydrant Fueling System, FY04 (EIE164)
Eielson AFB, Alaska

Page 1 of 1
Date: 14 May 2002

Drilling Agency: ☐ Alaska District ☒ Other USACE

Elevation Datum: ☒ MSL ☐ other

Location: Northing: 3,892,963 ft Easting: 1,474,106 ft

Top of Hole Elevation: 549.6 ft

Hole Number, Field: HB-5
Permanent: AP-5281

Operator: William Tester

Inspector: Robert Weakland

Type of Hole: ☐ other ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: 4.7 ft WD

Depth Drilled: 24.5 ft

Total Depth: 26.5 ft

Hammer Weight: 340 lbs

Split Spoon I.D.: 2.5 in

Size and Type of Bit: 4.3 in Drag bit

Type of Equipment: CME 850 with autohammer

Type of Samples: Grab and Drive

Depth (ft)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	Grain Size %Gravel	%Sand	%Fines	Max Size (in)	PID (ppm)	% Water	Description and Remarks
2		1	Nbn	PFS	Grab	GW	Well-graded GRAVEL with Sand				2.0	0.5		Brown, moist, subrounded to rounded gravel, medium sand, nonplastic (NP) fines
4, 6		2	Nbn	PFS	37 28 17 5	GW	Well-graded GRAVEL with Sand	64	32	4	2.5	0.5		Brown, wet, subrounded gravel, fine to coarse sand, NP fines
10		3		NFS	8 6 6 4	GP	Poorly graded GRAVEL with Sand	73	25	2	2.0			Brown, wet, subrounded to rounded gravel, fine to coarse sand, NP fines
16		4		NFS	4 6 4 4	GW	Well-graded GRAVEL with Sand	59	38	3	2.0			Brown, wet, subrounded gravel, fine to coarse sand, NP fines
20		5			4 6 13 17	GW	Well-graded GRAVEL with Sand				2.0			Brown, wet, subrounded gravel, fine to coarse sand, NP fines
26		6			6 6 8 6	GP	Poorly graded GRAVEL with Sand				1.5			Brown and gray, wet, rounded gravel, coarse sand

Bottom of Hole 26.5 ft
Elevation 523.1 ft
Groundwater Encountered While Drilling: at depth 4.7 ft
PID = (Hot) Photo Ionization Detector

EXPLORATION LOG EIE164.GPJ ACE_ANC.GDT 12/31/02

NPA Form 19-E
May 94 Prev. Ed. Obsolete

Project: Type III Hydrant Fueling System, FY04 (EIE164)

Hole Number: AP-5281

ALASKA DISTRICT
CORPS OF ENGINEERS
ENGINEERING SERVICES

Soils and Geology Section
EXPLORATION LOG

Eielson AFB, Alaska

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Date: 14 May 2002

Drilling Agency: ☐ Alaska District ☒ Other USACE

Elevation Datum: ☒ MSL ☐ other

Location: Northing: 3,893,041 ft Easting: 1,474,146 ft

Top of Hole Elevation: 549.4 ft

Hole Number, Field: HB-6

Permanent: AP-5282

Operator: William Tester

Inspector: Robert Weakland

Type of Hole: ☐ other ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: 6.3 ft WD

Depth Drilled: 24.5 ft

Total Depth: 26.5 ft

Hammer Weight: 340 lbs

Split Spoon I.D.: 2.5 in

Size and Type of Bit: 4.3 in Drag bit

Type of Equipment: CME 850 with autohammer

Type of Samples: Grab and Drive

Depth (ft)	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	%Gravel	%Sand	%Fines	Max Size (in)	PID (ppm)	% Water	Description and Remarks
2	1		S1	Grab	GM	Silty GRAVEL with Sand					0.4		Brown, moist, subrounded to rounded gravel, fine to coarse sand, nonplastic (NP) fines
4–6	2	Nbn	PFS	49 35 19 16	GP-GM	Poorly graded GRAVEL with Silt and Sand	64	31	5				Brown, moist, subrounded gravel, fine to coarse sand, nonplastic (NP) fines
8													2 ft. of heaving sand
10	3		NFS	6 6 6 5	GP	Poorly graded GRAVEL with Sand	69	29	2	2.0			Brown, moist, subangular to subrounded gravel, fine to coarse sand, nonplastic (NP) fines
14													1.5 ft. of heaving sand
16	4		NFS	3 4 5 4	GW	Well-graded GRAVEL with Sand				2.5			Brown to gray, wet, subrounded gravel, fine to coarse sand, NP fines
18													2 ft. of heaving sand
20	5			5 4 2 3	GP	Poorly graded GRAVEL with Sand				1.5			Brown, wet, rounded gravel, medium sand, NP fines
24													2.5 ft. heaving sand
26	6			8 9 9 11	GP	Poorly graded GRAVEL with Sand				1.5			Brown to gray, wet, subangular to subrounded gravel, medium to coarse sand
28													Bottom of Hole 26.5 ft Elevation 522.9 ft Groundwater Encountered While Drilling: at depth 6.3 ft PID = (Hot) Photo Ionization Detector
30													
32													

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Project: Type III Hydrant Fueling System, FY04 (EIE164)

Hole Number: AP-5282

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Project: *Type III Hydrant Fueling System, FY04 (EIE164)*
Eielson AFB, Alaska

Page 1 of 1
Date: *6 Jun 2002*

Drilling Agency: ☐ Alaska District ☒ Other *USACE*

Elevation Datum: ☒ MSL ☐ other

Location: Northing: *3,892,207 ft* Easting: *1,473,771 ft*

Top of Hole Elevation: *549.0 ft*

Hole Number, Field: *HB-7* Permanent: *AP-5283*

Operator: *William Tester*

Inspector: *Steven Henslee*

Type of Hole: ☐ other ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: *3.7 ft WD*

Depth Drilled: *9.5 ft*

Total Depth: *11.5 ft*

Hammer Weight: *340 lbs*

Split Spoon I.D: *2.5 in*

Size and Type of Bit: *4.3 in Drag bit*

Type of Equipment: *CME 850 with autohammer*

Type of Samples: *Grab and Drive*

Depth (ft)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	Grain Size %Gravel	%Sand	%Fines	Max Size (in)	PID (ppm)	% Water	Description and Remarks
2		1		F4	Grab	SM	Silty SAND with Gravel				0.5	0.4		Brown, moist, round gravel, fine sand, nonplastic (NP) fines
4, 6, 8		2		NFS	5 4 5 4	GW	Well-graded GRAVEL with Sand	66	32	2	2.5	0.4		Gray to rust, wet, round gravel, coarse to fine sand
10		3		NFS	2 3 3 3	GP	Poorly graded GRAVEL with Sand	76	23	1	2.0	0.2		Gray, wet, subangular to rounded gravel, coarse sand
12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32														Bottom of Hole 11.5 ft Elevation 537.5 ft Groundwater Encountered While Drilling: at depth 3.7 ft PID = (Hot) Photo Ionization Detector

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Project: *Type III Hydrant Fueling System, FY04 (EIE164)*

Hole Number: *AP-5283*

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Project: Type III Hydrant Fueling System, FY04 (EIE164)
Eielson AFB, Alaska

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Date: 6 Jun 2002

Drilling Agency: ☐ Alaska District ☒ Other USACE

Elevation Datum: ☒ MSL ☐ other

Location: Northing: 3,892,477 ft Easting: 1,473,901 ft

Top of Hole Elevation: 548.0 ft

Hole Number, Field: HB-8
Permanent: AP-5284

Operator: William Tester

Inspector: Steven Henslee

Type of Hole: ☐ other ☐ Test Pit ☐ Auger Hole ☐ Monitoring Well ☒ Piezometer

Depth to Groundwater: WD

Depth Drilled: 14.5 ft

Total Depth: 16.5 ft

Hammer Weight: 340 lbs

Split Spoon I.D.: 2.5 in

Size and Type of Bit: 4.3 in Drag bit

Type of Equipment: CME 850 with autohammer

Type of Samples: Grab and Drive

Depth (ft)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	Grain Size %Gravel	%Sand	%Fines	Max Size (in)	PID (ppm)	% Water	Description and Remarks
		1		F4	GRAB	ML	SILT with Sand					0.2		Gray to brown, fine sand, nonplastic (NP) fines
2														
4														
		2		F4	1 2 1 1	ML	SILT with Sand					1.1		Gray to black, fine sand, NP fines, organic lenses
6														
8														
10		3		F4	1 1 2 1									No recovery, very soft soil. Suspect ML soil.
12														
14														
		4a		F4	1 2	ML	SILT with Sand					0.1		Black, wet, fine sand, NP fines
16		4b		PFS	10 11	GP	Poorly graded GRAVEL with Sand	62	34	4	2.0			Gray, wet, rounded gravel, coarse sand
18														Bottom of Hole 16.5 ft Elevation 531.5 ft Groundwater Encountered While Drilling PID = (Hot) Photo Ionization Detector
20														
22														
24														
26														
28														
30														
32														

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Project: Type III Hydrant Fueling System, FY04 (EIE164)

Hole Number: AP-5284

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Project: Type III Hydrant Fueling System, FY04 (EIE164)
Eielson AFB, Alaska

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Date: 7 Jun 2002

Drilling Agency: ☐ Alaska District ☒ Other USACE

Elevation Datum: ☒ MSL ☐ other

Location: Northing: 3,892,753 ft Easting: 1,474,032 ft

Top of Hole Elevation: 547.7 ft

Hole Number, Field: HB-9
Permanent: AP-5285

Operator: William Tester

Inspector: Steven Henslee

Type of Hole: ☐ other ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: 2.7 ft WD

Depth Drilled: 9.5 ft

Total Depth: 11.5 ft

Hammer Weight: 340 lbs

Split Spoon I.D: 2.5 in

Size and Type of Bit: 4.3 in Drag bit

Type of Equipment: CME 850 with autohammer

Type of Samples: Grab and Drive

Depth (ft)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	Grain Size %Gravel	%Sand	%Fines	Max Size (in)	PID (ppm)	% Water	Description and Remarks
		1		F4	Grab	ML	SILT					0.4		Black, moist, nonplastic (NP) fines
2														
4		2		NFS	1 1 3 5	SP	Poorly graded SAND with Gravel				1.8	0.3		Gray, wet, rounded gravel, medium sand, NP fines
6														
8														
10		3		PFS	10 11 8 7	GW	Well-graded GRAVEL with Sand and Cobbles	68	28	4	>3.0	0.4		Gray, wet, subangular to rounded gravel, coarse to medium sand, NP fines
12														Bottom of Hole 11.5 ft Elevation 536.2 ft Groundwater Encountered While Drilling: at depth 2.7 ft PID = (Hot) Photo Ionization Detector
14														
16														
18														
20														
22														
24														
26														
28														
30														
32														

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Project: Type III Hydrant Fueling System, FY04 (EIE164)

Hole Number: AP-5285

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Date: 7 Jun 2002

Drilling Agency: ☐ Alaska District ☒ Other USACE

Elevation Datum: ☒ MSL ☐ other

Location: Northing: 3,892,904 ft Easting: 1,474,123 ft

Top of Hole Elevation: 549.2 ft

Hole Number, Field: HB-10 Permanent: AP-5286

Operator: William Tester

Inspector: Steven Henslee

Type of Hole: ☐ other ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: 4.8 ft WD

Depth Drilled: 9.0 ft

Total Depth: 11.0 ft

Hammer Weight: 340 lbs

Split Spoon I.D: 2.5 in

Size and Type of Bit: 4.3 in Drag bit

Type of Equipment: CME 850 with autohammer

Type of Samples: Grab and Drive

Depth (ft)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	Grain Size %Gravel	%Sand	%Fines	Max Size (in)	PID (ppm)	% Water	Description and Remarks
		1		F2	Grab	SM	Silty SAND with Gravel				0.8	1.1		Brown, moist, round gravel, medium to find sand, nonplastic (NP) fines
2														
4														
		2		NFS	7 7 6 4	SP	Poorly graded SAND with Gravel				2.0	0.4		Gray, wet, round gravel, coarse to medium sand, NP fines
6														
8														
		3		NFS	4 7 10 9	SP	Poorly graded SAND with Gravel				1.8	0.2		Gray, wet, subrounded to rounded gravel, coarse to medium sand
10														
12														Bottom of Hole 11.0 ft Elevation 538.2 ft Groundwater Encountered While Drilling: at depth 4.8 ft PID = (Hot) Photo Ionization Detector
14														
16														
18														
20														
22														
24														
26														
28														
30														
32														

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Project: Type III Hydrant Fueling System, FY04 (EIE164)

Hole Number: AP-5286

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Date: 7 Jun 2002

Drilling Agency: ☐ Alaska District ☒ Other USACE

Elevation Datum: ☒ MSL ☐ other

Location: Northing: 3,893,110 ft Easting: 1,474,131 ft

Top of Hole Elevation: 549.1 ft

Hole Number, Field: HB-11 Permanent: AP-5287

Operator: William Tester

Inspector: Steven Henslee

Type of Hole: ☐ other ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: 6.2 ft WD

Depth Drilled: 14.5 ft

Total Depth: 16.5 ft

Hammer Weight: 340 lbs

Split Spoon I.D.: 2.5 in

Size and Type of Bit: 4.3 in Drag bit

Type of Equipment: CME 850 with autohammer

Type of Samples: Grab and Drive

Depth (ft)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	%Gravel	%Sand	%Fines	Max Size (in)	PID (ppm)	% Water	Description and Remarks
		1		NFS	Grab	SP	Poorly graded SAND				0.5	0.3		Brown, medium gravel, medium to coarse sand, at surface 2 in of organics and silt
2														
4														
		2		PFS	6 8 9 9	GW	Well-graded GRAVEL with Sand	64	32	4	2.5	0.3		Gray, wet, subangular to rounded gravel, medium to coarse sand
6														
8														
10		3		NFS	3 4 6 6	SP	Poorly graded SAND with Gravel				2.0	0.3		Gray, wet, subangular to rounded gravel, medium to coarse sand
12														
14														6 in. of sand heave
		4		NFS	3 4 6 7	SP	Poorly graded SAND with Gravel				2.5	0.3		Gray, wet subrounded to rounded gravel, medium to coarse sand
16														
18														Bottom of Hole 16.5 ft Elevation 532.6 ft Groundwater Encountered While Drilling: at depth 6.2 ft PID = (Hot) Photo Ionization Detector
20														
22														
24														
26														
28														
30														
32														

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Project: Type III Hydrant Fueling System, FY04 (EIE164)

Hole Number: AP-5287

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Eielson AFB, Alaska

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Date: 7 Jun 2002

Drilling Agency: ☐ Alaska District ☒ Other USACE

Elevation Datum: ☒ MSL ☐ other

Location: Northing: 3,893,102 ft Easting: 1,474,176 ft

Top of Hole Elevation: 550.7 ft

Hole Number, Field: HB-12

Permanent: AP-5288

Operator: William Tester

Inspector: Steven Henslee

Type of Hole: ☐ other ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: 8.0 ft WD

Depth Drilled: 15.0 ft

Total Depth: 17.0 ft

Hammer Weight: 340 lbs

Split Spoon I.D: 2.5 in

Size and Type of Bit: 4.3 in Drag bit

Type of Equipment: CME 850 with autohammer

Type of Samples: Grab and Drive

Depth (ft)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	Grain Size %Gravel	%Sand	%Fines	Max Size (in)	PID (ppm)	% Water	Description and Remarks
2		1		NFS	Grab	SP	Poorly graded SAND with Gravel				0.8	0.3		Brown, moist, rounded gravel, fine to medium sand
6		2		PFS	7 10 14 16	GW-GM	Well-graded GRAVEL with Silt and Sand	59	36	5	1.8	0.3		Yellowish gray, subrounded to rounded gravel, medium to coarse sand
10		3	Nbn	NFS	14 29 13 5	SP	Poorly graded SAND with Gravel				2.5	0.4		Gray, frozen, subrounded gravel, fine to medium sand
														2 ft. of heaving sand
16		4		NFS	4 8 11 9	GP	Poorly graded GRAVEL with Sand and Cobbles				>3.0	0.4		Gray, wet, subrounded gravel, medium sand

Bottom of Hole 17.0 ft
Elevation 533.7 ft
Groundwater Encountered While Drilling: at depth 8.0 ft
PID = (Hot) Photo Ionization Detector

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Project: Type III Hydrant Fueling System, FY04 (EIE164)

Hole Number: AP-5288

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Eielson AFB, Alaska

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Date: 7 Jun 2002

Drilling Agency: ☐ Alaska District ☒ Other USACE

Elevation Datum: ☒ MSL ☐ other

Location: Northing: 3,893,059 ft Easting: 1,474,243 ft

Top of Hole Elevation: 549.9 ft

Hole Number, Field: HB-13 Permanent: AP-5289

Operator: William Tester

Inspector: Steven Henslee

Type of Hole: ☐ other ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: 5.8 ft WD

Depth Drilled: 24.5 ft

Total Depth: 26.5 ft

Hammer Weight: 340 lbs

Split Spoon I.D: 2.5 in

Size and Type of Bit: 4.3 in Drag bit

Type of Equipment: CME 850 with autohammer

Type of Samples: Grab and Drive

Depth (ft)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	Grain Size %Gravel	%Sand	%Fines	Max Size (in)	PID (ppm)	% Water	Description and Remarks
		1		F2	Grab	SM	Silty SAND					0.4		Brown, moist, subangular to rounded gravel, fine sand
2														
4														
6		2		NFS	7 4 6 8	SP	Poorly graded SAND with Gravel				1.5	0.3		Gray, wet, subrounded gravel, medium sand
8														
10		3		NFS	2 2 2 2	GP	Poorly graded GRAVEL with Sand	66	33	1	1.0	0.3		Gray, wet, subrounded gravel, medium to coarse sand
12														
14		4		NFS	2 4 5 5	GP	Poorly graded GRAVEL with Sand				1.0	0.4		Gray, wet, subrounded to rounded gravel, coarse sand
16														
18														2 ft. of heaving sand
20		5			5 4 4 4	SP	Poorly graded SAND with Gravel				1.5	0.2		Gray, wet, rounded gravel, medium to coarse sand
22														
24		6			9 14 15 10	SP	Poorly graded SAND with Gravel				1.0	0.2		Gray, wet, rounded gravel, medium sand
26														
28														Bottom of Hole 26.5 ft Elevation 523.4 ft Groundwater Encountered While Drilling: at depth 5.8 ft PID = (Hot) Photo Ionization Detector
30														
32														

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Project: Type III Hydrant Fueling System, FY04 (EIE164)

Hole Number: AP-5289

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EXPLORATION LOG

Eielson AFB, Alaska	Date: 7 Jun 2002
Drilling Agency: ☐ Alaska District ☒ Other USACE	Elevation Datum: ☒ MSL ☐ other
Location: Northing: 3,893,138 ft Easting: 1,474,281 ft	Top of Hole Elevation: 550.1 ft
Hole Number, Field: HB-14 Permanent: AP-5290	Operator: William Tester
Inspector: Steven Henslee	
Type of Hole: ☐ other ☐ Test Pit ☐ Auger Hole ☐ Monitoring Well ☒ Piezometer	Depth to Groundwater: 3.0 ft WD
Depth Drilled: 24.5 ft	Total Depth: 26.5 ft
Hammer Weight: 340 lbs	Split Spoon I.D.: 2.5 in
Size and Type of Bit: 4.3 in Drag bit	Type of Equipment: CME 850 with autohammer
Type of Samples: Grab and Drive	

Depth (ft)	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	%Gravel	%Sand	%Fines	Max Size (in)	PID (ppm)	% Water	Description and Remarks
	1		F2	Grab	SM	Silty SAND					0.2		Brown, moist
2													
4	2a		F4	3 3 6 6	ML	SILT		12	88		0.2		Gray, wet, nonplastic (NP) fines
6	2b				SP-SM	Poorly graded SAND with Silt					0.2		Gray, wet, medium sand, NP fines
8													
10	3		NFS	4 5 5 5	SP	Poorly graded SAND with Gravel				1.5	0.2		Gray, wet, subangular to rounded gravel, medium sand
12													
14	4		NFS	5 10 7 7	GP	Poorly graded GRAVEL with Sand	74	24	2	2.5	0.2		Gray, wet, subangular to rounded gravel, medium sand
18													1.5 ft. of heaving sand
20	5			3 4 6 6						>3.0			Shoe plugged with fractured cobble
22													
24													1 ft. of heaving sand
26	6			4 13 17 18	GP	Poorly graded GRAVEL with Sand and Cobbles				>3.0			Gray, wet, subangular gravel, medium to coarse sand, NP fines
28													Bottom of Hole 26.5 ft Elevation 523.6 ft Groundwater Encountered While Drilling: at depth 3.0 ft PID = (Hot) Photo Ionization Detector
30													
32													

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Project: Type III Hydrant Fueling System, FY04 (EIE164)

Hole Number: AP-5290

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Eielson AFB, Alaska	Date: 8 Jun 2002
Drilling Agency: ☐ Alaska District ☒ Other USACE	Elevation Datum: ☒ MSL ☐ other
Location: Northing: 3,893,170 ft Easting: 1,474,209 ft	Top of Hole Elevation: 550.9 ft
Hole Number, Field: HB-15 Permanent: AP-5291	Operator: William Tester
Inspector: Steven Henslee	
Type of Hole: ☐ other ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer	Depth to Groundwater: 7.0 ft WD
Depth Drilled: 25.0 ft	Total Depth: 27.0 ft
Hammer Weight: 340 lbs	Split Spoon I.D.: 2.5 in
Size and Type of Bit: 4.3 in Drag bit	Type of Equipment: CME 850 with autohammer
Type of Samples: Grab and Drive	

Depth (ft)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	%Gravel	%Sand	%Fines	Max Size (in)	PID (ppm)	% Water	Description and Remarks
		1		S2	Grab	SP-SM	Poorly graded SAND with Silt and Gravel					0.4		Brown, moist, subrounded to rounded gravel, fine to medium sand, nonplastic (NP) fines
2														
4														
6		2		S2	4 7 6 8	SP-SM	Poorly graded SAND with Silt and Gravel				1.0	0.3		Brown, moist, rounded gravel, medium to coarse sand, nonplastic (NP) fines
8														
10		3		PFS	7 10 8 5	GW	Well-graded GRAVEL with Sand	59	37	4	1.5	0.4		Brown, wet, subrounded gravel, fine to coarse sand, nonplastic (NP) fines
12														
14														1.5 ft. of heaving sand
16		4		NFS	4 5 5 7	GP	Poorly graded GRAVEL with Sand and Cobbles				>3.0	0.3		Gray, wet, subangular to subrounded gravel, medium to coarse sand
18														
20														
22														
24														
26		5			9 11 15 10	GP	Poorly graded GRAVEL with Sand and Cobbles				>3.0			Gray, wet, subangular to round gravel, medium to coarse sand
28														Bottom of Hole 27.0 ft Elevation 523.9 ft Groundwater Encountered While Drilling: at depth 7.0 ft PID = (Hot) Photo Ionization Detector
30														
32														

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Project: Type III Hydrant Fueling System, FY04 (EIE164)

Hole Number: AP-5291

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Eielson AFB, Alaska		Date: 8 Jun 2002
Drilling Agency: ☐ Alaska District ☒ Other USACE		Elevation Datum: ☒ MSL ☐ other
Location: Northing: 3,893,302 ft Easting: 1,474,281 ft		Top of Hole Elevation: 550.4 ft
Hole Number, Field: HB-16	Permanent: AP-5292	
Operator: William Tester		Inspector: Steven Henslee
Type of Hole: ☐ other ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer	Depth to Groundwater: 7.0 ft WD	Depth Drilled: 9.5 ft / Total Depth: 11.5 ft
Hammer Weight: 340 lbs	Split Spoon I.D: 2.5 in	Size and Type of Bit: 4.3 in Drag bit
Type of Equipment: CME 850 with autohammer		Type of Samples: Grab and Drive

Depth (ft)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	%Gravel	%Sand	%Fines	Max Size (in)	PID (ppm)	% Water	Description and Remarks
		1		F4	Grab	SM	Silty SAND					0.3		Brown, moist, fine sand, nonplastic (NP) fines
2														
4				F4	2 2 3 9	ML	SILT		11	89		0.4	40	Gray, moist, fine sand, NP fines
6		2												
8														
10		3		PFS	8 9 8 7	GW	Well-graded GRAVEL with Sand	60	35	5		0.4		Dark gray, wet, subangular gravel, fine to coarse sand, NP fines
12														Bottom of Hole 11.5 ft Elevation 538.9 ft Groundwater Encountered While Drilling: at depth 7.0 ft PID = (Hot) Photo Ionization Detector
14														
16														
18														
20														
22														
24														
26														
28														
30														
32														

EXPLORATION LOG EIE164.GPJ ACE_ANC.GDT 12/31/02

NPA Form 19-E May 94 Prev. Ed. Obsolete	Project: Type III Hydrant Fueling System, FY04 (EIE164)	Hole Number: AP-5292

CORPS OF ENGINEERS
ENGINEERING SERVICES

Soils and Geology Section
EXPLORATION LOG

Eielson AFB, Alaska		Date: 8 Jun 2002
Drilling Agency: ☐ Alaska District ☒ Other USACE		Elevation Datum: ☒ MSL ☐ other
Location: Northing: 3,893,313 ft Easting: 1,474,176 ft		Top of Hole Elevation: 550.0 ft
Hole Number, Field: HB-17	Permanent: AP-5293	
Operator: William Tester		Inspector: Steven Henslee
Type of Hole: ☐ other ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer	Depth to Groundwater: 6.3 ft WD	Depth Drilled: 9.0 ft / Total Depth: 11.0 ft
Hammer Weight: 340 lbs	Split Spoon I.D: 2.5 in	Size and Type of Bit: 4.3 in Drag bit
Type of Equipment: CME 850 with autohammer		Type of Samples: Grab and Drive

Depth (ft)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	%Gravel	%Sand	%Fines	Max Size (in)	PID (ppm)	% Water	Description and Remarks
2		1		F2	Grab	SM	Silty SAND with Gravel	26	37	37		0.3	17	Brown, moist, subangular gravel, fine sand, nonplastic (NP) fines
4, 6		2		S2	1 1 3 3	SP-SM	Poorly graded SAND with Silt and Gravel	22	69	9	0.5	0.3		Dark gray, wet, angular gravel, medium sand, wood bits, organic oder
10		3		NFS	3 4 4 3	SP	Poorly graded SAND with Gravel				2.5	0.3		Gray, wet, subrounded to rounded gravel, medium to coarse sand
12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32														Bottom of Hole 11.0 ft Elevation 539.0 ft Groundwater Encountered While Drilling: at depth 6.3 ft PID = (Hot) Photo Ionization Detector

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Project: Type III Hydrant Fueling System, FY04 (EIE164)

Hole Number: AP-5293

EXPLORATION LOG EIE164.GPJ ACE_ANC.GDT 12/31/02

CORPS OF ENGINEERS
ENGINEERING SERVICES

Soils and Geology Section
EXPLORATION LOG

Eielson AFB, Alaska			Date: 8 Jun 2002
Drilling Agency: ☐ Alaska District ☒ Other USACE			Elevation Datum: ☒ MSL ☐ other
Location: Northing: 3,893,392 ft Easting: 1,473,946 ft			Top of Hole Elevation: 550.5 ft
Hole Number, Field: HB-18	Permanent: AP-5294	Operator: William Tester	Inspector: Steven Henslee
Type of Hole: ☐ other ☐ Test Pit ☐ Auger Hole ☐ Monitoring Well ☒ Piezometer		Depth to Groundwater: 8.2 ft WD	Depth Drilled: 14.5 ft / Total Depth: 16.5 ft
Hammer Weight: 340 lbs	Split Spoon I.D.: 2.5 in	Size and Type of Bit: 4.3 in Drag bit	Type of Equipment: CME 850 with autohammer / Type of Samples: Grab and Drive

Depth (ft)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	%Gravel	%Sand	%Fines	Max Size (in)	PID (ppm)	% Water	Description and Remarks
		1		F4	Grab	SM	Silty SAND					0.5		Brown, moist, fine sand, nonplastic (NP) fines
2														
4														
		2a		F4	4	SM	Silty SAND					0.5		Brown, moist, fine sand, NP fines
6		2b		PFS	5 6 4	SP	Poorly graded SAND with Gravel				1.5			Rust to brown, moist, subrounded gravel, medium sand
8														▼
10		3		NFS	2 2 2 3	SP	Poorly graded SAND					0.5		Gray, wet, medium sand
12														
14														15 cm of heaving sand
16		4		NFS	4 4 5 5	SP	Poorly graded SAND with Gravel				1.8	0.4		Gray, wet, subrounded to rounded gravel, coarse to medium sand
18														Bottom of Hole 16.5 ft Elevation 534.0 ft Groundwater Encountered While Drilling: at depth 8.2 ft PID = (Hot) Photo Ionization Detector
20														
22														
24														
26														
28														
30														
32														

EXPLORATION LOG EIE164.GPJ ACE_ANC.GDT 12/31/02

NPA Form 19-E
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Project: Type III Hydrant Fueling System, FY04 (EIE164)

Hole Number: AP-5294

CORPS OF ENGINEERS
ENGINEERING SERVICES

Soils and Geology Section
EXPLORATION LOG

Eielson AFB, Alaska	Date: 8 Jun 2002
Drilling Agency: ☐ Alaska District ☒ Other USACE	Elevation Datum: ☒ MSL ☐ other
Location: Northing: 3,893,617 ft Easting: 1,474,012 ft	Top of Hole Elevation: 551.5 ft
Hole Number, Field: HB-19 Permanent: AP-5295	Operator: William Tester / Inspector: Steven Henslee
Type of Hole: ☐ other ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer	Depth to Groundwater: 7.8 ft WD / Depth Drilled: 9.5 ft / Total Depth: 11.5 ft
Hammer Weight: 340 lbs / Split Spoon I.D.: 2.5 in / Size and Type of Bit: 4.3 in Drag bit	Type of Equipment: CME 850 with autohammer / Type of Samples: Grab and Drive

Depth (ft)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	%Gravel	%Sand	%Fines	Max Size (in)	PID (ppm)	% Water	Description and Remarks
		1		NFS	Grab	ASPH	Asphalt							
						SP	Poorly graded SAND with Gravel				0.8	0.5		Brown, moist, round gravel, medium to fine sand, FILL
2		2		F4	Grab	ML	Sandy SILT							Brown, moist, fine sand, nonplastic (NP) fines
4														
6		3	Nbn	F4	10 10 7 5	ML	Sandy SILT		37	63		0.5		Gray, frozen, fine sand, NP fines, wood
8														
10		4		NFS	3 6 6 9	SP	Poorly graded SAND					0.4		Gray, wet, medium gravel, medium sand
12														Bottom of Hole 11.5 ft Elevation 540.0 ft Groundwater Encountered While Drilling: at depth 7.8 ft PID = (Hot) Photo Ionization Detector
14														
16														
18														
20														
22														
24														
26														
28														
30														
32														

NPA Form 19-E
May 94 Prev. Ed. Obsolete

Project: Type III Hydrant Fueling System, FY04 (EIE164)

Hole Number: AP-5295

EXPLORATION LOG EIE164.GPJ ACE_ANC.GDT 12/31/02

CORPS OF ENGINEERS
ENGINEERING SERVICES

Soils and Geology Section
EXPLORATION LOG

Eielson AFB, Alaska

Date: 8 Jun 2002

Drilling Agency: ☐ Alaska District ☒ Other USACE

Elevation Datum: ☒ MSL ☐ other

Location: Northing: 3,893,844 ft Easting: 1,474,057 ft

Top of Hole Elevation: 552.0 ft

Hole Number, Field: HB-20 Permanent: AP-5296

Operator: William Tester

Inspector: Steven Henslee

Type of Hole: ☐ other ☐ Test Pit ☐ Auger Hole ☐ Monitoring Well ☒ Piezometer

Depth to Groundwater: 9.1 ft WD

Depth Drilled: 14.0 ft

Total Depth: 16.0 ft

Hammer Weight: 340 lbs

Split Spoon I.D: 2.5 in

Size and Type of Bit: 4.3 in Drag bit

Type of Equipment: CME 850 with autohammer

Type of Samples: Grab and Drive

Depth (ft)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	Grain Size %Gravel	%Sand	%Fines	Max Size (in)	PID (ppm)	% Water	Description and Remarks
2		1		F4	Grab	ML	SILT with Sand				0.5	0.4		Tan, moist, rounded gravel, fine sand, nonplastic (NP) fines
4–6		2		PFS	6 6 9 10	GP	Poorly graded GRAVEL with Sand				1.5	0.4		Brown, moist, subangular to subrounded gravel, fine to medium sand
10		3	Nbn	PFS	27 60	GP	Poorly graded GRAVEL with Sand	59	36	5	1.3	0.4		Gray to brown, frozen, subangular to subrounded gravel, medium to coarse sand
14–16		4		PFS	6 6 5 4	GP	Poorly graded GRAVEL with Sand					0.3		Gray, wet, subrounded to rounded gravel, fine to coarse sand

Bottom of Hole 16.0 ft
Elevation 536.0 ft
Groundwater Encountered While Drilling: at depth 9.1 ft
PID = (Hot) Photo Ionization Detector

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May 94 Prev. Ed. Obsolete

Project: Type III Hydrant Fueling System, FY04 (EIE164)

Hole Number: AP-5296

EXPLORATION LOG EIE164.GPJ ACE_ANC.GDT 12/31/02

Appendix C

Analytical Data Table

Table 1
Eielson Hydrant Fueling System
Method 8021B - BTEX
Method AK101 - Gasoline Range Organics
Method AK102 - Diesel Range Organics
Method AK103 - Residual Range Organics
June, 2002

LOCATION OF SAMPLE:	HP12-8-9	HP12-4.5	HP16-30-	HP17-5-7
DATE OF SAMPLE:	6/7/2002	6/7/2002	6/8/2002	6/8/2002
TYPE OF SAMPLE:	Soil	Soil	Soil	Soil
DEPTH OF SAMPLE: (FEET)	8 - 9	4.5 - 6.5	30 - 32	5 - 7
FIELD SAMPLE ID: 02EHFS-	8 - 9	02SL	03SL	04SL
TESTING LABORATORY:	STL8	STL8	STL8	STL8
LABORATORY SAMPLE ID:	106557-01	106557-02	106557-03	106557-04
DATE RECEIVED:	6/11/2002	6/11/2002	6/11/2002	6/11/2002
DATE ANALYZED:	6/11 - 13/02	6/11 - 13/02	6/12/2002	6/12/2002
CONCENTRATION UNITS:	mg/Kg	mg/Kg	mg/Kg	mg/Kg
Benzene	ND (0.0149)	ND (0.0107)	ND (0.02)	ND (0.035)
Toluene	ND (0.0299)	ND (0.0214)	ND (0.04)	ND (0.0699)
Ethylbenzene	ND (0.0299)	ND (0.0214)	ND (0.04)	ND (0.0699)
o-Xylene	ND (0.0299)	ND (0.0214)	ND (0.04)	ND (0.0699)
Xylene, Isomers m & p	ND (0.0598)	ND (0.0427)	ND (0.08)	ND (0.14)
Gasoline Range Organics	ND (1.49)	ND (1.07)	ND (2)	ND (3.5)
Diesel Range Organics	7.82 J	ND (18.3)	NT	10.9 J
Residual Range Organics	ND (38.5)	ND (36.6)	NT	82.6 B
Lead	5.12	5.27	NT	6.64

STL8: Severn Trent Services, Seattle, WA.
J: Estimated Value.
NT: Not Tested.
ND: Not Detected. (The number in parentheses is the Practical Quanitative Limit (PQL)).

United States Army
Corps of Engineers

Alaska District
PO Box 898
Anchorage, AK
99506-0898

Chemical Data Report

EIE174 Parking Apron Upgrade, Eielson Air Force Base, Alaska

Prepared by
Engineering Services Branch
Materials Section

March 2003

Executive Summary

The U.S. Army Corps of Engineers Alaska District Engineering Services Branch, Materials Section (CEPOA-EN-ES-M), prepared this chemical data report at the request of the Alaska District Project Management Division Military Branch (CEPOA-PM-M). The primary purpose of this sampling event was to evaluate potential contamination in subsurface soils at the site under consideration for the proposed Parking Apron Upgrade at Eielson AFB, Alaska.

Soil samples were collected by CEPOA-EN-ES-M personnel and analyzed for gasoline range organics (GRO), benzene, toluene, ethylbenzene, and total xylenes (BTEX), diesel range organics (DRO), residual range organics (RRO), and total lead, at the request of CEPOA-PM-M. Within the proposed project footprint, GRO and DRO were reported above the applicable State of Alaska 18AAC75 regulatory limits. Historical fuel contamination has been identified within the proposed project footprint. Contamination is the result of refueling activities at the E7 and E8 Fuel Pumphouses (Source Area ST20), and potentially the ST49 Source Area. Contaminated soils from these source areas that are usable from an engineering standpoint are to be utilized for the project so long as the soils are not transported from the known source area boundaries. It is estimated that no more than 300 cubic yards of non-usable contaminated material is present in the project footprint.

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3 Site Background 1

3.1 Location and Project Background 1

3.2 Site Characteristics 1

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5.1.1 Soil BTEX 10

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Appendix A: Chemist Field Logs

Appendix B: Soil Boring Logs

Appendix C: Analytical Data Tables

1 Introduction

The U.S. Army Corps of Engineers Alaska District Engineering Services Branch, Materials Section (CEPOA-EN-ES-M), prepared this chemical data report at the request of the Alaska District Project Management Division Military Branch (CEPOA-PM-M). The primary purpose of this sampling event was to evaluate potential contamination in subsurface soils at the site under consideration for the proposed Parking Apron Upgrade at Eielson AFB, Alaska.

2 Objective

The purpose of the investigation was to characterize soils in the proposed construction area in order to facilitate planning for the disposal of potential contaminated soils excavated during construction. The obtained data are to be used to estimate the amount, nature, and approximate extent of contamination present in soil that is expected to be disturbed during construction. Groundwater was not sampled, and this investigation was not intended to be a comprehensive environmental assessment of the site.

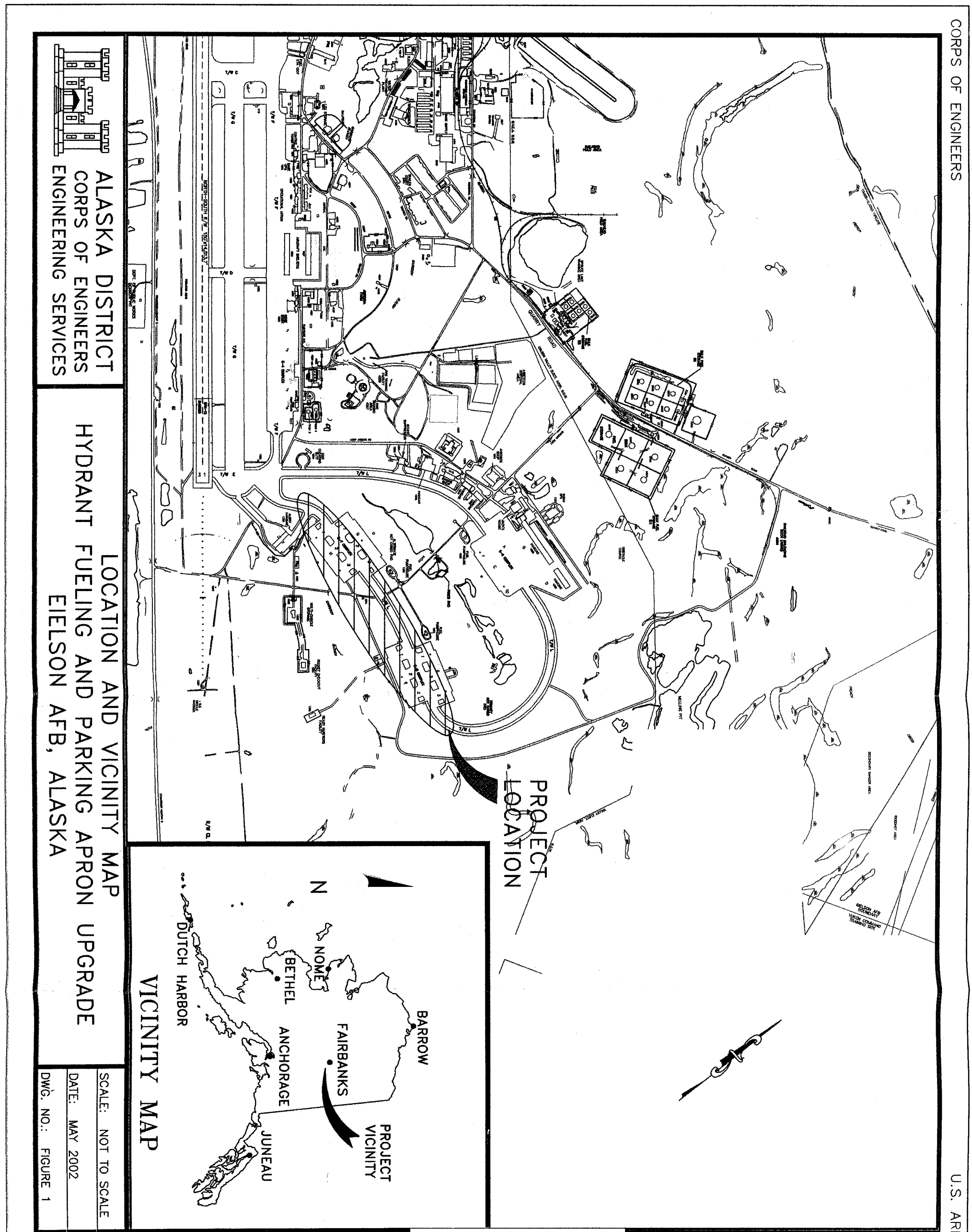
3 Site Background

3.1 Location and Project Background

The project site is on Eielson Air Force Base (AFB). Eielson AFB covers approximately 19,700 acres. It is located along the Richardson Highway within the Fairbanks North Star Borough, approximately 24 miles southeast of Fairbanks and 10 miles southeast of the city of North Pole, Alaska (Figure 1). Approximately 3,650 acres are improved or partially improved with the remaining land encompassing forest, wetlands, lakes, and ponds. Residential and occupational populations are primarily concentrated in the developed portion of the Base. Since its establishment in 1944, the mission of Eielson AFB has been to train and equip personnel for close air support of ground troops in an arctic environment.

3.2 Site Characteristics

Eielson AFB is in the broad, essentially level flood plain of the Tanana River. The site is on a higher, older portion of the flood plain removed from the active stream channels and normally is not subject to flooding. The floodplain consists of deposits of silt, sand and gravel to depths of over 100 meters overlaying bedrock. Groundwater generally is encountered a few meters below the ground surface (bgs) within the flood plain area. Groundwater was encountered between 2 and 2.5 meters bgs during field activities in September 2000. Discontinuous permafrost is present throughout the region.


CORPS OF ENGINEERS
U.S. ARMY
ALASKA DISTRICT
CORPS OF ENGINEERS
ENGINEERING SERVICES
LOCATION AND VICINITY MAP
HYDRANT FUELING AND PARKING APRON UPGRADE
EIELSON AFB, ALASKA
SCALE: NOT TO SCALE
DATE: MAY 2002
DWG. NO.: FIGURE 1
PROJECT LOCATION
QUARRY ROAD
VICINITY MAP
BARROW
FAIRBANKS
PROJECT VICINITY
NOME
BETHEL
ANCHORAGE
JUNEAU
DUTCH HARBOR
N

3.3 Site History and Known Contamination

In carrying out its defense mission, the soils and groundwater at the base have been contaminated from the storage and handling of fuels and solvents plus the operation of landfills. Initially, this contamination was evaluated under the U.S. Air Force Installation Restoration Program (IRP). The four-phase IRP was initiated in 1982 with a Phase I records search to identify past disposal sites containing contaminants that may pose a hazard to human health or the environment. Under the IRP, the U.S. Air Force identified potential areas of contamination at Eielson AFB. Potential source areas included old landfills, storage and disposal areas, fueling system leaks, and spill areas.

Eielson AFB was listed on the National Priorities List (NPL) (54 FR 48184) on November 21, 1989, by the U.S. Environmental Protection Agency (EPA). This listing designated the facility as a federal Superfund site subject to the remedial response requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA). In May 1991, the U.S. Air Force, the State of Alaska, and EPA entered into the Federal Facility Agreement (FFA), under CERCLA Section 120 (U.S. Environmental Protection Agency et al. 1991), which establishes the procedural framework and schedule for developing, implementing, and monitoring CERCLA response actions. An additional goal of the FFA was to integrate the U.S. Air Force's CERCLA response obligations and Resource Conservation and Recovery Act (RCRA) corrective action obligations. Under the FFA, potential source areas were placed in one of six operable units (OUs), based on similar contaminant and environmental characteristics, or were included for evaluation under a source evaluation report (SER).

As with many Superfund sites, the problems at Eielson AFB were complex. Thus, the FFA divided the potential source areas at Eielson AFB into six Operable Units (OUs). OU1 refers to the eight sources that have caused petroleum contamination at the base. The eight source areas with petroleum contamination designated under OU1 were: ST20 E-7, E-8, and E-9 Complexes (Refueling Loop); ST48 Power Plant; ST49 Alert Hanger; SS50 Blair Lakes Vehicle Maintenance; SS51 Blair Lakes Ditch; SS52 Blair Lakes Diesel Spill; SS53 Blair Lakes Fuel Spill; and DP54 Blair Lakes Drum Disposal Site. OU1 addresses sites contaminated by leaks and spills of fuels. Soils contaminated with petroleum products occur at or near the source of contamination. Contaminated subsurface soil and groundwater occurs in plumes on the top of a shallow groundwater table that fluctuates seasonally. Most of the contamination is in subsurface soils and the shallow groundwater. Much of the groundwater contamination is believed to migrate from the smear zone because of fluctuations in the groundwater table, rather than infiltration from precipitation. The OU1 source area directly affecting the proposed fuel hydrant/parking apron upgrade is ST-20 (Figure 2). Contaminants of concern at ST-20 are fuel constituent petroleum hydrocarbons, including benzene, toluene, ethylbenzene, and xylenes (BTEX).

Source area ST20 contains three refueling complexes (E-7, E-8, and E-9). Each complex consists of an asphalt pad centered along the taxiway with adjacent unpaved areas of gravel and grass. The complexes are served by a fuel pump house with three associated 190,000-L JP-4 underground storage tanks (UST) and one 95,000-L defuel UST along with fueling and defueling

transfer pipes. The large area enclosed by the taxiway loop, north of the complex, contains surface water ponds. Garrison Slough is approximately 300 meters southwest of the complex.

The majority of aircraft refueling operations are conducted at the refueling loop, and numerous fuel spills have occurred there in the past. The source of contamination at the E-7 Complex is believed to be leaks in the subsurface JP-4 fueling and defueling transfer pipes.

The source of contamination at the E-8 Complex is believed to be surface spills of JP-4 jet fuel resulting from overfilling of storage tanks.

Soil Contamination at the E-7 Complex (EPA Superfund Record of Decision, 1994)

Twelve soil samples were analyzed for volatile organic analytes in 1986; nine soil samples were analyzed for volatile organic analytes from 1988 to 1989; three soil samples were analyzed for volatile organic analytes in 1993. No subsurface TPH contamination in excess of 100 mg/kg was identified in soil. However, areas of elevated TPH and BTEX are likely to be present near the free product pool, where smearing of the floating product caused by seasonal changes in the water table is expected to have occurred (smear zone).

Groundwater Contamination at the E-7 Complex

Groundwater contamination at concentrations exceeding the Safe Drinking Water Act maximum contaminant levels (MCLs) and action levels were identified for benzene and toluene. The MCL for benzene is 5 mg/L; the MCL for toluene is 1,000 mg/L. The highest BTEX concentrations occur in the same monitoring wells that contain floating product. The downgradient extent of benzene contamination in groundwater has been defined by the groundwater probe and monitoring well data collected in 1988, 1989, and 1993. A comparison of data for 1988, 1989, and 1993 shows that benzene concentrations within the plume are decreasing. In 1989, the highest concentration of benzene was 12,000 mg/L in well 53M04 (Figure 5.1). In 1993, the concentration in this well was 200 mg/L. In addition to the petroleum-related contamination at the E-7 Complex, 2-methylphenol, 4-methylphenol and acetophenone (all semivolatile compounds) were found.

Floating Fuel at the E-7 Complex

In 1988 and 1989, up to nine wells and product probes reported floating fuel product. Well 20M04 had a reported thickness of 51.8 cm. In May 1993, product thickness was detected in only one well, 20M04 (65.2 cm), and in one product probe, 20PP12 (12.19 cm). The lateral extent of the product has diminished, but product thickness has increased slightly at well 20M04.

Soil Contamination at the E-8 Complex

During the 1988 study, TPH was detected at concentrations greater than 100 mg/kg in surface and subsurface soil samples from boring 20M06; BTEX compounds were also detected. In 1989 TPH concentrations greater than 100 mg/kg were detected in 1) surface and subsurface samples from a boring 40 m south of boring 20M06 and 2) subsurface (approximately 1 m depth) samples in a boring 30 m to the northeast of boring 20M06. In both borings, TPH concentrations increase near the water table. This is probably a result of the original free phase liquid being smeared

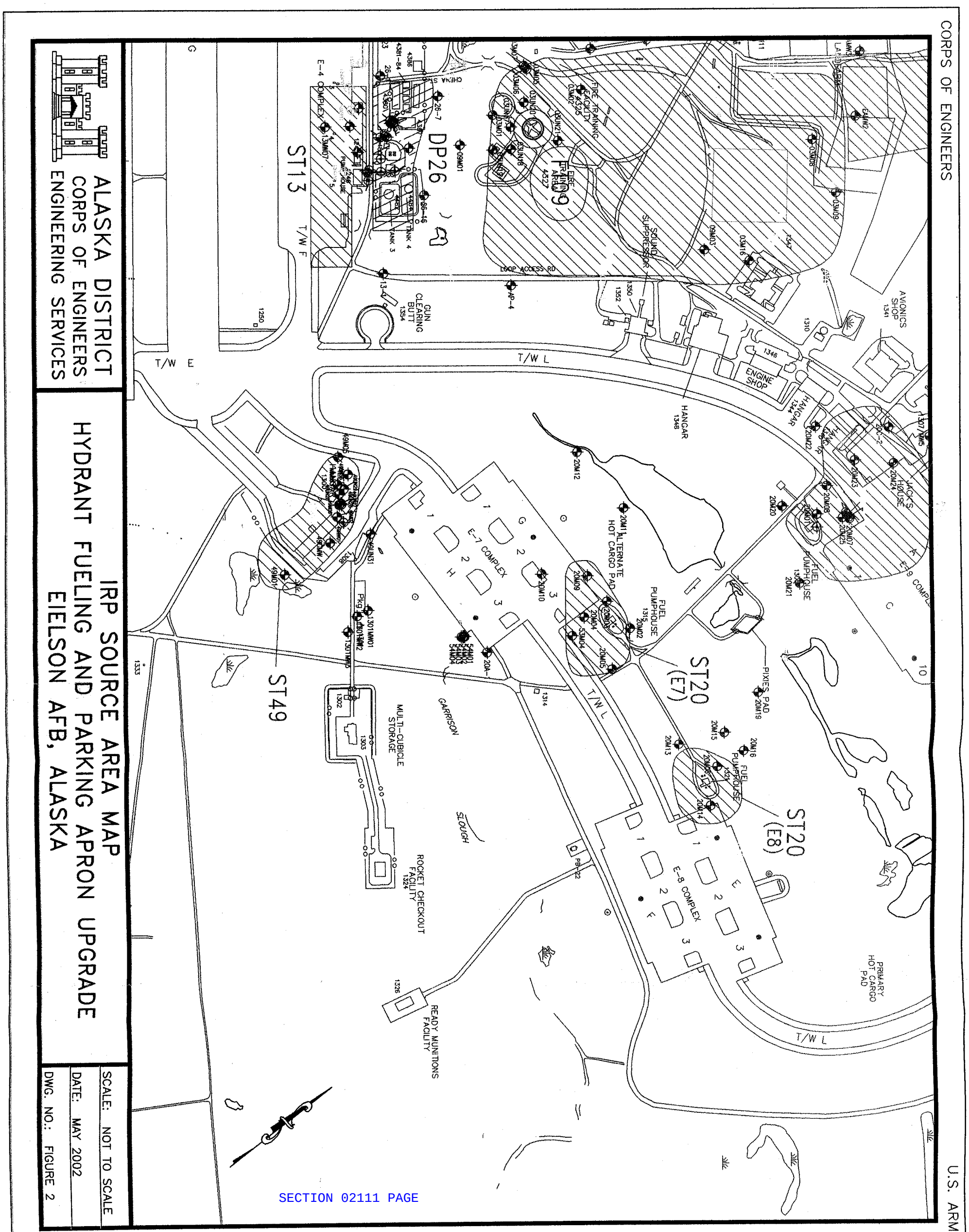
over an area near the top of the water table by water table fluctuations. This could have resulted in high soil TPH values in the area around well 20M06. BTEX associated with floating product also are expected to be present in subsurface soils within the smear zone. No additional soil samples were collected during the May 1993 sampling.

Groundwater Contamination at the E-8 Complex

The extent of benzene contamination in groundwater is defined by groundwater probe and monitoring well data collected in 1989 and 1993. The highest concentration of benzene have historically been in well 20M06, which is near the fuel pump house (Figure 5.2). The 1993 levels in this well were 570 mg/L. This level of concentration is similar to the 481 mg/L concentration in 1989. A comparison of data from 1989 and 1993 indicate that the benzene concentrations are stable and the benzene plume does not appear to be migrating with groundwater as would be anticipated. BTEX have not been detected in the downgradient wells 20M15 and 20M16. Toluene, ethylbenzene and xylenes were detected in groundwater; the highest concentrations occurred in well 20M06. The MCLs for ethylbenzene and toluene were exceeded in the 1993 data set for well 20M06.

Floating Fuel at the E-8 Complex

No floating product was detected in any wells or product probes during May 1993. In 1989, product thickness measurements indicated floating product in five wells and product probes with thicknesses of up to 17.7 cm in well 20M06. No product was detected in this well in subsequent measurements in 1991 or 1993.


CORPS OF ENGINEERS
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IRP SOURCE AREA MAP
HYDRANT FUELING AND PARKING APRON UPGRADE
EIELSON AFB, ALASKA
SCALE: NOT TO SCALE
DATE: MAY 2002
DWG. NO.: FIGURE 2
ST20 (E8)
ST20 (E7)
ST49
ST13
DP26
DP19
E-7 COMPLEX
E-8 COMPLEX
E-4 COMPLEX
ALTERNATE HOT CARGO PAD
PRIMARY HOT CARGO PAD
FUEL PUMPHOUSE
HANGAR 1348
ENGINE SHOP
AVIONICS SHOP 1341
JACKS HOUSE
GUN CLEARING BUTT 1354
MULTI-CUBICLE STORAGE
ROCKET CHECKOUT FACILITY 1324
READY MUNITIONS FACILITY
SOUND SUPPRESSOR
FIRE TRAINING FACILITY
LOOP ACCESS RD
T/W E
T/W L
GARRISON
SLOUGH
PIXIES PAD

4 Field Activities

The subsurface exploration for the proposed project site was conducted in May, June, and July 2002. . All work was conducted under the Sampling and Analysis Plan and the Site-Specific Health & Safety Plan for the Hydrant Fueling and Parking Apron Upgrades. These plans were finalized in May 2002 by EN-ES-M and are on file. Unless stated otherwise herein, there were no major deviations from these plans. Sixty-four borings were drilled to a depth of 15 feet bgs, using a track mounted CME 850 drill rig fitted with continuous flight, 8-inch diameter hollow stem augers. From CEPOA-EN-ES-SG, a drill crew performed the drilling, and a geotechnical engineer collected samples to determine physical and engineering properties. The results are presented separately in a geotechnical recommendations report. Doug Deters, Gerald Archibald and Charley Peyton (CEPOA-EN-ES-M chemists) conducted screening and sampling for chemical contaminants, using the methods described below. Chemist's field notes are provided in Appendix A.

Test borings AP-5297 through AP-5360 (Figure 3) were drilled during this project. Soil samples for geotechnical analysis were collected near the surface and at approximately 5-foot intervals until borehole completion or refusal. Surface samples were collected from the sidewalls of the borings. Subsurface soil samples were collected from a split spoon, driven approximately 18 inches ahead of the auger with a 340 pound sliding hammer. Upon retrieval from the boring, a preliminary photoionization detector (PID) reading was taken from the end of the split spoon and recorded in the field log. Selected samples were collected to confirm the presence of fuel range organics and also to determine concentrations of lead. When analytical samples were collected, the soil samples were rapidly collected with a clean stainless steel spoon and placed in appropriate containers provided by the laboratory. Samples to be analyzed for volatile analytes were collected before samples for non- or semi-volatile analytes. A new spoon and a new pair of nitrile gloves were used for each sample. A final PID reading was obtained on soil collected from the split spoon, placed into a small plastic Ziploc bag, and then allowed to warm on the dash of a vehicle for a minimum of 15 minutes (heated headspace method). If the split spoon retrieved from the borehole was saturated with groundwater, a heated headspace PID reading was not obtained due to the interference from water vapors. Groundwater was encountered at approximately 5-7 feet bgs. Observations made during sampling, such as, time, weather, and odor or sheen, were also recorded in the field log.

At the discretion of the sampler, submitted samples were tested for benzene, toluene, ethylbenzene and xylenes (BTEX), gasoline range organics (GRO), diesel range organics (DRO), residual range organics (RRO), and lead. Labeled sample containers were wrapped in paper towels (for cushioning and absorbency), sealed in individual Ziploc bags (to prevent cross-contamination), and packed in a cooler with ice packs and enough vermiculite to fill any voids in the cooler. A Chain-of-Custody (COC) form and a temperature blank were included in each cooler. Coolers were taped shut with strapping tape in two places and two custody seals were placed on the coolers. Samples (including blind duplicates and field blanks) were shipped to STL Seattle. Samples delivered to the lab were analyzed by the following methods:

BTEX by EPA Method 8021B
GRO by State of Alaska Method AK101
DRO by State of Alaska Method AK102
RRO by State of Alaska Method AK103
Lead by EPA Method 6010B

At Auger Points (AP) 5300, 5314, and 5353, PID readings, odors, and appearances indicated fuel contamination. Cuttings from these borings were drummed for later disposal at a commercial soil processing facility. For those auger points where PID readings and field observation did not indicate contamination, drill cuttings were backfilled into the auger holes and remains were spread out over the surrounding soils. Due to the current use of the facility for jet-aircraft operations, care was taken to remove cuttings and other debris from the pavement. All other Investigative-Derived Waste (IDW), such as disposable gloves and sampling spoons, were bagged and placed in appropriate waste receptacles.

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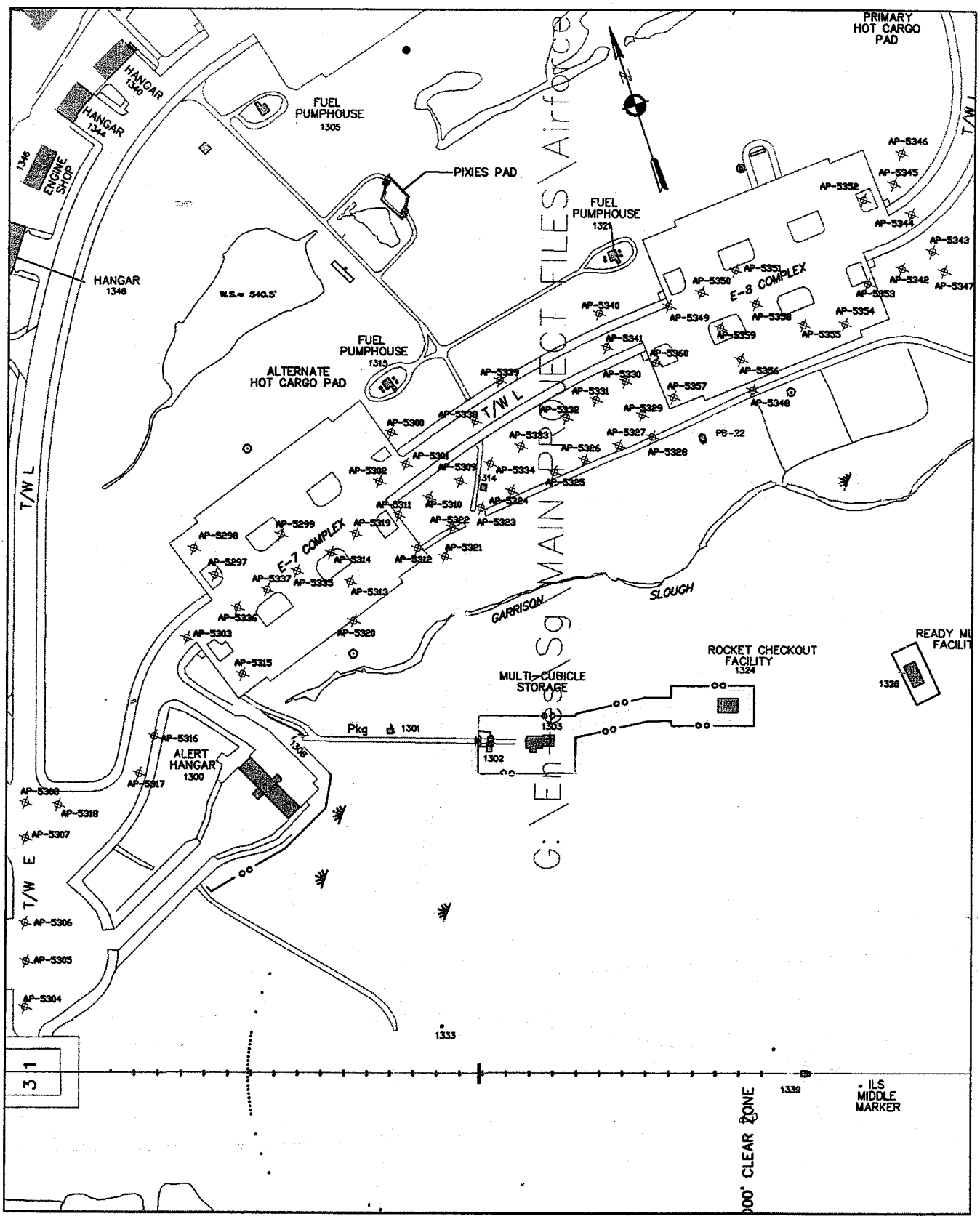

ALASKA DISTRICT
CORPS OF ENGINEERS
SOILS AND GEOLOGY

TEST BORING LOCATION MAP
EXPAND AND REPAIR REFUELING APRON
EIELSON AIR FORCE BASE, ALASKA

SCALE: 1 IN = 600 FT
DATE: OCT. 2002
DRAWN/RVW: HJW/CRW

Figure 3

5 Analytical Results

5.1 Chemical Results

Complete data packages are on file at the Alaska District U.S. Army Corps of Engineers. The analytical methods used for this project were selected based upon the nature of the contaminants known to exist in the area, and on the expected regulatory requirements. This report identifies results that exceed the most conservative ADEC 18 AAC 75 cleanup levels. A data summary table is provided in Appendix C. Soil sample results for GRO and DRO are compared to 18 AAC 75 Method One, Category A, Soil Cleanup Levels. Soil sample results analyzed for BTEX and lead were compared to 18 AAC 75 Method Two Soil Cleanup Levels (Migration to Groundwater in the Under 40 Inch Zone). Table 1, below, summarizes the Cleanup Level (CL) that was used for each analyte and the regulation that was used to derive that value.

TABLE 1: APPLICABLE CLEANUP LEVELS

Contaminant of Concern	18 AAC 75 Soil Cleanup Levels
GRO	50 mg/kg
DRO	100 mg/kg
RRO	2000 mg/kg
Benzene	0.020 mg/kg
Toluene	5.4 mg/kg
Ethylbenzene	5.5 mg/kg
Total Xylenes	78 mg/kg
Lead	400 mg/kg

5.1.1 Soil BTEX

BTEX (benzene, toluene, ethylbenzene, and total xylenes) results for the twenty-three analyzed samples did not exceed the most stringent 18 AAC 75 regulatory limits given above. Reportable detections of three or more of the analytes were made in samples 02PARK01SL, -02SL and –38SL. These detections were confirmed by a second analysis. Complete data tables are provided in Appendix C.

5.1.2 GRO, DRO, RRO

Sample 02PARK02SL exceeded 18AAC75 Soil Cleanup Levels for GRO and DRO (213 and 999 mg/Kg, respectively). Samples 02PARK31SL, -38SL, -40SL, –42SL, and/or their respective QC duplicates, all were reported with DRO detections at or above the Soil Cleanup Level. While no sample was reported with RRO above 2000 mg/Kg, thirteen of the samples had reportable levels of RRO, ranging from 50.4 to 664 mg/Kg.

5.1.3 Lead

Low levels of lead were reported in all twenty-two samples analyzed for this metal. Results ranged from 2.97 to 31.4 mg/Kg.

5.2 Data Quality Review

Validata Chemical Services performed an independent Chemical Data Quality Review (CDQR), a copy of which is presented in Appendix D. No major deficiencies in data quality were reported. Minor data qualifications (holding time expirations, surrogate recoveries out of range, and Relative Percent Differences (RPD) between duplicates out of range) were reported in two of the four Sample Data Groups. This resulted in associated results being flagged as estimated. Surrogate recovery and RPD issues for field samples were probably a result of matrix interference and not indicative of poor data quality.

None of the data were rejected, and all data are considered usable for project purposes with minor qualifications.

6 Conclusion

Soil samples were collected by CEPOA-EN-ES-M personnel and analyzed for gasoline range organics (GRO), benzene, toluene, ethylbenzene, and total xylenes (BTEX), diesel range organics (DRO), residual range organics (RRO), and total lead, at the request of CEPOA-PM-M. Within the proposed project footprint, GRO and DRO were reported above the applicable State of Alaska 18AAC75 regulatory limits. Historical fuel contamination has been identified within the proposed project footprint. Contamination is the result of refueling activities at the E7 and E8 Fuel Pumphouses (Source Area ST20), and potentially the ST49 Source Area. Contaminated soils from these source areas that are usable from an engineering standpoint are to be utilized for the project so long as the soils are not transported from the known source area boundaries. It is estimated that no more than 300 cubic yards of non-usable contaminated material is present in the project footprint.

7 References

18 AAC 75. Oil and Hazardous Substances Pollution Control Regulations, effective October 1, 1999.

Eielson Air Force Base, Operable Unit 1 EPA Superfund Record of Decision, 1994.

U.S. Army Corps of Engineers. November 2000. Geotechnical Findings Report for the Joint Mobility Complex, Eielson AFB, Alaska. Prepared by CEPOA-EN-ES-SG.

Appendix A

Chemist Field Sampling Log

DURA Flex®
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LEVEL
Waterproof Notebook
No. 611

EIE 24 02-029
Parking Apron Upgrade
Doug Peters - Project Checklist
May 15 -

4 5/8" x 7" - 48 Numbered Pages

CONTENTS

PAGE	REFERENCE	DATE
	Doug Deters - Chemist	
	Rob Weakland } Geotech	
	Steve Hensley } Engineers	
	Bill Tester - Driller	
	Ron Nguriland - Driller Assistant	
	Samples Submitted are tested for:	
	BTEX by 8021B	
	GRO by AK 101	
	DRO by AK 102	
	RRO by AK 103	
	Lead by 6010B or 6020	

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INCHES

API (15') 15 May 2002

0800 Onsite 58° Mostly Cloudy

Calibrate PID - Background: 0.4

~~Drilling through Asphalt~~ while trying to drill through asphalt the cutting shaft sheared grass island in apron.

Moved to adjacent borehole on

Time	Depth	spoon/hole	cold	warm
1454	1'	0.3	0.3	0.3
1503	5'	0.3	0.2	0.3
1510	10'	0.2	NT - Sample saturated	
1517	15'	0.3	"	"
1620	offsite			

15 May 2002 API (15')

Sample #	Notes
DNS	No signs of contamination
DNS	" "
DNS -	" "
"	" "

AP2 (15')

16 May 2002

1030 Onsite. 50° mostly cloudy.
Calibrate PID - background : 0.2
Drilled Through asphalt

Time	Depth	spoon	cold	warm
1117	1'	0.6	0.4	0.6
1121	2½'	0.3	0.3	0.5
1138	7'	0.3	0.3	0.3
1154	13'	0.3	NT - Sample Saturated	

16 May 2002 (15') AP2

Sample #	Notes
DNS	- No odors or signs of contamination Encountered resistance (rock?) while drilling - Drove spoon to clear path in front of augers. No signs of contam
	Sample frozen. No signs of contamination. DNS
DNS	- No signs of contamination.

No signs of contamination in any of the drill cuttings. Muddy cuttings were drummed to be spread out offsite, backfilled with cuttings and clean gravel. Patched asphalt.

1300 offsite

AP3 (15') 16 May 2002

1347 Onsite 55° Partly cloudy

Background PID: 0.3

Drilled through asphalt - sheared another shaft in the process.

Time	Depth	Spoon	PID Cold	PID Warm
1506	1'	1.0	0.4	0.4
1512	5'	0.4	0.3	0.4
1527	10'	0.3	0.3	0.5
1533	15'	0.2	NT - Saturated	

16 May 2002 AP3 (15')

Sample #	Notes
DNS -	No fuel odor or signs of contamination
"	" "
DNS -	Sample frozen - no signs of contamination
DNS	No signs of contam.

Backfill cuttings and patch asphalt.

1630 walk drill rig off apron.

AP5 (15')

17 May 2002

1000 Oasite 60° Sunny

Calibrate PID - Background: 0.3

Rented Electric Coring machine

Cored through asphalt near E-7

Time	Depth	PID spoon	PID cold	PID warm
1202	1'	0.4	0.4	0.4
1211	5'	0.3	0.3	0.4
1227	10'	0.3	NT - Saturated	
1240	15'	0.3	"	"

17 May 2002

AP5 (15')

Sample #	Notes
DNS	No signs of contamination
"	" " "
"	Part of sample was frozen
"	Sample wet

No signs of contamination in any of the drill cuttings. Backfilled and patched asphalt.

1255 offsite

AP6 (15') 17 May 2002

1330 Onsite 60° Sunny, SE breeze
Background PID: 0.3
Core through asphalt

Time	Depth	spoon/hole	PID cold	PID warm
1433	1'	0.4	0.2	0.4
1441	5'	0.3	0.4	0.5
1452	10'	0.4	NT - Saturated	
1512	15'	0.2	"	"

17 May 2002 AP6

Sample #	Notes
DNS	- No signs of contamination
"	" " "
"	" " "
"	" " "

No signs of contamination in any of the drill cuttings, back filled borehole and patched asphalt. cleaned up and swept site.

1642 offsite

AP8 (15') 18 May 2002

1000 Onsite 55° Sunny
Calibrat PID · Background : 0.3
Drilled through asphalt

Time	Depth	PID	
1035	1'	0.5	from ziplock
1036	5'	0.4	
1039	10'	0.3	Sample Saturated
1050	15'	0.3	"

18 May 2002 AP8 (15')

Sample #	Notes
DNS	Samples drilled + collected
DNS	while I picked up containers @ Gdds
DNS	No signs of contamination
"	

Backfilled borehole and patched asphalt

1130 offsite

AP9 (15')

18 May 2002

1220 Oasite 65° Sunny
Background PID: 0.3
Drilled through asphalt
hole is the closest one to the runway

Time	Depth	Spoon/hole	PID Cold	PID Warm
1302	1'	0.9	0.3	0.6
1311	3-5'	0.4	0.4	0.4
1322	7'	0.4	NT - Sample	
1333	15'	0.1	NT Saturated	

18 May 2002

AP9 (15')

Sample #	Notes
DNS	No signs of contamination
"	" " "
DNS	Frozen, with groundwater saturated around sample
	No signs of contamination
DNS	No signs of contamination in cuttings
GW @ 5.91' bgs	
	No signs of contamination in cuttings
	Backfill borehole + patch asphalt.

1600 Offsite

AP10 (15') 18 May 2002

1610 Onsite 70° Sunny, slight W breeze
PID background: 0.3
hole drilled through asphalt

Time	Depth	spoon/hole	cold	warm
1647	1'	0.4	0.3	0.6
1657	5'	0.3	0.3	0.4
1712	10'	0.3	NT	Sample wet
1730	15'	0.4	NT	" "

18 May 2002 AP10 (15')

Sample #	Notes
DNS	No signs of contamination
DNS	No signs of contamination
DNS	No signs of contamination
DNS	" " "

No signs of contamination in drill cuttings - backfilled.

Offsite

18

AP 11 (15') 19 May 2002

1000 Onsite 65° sunny
Calibrate PID - background: 0.3
Cored through asphalt before drilling.

Time	Depth	Spoon/hole	PID cold	PID warm
1115	1'	2.4	0.7	1.0
1126	5'	0.3	NT - Spoon Saturated	
1145	10'	0.3	NT	"
1203	15'	0.3	NT	"

19

19 May 2002 AP 11 (15')

Sample #	Notes
DNS	- No fuel odors or signs of contamination
DNS	- No signs of contamination GW@3.9' bgs
"	" " "
"	" " "

No signs of contamination in any of the drill cuttings - backfilled dry cuttings and containerized muddy cuttings for spreading out in the grass off the taxiway. Patched asphalt and cleaned up site.

20

AP12 (15') 19 May 2002

1335 Onsite, 76° Sunny

Background PID: 0.3

Cored through asphalt prior to drilling

Time	Depth	spoon/hole	PID Cold	PID warm
1411	1'	0.9	0.4	0.5
1451	3'	0.3	0.2	0.7
1459	7'	0.4	Sample Saturated	
1512	13'	0.3	"	"

21

19 May 2002 AP12 (15')

Sample #	Notes
DNS	No signs of contamination
DNS	No fuel odors or evidence of contamination
DNS	No signs of contamination
DNS	No signs of contamination

All drill cuttings field screened clean will be used for backfill. Patch asphalt.

1610 offsite

22 AP13

19 May 2002

1610 Onsite. 80° Sunny
Background PID: 0.3
Cored through asphalt prior to drilling.

Time	Depth	Spoon/hole	PID Cold	PID Warm	Sample #	Notes
1721	1'	0.4	0.3		DNS	No signs of contamination
1724	5'	0.3	NT-spoon wet		DNS	No signs of contamination
1737	10'	0.4	NT-spoon wet, sample frozen		DNS	refusal after ~4" - recovered sample frozen
1752	15'	0.3	NT sample ~~saturated~~		DNS	No signs of contamination

19 May 2002 AP13 23

24 ~~AP~~ 20 AP 4 (15') 20 May 2002

1330 Onsite 75° Sunny

Calibrate PID - Background : 0.3

Drilled near E-7 pump house

Time	Depth	hole/spoon	cold	warm	Sample #	Notes
1358	1'	1.4	0.6		02PARK01SL	No fuel odor, slightly elevated PID
1415	5-7'	drill cuttings test @ 235 ppm			will drum cuttings from hole	
1422	7'	165 obvious fuel odor			~~02PARK02SL~~ DP	Poor sample recovery - moved over 3' and drilled new hole. Decon spoon and stopped using augers until washed.

New Borehole 3' over

Fuel pipline office rep. onsite and told us that the borehole was supposed to be moved due to the potential of a pipeline in the area. Due to this potential hazard we ~~did~~ made the decision not to drill again in the area. Drummed hot cuttings. Grouted borehole. Borehole logs and chemical results are available for historical work in the area. These will be picked up from Brent Koener @ CES.

1540 Offsite

DD

26

AP14 (15') 20 May 2002
1546 Onsite 80° Sunny & hot
Background PID: 0.3-0.5
Drilled off taxiway next to woods.

Time	Depth	hole/spoon	PID Cold	PID Warm
1605	1'	0.7	0.5	0.6
1612	5	0.4	0.6	0.7
1627	10'	3.4	0.5	NT
1637	15'	0.5	NT - saturated	

27

20 May 2002 AP14 (15')

Sample #	Notes
DNS	No signs of contamination
"	" "
DNS	Sample saturated, No signs of cont. w/in spoon contents.
"	" " "

No signs of contamination within drill cuttings. Backfilled borehole.

1652 off site

28

AP15 (15') 20 May 2002
1653 Onsite 80° Sunny NE Wind
Background PID: 0.4
Drilled along same woods as AP14

Time	Depth	hole/spoon	cold	warm	Sample #	Notes
1659	1'	0.4	0.4	0.6	DNS	No signs of contamination
1708	5'	0.4	0.5	0.8	"	" " "
1719	10'	0.4	NT - Spoon Saturated		"	" " "
1735	15'	0.3	NT	" "	"	" " "

No signs of contamination encountered in any of the drill cuttings. Used to backfill borehole.

29

20 May 2002 AP15 (5')

30

AP16 (15') 21 May 2002

0845 Onsite 68° Sunny

Calibrate PID - Background: 0.3

Drilled Next to parking apron.

Time	Depth	hole/span	PID Cold	PID Warm	Sample #	Notes
1013	1'	0.4	0.3	0.3	DNS	No signs of contamination
1022	3'	0.3	0.3	0.7	"	" " "
1036	8'	0.4	NT - Sample wet		"	No signs of contamination
1050	13'	0.3	"	"	"	" " "

Backfill Borehole

1105 offsite

31

21 May 2002 AP16 (15')

32

AP17 21 May 2002

1106 Onsite, 75° Sunny

Background PID: 0.3

Drilled through asphalt

Time	Depth	hole/spoon	PID cold	PID warm	Sample #	Notes
1121	1'	1.4	0.4	0.5	DNS	No signs of contamination
1130	5'	0.4	0.3	0.4	"	" " "
1145	10'	0.3	NT - sample damp		DNS	Poor recovery, No signs of contamination.
1158	15'	0.3	" spoon wet		"	No signs of contamination.

Backfilled borehole + patched asphalt

1220 offsite

21 May 2002 AP17

AP 18 (15') 21 May 2002

1308 Onsite, 78° sunny

Background PID:

Drilled through asphalt - asphalt when we pulled the auger found out the we drilled w/o coring

Time	Depth	hole/spoon	PID cold	warm
1324	1'	0.5	0.7	1.4
1334	5'	0.4	0.3	NT - sample wet
1346	10'	0.3	NT - spoon saturated	
1359	15'	0.4	"	"

21 May 2002 AP 18(15')

started lifting so cored the hole instead. asphalt is only 3½", so will lift even if cored so

Sample #	Notes
DNS	No signs of contamination.
DNS	No signs of contamination
DNS	" " "
DNS	" " "

No signs of contamination in any of the drill cuttings. backfilled borehole and patched asphalt.

1440 offsite

AP19 (15') 21 May 2002

1445 Onsite, 80° sunny East wind
Background PID: 0.3
Drilled in grass island just next to pavement

Time	Depth	hole/spoon	PID Cold	PID Warm	Sample #	Notes
1503	1'	0.4	0.3	0.9	DNS	No signs of contamination
1517	3'	2.4	0.9	1.1	DNS	No fuel odor, but slightly elevated PID
1534	8'	127	60.6	195	02PARK025L	Fuel odor partial ice & saturated with water. Collect sample.
1542	13'	1.8	~~1.8~~ 2.0	NT - saturated.	DNS	Much less fuel odor. Contamination most likely concentrated in the smear zone.

Drummed cuttings that screened "hot" and used clean cuttings & gravel for backfill. Drummed "hot" cuttings. Take augers out of service until decontaminated. Decon spoon.

21 May 2002 AP19 (15')

Offsite

AP20(15')

22 May 2002

1205 Onsite, 75° SE Wind 10-15 mph
Calibrate PID - background: 0.3
Cored through asphalt prior to drilling

Time	Depth	hole/spoon	PID Cold	PID Warm
1405	1'	0.7	0.5	2.4
Blank			Left blank	
1415	5'	0.4	0.5	0.5
1432	10'	0.4	NT	Sample Frozen
1439	15'	0.4	"	Sample Saturated

Blank

22 May 2002 AP20 (15

Drilled in corner of parking apron near Alert hangar. IRP Map shows contamina near this hole. Will collect samples.

Sample #	Notes
~~02 PARK 035L~~	No signs of contaminate
02 PARK 045L	QC dup collected duplicate Samp
~~02PARK 055L~~	Not collected No signs of contaminati
DNS	No signs of contamination
DNS	" " "

No signs of contamination in any of the drill cuttings. backfilled borehole with non-muddy cuttings + gravel. Patched asphalt.

AP20 - offsite

AP 21 (15') 22 May 2002

1522 Onsite, 77° sunny, South wind 10-20
Background PID: 0.4
Cored through asphalt before drilling

Time	Depth	PID hole/spoon	PID cold	PID warm	Sample #	Notes
1542	1'	0.4	0.3	0.5	DNS	No signs of contamination.
1552	5'	0.4	0.3	0.4	DNS	Spoon saturated (appears to have been driven through perched melt water. Bottom 2/3 damp, but not saturated. May also have been water + mud stuck in A-Rod
		Blank			Blank	
1602	10'	0.3	NT - Sample Wet		DNS	No signs of contamination
1612	15'	0.3	" "		"	" " "

Blank

22 May 2002 AP21 (15')

hole drilled on taxiway adjacent to Alert hangar. IRP map shows potential contamination.

Blank

No signs of contamination. Backfilled and patched asphalt. Sweep up site.

1655 Offsite

AP 22 (15') 22 May 2002

1700 Onsite, 75° sunny wind SW 15-20 mph
Background PID: 0.4
Cored through asphalt prior to drilling

Time	Depth	Hole/spoon	PID Cold	PID Warm
1746	1"	0.5	0.4	0.5
1757	3'	0.3	0.3	0.4
1809	8'	0.3	0.3	0.4
1818	13'	0.3	NT-	sample frozen

Blank

22 May 2002 AP22 (15')

Boreholes on taxiway next to alert hangar.

Blank

Sample #	Notes
DNS	No signs of contamination
"	" " "
"	" " "
"	" " "
	Poor recovery

No signs of contamination in any of the drill cuttings. backfilled with non-Muddy cuttings + gravel. Patched asphalt and cleaned site.

1840 Offsite

44

AP23 (15') 22 May 2002
1907 Onsite 80° Sunny, wind 10-20 mph
Background PID: 0.3
Drilled through asphalt.

Time	Depth	hole/spoil	PID cold	PID warm	Sample #	Notes
1922	1'	3.6	0.6	1.5	DNS	Elevated initial PID due to drilling asphalt No other indications of contamination.
Blank						
1951	5'	Not reached				slow drilling Encountered chunks of re-bar in drill cuttings, electric wire, what looks like roofing felt. Appear to be drilling through concrete at 3-4 feet, drilling very slow- decided to abort borehole. Backfilled and patched

Blank

2130 offsite

45

22 May 2002 AP23 (15')

Blank

24 May 2002
Drove back to Anchorage for weekend. Will be replaced in the field by Gerry Archibald.

Trip Blank.

02 PARK058L prepared
24 May 2002

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LEVEL

Waterproof Notebook
No. 611

EIE174

May 30 -

4 5/8" x 7" - 48 Numbered Pages

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PAGE	REFERENCE	DATE
	Gerald Anchorb	
	Chemist	
	Steve Henslee	
	Geologist	
	Bill Horton Dr. Hen	

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INCHES

May 30 2002
on site 1000
AB-24
Cloudy 50°F
Back ground 0.4

time	depth	PID sgram	cold	Hot	Sample	depth
1100	1/2-2 1/2	0.4	0.5	0.5	NS	1/2-2 1/2
1105	~~2 1/2-4 1/2~~	0.5	0.4	0.5	NS	4 1/2-6 1/2
1115	~~4 1/2-5 1/2~~	0.4	0.4	0.4	NS	9 1/2-10 1/2
1130	14 1/2-16 1/2	0.4	0.4	0.5	NS	14 1/2-16 1/2
1135	Gw		0.4	0.5	NS	

AB-25
on site 1320
Back ground 0.4

time	depth	PID	cold	Hot	Sample
1320	1'	-	0.4	~~0.5~~ 0.4	NS
1335	2 1/2-4 1/2	0.4	0.4	0.6	NS
1345	9.5-10.5	0.4	0.5	1.6	NS
1400	14.5-16.5	0.4	0.4	0.4	NS

4

on site 1500
overcast 55°F
Background 0.4
AB-26

Time	depth	PID	Cold	Hot	Sample
1525	1'	—	0.3	0.3	NS
1535	4.5-6.5	0.2	0.3	0.4	NS
1546	9.5-10.5	0.3	0.3	0.3	NS
1550	14.5-16.5	0.2	0.3	0.3	NS

AB-27
on site 1616
Background 0.2

Time	depth	PID	Cold	Hot	Sample

Geo'l Analysis

5

May 31 02
On Site 830
AB-27
Background 0.4
Overcast 60°F

Time	depth	PID	Cold	Hot	Sample
1000	1'	–	4.3	18.0	NS
1005	2.5-4.5	0.4	0.4	0.6	-OGSL
1020	7-9	0.4	0.4	0.7	NS
1030	12.5-14.5	0.5	0.6	0.6	NS

AB-28
Background 0.4
Overcast 60°F
On Site

Time	depth	PID	Cold	Hot	Sample
1105	1.5'	~~0.3~~	0.3	0.4	Ns
1110	4-6'	0.3	0.4	0.6	NS
1125	9-11'	0.4	0.5		NS

AB-29
on site 1200
Background 0.3
Overcast 60°F

Time	depth	PID	Cold	Hot	Sample
1210	1'	—	0.3	0.2	NS
1215	4.5-6.5	no recovery			NS
1225	9.5-11.5	0.2	0.2	0.3	NS
1240	14.5-16.5	0.3	0.3	0.3	NS

AB-30
on site 1315
Background 0.4
Overcast 60°F

Time	depth	PID	Cold	Hot	Sample
1330	1'	—	0.3	0.6	NS
1335	2.5-4.5	0.3	0.4	0.5	NS
1340	7.5-9.5	0.4	0.3	0.2	NS
1350	12.5-14.5	0.2	0.2	0.2	NS

AB-31
on site 1440
Background 0.4
overcast 55°F

Time	depth	PID	Cold	Hot	Sample
1450	1	~~0.3~~	0.3	0.4	NS
1455	4-6	0.3	0.3	0.3	NS
1505	9-11	0.4	0.6	1.2	NS
1510	14-16	0.3	2.2	2.6	NS

Cold Ave h.l.l

June 1 02
on site 0800
AB-32
light rain 60°F
Background 1.0

Time	depth	PID	cold	Hot	Sample
0905	1'	~~0~~	0.2	0.4	NS
0910	4-6	0.3	0.2	0.3	NS
0920	9.11	0.2	0.2	0.3	NS
0925	14-16	0.3	0.3	0.3	NS

on site 0950
AB-33
overcast 60°F
Background

Time	depth	PID	cold	Hot	Sample
1000	1	—	1.0	2.2	NS
1005	2.5-4.5	0.2	0.2	0.3	NS
1015	7.5-9.5	0.2	0.2	0.2	NS
1030	12.5-14.5	No recovery			

on site 1100
AB-34
overcast 60°F
Background 0.4

Time	depth	PID	Cold	Hot	Sample
1105	1'	—	0.4	0.4	NS
1110	4-6'	0.4	~~0.4~~ 0.4	0.4	0.75L
1115	9-11	0.4	0.4	0.4	NS
1120	14-16	No recovery			NS

on site 1145
AB-35
overcast 60°F
Background 0.2

Time	depth	PID	Cold	Hot	Sample
1150	1	—	0.3	0.4	NS
1155	2.5-4.5	0.4	0.4	0.4	↓
1200	7.5-9.5	0.3	0.4	0.4	
1205	12.5-14.5	0.3	0.3	0.4	NS

on site 1220
AB-36
Background 0.2
Overcast 65°F

Time	depth	PID	cold	Hot	Sample
1230	1'	←	0.4	0.4	
1235	4-6	0.4	0.4	0.4	NS
1245	9-11	0.4	0.4	0.4	NS
1250	14-16	0.4	0.4	0.2	NS
					NS

on site 1320
AB-37
Background 0.2
overcast 65°F

Time	depth	PID	cold	Hot	Sample
1325	1'	~~0.2~~	0.2	0.3	
1330	~~2.5-4.5~~ ~~1-6~~	0.2	0.2	0.6	NS
1335	~~9-11~~ 7.5-9.5	0.6	0.6	0.5	NS
1345	~~14-16~~ 12.5-14.5	0.5	0.5	0.5	NS
					NS

On site 1405
AB-38
Background 0.2
partly Cloudy 65°F

Time	Depth	PID	Cold	Hot		Sample
1410	1'	—	0.2	0.2		NS
1415	4-6	0.2	0.2	0.2		NS
1420	9-11	0.2	0.2	0.2		NS
1430	14-16	0.2	low recovery		all to geo	

Onsite 1445
AB-39
Background 0.3
Partly Cloudy 65°F

Time	depth	PID	Cold	Hot		Sample
1450	1'	~~0.3~~	0.3	0.4		NS
1455	4-6	0.3	0.3	0.3		|
1505	9-11	0.3	0.4	0.4		|
1515	14-16	0.4	0.3	0.4		NS

AB-40
on site 1600
Background 0.4
Partly cloudy 65°F

Time	depth	PID	Cold	Hot	Sample
1700	4-6'	0.2	0.2	0.2	#5
1710	9-10'	0.1	0.2	0.2	N5
1725	14-16	0.2	0.3	0.2	N5

off site 1800

Gerald Bach Sr

AB-40
on site 1600
Background 0.4
Partly cloudy 63°F

Time	depth	PID	Cold	Hot	Sample
1700	4-6'	0.2	0.2	0.2	NS
1710	9-10'	0.1	0.2	0.2	NS
1725	14-16	0.2	0.3	0.2	NS

off site 1800

Gerald Bachsdell

On site 1405
AB-38
Background 0.2
partly Cloudy 65°F

Time	Depth	PID	Cold	Hot		Sample
1410	1'	—	0.2	0.2		NS
1415	4-6	0.2	0.2	0.2		NS
1420	9-11	0.2	0.2	0.2		NS
1430	14-16	0.2	low recovery		all to seo	

Onsite 1445
AB-39
Background 0.3
Partly Cloudy 65°F

Time	depth	PID	Cold	Hot		Sample
1450	1'	~~0.3~~	0.3	0.4		NS
1455	4-6	0.3	0.3	0.3		|
1505	9-11	0.3	0.4	0.4		|
1515	14-16	0.4	0.3	0.4		NS

June 2 02
on site 0900
Partly cloudy 60°F
Background 0.4
AB-41

Time	depth	PID	coll	Hot	Sample
0930	~~1-3'~~ 1.5-2.5	0.4	0.4	0.5	NS
0945	2.5-4.5	0.3	0.4	0.4	
1000	4.5-6.5	0.4	0.3	0.4	
1020	9-10.5	0.3	0.4	0.4	
1040	14-14.5	0.3	0.4	0.3	NS

AB-42
on Site 1200
Partly Cloudy 60°F
Background 0.6

Time	depth	PID	coll	Hot	Sample
1230	1'	—	0.3	0.3	NS
1235	4-6'	0.4	0.4	0.4	NS
1250	9-11	0.2	0.3	8.5	NS
1300	14-16	2.8	6.5	6.6	NS

on site 1430
AB-43
Background 0.2
rain 55°F

Time	Depth	PID	Coll	Hot	Sample
1600	1'	—	0.4	0.8	NS
1615	~~2.5-4.5~~ 3-5	—	0.4	0.4	NS
1625	8-10	0.3	0.4	0.6	-085C
1640	13-14	0.3	0.2	0.3	NS

on site 1730
AB-44
Background 0.2
partly cloudy 55°F

Time	depth	PID	Coll	Hot	Sample
1750	1'	—	0.2	0.3	NS
1755	4.5-6.5	0.3	0.3	0.3	NS
1800	9.5-11.5	0.3	0.3	0.3	NS
1816	14.5-16.5	0.3	0.3	0.3	NS

Geotech Arc 1.1.1/1

3 June 02
AB45
on site 1600
clear 65°F
Background 0.3

Time	depth	PIN	Cold	Hot	Sample
1610	1	—	0.2	0.4	NS
1616	4-6	0.3	0.2	0.2	NS
1625	9-11	0.3	0.3	0.3	NS
1630	14-16	0.3	0.2	0.3	NS

28

5 June 05
on site 0900
AB 46
light overcast 60°F
Background 0.5

Time	depth	PID	Cold	Hot	Sample
0920	1'	~~0.4~~	0.4	0.5	NS
0925	2-4	0.3	0.4	0.3	↓
0935	7-9	0.3	0.3	0.4	
0945	12-14	0.3	0.2	0.4	NS

on site 1100
AB-47
light overcast 60°F
Background 0.3

Time	depth	PID	Cold	Hot	Sample
1110	1'	—	0.3	0.5	NS
1115	4-6	0.3	0.4	0.4	NS
1120	9-11	0.3	0.3	0.4	NS
1130	14-16	0.4	0.3	0.3	NS

on site 1145
Clear 65°F
Background 0.3
~~partly cloud~~
AB-48

Time	depth	PID	Cold	Hot	Sample
1150	1'	–	0.3	0.4	NS
1155	4-6	0.4	0.4	0.3	↓
1200	9-11	0.3	0.3	0.3	
1210	14-16	0.4	0.4	0.3	NS

on site 1255
Clear 70°F
Background 0.2
AB-49

Time	depth	PID	Cold	Hot	Sample
1315	1'	–	0.3	0.4	NS
1320	4.5-6.5	0.2	0.3	0.2	↓
1330	9.5-10.5	0.3	0.3	0.2	
1345	14.5-16.5	0.2	0.2	0.3	

32

on site 1440
AB-50
Background 0.4
Cloudy 55°F

Time	depth	PID	Cold	Hot
1442	1'	—	0.4	0.6
1445	2.5-4.5	0.4	0.3	0.3
1450	7.5-9.5	0.3	0.3	0.3
1505	12.5-14.5	0.3	0.3	0.3

Sample
NS
↓
NS

on site 1530
AB-51
Background 0.2
light rain 55°F

Time	depth	PID	Cold	Hot
1540	1'	—	0.2	0.3
1545	4.5-6.5	0.2	0.2	0.2
1550	9.5-11.5	0.2	0.2	0.3
1555	14.5-16.5	0.1	0.2	0.3

33

6 June 02
on site 1100
AB-52
Partly cloudy 60°F
Background 0.7

Time	depth	PID	Cold	Hot	Sample
1130	1'	—	0.6	0.7	NS
1135	4.5-6.5	0.6	0.5	0.5	-10SL
1145	9.5-11.5	0.5	0.6	0.5	NS
1200	14.5-16.5	0.5	0.5	0.5	

on site 1300
AB-53
Clear 65°F
Background 0.3

Time	depth	PID	Cold	Hot	Sample
1310	1'	~~2.~~	2.7	12.0	
1320	4.5-6.5	0.3	0.3	0.3	-11,-12SL
1330	9.5-11.5	0.4	0.3	0.4	
1340	14.5-16.5	0.3	0.3	0.4	

DURAble® WATERPROOF

LEVEL

Waterproof Notebook
No. 611

EIE174

Charley Peyton

2-July-2002 thru

4 5/8" x 7" - 48 Numbered Pages

4-Jul-2002 Partly Cloudy ~50°F

0815 Arrived @ Eielson, parked @ Apron Area.

0915: Rig set @ AB54; HNu checked, zeroed Calibrated to 160 on 100 ppm calgas (iso-butylene)

0935: Went to Fire Dept. to Fill tank w/ H_2O

1005: Collected grab @ surface of AB54. → Table

1[illegible]5: Rig set @ AB55; → Table

1225: Rig set @ AB56 → Table

1307: Drill rig refueled w/ Diesel

1407: Rig set @ AB57 → Table (AB54-AB57 in near line)

1517: Rig set @ AB58 → Table

1610: Drummed cuttings from AB58

Sample	Time Collected	HHS Time HNu'd	Reading	
AB54 surface	1005	1020	0	sand gravel mix
AB54-5'	1015	1033	0	sand gravel mix
54-10'	1025	1043	0	sandy fine mix
54-15'	1040	1055	0	wood, ice in gravel mix
55-surf	1120	1135	6	Ship QC
55-5'	1131	1147	0.0	
55-10'	1140	1157	0.0	
55-15'	1151	1206	0.0	
56-surf	1305	1318	0.0	
56-5'	1316	1332	2.4	
56-10'	1323	1333	0.0	
56-15'	1331	1346	0.0	
57-surf	1414	1429	6.8	Ship
57-5'	1427	1446	8.1	Ship
57-10'	1435	1459	3.8	Ship
57-15'	1443	15:02	8.8	Ship
Empty Bag	—	15:03	0.0	
58-surf	1529	~~1527~~ 1542	120.	Ship QC
58-5'	1534	1545	4.4	Ship
58-10'	~~14~~ 1540	1556	0.0	
58-15'	1553	1607	0.0	

5-Jul-02

Steady Rain
~50°F

0830 Arrive @ Apron. Try to locate 3 missing marks.

0947 Set Rig @ AB59
0951: Calibrated HNU →

1205: Set Rig @ AB60 →

1410: Set Rig @ AB61 →

Sample	Time Collected	Time Hrs HNUd	Reading	
59-surf	1004	1022	11.2	Ship Cuttings drummed
59-5'	1021	1037	3.8	~~Ship~~
59-10'	1032	1051	4.8	~~Ship~~
59-15'	1049	1104	9.8	Ship
60-surf	1251	1310	0.2	
60-5'	1259	1327	0.0	
60-10'	1308	~~1328~~	0.0	
60-15'	1333	1346	0.0	
61-surf	1423	1446	~~0.6~~ 0.6	
61-5'	1433	1448	0.2	
61-10'	1444	1505	0.0	
61-15'	1503	1643	0.0	

6-5-1-02 Cloudy ~ 45°F

0830: Arrive @ Apron; SH & BT w drill set @ AB 62

0840: DEET applied lightly to Chemist CP

0845: HNAD Calibrated →

0915-0940: New bit Fabricated; old one getting stuck

0945: Drilling resumed →

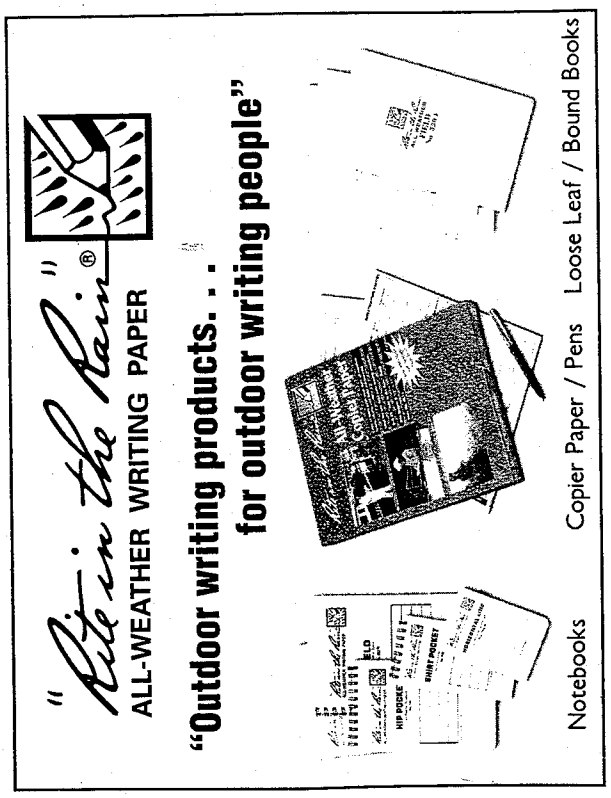
1050: Rig set @ AB 63 →
Drilled AB62 continuous for (0'-6')

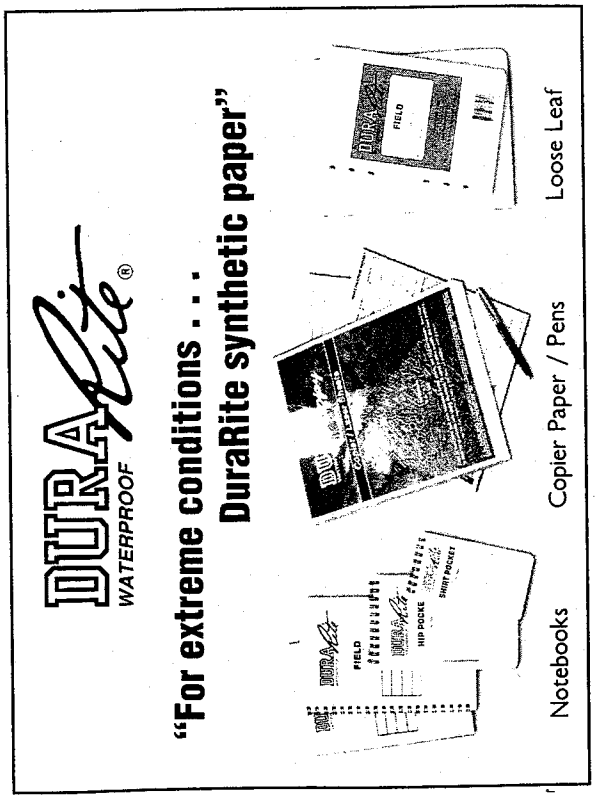
1155 Rain started; intermittant for PM

1230 set rig @ AB-64 →

1335 Set rig @ AB-65 →
AB5 surface sniff: 150ppm →

Sample	Time collected	Time HNAD	PPM Reading	
~~0850~~				
62-surf	0850	0909	0.8	
62-5'	0908	0921	0.2	
62-10'	0954	1007	0.0	
62-15'	1005	1021	0.2	
63-surf	1109	1124	38.	From 0-2 split spoon possible fuel odor (Ship)
63-5'	1129	1143	0.6	from 4-6 split spoon (Ship) normal
63-10'	1140	1154	0.2	
63-15'	1152	1208	0.2	normal
64-surf	1244	1253	0.0	
64-5'	1251	0.2 ⟷	1257	
64-10'	1259	1315	0.2	
64-15'	1306	1318	0.0	
65-surf	1350	1403	3.4	(Ship)
65-5'	1401	1416	0.0	
65-10'	1411	1426	0.2	
65-15'	1423	1438	0.2	





Sample Key

02PARK3150	AB58 - surface	4-Jul-02	1529
32	AB58 - surface QC	4-Jul-02	"1605"
33	AB58 - 5'	4-Jul-02	1534
34	AB57 - surface	4-Jul-02	1414

Appendix B

Soils and Geology Section

Soil Boring Logs

ALASKA DISTRICT
CORPS OF ENGINEERS
ENGINEERING SERVICES

Soils and Geology Section

EXPLORATION LOG

Project: *Expand and Repair Refueling Apron (EIE174)*
Eielson Air Force Base, Alaska

Page 1 of 1
Date: *15 May 2002*

Drilling Agency: ☒ Alaska District ☐ Other

Elevation Datum: ☒ MSL ☐ other

Location: Northing: *3,892,505 ft.* Easting: *1,472,529 ft.*

Top of Hole Elevation: *552.7 ft.*

Hole Number, Field: *AB-1* Permanent: *AP-5297*

Operator: *William Tester*

Inspector: *Robert Weakland*

Type of Hole: ☐ other _____
☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: *7.5 ft. AD*

Depth Drilled: *14.5 ft.*

Total Depth: *16.5 ft.*

Hammer Weight: *340 lbs*

Split Spoon I.D: *2.5 in.*

Size and Type of Bit: *8-in HSA w/Bullet Bit*

Type of Equipment: *CME 850 with Automatic Hammer*

Type of Samples: *Grab and Drive*

Depth (ft.)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	Grain Size %Gravel	%Sand	%Fines	Max Size (in.)	PID (ppm)	% Water	Description and Remarks Surface: low cut vegetation
2		1		F4	Grab	ML	SILT with Sand	9	39	52	0.5	0.3	20	Brown, moist, fine sand, nonplastic (NP) fines
6		2		S2	2 2 3 4	SM	Silty SAND	4	63	33	2.5	0.3	30	Brown, moist, fine sand, NP fines, wood
10		3		NFS	3 2 4 7	GW	Well-graded GRAVEL with Sand	74	24	2	2.5			Brown to gray, wet, angular to subrounded gravel, medium to coarse sand
16		4			4 4 7 5	SP	Poorly graded SAND	12	85	3	2.5			Gray, wet, medium sand
18														Bottom of Hole 16.5 ft. Elevation 536.2 ft. Groundwater Encountered After Drilling: at depth 7.5 ft. PID = (Hot) Photo Ionization Detector

EXPLORATION LOG EIE174.GPJ ACE_ANC.GDT 3/24/03

NPA Form 19-E
May 94 Prev. Ed. Obsolete

Project: *Expand and Repair Refueling Apron (EIE174)*

Hole Number: *AP-5297*

ALASKA DISTRICT
CORPS OF ENGINEERS
ENGINEERING SERVICES

Soils and Geology Section
EXPLORATION LOG

Project: *Expand and Repair Refueling Apron (EIE174)*
Eielson Air Force Base, Alaska

Page 1 of 1
Date: *16 May 2002*

Drilling Agency: ☒ Alaska District ☐ Other

Elevation Datum: ☒ MSL ☐ other

Location: Northing: *3,892,628 ft.* Easting: *1,472,606 ft.*

Top of Hole Elevation: *552.5 ft.*

Hole Number, Field: *AB-2* Permanent: *AP-5298*

Operator: *William Tester*

Inspector: *Steven Henslee*

Type of Hole: ☐ other _____
☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: *3.3 ft. WD*

Depth Drilled: *13.0 ft.*

Total Depth: *15.0 ft.*

Hammer Weight: *340 lbs*

Split Spoon I.D: *2.5 in.*

Size and Type of Bit: *8-in HSA w/Bullet Bit*

Type of Equipment: *CME 850 with Automatic Hammer*

Type of Samples: *Grab and Drive*

Depth (ft.)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	%Gravel	%Sand	%Fines	Max Size (in.)	PID (ppm)	% Water	Description and Remarks
						ASPH	Asphalt							Surface: 3 in of A.C. pavement
		1		NFS	Grab	GW	Well-graded GRAVEL with Sand	62	33	5	2	0.6	6	Brown, moist, subrounded to rounded gravel, medium sand, FILL
2		2		PFS	5 7 6 4	GP	Poorly graded GRAVEL with Sand	57	38	5	2	0.5	4	Brown, moist, subrounded to rounded gravel, medium sand, FILL
4														
6														
		3	Nbn	NFS	8 14 22 26	SP	Poorly graded SAND					0.3		Gray, frozen, medium sand
8														
10														
12														
		4		NFS	4 8 11 14	SP	Poorly graded SAND with Gravel				1.75			Gray, wet, subrounded gravel, fine to coarse sand
14														
16														Bottom of Hole 15.0 ft. Elevation 537.5 ft. Groundwater Encountered While Drilling: at depth 3.3 ft. PID = (Hot) Photo Ionization Detector
18														

EXPLORATION LOG EIE174.GPJ ACE_ANC.GDT 3/24/03

NPA Form 19-E
May 94 Prev. Ed. Obsolete

Project: *Expand and Repair Refueling Apron (EIE174)*

Hole Number: *AP-5298*

ALASKA DISTRICT
CORPS OF ENGINEERS
ENGINEERING SERVICES

Soils and Geology Section

EXPLORATION LOG

Project: *Expand and Repair Refueling Apron (EIE174)*
Eielson Air Force Base, Alaska

Page 1 of 1
Date: *16 May 2002*

Drilling Agency: ☒ Alaska District ☐ Other

Elevation Datum: ☒ MSL ☐ other

Location: Northing: *3,892,296 ft.* Easting: *1,472,789 ft.*

Top of Hole Elevation: *553.0 ft.*

Hole Number, Field: *AB-3* Permanent: *AP-5299*

Operator: *William Tester*

Inspector: *Steven Henslee*

Type of Hole: ☐ other ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: *7.5 ft. WD*

Depth Drilled: *13.0 ft.*

Total Depth: *15.0 ft.*

Hammer Weight: *340 lbs*

Split Spoon I.D: *2.5 in.*

Size and Type of Bit: *8-in HSA w/Bullet Bit*

Type of Equipment: *CME 850 with Automatic Hammer*

Type of Samples: *Grab and Drive*

Depth (ft.)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	%Gravel	%Sand	%Fines	Max Size (in.)	PID (ppm)	% Water	Description and Remarks
						ASPH	Asphalt							Surface: 3 in of A.C. pavement
		1		F3	Grab	SM	Silty SAND with Gravel	17	39	44	0.75	0.4	16	Brown, moist, fine sand, nonplastic (NP) fines, FILL
2														
4					9									
		2	Nbn	NFS	27 38 48	SP	Poorly graded SAND with Gravel				1.5	0.4		Gray, frozen, subrounded to rounded gravel, medium to coarse sand
6														
8														
			Nbn	NFS	12 23 38 45	SP	Poorly graded SAND				1.5			Gray, frozen, fine to medium sand
10		3												
12														
		4		NFS	7 7 5 4	GP	Poorly graded GRAVEL with Sand				2			Gray, wet, subrounded to rounded gravel, medium to coarse sand
14														
16														Bottom of Hole 15.0 ft. Elevation 538.0 ft. Groundwater Encountered While Drilling: at depth 7.5 ft. PID = (Hot) Photo Ionization Detector
18														

EXPLORATION LOG EIE174.GPJ ACE_ANC.GDT 3/24/03

NPA Form 19-E
May 94 Prev. Ed. Obsolete

Project: *Expand and Repair Refueling Apron (EIE174)*

Hole Number: *AP-5299*

ALASKA DISTRICT
CORPS OF ENGINEERS
ENGINEERING SERVICES

Soils and Geology Section

EXPLORATION LOG

Project: *Expand and Repair Refueling Apron (EIE174)*
Eielson Air Force Base, Alaska

Page 1 of 1
Date: *20 May 2002*

Drilling Agency: ☒ Alaska District ☐ Other

Elevation Datum: ☒ MSL ☐ other

Location: Northing: *3,891,999 ft.* Easting: *1,473,362 ft.*

Top of Hole Elevation: *551.7 ft.*

Hole Number, Field: *AB-4* Permanent: *AP-5300*

Operator: *William Tester*

Inspector: *Steven Henslee*

Type of Hole: ☐ other ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: *8.5 ft. WD*

Depth Drilled: *7.5 ft.*

Total Depth: *9.5 ft.*

Hammer Weight: *340 lbs*

Split Spoon I.D: *2.5 in.*

Size and Type of Bit: *8-in HSA w/Bullet Bit*

Type of Equipment: *CME 850 with Automatic Hammer*

Type of Samples: *Grab and Drive*

Depth (ft.)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	%Gravel	%Sand	%Fines	Max Size (in.)	PID (ppm)	% Water	Description and Remarks Surface: low cut vegetation
		1	Nbn	F4	Grab	ML	Sandy SILT					5.0		Brown, moist to frozen, subrounded to rounded gravel, fine sand, nonplastic (NP) fines, FILL
2														
4														
6														
8		2			8 10 10 9	OH	Organic SOIL					165.0	▼	Organics with wood chips, strong petroleum odor, this boring in a known area of contamination, FILL
10														Bottom of Hole 9.5 ft. Elevation 542.2 ft. Groundwater Encountered While Drilling: at depth 8.5 ft. PID = (Hot) Photo Ionization Detector
12														
14														
16														
18														

EXPLORATION LOG EIE174.GPJ ACE_ANC.GDT 3/24/03

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Project: *Expand and Repair Refueling Apron (EIE174)*

Hole Number: *AP-5300*

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EXPLORATION LOG

Project: *Expand and Repair Refueling Apron (EIE174)*
Eielson Air Force Base, Alaska

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Date: *17 May 2002*

Drilling Agency: ☒ Alaska District ☐ Other

Elevation Datum: ☒ MSL ☐ other

Location: Northing: *3,891,891 ft.* Easting: *1,473,256 ft.*

Top of Hole Elevation: *553.6 ft.*

Hole Number, Field: *AB-5* Permanent: *AP-5301*

Operator: *William Tester*

Inspector: *Steven Henslee*

Type of Hole: ☐ other ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: *NE*

Depth Drilled: *14.0 ft.*

Total Depth: *15.0 ft.*

Hammer Weight: *340 lbs*

Split Spoon I.D: *2.5 in.*

Size and Type of Bit: *8-in HSA w/Bullet Bit*

Type of Equipment: *CME 850 with Automatic Hammer*

Type of Samples: *Grab and Drive*

Depth (ft.)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	Grain Size %Gravel	%Sand	%Fines	Max Size (in.)	PID (ppm)	% Water	Description and Remarks
						ASPH	Asphalt							Surface: 5 in of A.C. pavement
		1		PFS	Grab	SP-SM	Poorly graded SAND with Silt and Gravel				0.75	0.4		Brown, moist, subrounded to angular gravel, fine to coarse sand, nonplastic (NP) fines, FILL
2														
4		2		PFS	17 25 26 24	GW-GM	Well-graded GRAVEL with Silt and Sand	58	35	7	0.75	0.4	5	Brown, moist, subangular to subrounded gravel, medium to coarse sand, possible Fill
6														
8														
		3	Nbn	NFS	12 65 41/3 in	GW	Well-graded GRAVEL with Sand				0.5			Brown, frozen, rounded gravel, fine to coarse sand
10														
12														
14		4	Nbn		20 75	GW	Well-graded GRAVEL with Sand				2.25			Brown, frozen, subrounded to rounded gravel, fine to medium sand
16														Bottom of Hole 15.0 ft. Elevation 538.6 ft. Groundwater Not Encountered PID = (Hot) Photo Ionization Detector
18														

EXPLORATION LOG EIE174.GPJ ACE_ANC.GDT 3/24/03

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Project: *Expand and Repair Refueling Apron (EIE174)*

Hole Number: *AP-5301*

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Project: *Expand and Repair Refueling Apron (EIE174)*
Eielson Air Force Base, Alaska

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Date: *17 May 2002*

Drilling Agency: ☒ Alaska District ☐ Other

Elevation Datum: ☒ MSL ☐ other

Location: Northing: *3,891,891 ft.* Easting: *1,473,256 ft.*

Top of Hole Elevation: *553.6 ft.*

Hole Number, Field: *AB-5* Permanent: *AP-5301*

Operator: *William Tester*

Inspector: *Steven Henslee*

Type of Hole: ☐ other ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: *NE*

Depth Drilled: *14.0 ft.*

Total Depth: *15.0 ft.*

Hammer Weight: *340 lbs*

Split Spoon I.D: *2.5 in.*

Size and Type of Bit: *8-in HSA w/Bullet Bit*

Type of Equipment: *CME 850 with Automatic Hammer*

Type of Samples: *Grab and Drive*

Depth (ft.)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	Grain Size %Gravel	%Sand	%Fines	Max Size (in.)	PID (ppm)	% Water	Description and Remarks
						ASPH	Asphalt							Surface: 5 in of A.C. pavement
		1		PFS	Grab	SP-SM	Poorly graded SAND with Silt and Gravel				0.75	0.4		Brown, moist, subrounded to angular gravel, fine to coarse sand, nonplastic (NP) fines, FILL
2														
4		2		PFS	17 25 26 24	GW-GM	Well-graded GRAVEL with Silt and Sand	58	35	7	0.75	0.4	5	Brown, moist, subangular to subrounded gravel, medium to coarse sand, possible Fill
6														
8														
10		3	Nbn	NFS	12 65 41/3 in	GW	Well-graded GRAVEL with Sand				0.5			Brown, frozen, rounded gravel, fine to coarse sand
12														
14		4	Nbn		20 75	GW	Well-graded GRAVEL with Sand				2.25			Brown, frozen, subrounded to rounded gravel, fine to medium sand
16														Bottom of Hole 15.0 ft. Elevation 538.6 ft. Groundwater Not Encountered PID = (Hot) Photo Ionization Detector
18														

EXPLORATION LOG EIE174.GPJ ACE_ANC.GDT 3/24/03

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Project: *Expand and Repair Refueling Apron (EIE174)*

Hole Number: *AP-5301*

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Project: *Expand and Repair Refueling Apron (EIE174)*
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Date: *16 May 2002*

Drilling Agency: ☒ Alaska District ☐ Other

Elevation Datum: ☒ MSL ☐ other

Location: Northing: *3,891,976 ft.* Easting: *1,473,148 ft.*

Top of Hole Elevation: *553.7 ft.*

Hole Number, Field: *AB-6* Permanent: *AP-5302*

Operator: *William Tester*

Inspector: *Steven Henslee*

Type of Hole: ☐ other ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: *14.2 ft. WD*

Depth Drilled: *14.0 ft.*

Total Depth: *15.5 ft.*

Hammer Weight: *340 lbs*

Split Spoon I.D: *2.5 in.*

Size and Type of Bit: *8-in HSA w/Bullet Bit*

Type of Equipment: *CME 850 with Automatic Hammer*

Type of Samples: *Grab and Drive*

Depth (ft.)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	Grain Size %Gravel	%Sand	%Fines	Max Size (in.)	PID (ppm)	% Water	Description and Remarks
						ASPH	Asphalt							Surface: 6 in of A.C. pavement
		1		NFS	Grab	SP	Poorly graded SAND with Gravel				1	0.4		Brown, moist, subrounded to rounded gravel, fine to coarse sand, FILL
2														
4		2		PFS	18 27 23 24	GP-GM	Poorly graded GRAVEL with Silt and Sand	50	42	8	2.5	0.5	4	Brown, moist, subrounded to rounded gravel, coarse sand
6														
8														
		3		PFS	61 10/0 in	GP-GM	Poorly graded GRAVEL with Silt, Sand, and Cobbles				>3			Brown, wet, subrounded to rounded gravel, fine to coarse sand
10														
12														
14		4		PFS	23 46 48 10/0 in	GW-GM	Well-graded GRAVEL with Silt, Sand, and Cobbles	48	43	9	>3		6	Gray to brown, wet, subangular to subrounded gravel, medium to coarse sand, shoe blocked by cobble
16														Bottom of Hole 15.5 ft. Elevation 538.2 ft. Groundwater Encountered While Drilling: at depth 14.2 ft. PID = (Hot) Photo Ionization Detector
18														

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Project: *Expand and Repair Refueling Apron (EIE174)*

Hole Number: *AP-5302*

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Date: *18 May 2002*

Drilling Agency: ☒ Alaska District ☐ Other

Elevation Datum: ☒ MSL ☐ other

Location: Northing: *3,892,524 ft.* Easting: *1,472,236 ft.*

Top of Hole Elevation: *553.8 ft.*

Hole Number, Field: *AB-8* Permanent: *AP-5303*

Operator: *William Tester*

Inspector: *Steven Henslee*

Type of Hole: ☐ other ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: *14.2 ft. WD*

Depth Drilled: *14.0 ft.*

Total Depth: *15.5 ft.*

Hammer Weight: *340 lbs*

Split Spoon I.D.: *2.5 in.*

Size and Type of Bit: *8-in HSA w/Bullet Bit*

Type of Equipment: *CME 850 with Automatic Hammer*

Type of Samples: *Grab and Drive*

Depth (ft.)	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	%Gravel	%Sand	%Fines	Max Size (in.)	PID (ppm)	% Water	Description and Remarks
					ASPH	Asphalt							Surface: 5 in of asphalt pavment
	1		PFS	Grab	SP	Poorly graded SAND with Gravel				0.75	0.5		Brown, moist, rounded gravel, fine to medium sand, FILL
4	2		PFS	18 25 34 30	GP-GM	Poorly graded GRAVEL with Silt and Sand	55	38	7	2.5	0.4	4	Brown, moist, subrounded to rounded gravel, fine to medium sand
10	3		PFS	45 50/3 in	GP-GM	Poorly graded GRAVEL with Silt, Sand, and Cobbles				>3	0.3		Brown, moist, subangular to subrounded gravel, medium to coarse sand
14	4		PFS	23 80 86	GP-GM	Poorly graded GRAVEL with Silt, Sand, and Cobbles				>3	0.3	▼	Gray, wet, subrounded gravel, medium to coarse sand
16													Bottom of Hole 15.5 ft. Elevation 538.3 ft. Groundwater Encountered While Drilling: at depth 14.2 ft. PID = (Hot) Photo Ionization Detector
18													

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Project: *Expand and Repair Refueling Apron (EIE174)*

Hole Number: *AP-5303*

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Date: *18 May 2002*

Drilling Agency: ☒ Alaska District ☐ Other

Elevation Datum: ☒ MSL ☐ other

Location: Northing: *3,892,639 ft.* Easting: *1,470,515 ft.*

Top of Hole Elevation: *549.5 ft.*

Hole Number, Field: *AB-9* Permanent: *AP-5304*

Operator: *William Tester*

Inspector: *Steven Henslee*

Type of Hole: ☐ other ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: *8.5 ft. WD*

Depth Drilled: *13.0 ft.*

Total Depth: *15.0 ft.*

Hammer Weight: *340 lbs*

Split Spoon I.D: *2.5 in.*

Size and Type of Bit: *8-in HSA w/Bullet Bit*

Type of Equipment: *CME 850 with Automatic Hammer*

Type of Samples: *Grab and Drive*

Depth (ft.)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	%Gravel	%Sand	%Fines	Max Size (in.)	PID (ppm)	% Water	Description and Remarks
						ASPH	Asphalt							Surface: 5.5 in of asphalt pavment
2		1		NFS	Grab	SP	Poorly graded SAND with Gravel				0.75	0.6		Brown, moist, subrounded to rounded gravel, fine to medium sand
4		2		PFS	12 17 18 20	GP-GM	Poorly graded GRAVEL with Silt and Sand				2	0.4		Brown, moist, subangular to subrounded gravel, fine to medium sand, nonplastic (NP) fines
8		3	Nbn	PFS	27 100	GP-GM	Poorly graded GRAVEL with Silt and Sand	55	39	6	1		7	Brown, frozen, subrounded to rounded gravel, fine to coarse sand, NP fines
14		4		NFS	14 10 4 6	GP	Poorly graded GRAVEL with Sand	65	31	4	0.75			Brown, wet, subrounded to rounded gravel, fine to coarse sand
16														Bottom of Hole 15.0 ft. Elevation 534.5 ft. Groundwater Encountered While Drilling: at depth 8.5 ft. PID = (Hot) Photo Ionization Detector
18														

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Project: *Expand and Repair Refueling Apron (EIE174)*

Hole Number: *AP-5304*

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Date: *18 May 2002*

Drilling Agency: ☒ Alaska District ☐ Other

Elevation Datum: ☒ MSL ☐ other

Location: Northing: *3,892,701 ft.* Easting: *1,470,699 ft.*

Top of Hole Elevation: *551.6 ft.*

Hole Number, Field: *AB-10* Permanent: *AP-5305*

Operator: *William Tester*

Inspector: *Steven Henslee*

Type of Hole: ☐ other ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: *8.0 ft. WD*

Depth Drilled: *14.0 ft.*

Total Depth: *16.0 ft.*

Hammer Weight: *340 lbs*

Split Spoon I.D: *2.5 in.*

Size and Type of Bit: *8-in HSA w/Bullet Bit*

Type of Equipment: *CME 850 with Automatic Hammer*

Type of Samples: *Grab and Drive*

Depth (ft.)	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	%Gravel	%Sand	%Fines	Max Size (in.)	PID (ppm)	% Water	Description and Remarks
					ASPH	Asphalt							Surface: 6 in of A.C. pavement
	1		PFS	Grab	SP	Poorly graded SAND with Gravel				1	0.6		Brown, moist, subrounded to rounded gravel, fine to medium sand, FILL
4	2		PFS	7 11 10 9	GP-GM	Poorly graded GRAVEL with Silt and Sand	58	34	8	0.75	0.4	5	Brown, moist, subrounded to rounded gravel, fine to medium sand, nonplastic (NP) fines, possible FILL
10	3	Nf	S1	22 50 50/3 in	GW-GM	Well-graded GRAVEL with Silt and Sand	60	31	9	1.75			Gray, frozen, subrounded to rounded gravel, fine to coarse sand, NP fines
14	4			6 4 6 4	GW-GM	Well-graded GRAVEL with Silt and Sand				2.5			Brown, wet, subangular to rounded gravel, medium to coarse sand
16													Bottom of Hole 16.0 ft. Elevation 535.6 ft. Groundwater Encountered While Drilling: at depth 8.0 ft. PID = (Hot) Photo Ionization Detector

EXPLORATION LOG EIE174.GPJ ACE_ANC.GDT 3/24/03

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Project: *Expand and Repair Refueling Apron (EIE174)*

Hole Number: *AP-5305*

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Date: *19 May 2002*

Drilling Agency: ☒ Alaska District ☐ Other

Elevation Datum: ☒ MSL ☐ other

Location: Northing: *3,892,762 ft.* Easting: *1,470,852 ft.*

Top of Hole Elevation: *550.1 ft.*

Hole Number, Field: *AB-11* Permanent: *AP-5306*

Operator: *William Tester*

Inspector: *Steven Henslee*

Type of Hole: ☐ other ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: *5.9 ft. WD*

Depth Drilled: *14.0 ft.*

Total Depth: *16.0 ft.*

Hammer Weight: *340 lbs*

Split Spoon I.D: *2.5 in.*

Size and Type of Bit: *8-in HSA w/Bullet Bit*

Type of Equipment: *CME 850 with Automatic Hammer*

Type of Samples: *Grab and Drive*

Depth (ft.)	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	%Gravel	%Sand	%Fines	Max Size (in.)	PID (ppm)	% Water	Description and Remarks
					ASPH	Asphalt							Surface: 6 in of A.C. pavement
	1		PFS	Grab	GW-GM	Well-graded GRAVEL with Silt and Sand	60	35	5	1.5	1.0	2	Brown, moist, subrounded gravel, fine to medium sand, nonplastic (NP) fines, FILL
4	2	Nbn	NFS	6 7 12 26	SP	Poorly graded SAND							Brown, moist and frozen, medium sand
10	3	Vc	NFS	18 67 50/3 in	GP	Poorly graded GRAVEL with Sand	74	22	4	2		5	Brown to gray, frozen, subangular to rounded gravel, coarse sand, wood fragments
14	4		NFS	4 4 4 4	GP	Poorly graded GRAVEL with Sand				2			Gray, wet, subrounded gravel, coarse sand, part of sample washed out
16													Bottom of Hole 16.0 ft. Elevation 534.1 ft. Groundwater Encountered While Drilling: at depth 5.9 ft. PID = (Hot) Photo Ionization Detector

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Project: *Expand and Repair Refueling Apron (EIE174)*

Hole Number: *AP-5306*

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Eielson Air Force Base, Alaska

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Date: *19 May 2002*

Drilling Agency: ☒ Alaska District ☐ Other

Elevation Datum: ☒ MSL ☐ other

Location: Northing: *3,892,885 ft.* Easting: *1,471,192 ft.*

Top of Hole Elevation: *550.6 ft.*

Hole Number, Field: *AB-12* Permanent: *AP-5307*

Operator: *William Tester*

Inspector: *Steven Henslee*

Type of Hole: ☐ other ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: *NE*

Depth Drilled: *12.5 ft.*

Total Depth: *13.5 ft.*

Hammer Weight: *340 lbs*

Split Spoon I.D: *2.5 in.*

Size and Type of Bit: *8-in HSA w/Bullet Bit*

Type of Equipment: *CME 850 with Automatic Hammer*

Type of Samples: *Grab and Drive*

Depth (ft.)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	%Gravel	%Sand	%Fines	Max Size (in.)	PID (ppm)	% Water	Description and Remarks
						ASPH	Asphalt							Surface: 6 in of A.C. pavement
		1		PFS	Grab	GP-GM	Poorly graded GRAVEL with Silt and Sand				1	0.5		Brown, moist, subrounded to rounded gravel, fine to medium sand, nonplastic (NP) fines, FILL
2		2		NFS	5 14 16 15	GP-GM	Poorly graded GRAVEL with Silt and Sand	60	34	6	1.25	0.7	4	Brown, moist, subrounded to rounded gravel, fine to coarse sand, NP fines, 4-inch lense of black, fine sand at 3 feet with organic odor
4														
6														
		3	Nbn	PFS	34 75	GP-GM	Poorly graded GRAVEL with Silt and Sand				0.75			Brown to gray, wet to frozen, rounded gravel, fine to coarse sand, NP fines
8														
10														
12		4		PFS	15 75	GP-GM	Poorly graded GRAVEL with Silt and Sand				1			Gray, wet, subrounded to rounded gravel, fine to coarse sand, NP fines
14														Bottom of Hole 13.5 ft. Elevation 537.1 ft. Groundwater Not Encountered PID = (Hot) Photo Ionization Detector
16														
18														

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Project: *Expand and Repair Refueling Apron (EIE174)*

Hole Number: *AP-5307*

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Project: *Expand and Repair Refueling Apron (EIE174)*
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Date: *19 May 2002*

Drilling Agency: ☒ Alaska District ☐ Other

Elevation Datum: ☒ MSL ☐ other

Location: Northing: *3,892,936 ft.* Easting: *1,471,334 ft.*

Top of Hole Elevation: *551.0 ft.*

Hole Number, Field: *AB-13* Permanent: *AP-5308*

Operator: *William Tester*

Inspector: *Steven Henslee*

Type of Hole: ☐ other ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: *7.6 ft. WD*

Depth Drilled: *14.0 ft.*

Total Depth: *16.0 ft.*

Hammer Weight: *340 lbs*

Split Spoon I.D: *2.5 in.*

Size and Type of Bit: *8-in HSA w/Bullet Bit*

Type of Equipment: *CME 850 with Automatic Hammer*

Type of Samples: *Grab and Drive*

Depth (ft.)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	%Gravel	%Sand	%Fines	Max Size (in.)	PID (ppm)	% Water	Description and Remarks
						ASPH	Asphalt							Surface: 6 in of A.C. pavement
		1		PFS	Grab	SP	Poorly graded SAND with Gravel				0.75	0.3		Brown, moist, subrounded to rounded gravel, fine to medium sand, FILL
2														
4		2		NFS	5 6 6 10	GP	Poorly graded GRAVEL with Sand	63	33	4	2		6	Brown, wet, subrounded to rounded gravel, fine to medium sand
6														
8														
		3	Nbn	NFS	25 15/0 in	SP	Poorly graded SAND							Gray, frozen, medium sand
10														
12														
14		4		NFS	4 3 3 4	GP	Poorly graded GRAVEL with Sand	59	39	2	0.75			2 ft heaving sand Gray, wet, subrounded to rounded gravel, fine to medium sand
16														Bottom of Hole 16.0 ft. Elevation 535.0 ft. Groundwater Encountered While Drilling: at depth 7.6 ft. PID = (Hot) Photo Ionization Detector
18														

EXPLORATION LOG EIE174.GPJ ACE_ANC.GDT 3/24/03

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Project: *Expand and Repair Refueling Apron (EIE174)*

Hole Number: *AP-5308*

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Project: *Expand and Repair Refueling Apron (EIE174)*
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Date: *20 May 2002*

Drilling Agency: ☒ Alaska District ☐ Other

Elevation Datum: ☒ MSL ☐ other

Location: Northing: *3,891,649 ft.* Easting: *1,473,267 ft.*

Top of Hole Elevation: *551.5 ft.*

Hole Number, Field: *AB-14* Permanent: *AP--5309*

Operator: *William Tester*

Inspector: *Steven Henslee*

Type of Hole: ☐ other ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: *5.9 ft. AD*

Depth Drilled: *14.0 ft.*

Total Depth: *16.0 ft.*

Hammer Weight: *340 lbs*

Split Spoon I.D: *2.5 in.*

Size and Type of Bit: *8-in HSA w/Bullet Bit*

Type of Equipment: *CME 850 with Automatic Hammer*

Type of Samples: *Grab and Drive*

Depth (ft.)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	%Gravel	%Sand	%Fines	Max Size (in.)	PID (ppm)	% Water	Description and Remarks Surface: low cut vegetation
		1		F2	Grab	SP-SM	Poorly graded SAND with Silt					0.6		Brown, moist, fine sand, nonplastic (NP) fines
2														
4		2	Nbn	PFS	47 72	GW-GM	Well-graded GRAVEL with Silt and Sand	62	32	6	2	0.7	4	Gray, moist to frozen, subangular to rounded gravel, fine to coarse sand, gravel fractured while driving
6														
8														
		3a		NFS	6 10	SP	Poorly graded SAND							Gray, wet, medium sand
10		3b		NFS	11 13	SP	Poorly graded SAND with Gravel							Brown, wet, subrounded gravel, coarse sand. Encountered groundwater at 10 feet while drilling, level rose to 5.9 feet in less than 3 minutes, possible frozen layer from 9.5 to 10 feet, no evidence of frost in sample
12														
14		4		NFS	7 6 7 5	GP	Poorly graded GRAVEL with Sand and Cobbles	68	30	2	>3			6 in heaving sand Gray, wet, rounded gravel, medium to coarse sand
16														Bottom of Hole 16.0 ft. Elevation 535.5 ft. Groundwater Encountered After Drilling: at depth 5.9 ft. PID = (Hot) Photo Ionization Detector
18														

EXPLORATION LOG EIE174.GPJ ACE_ANC.GDT 3/24/03

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Project: *Expand and Repair Refueling Apron (EIE174)*

Hole Number: *AP--5309*

ALASKA DISTRICT
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EXPLORATION LOG

Project:	*Expand and Repair Refueling Apron (EIE174)* *Eielson Air Force Base, Alaska*
Page	1 of 1
Date:	*20 May 2002*
Drilling Agency:	☒ Alaska District ☐ Other
Elevation Datum:	☒ MSL ☐ other
Location:	Northing: *3,891,748 ft.* Easting: *1,473,155 ft.*
Top of Hole Elevation:	*551.2 ft.*
Hole Number, Field:	*AB-15*
Permanent:	*AP-5310*
Operator:	*William Tester*
Inspector:	*Steven Henslee*
Type of Hole:	☐ other ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer
Depth to Groundwater:	*5.4 ft. AD*
Depth Drilled:	*14.0 ft.*
Total Depth:	*16.0 ft.*
Hammer Weight:	*340 lbs*
Split Spoon I.D:	*2.5 in.*
Size and Type of Bit:	*8-in HSA w/Bullet Bit*
Type of Equipment:	*CME 850 with Automatic Hammer*
Type of Samples:	*Grab and Drive*

Depth (ft.)	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	%Gravel	%Sand	%Fines	Max Size (in.)	PID (ppm)	% Water	Description and Remarks Surface: low cut vegetation
	1		F4	Grab	ML	SILT with Sand				0.5	0.6		Brown, moist, rounded gravel, fine sand, nonplastic (NP) fines
2													
4	2		PFS	10 30 16 9	GW-GM	Well-graded GRAVEL with Silt and Sand				2	0.8	▼	Brown, moist to wet, subrounded to rounded gravel, fine to coarse sand
6													
8													
10	3	Nbn	NFS	8 5 5 5	GP	Poorly graded GRAVEL with Sand	64	32	4	2.25			Brown to gray, frozen, subrounded to rounded gravel, fine to medium sand
12													
14	4		NFS	8 4 3 3	SP	Poorly graded SAND with Gravel				1			Gray, wet, subrounded to rounded gravel, medium to coarse sand
16													Bottom of Hole 16.0 ft. Elevation 535.2 ft. Groundwater Encountered After Drilling: at depth 5.4 ft. PID = (Hot) Photo Ionization Detector
18													

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Project: *Expand and Repair Refueling Apron (EIE174)*

Hole Number: *AP-5310*

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Project: *Expand and Repair Refueling Apron (EIE174)*
Eielson Air Force Base, Alaska

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Date: *20 May 2002*

Drilling Agency: ☒ Alaska District ☐ Other

Elevation Datum: ☒ MSL ☐ other

Location: Northing: *3,891,847 ft.* Easting: *1,473,042 ft.*

Top of Hole Elevation: *551.9 ft.*

Hole Number, Field: *AB-16* Permanent: *AP-5311*

Operator: *William Tester*

Inspector: *Steven Henslee*

Type of Hole: ☐ other _____
☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: *7.6 ft. WD*

Depth Drilled: *13.0 ft.*

Total Depth: *15.0 ft.*

Hammer Weight: *340 lbs*

Split Spoon I.D: *2.5 in.*

Size and Type of Bit: *8-in HSA w/Bullet Bit*

Type of Equipment: *CME 850 with Automatic Hammer*

Type of Samples: *Grab and Drive*

Depth (ft.)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	%Gravel	%Sand	%Fines	Max Size (in.)	PID (ppm)	% Water	Description and Remarks Surface: low cut vegetation
		1		PFS	Grab	GP-GM	Poorly graded GRAVEL with Silt and Sand	54	40	6	0.5	0.3	3	Brown, moist, fine to medium sand, nonplastic (NP) fines
2														
4		2		PFS	10 11 13 14	GP-GM	Poorly graded GRAVEL with Silt and Sand	64	30	6	1	0.7	6	Brown, moist, subrounded to rounded gravel, medium to coarse sand
6														
8		3	Nbn	PFS	20 65	GP-GM	Poorly graded GRAVEL with Silt and Sand				1			Gray, frozen, rounded gravel, coarse sand
10														
12														
14		4		PFS	8 7 6 5	GP-GM	Poorly graded GRAVEL with Silt, Sand, and Cobbles				>3			Gray, wet, subrounded to rounded gravel, medium to coarse sand
16														Bottom of Hole 15.0 ft. Elevation 536.9 ft. Groundwater Encountered While Drilling: at depth 7.6 ft. PID = (Hot) Photo Ionization Detector
18														

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Project: *Expand and Repair Refueling Apron (EIE174)*

Hole Number: *AP-5311*

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Project: *Expand and Repair Refueling Apron (EIE174)*
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Date: *21 May 2002*

Drilling Agency: ☒ Alaska District ☐ Other

Elevation Datum: ☒ MSL ☐ other

Location: Northing: *3,891,721 ft.* Easting: *1,472,934 ft.*

Top of Hole Elevation: *551.5 ft.*

Hole Number, Field: *AB-17* Permanent: *AP-5312*

Operator: *William Tester*

Inspector: *Steven Henslee*

Type of Hole: ☐ other ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: *7.7 ft. WD*

Depth Drilled: *14.0 ft.*

Total Depth: *16.0 ft.*

Hammer Weight: *340 lbs*

Split Spoon I.D: *2.5 in.*

Size and Type of Bit: *8-in HSA w/Bullet Bit*

Type of Equipment: *CME 850 with Automatic Hammer*

Type of Samples: *Grab and Drive*

Depth (ft.)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	%Gravel	%Sand	%Fines	Max Size (in.)	PID (ppm)	% Water	Description and Remarks
														Surface: 3 in of A.C. pavement
		1		PFS	Grab	ASPH SP	Asphalt Poorly graded SAND with Gravel				0.75	0.5		Brown, moist, rounded gravel, medium to coarse sand, FILL
2														
4		2		PFS	17 45 65	GP	Poorly graded GRAVEL with Sand				2.5	0.4		Brown to gray, moist, subrounded to rounded gravel, medium sand
6														
8														
		3		PFS	22 12/0 in	GP-GM	Poorly graded GRAVEL with Silt, Sand, and Cobbles	62	33	5	>3			Brown, wet, subangular to subrounded gravel, medium sand
10														
12														
14		4			17 33 12 8	GP-GM	Poorly graded GRAVEL with Silt and Sand				2			Gray, wet, subrounded to rounded gravel, fine to coarse sand
16														
18														Bottom of Hole 16.0 ft. Elevation 535.5 ft. Groundwater Encountered While Drilling: at depth 7.7 ft. PID = (Hot) Photo Ionization Detector

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Project: *Expand and Repair Refueling Apron (EIE174)*

Hole Number: *AP-5312*

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Date: *21 May 2002*

Drilling Agency: ☒ Alaska District ☐ Other

Elevation Datum: ☒ MSL ☐ other

Location: Northing: *3,891,947 ft.* Easting: *1,472,701 ft.*

Top of Hole Elevation: *552.3 ft.*

Hole Number, Field: *AB-18* Permanent: *AP-5313*

Operator: *William Tester*

Inspector: *Steven Henslee*

Type of Hole: ☐ other _____
☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: *9.5 ft. WD*

Depth Drilled: *14.0 ft.*

Total Depth: *16.0 ft.*

Hammer Weight: *340 lbs*

Split Spoon I.D: *2.5 in.*

Size and Type of Bit: *8-in HSA w/Bullet Bit*

Type of Equipment: *CME 850 with Automatic Hammer*

Type of Samples: *Grab and Drive*

Depth (ft.)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	%Gravel	%Sand	%Fines	Max Size (in.)	PID (ppm)	% Water	Description and Remarks
						ASPH	Asphalt							Surface: 3 in of A.C. pavement
2		1		NFS	Grab	SP	Poorly graded SAND with Gravel and Cobbles				>3	1.4		Brown, moist, subrounded to rounded gravel, fine to medium sand, FILL
4, 6, 8		2		NFS	10 15 27 41	SP	Poorly graded SAND with Gravel				2.25			Brown, moist, subrounded to rounded gravel, medium to coarse sand
10, 12		3	Nbn	NFS	25 53 57	SP	Poorly graded SAND with Gravel	30	66	4	1.25		15 ▼	Gray, frozen, rounded gravel, fine to medium sand
14, 16		4		NFS	8 7 4 3	SP	Poorly graded SAND with Gravel				2			Gray, wet, subrounded to rounded gravel, fine to coarse sand
18														Bottom of Hole 16.0 ft. Elevation 536.3 ft. Groundwater Encountered While Drilling: at depth 9.5 ft. PID = (Hot) Photo Ionization Detector

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Project: *Expand and Repair Refueling Apron (EIE174)*

Hole Number: *AP-5313*

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Project: *Expand and Repair Refueling Apron (EIE174)*
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Date: *21 May 2002*

Drilling Agency: ☒ Alaska District ☐ Other

Elevation Datum: ☒ MSL ☐ other

Location: Northing: *3,892,067 ft.* Easting: *1,472,789 ft.*

Top of Hole Elevation: *552.7 ft.*

Hole Number, Field: *AB-19* Permanent: *AP-5314*

Operator: *William Tester*

Inspector: *Steven Henslee*

Type of Hole: ☐ other ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: *7.8 ft. WD*

Depth Drilled: *13.0 ft.*

Total Depth: *15.0 ft.*

Hammer Weight: *340 lbs*

Split Spoon I.D: *2.5 in.*

Size and Type of Bit: *8-in HSA w/Bullet Bit*

Type of Equipment: *CME 850 with Automatic Hammer*

Type of Samples: *Grab and Drive*

Depth (ft.)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	%Gravel	%Sand	%Fines	Max Size (in.)	PID (ppm)	% Water	Description and Remarks Surface: low cut vegetation
		1		F3	Grab	SM	Silty SAND with Gravel	18	36	46	0.5	0.9	16	Brown, moist, rounded gravel, fine sand, nonplastic (NP) fines
2		2		NFS	9 20 22 19	SP	Poorly graded SAND with Gravel				2	1.1		Gray, moist, subrounded to rounded gravel, fine sand
4														
6														
8		3	Nf	NFS	13 28 37 60	SP	Poorly graded SAND with Gravel				2	195.0	▼	Gray, moist to frozen, subrounded to rounded gravel, coarse sand, petroleum odor
10														
12														
14		4		NFS	9 9 9 8	GP	Poorly graded GRAVEL with Sand	61	36	3	1.75	2.8		Gray, wet, subrounded to rounded gravel, fine to coarse sand
16														Bottom of Hole 15.0 ft. Elevation 537.7 ft. Groundwater Encountered While Drilling: at depth 7.8 ft. PID = (Hot) Photo Ionization Detector
18														

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Project: *Expand and Repair Refueling Apron (EIE174)*

Hole Number: *AP-5314*

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Date: *22 May 2002*

Drilling Agency: ☒ Alaska District ☐ Other

Elevation Datum: ☒ MSL ☐ other

Location: Northing: *3,892,247 ft.* Easting: *1,472,170 ft.*

Top of Hole Elevation: *552.5 ft.*

Hole Number, Field: *AB-20* Permanent: *AP-5315*

Operator: *William Tester*

Inspector: *Steven Henslee*

Type of Hole: ☐ other ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: *8.9 ft. WD*

Depth Drilled: *14.0 ft.*

Total Depth: *16.0 ft.*

Hammer Weight: *340 lbs*

Split Spoon I.D: *2.5 in.*

Size and Type of Bit: *8-in HSA w/Bullet Bit*

Type of Equipment: *CME 850 with Automatic Hammer*

Type of Samples: *Grab and Drive*

Depth (ft.)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	Grain Size %Gravel	%Sand	%Fines	Max Size (in.)	PID (ppm)	% Water	Description and Remarks
														Surface: 3 in of A.C. pavement
		1		PFS	Grab	ASPH SP	Asphalt Poorly graded SAND with Gravel				0.75	2.4		Brown, moist, subrounded to rounded gravel, fine to medium sand, FILL
2														
4		2		F4	6 14 23 56/3	ML	Sandy SILT	6	32	62	1.5	0.5	26	Brown, moist to frozen, fine sand, nonplastic (NP) fines
6			Nbn											
8														
10		3		NFS	25 60	GP	Poorly graded GRAVEL with Sand and Cobbles				>3			Gray, frozen, subrounded gravel, medium sand
12														
14		4		NFS	4 6 5 3	GP	Poorly graded GRAVEL with Sand	62	35	3	2		8	Gray, wet, subrounded to rounded gravel, fine and coarse sand
16														Bottom of Hole 16.0 ft. Elevation 536.5 ft. Groundwater Encountered While Drilling: at depth 8.9 ft. PID = (Hot) Photo Ionization Detector
18														

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Project: *Expand and Repair Refueling Apron (EIE174)*

Hole Number: *AP-5315*

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Date: *22 May 2002*

Drilling Agency: ☒ Alaska District ☐ Other

Elevation Datum: ☒ MSL ☐ other

Location: Northing: *3,892,511 ft.* Easting: *1,471,792 ft.*

Top of Hole Elevation: *551.8 ft.*

Hole Number, Field: *AB-21* Permanent: *AP-5316*

Operator: *William Tester*

Inspector: *Steven Henslee*

Type of Hole: ☐ other ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: *7.1 ft. WD*

Depth Drilled: *14.0 ft.*

Total Depth: *16.0 ft.*

Hammer Weight: *340 lbs*

Split Spoon I.D: *2.5 in.*

Size and Type of Bit: *8-in HSA w/Bullet Bit*

Type of Equipment: *CME 850 with Automatic Hammer*

Type of Samples: *Grab and Drive*

Depth (ft.)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	%Gravel	%Sand	%Fines	Max Size (in.)	PID (ppm)	% Water	Description and Remarks
														Surface: 3 in of A.C. pavement
		1		PFS	Grab	ASPH GW-GM	Asphalt Well-graded GRAVEL with Silt and Sand				0.75	0.5		Brown, moist, subrounded to rounded gravel, fine to medium sand, nonplastic (NP) fines, FILL
2														
4		2		PFS	10 10 9 9	GW-GM	Well-graded GRAVEL with Silt, Sand, and Cobbles	55	37	8	>3	0.4	5	Brown, wet to moist, subrounded to rounded gravel, fine and coarse sand, NP fines, top of sample wet
6														
8														
		3	Nbn	NFS	19 62	GP	Poorly graded GRAVEL with Sand	61	36	3	2.25			Gray, frozen, subrounded to rounded gravel, fine and coarse sand
10														
12														
14		4		PFS	6 6 5 5	GP	Poorly graded GRAVEL with Sand				2			Gray, wet, subrounded to rounded gravel, fine to coarse sand
16														Bottom of Hole 16.0 ft. Elevation 535.8 ft. Groundwater Encountered While Drilling: at depth 7.1 ft. PID = (Hot) Photo Ionization Detector
18														

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Project: *Expand and Repair Refueling Apron (EIE174)*

Hole Number: *AP-5316*

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Project: *Expand and Repair Refueling Apron (EIE174)*
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Date: *22 May 2002*

Drilling Agency: ☒ Alaska District ☐ Other

Elevation Datum: ☒ MSL ☐ other

Location: Northing: *3,892,518 ft.* Easting: *1,471,618 ft.*

Top of Hole Elevation: *550.8 ft.*

Hole Number, Field: *AB-22* Permanent: *AP-5317*

Operator: *William Tester*

Inspector: *Steven Henslee*

Type of Hole: ☐ other ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: *NE*

Depth Drilled: *13.0 ft.*

Total Depth: *13.5 ft.*

Hammer Weight: *340 lbs*

Split Spoon I.D: *2.5 in.*

Size and Type of Bit: *8-in HSA w/Bullet Bit*

Type of Equipment: *CME 850 with Automatic Hammer*

Type of Samples: *Grab and Drive*

Depth (ft.)	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	%Gravel	%Sand	%Fines	Max Size (in.)	PID (ppm)	% Water	Description and Remarks
					ASPH	Asphalt							Surface: 6 in of A.C. pavement
	1		PFS	GRAB	GP-GM	Poorly graded GRAVEL with Silt and Sand				0.75	0.5		Brown, moist, subrounded to rounded gravel, fine to medium sand, nonplastic (NP) fines, FILL
	2		S1	13 20 22 23	GP-GM	Poorly graded GRAVEL with Silt and Sand	48	44	8	2	0.4	6	Brown, moist, subrounded to rounded gravel, fine sand
	3	Nf	S1	28 54/4 in	GW-GM	Well-graded GRAVEL with Silt and Sand	58	35	7	2.25	0.4	5	Gray, frozen, subrounded gravel, fine and coarse sand
	4		F1	34 12/0 in	GM	Silty GRAVEL with Sand and Cobbles				>3			Gray, wet, subrounded gravel, fine to medium sand, NP fines

Depth (ft.): 2, 4, 6, 8, 10, 12, 14, 16, 18

Bottom of Hole 13.5 ft.
Elevation 537.3 ft.
Groundwater Not Encountered
PID = (Hot) Photo Ionization Detector

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Project: *Expand and Repair Refueling Apron (EIE174)*

Hole Number: *AP-5317*

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Project: *Expand and Repair Refueling Apron (EIE174)*
Eielson Air Force Base, Alaska

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Date: *22 May 2002*

Drilling Agency: ☒ Alaska District ☐ Other

Elevation Datum: ☒ MSL ☐ other

Location: Northing: *3,892,800 ft.* Easting: *1,471,373 ft.*

Top of Hole Elevation: *550.3 ft.*

Hole Number, Field: *AB-23* Permanent: *AP-5318*

Operator: *William Tester*

Inspector: *Steven Henslee*

Type of Hole: ☐ other _____
☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: *NE*

Depth Drilled: *3.3 ft.*

Total Depth: *3.3 ft.*

Hammer Weight: *340 lbs*

Split Spoon I.D: *2.5 in.*

Size and Type of Bit: *8-in HSA w/Bullet Bit*

Type of Equipment: *CME 850 with Automatic Hammer*

Type of Samples: *Grab and Drive*

Depth (ft.)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	Grain Size %Gravel	%Sand	%Fines	Max Size (in.)	PID (ppm)	% Water	Description and Remarks Surface: 6 in of A.C. pavement
						ASPH	Asphalt							
		1				SP	Poorly graded SAND with Gravel				1	1.5		Brown, moist, subrounded to rounded gravel, fine to medium sand, nonplastic (NP) fines, FILL
2														
		2												Concrete utilidor
4														Bottom of Hole 3.3 ft. Elevation 547.1 ft. Groundwater Not Encountered PID = (Hot) Photo Ionization Detector
6														
8														
10														
12														
14														
16														
18														

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Project: *Expand and Repair Refueling Apron (EIE174)*

Hole Number: *AP-5318*

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Project: *Expand and Repair Refueling Apron (EIE174)*
Eielson Air Force Base, Alaska

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Date: *30 May 2002*

Drilling Agency: ☒ Alaska District ☐ Other

Elevation Datum: ☒ MSL ☐ other

Location: Northing: *3,891,996 ft.* Easting: *1,472,902 ft.*

Top of Hole Elevation: *553.9 ft.*

Hole Number, Field: *AB-24* Permanent: *AP-5319*

Operator: *William Tester*

Inspector: *Steven Henslee*

Type of Hole: ☐ other _____
☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: *6.6 ft. AD*

Depth Drilled: *14.5 ft.*

Total Depth: *16.5 ft.*

Hammer Weight: *340 lbs*

Split Spoon I.D: *2.5 in.*

Size and Type of Bit: *8-in HSA w/Bullet Bit*

Type of Equipment: *CME 850 with Automatic Hammer*

Type of Samples: *Grab and Drive*

Depth (ft.)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	%Gravel	%Sand	%Fines	Max Size (in.)	PID (ppm)	% Water	Description and Remarks
						ASPH	Asphalt							Surface: 6 in of A.C. pavement
2		1		S1	12 19 19	GW-GM	Well-graded GRAVEL with Silt and Sand	54	39	7	2	0.6	1	Brown, moist, subrounded gravel, fine to medium sand, nonplastic (NP) fines, FILL
4–6		2		PFS	13 20 25 26	GP-GM	Poorly graded GRAVEL with Silt and Sand	50	43	7	1	0.5	4	Brown, moist, subrounded gravel, fine to coarse sand, NP fines
10		3		PFS	33 55	GW-GM	Well-graded GRAVEL with Silt and Sand	61	32	7	2.5	0.4		Brown, wet, subangular to subrounded gravel, fine to coarse sand, NP fines
14–16		4	Vc	PFS	25 37 26 7	GW-GM	Well-graded GRAVEL with Silt and Sand				2	0.5		Gray, frozen to wet, subangular to rounded gravel, medium to coarse sand, NP fines, visible ice
18														Bottom of Hole 16.5 ft. Elevation 537.4 ft. Groundwater Encountered After Drilling: at depth 6.6 ft. PID = (Hot) Photo Ionization Detector

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Project: *Expand and Repair Refueling Apron (EIE174)*

Hole Number: *AP-5319*

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Soils and Geology Section

EXPLORATION LOG

Project: *Expand and Repair Refueling Apron (EIE174)*
Eielson Air Force Base, Alaska

Page 1 of 1
Date: *30 May 2002*

Drilling Agency: ☒ Alaska District ☐ Other

Elevation Datum: ☒ MSL ☐ other

Location: Northing: *3,891,876 ft.* Easting: *1,472,548 ft.*

Top of Hole Elevation: *551.6 ft.*

Hole Number, Field: *AB-25* Permanent: *AP-5320*

Operator: *William Tester*

Inspector: *Steven Henslee*

Type of Hole: ☐ other ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: *7.0 ft. WD*

Depth Drilled: *14.5 ft.*

Total Depth: *16.5 ft.*

Hammer Weight: *340 lbs*

Split Spoon I.D: *2.5 in.*

Size and Type of Bit: *8-in HSA w/Bullet Bit*

Type of Equipment: *CME 850 with Automatic Hammer*

Type of Samples: *Grab and Drive*

Depth (ft.)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	%Gravel	%Sand	%Fines	Max Size (in.)	PID (ppm)	% Water	Description and Remarks Surface: low cut vegetation
		1		PFS	Grab	GP	Poorly graded GRAVEL with Sand				1	0.4		Brown, moist, subrounded to rounded gravel, medium sand
2														
4														
		2		PFS	7 12 11 10	GP	Poorly graded GRAVEL with Sand	64	31	5	2.5	0.6	4	Brown, moist, subangular to rounded gravel, fine to coarse sand
6														
8														
10		3	Nbn	F2	14 22 50/3 in	SM	Silty SAND with Gravel	16	50	34	2	1.6	4	Gray, frozen, fine sand, nonplastic (NP) fines, 0.75 in diameter tree branch
12														
14														
		4		PFS	7 5 3 4	GP	Poorly graded GRAVEL with Sand				2.25	0.4		Gray, wet, subangular to subrounded gravel, medium to coarse sand
16														
18														Bottom of Hole 16.5 ft. Elevation 535.1 ft. Groundwater Encountered While Drilling: at depth 7.0 ft. PID = (Hot) Photo Ionization Detector

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Project: *Expand and Repair Refueling Apron (EIE174)*

Hole Number: *AP-5320*

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Project: *Expand and Repair Refueling Apron (EIE174)*
Eielson Air Force Base, Alaska

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Date: *30 May 2002*

Drilling Agency: ☒ Alaska District ☐ Other

Elevation Datum: ☒ MSL ☐ other

Location: Northing: *3,891,598 ft.* Easting: *1,472,941 ft.*

Top of Hole Elevation: *552.1 ft.*

Hole Number, Field: *AB-26* Permanent: *AP-5321*

Operator: *William Tester*

Inspector: *Steven Henslee*

Type of Hole: ☐ other ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: *7.0 ft. WD*

Depth Drilled: *14.5 ft.*

Total Depth: *16.5 ft.*

Hammer Weight: *340 lbs*

Split Spoon I.D: *2.5 in.*

Size and Type of Bit: *8-in HSA w/Bullet Bit*

Type of Equipment: *CME 850 with Automatic Hammer*

Type of Samples: *Grab and Drive*

Depth (ft.)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	%Gravel	%Sand	%Fines	Max Size (in.)	PID (ppm)	% Water	Description and Remarks
														Surface: low cut vegetation
		1		F4	Grab	ML	Sandy SILT		46	54		0.3	8	Brown, moist, fine sand, nonplastic (NP) fines
2														
4														
		2		NFS	10 7 6 6	GW	Well-graded GRAVEL with Sand	60	36	4	2.5	0.4	6	Brown, moist, subangular to rounded gravel, fine to coarse sand
6														
8														
10		3		PFS	8 7 6 5	GP-GM	Poorly graded GRAVEL with Silt, Sand, and Cobbles				>3	0.3		Gray, wet, subrounded to rounded gravel, medium sand, NP fines
12														
14														6 in heaving sand
		4		PFS	4 4 4 4	GP	Poorly graded GRAVEL with Sand and Cobbles				>3	0.3		Gray, wet, subrounded to rounded gravel, medium to coarse sand
16														
18														Bottom of Hole 16.5 ft. Elevation 535.6 ft. Groundwater Encountered While Drilling: at depth 7.0 ft. PID = (Hot) Photo Ionization Detector

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Project: *Expand and Repair Refueling Apron (EIE174)*

Hole Number: *AP-5321*

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Project: *Expand and Repair Refueling Apron (EIE174)*
Eielson Air Force Base, Alaska

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Date: *31 May 2002*

Drilling Agency: ☒ Alaska District ☐ Other

Elevation Datum: ☒ MSL ☐ other

Location: Northing: *3,891,612 ft.* Easting: *1,473,070 ft.*

Top of Hole Elevation: *553.6 ft.*

Hole Number, Field: *AB-27* Permanent: *AP-5322*

Operator: *William Tester*

Inspector: *Steven Henslee*

Type of Hole: ☐ other ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: *8.6 ft. WD*

Depth Drilled: *12.5 ft.*

Total Depth: *14.5 ft.*

Hammer Weight: *340 lbs*

Split Spoon I.D: *2.5 in.*

Size and Type of Bit: *8-in HSA w/Bullet Bit*

Type of Equipment: *CME 850 with Automatic Hammer*

Type of Samples: *Grab and Drive*

Depth (ft.)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	Grain Size %Gravel	%Sand	%Fines	Max Size (in.)	PID (ppm)	% Water	Description and Remarks
														Surface: low cut vegetation
		1		F2	Grab	SM	Silty SAND with Gravel				2	18.0		Brown, moist, subangular to rounded gravel, fine to medium sand, nonplastic (NP) fines, FILL
2		2	Nbn	F4	3 4 8 13	ML	SILT with Sand		27	73		0.6	23	Brown to red, moist to frozen, fine sand, NP fines
6														
8		3		NFS	12 8 7 5	SP	Poorly graded SAND with Gravel				2.5	0.7		Gray, wet, subrounded to rounded gravel, medium to coarse sand
10														
12														6 in heaving sand
14		4		NFS	3 6 6 6	GW	Well-graded GRAVEL with Sand and Cobbles	68	29	3	>3	0.6		Gray, wet, subrounded to rounded gravel, fine to coarse sand
16														Bottom of Hole 14.5 ft. Elevation 539.1 ft. Groundwater Encountered While Drilling: at depth 8.6 ft. PID = (Hot) Photo Ionization Detector
18														

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Project: *Expand and Repair Refueling Apron (EIE174)*

Hole Number: *AP-5322*

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Date: *31 May 2002*

Drilling Agency: ☒ Alaska District ☐ Other

Elevation Datum: ☒ MSL ☐ other

Location: Northing: *3,891,524 ft.* Easting: *1,473,190 ft.*

Top of Hole Elevation: *553.0 ft.*

Hole Number, Field: *AB-28* Permanent: *AP-5323*

Operator: *William Tester*

Inspector: *Steven Henslee*

Type of Hole: ☐ other ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: *5.8 ft. WD*

Depth Drilled: *9.5 ft.*

Total Depth: *11.5 ft.*

Hammer Weight: *340 lbs*

Split Spoon I.D: *2.5 in.*

Size and Type of Bit: *8-in HSA w/Bullet Bit*

Type of Equipment: *CME 850 with Automatic Hammer*

Type of Samples: *Grab and Drive*

Depth (ft.)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	%Gravel	%Sand	%Fines	Max Size (in.)	PID (ppm)	% Water	Description and Remarks Surface: low cut vegetation
2		1		PFS	Grab	SP	Poorly graded SAND with Gravel and Cobbles				>3	0.4		Brown, moist, rounded gravel, medium sand
4		2a		NFS	2 3	SP	Poorly graded SAND					0.6		Gray, moist, medium sand
6		2b		PFS	12 19	GP-GM	Poorly graded GRAVEL with Silt and Sand				2.5			Brown, moist, rounded gravel, fine to coarse sand
10		3	Vx	PFS	14 29 20 10	GP-GM	Poorly graded GRAVEL with Silt and Sand	65	30	5	1.75		9	Brown, moist to frozen, rounded gravel, fine to coarse sand
12														Bottom of Hole 11.5 ft. Elevation 541.5 ft. Groundwater Encountered While Drilling: at depth 5.8 ft. PID = (Hot) Photo Ionization Detector
14														
16														
18														

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Project: *Expand and Repair Refueling Apron (EIE174)*

Hole Number: *AP-5323*

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Date: *31 May 2002*

Drilling Agency: ☒ Alaska District ☐ Other

Elevation Datum: ☒ MSL ☐ other

Location: Northing: *3,891,424 ft.* Easting: *1,473,303 ft.*

Top of Hole Elevation: *552.0 ft.*

Hole Number, Field: *AB-29* Permanent: *AP-5324*

Operator: *William Tester*

Inspector: *Steven Henslee*

Type of Hole: ☐ other ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: *6.0 ft. WD*

Depth Drilled: *14.0 ft.*

Total Depth: *16.0 ft.*

Hammer Weight: *340 lbs*

Split Spoon I.D: *2.5 in.*

Size and Type of Bit: *8-in HSA w/Bullet Bit*

Type of Equipment: *CME 850 with Automatic Hammer*

Type of Samples: *Grab and Drive*

Depth (ft.)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	%Gravel	%Sand	%Fines	Max Size (in.)	PID (ppm)	% Water	Description and Remarks
														Surface: low cut vegetation
		1		F4	Grab	ML	SILT					0.2		Brown, moist, nonplastic (NP) fines
2			Nbn											Frozen between 18 and 24 in
4														
		2			10 9 10 8	NR	No Recovery				>3			No recovery, shoe blocked by cobble
6														
8														
		3		PFS	5 3 3 4	SP	Poorly graded SAND with Gravel and Cobbles				>3	0.3		Gray, wet, coarse sand, shoe blocked by cobble
10														
12														
14		4		PFS	5 6 7 6	SP	Poorly graded SAND with Gravel and Cobbles				>3	0.3		Gray, wet, rounded gravel, fine to coarse sand, gravel and cobbles fractured while driving.
16														Bottom of Hole 16.0 ft. Elevation 536.0 ft. Groundwater Encountered While Drilling: at depth 6.0 ft. PID = (Hot) Photo Ionization Detector
18														

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Project: *Expand and Repair Refueling Apron (EIE174)*

Hole Number: *AP-5324*

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EXPLORATION LOG

Project: *Expand and Repair Refueling Apron (EIE174)*
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Date: *31 May 2002*

Drilling Agency: ☒ Alaska District ☐ Other

Elevation Datum: ☒ MSL ☐ other

Location: Northing: *3,891,279 ft.* Easting: *1,473,441 ft.*

Top of Hole Elevation: *551.6 ft.*

Hole Number, Field: *AB-30* Permanent: *AP-5325*

Operator: *William Tester*

Inspector: *Steven Henslee*

Type of Hole: ☐ other ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: *6.0 ft. WD*

Depth Drilled: *13.0 ft.*

Total Depth: *15.0 ft.*

Hammer Weight: *340 lbs*

Split Spoon I.D: *2.5 in.*

Size and Type of Bit: *8-in HSA w/Bullet Bit*

Type of Equipment: *CME 850 with Automatic Hammer*

Type of Samples: *Grab and Drive*

Depth (ft.)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	%Gravel	%Sand	%Fines	Max Size (in.)	PID (ppm)	% Water	Description and Remarks
														Surface: low cut vegetation
		1		F4	Grab	ML	SILT					0.6		Brown, moist, nonplastic (NP) fines
2														
		2a	Nbn	NFS	7 16	SP	Poorly graded SAND					0.5		Gray, frozen, medium sand
4		2b	Nbn	NFS	9 3	GP	Poorly graded GRAVEL with Sand	61	35	4	1	0.5	7	Brown, frozen, subrounded to rounded gravel, fine and coarse sand
6														
8		3		NFS	5 3 4 5	GP	Poorly graded GRAVEL with Sand	56	40	4	1.5	0.2		Gray, wet, subangular to rounded gravel, fine and coarse sand, 3-in lense of medium sand
10														
12														1 ft heaving sand
14		4		F1	4 8 15 11	GM	Silty GRAVEL with Sand				2	0.2		Brown, wet, subangular to subrounded gravel, medium to coarse sand, NP fines
16														Bottom of Hole 15.0 ft. Elevation 536.6 ft. Groundwater Encountered While Drilling: at depth 6.0 ft. PID = (Hot) Photo Ionization Detector
18														

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Project: *Expand and Repair Refueling Apron (EIE174)*

Hole Number: *AP-5325*

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Project: *Expand and Repair Refueling Apron (EIE174)*
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Date: *31 May 2002*

Drilling Agency: ☒ Alaska District ☐ Other

Elevation Datum: ☒ MSL ☐ other

Location: Northing: *3,891,175 ft.* Easting: *1,473,535 ft.*

Top of Hole Elevation: *551.6 ft.*

Hole Number, Field: *AB-31* Permanent: *AP-5326*

Operator: *William Tester*

Inspector: *Steven Henslee*

Type of Hole: ☐ other ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: *7.0 ft. WD*

Depth Drilled: *14.0 ft.*

Total Depth: *16.0 ft.*

Hammer Weight: *340 lbs*

Split Spoon I.D: *2.5 in.*

Size and Type of Bit: *8-in HSA w/Bullet Bit*

Type of Equipment: *CME 850 with Automatic Hammer*

Type of Samples: *Grab and Drive*

Depth (ft.)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	%Gravel	%Sand	%Fines	Max Size (in.)	PID (ppm)	% Water	Description and Remarks
														Surface: low cut vegetation
		1		F3	Grab	SM	Silty SAND with Gravel	21	33	46	0.75	0.4	22	Brown, moist, fine sand, nonplastic (NP) fines
2														
4		2		S2	2 3 2 7	SM	Silty SAND		77	23		0.3	28	Gray to brown, moist, fine sand, 4 in lense of wood fragments
6														
8														
10		3		NFS	6 4 10 11	GP	Poorly graded GRAVEL with Sand and Cobbles				>3	1.2		Gray, wet, subrounded gravel, medium to coarse sand
12														
14		4		NFS	6 7 6 15	GP	Poorly graded GRAVEL with Sand and Cobbles				>3	2.6		Gray, wet, subangular to rounded gravel, medium to coarse sand
16														Bottom of Hole 16.0 ft. Elevation 535.6 ft. Groundwater Encountered While Drilling: at depth 7.0 ft. PID = (Hot) Photo Ionization Detector
18														

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Project: *Expand and Repair Refueling Apron (EIE174)*

Hole Number: *AP-5326*

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EXPLORATION LOG

Project:	*Expand and Repair Refueling Apron (EIE174)* *Eielson Air Force Base, Alaska*
Page	1 of 1
Date:	*31 May 2002*
Drilling Agency:	☒ Alaska District ☐ Other
Elevation Datum:	☒ MSL ☐ other
Location:	Northing: *3,891,056 ft.* Easting: *1,473,643 ft.*
Top of Hole Elevation:	*552.1 ft.*
Hole Number, Field:	*AB-32*
Permanent:	*AP-5327*
Operator:	*William Tester*
Inspector:	*Steven Henslee*
Type of Hole:	☐ other ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer
Depth to Groundwater:	*7.4 ft. WD*
Depth Drilled:	*14.5 ft.*
Total Depth:	*16.5 ft.*
Hammer Weight:	*340 lbs*
Split Spoon I.D:	*2.5 in.*
Size and Type of Bit:	*8-in HSA w/Bullet Bit*
Type of Equipment:	*CME 850 with Automatic Hammer*
Type of Samples:	*Grab and Drive*

Depth (ft.)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	Grain Size %Gravel	%Sand	%Fines	Max Size (in.)	PID (ppm)	% Water	Description and Remarks Surface: low cut vegetation
		1		NFS	Grab	SP	Poorly graded SAND with Gravel				0.75	0.4		Brown, moist, subrounded to rounded gravel, medium to coarse sand
2														
4		2	Nbn	NFS	3 16 12 5	SP	Poorly graded SAND	10	86	4		0.3	21	Gray, moist to frozen, fine sand
6														
8														
10		3		NFS	7 9 6 5	GP	Poorly graded GRAVEL with Sand	62	34	4	1.75	0.3		Gray, wet, subrounded to rounded gravel, fine to coarse sand
12														
14														
16		4		NFS	5 11 12 14	GP	Poorly graded GRAVEL with Sand				2	0.3		Gray, wet, subrounded to rounded gravel, medium to coarse sand
18														Bottom of Hole 16.5 ft. Elevation 535.6 ft. Groundwater Encountered While Drilling: at depth 7.4 ft. PID = (Hot) Photo Ionization Detector

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Project: *Expand and Repair Refueling Apron (EIE174)*

Hole Number: *AP-5327*

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Project: *Expand and Repair Refueling Apron (EIE174)*
Eielson Air Force Base, Alaska

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Date: *1 Jun 2002*

Drilling Agency: ☒ Alaska District ☐ Other

Elevation Datum: ☒ MSL ☐ other

Location: Northing: *3,890,933 ft.* Easting: *1,473,727 ft.*

Top of Hole Elevation: *554.6 ft.*

Hole Number, Field: *AB-33* Permanent: *AP-5328*

Operator: *William Tester*

Inspector: *Steven Henslee*

Type of Hole: ☐ other ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: *8.9 ft. WD*

Depth Drilled: *12.5 ft.*

Total Depth: *14.5 ft.*

Hammer Weight: *340 lbs*

Split Spoon I.D: *2.5 in.*

Size and Type of Bit: *8-in HSA w/Bullet Bit*

Type of Equipment: *CME 850 with Automatic Hammer*

Type of Samples: *Grab and Drive*

Depth (ft.)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	%Gravel	%Sand	%Fines	Max Size (in.)	PID (ppm)	% Water	Description and Remarks
														Surface: 2 in of A.C. pavement
		1		PFS	Grab	ASPH GP	Asphalt Poorly graded GRAVEL with Sand				1	2.2		Brown, moist, subrounded to rounded gravel, medium sand, FILL
2		2		NFS	5 7 7 12	SP	Poorly graded SAND				1.75	0.3		Brown, moist, medium sand, trace of wood fragments
4														
6														
8		3	Vx	NFS	4 21 34 50/5 in	SP	Poorly graded SAND with Gravel	45	51	4	0.75	0.2	9	Gray, frozen, subrounded gravel, fine to coarse sand, visible ice
10														
12		4			7 8 5 4	NR	No Recovery							No recovery
14														
16														Bottom of Hole 14.5 ft. Elevation 540.1 ft. Groundwater Encountered While Drilling: at depth 8.9 ft. PID = (Hot) Photo Ionization Detector
18														

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Project: *Expand and Repair Refueling Apron (EIE174)*

Hole Number: *AP-5328*

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Date: *1 Jun 2002*

Drilling Agency: ☒ Alaska District ☐ Other

Elevation Datum: ☒ MSL ☐ other

Location: Northing: *3,891,006 ft.* Easting: *1,473,802 ft.*

Top of Hole Elevation: *551.6 ft.*

Hole Number, Field: *AB-34* Permanent: *AP-5329*

Operator: *William Tester*

Inspector: *Steven Henslee*

Type of Hole: ☐ other ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: *7.6 ft. WD*

Depth Drilled: *14.5 ft.*

Total Depth: *16.5 ft.*

Hammer Weight: *340 lbs*

Split Spoon I.D: *2.5 in.*

Size and Type of Bit: *8-in HSA w/Bullet Bit*

Type of Equipment: *CME 850 with Automatic Hammer*

Type of Samples: *Grab and Drive*

Depth (ft.)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	%Gravel	%Sand	%Fines	Max Size (in.)	PID (ppm)	% Water	Description and Remarks Surface: low cut vegetation
2		1		S1	Grab	GP-GM	Poorly graded GRAVEL with Silt and Sand	46	43	11	0.75	0.4	3	Brown, moist, rounded gravel, fine sand, nonplastic (NP) fines
4, 6		2	Nbn	NFS	8 3 3 3	SP	Poorly graded SAND					0.4		Brown, frozen, medium sand
8, 10, 12		3		NFS	3 3 3 4	GP	Poorly graded GRAVEL with Sand	68	31	1	1.5	0.4		Gray, wet, subangular to subrounded gravel, fine to coarse sand
14, 16		4		NFS	6 4 2 3	SP	Poorly graded SAND							6 in heaving sand Gray, wet, fine to medium sand
18														Bottom of Hole 16.5 ft. Elevation 535.1 ft. Groundwater Encountered While Drilling: at depth 7.6 ft. PID = (Hot) Photo Ionization Detector

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Project: *Expand and Repair Refueling Apron (EIE174)*

Hole Number: *AP-5329*

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Date: *1 Jun 2002*

Drilling Agency: ☒ Alaska District ☐ Other

Elevation Datum: ☒ MSL ☐ other

Location: Northing: *3,891,124 ft.* Easting: *1,473,910 ft.*

Top of Hole Elevation: *552.5 ft.*

Hole Number, Field: *AB-35* Permanent: *AP-5330*

Operator: *William Tester*

Inspector: *Steven Henslee*

Type of Hole: ☐ other ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: *7.3 ft. WD*

Depth Drilled: *13.0 ft.*

Total Depth: *15.0 ft.*

Hammer Weight: *340 lbs*

Split Spoon I.D: *2.5 in.*

Size and Type of Bit: *8-in HSA w/Bullet Bit*

Type of Equipment: *CME 850 with Automatic Hammer*

Type of Samples: *Grab and Drive*

Depth (ft.)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	Grain Size %Gravel	%Sand	%Fines	Max Size (in.)	PID (ppm)	% Water	Description and Remarks Surface: low cut vegetation
		1		NFS	Grab	SP	Poorly graded SAND					0.4		Brown, moist, fine to medium sand
2														
4		2		NFS	3 3 4 8	SP-SM	Poorly graded SAND with Silt	6	89	5		0.4	5	Brown, moist, fine sand, organics
6														
8		3		NFS	5 11 11 13	GW	Well-graded GRAVEL with Sand	61	35	4	1	0.4		Gray, wet, subrounded to rounded gravel, fine to coarse sand
10														
12														
14		4		NFS	6 5 5 3	GP	Poorly graded GRAVEL with Sand and Cobbles				>3	0.4		Gray, wet, subangular to rounded gravel, fine to coarse sand
16														Bottom of Hole 15.0 ft. Elevation 537.5 ft. Groundwater Encountered While Drilling: at depth 7.3 ft. PID = (Hot) Photo Ionization Detector
18														

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Project: *Expand and Repair Refueling Apron (EIE174)*

Hole Number: *AP-5330*

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Project: *Expand and Repair Refueling Apron (EIE174)*
Eielson Air Force Base, Alaska

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Date: *1 Jun 2002*

Drilling Agency: ☒ Alaska District ☐ Other

Elevation Datum: ☒ MSL ☐ other

Location: Northing: *3,891,217 ft.* Easting: *1,473,793 ft.*

Top of Hole Elevation: *551.8 ft.*

Hole Number, Field: *AB-36* Permanent: *AP-5331*

Operator: *William Tester*

Inspector: *Steven Henslee*

Type of Hole: ☐ other ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: *8.4 ft. WD*

Depth Drilled: *14.5 ft.*

Total Depth: *16.5 ft.*

Hammer Weight: *340 lbs*

Split Spoon I.D: *2.5 in.*

Size and Type of Bit: *8-in HSA w/Bullet Bit*

Type of Equipment: *CME 850 with Automatic Hammer*

Type of Samples: *Grab and Drive*

Depth (ft.)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	%Gravel	%Sand	%Fines	Max Size (in.)	PID (ppm)	% Water	Description and Remarks Surface: low cut vegetation
		1		PFS	Grab	SP	Poorly graded SAND				0.5	0.4		Brown, moist, fine to medium sand
2														
4														
		2		NFS	2 3 4 5	SP	Poorly graded SAND					0.4		Gray, moist, medium sand
6														
8														
10		3		NFS	5 3 3 2	GP	Poorly graded GRAVEL with Sand	67	31	2	1.5	0.4		Gray, wet, subangular to subrounded gravel, fine and coarse sand
12														
14		4			2 2 2 3	SP	Poorly graded SAND					0.2		8 in heaving sand Gray, wet, fine to medium sand
16														
18														Bottom of Hole 16.5 ft. Elevation 535.3 ft. Groundwater Encountered While Drilling: at depth 8.4 ft. PID = (Hot) Photo Ionization Detector

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Project: *Expand and Repair Refueling Apron (EIE174)*

Hole Number: *AP-5331*

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Date: *1 Jun 2002*

Drilling Agency: ☒ Alaska District ☐ Other

Elevation Datum: ☒ MSL ☐ other

Location: Northing: *3,891,312 ft.* Easting: *1,473,677 ft.*

Top of Hole Elevation: *551.3 ft.*

Hole Number, Field: *AB-37* Permanent: *AP-5332*

Operator: *William Tester*

Inspector: *Steven Henslee*

Type of Hole: ☐ other ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: *6.8 ft. WD*

Depth Drilled: *12.0 ft.*

Total Depth: *14.0 ft.*

Hammer Weight: *340 lbs*

Split Spoon I.D: *2.5 in.*

Size and Type of Bit: *8-in HSA w/Bullet Bit*

Type of Equipment: *CME 850 with Automatic Hammer*

Type of Samples: *Grab and Drive*

Depth (ft.)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	%Gravel	%Sand	%Fines	Max Size (in.)	PID (ppm)	% Water	Description and Remarks
														Surface: low cut vegetation
		1		F4	Grab	ML	SILT with Sand	1	27	72		0.3	41	Brown, moist, fine sand, nonplastic (NP) fines
2		2a		F4	2 3	ML	SILT					0.6		Brown, moist, fine sand, NP fines
		2b		F4	4 5	ML	Sandy SILT		41	59		0.0	23	Brown, moist, fine sand, NP fines
4														
6														
		3a		F2	7 9 5	SM	Silty SAND with Gravel				2.5	0.5		Brown, wet, subangular to subrounded gravel, coarse sand, NP fines
8		3b		NFS	7	SP	Poorly graded SAND					0.0		Gray, wet, fine to medium sand
10														
12		4		NFS	7 7 8 8	SP	Poorly graded SAND				2	0.5		Gray, wet, subrounded to rounded gravel, medium to coarse sand
14														Bottom of Hole 14.0 ft. Elevation 537.3 ft. Groundwater Encountered While Drilling: at depth 6.8 ft. PID = (Hot) Photo Ionization Detector
16														
18														

EXPLORATION LOG EIE174.GPJ ACE_ANC.GDT 3/24/03

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Hole Number: *AP-5332*

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Drilling Agency: ☒ Alaska District ☐ Other

Elevation Datum: ☒ MSL ☐ other

Location: Northing: *3,891,452 ft.* Easting: *1,473,497 ft.*

Top of Hole Elevation: *551.1 ft.*

Hole Number, Field: *AB-38* Permanent: *AP-5333*

Operator: *William Tester*

Inspector: *Steven Henslee*

Type of Hole: ☐ other ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: *6.4 ft. WD*

Depth Drilled: *14.0 ft.*

Total Depth: *16.0 ft.*

Hammer Weight: *340 lbs*

Split Spoon I.D: *2.5 in.*

Size and Type of Bit: *8-in HSA w/Bullet Bit*

Type of Equipment: *CME 850 with Automatic Hammer*

Type of Samples: *Grab and Drive*

Depth (ft.)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	%Gravel	%Sand	%Fines	Max Size (in.)	PID (ppm)	% Water	Description and Remarks
														Surface: low cut vegetation
		1		S2	Grab	ASPH SM	Asphalt Silty SAND				0.5	0.2		Brown, moist, fine to medium sand, nonplastic (NP) fines
4		2		NFS	2 4 2 2	SP-SM	Poorly graded SAND with Silt and Gravel	18	76	6	0.5	0.2	18	Gray, wet, medium sand
10		3		NFS	3 3 4 3	GP	Poorly graded GRAVEL with Sand	70	27	3	1.75	0.2		1.5 ft heaving sand Gray, wet, subrounded to rounded gravel, medium to coarse sand
14		4		NFS	3 6 7 7	SP	Poorly graded SAND				0.75			6 in heaving sand Gray, wet, subrounded to rounded gravel, coarse sand
16														Bottom of Hole 16.0 ft. Elevation 535.1 ft. Groundwater Encountered While Drilling: at depth 6.4 ft. PID = (Hot) Photo Ionization Detector

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Project: *Expand and Repair Refueling Apron (EIE174)*

Hole Number: *AP-5333*

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Date: *1 Jun 2002*

Drilling Agency: ☒ Alaska District ☐ Other

Elevation Datum: ☒ MSL ☐ other

Location: Northing: *3,891,551 ft.* Easting: *1,473,380 ft.*

Top of Hole Elevation: *551.0 ft.*

Hole Number, Field: *AB-39* Permanent: *AP-5334*

Operator: *William Tester*

Inspector: *Steven Henslee*

Type of Hole: ☐ other ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: *6.7 ft. WD*

Depth Drilled: *14.5 ft.*

Total Depth: *16.5 ft.*

Hammer Weight: *340 lbs*

Split Spoon I.D: *2.5 in.*

Size and Type of Bit: *8-in HSA w/Bullet Bit*

Type of Equipment: *CME 850 with Automatic Hammer*

Type of Samples: *Grab and Drive*

Depth (ft.)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	%Gravel	%Sand	%Fines	Max Size (in.)	PID (ppm)	% Water	Description and Remarks
														Surface: low cut vegetation
		1		F4	Grab	ML	SILT					0.4		Brown, wet to moist, nonplastic (NP) fines
2														
4		2		NFS	6 4 4 2	GP	Poorly graded GRAVEL with Sand	62	35	3	2	0.3	5	Gray, moist, subrounded to rounded gravel, fine to coarse sand
6														
8														
10		3		NFS	6 7 4 5	GW	Well-graded GRAVEL with Sand	62	35	3	2.5	0.4		Gray, wet, subangular to subrounded gravel, fine to coarse sand
12														
14		4		NFS	5 5 5 6	GW	Well-graded GRAVEL with Sand				2	0.4		8 in heaving sand Gray, wet, subrounded to rounded gravel, fine to coarse sand
16														
18														Bottom of Hole 16.5 ft. Elevation 534.5 ft. Groundwater Encountered While Drilling: at depth 6.7 ft. PID = (Hot) Photo Ionization Detector

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Project: *Expand and Repair Refueling Apron (EIE174)*

Hole Number: *AP-5334*

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Date: *2 Jun 2002*

Drilling Agency: ☒ Alaska District ☐ Other

Elevation Datum: ☒ MSL ☐ other

Location: Northing: *3,892,179 ft.* Easting: *1,472,664 ft.*

Top of Hole Elevation: *553.8 ft.*

Hole Number, Field: *AB-40* Permanent: *AP-5335*

Operator: *William Tester*

Inspector: *Steven Henslee*

Type of Hole: ☐ other _____
☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: *10.6 ft. AD*

Depth Drilled: *14.0 ft.*

Total Depth: *16.0 ft.*

Hammer Weight: *340 lbs*

Split Spoon I.D: *2.5 in.*

Size and Type of Bit: *8-in HSA w/Bullet Bit*

Type of Equipment: *CME 850 with Automatic Hammer*

Type of Samples: *Grab and Drive*

Depth (ft.)	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	%Gravel	%Sand	%Fines	Max Size (in.)	PID (ppm)	% Water	Description and Remarks
					ASPH	Asphalt							Surface: low cut vegetation
	1		NFS	Grab	GP	Poorly graded GRAVEL with Sand					0.2		Brown, moist, subrounded to rounded gravel, FILL
4	2		S2	15 21 22 20	SP-SM	Poorly graded SAND with Silt and Gravel	45	46	9	2.25	0.2	4	Gray to tan, moist, subrounded to rounded gravel, fine to coarse sand, nonplastic (NP) fines
10	3		PFS	10 66 17/2 in	GW	Well-graded GRAVEL with Sand	60	35	5	1.75	0.2	6	Gray, moist, subrounded to rounded gravel, fine to medium sand
14	4	Nbn	F3	11 10 9 7	SM	Silty SAND with Gravel	15	43	42		1.0		Gray to black, frozen, subrounded to subangular, fine sand, NP fines, organics
16													Bottom of Hole 16.0 ft. Elevation 537.8 ft. Groundwater Encountered After Drilling: at depth 10.6 ft. PID = (Hot) Photo Ionization Detector

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Project: *Expand and Repair Refueling Apron (EIE174)*

Hole Number: *AP-5335*

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Date: *2 Jun 2002*

Drilling Agency: ☒ Alaska District ☐ Other

Elevation Datum: ☒ MSL ☐ other

Location: Northing: *3,892,365 ft.* Easting: *1,472,430 ft.*

Top of Hole Elevation: *553.8 ft.*

Hole Number, Field: *AB-41* Permanent: *AP-5336*

Operator: *William Tester*

Inspector: *Steven Henslee*

Type of Hole: ☐ other ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: *13.7 ft. WD*

Depth Drilled: *14.0 ft.*

Total Depth: *15.0 ft.*

Hammer Weight: *340 lbs*

Split Spoon I.D.: *2.5 in.*

Size and Type of Bit: *8-in HSA w/Bullet Bit*

Type of Equipment: *CME 850 with Automatic Hammer*

Type of Samples: *Grab and Drive*

Depth (ft.)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	%Gravel	%Sand	%Fines	Max Size (in.)	PID (ppm)	% Water	Description and Remarks
						ASPH	Asphalt							Surface: low cut vegetation
2		1		PFS	6 18 26 29	GW-GM	Well-graded GRAVEL with Silt and Sand	61	33	6	2.5	0.5	1	Brown, moist, subrounded to rounded gravel, fine to coarse sand, nonplastic (NP) fines, gravel fractured while driving
4		2		PFS	13 28 36 38	GP-GM	Poorly graded GRAVEL with Silt and Sand	49	43	8	2	0.4	2	Brown, moist, subangular to rounded gravel, fine and coarse sand, NP fines, gravel fractured while driving
6		3		S1	10 28 35 36	GP-GM	Poorly graded GRAVEL with Silt and Sand	48	40	12	2.25	0.4	4	Brown, moist, subrounded to rounded gravel, fine to coarse sand, NP fines, gravel fractured while driving
10		4	Nbn	S1	16 81 50/3 in	GP-GM	Poorly graded GRAVEL with Silt and Sand				1.5	0.4		Gray, frozen, subrounded to rounded gravel, coarse sand, NP fines
14		5		S1	46 80	GP-GM	Poorly graded GRAVEL with Silt, Sand, and Cobbles	51	39	10	>3	0.3		Dark gray, wet, subangular gravel, fine to coarse sand, NP fines
16														Bottom of Hole 15.0 ft. Elevation 538.8 ft. Groundwater Encountered While Drilling: at depth 13.7 ft. PID = (Hot) Photo Ionization Detector
18														

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Hole Number: *AP-5336*

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Date: *2 Jun 2002*

Drilling Agency: ☒ Alaska District ☐ Other

Elevation Datum: ☒ MSL ☐ other

Location: Northing: *3,892,272 ft.* Easting: *1,472,546 ft.*

Top of Hole Elevation: *553.3 ft.*

Hole Number, Field: *AB-42* Permanent: *AP-5337*

Operator: *William Tester*

Inspector: *Steven Henslee*

Type of Hole: ☐ other ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: *8.7 ft. WD*

Depth Drilled: *14.0 ft.*

Total Depth: *16.0 ft.*

Hammer Weight: *340 lbs*

Split Spoon I.D: *2.5 in.*

Size and Type of Bit: *8-in HSA w/Bullet Bit*

Type of Equipment: *CME 850 with Automatic Hammer*

Type of Samples: *Grab and Drive*

Depth (ft.)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	%Gravel	%Sand	%Fines	Max Size (in.)	PID (ppm)	% Water	Description and Remarks
						ASPH	Asphalt							Surface: 3 in of A.C. pavement
		1		S1	Grab	GP-GM	Poorly graded GRAVEL with Silt and Sand					0.3		Brown, moist, rounded gravel, medium sand, nonplastic (NP) fines
2														
4		2		S1	14 20 18 15	GP-GM	Poorly graded GRAVEL with Silt and Sand	52	39	9	1.5	0.4	4	Brown, moist, subangular to subrounded gravel, fine to coarse sand
6														
8														
10		3	Vx	PFS	20 47 65 61	GW-GM	Well-graded GRAVEL with Silt and Sand	53	41	6	2.5	8.5		Gray, frozen, subrounded gravel, fine to coarse sand, visible ice crystals
12														
14		4		NFS	4 6 6 5	GP	Poorly graded GRAVEL with Sand				2	6.6		Gray, wet, subrounded to rounded gravel, fine to coarse sand
16														Bottom of Hole 16.0 ft. Elevation 537.3 ft. Groundwater Encountered While Drilling: at depth 8.7 ft. PID = (Hot) Photo Ionization Detector
18														

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Project: *Expand and Repair Refueling Apron (EIE174)*

Hole Number: *AP-5337*

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Date: *2 Jun 2002*

Drilling Agency: ☒ Alaska District ☐ Other

Elevation Datum: ☒ MSL ☐ other

Location: Northing: *3,891,676 ft.* Easting: *1,473,530 ft.*

Top of Hole Elevation: *553.9 ft.*

Hole Number, Field: *AB-43* Permanent: *AP-5338*

Operator: *William Tester*

Inspector: *Steven Henslee*

Type of Hole: ☐ other ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: *11.9 ft. WD*

Depth Drilled: *13.0 ft.*

Total Depth: *13.8 ft.*

Hammer Weight: *340 lbs*

Split Spoon I.D: *2.5 in.*

Size and Type of Bit: *8-in HSA w/Bullet Bit*

Type of Equipment: *CME 850 with Automatic Hammer*

Type of Samples: *Grab and Drive*

Depth (ft.)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	%Gravel	%Sand	%Fines	Max Size (in.)	PID (ppm)	% Water	Description and Remarks
						ASPH	Asphalt							Surface: 6 in of A.C. pavement
		1		S1	Grab	GW-GM	Well-graded GRAVEL with Silt and Sand					0.8		Brown, moist, subrounded to rounded gravel, medium sand, nonplastic (NP) fines
2														
4		2		S1	14 29 34 31	GW-GM	Well-graded GRAVEL with Silt and Sand	55	38	7	1.75	0.4	2	Brown, moist, subrounded to rounded gravel, fine to coarse sand
6														
8		3	Nbn	PFS	4 11 19 66	GP-GM	Poorly graded GRAVEL with Silt and Sand	50	43	7	2	0.6	10	Gray, frozen, subrounded to rounded gravel, fine to coarse sand, NP fines
10														
12														
		4		PFS	55 66/3 in	GW-GM	Well-graded GRAVEL with Silt, Sand, and Cobbles	56	38	6	>3	0.3		Gray, wet, subrounded gravel, fine to coarse sand, NP fines
14														Bottom of Hole 13.8 ft. Elevation 540.2 ft. Groundwater Encountered While Drilling: at depth 11.9 ft. PID = (Hot) Photo Ionization Detector
16														
18														

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Project: *Expand and Repair Refueling Apron (EIE174)*

Hole Number: *AP-5338*

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Date: *2 Jun 2002*

Drilling Agency: ☒ Alaska District ☐ Other

Elevation Datum: ☒ MSL ☐ other

Location: Northing: *3,891,635 ft.* Easting: *1,473,729 ft.*

Top of Hole Elevation: *552.8 ft.*

Hole Number, Field: *AB-44* Permanent: *AP-5339*

Operator: *William Tester*

Inspector: *Steven Henslee*

Type of Hole: ☐ other ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: *8.0 ft. WD*

Depth Drilled: *14.5 ft.*

Total Depth: *16.5 ft.*

Hammer Weight: *340 lbs*

Split Spoon I.D: *2.5 in.*

Size and Type of Bit: *8-in HSA w/Bullet Bit*

Type of Equipment: *CME 850 with Automatic Hammer*

Type of Samples: *Grab and Drive*

Depth (ft.)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	%Gravel	%Sand	%Fines	Max Size (in.)	PID (ppm)	% Water	Description and Remarks Surface: low cut vegetation
		1		PFS	Grab	SP	Poorly graded SAND with Gravel				0.75	0.3		Brown, moist, subrounded to rounded gravel, medium sand
2														
4		2		S2	3 3 3 2	SM	Silty SAND		58	42		0.3	28	Brown, moist, fine sand, nonplastic (NP) fines, wood fragments
6														
8														▼
10		3		NFS	5 6 7 6	SP	Poorly graded SAND with Gravel				2	0.3		Gray, wet, subrounded to rounded gravel, medium sand, wood fragments
12														
14		4		PFS	2 6 8 8	GP-GM	Poorly graded GRAVEL with Silt and Sand				1.75	0.3		Gray, wet, subangular to rounded gravel, medium to coarse sand, NP fines
16														
18														Bottom of Hole 16.5 ft. Elevation 536.3 ft. Groundwater Encountered While Drilling: at depth 8.0 ft. PID = (Hot) Photo Ionization Detector

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Project: *Expand and Repair Refueling Apron (EIE174)*

Hole Number: *AP-5339*

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Date: *2 Jun 2002*

Drilling Agency: ☒ Alaska District ☐ Other

Elevation Datum: ☒ MSL ☐ other

Location: Northing: *3,891,330 ft.* Easting: *1,474,143 ft.*

Top of Hole Elevation: *553.0 ft.*

Hole Number, Field: *AB-45* Permanent: *AP-5340*

Operator: *William Tester*

Inspector: *Steven Henslee*

Type of Hole: ☐ other ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: *8.4 ft. WD*

Depth Drilled: *14.0 ft.*

Total Depth: *16.0 ft.*

Hammer Weight: *340 lbs*

Split Spoon I.D: *2.5 in.*

Size and Type of Bit: *8-in HSA w/Bullet Bit*

Type of Equipment: *CME 850 with Automatic Hammer*

Type of Samples: *Grab and Drive*

Depth (ft.)	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	%Gravel	%Sand	%Fines	Max Size (in.)	PID (ppm)	% Water	Description and Remarks Surface: low cut vegetation
2	1		F3		SM	Silty SAND	24	38	38	1		12	Brown, moist, fine sand, nonplastic (NP) fines
4	2a	Nf	NFS	10 25	SP	Poorly graded SAND with Gravel				1.25	0.2		Brown, frozen, rounded gravel, coarse sand
6	2b	Nbn	NFS	17 9	SP-SM	Poorly graded SAND with Silt and Gravel				0.75	0.2		Gray, frozen, subrounded to rounded gravel, medium to coarse sand, NP fines
10	3		NFS	3 3 2 3	SP-SM	Poorly graded SAND with Silt and Gravel		94	6		0.3	21	Gray, wet, fine sand, NP fines
14	4a		NFS	5 5	SP-SM	Poorly graded SAND with Silt and Gravel					0.3		Gray, wet, fine sand, NP fines
	4b			3 3	GP	Poorly graded GRAVEL with Sand				2.5			Gray, wet, subrounded to rounded gravel, medium to coarse sand
16													Bottom of Hole 16.0 ft. Elevation 537.0 ft. Groundwater Encountered While Drilling: at depth 8.4 ft. PID = (Hot) Photo Ionization Detector
18													

EXPLORATION LOG EIE174.GPJ ACE_ANC.GDT 3/24/03

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Project: *Expand and Repair Refueling Apron (EIE174)*

Hole Number: *AP-5340*

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Project: *Expand and Repair Refueling Apron (EIE174)*
Eielson Air Force Base, Alaska

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Date: *2 Jun 2002*

Drilling Agency: ☒ Alaska District ☐ Other

Elevation Datum: ☒ MSL ☐ other

Location: Northing: *3,891,330 ft.* Easting: *1,474,143 ft.*

Top of Hole Elevation: *553.0 ft.*

Hole Number, Field: *AB-45* Permanent: *AP-5340*

Operator: *William Tester*

Inspector: *Steven Henslee*

Type of Hole: ☐ other ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: *8.4 ft. WD*

Depth Drilled: *14.0 ft.*

Total Depth: *16.0 ft.*

Hammer Weight: *340 lbs*

Split Spoon I.D: *2.5 in.*

Size and Type of Bit: *8-in HSA w/Bullet Bit*

Type of Equipment: *CME 850 with Automatic Hammer*

Type of Samples: *Grab and Drive*

Depth (ft.)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	Grain Size %Gravel	%Sand	%Fines	Max Size (in.)	PID (ppm)	% Water	Description and Remarks
														Surface: low cut vegetation
2		1		F3		SM	Silty SAND	24	38	38	1		12	Brown, moist, fine sand, nonplastic (NP) fines
4		2a	Nf	NFS	10 25	SP	Poorly graded SAND with Gravel				1.25	0.2		Brown, frozen, rounded gravel, coarse sand
6		2b	Nbn	NFS	17 9	SP-SM	Poorly graded SAND with Silt and Gravel				0.75	0.2		Gray, frozen, subrounded to rounded gravel, medium to coarse sand, NP fines
8														▼
10		3		NFS	3 3 2 3	SP-SM	Poorly graded SAND with Silt and Gravel		94	6		0.3	21	Gray, wet, fine sand, NP fines
12														
14		4a		NFS	5 5	SP-SM	Poorly graded SAND with Silt and Gravel					0.3		Gray, wet, fine sand, NP fines
		4b			3 3	GP	Poorly graded GRAVEL with Sand				2.5			Gray, wet, subrounded to rounded gravel, medium to coarse sand
16														Bottom of Hole 16.0 ft. Elevation 537.0 ft. Groundwater Encountered While Drilling: at depth 8.4 ft. PID = (Hot) Photo Ionization Detector
18														

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Project: *Expand and Repair Refueling Apron (EIE174)*

Hole Number: *AP-5340*

EXPLORATION LOG EIE174.GPJ ACE_ANC.GDT 3/24/03

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Project: *Expand and Repair Refueling Apron (EIE174)*
Eielson Air Force Base, Alaska

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Date: *2 Jun 2002*

Drilling Agency: ☒ Alaska District ☐ Other

Elevation Datum: ☒ MSL ☐ other

Location: Northing: *3,891,251 ft.* Easting: *1,474,019 ft.*

Top of Hole Elevation: *554.8 ft.*

Hole Number, Field: *AB-46* Permanent: *AP-5341*

Operator: *William Tester*

Inspector: *Steven Henslee*

Type of Hole: ☐ other ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: *8.8 ft. WD*

Depth Drilled: *12.5 ft.*

Total Depth: *13.5 ft.*

Hammer Weight: *340 lbs*

Split Spoon I.D: *2.5 in.*

Size and Type of Bit: *8-in HSA w/Bullet Bit*

Type of Equipment: *CME 850 with Automatic Hammer*

Type of Samples: *Grab and Drive*

Depth (ft.)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	%Gravel	%Sand	%Fines	Max Size (in.)	PID (ppm)	% Water	Description and Remarks
						ASPH	Asphalt							Surface: 6 in of A.C. pavement
		1		S1	Grab	GP-GM	Poorly graded GRAVEL with Silt and Sand				0.75			Brown, moist, subrounded to rounded gravel, medium sand, nonplastic (NP) fines, FILL
2		2		S1	16 26 31 35	GP-GM	Poorly graded GRAVEL with Silt and Sand	47	43	10	1.25		3	Brown, moist, subrounded to rounded gravel, fine to coarse sand, NP fines
4														
6														
8		3		PFS	7 19 24 24	GP-GM	Poorly graded GRAVEL with Silt and Sand	53	39	8	1		5	Brown, moist, rounded gravel, fine to coarse sand, NP fines, gravel fractured while driving
10														
12		4	Nf	PFS	23 90	GP-GM	Poorly graded GRAVEL with Silt and Sand				1			Gray, frozen, subrounded gravel, fine to coarse sand, NP fines
14														Bottom of Hole 13.5 ft. Elevation 541.3 ft. Groundwater Encountered While Drilling: at depth 8.8 ft.
16														
18														

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Project: *Expand and Repair Refueling Apron (EIE174)*

Hole Number: *AP-5341*

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Project: *Expand and Repair Refueling Apron (EIE174)*
Eielson Air Force Base, Alaska

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Date: *5 Jun 2002*

Drilling Agency: ☒ Alaska District ☐ Other

Elevation Datum: ☒ MSL ☐ other

Location: Northing: *3,890,167 ft.* Easting: *1,474,764 ft.*

Top of Hole Elevation: *552.5 ft.*

Hole Number, Field: *AB-47* Permanent: *AP-5342*

Operator: *William Tester*

Inspector: *Steven Henslee*

Type of Hole: ☐ other _____
☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: *8.8 ft. WD*

Depth Drilled: *14.0 ft.*

Total Depth: *16.0 ft.*

Hammer Weight: *340 lbs*

Split Spoon I.D: *2.5 in.*

Size and Type of Bit: *8-in HSA w/Bullet Bit*

Type of Equipment: *CME 850 with Automatic Hammer*

Type of Samples: *Grab and Drive*

Depth (ft.)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	Grain Size %Gravel	%Sand	%Fines	Max Size (in.)	PID (ppm)	% Water	Description and Remarks
														Surface: low cut vegetation
		1			Grab	SM	Silty SAND				0.5	0.5		Brown, moist, rounded gravel, fine sand, nonplastic (NP) fines
2														
4		2		NFS	8 9 9 11	GP	Poorly graded GRAVEL with Sand	60	37	3	1.5	0.4	6	Brown, moist, subrounded to rounded gravel, fine and coarse sand
6														
8														
10		3		NFS	5 3 5 4	GW	Well-graded GRAVEL with Sand	66	32	2	1.75	0.4		Gray, wet, subrounded gravel, fine to coarse sand
12														
14		4		S2	8 9 10 10	SM	Silty SAND with Gravel				2	0.3		Gray, wet, subangular to rounded gravel, fine to coarse sand
16														Bottom of Hole 16.0 ft. Elevation 536.5 ft. Groundwater Encountered While Drilling: at depth 8.8 ft. PID = (Hot) Photo Ionization Detector
18														

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Project: *Expand and Repair Refueling Apron (EIE174)*

Hole Number: *AP-5342*

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Date: *5 Jun 2002*

Drilling Agency: ☒ Alaska District ☐ Other

Elevation Datum: ☒ MSL ☐ other

Location: Northing: *3,890,070 ft.* Easting: *1,474,879 ft.*

Top of Hole Elevation: *552.6 ft.*

Hole Number, Field: *AB-48* Permanent: *AP-5343*

Operator: *William Tester*

Inspector: *Steven Henslee*

Type of Hole: ☐ other ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: *7.6 ft. WD*

Depth Drilled: *14.0 ft.*

Total Depth: *16.0 ft.*

Hammer Weight: *340 lbs*

Split Spoon I.D: *2.5 in.*

Size and Type of Bit: *8-in HSA w/Bullet Bit*

Type of Equipment: *CME 850 with Automatic Hammer*

Type of Samples: *Grab and Drive*

Depth (ft.)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	%Gravel	%Sand	%Fines	Max Size (in.)	PID (ppm)	% Water	Description and Remarks
														Surface: low cut vegetation
2		1		S2	Grab	SM	Silty SAND with Gravel	8	69	23	0.5	0.4	10	Brown, moist, fine sand, nonplastic (NP) fines
4, 6		2		NFS	4 4 4 12	GW	Well-graded GRAVEL with Sand	62	35	3	2.25	0.3	8	Brown, moist, subrounded gravel, fine and coarse sand, NP fines
8, 10, 12		3		NFS	5 3 4 5	SP	Poorly graded SAND with Gravel				2.5	0.3		Gray, wet, subangular to rounded gravel, fine to coarse sand
14		4		NFS	2 1 1 2	SP	Poorly graded SAND					0.3		1.5 ft heaving sand Gray, wet, medium sand
16, 18														Bottom of Hole 16.0 ft. Elevation 536.6 ft. Groundwater Encountered While Drilling: at depth 7.6 ft. PID = (Hot) Photo Ionization Detector

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Project: *Expand and Repair Refueling Apron (EIE174)*

Hole Number: *AP-5343*

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Date: *5 Jun 2002*

Drilling Agency: ☒ Alaska District ☐ Other

Elevation Datum: ☒ MSL ☐ other

Location: Northing: *3,890,209 ft.* Easting: *1,474,995 ft.*

Top of Hole Elevation: *555.0 ft.*

Hole Number, Field: *AB-49* Permanent: *AP-5344*

Operator: *William Tester*

Inspector: *Steven Henslee*

Type of Hole: ☐ other ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: *8.3 ft. WD*

Depth Drilled: *14.0 ft.*

Total Depth: *16.0 ft.*

Hammer Weight: *340 lbs*

Split Spoon I.D: *2.5 in.*

Size and Type of Bit: *8-in HSA w/Bullet Bit*

Type of Equipment: *CME 850 with Automatic Hammer*

Type of Samples: *Grab and Drive*

Depth (ft.)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	%Gravel	%Sand	%Fines	Max Size (in.)	PID (ppm)	% Water	Description and Remarks
						ASPH	Asphalt							Surface: 6 in of A.C. pavement
		1		PFS	Grab	GW	Well-graded GRAVEL with Sand				0.5	0.4		Brown, moist, rounded gravel, fine to medium sand
2														
4		2		NFS	10 16 14 12	GW	Well-graded GRAVEL with Sand	59	36	5	1.5	0.2	2	Brown, moist, subrounded to rounded gravel, fine to coarse sand, nonplastic (NP) fines
6														
8														
		3		NFS	13 63	GP	Poorly graded GRAVEL with Sand	61	34	5	2	0.2		Gray to brown, wet, subrounded gravel, fine to coarse sand, NP fines
10														
12														
14		4		NFS	11 6 6 4	GP	Poorly graded GRAVEL with Sand				2	0.3		Gray, wet, subangular to subrounded gravel, fine to coarse sand
16														Bottom of Hole 16.0 ft. Elevation 539.0 ft. Groundwater Encountered While Drilling: at depth 8.3 ft. PID = (Hot) Photo Ionization Detector
18														

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Project: *Expand and Repair Refueling Apron (EIE174)*

Hole Number: *AP-5344*

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Eielson Air Force Base, Alaska

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Date: *5 Jun 2002*

Drilling Agency: ☒ Alaska District ☐ Other

Elevation Datum: ☒ MSL ☐ other

Location: Northing: *3,890,324 ft.* Easting: *1,475,091 ft.*

Top of Hole Elevation: *552.5 ft.*

Hole Number, Field: *AB-50* Permanent: *AP-5345*

Operator: *William Tester*

Inspector: *Steven Henslee*

Type of Hole: ☐ other ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: *6.6 ft. WD*

Depth Drilled: *13.0 ft.*

Total Depth: *15.0 ft.*

Hammer Weight: *340 lbs*

Split Spoon I.D: *2.5 in.*

Size and Type of Bit: *8-in HSA w/Bullet Bit*

Type of Equipment: *CME 850 with Automatic Hammer*

Type of Samples: *Grab and Drive*

Depth (ft.)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	%Gravel	%Sand	%Fines	Max Size (in.)	PID (ppm)	% Water	Description and Remarks
														Surface: low cut vegetation
2		1		NFS	Grab	SP	Poorly graded SAND				1	0.6		Brown, moist, fine to medium sand
4		2		NFS	5 5 5 6	GP	Poorly graded GRAVEL with Sand	49	48	3	1	0.3	5	Brown, moist, subrounded to rounded gravel, fine sand
8		3		NFS	5 5 5 4	GP	Poorly graded GRAVEL with Sand	66	32	2	2	0.3		Gray, wet, rounded gravel, fine to coarse sand
14		4		NFS	4 5 4 5	GP	Poorly graded GRAVEL with Sand	75	24	1	2.5	0.3		Gray, wet, subrounded to rounded gravel, fine and coarse sand
16														Bottom of Hole 15.0 ft. Elevation 537.5 ft. Groundwater Encountered While Drilling: at depth 6.6 ft. PID = (Hot) Photo Ionization Detector
18														

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Project: *Expand and Repair Refueling Apron (EIE174)*

Hole Number: *AP-5345*

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Project: *Expand and Repair Refueling Apron (EIE174)*
Eielson Air Force Base, Alaska

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Date: *5 Jun 2002*

Drilling Agency: ☒ Alaska District ☐ Other

Elevation Datum: ☒ MSL ☐ other

Location: Northing: *3,890,337 ft.* Easting: *1,475,225 ft.*

Top of Hole Elevation: *552.1 ft.*

Hole Number, Field: *AB-51* Permanent: *AP-5346*

Operator: *William Tester*

Inspector: *Steven Henslee*

Type of Hole: ☐ other _____
☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: *5.3 ft. WD*

Depth Drilled: *14.0 ft.*

Total Depth: *16.0 ft.*

Hammer Weight: *340 lbs*

Split Spoon I.D: *2.5 in.*

Size and Type of Bit: *8-in HSA w/Bullet Bit*

Type of Equipment: *CME 850 with Automatic Hammer*

Type of Samples: *Grab and Drive*

Depth (ft.)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	Grain Size %Gravel	%Sand	%Fines	Max Size (in.)	PID (ppm)	% Water	Description and Remarks Surface: low cut vegetation
		1		NFS	Grab	GW	Well-graded GRAVEL with Sand				0.5	0.3		Brown, moist, rounded gravel, fine to medium sand
2														
4		2	Nf	NFS	5 9 9 10	GW	Well-graded GRAVEL with Sand	62	34	4	2.75	0.2	6	Brown to gray, frozen to wet, subangular to rounded gravel, fine and coarse sand
6														
8														
		3		NFS	3 6 4 5	GP	Poorly graded GRAVEL with Sand	74	25	1	2.5	0.3		Gray, wet, subrounded to rounded gravel, fine to coarse sand
10														
12														6 in heaving sand
14		4		NFS	3 2 4 3	GP	Poorly graded GRAVEL with Sand				2	0.3		Gray, wet, subrounded to rounded gravel, fine to coarse sand
16														Bottom of Hole 16.0 ft. Elevation 536.1 ft. Groundwater Encountered While Drilling: at depth 5.3 ft. PID = (Hot) Photo Ionization Detector
18														

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Project: *Expand and Repair Refueling Apron (EIE174)*

Hole Number: *AP-5346*

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Project: *Expand and Repair Refueling Apron (EIE174)*
Eielson Air Force Base, Alaska

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Date: *6 Jun 2002*

Drilling Agency: ☒ Alaska District ☐ Other

Elevation Datum: ☒ MSL ☐ other

Location: Northing: *3,889,994 ft.* Easting: *1,474,816 ft.*

Top of Hole Elevation: *553.3 ft.*

Hole Number, Field: *AB-52* Permanent: *AP-5347*

Operator: *William Tester*

Inspector: *Steven Henslee*

Type of Hole: ☐ other ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: *7.4 ft. WD*

Depth Drilled: *14.0 ft.*

Total Depth: *16.0 ft.*

Hammer Weight: *340 lbs*

Split Spoon I.D: *2.5 in.*

Size and Type of Bit: *8-in HSA w/Bullet Bit*

Type of Equipment: *CME 850 with Automatic Hammer*

Type of Samples: *Grab and Drive*

Depth (ft.)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	%Gravel	%Sand	%Fines	Max Size (in.)	PID (ppm)	% Water	Description and Remarks
														Surface: low cut vegetation
		1		F2	Grab	SM	Silty SAND	6	45	49			21	Brown, moist, fine sand, nonplastic (NP) fines
4		2	Nf	PFS	34 34 15 8	GW-GM	Well-graded GRAVEL with Silt and Sand	61	34	5	1.5		5	Gray, frozen, subrounded to rounded gravel, fine to coarse sand
10		3		NFS	4 8 9 17	GW	Well-graded GRAVEL with Sand				2.25			Gray, wet, subrounded to rounded gravel, fine to coarse sand
14		4		NFS	5 6 4 4	GW	Well-graded GRAVEL with Sand				2			8 in heaving sand Gray, wet, subrounded to rounded gravel, fine to coarse sand
16														Bottom of Hole 16.0 ft. Elevation 537.3 ft. Groundwater Encountered While Drilling: at depth 7.4 ft.

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Project: *Expand and Repair Refueling Apron (EIE174)*

Hole Number: *AP-5347*

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Project: *Expand and Repair Refueling Apron (EIE174)*
Eielson Air Force Base, Alaska

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Date: *6 Jun 2002*

Drilling Agency: ☒ Alaska District ☐ Other

Elevation Datum: ☒ MSL ☐ other

Location: Northing: *3,890,596 ft.* Easting: *1,474,059 ft.*

Top of Hole Elevation: *554.6 ft.*

Hole Number, Field: *AB-53* Permanent: *AP-5348*

Operator: *William Tester*

Inspector: *Steven Henslee*

Type of Hole: ☐ other ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: *9.1 ft. WD*

Depth Drilled: *14.0 ft.*

Total Depth: *16.0 ft.*

Hammer Weight: *340 lbs*

Split Spoon I.D: *2.5 in.*

Size and Type of Bit: *8-in HSA w/Bullet Bit*

Type of Equipment: *CME 850 with Automatic Hammer*

Type of Samples: *Grab and Drive*

Depth (ft.)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	Grain Size %Gravel	%Sand	%Fines	Max Size (in.)	PID (ppm)	% Water	Description and Remarks
														Surface: road shoulder
		1		S2	Grab	SP-SM	Poorly graded SAND with Silt				0.5		2	Black, moist, fine to coarse sand, nonplastic (NP) fines, asphalt particles in sample, FILL
2														
4		2		PFS	7 9 16 19	GP-GM	Poorly graded GRAVEL with Silt and Sand	52	42	6	1		3	Brown, moist, subrounded to rounded gravel, fine and coarse sand
6														
8														
10		3		NFS	7 7 6 5	GP	Poorly graded GRAVEL with Sand	66	30	4	1			Gray, moist to wet, subangular to rounded gravel, fine and coarse sand
12														
14		4		NFS	3 5 6 6	GP	Poorly graded GRAVEL with Sand				1.75			Gray, wet, subrounded to rounded gravel, fine to coarse sand
16														Bottom of Hole 16.0 ft. Elevation 538.6 ft. Groundwater Encountered While Drilling: at depth 9.1 ft.
18														

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Project: *Expand and Repair Refueling Apron (EIE174)*

Hole Number: *AP-5348*

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Project: *Expand and Repair Refueling Apron (EIE174)*
Eielson Air Force Base, Alaska

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Date: *4 Jul 2002*

Drilling Agency: ☒ Alaska District ☐ Other

Elevation Datum: ☒ MSL ☐ other

Location: Northing: *3,891,057 ft.* Easting: *1,474,272 ft.*

Top of Hole Elevation: *554.3 ft.*

Hole Number, Field: *AB-54* Permanent: *AP-5349*

Operator: *William Tester*

Inspector: *Steven Henslee*

Type of Hole: ☐ other ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: *8.8 ft. WD*

Depth Drilled: *14.0 ft.*

Total Depth: *16.0 ft.*

Hammer Weight: *340 lbs*

Split Spoon I.D: *2.5 in.*

Size and Type of Bit: *8-in HSA w/Bullet Bit*

Type of Equipment: *CME 850 with Automatic Hammer*

Type of Samples: *Grab and Drive*

Depth (ft.)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	%Gravel	%Sand	%Fines	Max Size (in.)	PID (ppm)	% Water	Description and Remarks
						ASPH	Asphalt					0.0		Surface: 6 in of A.C. pavement
		1		PFS	Grab	SP	Poorly graded SAND with Gravel					0.0		Gray moist, rounded gravel, fine to medium sand, nonplastic (NP) fines, FILL
2														
4		2		PFS	10 15 12 13	SP	Poorly graded SAND with Gravel					0.0		Gray, moist, subangular to subrounded gravel, fine to medium sand, NP fines, 3 in lense of silty sand at 5 feet, FILL to 4.5 feet
6														
8														
10		3	Nf	PFS	4 5 25 60	GP-GM	Poorly graded GRAVEL with Silt and Sand	47	46	7		0.0		Gray, frozen, subrounded to rounded gravel, fine to coarse sand, NP fines
12														
14		4	Nbn	NFS	12 5 7 7	GP	Poorly graded GRAVEL with Sand							Gray, frozen, subrounded gravel, coarse sand, wood particles
16														Bottom of Hole 16.0 ft. Elevation 538.3 ft. Groundwater Encountered While Drilling: at depth 8.8 ft. PID = (Hot) Photo Ionization Detector
18														

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Project: *Expand and Repair Refueling Apron (EIE174)*

Hole Number: *AP-5349*

EXPLORATION LOG EIE174.GPJ ACE_ANC.GDT 3/24/03

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Soils and Geology Section
EXPLORATION LOG

Project: *Expand and Repair Refueling Apron (EIE174)*
Eielson Air Force Base, Alaska

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Date: *4 Jul 2002*

Drilling Agency: ☒ Alaska District ☐ Other

Elevation Datum: ☒ MSL ☐ other

Location: Northing: *3,890,947 ft.* Easting: *1,474,374 ft.*

Top of Hole Elevation: *554.8 ft.*

Hole Number, Field: *AB-55* Permanent: *AP-5350*

Operator: *William Tester*

Inspector: *Steven Henslee*

Type of Hole: ☐ other _____
☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: *8.9 ft. WD*

Depth Drilled: *14.0 ft.*

Total Depth: *16.0 ft.*

Hammer Weight: *340 lbs*

Split Spoon I.D: *2.5 in.*

Size and Type of Bit: *8-in HSA w/Bullet Bit*

Type of Equipment: *CME 850 with Automatic Hammer*

Type of Samples: *Grab and Drive*

Depth (ft.)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	%Gravel	%Sand	%Fines	Max Size (in.)	PID (ppm)	% Water	Description and Remarks
						ASPH	Asphalt							Surface: 6 in of A.C. pavement
		1		PFS	Grab	SP	Poorly graded SAND				0.75	6.0		Brown, moist, subrounded gravel, fine to coarse sand, nonplastic (NP) fines, FILL
4		2		S1	18 24 27 24	GP-GM	Poorly graded GRAVEL with Silt and Sand	51	39	10	2.5	0.0	2	Tan, moist, subangular to rounded gravel, fine to coarse sand, NP fines
10		3		NFS	8 8 8 7	SP	Poorly graded SAND with Gravel				2	0.0		Gray, wet, subrounded to rounded gravel, fine to coarse sand
14		4	Nbn	NFS	31 16 8 9	GP	Poorly graded GRAVEL with Sand				2.25	0.0		Tan to orange, frozen, subrounded gravel, fine to coarse sand
16														Bottom of Hole 16.0 ft. Elevation 538.8 ft. Groundwater Encountered While Drilling: at depth 8.9 ft. PID = (Hot) Photo Ionization Detector

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Project: *Expand and Repair Refueling Apron (EIE174)*

Hole Number: *AP-5350*

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Date: *4 Jul 2002*

Drilling Agency: ☒ Alaska District ☐ Other

Elevation Datum: ☒ MSL ☐ other

Location: Northing: *3,890,841 ft.* Easting: *1,474,514 ft.*

Top of Hole Elevation: *553.8 ft.*

Hole Number, Field: *AB-56* Permanent: *AP-5351*

Operator: *William Tester*

Inspector: *Steven Henslee*

Type of Hole: ☐ other ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: *8.1 ft. WD*

Depth Drilled: *14.0 ft.*

Total Depth: *16.0 ft.*

Hammer Weight: *340 lbs*

Split Spoon I.D: *2.5 in.*

Size and Type of Bit: *8-in HSA w/Bullet Bit*

Type of Equipment: *CME 850 with Automatic Hammer*

Type of Samples: *Grab and Drive*

Depth (ft.)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	Grain Size %Gravel	%Sand	%Fines	Max Size (in.)	PID (ppm)	% Water	Description and Remarks Surface: low cut vegetation
		1		PFS	Grab	GP	Poorly graded GRAVEL	73	23	4	2.5	0.0	2	Brown, moist, subrounded to rounded gravel, fine to coarse sand, nonplastic (NP) fines
2														
4		2		NFS	3 3 4 6	SP	Poorly graded SAND with Gravel					2.4		Gray to brown, moist, medium sand
6														
8														
10		3		NFS	6 3 3 4	GP	Poorly graded GRAVEL with Sand	69	28	3	2	0.0		Gray, wet, subrounded gravel, fine to coarse sand
12														
14		4			3 2 4 4	GP	Poorly graded GRAVEL with Sand				2.5	0.0		Gray, wet, subangular to rounded gravel, fine to coarse sand
16														Bottom of Hole 16.0 ft. Elevation 537.8 ft. Groundwater Encountered While Drilling: at depth 8.1 ft. PID = (Hot) Photo Ionization Detector
18														

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Project: *Expand and Repair Refueling Apron (EIE174)*

Hole Number: *AP-5351*

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Date: *4 Jul 2002*

Drilling Agency: ☒ Alaska District ☐ Other

Elevation Datum: ☒ MSL ☐ other

Location: Northing: *3,890,424 ft.* Easting: *1,474,984 ft.*

Top of Hole Elevation: *553.7 ft.*

Hole Number, Field: *AB-57* Permanent: *AP-5352*

Operator: *William Tester*

Inspector: *Steven Henslee*

Type of Hole: ☐ other ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: *8.2 ft. WD*

Depth Drilled: *14.5 ft.*

Total Depth: *16.5 ft.*

Hammer Weight: *340 lbs*

Split Spoon I.D: *2.5 in.*

Size and Type of Bit: *8-in HSA w/Bullet Bit*

Type of Equipment: *CME 850 with Automatic Hammer*

Type of Samples: *Grab and Drive*

Depth (ft.)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	%Gravel	%Sand	%Fines	Max Size (in.)	PID (ppm)	% Water	Description and Remarks Surface: low cut vegetation
		1		F3	Grab	SM	Silty SAND	8	43	49	0.25	6.8	13	Brown, moist, fine sand, nonplastic (NP) fines
2														
4														
		2		PFS	9 11 10 9	GP	Poorly graded GRAVEL with Sand	57	38	5	1.5	8.1	4	Gray, moist, subangular to rounded gravel, fine and coarse sand
6														
8														
10		3		PFS	8 8 4 5	GP	Poorly graded GRAVEL with Sand				1.5	3.8		Gray, wet, subrounded to rounded gravel, fine to coarse sand
12														
14														1 ft heaving sand
		4		PFS	2 3 5 6	GP	Poorly graded GRAVEL with Sand					8.8		Gray, wet, subrounded to rounded gravel, fine to coarse sand
16														
18														Bottom of Hole 16.5 ft. Elevation 537.2 ft. Groundwater Encountered While Drilling: at depth 8.2 ft. PID = (Hot) Photo Ionization Detector

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Project: *Expand and Repair Refueling Apron (EIE174)*

Hole Number: *AP-5352*

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Drilling Agency: ☒ Alaska District ☐ Other

Elevation Datum: ☒ MSL ☐ other

Location: Northing: *3,890,285 ft.* Easting: *1,474,654 ft.*

Top of Hole Elevation: *553.0 ft.*

Hole Number, Field: *AB-58* Permanent: *AP-5353*

Operator: *William Tester*

Inspector: *Steven Henslee*

Type of Hole: ☐ other ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: *7.1 ft. WD*

Depth Drilled: *14.0 ft.*

Total Depth: *16.0 ft.*

Hammer Weight: *340 lbs*

Split Spoon I.D: *2.5 in.*

Size and Type of Bit: *8-in HSA w/Bullet Bit*

Type of Equipment: *CME 850 with Automatic Hammer*

Type of Samples: *Grab and Drive*

Depth (ft.)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	%Gravel	%Sand	%Fines	Max Size (in.)	PID (ppm)	% Water	Description and Remarks Surface: low cut vegetation
		1		PFS	Grab	GP-GM	Poorly graded GRAVEL with Silt and Sand				0.5	120.0		Brown, moist, subrounded to rounded gravel, medium sand, nonplastic (NP) fines
2														
4		2		PFS	10 12 10 9	GP-GM	Poorly graded GRAVEL with Silt and Sand	59	35	6	1.5	4.4	4	Brown, moist, subangular to rounded gravel, fine to coarse sand
6														
8														
10		3	Nbn	PFS	10 16 50/5 in	GP-GM	Poorly graded GRAVEL with Silt and Sand				2.5	0.0		Gray, wet to frozen, subangular gravel, fine to coarse sand
12														
14		4	Nf	PFS	15 22 13 11	GP-GM	Poorly graded GRAVEL with Silt and Sand				2.5			Gray, frozen, subangular to rounded gravel, fine to coarse sand
16														Bottom of Hole 16.0 ft. Elevation 537.0 ft. Groundwater Encountered While Drilling: at depth 7.1 ft. PID = (Hot) Photo Ionization Detector
18														

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Hole Number: *AP-5353*

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Date: *5 Jul 2002*

Drilling Agency: ☒ Alaska District ☐ Other

Elevation Datum: ☒ MSL ☐ other

Location: Northing: *3,890,320 ft.* Easting: *1,474,460 ft.*

Top of Hole Elevation: *554.3 ft.*

Hole Number, Field: *AB-59* Permanent: *AP-5354*

Operator: *William Tester*

Inspector: *Steven Henslee*

Type of Hole: ☐ other ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: *14.0 ft. WD*

Depth Drilled: *14.0 ft.*

Total Depth: *15.0 ft.*

Hammer Weight: *340 lbs*

Split Spoon I.D: *2.5 in.*

Size and Type of Bit: *8-in HSA w/Bullet Bit*

Type of Equipment: *CME 850 with Automatic Hammer*

Type of Samples: *Grab and Drive*

Depth (ft.)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	%Gravel	%Sand	%Fines	Max Size (in.)	PID (ppm)	% Water	Description and Remarks
														Surface: 4 in of A.C. pavement
		1		NFS	Grab	ASPH SP	Asphalt Poorly graded SAND with Gravel				1	11.2		Brown, moist, subrounded to rounded gravel, medium sand, nonplastic (NP) fines
2														
4		2		PFS	6 19 23 26	GP	Poorly graded GRAVEL with Sand				2	3.8		Brown, moist, subangular to subrounded gravel, fine to coarse sand
6														
8														
10		3		PFS	5 9 11 11	GP	Poorly graded GRAVEL with Sand	56	40	4	1.75	4.8	7	Gray, wet, subangular to rounded gravel, fine and coarse sand
12														
14		4		PFS	38 80	GP	Poorly graded GRAVEL with Sand and Cobbles				>3	9.8		Gray, wet, subrounded to rounded gravel, fine to coarse sand
16														Bottom of Hole 15.0 ft. Elevation 539.3 ft. Groundwater Encountered While Drilling: at depth 14.0 ft. PID = (Hot) Photo Ionization Detector
18														

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Drilling Agency: ☒ Alaska District ☐ Other

Elevation Datum: ☒ MSL ☐ other

Location: Northing: *3,890,488 ft.* Easting: *1,474,395 ft.*

Top of Hole Elevation: *553.2 ft.*

Hole Number, Field: *AB-60* Permanent: *AP-5355*

Operator: *William Tester*

Inspector: *Steven Henslee*

Type of Hole: ☐ other ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: *9.5 ft. WD*

Depth Drilled: *14.0 ft.*

Total Depth: *16.0 ft.*

Hammer Weight: *340 lbs*

Split Spoon I.D: *2.5 in.*

Size and Type of Bit: *8-in HSA w/Bullet Bit*

Type of Equipment: *CME 850 with Automatic Hammer*

Type of Samples: *Grab and Drive*

Depth (ft.)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	Grain Size %Gravel	%Sand	%Fines	Max Size (in.)	PID (ppm)	% Water	Description and Remarks Surface: 3 in of A.C. pavement
						ASPH	Asphalt							
		1		NFS	Grab	GP	Poorly graded GRAVEL with Sand				0.75	0.2		Brown, moist, rounded gravel, fine to medium sand, nonplastic (NP) fines, FILL
2														
4		2		NFS	7 7 6 5	GP	Poorly graded GRAVEL with Sand				1.75	0.0		Brown, moist, subrounded gravel, fine to coarse sand
6														
8														
10		3		NFS	4 4 7 8	GP	Poorly graded GRAVEL with Sand				2.5	0.0	▼	Gray, wet, subrounded gravel, fine to coarse sand
12														
14		4		PFS	24 24 11 7	GP-GM	Poorly graded GRAVEL with Silt and Sand				2	0.0		Gray, wet, subangular to subrounded gravel, fine to coarse sand
16														Bottom of Hole 16.0 ft. Elevation 537.2 ft. Groundwater Encountered While Drilling: at depth 9.5 ft. PID = (Hot) Photo Ionization Detector
18														

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Date: *5 Jul 2002*

Drilling Agency: ☒ Alaska District ☐ Other

Elevation Datum: ☒ MSL ☐ other

Location: Northing: *3,890,690 ft.* Easting: *1,474,165 ft.*

Top of Hole Elevation: *553.1 ft.*

Hole Number, Field: *AB-61* Permanent: *AP-5356*

Operator: *William Tester*

Inspector: *Steven Henslee*

Type of Hole: ☐ other ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: *8.4 ft. WD*

Depth Drilled: *14.0 ft.*

Total Depth: *16.0 ft.*

Hammer Weight: *340 lbs*

Split Spoon I.D: *2.5 in.*

Size and Type of Bit: *8-in HSA w/Bullet Bit*

Type of Equipment: *CME 850 with Automatic Hammer*

Type of Samples: *Grab and Drive*

Depth (ft.)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	%Gravel	%Sand	%Fines	Max Size (in.)	PID (ppm)	% Water	Description and Remarks
						ASPH	Asphalt							Surface: 3 in of A.C. pavement
		1		PFS	Grab	GP	Poorly graded GRAVEL with Sand	70	25	5	2	0.6	1	Brown, moist, subrounded to rounded gravel, fine to medium sand, FILL
2														
4		2		PFS	10 12 10 8	SP	Poorly graded SAND with Gravel				0.75	0.2		Brown to gray, moist, rounded gravel, fine to coarse sand
6														
8														
		3		NFS	3 5 38/2 in	GP	Poorly graded GRAVEL with Sand	63	33	4	1.25	0.0		Gray, wet to frozen, subrounded to rounded gravel, fine to coarse sand
10			Nbn									0.0		
12														
14		4		NFS	2 2 2 5	SP	Poorly graded SAND							Gray, wet, medium sand
16														Bottom of Hole 16.0 ft. Elevation 537.1 ft. Groundwater Encountered While Drilling: at depth 8.4 ft. PID = (Hot) Photo Ionization Detector
18														

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Date: *6 Jul 2002*

Drilling Agency: ☒ Alaska District ☐ Other

Elevation Datum: ☒ MSL ☐ other

Location: Northing: *3,890,907 ft.* Easting: *1,473,916 ft.*

Top of Hole Elevation: *552.8 ft.*

Hole Number, Field: *AB-62* Permanent: *AP-5357*

Operator: *William Tester*

Inspector: *Steven Henslee*

Type of Hole: ☐ other ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: *7.4 ft. WD*

Depth Drilled: *14.0 ft.*

Total Depth: *16.0 ft.*

Hammer Weight: *340 lbs*

Split Spoon I.D: *2.5 in.*

Size and Type of Bit: *8-in HSA w/Bullet Bit*

Type of Equipment: *CME 850 with Automatic Hammer*

Type of Samples: *Grab and Drive*

Depth (ft.)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	%Gravel	%Sand	%Fines	Max Size (in.)	PID (ppm)	% Water	Description and Remarks
						ASPH	Asphalt							Surface: 2.5 in of A.C. pavement
		1		PFS	Grab	SP-SM	Poorly graded SAND with Silt and Gravel				1	0.8		Brown, moist, subrounded to rounded gravel, medium sand, nonplastic (NP) fines
2														
4		2		NFS	5 5 7 10	SP	Poorly graded SAND with Gravel				0.75	0.2		Brown, moist, rounded gravel, fine to coarse sand
6														
8														
10		3		NFS	5 4 9 14	SP-SM	Poorly graded SAND with Silt and Gravel	37	57	6	1	0.0		Gray, wet, subrounded to rounded gravel, fine sand
12														
14		4		NFS	7 7 6 4	SP	Poorly graded SAND with Gravel				1.75	0.2		Gray, wet, subrounded to rounded gravel, fine to coarse sand
16														Bottom of Hole 16.0 ft. Elevation 536.8 ft. Groundwater Encountered While Drilling: at depth 7.4 ft. PID = (Hot) Photo Ionization Detector
18														

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Project: *Expand and Repair Refueling Apron (EIE174)*

Hole Number: *AP-5357*

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Drilling Agency: ☒ Alaska District ☐ Other

Elevation Datum: ☒ MSL ☐ other

Location: Northing: *3,890,710 ft.* Easting: *1,474,409 ft.*

Top of Hole Elevation: *554.9 ft.*

Hole Number, Field: *AB-63* Permanent: *AP-5358*

Operator: *William Tester*

Inspector: *Steven Henslee*

Type of Hole: ☐ other ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: *8.4 ft. WD*

Depth Drilled: *14.0 ft.*

Total Depth: *16.0 ft.*

Hammer Weight: *340 lbs*

Split Spoon I.D: *2.5 in.*

Size and Type of Bit: *8-in HSA w/Bullet Bit*

Type of Equipment: *CME 850 with Automatic Hammer*

Type of Samples: *Grab and Drive*

Depth (ft.)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	%Gravel	%Sand	%Fines	Max Size (in.)	PID (ppm)	% Water	Description and Remarks
														Surface: 4 in of A.C. pavement
						ASPH	Asphalt				1			
		1		S1	9 13 28 17	GP-GM	Poorly graded GRAVEL with Silt and Sand				1.5	38.0		Brown, moist, subrounded to rounded gravel, fine to medium sand, FILL
2		2		S1	16 24 25 29	GP-GM	Poorly graded GRAVEL with Silt and Sand	46	43	11	1	0.6	4	Brown, moist, subrounded to rounded gravel, fine and coarse sand
4		3		PFS	22 23 19 13	GP-GM	Poorly graded GRAVEL with Silt and Sand	48	44	8	1.5		3	Brown, moist, subrounded to rounded gravel, fine and coarse sand
8													▼	
10		4		PFS	5 4 6 6	SP	Poorly graded SAND with Gravel				2	0.2		Gray, wet, subrounded gravel, fine to coarse sand
14		5		PFS	7 6 6 6	SP	Poorly graded SAND with Gravel				2	0.2		Gray, wet subrounded to rounded gravel, fine to coarse sand
16														Bottom of Hole 16.0 ft. Elevation 538.9 ft. Groundwater Encountered While Drilling: at depth 8.4 ft. PID = (Hot) Photo Ionization Detector
18														

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Project: *Expand and Repair Refueling Apron (EIE174)*

Hole Number: *AP-5358*

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Drilling Agency: ☒ Alaska District ☐ Other

Elevation Datum: ☒ MSL ☐ other

Location: Northing: *3,890,819 ft.* Easting: *1,474,262 ft.*

Top of Hole Elevation: *554.0 ft.*

Hole Number, Field: *AB-64* Permanent: *AP-5359*

Operator: *William Tester*

Inspector: *Steven Henslee*

Type of Hole: ☐ other ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: *8.6 ft. WD*

Depth Drilled: *14.0 ft.*

Total Depth: *16.0 ft.*

Hammer Weight: *340 lbs*

Split Spoon I.D: *2.5 in.*

Size and Type of Bit: *8-in HSA w/Bullet Bit*

Type of Equipment: *CME 850 with Automatic Hammer*

Type of Samples: *Grab and Drive*

Depth (ft.)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	Grain Size %Gravel	%Sand	%Fines	Max Size (in.)	PID (ppm)	% Water	Description and Remarks
														Surface: broken A.C. pavement
		1		F4	Grab	ML	SILT	3	28	69		0.0	20	Brown, moist, fine sand, nonplastic (NP) fines
2														
4		2		NFS	7 9 11 11	GP-GM	Poorly graded GRAVEL with Silt and Sand	58	37	5	1.5	0.2	3	Brown, moist, subangular to rounded gravel, fine and coarse sand
6														
8														
10		3		PFS	11 16 13 13	GP-GM	Poorly graded GRAVEL with Silt and Sand				1.5	0.2		Gray, wet, subangular to rounded gravel, fine to coarse sand
12														
14		4			3 4 4 4	SP	Poorly graded SAND with Gravel				1.5	0.0		Gray, wet, subrounded to rounded gravel, fine to coarse sand
16														Bottom of Hole 16.0 ft. Elevation 538.0 ft. Groundwater Encountered While Drilling: at depth 8.6 ft. PID = (Hot) Photo Ionization Detector
18														

EXPLORATION LOG EIE174.GPJ ACE_ANC.GDT 3/24/03

NPA Form 19-E
May 94 Prev. Ed. Obsolete

Project: *Expand and Repair Refueling Apron (EIE174)*

Hole Number: *AP-5359*

ALASKA DISTRICT
CORPS OF ENGINEERS
ENGINEERING SERVICES

Soils and Geology Section
EXPLORATION LOG

Project: *Expand and Repair Refueling Apron (EIE174)*
Eielson Air Force Base, Alaska

Page 1 of 1
Date: *6 Jul 2002*

Drilling Agency: ☒ Alaska District ☐ Other

Elevation Datum: ☒ MSL ☐ other

Location: Northing: *3,891,029 ft.* Easting: *1,474,028 ft.*

Top of Hole Elevation: *553.1 ft.*

Hole Number, Field: *AB-65* Permanent: *AP-5360*

Operator: *William Tester*

Inspector: *Steven Henslee*

Type of Hole: ☐ other ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: *7.6 ft. WD*

Depth Drilled: *14.0 ft.*

Total Depth: *16.0 ft.*

Hammer Weight: *340 lbs*

Split Spoon I.D: *2.5 in.*

Size and Type of Bit: *8-in HSA w/Bullet Bit*

Type of Equipment: *CME 850 with Automatic Hammer*

Type of Samples: *Grab and Drive*

Depth (ft.)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	%Gravel	%Sand	%Fines	Max Size (in.)	PID (ppm)	% Water	Description and Remarks
														Surface: 2.5 in of A.C. pavement
		1		S2	Grab	ASPH SP-SM	Asphalt / Poorly graded SAND with Silt and Gravel				1	3.4		Brown, moist, rounded gravel, fine to medium sand, nonplastic (NP) fines, FILL
2														
4		2a		F2	5 10	SM	Silty SAND with Gravel	12	48	40		0.0	13	Brown, moist, subrounded gravel, fine sand, NP fines, wood fragements
		2b		PFS	9 8	SP	Poorly graded SAND with Gravel				1.25			Brown, moist, subrounded gravel, fine to coarse sand
6														
8														
		3	Nbn	NFS	35 58	SP	Poorly graded SAND with Gravel				1	0.2		Gray, frozen, rounded gravel, fine to coarse sand
10														
12														
14		4		NFS	4 10 13 11	GP	Poorly graded GRAVEL with Sand				2	0.2		Gray, wet, subrounded to rounded gravel, fine to coarse sand
16														Bottom of Hole 16.0 ft. Elevation 537.1 ft. Groundwater Encountered While Drilling: at depth 7.6 ft. PID = (Hot) Photo Ionization Detector
18														

NPA Form 19-E
May 94 Prev. Ed. Obsolete

Project: *Expand and Repair Refueling Apron (EIE174)*

Hole Number: *AP-5360*

EXPLORATION LOG EIE174.GPJ ACE_ANC.GDT 3/24/03

Appendix C

Analytical Data Table

Table 1
Eielson Fuel Apron Upgrade
Method 8021B - BTEX
Method AK101 - Gasoline Range Organics
Method AK102 - Diesel Range Organics
Method AK103 - Residual Range Organics
June, 2002

LOCATION OF SAMPLE:	AP-5300	AP-5314	AP-5315	AP-5316	AP-5322
DATE OF SAMPLE:	5/20/2002	5/21/2002	5/22/2002	5/22/2002	5/31/2002
TYPE OF SAMPLE:	Soil	Soil	Soil	Soil	Soil
DEPTH OF SAMPLE: (FEET)	1	8	1	1	2 - 4
FIELD SAMPLE ID: 02PARK-	01SL	02SL	03SL	04SL	06SL
TESTING LABORATORY:	STL8	STL8	STL8	STL8	STL8
LABORATORY SAMPLE ID:	106306-01	106306-02	106306-03	106306-04	106404-01
DATE RECEIVED:	5/30/2002	5/30/2002	5/30/2002	5/30/2002	6/4/2002
DATE ANALYZED:	5/30/2002	5/30 - 6/4/02	5/30 - 6/4/02	5/30 - 6/4/02	6/6 - 7/02
CONCENTRATION UNITS:	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg
Benzene	ND (0.0173)	ND (0.0208)	ND (0.0071)	ND (0.0077)	ND (0.03)
Toluene	0.0296 J	0.203	ND (0.0142)	ND (0.0155)	ND (0.0601)
Ethylbenzene	ND (0.0346)	1.87	ND (0.0142)	ND (0.0155)	ND (0.0601)
o-Xylene	0.0152 J	ND (0.0417)	ND (0.0142)	ND (0.0155)	ND (0.0601)
Xylene, Isomers m & p	0.0239 J	3.84	ND (0.0285)	ND (0.0311)	ND (0.12)
Gasoline Range Organics	1.48 J	213	ND (0.712)	ND (0.777)	ND (3)
Diesel Range Organics	15.7 J	999	16.8 J	18.4 B	ND (20.3)
Residual Range Organics	39.8 J	ND (35.6)	94.6	91.4	ND (40.7)
Lead	9.68	9.36	8.16	9.65	8.24

STL8: Severn Trent Services, Seattle, WA.
B: Analyted detected in the associated method blank.
J: Estimated Value.
ND: Not Detected. (The number in parentheses is the Practical Quanitative Limit (PQL)).

Table 1
Eielson Fuel Apron Upgrade
Method 8021B - BTEX
Method AK101 - Gasoline Range Organics
Method AK102 - Diesel Range Organics
Method AK103 - Residual Range Organics
June, 2002

LOCATION OF SAMPLE:	AP-5329	AP-5338	AP-5340	AP-5347	AP-5348
DATE OF SAMPLE:	6/1/2002	6/2/2002	6/3/2002	6/6/2002	6/6/2002
TYPE OF SAMPLE:	Soil	Soil	Soil	Soil	Soil
DEPTH OF SAMPLE: (FEET)	4 - 6	8 - 10	8 - 10	4.5 - 6.5	4.5 - 6.5
FIELD SAMPLE ID: 02PARK-	07SL	08SL	09SL	10SL	11SL
TESTING LABORATORY:	STL8	STL8	STL8	STL8	STL8
LABORATORY SAMPLE ID:	106404-02	106404-03	106404-04	106572-01	106572-02
DATE RECEIVED:	6/4/2002	6/4/2002	6/4/2002	6/11/2002	6/11/2002
DATE ANALYZED:	6/6 - 7/02	6/6 - 7/02	6/7/2002	6/12 - 13/02	6/12 - 13/02
CONCENTRATION UNITS:	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg
Benzene	ND (0.0289)	ND (0.015)	ND (0.02)	ND (0.0181)	ND (0.0174)
Toluene	ND (0.0577)	ND (0.03)	ND (0.04)	ND (0.0362)	ND (0.0348)
Ethylbenzene	ND (0.0577)	ND (0.03)	ND (0.04)	ND (0.0362)	ND (0.0348)
o-Xylene	ND (0.0577)	ND (0.03)	ND (0.04)	ND (0.0362)	ND (0.0348)
Xylene, Isomers m & p	ND (0.115)	ND (0.0601)	ND (0.08)	ND (0.0724)	ND (0.0697)
Gasoline Range Organics	ND (2.89)	ND (1.5)	ND (2)	ND (1.81)	ND (1.74)
Diesel Range Organics	ND (20.2)	ND (18.6)	NT	ND (17.9)	ND (17)
Residual Range Organics	ND (40.5)	ND (37.2)	NT	ND (35.8)	ND (34.1)
Lead	5.46	3.33	NT	2.97	3.86

STL8: Severn Trent Services, Seattle, WA.
NT: Not Tested.
ND: Not Detected. (The number in parentheses is the Practical Quanitative Limit (PQL)).

Table 1

Eielson Fuel Apron Upgrade
Method 8021B - BTEX
Method AK101 - Gasoline Range Organics
Method AK102 - Diesel Range Organics
Method AK103 - Residual Range Organics
June, 2002

			QC Dup		
LOCATION OF SAMPLE:	AP-5348	AP-5353	AP-5353	AP-5353	AP-5352
DATE OF SAMPLE:	6/6/2002	7/4/2002	7/4/2002	7/4/2002	7/4/2002
TYPE OF SAMPLE:	Soil	Soil	Soil	Soil	Soil
DEPTH OF SAMPLE: (FEET)	6.5 - 7.5	Surface	Surface	5	Surface
FIELD SAMPLE ID: 02PARK-	12SL	31SL	32SL	33SL	34SL
TESTING LABORATORY:	STL8	STL8	STL8	STL8	STL8
LABORATORY SAMPLE ID:	106572-03	107159-01	107159-02	107159-03	107159-04
DATE RECEIVED:	6/11/2002	7/9/2002	7/9/2002	7/9/2002	7/9/2002
DATE ANALYZED:	6/12 - 13/02	7/10 - 13/02	7/10 - 13/02	7/10 - 14/02	7/10 - 14/02
CONCENTRATION UNITS:	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg
Benzene	ND (0.0146)	ND (0.0094)	ND (0.0099)	ND (0.0089)	ND (0.0118)
Toluene	ND (0.0293)	ND (0.0188)	ND (0.0199)	ND (0.0179)	ND (0.0236)
Ethylbenzene	ND (0.0293)	ND (0.0188)	ND (0.0199)	ND (0.0179)	ND (0.0236)
o-Xylene	ND (0.0293)	ND (0.0188)	ND (0.0199)	ND (0.0179)	ND (0.0236)
Xylene, Isomers m & p	ND (0.0585)	ND (0.0376)	ND (0.0398)	ND (0.0358)	ND (0.0473)
Gasoline Range Organics	ND (1.46)	ND (0.94)	ND (0.995)	ND (0.895)	ND (1.18)
Diesel Range Organics	11.4 J	92.8 B	228 B	ND (16.5)	18.2 J
Residual Range Organics	67.5	404	599	ND (33.1)	68.4 B
Lead	5.23	15.8	31.4	4.92	9.01

STL8: Severn Trent Services, Seattle, WA.
B: Analyted detected in the associated method blank.
J: Estimated Value.
ND: Not Detected. (The number in parentheses is the Practical Quanitative Limit (PQL)).

Table 1
Eielson Fuel Apron Upgrade
Method 8021B - BTEX
Method AK101 - Gasoline Range Organics
Method AK102 - Diesel Range Organics
Method AK103 - Residual Range Organics
June, 2002

LOCATION OF SAMPLE:	AP-5352	AP-5352	AP-5352	AP-5358	AP-5358
DATE OF SAMPLE:	7/4/2002	7/4/2002	7/4/2002	7/6/2002	7/6/2002
TYPE OF SAMPLE:	Soil	Soil	Soil	Soil	Soil
DEPTH OF SAMPLE: (FEET)	5	10	15	Surface	5
FIELD SAMPLE ID: 02PARK-	35SL	36SL	37SL	38SL	39SL
TESTING LABORATORY:	STL8	STL8	STL8	STL8	STL8
LABORATORY SAMPLE ID:	107159-05	107159-06	107159-07	107159-08	107159-09
DATE RECEIVED:	7/9/2002	7/9/2002	7/9/2002	7/9/2002	7/9/2002
DATE ANALYZED:	7/10 - 14/02	7/10 - 14/02	7/10 - 14/02	7/10 - 14/02	7/10 - 14/02
CONCENTRATION UNITS:	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg
Benzene	ND (0.0086)	ND (0.0064)	ND (0.0104)	0.018	ND (0.0091)
Toluene	ND (0.0174)	ND (0.0128)	ND (0.0209)	0.0827	ND (0.0183)
Ethylbenzene	ND (0.0174)	ND (0.0128)	ND (0.0209)	0.0183 J	ND (0.0183)
o-Xylene	ND (0.0174)	ND (0.0128)	ND (0.0209)	0.0551	ND (0.0183)
Xylene, Isomers m & p	ND (0.0348)	ND (0.0257)	ND (0.0417)	0.0817	ND (0.0367)
Gasoline Range Organics	ND (0.869)	ND (0.641)	ND (1.04)	2.77	ND (0.917)
Diesel Range Organics	ND (16.4)	ND (17.8)	ND (17.9)	106 B	9.21 J
Residual Range Organics	ND (32.8)	ND (35.6)	ND (35.9)	529	50.4
Lead	6.19	5.16	3.78	17.2	4.53

STL8: Severn Trent Services, Seattle, WA.
B: Analyted detected in the associated method blank.
ND: Not Detected. (The number in parentheses is the Practical Quanitative Limit (PQL)).

Table 1
Eielson Fuel Apron Upgrade
Method 8021B - BTEX
Method AK101 - Gasoline Range Organics
Method AK102 - Diesel Range Organics
Method AK103 - Residual Range Organics
June, 2002

		QC Dup			
LOCATION OF SAMPLE:	AP-5350	AP-5350	AP-5354	AP-5354	AP-5360
DATE OF SAMPLE:	7/4/2002	7/4/2002	7/5/2002	7/5/2002	7/6/2002
TYPE OF SAMPLE:	Soil	Soil	Soil	Soil	Soil
DEPTH OF SAMPLE: (FEET)	Surface	Surface	Surface	15	Surface
FIELD SAMPLE ID: 02PARK-	40SL	41SL	42SL	43SL	44SL
TESTING LABORATORY:	STL8	STL8	STL8	STL8	STL8
LABORATORY SAMPLE ID:	107159-10	107159-11	107159-12	107159-13	107159-14
DATE RECEIVED:	7/9/2002	7/9/2002	7/9/2002	7/9/2002	7/9/2002
DATE ANALYZED:	7/10 - 14/02	7/10 - 14/02	7/10 - 14/02	7/10 - 14/02	7/10 - 14/02
CONCENTRATION UNITS:	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg
Benzene	ND (0.0073)	ND (0.0073)	ND (0.0086)	ND (0.0098)	ND (0.0099)
Toluene	ND (0.0147)	ND (0.0146)	ND (0.0174)	ND (0.0197)	ND (0.0198)
Ethylbenzene	ND (0.0147)	ND (0.0146)	ND (0.0174)	ND (0.0197)	ND (0.0198)
o-Xylene	ND (0.0147)	ND (0.0146)	ND (0.0174)	ND (0.0197)	ND (0.0198)
Xylene, Isomers m & p	ND (0.0295)	ND (0.0292)	ND (0.0347)	ND (0.0395)	ND (0.0396)
Gasoline Range Organics	ND (0.737)	ND (0.73)	ND (0.868)	ND (0.986)	ND (0.991)
Diesel Range Organics	162 B	166 B	98.7 B	51.7 B	13.8 J
Residual Range Organics	664	647	481	240	60.2
Lead	3.66	4.49	4.23	7.42	4.56

STL8: Severn Trent Services, Seattle, WA.
B: Analyted detected in the associated method blank.
J: Estimated Value.
ND: Not Detected. (The number in parentheses is the Practical Quanitative Limit (PQL)).

Table 2

Eielson Fuel Apron Upgrade
Method 8260B- BTEX (confirmation of 8021B detections)
May, 2002

LOCATION OF SAMPLE:	AP-5300	AP-5314	AB-63
DATE OF SAMPLE:	5/20/2002	5/21/2002	7/6/2002
TYPE OF SAMPLE:	Soil	Soil	Soil
DEPTH OF SAMPLE: (FEET)	1	8	Surface
FIELD SAMPLE ID: 02PARK-	01SL	02SL	38SL
TESTING LABORATORY:	STL8	STL8	STL8
LABORATORY SAMPLE ID:	106306-01	106306-02	107159-08
DATE RECEIVED:	5/30/2002	5/30/2002	7/9/2002
DATE ANALYZED:	6/6/2002	6/6/2002	7/16/2002
CONCENTRATION UNITS:	mg/Kg	mg/Kg	mg/Kg
Benzene	ND (0.0346)	ND (0.0208)	0.0181 J
Toluene	0.0296 J	0.0165 J	0.0729
Ethylbenzene	ND (0.0346)	0.129	0.0228
Xylene, Isomers m & p	ND (0.0693)	0.493	0.0841
o-Xylene	ND (0.0346)	0.169	0.0444

STL8: Severn Trent Services, Seattle, WA.
J: Estimated Value.
ND: Not Detected. (The number in parentheses is the Practical Quanitative Limit (PQL)).

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DIVISION 02 - SITE CONSTRUCTION

SECTION 02115

REMOVAL AND DISPOSAL OF UNDERGROUND STORAGE TANKS

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-- End of Section Table of Contents --

SECTION 02115

REMOVAL AND DISPOSAL OF UNDERGROUND STORAGE TANKS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced. The publications are referenced in the text by basic designation only.

AMERICAN PETROLEUM INSTITUTE (API)

API Pub 1628	(1996) Assessment and Remediation of Underground Petroleum Releases
API Pub 2217A	(1997) Guidelines for Work in Inert Confined Spaces in the Petroleum Industry
API Pub 2219	(1999) Safe Operation of Vacuum Trucks in Petroleum Service, 2nd Edition
API RP 1604	(1996) Closure of Underground Petroleum Storage Tanks
API RP 2003	(1998) Protection Against Ignitions Arising out of Static, Lightning, and Stray Currents
API Std 2015	(1994) Safe Entry and Cleaning of Petroleum Storage Tanks

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 4397	(1996) Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications

STATE OF ALASKA ADMINISTRATIVE CODE (AAC)

18 AAC 78	(1999) Underground Storage Tanks

U.S. ARMY CORPS OF ENGINEERS (USACE)

COE EM-385-1-1	(1996) Safety and Health Requirements Manual

U.S ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA SW-846	(Rev O; Updates I, II, IIA, IIB, and III) Test Methods for Evaluating Solid Waste (Vol IA, IB, IC, and II)
EPA 600/4-79/20	(1984) Methods for Chemical Analysis of

Water and Wastes

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910	Occupational Safety and Health Standards
40 CFR 262	Standards Applicable to Generators of Hazardous Waste
40 CFR 264	Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 265	Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 280	Technical Standards and Corrective Action Requirements for Owners and Operators of Underground Storage Tanks (UST)

1.2 DESCRIPTION OF WORK

The work includes removing and disposing of underground storage tanks and related work, including provision of worker safety measures specified in SECTION 01351 SAFETY HEALTH AND EMERGENCY RESPONSE (HTRW/UST).

1.2.1 Tank Closure

Perform work to close, remove, and dispose of underground storage tanks, and connecting piping; including but not limited to laboratory testing, providing reports which are required by regulatory agencies, and backfilling.

1.2.2 Regulations

Perform work in accordance with applicable local and State of Alaska 18 AAC 78 regulations and 40 CFR 262, 40 CFR 264, 40 CFR 265, and 40 CFR 280.

1.3 SUBMITTALS

Submit the following in accordance with SECTION 01330, SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Excavation and material handling plan; G, AO.

Site safety and health plan; G, AO.

Describe safety and health plan and procedures as related to underground tank removal and pipe removal, and as related to operations associated with petroleum contaminated soils and water. Furnish the name and qualifications based on education, training, and work experience of the proposed Site Safety and Health Officer.

Work plan; G, AO.

SD-06 Test Reports

Laboratory Testing.

Laboratory testing reports, including location of soil excavated and associated OVA/FID (organic vapor analyzer/flame ionization device) readings, sampling, and test results.

SD-07 Certificates

Qualification; G, AO.

SD-11 Closeout Submittals

Closure report; G, AO.

Incorporate reports, records, and data into a single binder with the title "SITE ASSESSMENT REPORT" on the cover of the binder.

1.4 AREAS OF CONTAMINATION

Assume for bidding purposes that soil encountered during the removal of the underground tanks are petroleum contaminated and shall be handled as specified. Assume that groundwater will not be encountered during excavation. Wash water shall be collected, stored and disposed of as specified.

1.5 QUALIFICATION (CONTRACTOR EXPERIENCE)

Submit data for approval showing that the tank removal Contractor, subcontractors, and personnel employed on the project have been engaged in removal, transportation, and disposal of underground tanks and associated piping, are familiar with and shall abide with the following:

a. API RP 1604.

b. 40 CFR 280 and State and local regulations and procedures.

c. Applicable safety rules and regulations.

d. Use of equipment and procedures for testing and vapor-freeing tanks.

e. Handling and disposal of types of wastes encountered in underground tank and pipe removal including disposal of underground tanks and associated piping.

f. Excavation, testing, and disposal of petroleum contaminated soils, liquids, and sludge.

g. Provide documentation that tank removers are certified by the State of Alaska for tank removal work. Contractor shall have a minimum of two (2) years of tank removal experience.

In addition, furnish data proving experience on at least three prior projects which included types of activities similar to those in this project. Provide project titles, dates of projects, owners of projects, point of contact for each project, and phone numbers of each point of contact.

1.6 COMPLIANCE

Comply with applicable local, State, and Federal regulations and procedures.

1.7 QUALITY ASSURANCE

1.7.1 Excavation and Material Handling Plan

Describe methods, means, equipment, sequence of operations and schedule to be employed in excavation, transport, handling, and stockpiling of soil during underground tank removal. Fifteen days before beginning tank removal work, submit to the Contracting Officer for approval a material handling plan that describes phases of dealing with the contaminated soil and water as it relates to the proposed tanks and piping removal, including methods of excavating, a material handling plan for the contaminated material, soil testing requirements, safety precautions and requirements, and water pumping and collection requirements.

1.7.2 Sampling and Analysis Plan

Field sampling and laboratory testing shall be in accordance with the requirements of SECTION 02111, EXCAVATION AND HANDLING OF CONTAMINATED MATERIAL.

1.7.3 Work Plan

The Contractor shall develop, implement, maintain, and supervise as part of the work, a comprehensive plan for tank removal and related operations. As a minimum, the plan shall include, but not be limited to, excavation, removal, and ultimate disposal of the tank, its contents, and any contaminated materials. The Work Plan shall be based on work experience, on the requirements of this specification, and on the following references:

a. API RP 1604.

b. API Std 2015.

c. API RP 2003.

d. API Pub 2217A.

e. API Pub 2219.

f. ADEC 18 AAC 78.

No work at the site, with the exception of site inspections and mobilization, shall be performed until the Work Plan is approved. At a minimum, the Work Plan shall include:

a. Discussion of the removal approach, tank cleaning, and tank cutting procedures.

b. A Sampling and Analysis Plan.

c. Methods to be employed for product, sludge, vapor, and pumpable liquid removal; purging and inerting; and storage methods proposed for control of surface water.

d. Treatment options.

e. Identification of waste, tank transporters and means of transportation.

f. Treatment, disposal, and alternate facilities, and means of treatment, disposal or remediation.

g. Spill and discharge control.

h. Decontamination procedures, shoring plan, and safety measures.

1.8 SEQUENCING AND SCHEDULING

The Contractor shall notify the Installation Environmental Coordinator and the Contracting Officer 30 days prior to tank removal. The Contractor shall be responsible for contacting ADEC in accordance with 18 AAC 78 requirements.

PART 2 PRODUCTS

2.1 PLASTIC SHEETING

ASTM D 4397.

PART 3 EXECUTION

3.1 REMOVAL AND DISPOSAL OF TANKS

Furnish labor, materials, necessary permits, laboratory tests, and reports and equipment to remove and dispose of products remaining in the underground tank; clean and vapor free the underground tank and connecting piping; excavate, remove underground tanks and associated piping, and backfill to the level of the adjacent ground; sample soil and water to determine if contaminated; dispose of tanks and associated piping and water. Provide work in accordance with 40 CFR 280, 18 AAC 78 and in accordance with appropriate Federal, State, and local regulations.

3.2 SITE SAFETY AND HEALTH PLAN (SSHP)

Furnish safety, health, and accident prevention provisions and develop a Site Safety and Health Plan (SSHP) in accordance with SECTION 01351, SAFETY, HEALTH, AND EMERGENCY RESPONSE (HTRW/UST). The SSHP shall identify details specific to the removal and disposal of the underground storage tanks and associated piping. Site work shall not start until the SSHP is approved by the Contracting Officer.

3.3 SITE SAFETY AND HEALTH OFFICER

Identify an individual to serve as the Site Safety and Health Officer (SSHO) in accordance with SECTION 01351 SAFETY, HEALTH, AND EMERGENCY RESPONSE (HTRW/UST). The SSHO shall report problems and concerns regarding health and safety to the Contracting Officer.

3.4 SPILL AND DISCHARGE CONTROL PLAN

Develop, implement, and maintain a comprehensive spill and discharge control plan. The plan shall provide contingency measures for potential spills and discharges from handling and transportation of contaminated soils and water. A possible source of guidance for assessment and

remediation is API Pub 1628.

3.5 EXCLUSION ZONE (EZ) AND CONTAMINATION REDUCTION ZONE (CRZ)

Do not permit personnel, not directly involved with the project, to enter work zones, called the EZ and CRZ. The EZ shall be an area around the tank a minimum of 10' from the limits of the tank excavation. At the perimeter of the EZ, establish a CRZ. Limits of the CRZ shall be established by the Contractor. Within the CRZ, equipment and personnel shall be cleaned as stated in the paragraph entitled "PERSONNEL AND EQUIPMENT DECONTAMINATION." The Contractor's site office, parking area, and other support facilities shall be located outside the EZ and CRZ. Boundaries of the EZ and CRZ shall be clearly marked and posted. Include a site map, outlining the extent of work zones and location of support facilities, in the SSHP.

3.6 PERSONNEL PROTECTION

Furnish appropriate personal safety equipment and protective clothing to personnel and ensure that safety equipment and protective clothing is kept clean and well maintained. Furnish personal protective equipment and clothing for use by the Contracting Officer or official visitors for entry into the EZ as required by SECTION 01351 SAFETY, HEALTH, AND EMERGENCY RESPONSE (HTRW/UST).

3.7 RESPIRATORY PROTECTION PROGRAM

Develop a respiratory protection program, addressing respirator usage and training, in accordance with 29 CFR 1910 and COE EM-385-1-1.

3.8 DECONTAMINATION

Decontaminate or properly dispose of personal protective equipment and clothing worn in contaminated areas at the end of the work day. The SSHO shall be responsible for ensuring that personal protective clothing and equipment are decontaminated before being reissued as required by SECTION 01351 SAFETY, HEALTH, AND EMERGENCY RESPONSE (HTRW/UST).

3.9 FIRST AID AND EMERGENCY RESPONSE EQUIPMENT AND PROCEDURES

Provide appropriate emergency first aid equipment for treatment of exposure to site physical and chemical hazards. Provide and post a list of emergency phone numbers and points of contact for fire, hospital, police, ambulance, and other necessary contacts. Provide and post a route map detailing the directions to the nearest medical facility. Meet requirements of SECTION 01351 SAFETY, HEALTH, AND EMERGENCY RESPONSE (HTRW/UST).

3.10 IGNITION SOURCES

Do not permit ignition sources in the EZ and CRZ.

3.11 PERSONNEL AND EQUIPMENT DECONTAMINATION

Decontaminate personnel and equipment before exiting the work zones. Meet requirements of SECTION 01351 SAFETY, HEALTH, AND EMERGENCY RESPONSE (HTRW/UST)

3.12 WASTE DISPOSAL

The SSHP shall detail the practices and procedures to be utilized to dispose of wastes. Upon completion of the project, certify that equipment and materials were properly decontaminated prior to being removed from the site.

3.13 EMERGENCY RESPONSE REQUIREMENTS

Furnish emergency response and contingency plan in accordance with 29 CFR 1910 and SECTION 01351 SAFETY, HEALTH, AND EMERGENCY RESPONSE (HTRW/UST). In an emergency, take action to remove or minimize the cause of the emergency, alert the Contracting Officer, and institute necessary measures to prevent repetition of the emergency. Equip site-support vehicles with route maps providing directions to the medical treatment facility.

3.14 UNFORESEEN HAZARDS

Notify the Contracting Officer of any unforeseen hazard or condition which becomes evident during work.

3.15 ADDITIONAL REQUIREMENTS

Provide clean and vapor free tank in accordance with API RP 1604 and the following:

a. Table of Tank History

Tank Number	Tank Location	Tank Capacity	Date Constructed	Type of Lining (If Applicable)	Type of Fuel	Remarks From the Last Inspection

b. Fuel Removal

All possible fuel will be pumped or otherwise removed from the tank by the Government. Consider remaining fuel contaminated or waste fuel. Dispose of remaining fuel emulsions in accordance with applicable local, State, and Federal regulations. Drums or tanks used for containerizing waste fuel shall be furnished by the Contractor.

3.16 TEMPORARY CONTAINMENT OF EXCAVATED SOIL

Provide temporary containment area near the excavated area. Cover containment area with 30 mil polyethylene sheeting. Place excavated soil on the impervious barrier and cover with 6 mil polyethylene sheeting. Provide straw bale berm around the outer limits of the containment area and cover with polyethylene sheets. Secure edges of sheets to keep the polyethylene sheeting in place.

3.17 EXCAVATION

Provide Contracting Officer with written documentation, no later than 30 days before work begins, that proper State or local authorities have been notified. Notify the Contracting Officer at least 48 hours prior to start of tank removal work. Stage operations to minimize the time that tank excavation is open and the time that contaminated soil is exposed to the weather. Provide protection measures around the excavation area to prevent

water runoff from entering the excavation and to provide stability of soils within the excavation area.

3.17.1 Excavation Procedures

Excavate as required to remove tank and piping. Place soil removed from the excavation in a temporary containment area. Contaminated soil materials that meets the physical requirements of the project and does not contain free product may be used as backfill for tank and pipe excavations and shall be placed within the same approximate location and depth from which it was excavated.

3.17.2 Excavation Methods

Select methods and equipment to remove soil to minimize disturbance to areas beyond the limits of the excavation area. Material that becomes contaminated as a result of the Contractor's operations shall be removed and disposed of at no additional cost to the Government.

3.17.3 Structures

During excavation activities, if concrete slabs, or other structures are encountered, remove and wash with high pressure water cleaning equipment. Remove and dispose of the pavement, concrete, and other structures as specified in SECTION 02220, DEMOLITION.

3.18 LABORATORY TESTING

3.18.1 Testing Under Tank After Removal of Tank

Sampling and analysis shall be in accordance with SECTION 02111, EXCAVATION AND HANDLING OF CONTAMINATED MATERIAL. Furnish results to the Contracting Officer within 24 hours after the results are obtained. Along with the results furnish a sketch showing underground tank, sampling location, and extent of excavations.

3.19 WATER DISPOSAL

Dewatering will not be permitted. Surface water generated by the Contractor for cleaning and rinsing of tanks, piping, and encountered structures shall be stored and tested in accordance with EPA SW-846 and EPA 600/4-79/20 and state or locally required analyses. Water that contains contaminants above locally acceptable levels shall be transported and disposed of in accordance with Federal, State, and local regulations. Non-contaminated water may be disposed of on-site.

3.20 SECURING TANK SYSTEM

API RP 1604. Drain product lines into the tanks and remove liquids and sludge from tanks. Hydrocarbon products, sludge, and wastewater recovered from the tanks shall be the property of the Contractor and shall be disposed of in accordance with applicable Federal, State, and local requirements. Cap the fill pipe, gauge pipe, tank vapor recovery fitting, and vapor return. Cap the product piping at associated buildings. Disconnect electric power to the pumps. Leave vent piping open.

3.21 REMOVAL OF UNDERGROUND TANKS AND ASSOCIATED PIPING

3.21.1 Preparation

API RP 1604. Remove the fill pipe, gauge pipe, and drop tube. Cap or remove non-product piping, except vent piping. Plug tank openings so that vapors will exit through vent piping during the vapor-freeing process.

3.21.2 Purging

Remove flammable vapors in accordance with API RP 1604. Tanks shall be certified as "vapor free" prior to further work.

3.21.3 Cleaning and Testing

Cleaning and tank atmosphere testing shall be in accordance with API RP 1604. Distribution (product delivery) piping shall be cleaned and removed. Test the tank atmosphere and the excavation area for flammable or combustible vapor concentrations, with a combustible gas indicator until the tank is removed from the excavation and from the site.

3.21.4 Tank Removal

Plug or cap accessible holes. One plug shall have a minimum 1/8" vent hole. Excavate around the tank to uncover it for removal. Remove the tank from the excavation and place it on a level surface and render it useless in accordance with API RP 1604. Provide warning labels on tank if tank contained leaded fuels. Warning shall read as follows or similar wording:

TANK HAS CONTAINED JET FUEL
NOT VAPOR FREE
NOT SUITABLE FOR STORAGE OF FOOD OR
LIQUIDS INTENDED FOR HUMAN OR ANIMAL
CONSUMPTION
DATE OF REMOVAL: MONTH/DAY/YEAR"

Make tank unusable for future use, then transport and dispose of tank in accordance with Federal, State, and local regulations.

3.22 INSPECTIONS

Arrange for and perform required inspections. Provide copies of inspections to Contracting Officer.

3.23 CLOSURE REPORT (SITE ASSESSMENT REPORT)

Provide the Contracting Officer a Site Assessment Report in a single binder notebook which shall contain a collection of reports, records, starting and ending dates of reporting period, inspections, documentation, and data as follows:

a. Complete UST Notification Form (within 30 days of closure).

b. Description of work, including removal procedures, number of tanks removed, identification of tanks removed and disposed of, cubic yards of excavated soil, location of disposal sites, and dates of excavation.

c. Site plan, including location of tanks and piping, limits of excavation, sampling points, results of excavation, and depths.

d. Laboratory testing reports, copies of data and test results from testing laboratory.

e. Tank disposal paperwork and contaminated water disposal paperwork.

f. Certifications required by implementing agency.

g. Permits required for underground tank removal, notifications, and inspection reports.

3.24 SPILLS OF CONTAMINATED SOILS

Use appropriate vehicles and operating practices to prevent spillage or leakage of contaminated materials from occurring during operations. Inspect vehicles leaving the area of contamination to ensure that no contaminated materials adhere to the wheels or undercarriage.

3.25 BACKFILL

Provide backfill, compaction, grading, and seeding in accordance with SECTION 02319, EARTHWORK FOR VEHICLE TRAFFIC AREAS, STRUCTURES, SIDEWALKS AND CURBS, AND AREA GRADING.

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SECTION 02218

FLEXIBLE MEMBRANE LINER (FML)

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 471	(1998e1) Rubber Property - Effect of Liquids
ASTM D 543	(1995) Evaluating the Resistance of Plastics to Chemical Reagents
ASTM D 747	(1993) Apparent Bending Modulus of Plastics by Means of a Cantilever Beam
ASTM D 751	(2000) Coated Fabrics
ASTM D 2565	(1992a) Practice for Operating Xenon Arc-Type Light Exposure Apparatus With and Without Water for Exposure of Plastics
ASTM D 3389	(1994) Coated Fabric Abrasion Resistance (Rotary Platform, Double-Head Abrader)
ASTM E 96	(2000) Water Vapor Transmission of Materials

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-T-83133	(Rev. E) Turbine Fuel, Aviation, Kerosene Types, NATO F-34 (JP-8) and NATO F-35

1.2 SYSTEM DESCRIPTION

This specification covers the requirements for a Flexible Membrane Liner (FML) system which is to be used beneath an aboveground vertical steel tank intended for storage of petroleum products. Reference SECTION 02276 GEOMEMBRANE LINER for geomembrane requirements outside the fuel tanks.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with SECTION 01330 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Tests.

A letter, at least 10 working days in advance of each test, advising the Contracting Officer of the test. A separate letter shall be submitted for each individual test.

Inspections.

A letter, at least 5 working days in advance of each inspection, advising the Contracting Officer of the inspection. A separate letter shall be submitted for each individual inspection.

SD-02 Shop Drawings

FML Drawings; G-AO.

Detail drawings, prior to any fabrication or installation, which include as a minimum the FML layout plan with joint description, penetration detail, anchorage details, and installation instructions.

SD-03 Product Data

Manufacturer's Catalog Data; G-AE.

Manufacturer's standard catalog data giving the brand names and catalog numbers of all materials and the FML system in sufficient detail to demonstrate complete compliance with this section. Indicate the total number of job lots necessary to produce the total amount of FML required for the job.

SD-04 Samples

FML Samples.

Samples, each tagged to identify:

1. Date the sample was taken.

2. Panel or sheet from which the sample was taken.

3. The location in the panel or sheet each sample was taken.

4. Who took the sample.

5. Any visual inspection comments.

SD-06 Test Reports

FML Factory Test.

Four copies of the information described below in a bound 8-1/2 by 11-inch booklet. Drawings shall be folded, with the title block visible, and placed in plastic pockets with reinforced holes. The FML factory tests shall be submitted and approved prior to the installation of any FML. Each section shall contain a detailed description of the test including:

1. A list of equipment used along with calibration certifications.

2. A copy of measurements taken.

3. The date of testing.

4. The parameters being verified.

5. The condition specified for the parameter.

6. The test results, signed and dated.

7. A description of adjustments made during the test.

Tests.

Four copies of each test containing the information described below in a bound 8-1/2 by 11-inch booklet. Drawings shall be folded, with the title block visible, and placed in plastic pockets with reinforced holes.

1. A list of equipment used along with calibration certifications.

2. A copy of measurements taken.

3. The date of testing.

4. The parameters to be verified.

5. The condition specified for the parameter.

6. The test results, signed, dated, and certified by the field engineer. The certification shall state that required procedures were accomplished, that the procedures were conducted in compliance with the plans and specifications.

7. A description of adjustments performed.

Inspections.

Four copies of each inspection containing the information described below in a bound 8-1/2 by 11-inch booklet. Drawings shall be folded, with the title block visible, and placed in plastic pockets with reinforced holes.

1. A list of equipment used along with calibration certifications.

2. A copy of measurements taken.

3. The date of inspection.

4. The parameters to be verified.

5. The condition specified for the parameter.

6. The inspection results, signed, dated, and certified by the field engineer. The certification shall state that required procedures were accomplished, that the procedures were conducted in compliance with the plans and specifications.

7. A description of adjustments performed.

SD-07 Certificates

Early Construction Statements - Equipment.

A letter, prior to beginning any specified work, listing proposed testing equipment to be used throughout the project. The letter shall include calibration records for each piece of equipment.

Qualifications.

A letter providing evidence of the Contractor's and the field engineer's experience, training, and licensing. Statements of previous FML job experience shall be provided with a point of contact, a phone number, address, the type of installation, and the current status of the installation.

Verification of Dimensions.

A letter stating the date the site was visited and a listing of all discrepancies found.

FML Manufacturer's Representative.

A letter, prior to placing the FML, from the FML manufacturer naming their authorized representative complete with their address, phone number, and a point of contact.

SD-09 Manufacturer's Field Reports

Manufacturers Instructions.

The manufacturer's installation instructions and procedures for the FML and materials.

1.4 QUALIFICATIONS

The Contractor shall meet the licensing requirements of the State in which the work is to be performed. The Contractor shall provide a field engineer full time to this project. The field engineer shall have successfully completed manufacturer's training for handling and installing FML systems as well as have at least one million square feet of installation experience.

1.5 DELIVERY, STORAGE, AND HANDLING

Stored items shall be protected from the weather and contamination. Proper protection and care of all material before, during, and after installation is the Contractor's responsibility. Any materials found to be damaged shall be replaced at the Contractor's expense. The FML shall be stored in its original crates and if stored outdoors, the crates shall be placed on pallets and protected from the direct rays of the sun under a light-colored, heat-reflective, opaque cover in a manner that provides free-flowing air space between the crate and the cover.

1.6 PROJECT/SITE CONDITIONS

1.6.1 Verification of Dimensions

The Contractor shall become familiar with all details of the work, verify dimensions in the field, and advise the Contracting Officer of any problems before performing any work.

1.6.2 Testing and Flushing

Products (water, fuel, etc.) required for the testing and flushing of materials, equipment, instruments, personnel, supplies, etc. specified by this section shall be provided and disposed of by the Contractor.

PART 2 PRODUCTS

2.1 STANDARD PRODUCTS

System components shall be environmentally suitable for the locations shown and be the manufacturer's standard as offered in catalogs for commercial or industrial use. Any non-standard product or component and the reason for its use shall be specifically identified by the Contractor in any required submittal.

2.2 NAMEPLATES

Nameplates shall be durable and legible throughout equipment life and made of stainless steel. One plate shall be fixed to each tank in prominent locations. Each plate shall list the FML manufacturer's name, address, telephone number, and material type.

2.3 MATERIALS

Components such as sleeves, boots, etc., shall be factory prefabricated from the FML material and have the same fabrication characteristics.

2.3.1 Fuels

Materials, other than the FML, shall be resistant to the fuel or fuels being stored. Fuels as required or mentioned by this specification shall be in accordance with the following:

2.3.1.1 JP-8

Fuel shall be in accordance with MIL-T-83133.

2.3.1.2 ASTM Fuel B

ASTM Fuel B as referenced in this section shall be in accordance with ASTM D 471.

2.3.2 FML Ring Wall Sealant

The FML ring wall sealant shall be compatible with the FML, concrete, and the fuel being stored.

2.4 FLEXIBLE MEMBRANE LINER (FML)

The FML shall demonstrate the acceptable limits of the properties listed

under Table 1. The FML shall be factory produced from a base fabric that is completely covered with a polymer. The base fabric shall weigh no less than 13 ounces per square yard and be made of aramid (kevlar), polyester, or nylon. The FML shall have an overall finished weight no less than 30 ounces per square yard. Factory seams shall be made with a 2-inch overlap plus or minus 1/4-inch by an automatic thermal high-pressure welding process. The FML shall retard the growth of mildew and be capable of containing the liquid stored, withstanding temperatures up to 180 degrees F, withstanding humidity up to 99 percent relative humidity, and withstanding direct exposure to sunlight.

2.4.1 Job Lot of FML

A job lot of FML is defined by this specification as the amount of FML product that can be produced from a singular mixture of chemicals. Any FML material created from a new or altered mixture of chemicals shall be considered a new job lot.

2.4.2 FML Samples

Twenty four samples shall be cut from every job lot of FML. Each sample shall be approximately 8-1/2 inches by 11-inches in size. Eight of the samples shall be cut across factory seams.

2.4.3 FML Factory Test

Each manufacturer's job lot of FML shall have each of the FML properties verified by the factory test procedures and methods listed below. No substitute methods shall be allowed for verification of any property. Each separate verification of a property shall be made on a separate sample. The FML shall demonstrate through factory testing the acceptable limits of the following properties listed in Table 1. The properties shall be verified by each of the test standards listed.

TABLE 1. Standards and Limits for FML Properties

Property	Acceptable Limits	Test Standard	Notes
Minimum Overall Finished Thickness	32 mils	ASTM D 751	
Minimum Tear Strength	40 pounds (ibd)	ASTM D 751 Tongue Method	(Warp & Fill)
Minimum Adhesion Strength	20 pounds per inch	ASTM D 751	
Minimum FML (MTS)	1000 pounds (ibd)	ASTM D 751 Grab Method	(Warp & Fill)
Minimum FML (MTS)	600 pounds (ibd)	ASTM D 751 Cut Strip Method	(Warp & Fill)
Minimum FML Seam Shear Strength	See Note 1	ASTM D 751 Section 53	
Minimum Abrasion			

TABLE 1. Standards and Limits for FML Properties

Property	Acceptable Limits	Test Standard	Notes
Resistance	5,000 cycles	ASTM D 3389	See Note 2
Minimum Withstanding of Accelerated Weathering	1,000 hours	ASTM D 2565	See Note 3
Minimum Bursting Strength	1,500 pounds	ASTM D 751 Ball Tip Method	
Maximum Stiffness	30,000 pounds (ibd)	ASTM D 747	
Hydro Static Resistance	500 pounds per square inch	ASTM D 751	
Maximum Permeability	0.10 ounces per square foot per 24 hours	ASTM E 96 Procedure BW	See Note 4
Fuel Compatibility	No Delamination, No Bubbles, No Discoloration		See Note 5
Maximum Volume Swell (Coating Compound Only)	15 percent of original		See Note 6
Maximum Weight Gain or Loss	10 percent of original		See Note 5

Table Abbreviations: (ibd) in both directions
(MTS) Material Tensile Strength

Notes:

1. The acceptable limit for the seam shear strength shall be 95 percent of the minimum (MTS) property using the Strip Method.

2. Test until fabric exposure with an H-22 wheel loaded to 1,000 grams.

3. Manufacturer's certification of the FML, instead of actual factory testing, may be considered acceptable for the Minimum Withstanding of Accelerated Weathering if the certification verifies that the acceptable limits listed were previously achieved using the test standard listed. Data from either a manufacturer's certification or an actual factory test shall verify that no visible cracking or appreciable changes resulted as a result of the testing.

4. The test shall be performed using the Inverted Water Method with ASTM Fuel B.

5. Testing shall be performed in accordance with ASTM D 543 by immersion in ASTM Fuel B for 14 continuous days at room temperature.

6. Testing shall be performed in accordance with ASTM D 471.

PART 3 EXECUTION

3.1 FIELD ENGINEER

The field engineer shall supervise the complete installation of the FML and perform each FML inspection and test.

3.2 PREPARATION

Prior to laying out the FML, three sample field seams shall be performed. Each seam shall be 5 feet in length. Seams shall be made only when the ambient temperature and the temperature of the FML are both 50 degrees F or higher.

3.3 INSTALLATION

Parts subject to degradation or requiring adjustment, inspection or repair shall be accessible and capable of convenient removal.

3.3.1 Surface Preparation

The surfaces to be covered shall be free of rocks, debris, etc., graded true, and be smooth with no abrupt projections of any kind. See SECTION 03300 CAST-IN-PLACE STRUCTURAL CONCRETE for finishing requirements.

3.3.2 FML Installation

After successful completion of the FML visual inspection, the FML shall be laid out. Laying out and welding FML shall only be done when the ambient temperature and the temperature of the FML are both 50 degrees F or higher. Field seams shall have a 2-inch overlap plus or minus 1/4-inch, and be made by the FML manufacturer's authorized representative. Panels or sheets of FML to be seam welded together shall be laid out prior to welding field seams. The overlapped areas shall be cleaned and prepared according to the installation instructions and procedures. Welds shall be tightly bonded.

3.4 TESTS

3.4.1 FML Vacuum Box Test

After successful completion of the FML visual inspection, a vacuum box test shall be performed on all field seams, the area around the seams, and all FML surfaces showing injury due to scuffing, penetration by foreign objects, or distress from rough subgrade. A glass topped vacuum box which has a neoprene sealing gasket shall be used. The vacuum box test shall be performed as follows:

1. A commercial bubble forming solution shall be applied to the area to be tested.

2. The vacuum box shall be positioned over the area and a vacuum slowly applied until a differential pressure of 1 pound per square inch is achieved and held for at least 5 seconds while observing the solution for bubble formation.

3. If the vacuum box test indicates a continuous stream of bubbles on repeated testing at the same location, then the area being tested shall be considered damaged and shall be repaired and retested.

4. If the vacuum box test do not indicate a leak, then the vacuum shall be slowly increased until a maximum differential pressure of 2 plus 0.0 or minus 0.25 pounds per square inch is achieved and held for at least 20 seconds. If the test indicates a continuous stream of bubbles on repeated testing at the same location, then the area being tested shall be considered damaged and shall be repaired and retested. Care must be taken to limit the vacuum to no more than the maximum differential pressure because, if it is exceeded by more than 0.25 psi the FML shall be considered damaged and shall be replaced and retested.

3.4.2 FML Air Lance Tests

After successful completion of the FML vacuum box test, an air lance test shall be performed on all seams not accessible with a vacuum box test (i.e., small seams around penetrations, oddball types of patches). The air lance test will be performed using a 50 psig jet of air regulated and directed through a 3/16-inch diameter nozzle, applied to the upper edge of an overlapped seam or repaired area to detect an unbonded area. Inflation of any section of the seam by the impinging air stream shall be indicative of an unbonded area. Unbonded areas shall be repaired and retested.

3.5 INSPECTIONS

3.5.1 Sample Field Seam Inspection

3.5.1.1 Visual Inspection

Sample field seams shall be subjected to a visual inspection performed within 30 hours after the seam has been made, cured, and cooled.

3.5.2 FML Initial Inspection

A visual inspection of the FML shall be performed on each FML panel or sheet as it is unrolled. The Contracting Officer shall be notified of any visually detected damage. The visual inspection shall also verify the finished surface to be covered with the FML is properly prepared.

3.5.3 FML Seam Inspection

Field seams shall be subjected to a visual inspection performed within 30 hours after the seam has been made, cured, and cooled. Any seams visually found to be defective shall be repaired and reinspected.

3.5.4 Acceptance Inspection

As soon as practicable after successful completion of the FML vacuum box test and the air lance tests, an acceptance inspection shall be performed. If the inspection reveals any defects in the work, such defects shall be repaired or the unsatisfactory work replaced before acceptance. The cost of such repairs and replacements shall be borne by the Contractor. The Contractor shall provide materials, facilities, and equipment necessary to permit adequate inspection by the Contracting Officer or his representative.

3.6 MANUFACTURERS FIELD SERVICE

If any problems are noticed in any inspection of a seam, the Contracting Officer shall be notified immediately. The FML manufacturer's point of contact shall also be contacted by telephone and informed that the installation of their product can not be adequately completed. After a

solution has been formed, jointly between the FML manufacturer and their authorized representative, as to why the problems were encountered, another set of sample field seams shall be made and reinspected.

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SECTION 02220

DEMOLITION

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A10.6	(1990) Safety Requirements for Demolition Operations

AIR CONDITIONING AND REFRIGERATION INSTITUTE (ARI)

ARI Guideline K	(1997) Containers for Recovered Fluorocarbon Refrigerants

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

40 CFR 82	Protection of Stratospheric Ozone; Refrigerant Recycling
49 CFR 173.301	Shipment of Compressed Gas Cylinders

U.S. DEFENSE LOGISTICS AGENCY (DLA)

DLA 4145.25	(June 2000) Storage and Handling of Liquefied and Compressed Gases and Their Full and Empty Cylinders

U.S. DEPARTMENT OF DEFENSE (DOD)

DOD 4000.25-1-M	Requisitioning and Issue Procedures
MIL-STD-129	(Rev. N) Marking for Shipment and Storage

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2003) U.S. Army Corps of Engineers Safety and Health Requirements Manual

1.2 GENERAL REQUIREMENTS

Do not begin demolition until authorization is received from the Contracting Officer. The work includes demolition, salvage of identified items and materials, and removal of resulting rubbish and debris. Rubbish and debris shall be removed from Government property daily, unless otherwise directed, to avoid accumulation at the demolition site. Materials that cannot be removed daily shall be stored in areas specified by the Contracting Officer. Do not allow accumulations on airfield

pavements or roadways. In the interest of occupational safety and health, the work shall be performed in accordance with EM 385-1-1, SECTION 23, Demolition, and other applicable Sections. In the interest of conservation, salvage shall be pursued to the maximum extent possible (in accordance with SECTION 01572 CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT, if applicable; salvaged items and materials shall be disposed of as specified.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with SECTION 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Work Plan; G, AO.

The procedures proposed for the accomplishment of the work. The procedures shall provide for safe conduct of the work, including procedures and methods to provide necessary supports, lateral bracing and shoring when required, careful removal and disposition of materials specified to be salvaged, protection of property which is to remain undisturbed, coordination with other work in progress, and timely disconnection of utility services. The procedures shall include a detailed description of the methods and equipment to be used for each operation, and the sequence of operations in accordance with EM 385-1-1.

SD-07 Certificates

Demolition plan; G-AO.

Submit proposed salvage, demolition and removal procedures to the Contracting Officer for approval before work is started.

SD-11 Closeout Submittals

Receipts.

1.4 REGULATORY AND SAFETY REQUIREMENTS

Comply with federal, state, and local hauling and disposal regulations. In addition to the requirements of the "Contract Clauses," safety requirements shall conform with ANSI A10.6.

1.4.1 Receipts

Submit a shipping receipt or bill of lading for all containers of ozone depleting substance (ODS) shipped to the Defense Depot, Richmond, Virginia.

1.5 DUST AND DEBRIS CONTROL

Prevent the spread of dust and debris on airfield pavements and avoid the creation of a nuisance or hazard in the surrounding area. Do not use water if it results in hazardous or objectionable conditions such as, but not

limited to, ice, flooding, or pollution. Sweep pavements as often as necessary to control the spread of debris that may result in foreign object damage potential to aircraft.

1.6 PROTECTION

1.6.1 Traffic Control Signs

Where aircraft safety is endangered in the area of removal work, use traffic barricades with flashing lights. Anchor barricades in a manner to prevent displacement by jet blast. Notify the Contracting Officer prior to beginning such work.

1.6.2 Existing Work

Before beginning any demolition work, the Contractor shall survey the site and examine the drawings and specifications to determine the extent of the work. The Contractor shall take necessary precautions to avoid damage to existing items to remain in place, to be reused, or to remain the property of the Government; any damaged items shall be repaired or replaced as approved by the Contracting Officer. The Contractor shall coordinate the work of this section with all other work and shall construct and maintain shoring, bracing, and supports as required. The Contractor shall ensure that structural elements are not overloaded and shall be responsible for increasing structural supports or adding new supports as may be required as a result of any cutting, removal, or demolition work performed under this contract. Do not overload pavements to remain. Provide new supports and reinforcement for existing construction weakened by demolition or removal work. Repairs, reinforcement, or structural replacement must have Contracting Officer approval.

1.6.3 Weather Protection

Protect equipment to be salvaged from the weather at all times. Where removal of existing roofing is necessary to accomplish work, have materials and workmen ready to provide adequate and temporary covering of exposed areas so as to ensure effectiveness and to prevent displacement.

1.6.4 Trees

Trees within the project site which might be damaged during demolition, and which are indicated to be left in place, shall be protected by a 6' high fence. The fence shall be securely erected a minimum of 5' from the trunk of individual trees or follow the outer perimeter of branches or clumps of trees. Any tree designated to remain that is damaged during the work under this contract shall be replaced in kind or as approved by the Contracting Officer.

1.6.5 Facilities

Protect electrical and mechanical services and utilities. Where removal of existing utilities and pavement is specified or indicated, provide approved barricades, temporary covering of exposed areas, and temporary services or connections for electrical and mechanical utilities. Floors, roofs, walls, columns, pilasters, and other structural components that are designed and constructed to stand without lateral support or shoring, and are determined to be in stable condition, shall remain standing without additional bracing, shoring, of lateral support until demolished, unless directed otherwise by the Contracting Officer. The Contractor shall ensure that no

elements determined to be unstable are left unsupported and shall be responsible for placing and securing bracing, shoring, or lateral supports as may be required as a result of any cutting, removal, or demolition work performed under this contract.

1.6.6 Protection of Personnel

During the demolition work the Contractor shall continuously evaluate the condition of the structure being demolished and take immediate action to protect all personnel working in and around the demolition site. No area, section, or component of floors, roofs, walls, columns, pilasters, or other structural element will be allowed to be left standing without sufficient bracing, shoring, or lateral support to prevent collapse or failure while workmen remove debris or perform other work in the immediate area.

1.7 BURNING

The use of burning at the project site for the disposal of refuse and debris will not be permitted.

1.8 FOREIGN OBJECT DAMAGE (FOD)

Aircraft and aircraft engines are subject to FOD from debris and waste material lying on airfield pavements. Remove all such materials that may appear on operational aircraft pavements due to the Contractor's operations. If necessary, the Contracting Officer may require the Contractor to install a temporary barricade at the Contractor's expense to control the spread of FOD potential debris. The barricade shall consist of a fence covered with a fabric designed to stop the spread of debris; anchor the fence and fabric to prevent displacement by winds or jet/prop blasts. Remove barricade when no longer required.

1.9 RELOCATIONS

Perform the removal and reinstallation of relocated items as indicated with workmen skilled in the trades involved. Repair items to be relocated which are damaged or replace damaged items with new undamaged items as approved by the Contracting Officer.

1.10 Required Data

Demolition plan shall include procedures for careful removal and disposition of materials specified to be salvaged, coordination with other work in progress, a disconnection schedule of utility services, and airfield lighting, a detailed description of methods and equipment to be used for each operation and of the sequence of operations.

1.11 Environmental Protection

The work shall comply with the requirements of SECTION 01355 ENVIRONMENTAL PROTECTION.

1.12 USE OF EXPLOSIVES

Use of explosives will not be permitted.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 EXISTING FACILITIES TO BE REMOVED

Submit demolition work plan 14 days in advance of beginning work.

3.1.1 Structures

Existing structures shall be removed as indicated on the plans.

3.1.2 Utilities and Related Equipment

Remove existing utilities, as indicated and terminate in a manner conforming to the nationally recognized code covering the specific utility and approved by the Contracting Officer. When utility lines are encountered that are not indicated on the drawings, the Contracting Officer shall be notified prior to further work in that area. Remove meters and related equipment and deliver to a location in accordance with instructions of the Contracting Officer.

3.1.3 Paving and Slabs

Remove concrete and asphaltic concrete paving and slabs as indicated. Provide neat sawcuts at limits of pavement removal as indicated.

3.1.4 Roofing

Remove existing roof system and associated components in their entirety. Make provisions for worker safety during demolition and installation of new materials as described in paragraphs entitled "Statements" and "Regulatory and Safety Requirements." Sequence the work to minimize hazard to workers.

3.1.5 Masonry

Sawcut and remove masonry so as to prevent damage to surfaces to remain.

3.1.6 Concrete

Saw concrete along straight lines to a depth of not less than 2 inches. Make each cut in walls perpendicular to the face and in alignment with the cut in the opposite face. Break out the remainder of the concrete.

3.1.7 Airfield Lighting

Remove existing airfield lighting and terminate as indicated. Remove edge lights, associated transformers as indicated and dispose of off station.

3.1.8 Patching

Where removals leave holes and damaged surfaces exposed in the finished work, patch and repair these holes and damaged surfaces to match adjacent finished surfaces. Where new work is to be applied to existing surfaces, perform removals and patching in a manner to produce surfaces suitable for receiving new work. Finished surfaces of patched area shall be flush with the adjacent existing surface and shall match the existing adjacent surface as closely as possible as to texture and finish. Patching shall be as specified and indicated, and shall include:

a. Holes and depressions left as a result of removals in existing masonry walls to remain shall be completely filled with an approved masonry patching material, applied in accordance with the manufacturer's printed instructions.

b. Where existing partitions have been removed leaving damaged or missing resilient tile flooring, patch to match the existing floor tile.

c. Patch acoustic lay-in ceiling where partitions have been removed. The transition between the different ceiling heights shall be effected by continuing the higher ceiling level over to the first runner on the lower ceiling and closing the vertical opening with a painted sheet metal strip.

3.1.9 Cylinders and Canisters

Remove all fire suppression system cylinders and canisters and dispose of in accordance with the paragraph entitled "Disposal of Ozone Depleting Substance (ODS)."

3.1.10 Locksets on Swinging Doors

The Contractor shall remove all locksets from all swinging doors indicated to be removed and disposed of. Contractor shall give the locksets to the Contracting Officer after their removal.

3.2 FILLING

Holes, open basements and other hazardous openings shall be filled in accordance with SECTION 02319, EARTHWORK FOR VEHICLE TRAFFIC AREAS, STRUCTURES, SIDEWALKS AND CURBS, AND AREA GRADING.

3.3 DISPOSITION OF MATERIAL

3.3.1 Title to Materials

Except where specified in other sections, all materials and equipment removed, and not reused, shall become the property of the Contractor and shall be removed from Government property. Title to materials resulting from demolition, and materials and equipment to be removed, is vested in the Contractor upon approval by the Contracting Officer of the Contractor's demolition and removal procedures, and authorization by the Contracting Officer to begin demolition. The Government will not be responsible for the condition or loss of, or damage to, such property after contract award. Materials and equipment shall not be viewed by prospective purchasers or sold on the site.

3.3.2 Reuse of Materials and Equipment

Remove and store materials and equipment indicated to be reused or relocated to prevent damage, and reinstall as the work progresses.

3.3.3 Salvaged Materials and Equipment

Remove materials and equipment that are indicated to be removed by the Contractor and that are to remain the property of the Government, and deliver to a storage site, as directed within 5 miles of the work site.

Contractor shall salvage items and material to the maximum extent possible.

Material salvaged for the Contractor shall be stored as approved by the Contracting Officer and shall be removed from Government property before completion of the contract. Material salvaged for the Contractor shall not be sold on the site.

Salvaged items to remain the property of the Government shall be removed in a manner to prevent damage, and packed or crated to protect the items from damage while in storage or during shipment. Items damaged during removal or storage shall be repaired or replaced to match existing items. Containers shall be properly identified as to contents.

3.3.4 Disposal of Ozone Depleting Substance (ODS)

Class I and Class II ODS are defined in SECTION, 602(a) and (b), of The Clean Air Act. Prevent discharge of Class I and Class II ODS to the atmosphere. Place recovered ODS in cylinders meeting ARI Guideline K suitable for the type ODS (filled to no more than 80 percent capacity) and provide appropriate labeling. Recovered ODS shall be removed from Government property and dispose of in accordance with 40 CFR 82. Products, equipment and appliances containing ODS in a sealed, self-contained system shall be disposed of in accordance with 40 CFR 82.

3.3.4.1 Special Instructions

Each container shall have in it no more than one type of ODS. A warning/hazardous label shall be applied to the containers in accordance with Department of Transportation regulations. All cylinders including but not limited to fire extinguishers, spheres, or canisters containing an ODS shall have a tag with the following information:

a. Activity name and unit identification code

b. Activity point of contact and phone number

c. Type of ODS and pounds of ODS contained

d. Date of shipment

e. Naval stock number (for information, call (804) 279-4525).

3.3.4.2 Fire Suppression Containers

Fire suppression system cylinders and canisters with electrical charges or initiators shall be deactivated prior to shipment. Also, safety caps shall be used to cover exposed actuation mechanisms and discharge ports on these special cylinders.

3.3.5 Transportation Guidance

Shipment of all ODS containers shall be in accordance with MIL-STD-129, DLA 4145.25 (also referenced one of the following: Army Regulation 700-68, Naval Supply Instruction 4440.128C, Marine Corps Order 10330.2C, and Air Force Regulation 67-12), 49 CFR 173.301, and DOD 4000.25-1-M.

3.3.6 Unsalvageable Material

Concrete, masonry, and other noncombustible material, except concrete

permitted to remain in place, shall be disposed of in accordance with the approved Eielson AFB Waste Disposal Plan.

3.4 CLEANUP

Debris and rubbish shall be removed from basement and similar excavations. Debris shall be removed and transported in a manner that prevents spillage on streets or adjacent areas. Local regulations regarding hauling and disposal shall apply.

3.4.1 Debris and Rubbish

Debris and rubbish shall be removed from basement and similar excavations. Debris shall be removed and transported in a manner that prevents spillage on streets or adjacent areas. Local regulations regarding hauling and disposal shall apply.

-- End of Section --

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SECTION 02230

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SECTION 02230

CLEARING AND GRUBBING

PART 1 GENERAL

1.1 DEFINITIONS

1.1.1 Clearing

Clearing shall consist of the felling, trimming, and cutting of trees into sections and the satisfactory disposal of the trees and other vegetation designated for removal, including down timber, snags, brush, and rubbish occurring in the areas to be cleared.

1.1.2 Grubbing

Grubbing shall consist of the removal and disposal of stumps, roots, and matted roots from the designated grubbing areas.

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with SECTION 01330 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Disposal of Materials.

Written permission to dispose of such products on private property shall be filed with the Contracting Officer.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 CLEARING

Trees, stumps, roots, brush, and other vegetation in areas to be cleared shall be cut off flush with or below the original ground surface.

3.2 GRUBBING

Material to be grubbed, together with logs and other organic or metallic debris not suitable for foundation purposes, shall be removed to a depth of not less than 18 inches below the original surface level of the ground in areas indicated to be grubbed and in areas indicated as construction areas under this contract, such as areas for buildings, embankments, and areas to be paved. Depressions made by grubbing shall be filled with suitable material and compacted to make the surface conform with the original adjacent surface of the ground.

3.3 TREE REMOVAL

Where indicated or directed, trees and stumps that are designated as trees shall be removed from areas outside those areas designated for clearing and grubbing. This work shall include the felling of such trees and the removal of their stumps and roots as specified in paragraph GRUBBING. Trees shall be disposed of as specified in paragraph DISPOSAL OF MATERIALS.

3.4 DISPOSAL OF MATERIALS

3.4.1 Materials Other Than Salable Timber

Logs, stumps, roots, brush, rotten wood, and other refuse from the clearing and grubbing operations, shall be disposed of in accordance with the Eielson Air Force Base Waste Disposal/ Borrow Pit Plan, except when otherwise directed in writing. Such directive will state the conditions covering the disposal of such products and will also state the areas in which they may be placed.

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DIVISION 02 - SITE CONSTRUCTION

SECTION 02276

GEOMEMBRANE LINER

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SECTION 02276

GEOMEMBRANE LINER

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 413	(1982; R 1998) Rubber Property - Adhesion to Flexible Substrate
ASTM D 543	(1995) Evaluating the Resistance of Plastics to Chemical Reagents
ASTM D 696	(1998) Coefficient of Linear Thermal Expansion of Plastics Between Minus 30 degrees C and 30 degrees C
ASTM D 751	(2000) Coated Fabrics
ASTM D 1117	(1999) Nonwoven Fabrics
ASTM D 1777	(1996) Thickness of Textile Materials
ASTM D 2136	(1994; R 1998) Coated Fabrics - Low-Temperature Bend Test
ASTM D 3776	(1996) Mass Per Unit Area (Weight) of Fabric
ASTM D 3786	(2001) Hydraulic Bursting Strength of Textile Fabrics: Diaphragm Bursting Strength Tester Method
ASTM D 4533	(1991; R 1996) Trapezoid Tearing Strength of Geotextiles
ASTM D 4632	(1991; R 1997) Grab Breaking Load and Elongation of Geotextiles
ASTM D 4833	(2000) Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products
ASTM D 5641	(1994el) Practice for Geomembrane Seam Evaluation by Vacuum Chamber

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-T-83133	(Rev. E) Turbine Fuel, Aviation, Kerosene Types, NATO F-34 (JP-8) and NATO F-35

1.2 SYSTEM DESCRIPTION

This specification covers the requirements for a membrane liner in the secondary containment dike for the fuel storage tanks. This section does not cover the under tank flexible membrane liner, see SECTION 02218, FLEXIBLE MEMBRANE LINER (FML) for the under tank requirements.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with SECTION 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Geomembrane layout drawing.

Repair location drawing.

SD-03 Product Data

Geomembrane liner; G-AO.

Geocushion.

Boot assemblies for liner penetrations.

Attachment hardware for liner attachment.

Provide manufacturer's standard catalog data giving the brand names and catalog numbers in sufficient detail to demonstrate complete compliance with this section.

SD-06 Test Reports

Shop fabrication seam test reports.

Submit within 7 days of the test dates and prior to installation of the liner.

Geomembrane liner vacuum box test.

Geomembrane liner air lance tests.

Geomembrane liner seam strength tests.

Submit the day the tests are performed so as not to delay work.

SD-07 Certificates

Geomembrane liner installation plan.

Qualifications.

Field quality control plan.

Manufacturer's material warranty.

Installer's workmanship warranty.

Subgrade acceptance certificate.

Geomembrane liner certificate.

SD-08 Manufacturer's Instructions

Field seaming.

1.3.1 Geomembrane Layout Drawing

Prior to shop fabrication and installation, submit scale geomembrane layout drawings for the geomembrane liner system to the Contracting Officer for approval. As a minimum, the plan shall include panel and seam layout, attachment details, penetration details, and seam details.

Shop drawings shall indicate the direction of factory seams and shall show panel sizes consistent with the material quantity requirements.

Details shall be included to show the termination of the panels at the perimeter of lined areas, the methods of sealing around each type of penetration and the methods of attachment.

Reproduction of the contract drawings is unacceptable.

1.3.2 Repair Location Drawing

At the completion of the liner installation work, the Contractor shall provide a scaled drawing. As a minimum, the drawing shall show the exact location and size of each field installed repair.

1.3.3 Geomembrane Liner Installation Plan

Fifteen days prior to start of work, the Contractor shall submit a plan. As a minimum, the plan shall describe the methods, means, equipment, sequence of operations, weather limitations, expected daily production, and schedule to be employed for installation of the geomembrane liner, geocushion. The installation plan shall include manufacturer recommendations, precautionary notes, and the applicable placement requirements specified herein.

1.3.4 Qualifications

Fifteen days prior to start of work, the Contractor shall submit documentation of experience and resumes of personnel working on the project, including the experience and training of the individuals installing the liner system, and the individuals performing the geomembrane liner field tests. The letter shall also include points of contact with telephone numbers and addresses, where products similar to those herein were installed at similar facilities by the Contractor within the past 3 years and are currently in service. Furthermore, the Contractor shall provide letters from the liner manufacturer, naming their authorized

representatives, complete with phone numbers, addresses, and points of contact.

1.3.5 Field Quality Control Plan

Fifteen days prior to start of work, the Contractor shall submit a plan to ensure that the liner system is constructed and installed as indicated, as specified, and in accordance with the associated manufacturer's recommendations. As a minimum, the plan shall include the field testing requirements and frequency, and anticipated inspection schedules. The QC plan shall be coordinated with the geomembrane liner installation plan and schedules.

1.3.6 Manufacturer's Material Warranty

The manufacturer shall provide a written warranty agreeing to, within the specified warranty period, repair/replace defective materials characterized by leakage, abnormal aging, or deterioration of materials, and other failures of the materials, to perform as required. The specified warranty period shall be ten (10) years after the date of completion of the liner installation.

1.3.7 Installer's Workmanship Warranty

The installer shall provide a written warranty agreeing to, within the specified warranty period, repair/replace defective workmanship characterized by leaking seams, separated seams, fabric tears, improper seals at penetrations, and other installation/fabrication related problems. The specified warranty period shall be two (2) years after the date of completion of the liner installation.

1.3.8 Subgrade Acceptance Certificate

Prior to placing the liner, submit a certificate, signed by the geomembrane liner installation subcontractor, indicating that the liner subgrade was adequately prepared and that the certified subgrade will not damage the liner during installation. Submit a certificate for each area of subgrade accepted for geomembrane liner installation as work progresses. Each certificate shall identify the accepted area.

1.3.9 Geomembrane Liner Certificate

Prior to installation of the liner, submit a certificate for each batch of liner material shipped to the job site. The certificate shall be signed by the liner manufacturer and shall specifically reference the batch number, or numbers, of the liner material shipped to the job site. The certificate shall state that the referenced batch or batches of liner material delivered to the job site complies with the requirements of Paragraph 2.2, Geomembrane Liner, of this section. Each certificate shall have a copy of the referenced batch tickets attached.

1.3.10 Field Seaming

Provide manufacturer's or installer's installation instructions and procedures.

1.4 DELIVERY AND STORAGE

1.4.1 Geomembrane Liner, Geocushion, and Geogrid

The geomembrane liner shall be factory fabricated into panels as large as possible to minimize field seaming. Deliver the factory fabricated geomembrane liner panels accordion-folded, or rolled, on sturdy wooden pallets designed to be moved by forklift or similar equipment. Each factory fabricated panel shall be prominently and indelibly marked with the panel size. Protect from ultraviolet light sources during storage.

Keep all materials clean, dry, and protected from the weather. Damaged materials shall be removed from the site and shall be replaced by the Contractor at no additional cost to the Government.

Each delivery of geomembrane liner shall bear duplicate batch tickets attached to each roll or pallet of delivered product. Batch tickets shall identify the batch or production run from which it originated. This identification record shall remain with the delivered product until placed in the finished work. The duplicate ticket shall be collected, attached to the geomembrane liner certificate which references the batch number. Geomembrane liner material not bearing the batch ticket number, or bearing a batch ticket number not listed on geomembrane liner certificate shall not be incorporated in the finished work.

PART 2 PRODUCTS

2.1 MATERIAL STANDARDS

All materials for each different product in this section shall be from the same manufacturer. Mixing, cutting, patching, splicing or attaching of materials from two or more manufacturers shall not be permitted.

2.2 GEOMEMBRANE LINER

The geomembrane liner shall be factory produced from a base fabric that is completely covered with a jet fuel resistant ethylene interpolymer alloy (EIA). The base fabric shall weigh no less than 6.5 ounces per square yard and be made of polyester. The liner shall have an overall finished weight of no less than 28 ounces per square yard. All factory seams shall be made with a 2" overlap plus or minus 1/4" by an automatic thermal high-pressure welding process. The liner shall retard the growth of mildew and be capable of containing the liquid stored, withstanding up to 99 percent relative humidity, and withstanding direct exposure to sunlight.

The geomembrane liner shall conform to the following:

Property	Acceptable Limits	Test Standard	Notes
Minimum Overall Finished Thickness	30 mils	ASTM D 751	--
Weight	30.0 ± 2 oz/sq. yd	ASTM D 751	--
Minimum Tear Strength	35 pounds	ASTM D 1117	Trap Tear

Property	Acceptable Limits	Test Standard	Notes
Minimum Breaking Yield Strength	550 pounds	ASTM D 751	Grab Tensile
Cold Cracking	pass @ -35°C (pass @ -30°F)	ASTM D 2136	4 hr.-1/8" mandril
Minimum Hydrostatic Resistance	800 psi	ASTM D 751	Method A
Minimum Adhesion-Ply	15 pounds/inch	ASTM D 413	Film Tearing
Minimum Puncture Resistance	250 pounds	ASTM D 4833	--
Minimum Bursting Strength	650 pounds	ASTM D 751	Ball Tip
Fuel Compatibility	No delaminations, bubbles, or dis-coloration		See Note 1
Minimum Adhesion-heat sealed seam	35 pounds/2" seam	ASTM D 751	--
Minimum bonded seam shear strength	550 pounds	ASTM D 751	Modified by NSF 54
Maximum coefficients Thermal Expansion/ Contraction	$8x10^{-6}$ in/in°F	ASTM D 696	--

Note:

Testing shall be performed in accordance with ASTM D 543 by immersion in JP-8 (MIL-T-83133) for 30 continuous days at room temperature. JP-8 shall contain the full military additive package.

2.2.1 Boot Assemblies for Liner Penetration

Boot assemblies shall be fabricator's standard factory fabricated penetration assemblies at all geomembrane liner penetrations. Make standard boot penetration assemblies of the same material as geomembrane liner.

2.2.2 Attachment Hardware For Liner Attachment

Liner attachment hardware shall be stainless steel hardware as specified in SECTION 05500, MISCELLANEOUS METAL.

2.3 GEOCUSHION

The geocushion shall be a nonwoven polypropylene, ultraviolet resistant geotextile with uniform thickness and strength. The geocushion shall conform to the properties listed below:

Property	Acceptable Limits	Test Standard
Minimum Weight	12 oz/yd²	ASTM D 3776
Minimum Thickness	120 mils	ASTM D 1777
Minimum Grab tensile Strength	275 pounds	ASTM D 4632
Minimum Grab tensile elongation	max. 50%	ASTM D 4632
Minimum Puncture strength	175 pounds	ASTM D 4833
Minimum Mullen Burst strength	600 psi	ASTM D 3786
Minimum Trapezoidal tear strength	115 pounds	ASTM D 4533

PART 3 EXECUTION

3.1 Shop Fabrication

The shop fabricator shall shop seam the liner into as large a panels as possible which are custom designed for the project to minimize field seaming. Consideration shall be given to transportation and installation requirements.

The geomembrane liner fabricator shall perform 100% continuous visual inspection of all shop fabricated seams as they are produced. All shop fabricated seams shall be heat seamed with enough heat applied in the seaming process that a visible bead is extruded from both edges being welded. Any defective seams shall be immediately replaced and the process shall not continue until the cause of the defect has been corrected. Samples shall be taken from seams manufactured by each factory seam welding unit at the beginning of each work shift, but not less than every four hours of seaming, and tested for seam shear strength and peel strength as listed below.

Property	Acceptable Limits	Test Standard	Notes
Minimum Seam Shear	550 lbs.	ASTM D 751	Modified NSF 54
Minimum Seam Peel (Adhesion)	35 lbs. per 2"	ASTM D 751	--

Shop fabrication seam test reports shall be submitted presenting the results of the testing and batch numbers of the material batch used.

3.2 PLACEMENT OF GEOMEMBRANE LINER

The geomembrane liner installation shall not begin until the subgrade has been properly prepared and the subgrade acceptance certificate has been submitted. The liner subgrade shall be free from roots, grass, and vegetation. No rock or other object larger than 3/4" diameter shall remain on the subgrade. Foreign materials and protrusions shall be removed and all cracks and voids shall be filled and the surface made uniformly sloping as indicated. The subgrade shall be uniformly compacted to ensure against settlement. The surface on which the liner is to be placed shall be maintained in a firm, clean, dry and smooth condition during liner installation.

Coordinate installation of the geomembrane liner with installation of the geocushion.

Construction equipment can be used to deploy the liner providing excessive rutting of the subgrade is not created. Maximum allowed rutting depth is 1". Construction equipment shall not operate directly on top of the exposed liner. On side slopes, the liner shall be temporarily secured at the top and then unrolled as to minimize wrinkles and folds.

Materials, equipment, or other items shall not be dragged across the surface of the liner, or be allowed to slide down the slopes of the lining. All parties walking or work upon the lining material shall wear soft-soled shoes.

Liner sheets shall be closely fit and sealed around inlets, outlets, and other projections through the liner. Liner to concrete seals shall be made with an attachment as indicated. All piping, structures, and other penetrations through the liner shall be addressed as specified herein.

In areas where wind is prevalent, liner installation shall be started at the upwind side of the project and proceed downwind. The leading edge of the liner shall be secured at all times with sandbags or other means sufficient to hold it down during high winds.

3.2.1 Field Joints

Welding liner sections shall be done when the ambient temperature and the temperature of the liner are both 25°F or higher. Use lapped and sealed joints in field, matching factory fabricated joints. Form lapped joints by lapping edges of pieces 2". Use only manufacturer recommended methods of heat seam. Stitching and cementing shall not be allowed. Carefully inspect seams and reseal voids.

3.2.2 Geomembrane Liner Penetrations

Use only factory fabricated boots. Stainless steel bands shall be used to seal all penetrations. Field weld boot as per manufacturer's recommendations.

3.2.3 Protection

Protect installed liner in accordance with liner manufacturer's instructions. Repair or replace areas of liner showing injury from scuffing, penetration by foreign objects, distress from rough subgrade, or other unacceptable conditions. Do not allow accumulation of construction debris and garbage on liner. Remove debris and garbage immediately.

3.2.4 Liner Repairs

Repair tears, punctures, and other imperfections in liner fabric. Any repairs to the liner shall be patched with new liner material. The patch material shall have rounded corners and shall extend a minimum of 12" in each direction from the damaged area.

Damaged seams or seams which are rejected by the Contracting Officer shall be cap stripped with a 12" wide strip of the liner material.

3.3 PLACEMENT OF GEOCUSHION

Install geocushion where indicated in accordance with manufacturer's recommendations.

3.4 FIELD QUALITY CONTROL

3.4.1 Geomembrane Liner Field Inspection

A visual inspection of the geomembrane liner shall be performed by the Contractor's liner installer on each panel or sheet as it is deployed. The Contracting Officer shall be notified of all visually detected damage.

All field seams shall be subjected to a visual inspection performed by the Contractor's liner installer, and Contracting Officer within 30 hours after the seam has been made, cured, and cooled. Where problems are noticed, the liner shall be repaired and the area reinspected.

The Government's inspector shall, at all times, have free entry to all parts of the job while the work is being performed.

3.4.2 Geomembrane Liner Field Tests

3.4.2.1 Seam Strength Tests

Seam strength tests shall be performed on representative samples of the material at the ambient job site temperature. The tests shall be performed at the beginning of each work shift, but not less than every four hours of field seaming. The testing shall consist of the following:

Property	Acceptable Limits	Test Standard	Notes
Minimum Seam Shear Method	550 lbs.	ASTM D 751	Modified by NFS 54
Minimum Seam Peel (Adhesion)	35 lbs. per 2"	ASTM D 751	--

3.4.2.2 Vacuum Box Test

After successful completion of the visual inspection, a vacuum box test shall be performed on all field seams, the area around the seams, and all liner surfaces showing injury due to scuffing, penetration by foreign objects, or distress from rough subgrade. The vacuum box test shall be conducted in accordance with ASTM D 5641 except that a pressure of 3 to 5 psi or as directed by the manufacturer shall be used.

If the test indicates a continuous stream of bubbles on repeated testing at the same location, the area being tested shall be considered damaged and shall be repaired and retested. All repaired areas shall be located on a liner map drawing and submitted to the Contracting Officer at the completion of the liner installation work.

3.4.2.3 Air Lance Tests

After successful completion of the vacuum box test, an air lance test shall be performed on all seams not accessible with a vacuum box test (i.e., small seams around penetrations, irregular types of patches, etc.). The air lance test shall be performed using a 50 psig jet of air regulated and directed through a 3/16" diameter nozzle, applied to the upper edge of an overlapped seam or repaired area to detect an unbonded area. Inflation of any section of the seam by the impinging air stream shall be indicative of an unbonded area. All unbonded areas shall be repaired and retested. All repaired areas shall be located on a liner map drawing and submitted to the Contracting Officer at the completion of the liner installation work.

3.4.2.4 Acceptance Inspection

As soon as practicable after successful completion of the liner vacuum box tests and all air lance tests, an acceptance inspection shall be performed by the Contractor and Contracting Officer. If the inspection reveals any defects in the work, such defects shall be repaired or the unsatisfactory work replaced before acceptance. The cost of such repairs and replacements shall be borne by the Contractor.

3.5 BACKFILL OVER GEOMEMBRANE LINER

After the acceptance inspection has been performed, and after final approval by the Contracting Officer, the Contractor shall place ballast material over the installed geomembrane liner. Ballast material shall conform to the requirements of SECTION 02319 EARTHWORK FOR VEHICLE TRAFFIC AREAS, STRUCTURES, SIDEWALKS, CURBS AND GUTTERS, AND AREA GRADING.

Placement of the ballast material shall proceed from a stable work area adjacent to the deployed geomembrane liner and gradually progress outward.

The ballast material shall not be dropped directly on the liner. The soils shall be pushed forward in an upward tumbling action so as not to impact directly on the liner.

Construction equipment shall not be allowed to move on the exposed liner. A minimum of 6" of ballast shall be installed on the dike floor area prior to construction equipment being allowed on the liner. Construction equipment shall not weigh in excess of 22,000 pounds nor shall any equipment exert a ground contact pressure exceeding 5 psi.

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SECTION 02300

EARTHWORK

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 1556	(2000) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 2167	(1994) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D 2922	(2001) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 3017	(2001) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
ASTM E 1527	(2003) Practice for Environmental Site Assessments: Phase 1 Environmental Site Assessment Process

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with SECTION 01330 SUBMITTAL PROCEDURES:

SD-08 Manufacturer's Instructions

Earthwork.

Procedure and location for disposal of unused material.

SD-09 Manufacturer's Field Reports

Testing.

Within 24 hours of conclusion of physical tests, 6 copies of test results, including calibration curves and results of calibration tests.

SD-07 Certificates

Testing..

Certificate demonstrating the commercial testing laboratory has been inspected and approved by the Corps of Engineers.

1.3 CLASSIFICATION OF EXCAVATION

No consideration will be given to the nature of the materials, and all excavation will be designated as unclassified excavation.

1.4 BLASTING

Blasting will not be permitted.

1.5 UTILIZATION OF EXCAVATED MATERIALS

Material removed from excavations shall be appropriately processed to meet specification requirements and used, insofar as practicable, in the new construction. Materials removed from excavations that are not usable shall be disposed of in accordance with the Eielson AFB Waste Disposal/Borrow Pit Plan attached hereto. No excavated material shall be disposed of to obstruct the flow of any stream, endanger a partly finished structure, impair the efficiency or appearance of any structure, or be detrimental to the completed work in any way.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 GENERAL EXCAVATION

The Contractor shall perform excavation of every type of material encountered within the limits of the project to the lines, grades, and elevations indicated and as specified. Grading shall be in conformity with the typical sections shown and the tolerances specified in paragraph "Construction". During construction, excavation and placement of new materials shall be performed in a manner and sequence that will provide proper drainage at all times. Material required in excess of that produced by excavation and processing of existing materials within the grading limits shall be excavated from the borrow areas indicated or from other approved off-base areas selected by the Contractor as specified.

3.2 SELECTION OF BORROW MATERIAL

Borrow material shall be selected and manufactured to meet the requirements and conditions of the particular material for which it is to be used. Borrow material shall be obtained from the borrow areas shown or from other approved private sources selected by the Contractor. Unless otherwise provided in the contract, the Contractor shall obtain from the owners the right to procure material, pay royalties and other charges involved, and bear the expense of developing the sources, including rights-of-way for hauling. Borrow material from approved sources on Government-controlled land may be obtained without payment of royalties, however borrow extraction activities shall be in compliance with paragraph "BORROW PITS" of the Eielson AFB Waste Disposal/Borrow Pit Coordination Review. Unless specifically provided, no borrow shall be obtained within the limits of the project site without prior written approval. Necessary clearing, grubbing, and satisfactory drainage of borrow pits and the disposal of debris thereon

shall be considered related operations to the borrow excavation.

3.3 OPENING AND DRAINAGE OF EXCAVATION AND BORROW PITS

The Contractor shall notify the Contracting Officer 30 days in advance of the opening of any excavation or borrow pit to permit elevations and measurements of the undisturbed ground surface to be taken. Except as otherwise permitted, borrow pits and other excavation areas shall be excavated providing adequate drainage. Overburden and other spoil material shall be transported to designated spoil areas or otherwise disposed of as directed. Borrow pits shall be neatly trimmed and drained after the excavation is completed. The Contractor shall ensure that excavation of any area, operation of borrow pits, or dumping of spoil material is in accordance with the Eielson Air Force Base Waste Disposal/ Borrow Pit Plan.

3.4 NON-GOVERNMENT BORROW SOURCES

The Contractor shall check any non-Government, proposed borrow sources for the presence of hazardous substances and petroleum products as defined in ASTM E 1527. The publication includes guidance on previously examined sites. A Phase I Environmental Site Assessment, also as defined therein, shall be submitted for each proposed borrow site as a supplement to the Environmental Protection Plan. The report shall identify any previous or current presence of hazardous substances at the site, regardless of whether they have been, or can be, released to the environment. The Assessment shall be performed under the direct supervision of an independent, registered professional engineer, currently licensed by the State in which the borrow source is located, and within such timeframe as will ensure reports are valid when submitted. The engineer shall have a minimum of 3 years experience in performing satisfactory Environmental Site Assessments. All reports shall be certified in writing by the engineer and submitted in the standard format specified in the referenced publication, through the Contracting Officer, to the Base Environmental Office for review. Reports shall be submitted at least 30 days prior to needing borrow materials in the work. The qualifications of the engineer performing the Assessment shall be included in the report. Where hazardous materials are indicated, use of the source will not be allowed. No borrow materials shall be brought onto Government property without the approval of the Contracting Officer. The Government reserves the right to sample and test any borrow materials delivered to the project for conformance with this specification.

3.5 PREPARATION OF EXISTING SUBGRADE

3.5.1 Frozen Material

Neither classified material nor unclassified material shall be placed on a prepared subgrade or on subsequent layers of classified material which contains frozen material, or which has been subjected to freeze-thaw action subsequent to compaction. All material that freezes or has been subjected to freeze-thaw action during the construction work, or during periods of temporary shutdowns, such as, but not limited to, nights, holidays, weekends, winter shutdowns, or earthwork operations, shall be removed and replaced with new material. Alternatively, the material will be thawed, dried, reworked, and recompacted to the specified criteria before additional material is placed. New material shall not contain frozen clumps of soil, snow, or ice.

3.5.1.1 Construction

The prepared subgrade and subsequent layers of satisfactory material and classified material shall be shaped to line, grade, and cross section, and compacted as specified. This operation shall include plowing, disking, and any moistening or aerating required to obtain specified compaction. Soft or otherwise unsatisfactory material shall be removed and replaced with approved material as directed. Low areas resulting from removal of unsatisfactory material shall be brought up to required grade with satisfactory materials, and the entire prepared subgrade and subsequent layers of classified material shall be shaped to line, grade, and cross section and compacted as specified. After rolling, the surface of the classified material for airfields shall not show deviations greater than 1 inch when tested with a 10 foot straightedge applied both parallel and at right angles to the centerline of the area. The elevation of the finished classified material shall not vary more than 0.05 foot from the established grade and cross section.

3.6 TESTING

Testing shall be performed by a Corps of Engineers approved commercial testing laboratory. Field in-place density shall be determined in accordance with ASTM D 1556, ASTM D 2167, or ASTM D 2922. When ASTM D 2922 is used, the calibration curves shall be checked and adjusted using only the sand cone method as described in ASTM D 1556. ASTM D 2922 results in a wet unit weight of soil and when using this method ASTM D 3017 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall also be checked along with density calibration checks as described in ASTM D 3017; the calibration checks of both the density and moisture gauges shall be made at the beginning of a job on each different type of material encountered and at intervals as directed by the Contracting Officer. When test results indicate that compaction is not as specified, the material shall be removed, replaced and recompacted to meet specification requirements. Tests on recompacted areas shall be performed to determine conformance with specification requirements. The following number of tests will be the minimum acceptable for each type operation.

3.6.1 In-Place Densities; Prepared Subgrade

One test per 5000 square feet or fraction thereof.

3.6.2 Check Tests on In-Place Densities

If ASTM D 2922 is used, in-place densities shall be checked by ASTM D 1556 as follows:

One check test per lift for each 100,000 square feet or fraction thereof.

3.6.3 Moisture Contents

A minimum of two tests per day per type of material being compacted during stable weather conditions shall be performed. During unstable weather, tests shall be made as dictated by local conditions and approved by the Contracting Officer.

3.6.4 Optimum Moisture and Laboratory Maximum Density

Tests shall be made for each type material to determine the optimum moisture and laboratory maximum density values. One representative test per 50,000 square feet, or when any change in material occurs which may affect the optimum moisture content or laboratory maximum density.

3.6.5 Tolerance Tests for Classified Material

Continuous checks on the degree of finish specified in paragraph "Construction" shall be made during construction of the classified material.

3.7 EMBANKMENT PROTECTION

During construction, the classified material layers and excavations shall be kept shaped and drained. Ditches and drains shall be maintained to drain effectively at all times. The finished surface of the classified material shall be protected and maintained by the Contractor in a satisfactory condition until graded crushed aggregate base course is placed. The storage or stockpiling of materials on the finished surface of the classified material will not be permitted. No graded crushed aggregate base course shall be placed until the surface of the classified material has been checked and approved, and in no case shall graded crushed aggregate base course be placed on a muddy, spongy, or frozen material.

3.8 ATTACHMENTS

Eielson AFB Waste Disposal/Borrow Pit Coordination Review

EIELSON AFB WASTE DISPOSAL/BORROW PIT COORDINATION REVIEW

FTQW #/PROJECT TITLE: FTQW 01-3007, Expand Repair Aircraft Ramp;
FTQW 98-3006, Construct Type III Hydrant Fuel System

Air Force Project Manager/Telephone Number: Adrain Lum (PACAF) (808) 449-8082 and Captain Shaw (354th CES) (907) 377-5086

Contractor Project Engineer/Telephone Number:_____

DISPOSAL OF WASTES (to be filled out by reviewers):

1. Tree Removal and Disposal: Hydro-axing is the preferred method of removing trees and brush. Hydro-axed/soil mixture shall be hauled to Flightline swamp which is the designated disposal area for the hydro-axed / soil-mixture, see Sheet LV-1. The contractor shall push the excess hydro-axed / soil mixture to match the surrounding terrain. **Note: The contractor shall maintain/push the hydro-axed / soil mixture into Flightline swamp by the close of business each Friday and prior to project completion.**

2. Wastes to be disposed on base and site:

a. Non-incandescent Lights Bulbs – Non-incandescent light bulbs must be collected in contractor furnished containers/boxes in accordance with 40 CFR 261. Once all bulbs are collected, contact the Contracting Officers Representative (COR) to coordinate with the CES Hazardous Waste Facility (377-1668) in advance to arrange for waste drop-off.

b. PCB Light Ballasts - PCB light ballasts must be collected in contractor furnished DOT/UN containers in accordance with 40 CFR 745. Once all PCB light ballasts are collected, contact the COR to coordinate with the CES Hazardous Waste Facility (377-1668) in advance to arrange for waste drop-off.

c. Smoke Detectors – Smoke detectors must be collected in contractor furnished UN/DOT containers. Once all smoke detectors are collected, contact the COR to coordinate with the CES Hazardous Waste Facility (377-1668) in advance to arrange for waste drop-off.

3. Contaminated Soil: COMPLIANCE WITH INSTITUTIONAL CONTROLS FOR INSTALLATION RESTORATION PROGRAM SITE: POL contaminated soil may be encountered. POL contaminated soil from trench excavation will be segregated and stockpiled according to depth from which removed. The contaminated soil shall be placed in the fill areas (trenches) in the same level or profile at which it was excavated to eliminate any exposure pathway. Wet contaminated soil from near the water table should be placed on visqueen. All excavated soil not used at the project site for fill shall be sampled and disposed of by the contractor in accordance with federal and state regulations. Contact the COR, to coordinate with 354 CES/CEVQ, 377-1645, for guidance. Work at the site must be preformed under a site-specific health and safety plan (HASP) IAW 29 CFR 1910.120. Compliance monitoring of Institutional Controls is required and the contractor shall contact the COR to coordinate with 354 CES/CEVR, 377-1923, prior to beginning the project to establish a monitoring program.

4. Concrete: Flightline Swamp is the designated disposal area for clean concrete. Only clean concrete free from lead-based paint or oil based water-proofing or mastic and all other construction debris shall be disposed of in the Flightline Swamp. The contractor is responsible for removing all construction debris such as Styrofoam, wood, insulation, glass, roofing etc. from the concrete or the pond (if the contractor commits a violation). **Note: The contractor shall maintain/push the concrete into Flightline Swamp by the close of business each Friday and prior to project completion.**

5. Asphalt: All asphalt concrete shall be processed into 2” minus material and placed within the project boundaries in the locations indicated on the drawings. Alternatively, the asphalt concrete may be removed in chunks and placed in the asphalt disposal area indicated on the drawings. The Contractor shall be required and

shall have the necessary equipment to place/stack the asphalt concrete on top of the existing asphalt concrete already located within the asphalt disposed area.

6. Asbestos: Eielson AFB does operate a state permitted Asbestos Landfill. Asbestos containing mastic removed with chemicals must be collected in contractor furnished DOT/UN containers and taken to the CES Hazardous Waste Facility (377-1668) for turn in disposal. All friable and non-friable ACM that is removed (abated) as part of this project, properly packaged, and marked will be disposed in the Eielson Asbestos Landfill.

7. Wastes to be disposed off base:

All construction wastes not addressed above, except hazardous wastes, from this project shall be disposed off base by the contractor in an approved landfill in accordance with applicable state and federal regulations.

Note: Steel fuel pipe must go to an EPA/ADEC approved landfill or a scrap metal recycler. Contractor shall provide the Contracting Officer with a receipt(s) showing the quantities and type of pipe accepted by a metal recycler or a disposal facility.

8. Clean Soil – Flightline Pond:

The Contractor shall place the excess clean soil as final cover on the Flightline Pond disposal area with a 12 inch minimum to 48 inch maximum thick cap to match the surrounding terrain as directed by the COR in coordination with CEVN (377-5182). The Contractor shall have all necessary equipment to accomplish the final covering of the Flightline Pond disposal area. The clean soil shall be free of from demolition and construction debris, trees and roots two inches in diameter or larger. The Contractor shall contact the COR to coordinate with CEVN (377-5182) prior to taking the clean soil to the Flightline Pond for proper placement. The Contractor shall maintain/push the clean soil disposal site by close of business each Friday.

BORROW PITS:

1. Eielson AFB Borrow pit(s) to be used:

Gravel - Mullins Pit Borrow Pit.

a. Gravel extraction to a minimum depth of 60 feet is required. The contractor will create two separate gorges no closer then 200 feet from one another with a minimum depth of 60, width of 20 and length of 100 feet.

b. Other contractors may be using Mullins Pit Borrow Pit. Prior approval is required before establishing an extraction work area. A Contractor shall coordinate their proposed extraction work area with 354 CES/CEVN (377-5182) through the COR 30 days prior to beginning operations. Any waste or reject materials from processing, crushing or screening shall be disposed in close proximity as directed by the COR in coordination with 354 CES/CEVN.

2. Topsoil – Mullins Borrow Pit: The contractor shall coordinate with 354 CES/CEVN (377-5182) through the COR prior to removing topsoil from Mullins Pit Borrow Pit for instruction, location(s) and direction. The topsoil has been pushed into stockpiles. The topsoil will require screening. The screened topsoil shall be free from trees, roots, and rocks one inch in diameter or larger. The contractor shall have the necessary equipment to screen and remove the topsoil as directed by the COR in coordination with CEVN. Other contractors may be using Mullins Pit Borrow Pit. Contractor shall coordinate as required.

3. Pit development, rehabilitation, and/or expansion work required for privilege of using borrow pit(s):

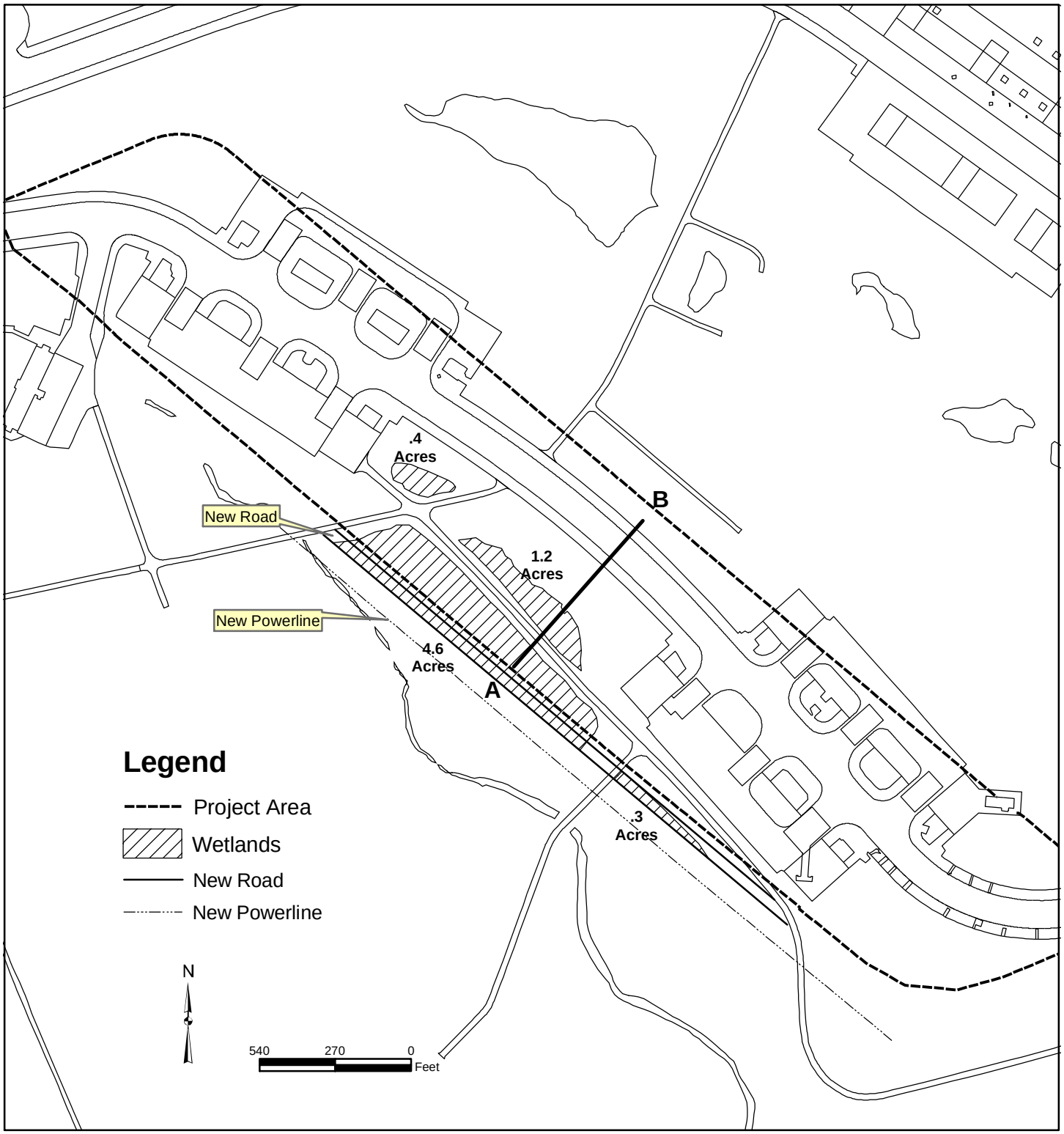
a. The Contractor shall create littoral zone and bank slope for 500 feet of shoreline in Mullins Pit as directed by the COR in coordination with 354 CES/CEVN (377-5182). The littoral zone shall be a minimum of 20 feet wide with a water depth less than 3 feet below normal water level and the bank slope shall not exceed a slope of 7:1 (horizontal to vertical).

b. The Contractor shall place two feet of unclassified soil (available at Mullins Pit) uniformly and in accordance with the prevailing grade along the peninsulas areas.

Reviewers:

CEVN___B.K.____CEVQ___F.I.___CEO___L.L.___CEORH____O.B.___CEOMI____G.C.___

Date of Issue:___24 Jul 03___. This Coordination Review becomes invalid if the project is not awarded within one year from the date of issue.



Proposed Expand/Repair Aircraft Ramp

Purpose: Extend and repair parking ramp.
Nearest Waterbody: Garrison Slough - Approximately 7.1 miles upstream from the confluence of Moose Creek.
Fairbanks North Star Borough, Alaska
Section 24, T3S, R3E, Fairbanks Meridian

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SECTION 02314

EARTHWORK FOR UTILITIES

PART 1 GENERAL

1.1 SCOPE

This section covers the excavation, trenching, filling, and backfilling for utilities systems to a point 5' outside the building to be served, complete.

1.2 ITEMS SPECIFIED IN OTHER SECTIONS

The following listed items shall conform to the requirements in SECTION 02319, "EARTHWORK FOR VEHICLE TRAFFIC AREAS, STRUCTURES, SIDEWALKS AND CURBS, AND AREA GRADING".

References

Definitions

Source of Materials

Maximum Density Determinations

Subsurface Investigations

Protection of Utilities

Operation of Borrow Pits

Access to Jobsite

Weather Limitations

Repair of Existing Work

Cleaning Up

Blasting

1.3 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2003) U.S. Army Corps of Engineers Safety and Health Requirements Manual

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 117	(1995) Materials Finer than 75 micrometer (No. 200) Sieve in Mineral Aggregates by

	Washing
ASTM C 136	(2001) Sieve Analysis of Fine and Coarse Aggregates
ASTM D 422	(1963; R 1998) Particle-Size Analysis of Soils

1.4 DEFINITIONS

As specified in SECTION 02319, "EARTHWORK FOR VEHICLE TRAFFIC AREAS, STRUCTURES, SIDEWALKS AND CURBS, AND AREA GRADING".

1.5 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with SECTION 01330, "SUBMITTAL PROCEDURES":

SD-03 Product Data

Compaction Test Plan.

The proposed locations of all compaction tests, in 3 copies prior to commencing placing operations.

SD-06 Test Reports

Compaction Test Report.

1.5.1 Compaction Test Report

Test results, with amended compaction test plan, as specified herein. A copy of the compaction test report must be provided before the fill or backfill will be accepted as completed work.

1.6 SOURCE OF MATERIALS

As specified in SECTION 02319, "EARTHWORK FOR VEHICLE TRAFFIC AREAS, STRUCTURES, SIDEWALKS AND CURBS, AND AREA GRADING".

1.7 MAXIMUM DENSITY DETERMINATIONS

As specified in SECTION 02319, "EARTHWORK FOR VEHICLE TRAFFIC AREAS, STRUCTURES, SIDEWALKS AND CURBS, AND AREA GRADING".

1.8 WORK NOT INCLUDED

All excavation for utilities systems occurring within the enclosing walls or appurtenances of buildings or other structures and out to a line 5' outside of walls or appurtenances thereof, is covered under SECTION 02319, "EARTHWORK FOR VEHICLE TRAFFIC AREAS, STRUCTURES, SIDEWALKS AND CURBS, AND AREA GRADING" for the particular structure or structures, and is not included under this section of the specifications.

PART 2 PRODUCTS

2.1 PLASTIC MARKING TAPE

Plastic marking tape shall be acid and alkali-resistant polyethylene film, 6" wide with minimum thickness of 0.004". Tape shall have a minimum strength of 1750 psi lengthwise and 1500 psi crosswise. The tape shall be manufactured with integral wires, foil backing or other means to enable detection by a metal detector when the tape is buried up to 3 feet deep. The tape shall be of a type specifically manufactured for marking and locating underground utilities. The metallic core of the tape shall be encased in a protective jacket or provided with other means to protect it from corrosion. Tape color shall be as specified in TABLE 1 and shall bear a continuous printed inscription describing the specific utility.

TABLE 1: Tape Color

Red:	Electric
Yellow:	Gas, Oil, Dangerous Materials
Orange:	Communications
Blue:	Water Systems
Green:	Sewer Systems

2.2 ROCK SHIELD

3/8" minimum thick perforated rock shield. Rock shield shall consist of a polyethylene outer surface bonded to a closed cell foam substrate with uniform perforations intended for use with cathodic protection systems. Rock shield shall overlap on itself no less than 6". Secure rock shield tightly to the pipe using either strapping tape or plastic ties.

PART 3 EXECUTION

3.1 PROTECTION OF UTILITIES

Location of the existing utilities indicated is approximate. The Contractor shall physically verify the location and elevation of the existing utilities indicated prior to starting construction. The Contractor shall scan the excavation areas with electromagnetic equipment and mark the surface of the ground where existing underground utilities are discovered.

When utility lines are encountered within the area of operations, the Contractor shall coordinate work with the Contracting Officer in ample time to prevent interruption of the service. Existing utilities to be retained and utilities constructed under this contract shall be protected from damage during excavation and backfilling and if damaged shall be repaired by the Contractor at his own expense. Inactive or abandoned utilities shall be removed and the remaining ends capped or plugged outside the excavation line as indicated.

3.1.1 Machinery and Equipment

Movement of construction machinery and equipment over pipes during construction shall be at the Contractor's risk. Repair, or remove and provide new pipe for existing or newly installed pipe that has been displaced or damaged.

3.2 CLEARING

The area to be excavated for utilities shall be cleared of all trees, stumps, roots and other natural obstructions, existing foundations, pavement, utility lines, and other items which will interfere with the construction operations. All logs, stumps, roots, brush, and other refuse from the clearing operations shall be disposed of in accordance with Eielson Air Force Base Waste Disposal / Borrow Pit Plan.

3.3 EXCAVATIONS

3.3.1 General

The Contractor shall perform all excavation of every description and of whatever substances encountered to the depth indicated on the drawing or otherwise specified. During excavation, material suitable for backfilling shall be piled in an orderly manner a sufficient distance from the banks of the trench to avoid overloading and to prevent slides or cave-ins. All excavated materials not required or unsuitable for backfill shall be removed and wasted as indicated. Such grading shall be done as may be necessary to prevent surface water from flowing into trenches or other excavations, and any accumulating therein shall be removed by pumping or by other acceptable methods. Such sheeting and shoring shall be done as may be necessary for the protection of the work and the safety of personnel. Unless otherwise indicated, excavation shall be by open cut.

3.3.1.1 Groundwater

The water table is near the excavation lines of new work. The surface of the groundwater fluctuates during the year and may impact excavation and backfill work. Dewatering will not be permitted.

3.3.1.2 Contaminated Soil

All excavated soils are to be field screen tested as specified in SECTION 02111, "EXCAVATION AND HANDLING OF CONTAMINATED MATERIAL". Contaminated soil encountered within known source areas, that meet the physical requirements of the project and does not contain free product shall be used for backfill and placed within the same approximate location and depth from which it was excavated.

3.3.2 Trench Excavation

Trenches shall be of the necessary width for proper laying of pipe or conduit and the banks shall be as nearly vertical as practicable and shall conform to "Safety and Health Requirements", EM 385-1-1. The bottom of the trenches shall be accurately graded to provide uniform bearing and support for each section of the pipe or conduit at every point along its entire length, except for the portion of the pipe or conduit sections where it is necessary to excavate bell holes for joints and for the proper sealing of the joints. Bell holes and depressions for joints shall be dug after the trench bottom has been graded and, in order that the pipe or conduit will rest on the prepared bottom for as nearly its full length as practicable, bell holes and depressions shall be only of such length, depth, and width as required for properly making the particular type of joint. Care shall be taken not to excavate below the depths indicated. Unauthorized overdepths shall be backfilled with classified material compacted to at least 95 percent compaction.

Whenever wet or otherwise unstable soil that is incapable of properly supporting the pipe, as determined by the Contracting Officer, is encountered in the bottom of the trench above the water table, such soil shall be removed to the depth required and the trench backfilled to the proper grade with classified material compacted to at least 95 percent compaction.

Where trench excavation encounters ground water, dewatering shall not be permitted. Notify Contracting Officer immediately.

Special requirements relating to specific utilities are as follows:

3.3.2.1 Storm Drains

The width of the trench from the top of the pipe and below shall be such that clear space between the wall of the pipe and the trench wall shall not exceed 8" on either side of the pipe.

The width of the trench above the top of the pipe shall be as wide as necessary for sheeting and bracing and the proper performance of the work. The bottom of the trench shall be rounded so that at least the bottom quadrant of the pipe shall rest firmly on undisturbed or compacted soil for as nearly the full length of the pipe segment as proper jointing operations will permit. This part of the excavation shall be done manually only a few feet in advance of the pipe laying, by persons skilled in this type of work.

3.3.2.2 Water Supply and Distribution Lines

Water lines shall be placed to the line and grade indicated on the drawings.

3.3.2.3 Concrete-Encased Ductwork

The trenches in which concrete-encased ductwork is to be placed shall be, in general, no wider than necessary for proper placing of such work. However, the banks of such trenches need not be kept vertical but may be sloped or widened to such general limits as may be set by the Contracting Officer, providing there is no interference with other utilities. Overexcavating and backfilling with suitable selected material where rock is encountered will not be required except for a gradual cushioning towards points of abrupt drop off of the rock to levels considerably below the grade of the duct.

3.3.2.4 Direct Burial Electrical Conduit and Cable

The trenches shall be, in general, no wider than necessary for proper placing of such work; however, the banks of such trenches need not be kept vertical but may be sloped or widened to such general limits as may be set by the Contracting Officer.

3.3.2.5 POL Distribution System

Trenches shall be, in general, no wider than necessary for proper placement of the work. The lines shall be graded to the elevations shown on the drawings. The POL pipelines shall not be constructed on frozen soil. The Contractor will verify that no frozen soil exists within one foot of the bottom of the pipeline when constructed. The native soils in the bottom of the trench will be compacted to 90 percent of ASTM D 1557, procedure C, maximum density prior to bedding placement. The pipe bedding below, adjacent, and over the pipe will be placed in 6-inch layers and compacted

to 90 percent of maximum density. The pipe bedding and trench backfill from below the pipe to 18-inches above the pipe will be compacted with hand operated plate compactors only.

3.4 FILL AND BACKFILL

3.4.1 General

Classified fill and backfill shall be used in the areas designated on the drawings or hereinafter specified. Classified fill and backfill under pipe or conduit, and ducts shall be placed in layers not exceeding 6" in thickness and thoroughly compacted, to 95 percent compaction, except that portion within the airfield paved areas shall be compacted to 100 percent of maximum density. Portions of any layer in which the materials become segregated to the extent that the required percent compaction cannot be attained, shall be removed and replaced with satisfactory materials, or blended with additional material until segregation is eliminated and specified percent compaction can be attained. Prior to backfilling, all form lumber shall be removed, and the excavated area cleaned of all trash and debris. No backfilling shall be done until construction work to be covered by backfill has been inspected and approved.

3.4.2 Backfilling of Trenches

The trenches shall not be backfilled until all required pressure and other tests are performed and until the utilities systems as installed conform to the requirements specified in the several sections covering the installation of the various utilities. Where, in the opinion of the Contracting Officer, damage is likely to result from withdrawing sheeting, the sheeting shall be left in place and the contract price will be adjusted accordingly. The trenches shall be carefully backfilled with the excavated materials as required for backfilling, which shall be deposited in 6 inch layers and thoroughly and carefully rammed until the pipe has a cover not less than 12 inches for electric conduit and concrete-encased ducts; and 2 feet for water mains. Backfill for pipe insulated or specially coated for protection against corrosion shall consist of bedding material from the bottom of the trench to 12 inches above the top of the pipe or conduit. The bedding material shall be placed in 4 inch layers which shall be carefully tamped into place in a manner recommended by the manufacturer of the pipe or conduit. The remainder of the backfill material shall then be placed into the trench in six inch layers and tamped. Settling the backfill with water will not be permitted, except when so directed by the Contracting Officer, and then only when the fill is noncohesive granular material and the backfill is under a nontraffic area. Any trenches improperly backfilled, or where settlement occurs, shall be reopened to the depth required for proper compaction, then refilled and compacted, with the surface restored to the required grade and compaction, mounded over and smoothed off. Open trenches across roadways or other areas to be surfaced shall be backfilled with classified materials the entire depth of trench in layers not exceeding 8 inches in loose thickness, and compacted to 95% percent compaction, except upper 6 inches shall be compacted to 100% of maximum density, so that surfacing of the area can proceed immediately after backfilling is completed. Open trenches across airfield pavement areas shall be backfilled with classified materials the entire depth of trench in layers not exceeding 8 inches in loose thickness, and compacted to 100% percent of maximum density. Along all other portions of the trenches, the ground shall be graded to a reasonable uniformity, and the mounding over of the trenches shall be left in a uniform and neat condition.

3.4.3 Fill and Backfill Against Walls of Structures

Fill and backfill against walls of utilidors, manholes and similar structures shall consist of unclassified material, unless otherwise shown on the drawings, which shall be placed in horizontal layers not in excess of 8" in thickness and shall have a moisture content such that the required degree of compaction may be attained. The material shall be compacted by hand or machine tampers or by other suitable equipment to a degree of compaction that will prevent excessive settlement or shrinkage. Fill and backfill shall be brought to a suitable elevation above grade to provide for anticipated settlement and shrinkage thereof. Care shall be exercised to avoid undue pressure against unsupported walls.

3.4.4 Fill and Backfill Over Utilidors and Concrete-Encased Duct

Upon completion of the structure, fill and backfill with unclassified material shall be used to effect top coverage and restore surface as nearly as practicable to match adjacent areas, with a minimum cover of 12 inches.

3.4.5 Utilization of Excavated Material

Material unsuitable or excess to the needs for fill or backfill will be authorized to be wasted and shall be disposed of in accordance with the Eielson Air Force Base Waste Disposal / Borrow Pit Plan. No material shall be deposited at any time in a manner that may endanger any structure by direct pressure or by overloading banks contiguous to the operations, or that may be in any way be detrimental to completed work.

3.5 PAVEMENT REMOVAL

Where necessary to remove existing concrete or asphalt pavement, the excavation shall be performed in a manner to prevent excessive breaking and spalling at the edges. Just prior to replacement of the pavement, the existing pavement shall be cut back not less than 24 inches beyond firm subgrade on each side of the excavation, to the full depth of the pavement. The cut shall be made with a concrete saw or similar abrasive and shall be true to line. The area shall then be repaired with surfacing of similar composition and thickness as the existing, flush with the adjacent unbroken pavement.

3.6 OPERATION OF BORROW PITS

3.6.1 General

Borrow pits shall be as specified in SECTION 02300, "EARTHWORK".

3.6.2 Disposal of Waste

All waste materials from stripping operations, and processing operations, and all other material designated as unsatisfactory or unsuitable by the Contracting Officer for use in the work, shall be disposed of in accordance with the Eielson Air Force Base Waste Disposal / Borrow Pit Plan.

3.7 ACCESS TO JOBSITE

The Contractor shall, for the duration of this contract, provide bridging of excavation or other means of access to existing structures or construction sites in the areas covered by this contract.

3.8 WEATHER LIMITATIONS

It shall be the responsibility of the Contractor to protect all areas of completed work against any detrimental effects due to weather. Any areas of completed work that are damaged by freezing or rain, shall be reconditioned, reshaped and recompacted by the Contractor in conformance with the requirements of this specification without additional cost to the Government.

3.9 REPAIR OF EXISTING WORK

All sidewalks, fences, poles and any other existing feature that is to be retained but has been damaged or removed as a result of performance of the work shall be repaired or replaced in kind in a satisfactory manner.

3.10 CLEANING UP

The Contractor shall at all times keep the construction area, including storage areas used by him, free from accumulations of waste materials or rubbish and, prior to completion of the work, remove any rubbish from and about the premises and all tools, equipment and materials not the property of the Government. Upon completion of the construction, the Contractor shall leave the work and premises in a clean, neat and satisfactory condition.

3.11 TESTING

Compaction tests, and gradation tests, including the percent finer than .02 millimeters, shall be performed on each layer of compacted material placed. Testing shall be the responsibility of the Contractor and shall be performed by a Corps of Engineers approved independent testing agency. The Contracting Officer's Representative may direct that the tests be taken at locations other than those shown on the submitted compaction test plan and that additional tests be taken to supplement these required tests. The Contractor shall remove and replace nonconforming materials and shall recompact and retest failed and replaced areas until the specified degree of compaction is obtained. The Contractor shall amend its submitted compaction test plan to show the exact location and number of tests taken. This plan shall be keyed to the test results. The record of each test shall reflect the type of test procedure and, for compaction tests, the volume or unit weight of the standard and the volume or unit weight of the compacted soil. The record shall also reflect the firm or person that performed the test, the project title and contract number. The area referred to hereinafter which determines the minimum number of tests required shall be an area that is compacted in one continuous operation.

a. Work is being accomplished to proper line and grade.

b. Backfill material is placed in horizontal layers and constructed of specified material, as verified by gradation tests, including percent finer than .02 millimeters.

c. Moisture content of materials is controlled to allow proper compaction of materials and compaction effort is as specified.

d. The number of density tests required for backfill in utility trenches shall conform to the following:

1. Bedding Layers Under Utilities: One test per 200 linear feet

of trench or a minimum of two tests, whichever is greater.

2. Trench Backfill in Graded Areas: Minimum of two tests per layer or one test per layer for each 300 linear feet of trench, whichever provides the greatest number of tests.

3. Trench Backfill in Traffic Areas: Minimum of two tests per layer or one test per layer for each 100 linear feet of trench, whichever provides the greatest number of tests.

e. Classified materials in-place shall be sampled and tested for gradation and the percent finer than .02 millimeters at least once for every layer of material that is compacted in one continuous operation. For these tests, gradation shall be determined in accordance with ASTM C 136, with ASTM C 117 used to determine minus No. 200 sieve material and ASTM D 422 used to determine minus .02 millimeter material.

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SECTION 02319

EARTHWORK FOR VEHICLE TRAFFIC AREAS, STRUCTURES, SIDEWALKS, CURBS AND GUTTERS, AND AREA GRADING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 117	(1995) Materials Finer than 75 micrometer (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C 136	(2001) Sieve Analysis of Fine and Coarse Aggregates
ASTM D 75	(2003) Sampling Aggregates
ASTM D 422	(1963; R 1998) Particle-Size Analysis of Soils
ASTM D 1556	(2000) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 1557	(2000) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu. m.))
ASTM D 2167	(1994) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D 2487	(2000) Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 2922	(2001) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 3017	(2001) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
ASTM E 1527	(2003) Practice for Environmental Site Assessments: Phase 1 Environmental Site Assessment Process

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2003) U.S. Army Corps of Engineers Safety

and Health Requirements Manual

1.2 DEFINITIONS

1.2.1 Nonfrost Susceptible Soils

Nonfrost susceptible soils are inorganic soils containing less than three percent by weight of grains finer than 0.02 mm. The methods of test used shall be ASTM C 117, ASTM C 136, ASTM D 75 and ASTM D 422.

1.2.2 Satisfactory Materials

Satisfactory materials shall be comprised of classified or unclassified material free from roots and other organic matter, trash, debris, and frozen materials. Satisfactory materials shall comprise any materials classified by ASTM D 2487 as GW, GP, GW-GM, GW-GC, GP-GM, GM, GC, GC-GM, SW, SP, SM, SW-SM, SC, SW-SC, SP-SM, SC-SM or SP-SC. Satisfactory materials for grading and for fill material for pavements shall be comprised of stones less than 4 inches in any dimension.

1.2.3 Unsatisfactory Materials

Materials which do not comply with the requirements for satisfactory materials are unsatisfactory. Unsatisfactory materials also include man-made fills; trash; refuse; backfills from previous construction; and material classified as satisfactory which contains root or other organic matter or frozen material. In addition, materials classified as PT, OL, OH, OL/OH, CL, ML, CL-ML, CH, or MH are unsatisfactory.

1.2.4 Classified Fill and Backfill

A specified soil mix or gradation of materials constructed to attain a maximum bearing strength and minimize consolidation or differential settlement under a load.

1.2.5 Unclassified Fill and Backfill

Specified material placed to obtain an indicated grade or elevation.

1.2.6 Subbase

The subbase shall extend from the top of the subgrade to the underside of the base course under pavements.

1.2.7 Subgrade

The material in excavation (cuts) and fills immediately below any subbase, base or other improvement. Also, as a secondary definition, the level below which work above is referenced.

1.2.8 Excavation

The removal of soil to obtain a specified depth or elevation.

1.2.9 Organics

Soil material classified in ASTM D 2487 as OH, OL, or PT.

1.2.10 Bedding Sand

Specified sand material used to bed pipes, conduits and other indicated areas.

1.2.11 Ballast Material

Material placed on top of the flexible membrane liner system.

1.2.12 Fill

Fill is considered to be material placed above the original ground line.

1.2.13 Backfill

Backfill is considered to be material placed in an excavation made under this contract.

1.2.14 Lift

A layer (or course) of soil placed on top of a previously prepared or placed soil.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with SECTION 01330 SUBMITTAL PROCEDURES:

SD-06 Test Reports

Testing.

Within 24 hours of conclusion of physical tests, copies of the test results, including calibration curves and results of calibration tests.

Non-Government Borrow Sources.

Test results and certification indicating that proposed materials meet all specification requirements for intended use, at least 30 days prior to being needed in the work. Tests shall be performed by a Corps of Engineers approved independent commercial testing agency.

SD-07 Certificates

Compaction Test Plan.

The proposed locations of all compaction tests, 3 copies prior to placing operations.

Heating and Monitoring Plan.

The procedures proposed for winter protection of foundations and slabs by heating and monitoring of temperature.

Non-Government Borrow Sources.

An abbreviated report of Preliminary Assessment for the presence of hazardous substances, as specified herein, for proposed materials, at least 30 days prior to being needed in the work.

1.4 MAXIMUM DENSITY DETERMINATIONS

1.4.1 Definition

Degree of compaction shall be expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D 1557, Method C.

1.4.2 Density Tests

a. Characteristics of backfill materials shall be determined in accordance with particle size analysis of soils ASTM D 422 and moisture-density relations of soils ASTM D 1557. A minimum of one particle size analysis and one moisture-density relation test shall be performed on each different type of material used for bedding and backfill.

b. Test shall be performed per paragraph 3.16 TESTING. Field in-place density shall be determined in accordance with ASTM D 1556, ASTM D 2167 or ASTM D 2922. ASTM D 2922 results in a wet unit weight of soil and when using this method, ASTM D 3017 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall be checked along with density calibration checks as described in ASTM D 3017. The calibration checks of both the density and moisture gauges shall be made at the beginning of a job, on each different type of material encountered, and at intervals as directed by the Contracting Officer. Copies of calibration curves, results of calibration tests, and field and laboratory density tests shall be furnished to the Contracting Officer.

1.5 SUBSURFACE DATA

Explorations consisting of drill holes and/or test pits have been made at the project site to assist the Contractor in ascertaining the character of the excavation material to be encountered; however, the Government does not guarantee that materials other than those disclosed by the drill holes or opened pits will not be encountered, or that the proportions of the various materials will not vary from those indicated by the explorations. Subsurface soil boring logs are shown on the Expand / Repair Aircraft Ramp Drawings.

1.6 WASTE DISPOSAL/BORROW PIT PLAN

The Contractor and all subcontractors, in performance of this contract involved in waste disposal and the excavation of gravel and topsoil on Eielson AFB, shall abide by the Eielson AFB Waste Disposal and Borrow Pit Plan. A copy of this plan is included at the end of the specification SECTION 02300 "EARTHWORK". The Contractor and all subcontractors, in performance of this contract, shall coordinate permission to use base waste disposal and borrow pit areas. Violation of the Eielson AFB Waste Disposal/Borrow Pit Plan by the Contractor may be cause for termination of the privilege to use the Eielson AFB waste disposal areas and borrow pits.

1.7 UTILIZATION OF EXCAVATED MATERIALS

Unsatisfactory materials removed from excavations shall be disposed of in accordance with the Eielson Air Force Base Waste Disposal / Borrow Pit Plan. Satisfactory material removed from excavations shall be used, insofar as practicable, in the construction of fills, embankments, subgrades, shoulders, bedding (as backfill), and for similar purposes. No satisfactory excavated material shall be wasted without specific written authorization. Satisfactory material authorized to be wasted shall be disposed of in accordance with the Eielson Air Force Base Waste Disposal / Borrow Pit Plan. Coarse rock from excavations shall be stockpiled and used for constructing slopes or embankments adjacent to streams, or sides and bottoms of channels and for protecting against erosion. No excavated material shall be disposed of to obstruct the flow of any stream, endanger a partly finished structure, impair the efficiency or appearance of any structure, or be detrimental to the completed work in any way.

PART 2 PRODUCTS

2.1 CLASSIFIED FILL AND BACKFILL

Classified fill and backfill shall be approved, well-graded nonfrost susceptible materials consisting of sand, gravel, broken stone, or similar material and containing 100% passing a 4-inch sieve, not more than 60 percent by weight passing the No. 4 sieve and not more than 5 percent passing a #200 sieve. All material shall be free of frozen lumps.

2.2 UNCLASSIFIED FILL AND BACKFILL

Unclassified fill and backfill shall be satisfactory materials consisting of sand, gravel or other materials, and shall be free of organic materials, frozen lumps, trash, lumber, or other debris. The material may be frost susceptible.

2.3 BALLAST MATERIAL

Meet the requirements of classified fill with no particle size greater than 2".

2.4 BEDDING SAND

Naturally occurring or crushed sand with clean air dry, hard, durable, uncoated particles, free from lumps of clay and deleterious substances with the following gradations:

Sieve Designation	Percent Passing by Weight (Square Mesh Sieve)
3/4"	100
No. 4	95-100
No. 10	30-64
No. 40	10-35
No. 200	0-6

PART 3 EXECUTION

3.1 EXCAVATION

3.1.1 Buildings and Structures Excavation

The excavation shall conform to the dimensions, elevations and lines indicated on the drawings for each building and structure except as specified below, and shall include trenching for utility systems to a point 5' outside the building lines of each building and structure, and all work incidental thereto. Walls of the excavation shall be as nearly vertical as practicable and shall conform to "Safety and Health Requirements", EM 385-1-1. The extent of excavation for the removal of undesirable materials such as frost susceptible materials has been determined from the results of the explorations and has been shown on the drawings as the excavation line. Any excavation beyond the authorized dimensions, elevations, and lines shall be backfilled with compacted classified material without cost to the Government.

Excavated material conforming to the contract specification requirements for materials to be used for embankments, fills, backfilling, and grading required for the project under the contract shall be considered as suitable. No materials shall be wasted or used for the convenience of the Contractor unless so authorized. Where excavated surfaces are of suitable material for placing slabs and footings, such subgrade surfaces shall be uniformly compacted by machine compaction equipment to at least 95 percent compaction unless otherwise indicated on the drawings, before placing concrete, except where rock or high density material is encountered at foundation grade. Contractor shall aerate or moisten soils materials as required to attain specified percent compaction.

3.1.2 Excavation Outside of Buildings and Structures

The Contractor shall perform all excavation of every description and of whatever substances encountered to the lines, grades, and cross-sections indicated on the drawings or specified herein. Any excavation beyond the authorized lines, grades, and cross-sections shall be backfilled with suitable compacted material without additional cost to the Government. The Contractor shall control the banks of all excavated areas as necessary to prevent movement of soil in areas supporting existing foundations or slabs.

3.1.3 Groundwater

The water table is as indicated on the subsurface boring logs. Excavations shall be performed to the limits indicated. Dewatering is not permitted. The Contractor shall conduct excavation activities to protect the excavation from ponding due to precipitation and drainage.

3.1.4 Contaminated Soil

Excavated soils are to be field screen tested and utilized as specified in SECTION 02111, "FIELD SCREEN TESTING OF SOILS FOR POL CONTAMINATION".

3.1.5 Field Modifications

If unsuitable soil conditions in the opinion of the Contracting Officer are encountered at the excavation lines specified, he may direct that extra excavation be performed. The Contractor shall perform such extra excavation only when so directed in writing, and the extra work shall

include both the necessary excavation and the placement and compaction of backfill material required to restore the excavation to the depth indicated on the drawings. When the excavation is carried to a line below the elevations specified, an equitable modification of the contract price will be made in accordance with the contract provisions. Backfill material shall not be placed until the Contractor has taken cross-sectional elevations and measurements of the area excavated in the presence of the Contracting Officer.

3.1.6 Drainage

The excavations and the area immediately surrounding each excavation, including slopes and ditches, shall be continually and effectively drained away from the excavation. The excavation for diversion ditches, as necessary, shall be performed under this specification. Suitable precautions shall be taken to prevent any erosion from undercutting previously concreted footings and slabs. Excavations shall be kept free from ponding until the permanent work in the excavations has been completed and accepted, and the excavations have been completely backfilled.

3.1.7 Shoring

Shoring, including sheet piping, shall be installed during excavation where required for the protection of workmen, banks, adjacent paving, structures and utilities.

3.1.8 Disposal of Excavated Material

Refer to SECTION 02300 "EARTHWORK"

3.1.9 Area Grading

Area grading consists of that type of work also commonly referred to by such terms as "site grading" or "overlot grading" and excavation therefore shall consist of the removal of all materials to the lines and grades indicated on the drawings. No special consideration will be given to whether or not frost-susceptible material exists in the subgrade for area grading and its removal therefrom will not be required.

3.1.10 Existing Service Lines and Utility Structures

All existing service lines and utility structures uncovered or encountered during all classes of excavation, including borrow, and during all operations incidental to all grading work, construction of embankments, and backfilling shall be safeguarded and protected from damage. Location of the existing utilities indicated is approximate. The Contractor shall physically verify the location and elevation of the existing utilities indicated prior to starting construction. The Contractor shall scan the excavation areas with electromagnetic equipment and mark the surface of the ground where existing underground utilities are discovered.

When utility lines are encountered within the area of operations, the Contractor shall coordinate work with the Contracting Officer in ample time to prevent interruption of the service. Existing utilities to be retained and utilities constructed under this contract shall be protected from damage during excavation and backfilling and if damaged shall be repaired by the Contractor at his own expense. Inactive or abandoned utilities shall be removed and the remaining ends capped or plugged outside the excavation line as indicated.

3.2 FILL AND BACKFILL FOR BUILDINGS AND STRUCTURES

3.2.1 General

No fill or backfill shall be placed until the subgrade has been checked and approved, and in no case shall it be placed on a subgrade that is muddy, frozen, or contains frost. Fill or backfill shall not be placed against foundation walls prior to 7 days after completion of the wall and then only after approval. Fill or backfill shall be brought up evenly on each side of the wall as far as practicable. Heavy equipment for spreading and compacting backfill shall not be operated closer to the wall than a distance equal to the height of the backfill above top of footing. Care shall be exercised to avoid any wedging action or eccentric action upon or against the structure, and to avoid any disturbance or damage to the work. Each layer of fill or backfill shall be spread, and moistened, or dried by aeration, to the moisture content required to attain the specified degree of compaction.

3.2.2 Classified Fill and Backfill

Where classified fill or backfill is shown on the drawings, or is required for additional excavation found necessary by the Contractor for its operations, such fill shall consist of material as specified and it shall be placed in layers not exceeding 8 inches in loose thickness, uniformly compacted to at least 95 percent compaction, unless otherwise shown on the drawings, with vibratory, or equal, machine compaction equipment of an approved type. Layer thickness shall not exceed 6 inches where power-driven hand tampers are used. Portions of any layer in which the materials become segregated to the extent that the required percent compaction cannot be attained, shall be removed and replaced with satisfactory materials, or blended with additional material until segregation is eliminated and specified percent compaction can be attained. Where classified fill or backfill extends below the footings, it shall also extend to the lines as shown on the drawings.

3.2.3 Unclassified Fill and Backfill

After completion of foundation footings and walls, and other construction below the elevation of the final grades, and prior to backfilling, all forms shall be removed and the excavation shall be cleaned of all trash and debris. Backfilling or fill placed outside the exterior walls and above the bottom of the footings shall be unclassified, except where otherwise indicated on the drawings, and shall be placed in horizontal layers not in excess of 12", in thickness. Each layer shall be compacted by hand or machine tampers or by other suitable equipment to at least 90 percent compaction. Backfill shall be brought to a suitable elevation above grade to provide for anticipated settlement and shrinkage thereof. Basement walls and floor slabs shall be protected from frost damage where construction is discontinued for the winter. To preclude frost damage to structures without basements, where construction is to be discontinued for the winter, no unclassified material shall be placed adjacent to exterior walls prior to placement of classified material within the structure.

3.2.4 Winter Protection

The Contractor shall take adequate precautions to protect foundations and floor slabs from damage due to frost action. It shall be the responsibility of the Contractor to repair or replace all such damage at no

additional cost to the Government, and with no extension of the contract completion date. If, in the opinion of the Contracting Officer, repair of damage will result in an unsuitable facility, replacement of damaged portions of work will be directed. The following minimum requirements shall be met:

3.2.4.1 Backfilling

Exterior foundation footings and walls for slab-on-grade structures shall be backfilled to finished grade prior to the ambient air temperature falling below 32 degrees F. The backfill and/or insitu material shall be complete within a minimum of 5' of each side of the footing or wall. In lieu of this backfilling, the exterior footings may be heated at specified below.

To preclude frost damage to slab-on-grade structures during winter construction, no unclassified material shall be placed adjacent to exterior walls prior to placement of classified material within the structure.

3.2.4.2 Heating

Exterior foundation footings and walls and all interior footings and floor slabs or slab-on-grade construction, shall be protected as specified herein. When the ambient air temperature is below 32 degrees F, foundation footings, walls, and floor slabs shall be enclosed and heated such that the minimum interior air temperature at all locations is 40 degrees F. When the exterior foundation footings or walls are not backfilled, the entire structure, to include all exterior surfaces and unbackfilled air spaces within 5' of the footings or walls, shall be heated to 40 degrees F minimum. All temperatures shall be constantly and adequately monitored. The Contractor shall submit a Heating and Monitoring Plan describing the proposed method(s) to be used for winter protection.

3.2.4.3 Alternatives

The Contractor may request an alternative method for winter protection by submitting Heating and Monitoring Plan in writing to the Contracting Officer for approval.

3.3 FILLING AND BACKFILLING OUTSIDE OF BUILDINGS AND STRUCTURES

3.3.1 General

Ground surface shall be cleared of all debris and organic materials. All depressions or holes below the general area surface level, whether caused by removal of debris or unacceptable materials, or otherwise, shall be backfilled with approved material and compacted to specified percent compaction and to a level, uniform surface before the construction of other embankment layers. Embankment is not to be placed on ground having a slope greater than one vertical to four horizontal unless specifically so ordered by the Contracting Officer, and, if so ordered, the surface of such ground shall be plowed, stepped, or broken-up, as directed, in such manner that the embankment material will bond with the existing surface. Prepared surfaces shall be wetted and compacted where directed.

3.3.2 Embankments

Embankments shall be exclusive of the base course and shall be constructed of classified and unclassified materials placed at the locations and to the

lines and grades indicated on the drawings. The materials shall be deposited and spread uniformly in successive horizontal layers not exceeding 12" in loose thickness, except that the subbase shall be constructed in layers not exceeding 8" in loose thickness. The layers shall be carried up full width from the bottom of the fill to avoid the necessity of widening the edges after the center has been brought up to grade. The layers shall be compacted to 95 percent compaction, as determined by the testing methods stated in Paragraph,3.16 TESTING. Blading, rolling, and tamping shall continue until the surface is smooth and free from waves and irregularities, and conforms to the elevations shown on the drawings. Water required as an aid in compaction shall be applied in an approved manner. If at any time the subbase material is excessively moistened by rain, it shall be aerated by means of blade graders, harrows, or other suitable equipment until the moisture content is satisfactory, and then compacted and finished as specified above. If specified percent compaction cannot be attained in any one layer, the Contractor shall remove the portions of the layer necessary to permit full compaction, replace, and compact the portions of the layer removed. No payment will be made for excavation or replacement of any material so removed and replaced. Portions of any layer in which the materials become segregated to the extent that the required percent compaction cannot be attained shall be removed and replaced with satisfactory material, mixed, or blended with additional material until segregation is eliminated and specified percent compaction can be attained. The top of the finished embankments shall be struck off and leveled to the elevations specified, and shall be maintained fully compacted with sufficient moisture content to prevent drying out prior to placing of the base course thereon.

3.3.3 Backfill

Material used to bring the excavated area of unsuitable material up to grade as the subbase shall be classified material from excavation or borrow. The backfill material shall be spread uniformly in the same layers, brought up to grade, compacted and finished as specified for embankments.

3.3.4 Preparation of Subbase

Subbase preparation shall consist of the dressing, shaping, wetting and compacting of the subbase of roads, streets, driveways, and parking areas. Surfaces shall be cleaned of all foreign substances. Any ruts, or soft yielding spots that may appear in the subbase surface shall be corrected by loosening, removing and adding approved material, reshaping and recompacting the affected areas to line and grade and to the specified percent compaction requirements shown on the drawings and shall extend to include the shoulders.

3.3.5 Shoulder Construction

Shoulders shall be constructed of satisfactory excavated or borrow material or as otherwise shown or specified. Shoulders shall be constructed as soon as possible after adjacent paving is complete, but in the case of rigid pavements, shoulders shall not be constructed until permission of the Contracting Officer has been obtained. The entire shoulder area shall be compacted to at least the percentage of maximum density as specified in paragraph PREPARATION OF SUBBASE above, for specific ranges of depth below the surface of the shoulder. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment. Shoulder construction

shall be done in proper sequence in such a manner that adjacent ditches will be drained effectively and that no damage of any kind is done to the adjacent completed pavement. The completed shoulders shall be true to alignment and grade and shaped to drain in conformity with the cross section shown.

3.3.6 Area Grading Fill

Area grading fill shall be constructed of unclassified fill materials reasonably free from organic, frozen, or other objectionable materials which may cause excessive settlement. The fill material shall be placed in successive horizontal layers not exceeding 12 inches in loose thickness and shall be compacted by the routing of the hauling equipment in such a manner that vehicles do not track one another. The elevation for area grading shall be such as to provide a finish grade at an elevation as indicated on the drawings. The finish grade surface shall be reasonably smooth and free from irregular surface changes. The degree of smoothness shall be that ordinarily obtainable from either bladegrader or scraper operations. The finish grade surface shall be not more than 2" above or below the established finish grade. In those areas where the grade at the limit of grading is above or below the elevation of the adjoining natural surface, the finish grade shall be maintained to the limit of grading, and the edge of the cut or fill feathered off to the natural slope as shown on the drawings.

3.3.7 Ballast Material Placement

Provide where indicated. Place in 6" lifts. Backfill adjacent to structures shall be placed as structural elements are completed and accepted. Backfill against concrete only when approved. Place and compact material to 95% compaction. Avoid loading upon or against structure. Protect geomembrane liner from damage during placement. Comply with the requirements of SECTION 02276, "GEOMEMBRANE LINER".

3.3.8 Bedding Sand Placement

Provide where indicated. Place in 6" lifts.

3.4 OPERATION OF BORROW PITS

3.4.1 General

Obtain borrow materials required in excess of those furnished from excavations from sources outside of Government property, except that borrow materials conforming to unclassified and classified fill may be obtained from the Government borrow pit identified as "Mullins Pit". Except as otherwise specified herein, work shall be in accordance with Eielson AFB Waste Disposal/Borrow Pit Plan. The Contractor shall coordinate work in advance with the Base Civil Engineer, through the Contracting Officer. Prospective bidders are advised to make personal inspection of the designated borrow area.

3.4.2 Disposal of Waste

Waste materials from stripping operations, and processing operations, and other material designated as unsuitable by the Contracting Officer for use in the work, shall be disposed of as indicated.

3.4.3 Final Clean-Up

Upon completion of the work covered by this contract, the Contractor shall leave the Government-owned borrow areas and adjacent premises in a satisfactory condition, with free drainage to adjacent drainage area.

3.5 NON-GOVERNMENT BORROW SOURCES

The Contractor shall check any non-Government, proposed borrow sources for the presence of hazardous substances and petroleum products as defined in ASTM E 1527. The publication includes guidance on previously examined sites. A Phase I Environmental Site Assessment, also as defined therein, shall be submitted for each proposed borrow site as a supplement to the Environmental Protection Plan. The report shall identify any previous or current presence of hazardous substances at the site, regardless of whether they have been, or can be, released to the environment. The Assessment shall be performed under the direct supervision of an independent, registered professional engineer, currently licensed by the State in which the borrow source is located, and within such timeframe as will ensure reports are valid when submitted. The engineer shall have a minimum of 3 years experience in performing satisfactory Environmental Site Assessments. All reports shall be certified in writing by the engineer and submitted in the standard format specified in the referenced publication, through the Contracting Officer, to the Base Environmental Office for review. Reports shall be submitted at least 30 days prior to needing borrow materials in the work. The qualifications of the engineer performing the Assessment shall be included in the report. Where hazardous materials are indicated, use of the source will not be allowed. No borrow materials shall be brought onto Government property without the approval of the Contracting Officer. The Government reserves the right to sample and test any borrow materials delivered to the project for conformance with this specification.

3.6 ACCESS TO JOBSITE

The Contractor shall, for the duration of this contract, provide bridging of excavation or other means of access to existing structures or construction sites in the areas covered by this contract.

3.7 WEATHER LIMITATIONS

It shall be the responsibility of the Contractor to protect all areas of completed work against any detrimental effects due to weather, by approved methods. Any areas of completed work that are damaged by freezing or rain, shall be reconditioned, reshaped and recompacted by the Contractor in conformance with the requirements of this specification without additional cost to the Government.

3.8 REPAIR OF EXISTING WORK

All pavement, fences, poles and any other existing feature that is to be retained but has been damaged or removed as a result of performance of the work shall be repaired or replaced in kind in a satisfactory manner.

3.9 CLEANING UP

The Contractor shall at all times keep the construction area, including storage areas used by it, free from accumulations of waste materials or rubbish and, prior to completion of the work, remove any rubbish from and about the premises and all tools, equipment and materials not the property

of the Government. Upon completion of the construction, the Contractor shall leave the work and premises in a clean, neat and satisfactory condition.

3.10 BLASTING

Blasting shall not be permitted.

3.11 TESTING

Compaction tests, and gradation tests, including percent finer than .02 millimeter, shall be performed on each layer of compacted material placed. Gradation tests, including percent finer than .02 millimeters shall be performed on samples taken from the placed and compacted layer. Testing shall be the responsibility of the Contractor and shall be performed by a Corps of Engineers approved independent testing agency satisfactory to the Contracting Officer. The Contracting Officer may direct that the tests be taken at locations other than those shown on the submitted compaction test plan and that additional tests be taken to supplement these required tests. The Contractor shall remove and replace nonconforming materials and shall recompact and retest failed and replaced areas until the specified degree of compaction is obtained. The Contractor shall amend its submitted compaction test plan to show the exact location and number of tests taken. This plan shall be keyed to the test results. The record of each test shall reflect the type of test procedure and, for compaction tests, the volume or unit weight of the standard and the volume or unit weight of the compacted soil. The record shall also reflect the firm or person that performed the test, the project title and contract number.

3.11.1 Density Tests

a. The following density tests are required. The number of tests shall apply to each layer of material placed.

DIKE WALLS

All Materials	1 Test per 200 LF each lift or increment thereof

DIKE FLOOR

All Materials	1 Test per 10000 SF per lift or increment thereof

BELOW TANK RINGWALL& BUILDING FOOTING

Classified Fill	1 Test per 200 LF per lift or increment thereof

SAND CUSHION	1 Test per 1000 SF per lift or increment thereof

TRENCHES

All Material	1 Test per 100 LF per lift or increment thereof

BENEATH STRUCTURES All Material	1 Test per 5000 SF per lift or increment thereof (Tank floor, building floor slabs, concrete sidewalks and slabs)

b. For vehicular roads, driveways and vehicular parking aprons or

lots, the number of density tests required shall conform to the following requirements for each layer of material placed:

1. Subbase and Base Course: A minimum one test for each 5000 square feet of compacted area.

2. Subgrade: A minimum of one test for each 10,000 square feet of compacted area.

3.11.2 Gradation and Moisture/Density Relationship Testing

a. Unclassified Material: Perform one moisture density relationship by ASTM D 1557, Method C for each layer of material placed and one for each change in source.

b. Base course, Subbase and classified materials in-place are sampled and tested for gradation and percent finer than .02 millimeters. Gradation tests, including percent passing .02 millimeters shall be performed on samples taken from the placed and compacted layer. Perform At least one test for each layer of compacted material or portion thereof. For these tests, gradation shall be determined in accordance with ASTM C 136, with ASTM C 117 used to determine minus No. 200 sieve material, and ASTM D 422 used to determine minus 0.02 mm material. Perform one moisture density relationship by ASTM D 1557, Method C for each layer of compacted material and one for each change in source.

c. Ballast Material Test: Test in accordance with ASTM C 136 for conformance to the project gradations. Perform one test for each source. Perform one moisture density relationship by ASTM D 1557 for each in source.

d. Bedding Sand Test: Test material in accordance with ASTM C 136 for conformance to the project gradations. Perform one test for each source. Perform one moisture density relationship by ASTM D 1557 for each source.

3.12 FINISHING

The surface of excavations, embankments, and subgrades shall be finished to a smooth and compact surface in accordance with the lines, grades, and cross sections or elevations shown. The degree of finish for graded areas shall be within 0.1' of the grades and elevations indicated except that the degree of finish for subgrades shall be specified in SECTION 02300 "EARTHWORK".

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DIVISION 02 - SITE CONSTRUCTION

SECTION 02320

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SECTION 02320

EARTHWORK FOR AIRFIELD PAVEMENTS AND AREA GRADING

PART 1 GENERAL

1.1 SCOPE

This section covers the excavation, embankment, preparation of subgrades and grading for airfields, and area grading including excavation, filling, and shaping of drainageways.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 117	(1995) Materials Finer than 75 micrometer (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C 136	(2001) Sieve Analysis of Fine and Coarse Aggregates
ASTM D 75	(2003) Sampling Aggregates
ASTM D 422	(1963; R 1998) Particle-Size Analysis of Soils
ASTM D 1556	(2000) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 1557	(2000) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu. m.))
ASTM D 2167	(1994) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D 2487	(2000) Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 2922	(2001) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 3017	(2001) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)

1.3 DEFINITIONS

1.3.1 Satisfactory Materials

Satisfactory materials shall be comprised of classified or unclassified material free from roots and other organic matter, trash, debris, and frozen materials. Satisfactory materials shall comprise any materials classified by ASTM D 2487 as GW, GP, GW-GM, GW-GC, GP-GM, GM, GC, GC-GM, SW, SP, SM, SW-SM, SC, SW-SC, SP-SM, SC-SM or SP-SC. Satisfactory materials for grading and for fill material for pavements shall be comprised of stones less than 4 inches in any dimension.

1.3.2 Unsatisfactory Materials

Materials which do not comply with the requirements for satisfactory materials are unsatisfactory. Unsatisfactory materials also include man-made fills; trash; refuse; backfills from previous construction; and material classified as satisfactory which contains root or other organic matter or frozen material. In addition, materials classified as PT, OL, OH, OL/OH, CL, ML, CL-ML, CH, or MH are unsatisfactory.

1.3.3 Nonfrost Susceptible Soils

Nonfrost susceptible soils are inorganic soils containing less than three percent by weight of grains finer than 0.02 mm. The methods of test used shall be the ASTM Standards ASTM C 117, ASTM C 136, ASTM D 75, and ASTM D 422.

1.3.4 Classified Material

Classified material shall be approved, well-graded nonfrost susceptible material consisting of sand, gravel, broken stone, or similar material and containing 100% passing a 4 inch sieve, not more than 60 percent by weight passing the No. 4 sieve and not more than 5 percent passing a #200 sieve. All material shall be free of frozen lumps.

1.3.5 Unclassified Material

Unclassified material shall be satisfactory material consisting of sand, gravel or other materials, and shall be free from organic material, frozen lumps, trash, lumber, or other debris. The material may be frost susceptible.

1.3.6 Fill

Fill is considered to be material placed above the original ground line.

1.3.7 Backfill

Backfill is considered to be material placed in an excavation made under this contract.

1.3.8 Subgrade

Subgrade applies to the natural soil in place and to fill material upon which layers of classified material is constructed.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with SECTION 01330 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Compaction Test Plan.

The proposed locations of all compaction tests, in 3 copies prior to commencing placing operations.

SD-06 Test Reports

Compaction Test Report.

Test results, with amended compaction test plan, as specified herein. A copy must be provided before the fill or backfill will be accepted as completed work.

1.5 MATERIALS

1.5.1 Classified and Unclassified

Classified material and unclassified material shall be obtained by selection from the excavated materials. Excavated material shall be used to the maximum extent possible for fill and backfill and construction of the subgrade. Excavated material not used shall be wasted in accordance with the Eielson Air Force Base Waste Disposal Borrow Pit Plan, provided, however, that no material shall be wasted prior to approval. If the excavation is insufficient in quantity or unsatisfactory, additional material may be obtained from the designated borrow pit.

1.5.2 Base Course

Graded Crushed Aggregate Base course shall conform to SECTION 02722.

1.6 MAXIMUM DENSITY DETERMINATIONS

1.6.1 Definition

Degree of compaction shall be expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D 1557, Method C.

1.6.2 Density Tests

a. Characteristics of backfill materials shall be determined in accordance with particle size analysis of soils ASTM D 422 and moisture-density relations of soils ASTM D 1557, Method C.

b. Tests shall be performed in accordance with paragraph TESTING. Field in-place density shall be determined in accordance with ASTM D 1556, ASTM D 2167, or ASTM D 2922. ASTM D 2922 results in a wet unit weight of soil and when using this method, ASTM D 3017 shall be used to determine the moisture content of the soil. The calibration curves

furnished with the moisture gauges shall be checked along with density calibration checks as described in ASTM D 3017. The calibration checks of both the density and moisture gauges shall be made at the beginning of a job, on each different type of material encountered, at intervals as directed by the Contracting Officer. Copies of calibration curves, results of calibration tests, and field and laboratory density tests shall be furnished to the Contracting Officer.

1.7 EQUIPMENT

Information on all equipment, tools and machines to be used in the performance of the work covered by this section of the specifications shall be submitted prior to commencement of work. All equipment, tools, and machines shall comply with applicable provisions of the Safety Requirements, and shall be maintained in satisfactory working condition at all times.

1.7.1 Rollers

Compaction shall be accomplished by heavy power rollers and other equipment well suited to the type of material being compacted.

1.7.2 Sprinkling Equipment

The sprinkling equipment shall consist of tank trucks, pressure distributors, or other equipment designed to apply water uniformly and in controlled quantities to variable widths of surface.

1.7.3 Aggregate Spreading Equipment

The equipment for spreading aggregate shall be adjustable, and capable of spreading aggregate at controlled amounts per square yard.

1.8 SUBSURFACE INVESTIGATIONS

Explorations consisting of drill holes and/or test pits have been made at the site of the project to assist the Contractor in ascertaining the character of the excavation material to be encountered; however, the Government does not guarantee that materials other than those disclosed by the drill holes will not be encountered, or that the proportions of the various materials will not vary from those indicated by the explorations.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 CLEARING AND GRUBBING

Clearing and grubbing shall be in accordance with Specification SECTION 02230, CLEARING AND GRUBBING

3.2 CONSERVING TOPSOIL

Material suitable for the support of plant life shall be removed from the area within the limits of excavation and, in so far as practicable, processed to meet the requirements for topsoil and utilized in the areas requiring topsoil and seeding. Topsoil shall be kept separated from other excavated materials, and shall be piled free of roots and other undesirable material.

3.3 EXCAVATION

3.3.1 General

The Contractor shall perform all excavation of every description and of whatever substances encountered to the lines, grades, and cross sections indicated on the drawings or specified herein. Any excavation beyond the authorized lines, grades, and cross sections shall be backfilled with satisfactory material and compacted in 8 inch layers to 95 percent of maximum density without additional cost to the Government. The Contractor shall control the banks of all excavated areas as necessary to prevent movement of soil in areas supporting existing foundations or slabs.

3.3.2 Field Modifications

If unsuitable soil conditions in the opinion of the Contracting Officer are encountered at the excavation lines specified, he may direct that extra excavation be performed. The Contractor shall perform such extra excavation only when so directed in writing, and the extra work shall include both the necessary excavation and the placement and compaction of backfill material required to restore the excavation to the depth indicated on the drawings. When excavation is carried to a line either above or below the elevations specified, an equitable modification of the contract will be made.

3.3.3 Area Grading

Area grading consists of that type of work also commonly referred to by such terms as "site grading" or "overlot grading" and excavation thereof shall consist of the removal of all materials to the lines and grades indicated on the drawings.

3.3.4 Ditches

Ditches shall be cut accurately to the cross-sections and grades indicated on the drawings. All roots, stumps, and other foreign matter in the sides and bottom of ditches shall be cut to conform to the slopes, grade, and shape of the section shown. Care shall be taken not to excavate ditches below the grades indicated. Any excessive ditch excavation shall be backfilled to grade either with suitable, thoroughly compacted material, or with suitable stone or cobbles to form an adequate gutter paving, as indicated. The Contractor shall maintain all ditches excavated under this specification free from detrimental quantities of leaves, sticks, and other debris until final acceptance of the work. All suitable material excavated from ditches shall be utilized as hereinafter specified. No excavated material shall be deposited within a distance of 3 feet from the edge of a ditch.

3.3.5 Existing Service Lines and Utility Structures

All existing service lines and utility structures uncovered or encountered during all classes of excavation, including borrow, and during all operations incidental to all grading work, construction of embankments, and backfilling shall be safeguarded and protected from damage. When utility lines are encountered, the Contractor shall notify the Contracting Officer in ample time for the necessary measures to be taken to prevent interruption of the service. The existing utilities that are shown on the drawings or the location of which is made known to the Contractor prior to

excavation shall be protected from damage during the excavation and backfilling and if damaged during excavation, shall be repaired by the Contractor at its own expense. If the Contractor damages any existing utility lines that are not shown or the location of which are not known to the Contractor, report thereof shall be made immediately to the Contracting Officer. If so directed by the Contracting Officer, repairs shall be made by the Contractor, and adjustment in payment will be made by the Government at the rates determined or approved by the Contracting Officer. Inactive or abandoned utilities shall be removed and the remaining ends capped outside the excavation line.

3.4 FILLING AND BACKFILLING

3.4.1 General

Ground surface shall be cleared of all debris and unsatisfactory materials. All depressions or holes below the general area surface level, whether caused by removal of debris or unsatisfactory materials, or otherwise, shall be backfilled with appropriate material, as indicated on the drawings, and compacted to the specified percent compaction and to a level, uniform surface before the construction of other embankment layers. Embankment is not to be placed on ground having a slope greater than one vertical to four horizontal unless the surface of such ground is plowed, stepped, or broken-up in such manner that the embankment material will bond with the existing surface. Prepared surfaces shall be wetted and compacted where required to attain the specified degree of density.

3.4.2 Embankments

Embankments shall be exclusive of the base course and shall be constructed of classified and unclassified materials placed at the locations and to the lines and grades indicated on the drawings. The materials shall be deposited and spread uniformly in successive horizontal layers not exceeding 8 inches in loose thickness, except that layers of classified material shall be constructed in layers not exceeding 6 inches in compacted thickness. The layers shall be carried up full width from the bottom of the fill to avoid the necessity of widening the edges after the center has been brought up to grade. The layers of unclassified material shall be compacted to 95 percent of maximum density and the layers of classified material shall be compacted to 100 percent of maximum density, as determined by the testing methods stated in Paragraph, Density Tests. Blading, rolling, and tamping shall continue until the surface is smooth and free from waves and irregularities, and conforms to the elevations shown on the drawings. Water required as an aid in compaction shall be applied in an approved manner. If at any time the material is excessively moistened by rain, it shall be aerated by means of blade graders, harrows, or other suitable equipment until the moisture content is satisfactory, and then compacted and finished as specified above. If specified percent compaction cannot be attained in any one layer, the Contractor shall remove the portions of the layer necessary to permit full compaction, replace, and compact the portions of the layer removed. No payment will be made for excavation or replacement of any material so removed and replaced. Portions of any layer in which the materials become segregated to the extent that the required percent compaction cannot be attained shall be removed and replaced with satisfactory material, mixed, or blended with additional material until segregation is eliminated and specified percent compaction can be attained. The top of the finished embankments shall be struck off and leveled to the elevations specified, and shall be maintained fully compacted with sufficient moisture content to prevent drying out

prior to placing subsequent layers thereon.

3.4.3 Backfill

Material used to bring areas, excavated of unsatisfactory materials, up to the subgrade line shall be classified material or unclassified material from excavation or borrow. Material used to bring the embankment area from the subgrade line up to the layer of graded crushed aggregate base course shall be classified material from the borrow area. The material shall be spread uniformly in the same layers, brought up to grade, compacted and finished as specified for embankments.

3.4.4 Preparation of Classified Layers

Preparation of classified material layers shall consist of the dressing, shaping, wetting and compacting of the layers. Surfaces shall be cleaned of all foreign substances. Any ruts, or soft yielding spots that may appear in the surface shall be corrected by loosening, removing and adding approved material, reshaping and recompacting the affected areas to line and grade and to the specified percent compaction requirements shown on the drawings and shall extend to include the shoulders.

3.4.5 Area Grading Fill

Area grading fill shall be constructed of unclassified fill materials reasonably free from organic, frozen, or other objectionable materials which may cause excessive settlement. Where shown on the drawings the top 4 inches of area grading fill shall be topsoil as specified in paragraph, CONSERVING TOPSOIL or from topsoil imported from the borrow pit and treated in accordance with specification SECTION 02921, SEEDING. The fill material shall be placed in successive horizontal layers not exceeding 12 inches in loose thickness and shall be compacted by the routing of the hauling equipment in such a manner that vehicles do not track one another. Soil compacted by construction equipment or soil on compacted cut slopes or grades shall be scarified to a 2 inch depth before applying topsoil. The elevation for area grading shall be such as to provide a finish grade at an elevation as indicated on the drawings. The finish grade surface shall be reasonably smooth and free from irregular surface changes. The degree of smoothness shall be that ordinarily obtainable from either bladegrader or scraper operations. The finish grade surface shall be not more than 2 inches above or below the established finish grade. In those areas where the grade at the limit of grading is above or below the elevation of the adjoining natural surface, the finish grade shall be maintained to the limit of grading, and the edge of the cut or fill feathered off to the natural slope as shown on the drawings.

3.4.6 Utilization of Excavated Materials

All satisfactory material removed from the excavation shall be used, insofar as practicable, for fill and backfill, and for such other purposes as directed. No excavated material shall be wasted without authorization. Satisfactory frost-susceptible materials removed from the excavations shall be utilized below the subgrade line indicated on the drawings or in the formation of area grading fill. Unsatisfactory materials or materials unsuitable or excess to the requirements for area grading fill will be authorized to be wasted and shall be disposed of in accordance with the Eielson Air Force Base Waste Disposal/ Borrow Pit Plan. No excavated material shall be deposited at any time in a manner that may endanger a partly finished structure by direct pressure, by overloading banks

contiguous to the operations, or that may in any other way be detrimental to the completed work.

3.5 TESTING

Compaction and gradation tests, including the percent finer than .02 millimeters, shall be performed on each layer of compacted material placed. Testing shall be the responsibility of the Contractor and shall be performed by a Corps of Engineers Approved independent testing agency satisfactory to the Contracting Officer. The Contracting Officer may direct that the tests be taken at locations other than those shown on the submitted compaction test plan and that additional tests be taken to supplement these required tests. The Contractor shall remove and replace nonconforming materials and shall recompact and retest failed and replaced areas until the specified degree of compaction is obtained. The Contractor shall amend its submitted compaction test plan to show the exact location and number of tests taken. This plan shall be keyed to the test results. The record of each test shall reflect the type of test procedure and, for compaction tests, the volume or unit weight of the standard and the volume or unit weight of the compacted soil. The record shall also reflect the firm or person that performed the test, the project title, and contract number. The area referred to hereinafter which determines the minimum number of tests required shall be a layer, or portion thereof, that is compacted in one continuous operation.

a. For aprons and taxiways the number of density tests required shall conform to the following requirements for each layer of material placed:

1. Classified material: A minimum of seven tests or one test for each 10,000 square feet of area, whichever provides the greatest number of tests.

2. Subgrade: A minimum of seven tests or one test for each 20,000 square feet of area, whichever provides the greatest number of tests.

3. Subgrade Line: A minimum of seven tests or one test for each 20,000 square feet of area, whichever provides the greatest number of tests.

b. Classified and unclassified materials, shall be sampled and tested for gradation, including the percent finer than .02 millimeters at least once for every 40,000 square yards of material placed (approximately once per every 6,700 compacted cubic yards of material). Gradation tests, including percent passing .02 millimeters shall be performed on samples taken from the placed and compacted layer. Gradation shall be determined in accordance with ASTM C 136, with ASTM C 117 used to determine minus 0.075 mm (No. 200) sieve material and ASTM D 422 used to determine minus 0.02 mm material.

c. Perform one moisture density relationship by ASTM D 1557, Method C at the same frequency as indicated for gradation tests and whom any change in material occurs.

d. Graded crushed aggregate base course in-place shall be sampled and tested in accordance with SECTION 02722 GRADED-CRUSHED AGGREGATE BASE COURSE.

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SECTION 02373

GEOTEXTILE FABRIC

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of the specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 3786	(2001) Hydraulic Bursting Strength of Textile Fabrics: Diaphragm Bursting Strength Tester Method
ASTM D 4354	(2000) Sampling of Geosynthetics for Testing
ASTM D 4355	(2001) Deterioration of Geotextiles from Exposure to Ultraviolet Light and Water (Xenon-Arc Type Apparatus)
ASTM D 4491	(1999a) Water Permeability of Geotextiles by Permittivity
ASTM D 4533	(1991; R 1996) Trapezoid Tearing Strength of Geotextiles
ASTM D 4632	(1991; R 1997) Grab Breaking Load and Elongation of Geotextiles
ASTM D 4751	(1999a) Determining Apparent Opening Size of a Geotextile
ASTM D 4759	(1988; R 1996) Determining the Specification Conformance of Geosynthetics
ASTM D 4833	(2000) Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products
ASTM D 4873	(2001) Identification, Storage, and Handling of Geosynthetic Rolls

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with SECTION 01330 SUBMITTAL PROCEDURES:

SD-06 Test Reports

Manufacturing Quality Control Sampling and Testing.

A minimum of 30 days prior to scheduled use, manufacturer's quality control manual including instructions for geotextile storage, handling, installation, seaming, and repair.

SD-07 Certificates

Geotextile.

A minimum of 30 days prior to scheduled use, manufacturer's certificate of compliance stating that the geotextile meets the requirements of this section. This submittal shall include copies of manufacturer's quality control test results. For needle punched geotextiles, the manufacturer shall also certify that the geotextile has been continuously inspected using permanent on-line full-width metal detectors and does not contain any needles which could damage other geosynthetic layers. The certificate of compliance shall be attested to by a person having legal authority to bind the geotextile manufacturer.

SD-04 Samples

Samples.

A 12 inch x 24 inch sample 30 days prior to scheduled use.

1.3 DELIVERY, STORAGE AND HANDLING

Delivery, storage, and handling of geotextile shall be in accordance with ASTM D 4873.

1.3.1 Delivery

The Contracting Officer will be present during delivery and unloading of the geotextile. Rolls shall be packaged in an opaque, waterproof, protective plastic wrapping. The plastic wrapping shall not be removed until deployment. If quality assurance samples are collected, rolls shall be immediately rewrapped with the plastic wrapping. Geotextile or plastic wrapping damaged during storage or handling shall be repaired or replaced, as directed. Each roll shall be labeled with the manufacturer's name, geotextile type, roll number, roll dimensions (length, width, gross weight), and date manufactured.

1.3.2 Storage

Geotextile rolls shall be protected from becoming saturated. Rolls shall either be elevated off the ground or placed on a sacrificial sheet of plastic. The geotextile rolls shall also be protected from the following: construction equipment, ultraviolet radiation, chemicals, sparks and flames, temperatures in excess of 160 degrees F, and any other environmental condition that may damage the physical properties of the geotextile.

1.3.3 Handling

Geotextile rolls shall be handled and unloaded with load carrying straps, a

fork lift with a stinger bar, or an axial bar assembly. Rolls shall not be dragged along the ground, lifted by one end, or dropped to the ground.

PART 2 PRODUCTS

2.1 RAW MATERIALS

2.1.1 Geotextile

Geotextile shall be a nonwoven pervious sheet of polymeric material and shall consist of long-chain synthetic polymers composed of at least 95 percent by weight polyolefins, polyesters, or polyamides. The use of woven slit film geotextiles (i.e. geotextiles made from yarns of a flat, tape-like character) will not be allowed. Stabilizers and/or inhibitors shall be added to the base polymer, as needed, to make the filaments resistant to deterioration by ultraviolet light, oxidation, and heat exposure. Regrind material, which consists of edge trimmings and other scraps that have never reached the consumer, may be used to produce the geotextile. Post-consumer recycled material shall not be used. Geotextile shall be formed into a network such that the filaments or yarns retain dimensional stability relative to each other, including the selvages. Geotextiles and factory seams shall meet the requirements specified in Table 1. Where applicable, Table 1 property values represent minimum average roll values (MARV) in the weakest principal direction. Values for AOS represent maximum average roll values.

TABLE 1. GEOTEXTILE PHYSICAL PROPERTIES

PROPERTY	TEST VALUE	TEST METHOD
Elongation at Break, percent	Greater Than 50	ASTM D 4632
Apparent Opening Size (U.S. Sieve)	.43 maximum	ASTM D 4751
Permittivity, sec-1	.5 minimum	ASTM D 4491
Puncture, lbs.	90	ASTM D 4833
Grab Tensile, lbs.	160	ASTM D 4632
Trapezoidal Tear, lbs.	65	ASTM D 4533
Burst Strength, psi	310	ASTM D 3786
Ultraviolet Stability (percent strength retained at 500 hours)	50	ASTM D 4355

2.1.2 Thread

Sewn seams, if used, shall be constructed with high-strength polyester,

nylon, or other approved thread type. Thread shall have ultraviolet light stability equivalent to the geotextile and the color shall contrast with the geotextile.

2.2 MANUFACTURING QUALITY CONTROL SAMPLING AND TESTING

Manufacturing quality control sampling and testing shall be performed in accordance with the manufacturer's approved quality control manual. As a minimum, geotextiles shall be randomly sampled for testing in accordance with ASTM D 4354, Procedure A. Acceptance of geotextile shall be in accordance with ASTM D 4759. Tests not meeting the specified requirements shall result in the rejection of applicable rolls.

PART 3 EXECUTION

3.1 QUALITY CONTROL SAMPLES AND TESTS

3.1.1 Quality Control Samples

Samples shall be collected upon delivery to the site for quality control testing in accordance with ASTM D 4354, Procedure B. Lot size for quality control sampling shall be considered to be the shipment quantity of the product or a truckload of the product, whichever is smaller. The unit size shall be considered one roll of geotextile. Samples shall be identified with a waterproof marker by manufacturer's name, product identification, lot number, roll number, and machine direction. The date and a unique sample number shall also be noted on the sample. The outer layer of the geotextile roll shall be discarded prior to sampling a roll. Samples shall then be collected by cutting the full-width of the geotextile sheet a minimum of 3 feet long in the machine direction. Rolls which are sampled shall be immediately rewrapped in their protective covering.

3.1.2 Quality Control Tests

The Contractor shall provide quality control samples to an Independent Laboratory hired by the Contractor. Samples will be tested to verify that geotextile meets the requirements specified in Table 1. Test method ASTM D 4355 shall not be performed on the collected samples. Geotextile product acceptance shall be based on ASTM D 4759. Tests not meeting the specified requirements shall result in the rejection of applicable rolls.

3.2 INSTALLATION

3.2.1 Surface Preparation

The surface underlying the geotextile shall be smooth and free of ruts or protrusions which could damage the geotextile.

3.2.2 Placement

Geotextile rolls which are damaged or contain imperfections shall be repaired or replaced as directed. The geotextile shall be laid flat and smooth so that it is in direct contact with the subgrade or classified material layer, as indicated on the drawings. The geotextile shall also be free of tensile stresses, folds, and wrinkles.

3.3 SEAMS

3.3.1 Overlap Seams

Geotextile panels shall be continuously overlapped a minimum of 18 inches. Where it is required that seams be oriented across the slope, the upper panel shall be lapped over the lower panel. The Contractor has the option of field sewing instead of overlapping.

3.4 PROTECTION

The geotextile shall be protected during installation from clogging, tears, and other damage. Damaged geotextile shall be repaired or replaced as directed. Adequate ballast (e.g. sand bags) shall be used to prevent uplift by wind. The geotextile shall not be left uncovered for more than 2 days during installation.

3.5 REPAIRS

Geotextile damaged during installation shall be repaired by placing a patch of the same type of geotextile which extends a minimum of 18 inches beyond the edge of the damage or defect. Patches shall be continuously fastened using a sewn seam or other approved method. The machine direction of the patch shall be aligned with the machine direction of the geotextile being repaired. Geotextile which cannot be repaired shall be replaced.

3.6 PENETRATIONS

Engineered penetrations of the geotextile shall be constructed by methods recommended by the geotextile manufacturer.

3.7 COVERING

Geotextile shall not be covered prior to approval by the Contracting Officer. The Contractor shall request the presence of the Contracting Officer during covering of the geotextile. Cover soil shall be satisfactory material or graded crushed aggregate base course, as indicated on the drawings. Satisfactory materials and graded crushed aggregate base course shall be placed in a manner that prevents soil from entering the geotextile overlap zone, prevents tensile stress from being mobilized in the geotextile, and prevents wrinkles from folding over onto themselves.

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SECTION 02390

TIEDOWNS / STATIC GROUND POINTS FOR AIRCRAFT

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM B 8	(1999) Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
ASTM B 371	(1996) Copper-Zinc-Silicon Alloy Rod

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 407	(1996) Aircraft Fuel Servicing

UNDERWRITERS LABORATORIES (UL)

UL 467	(1993; Rev thru Feb 2001) Grounding and Bonding Equipment

U.S. ARMY CORPS OF ENGINEERS (USACE)

COE CRD-C 300	(1990) Specifications for Membrane-Forming Compounds for Curing Concrete

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with SECTION 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

As-Built Drawings.

Drawings that provide current factual information, including deviations from and amendments to the drawings and changes in the work, concealed and visible.

SD-09 Manufacturer's Field Reports

Tests.

Each report shall be properly identified. Test methods used and test

standards shall be described.

SD-07 Certificates

Tiedowns.

Certificate of compliance stating that the tiedown devices meet the specified requirements.

Grounding Connectors.

Certificate of compliance stating that the grounding connectors meet the specified requirements.

Copper Conductors.

Certificate of compliance stating that the copper conductors meet the specified requirements.

PART 2 PRODUCTS

2.1 METALS

Combination of materials that forms an electrolytic couple, which accelerates corrosion in the presence of moisture, shall not be used, unless moisture is permanently excluded from the junction of such metals.

2.2 Tiedowns

Tiedowns shall conform to UL 467 and shall be made of copper-clad steel. The rods shall be not less than 3/4 inch in diameter and not less than 10 feet long. The copper cladding shall conform to the applicable requirements of ASTM B 371, Copper Alloy UNS No's. c 69400, c 69430, c 69440 or c 69450. The copper cladding shall be not less than 0.010 inches thick at any point and shall comply with adherence requirements and the banding requirements of UL 467. The Contractor shall submit certificates of compliance on the tiedown rods. Rods shall be provided with a closed eye or shepherd's hook bend as indicated on the drawings. The rods shall be pointed unless used for flexible pavement.

2.3 COPPER CONDUCTORS

Copper conductors shall be bare number 1/0 AWG copper wire conforming to ASTM B 8. The Contractor shall submit certificates of compliance on the copper conductors.

2.4 GROUNDING CONNECTORS

Grounding connectors shall comply with UL 467 for the required application. The Contractor shall submit certificates of compliance on the grounding connectors.

2.5 CONCRETE

Concrete shall be in accordance with SECTION 02753 CONCRETE PAVEMENT FOR AIRFIELDS.

PART 3 EXECUTION

3.1 TIEDOWNS IN NEW RIGID PAVEMENTS OR CONCRETE PADS

The tiedowns shall be installed in the locations shown on the contract drawings. The top of the tiedown shall be set within 1/4 inch of the plan pavement surface elevation, but not higher than the pavement surface. A recess, 3 inches wide, and not more than 6 inches long, with a smooth rounded edge shall be provided in the pavement around the tiedown anchor eye to permit the entrance of lines into the eye and to allow for attachment of the grounding cable. The depth of the recess shall be no deeper than the bottom of the opening of the tiedown point eye. The tiedown shall be installed by pushing or driving the rod through the pavement base courses and subgrade prior to concrete placement, or alternatively, in accordance with paragraph TIEDOWNS IN EXISTING RIGID PAVEMENTS. The installation technique chosen by the Contractor shall not damage the grounding rod. Hand finishing of the concrete around the tiedowns shall be kept to a minimum.

3.2 TIEDOWNS IN EXISTING RIGID PAVEMENTS

Tiedowns shall be installed in holes cored through the rigid pavement using rotary, non-percussion drilling techniques. The core holes shall have a minimum diameter of 6 inches. The tiedown shall be installed by pushing or driving the rod through the pavement base courses and subgrade. The installation technique chosen by the Contractor shall not damage the grounding rod or the pavement. Installation shall be completed by placing concrete around the tiedowns in two lifts with each lift consolidated with spud vibrators. The core holes shall be drilled in the locations shown on the contract drawings. The top of the tiedown device shall be installed within 1/4 inch of the surrounding pavement surfaces, but not higher.

3.2.1 Coring Requirements

The holes shall be cored using rotary, non-percussion drilling techniques. The sides of the core hole shall be perpendicular to the pavement surface. The sides of the core hole shall be cleaned of latence and roughened by sand blasting. The Contractor shall place the concrete around the tiedown in two or more lifts. The first lift shall be placed to within 5 inches of the pavement surface and thoroughly consolidated by spud vibrators. The second lift shall be placed and also consolidated by internal vibration. The surface of the concrete shall be finished and textured to match the adjacent pavement surface and elevation. White pigmented curing compound meeting the requirements of COE CRD-C 300 shall be uniformly applied at a coverage of not more than 200 square feet per gallon..

3.2.2 Cleanup

The Contractor shall control all operations to minimize the amount of dust, dirt, debris and laitance in the work area. The Contractor shall clean all dirt, dust, debris, or laitance from coring or concreting operations, from the pavement surfaces prior to final acceptance.

3.3 TESTS

Resistance to ground tests shall be measured as specified in NFPA 407. Test results shall be submitted to the Contracting Officer. Any ground rods that have more than 10,000 ohms of resistance shall be reported to the contracting officer immediately.

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SECTION 02456

FOUNDATION PILES

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 27	(1991) Steel Castings, Carbon, for General Applications
ASTM A 252	(1998; R 2002) Welded and Seamless Steel Pipe Piles
ASTM D 4945	(2000) High-Strain Dynamic Testing of Piles

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M	(2000) Structural Welding Code - Steel

1.2 SYSTEM DESCRIPTION

This specification covers the requirements for steel piles to be used as foundation piles supporting the fuel storage tanks. Reference SECTION 02457 STEEL PILES for steel piles to be used as pipe supports.

1.3 BASIS OF PAYMENT

1.3.1 Unit Price

The Contracting Officer reserves the right to increase or decrease the aggregate length of piles to be furnished and installed by changing the foundation pile locations or elevations, requiring the installation of additional piles, or requiring omission of piles from the requirements shown and specified. Whether or not such changes are made, the Contractor will be paid at the contract unit price per foot (including control test piles), multiplied by the total length in feet of acceptable piles actually installed.

1.3.2 Full Compensation

Payment in accordance with the above paragraph, Unit Price, shall constitute full compensation for furnishing, delivering, handling, and installing (as applicable) all material, labor, and equipment necessary including four 125-ton dynamic pile tests to meet contract requirements applicable to the foundation piles. The Contractor will not be allowed payment for withdrawn, broken, or rejected piles or for a portion of any pile remaining above the cut-off point.

1.3.3 Splices

The Contractor will be paid for work required to make each authorized pile splice at the applicable contract item.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with SECTION 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Fabricated Additions; G-AE.

Detail drawings of required fabricated additions to plain pile, prior to commencing work or ordering materials.

Pile Driving; G-AE

A complete and accurate record of each driven pile, within 3 days of completion of driving. The record shall indicate the pile location (as driven), size, driven length, embedded length, final elevations of tip and top, pile weight, number of splices and locations, blows required for each foot of penetration throughout the entire length of the pile and for the final 6 inches of penetration, and the total driving time. The record shall also include the type and size of the hammer used, the rate of operation, and the type and dimensions of driving helmet and cushion block used. Any unusual conditions encountered during pile installation shall be recorded and immediately reported to the Contracting Officer.

SD-03 Product Data

Equipment; G-AO.

Description of pile driving equipment to be employed in the work, prior to commencement of pile installations; including details of the pile hammer, power plant, leads, cushion material, and helmet.

SD-06 Test Reports

Field Tests and Inspections; G-AO.

The Contractor shall submit a description of the pile driving equipment, and a summary report detailing the results of a site specific wave equation analysis. The report shall be prepared by or under the direct supervision of a registered professional engineer experienced in pile load testing and analysis. The wave equation analysis shall be used to assess the ability of the proposed driving system to install the pile to the required capacity and penetration depth within the allowable driving stresses.

SD-07 Certificates

Materials; G-AO.

Certified copies of mill test reports for structural steel prior to commencement of pile installations.

1.5 EXPERIENCE

The work shall be performed by a general contractor or a specialty subcontractor specializing in the specified foundation system and having experience installing the specified foundation system under similar subsurface conditions.

1.6 SUBSURFACE DATA

Subsurface soil data logs are shown on the drawings (see EXPAND/REPAIR AIRCRAFT RAMP). The subsurface investigation reports are available for examination at the Alaska District Office.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Piles

Steel shall conform to ASTM A 252, Grade 2, ERW. Piles shall be of size and thickness indicated. Pile tips as driven shall be square and blunt as received from the mill. Cast steel pile points shall be used. Test piles shall be identical to production piles.

2.1.2 Pile Points

Pile points shall conform to ASTM A 27, N1, flush outside open end hardened points.

2.2 EQUIPMENT

2.2.1 Pile Hammers

The hammer used shall have a delivered energy suitable for the total weight of the pile, the character of subsurface material to be encountered, and the pile capacity to be developed. The driving energy of the hammer shall be not less than 15,000 foot-pounds.

2.2.2 Driving Helmets and Pile Cushions

A driving helmet or cap, including a pile cushion, shall be used between the top of the pile and the ram to prevent impact damage to the pile. The driving helmet, or cap and pile cushion combination, shall be capable of protecting the head of the pile, minimizing energy absorption and dissipation, and transmitting hammer energy uniformly over the top of the pile. The driving helmet or cap shall fit loosely around the top of the pile so that the pile is not restrained by the driving cap if the pile tends to rotate during driving. The pile cushion may be made of solid wood or of laminated construction using plywood, softwood, or hardwood boards or other cushion material as approved by the Contracting Officer. The pile cushion shall completely cover the top surface of the pile and shall be retained by the driving helmet. The minimum thickness of the pile cushion shall be 3 inches and the thickness shall be increased so as to be suitable for the size and length of pile, character of subsurface material

encountered, hammer characteristics, and required driving resistance.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Pile Driving

Excavation shall be stopped at 1 foot above foundation grade before piles are driven. When pile driving is completed, excavation shall be completed to lines and grades shown. Piles shall be driven to meet both the required driving resistance determined from the pile driving analyzer and wave equation analysis and the minimum depth of penetration indicated on the drawings. Piles shall be driven with pile points. The pile hammer used for driving shall be the same type, operated at the same rate and in the same manner, as that used for driving the test piles. Diesel-powered hammers shall be operated at the rate recommended by the manufacturer throughout the entire driving period. Sufficient pressure shall be maintained at the steam hammer so that: for a double-acting hammer, the number of blows per minute during and at the completion of driving of a pile is equal approximately to that at which the hammer is rated; for a single-acting hammer, there is full upward stroke of the ram; for a differential type hammer, there is a slight rise of the hammer base during each upward stroke. A new pile cushion shall be used at the start of driving for each pile and the cushion shall be replaced whenever it has become highly compressed, charred, burned, or deteriorated in any manner during driving. Each pile shall be driven continuously and without interruption until the required depth of penetration and penetration rate per blow have been attained. If a pile fails to reach the "calculated" tip elevation or if a pile reaches the "calculated" tip elevation without reaching the required driving resistance, the Contractor shall notify the Contracting Officer and perform directed corrective measures.

3.1.2 Pre-Drilling

Pre-drilling of piles will not be permitted.

3.1.3 Jetting of Piles

Jetting of piles will not be permitted.

3.1.4 Splices

Field splices shall be avoided if at all possible. When authorized by the Contracting Officer, splices shall be of the full penetration butt-weld type. Unless otherwise authorized by the Contracting Officer, only one splice will be permitted per length of pile. Splices shall be designed and constructed to maintain the true alignment and position of the pile sections. Splices shall develop the full strength of the pile in both bearing and bending. Proprietary prefabricated splicer sleeves may be used upon prior approval by the Contracting Officer.

3.1.5 Welding

Shop and field welding, qualification of welding procedures, welders, and welding operators shall be in accordance with AWS D1.1/D1.1M.

3.1.6 Tolerances in Driving

Top of pile at elevation of cut off shall be within 3 inches of the location indicated. Additionally, a variation in batter, as measured on the driven pile, of not more than 1/4 inch per foot of longitudinal axis will be permitted. Manipulation of piles to force them into position will not be permitted. Piles will be checked for heave. Piles found to have heaved shall be redriven to the required point elevation. Piles damaged or driven outside the above tolerances shall be replaced or additional piles driven at locations specified by the Contracting Officer at no expense to the Government.

3.1.7 Cutting of Piles

Piles shall be cut off at the elevations indicated by a method approved by the Contracting Officer.

3.2 FIELD TESTS AND INSPECTIONS

3.2.1 Test Piles

Test piles shall be driven in the same manner as specified for production piles. The Contractor will use the dynamic pile testing and wave equation analysis as well as test reports on soil samples, to determine the necessary driving resistance. Load test piles driven in permanent locations may be incorporated into the work if, after satisfactory completion of load test, they are approved for inclusion in the work. The Contractor shall use dynamic pile testing on 4 test piles. The dynamic pile test method shall be used as the pile is driven to the tip elevation specified or indicated for bidding lengths.

3.2.2 Dynamic Pile Testing

Dynamic pile testing shall be in accordance with ASTM D 4945, loading method. The dynamic pile tests shall be made on test piles placed to the tip elevation used for establishing lengths of piles for bidding, except as otherwise directed by the Contracting Officer. A report shall be submitted in accordance with paragraph SUBMITTALS. The installation of contract piles shall not proceed in a new area with substantially different subsurface conditions until a satisfactory load test has been performed in that area and the results approved by the Contracting Officer. A minimum of 14 days from submission of the report shall be allowed for approval.

3.2.3 Safe Design Capacity

The Dynamic Pile Testing results shall indicate an ultimate capacity that is at least 125 tons.

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SECTION 02457

STEEL PILES

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 27	(1991) Steel Castings, Carbon, for General Applications
ASTM A 252	(1998; R 2002) Welded and Seamless Steel Pipe Piles

1.2 SYSTEM DESCRIPTION

This specification covers the requirements for steel piles to be used as pipe supports. Reference SECTION 02456 FOUNDATION PILES for piles supporting the fuel storage tanks.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with SECTION 01330 SUBMITTAL PROCEDURES:

SD-11 Closeout Submittals

Pile Driving Records.

Submit to the Contracting Officer complete and accurate job pile records as specified in paragraph entitled "Records" of this section, within 15 calendar days after completion of driving.

1.4 BASIS FOR BIDS

a. Base bids on the number, size, and length of piles from tip to cutoff as indicated.

b. Subsurface soil data logs are shown on the drawings. The subsurface investigation reports are available for examination at the Omaha District Office.

PART 2 PRODUCTS

2.1 PILES

Steel piles shall conform to ASTM A 252, Grade 2, ERW. Piles shall be of size and thickness indicated.

2.2 PILE POINTS

Pile points shall conform to ASTM A 27, N1, inside fit, 60 degrees conical tip.

PART 3 EXECUTION

3.1 INSTALLATION

Inspect piles when delivered and when in the leads immediately before driving. Piles shall be driven with a pile point. After reaching the minimum depth, the piles shall be cut off at the desired elevation.

3.1.1 Pile Driving

Operate hammer at manufacturer's rated speed, and drive pile without interruption to the indicated depth.

3.1.2 Driving Equipment

Driving equipment shall be sufficient to drive the piles to the depths indicated without damaging the pile.

3.2 TOLERANCES IN DRIVING

At cutoff elevation, butts shall be within 2 inches of the location indicated. Manipulation of piles will not be permitted.

3.3 JETTING OF PILES

Jetting of piles will not be permitted.

3.4 PREDRILLLING

Predrilling shall not be permitted.

3.5 RECORDS

Keep a complete and accurate record of each pile driven. Indicate the pile location, deviations from design location, cross section shape and dimensions, original length, ground elevation, tip elevation, cutoff elevation, and unusual pile behavior or circumstances experienced during driving such as redriving, heaving, weaving, obstructions, and unanticipated interruptions.

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SECTION 02510

WATER DISTRIBUTION SYSTEM

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 536	(1999el) Ductile Iron Castings
ASTM B 88	(2002) Seamless Copper Water Tube

ASME INTERNATIONAL (ASME)

ASME B16.22	(2002) Wrought Copper and Copper Alloy Solder Joint Pressure Fittings

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA-01	(2000) Disinfecting Water Mains
AWWA C104	(1995) Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
AWWA C111	(2000) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C151	(1996) Ductile-Iron Pipe, Centrifugally Cast, for Water
AWWA C153	(1994; Errata Nov 1996) Ductile-Iron Compact Fittings, 3 In. Through 24 In. (76 mm through 610 mm) and 54 In. through 64 In. (1,400 mm through 1,600 mm) for Water Service
AWWA C500	(1993; C500a) Metal-Sealed Gate Valves for Water Supply Service
AWWA C502	(1994; C502a) Dry-Barrel Fire Hydrants
AWWA C509	(1994; Addendum 1995) Resilient-Seated Gate Valves for Water Supply Service
AWWA C600	(1999) Installation of Ductile-Iron Water Mains and Their Appurtenances
AWWA M20	(1980) Water Chlorination Principles and Practices

ASBESTOS CEMENT PRODUCT PRODUCERS ASSOCIATION (ACPPA)

ACPPA Work Practices	(1988) Recommended Work Practices for A/C Pipe

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-80	(1997) Bronze Gate, Globe, Angle and Check Valves

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC Paint 21	(1991) White or Colored Silicone Alkyd Paint
SSPC Paint 25	(1997) Oxide, Zinc Oxide, Raw Linseed Oil and Alkyd Primer (Without Lead and Chromate Pigments)

1.2 PIPING

This section covers water distribution lines. The Contractor shall have a copy of the manufacturer's recommendations for each material or procedure to be utilized available at the construction site at all times.

1.2.1 Distribution Lines 3" or Larger

Piping for water distribution lines shall be ductile iron.

1.2.2 Excavation, Trenching, and Backfilling

Excavation, trenching, and backfilling shall be in accordance with the applicable provisions of SECTION 02314 EARTHWORK FOR UTILITIES, except as modified herein.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with SECTION 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Disposal Method of Waste Water.

The method proposed for disposal of waste water from hydrostatic tests prior to performing hydrostatic tests.

Manufacture's literature on all products specified.

SD-06 Test Reports

Pressure Test Report.

Submit letter certifying passing result of pressure test. Include date of test, pressure sustained and duration, and leaking calculation.

1.4 HANDLING

Pipe and accessories shall be handled to ensure delivery to the trench in sound, undamaged condition, including no injury to the pipe coating or lining. If the coating or lining of any pipe or fitting is damaged, the repair shall be made by the Contractor in a satisfactory manner, at no additional cost to the Government. No other pipe or material shall be placed inside a pipe or fitting after the coating has been applied. Pipe shall be carried into position and not dragged. Use of pinch bars and tongs for aligning or turning pipe will be permitted only on the bare ends of the pipe. The interior of pipe and accessories shall be thoroughly cleaned of foreign matter before being lowered into the trench and shall be kept clean during laying operations by plugging or other approved method. Before installation, the pipe shall be inspected for defects. Material found to be defective before or after laying shall be replaced with sound material without additional expense to the Government. Rubber gaskets that are not to be installed immediately shall be stored in a cool and dark place.

PART 2 PRODUCTS

2.1 PIPE

Pipe shall conform to the respective specifications and other requirements specified below.

2.1.1 Ductile-Iron Pipe

Ductile-iron pipe shall conform to AWWA C151, Class 52, working pressure not less than 150 psi, unless otherwise shown or specified. Pipe shall be cement-mortar lined in accordance with AWWA C104. Linings shall be standard.

2.1.2 Copper Tubing

Copper tubing shall conform to ASTM B 88, Type K, hard drawn.

2.2 FITTINGS AND SPECIALS

2.2.1 Ductile-Iron Pipe System

Fittings and specials shall be suitable for 150 psi pressure rating, unless otherwise specified. Fittings and specials shall be cement-mortar lined (standard thickness) in accordance with AWWA C104. Ductile iron compact fittings shall conform to AWWA C153.

2.2.2 Copper Tubing System

Fittings and specials shall be solder joint and conform to ASME B16.22. Solder shall be approved lead-free type.

2.3 JOINTS

2.3.1 Ductile-Iron Pipe Jointing

Rubber gaskets and lubricants shall conform to the applicable requirements of AWWA C111.

2.3.2 Copper Tubing Jointing

Joints shall be made with the specified fittings and approved lead-free solder.

2.4 VALVES

2.4.1 Gate Valves

Gate valves shall be designed for a working pressure of not less than 150 psi. Valve connections shall be as required for the piping in which they are installed. Valves shall have a clear waterway equal to the full nominal diameter of the valve, and shall be opened by turning counterclockwise. The operating nut or wheel shall have an arrow, cast in the metal, indicating the direction of opening.

a. Valves smaller than 3 inches shall be all bronze and shall conform to MSS SP-80, Type 1, Class 150.

b. Valves 3 inches and larger shall be iron body, bronze mounted, and shall conform to AWWA C500.

c. Resilient-Seated Gate Valves: For valves 3 to 12 inches in size, resilient-seated gate valves shall conform to AWWA C509.

2.5 VALVE BOXES

Valve boxes shall be cast iron. Cast-iron boxes shall be extension type with slide-type adjustment and with flared base. The minimum thickness of metal shall be 3/16 inch. The word "WATER" shall be cast in the cover. The box length shall adapt, without full extension, to the depth of cover required over the pipe at the valve location.

2.6 FIRE HYDRANTS

Hydrants shall be dry-barrel type conforming to AWWA C502 with valve opening at least 5 inches in diameter and designed so that the flange at the main valve seat can be removed with the main valve seat apparatus remaining intact, closed and reasonably tight against leakage and with a breakable valve rod coupling and breakable flange connections located no more than 8 inches above the ground grade. Hydrants shall have a 6 inches bell connection, two 2-1/2 inches hose connections and one 4-1/2 inches pumper connection. Outlets shall have American National Standard fire-hose coupling threads. Working parts shall be bronze. Design, material, and workmanship shall be equal to the latest stock pattern ordinarily produced by the manufacturer. Hydrants shall be painted with 1 coat of red iron oxide, zinc oxide primer conforming to SSPC Paint 25 and 2 finish coats of silicone alkyd paint conforming to SSPC Paint 21, of the installation's standard colors or as directed by the Contracting Officer. Suitable bronze adapter for each outlet, with caps, shall be furnished.

2.7 ALUMINUM TAPE

Two-inch, 5 mil aluminum tape with 2 mil acrylic adhesive.

2.8 PIPE INSULATION

Insulation shall be factory or field applied urethane foam. Urethane foam shall be rigid closed cell two component type meeting the following requirements:

Thermal Conductivity: (k)	0.13 BTU in/hour Deg F.-FT^2 maximum
Compressive Strength:	23 psi minimum
Normal Density:	2-4 pounds per cubic foot

2.9 PIPE INSULATION JACKET

Factory applied polyethylene jacket, minimum 50 mils thickness, or spray applied polyurea jacket, minimum 50 mils thickness.

2.10 PIPE INSULATION JOINT KITS

Half shells fabricated of urethane foam as specified for pipe insulation. Polyethylene heat shrink sleeve with adhesive coated interior. Urecon Mec-Seal or approved equal.

2.11 CIRCULATION PUMPS

Single stage in-line wet rotor circulator, bronze body, stainless steel trim, stainless steel impeller, three-speed motor, Grundfos or approved equal.

2.12 WATER HEATER

Spiral wound copper tubes, cast iron shell, ASME Section 8, Division 1, construction and stamp, Graham Micro Mix II or approved equal.

2.13 Temperature Control Valve

Bronze body and trim, stainless steel spring, NPT ports, piston balanced 3 port type, self acting with set point adjustment, copper sensor well, Spirax Sarco TW 3 Port Valve with SA121 self acting temperature control system or approved equal.

2.14 Condensate Return Unit

Cast iron receiver, duplex low NPSH centrifugal pumps with mechanical seals rated for 210 degrees F, lever controls and control panel including motor starters, disconnect switches, alternator, and hand-off-auto switches, water level gauge with stop locks, WYE type inlet strainer, Paco Pumps, Type GRD or approved equal.

2.15 INSULATION BOARD

The insulation board shall conform to AASHTO M 230, except that extrusion is not required. The insulation board shall be rigid, homogeneous, and essentially unicellular, and shall conform to the following:

Property	Test Method	Value
Compression Strength, psi, minimum at yield or 5 percent compression	AASHTO M 230	35
Water absorption, maximum percent by volume	AASHTO M 230	0.25
Conductance per inch, max. BTU-inch(hr) (sq ft) (deg F)	ASTM C 177	0.23

2.16 MODULAR SEAL RUBBER LINKS

Shall be modular, mechanical type, consisting of inter-locking synthetic rubber links shaped to continuously fill the annular space between the pipe and the wall opening. The elastomeric element shall be sized and selected per manufacturer's recommendations and have the following properties as designated by ASTM. Coloration shall be throughout elastomer for positive field inspection.

For Standard Service Applications:
-40 to +250 F
EPDM = ASTM D2000 M3 BA510
Color = Black

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Cutting of Pipe

Cutting of pipe shall be done in a neat and workmanlike manner without damage to the pipe. Unless otherwise recommended by the manufacturer and authorized by the Contracting Officer, cutting shall be done with an approved type mechanical cutter. Wheel cutter shall be used when practicable. Copper tubing shall be cut square and all burrs shall be removed. Squeeze type mechanical cutters shall not be used for ductile iron.

3.1.2 Adjacent Facilities

3.1.2.1 Sewer Lines

The water pipe shall not be laid closer horizontally than 10 feet from a sewer. Where water lines cross under gravity-flow sewer lines, the sewer pipe, for a distance of at least 10 feet each side of the crossing, shall be fully encased in concrete or shall be made of pressure pipe with no joint located within 3 feet horizontally of the crossing. Water lines shall in all cases cross above sewage force mains or inverted siphons and shall be not less than 2 feet above the sewer main. Joints in the sewer main, closer horizontally than 3 feet to the crossing, shall be encased in concrete.

3.1.2.2 Water Lines

Water lines shall not be laid in the same trench with sewer lines, gas

lines, fuel lines, or electric wiring.

3.1.3 Joint Deflection

3.1.3.1 Allowable for Ductile-Iron Pipe

The maximum allowable deflection shall be as given in AWWA C600. If the alignment requires deflection in excess of the above limitations, special bends or a sufficient number of shorter lengths of pipe shall be furnished to provide angular deflections within the limit set forth.

3.1.4 Placing and Laying

Pipe and accessories shall be carefully lowered into the trench by means of derrick, ropes, belt slings, or other authorized equipment. Water-line materials shall not be dropped or dumped into the trench. Abrasion of the pipe coating shall be avoided. Except where necessary in making connections with other lines or as authorized by the Contracting Officer, pipe shall be laid with the bells facing in the direction of laying. The full length of each section of pipe shall rest solidly upon the pipe bed, with recesses excavated to accommodate bells, couplings, and joints. Pipe that has the grade or joint disturbed after laying shall be taken up and relaid. Pipe shall not be laid in water or when trench conditions are unsuitable for the work. Water shall be kept out of the trench until joints are complete. When work is not in progress, open ends of pipe, fittings, and valves shall be securely closed so that no trench water, earth, or other substance will enter the pipes or fittings. Where any part of the coating or lining is damaged, the repair shall be made by and at the Contractor's expense in a satisfactory manner. Pipe ends left for future connections shall be valved, plugged, or capped, and anchored, as shown.

3.1.4.1 Piping Connections

Where connections are made between new work and existing mains, the connections shall be made by using specials and fittings to suit the actual conditions. When made under pressure, these connections shall be installed using standard methods as approved by the Contracting Officer. Connections to existing asbestos-cement pipe shall be made in accordance with ACPPA Work Practices.

3.1.5 Jointing

3.1.5.1 Ductile-Iron Pipe Requirements

Mechanical and push-on type joints shall be installed in accordance with AWWA C600 for buried lines.

3.1.5.2 Copper Tubing Requirements

Joints shall be made with solder joint fittings. Use approved lead-free solders only.

3.1.5.3 Isolation Joints and Dielectric Fittings

Dielectric unions shall be encapsulated in a field-poured coal-tar covering, with at least 1/8 inch thickness of coal tar over all fitting surfaces.

3.1.5.4 Transition Fittings

Connections between different types of pipe and accessories shall be made with transition fittings approved by the Contracting Officer.

3.1.6 Setting of Fire Hydrants, Valves, and Valve Boxes

3.1.6.1 Location of Fire Hydrants

Fire hydrants shall be located and installed as shown. Each hydrant shall be connected to the main with a 6 inch branch line having at least as much cover as the distribution main. Hydrants shall be set plumb with pumper nozzle facing the taxiway, with the center of the lowest outlet not less than 18 inches above the finished surrounding grade, and the operating nut not more than 30 inches above the finished surrounding grade. Fire hydrants designated on the drawings as low profile shall have the lowest outlet not less than 18 inches above the finished surrounding grade, the top of the hydrant not more than 24 inches above the finished surrounding grade. Except where approved otherwise, the backfill around hydrants shall be thoroughly compacted to the finished grade immediately after installation to obtain beneficial use of the hydrant as soon as practicable. Not less than 7 cubic feet of free-draining broken stone or washed gravel shall be placed around and beneath the waste opening of dry barrel hydrants to ensure drainage.

3.1.6.2 Location of Valves

After delivery, valves, including those in hydrants, shall be drained to prevent freezing and shall have the interiors cleaned of all foreign matter before installation. Stuffing boxes shall be tightened and hydrants and valves shall be fully opened and fully closed to ensure that all parts are in working condition. Valves and valve boxes shall be installed where shown or specified, and shall be set plumb. Valve boxes shall be centered on the valves. Boxes shall be installed over each outside gate valve unless otherwise shown. Where feasible, valves shall be located outside the area of roads and streets. Earth fill shall be tamped around each valve box or pit to a distance of 4 feet on all sides of the box, or the undisturbed trench face if less than 4 feet.

3.1.7 Thrust Restraint

Plugs, caps, tees and bends deflecting 11.25 degrees or more, either vertically or horizontally, on waterlines 4 inches in diameter or larger, and fire hydrants shall be provided with thrust restraints. Valves shall be securely anchored or shall be provided with thrust restraints to prevent movement. Thrust restraints shall be restrained joints.

3.1.7.1 Restrained Joints

Mechanical joint restraint shall be incorporated in the design of the follower gland and shall include a restraining mechanism. Flexibility of the joint shall be maintained after burial. Glands shall be manufactured of ductile iron conforming to ASTM A 536. Restraining devices shall be of ductile iron heat treated to a minimum hardness of 370 BHN. Dimensions of the gland shall be such that it can be used with the standardized mechanical joint bell and tee-head bolts conforming to AWWA C111 and AWWA C153 of latest revision. Twist-off nuts shall be used to insure proper actuating of the restraining devices.

The mechanical joint restraint device shall have a working pressure of at least 250 psi with a minimum safety factor of 2:1.

3.1.8 Insulation

All buried water piping shall have 3 inches of insulation except hydrant laterals shall have 4 inches of insulation.

3.1.9 Flushing

All newly installed water line and circulation line shall be "Open-Bore" flushed to remove any foreign matter. "Open-Bore" flushing shall be accomplished prior to hydrostatic testing and disinfection at each extremity of the line, including all stubouts and deadends. The Contractor shall furnish, install, and remove all fittings and pipes necessary to perform the flushing, at no additional cost to the Government. Under no circumstances will open bore flushing through hydrants or reduced outlets be permitted.

It will be Contractor's responsibility to notify the Contracting Officer (24) hours in advance of any flushing operations.

3.2 HYDROSTATIC TESTS

Submit proposed disposal method of waste water from hydrostatic tests prior to performing hydrostatic tests.

3.2.1 Concurrent Hydrostatic Tests

The Contractor may elect to conduct the hydrostatic tests using either or both of the following procedures. Regardless of the sequence of tests employed, the results of pressure tests, leakage tests, and disinfection shall be as specified. Replacement, repair or retesting required shall be accomplished by the Contractor at no additional cost to the Government.

3.2.2 Pressure Test

After the pipe is laid, the joints completed, fire hydrants permanently installed, and the trench partially backfilled leaving the joints exposed for examination, the newly laid piping or any valved section of piping shall, unless otherwise specified, be subjected for 1 hour to a hydrostatic pressure test of 150 psi. Each valve shall be opened and closed several times during the test. Exposed pipe, joints, fittings, hydrants, and valves shall be carefully examined during the partially open trench test. Joints showing visible leakage shall be replaced or remade as necessary. Cracked or defective pipe, joints, fittings, hydrants and valves discovered in consequence of this pressure test shall be removed and replaced with sound material, and the test shall be repeated until the test results are satisfactory. The requirement for the joints to remain exposed for the hydrostatic tests may be waived by the Contracting Officer when one or more of the following conditions is encountered:

a. Wet or unstable soil conditions in the trench.

b. Compliance would require maintaining barricades and walkways around and across an open trench in a heavily used area that would require continuous surveillance to assure safe conditions.

c. Maintaining the trench in an open condition would delay completion

of the project.

The Contractor may request a waiver, setting forth in writing the reasons for the request and stating the alternative procedure proposed to comply with the required hydrostatic tests. Backfill placed prior to the tests shall be placed in accordance with the requirements of SECTION 02314 EARTHWORK FOR UTILITIES.

3.2.3 Leakage Test

Leakage test shall be conducted after the pressure tests have been satisfactorily completed. The duration of each leakage test shall be at least 2 hours, and during the test the water line and circulation lines shall be subjected to not less than 150 psi pressure. Leakage is defined as the quantity of water to be supplied into the newly laid pipe, or any valved or approved section, necessary to maintain pressure within 5 psi of the specified leakage test pressure after the pipe has been filled with water and the air expelled. Piping installation will not be accepted if leakage exceeds the allowable leakage which is determined by the following formula:

L = 0.0001351ND(P raised to 0.5 power)
L = Allowable leakage in gallons per hour
N = Number of joints in the length of pipeline tested
D = Nominal diameter of the pipe in inches
P = Average test pressure during the leakage test, in psi gauge

Should any test of pipe disclose leakage greater than that calculated by the above formula, the defective joints shall be located and repaired until the leakage is within the specified allowance, without additional cost to the Government.

3.2.4 Time for Making Test

Except for joint material setting necessitate a 5-day delay, pipelines jointed with rubber gaskets, mechanical or push-on joints, or couplings may be subjected to hydrostatic pressure, inspected, and tested for leakage at any time after partial completion of backfill. Cement-mortar lined pipe may be filled with water as recommended by the manufacturer before being subjected to the pressure test and subsequent leakage test.

3.3 DISINFECTION

After operational tests are complete, the entire water distribution system shall be disinfected. System shall be flushed as specified before introducing chlorinating material. The chlorinating material shall be hypochlorites or liquid chlorine. Water chlorination procedure shall be in accordance with AWWA M20. The chlorinating material shall be fed into the water piping system at a constant rate at a concentration of at least 50 parts per million (ppm). A properly adjusted hypochlorite solution injected into the main with a hypochlorinator, or liquid chlorine injected into the main through a solution-feed chlorinator and booster pump, shall be used. The chlorine residual shall be checked at intervals to ensure that the proper level is maintained. Chlorine application shall continue until the distribution and circulation lines are filled. The water shall remain in the system for a minimum of 24 hours. Each valve in the system being disinfected shall be opened and closed several times during the contact period to ensure its proper disinfection. Following the 24-hour

period, not less than 25 ppm chlorine residual shall remain in the system. The system shall then be flushed with clean water until the residual chlorine is reduced to less than one part per million. During the flushing period each valve, shall be opened and closed several times. From several points in the system, the Contractor will take samples of water in proper disinfection containers for bacterial examination. The samples of water shall be tested for bacterial examination. The samples of water shall be tested for total coliform organisms (coliform bacteria, fecal coliform, streptococcal, and other bacteria) in accordance with AWWA-01. The testing method used shall be either the multiple-tube fermentation technique or the membrane-filter technique. The sterilizing shall be repeated until tests indicated the absence of coliform organisms (zero mean coliform density per 100 milliliters) in the samples for at least two full days. The system will not be accepted until satisfactory bacteriological results have been obtained.

3.4 CLEANUP

Upon completion of the installation of water lines and appurtenances, all debris and surplus materials resulting from the work shall be removed.

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SECTION 02511

WATER DISTRIBUTION SYSTEMS IN UTILIDORS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 36/A 36M	(2001) Carbon Structural Steel
ASTM A 47	(1999) Ferritic Malleable Iron Castings
ASTM A 53/A 53M	(2002) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 307	(2002) Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
ASTM A 536	(1999el) Ductile Iron Castings
ASTM A 563	(2000) Carbon and Alloy Steel Nuts
ASTM A 780	(2001) Repair of Damaged and Uncoated Areas of Hot-Dipped Galvanized Coatings
ASTM B 209	(2002a) Aluminum and Aluminum-Alloy Sheet and Plate
ASTM C 881	(1999) Epoxy-Resin-Base Bonding Systems for Concrete
ASTM D 2000	(2001) Rubber Products in Automotive Applications
ASTM D 4586	(2000) Asphalt Roof Cement, Asbestos Free

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA B300	(1999) Hypochlorites
AWWA B301	(1999) Liquid Chlorine
AWWA C104	(1995) Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
AWWA C110	(1998) Ductile-Iron and Gray-Iron Fittings, 3 in. Through 48 in. (75 mm Through 1200 mm), for Water

AWWA C115	(1999) Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges
AWWA C151	(1996) Ductile-Iron Pipe, Centrifugally Cast, for Water
AWWA C203	(1997) Coal-Tar Protective Coatings and Lining for Steel Water Pipelines - Enamel and Tape - Hot-Applied
AWWA C205	(1995) Cement-Mortar Protective Lining and Coating for Steel Water Pipe - 4 in. and Larger - Shop Applied
AWWA C207	(2001) Steel Pipe Flanges for Waterworks Service - Sizes 4 In. Through 144 In. (100 mm Through 3,600 mm)
AWWA C500	(1993; C500a) Metal-Sealed Gate Valves for Water Supply Service
AWWA C502	(1994; C502a) Dry-Barrel Fire Hydrants
AWWA C509	(1994; Addendum 1995) Resilient-Seated Gate Valves for Water Supply Service
AWWA C600	(1999) Installation of Ductile-Iron Water Mains and Their Appurtenances
AWWA C606	(1997) Grooved and Shouldered Joints
AWWA C651	(1999) Disinfecting Water Mains

ASME INTERNATIONAL (ASME)

ASME B16.3	(1998) Malleable Iron Threaded Fittings

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-110	(1996) Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends
MSS SP-80	(1997) Bronze Gate, Globe, Angle and Check Valves

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 325M	(1991) Fire Hazard Properties of Flammable Liquids, Gases and Volatile Solids
NFPA 49	(1994) Hazardous Chemicals Data
NFPA 704	(1996) Identification of the Fire Hazards of Materials for Emergency Response

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC Paint 21	(1991) White or Colored Silicone Alkyd Paint
SSPC Paint 25	(1997) Oxide, Zinc Oxide, Raw Linseed Oil and Alkyd Primer (Without Lead and Chromate Pigments)

1.2 PIPING

This section covers water distribution lines, water service lines, connections to building services as shown on the drawings, fire lines and fire hydrants. The Contractor shall have a copy of the manufacturer's recommendations for each material or procedure to be utilized available at the construction site at all times.

1.2.1 Piping for Water Distribution Lines

Piping for water distribution lines shall be ductile iron, unless otherwise shown or specified.

1.2.2 Piping for Water Service Lines

Piping for water service lines less than 4" in diameter shall be galvanized steel or ductile iron, unless otherwise shown or specified.

1.2.3 Piping for Fire Lines

Piping for fire lines shall be ductile iron.

1.2.4 Standard Products

The equipment to be furnished under this specification shall be essentially the standard product of the manufacturer. Where two or more units of the same class of equipment are required, these units shall be the products of a single manufacturer; however, the component parts of the system need not be the products of the same manufacturer. The products of any reputable manufacturer regularly engaged in the commercial production of water distribution equipment will not be excluded on the basis of minor differences, provided all essential requirements of this specification relative to materials, capacity and performance are met.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with SECTION 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Materials.

SD-08 Manufacturer's Instructions

Manufacturer's Recommendations.

SD-06 Test Reports

Hydrostatic tests; G-AO.

Disinfection; G-AO.

1.4 SUBMITTALS SUPPLEMENTAL

See paragraphs below for further descriptions of submittals required by paragraph SUBMITTALS:

1.4.1 Materials

Manufacturer's descriptive data, catalog cuts, and brochures for all materials used.

1.4.2 Manufacturer's Recommendations

Manufacturer's recommendations for each material or procedure to be utilized which is required to be in accordance with such recommendations. The Contractor shall have a copy of the manufacturer's instructions available at the construction site at all times and shall follow these instructions unless otherwise directed by the Contracting Officer.

1.4.3 Hydrostatic tests

Submit a hydrostatic test procedure describing method including method proposed for disposal of wastewater.

1.4.4 Disinfection

Submit a disinfection and test procedure describing method of disinfection with drawings showing proposed flush points, proposed chlorine injection points, method for disposal of wastewater and proposed sampling locations 30 days prior to disinfection being conducted. Submit satisfactory test results conducted by a laboratory certified by the State of Alaska.

PART 2 PRODUCTS

2.1 MATERIALS

Materials shall conform to the respective specifications and other requirements specified below: Pipe and fittings that are connected to anchors shall be steel.

2.2 PIPE

2.2.1 Ductile-Iron Pipe

Ductile-Iron pipe shall conform to AWWA C151, Class 52, working pressure not less than 150 psi, unless otherwise shown or specified. Pipe shall be cement-mortar lined in accordance with AWWA C104. Linings shall be standard. Pipe 4" and larger shall be ductile iron.

2.2.2 Galvanized-Steel Pipe, Less Than 4"

Galvanized steel pipe shall conform to ASTM A 53/A 53M, standard weight.

2.3 JOINTS

2.3.1 Ductile-Iron Pipe

2.3.1.1 Mechanical Joints

Mechanical joints shall be of the restrained stuffing box type and shall conform to AWWA C606. Pipe joints shall be cut grooved and shouldered joints in accordance with AWWA C606 with a minimum working pressure of 150 psi. The coupling shall provide for full circumferential bearing against the face of the pipe groove or shoulder end, with a positive locking action when the components being joined are in line. Restrained joints shall be of the type that cannot be separated without failure of the pipe joint material.

Rubber gaskets and lubricants shall be as specified by the manufacturer of the jointing system and shall conform to the applicable requirements of ASTM D 2000.

2.3.1.2 Flanges

Flanges shall conform to AWWA C115 and/or AWWA C110. Flanges shall be flat faced.

2.3.2 Steel Pipe, Galvanized

2.3.2.1 Mechanical Joints

Pipe joints for steel piping 2" and larger shall be cut grooved and shouldered joints in accordance with AWWA C606 with a minimum working pressure of 150 psi. All joints are to be flexible and use the same gasket material as specified for ductile iron pipe.

2.3.2.2 Flanges

Flanges shall conform to AWWA C207. Flanges shall be flat faced.

2.3.2.3 Threaded Joints

Pipe joints for steel piping smaller than 2" shall be threaded.

2.4 ISOLATION JOINTS

Isolation joints shall be installed between nonthreaded ferrous and nonferrous metallic pipe, fittings, and valves. Isolation joints shall consist of a sandwich-type flange isolation gasket of the dielectric type, isolation washers, and isolation sleeves for flange bolts. Isolation gaskets shall be full faced with outside diameter equal to the flange outside diameter. Bolt isolation sleeves shall be full length. Units shall be of a shape to prevent metal-to-metal contact of dissimilar metallic piping elements and shall be suitable for the required working pressure.

2.5 FITTINGS AND SPECIALS

Fittings and specials for ductile-iron pipe and steel pipe may be interchanged where applicable. Mating surfaces between steel and iron flanges shall be plain faced. Hand line special fittings with epoxy sealer listed for use in potable water systems.

2.5.1 For Ductile-Iron Pipe

Fittings and specials shall have a pressure rating no less than that of adjoining pipe, unless otherwise specified. Fittings and specials for flanged joint pipe shall conform to AWWA C110. Fittings required on the drawings that are not covered in AWWA C110 shall have AWWA flanges and be based on AWWA C110 design principles. Fittings and specials for cut grooved and shouldered end pipe shall conform to AWWA C606 without field preparation. Malleable iron shall be ASTM A 47. Ductile iron shall be ASTM A 536.

2.5.2 For Galvanized-Steel Pipe Less Than 4"

Steel fittings shall be galvanized. Screwed fittings shall conform to ASME B16.3. Flanged fittings shall conform to AWWA C207. Dresser-type fitting shall not be used.

2.6 VALVES

2.6.1 Gate Valves

Gate valves shall be designed for a working pressure of not less than 150 psi. Valve connections shall be as required for the piping in which they are installed. Valves shall have a clear waterway equal to the full nominal diameter of the valve, and shall be opened by turning counterclockwise. The operating nut or wheel shall have an arrow cast in the metal, indicating the direction of opening.

a. Valves 2" and smaller shall be union bonnet all bronze and shall conform to MSS SP-80, Type 1, Class 300.

b. Valves larger than 2" shall be iron body, bronze mounted, and shall conform to AWWA C500, Class 125. Valves shall be non-rising stem and no raised faces.

c. Resilient-Seated Gate Valves: For valves 3" to 12" in size, resilient-seated gate valves shall conform to AWWA C509.

2.6.2 Ball Valve

Threaded ends 4" and smaller: 400# WOG., forged brass two piece body, hard chrome plated forged brass ball, true adjustable packing nut ("O"-ring only type stem seal not acceptable), blow-out proof stem meeting Manufacturers Standardization Society MSS SP-110.

2.7 FIRE HYDRANTS

Hydrants shall be dry-barrel type conforming to AWWA C502 with valve opening at least 5" in diameter and designed so that the flange at the main valve seat can be removed with the main valve seat apparatus remaining intact, closed and reasonably tight against leakage and with a breakable valve rod coupling and breakable flange connections located no more than 8" above the ground or concrete lid. Hydrants shall have a 6" bell connection, two 2-1/2" hose connections and one 4-1/2" pumper connection. Outlets shall have American National Standard fire-hose coupling threads. Working parts shall be bronze. Design, material and workmanship shall be similar and equal to the latest stock pattern ordinarily produced by the manufacturer. The exterior of fire hydrants below the breakable coupling

shall be painted as specified for pipes inside the utilidor, with the added requirement of two (total) coats of the asphalt varnish. Hydrants shall be painted with one coat of zinc oxide primer conforming to SSPC Paint 25, and two finish coats of silicone alkyd enamel conforming to SSPC Paint 21, of the installation's standard colors or as directed by the Contracting Officer. Suitable bronze adapter for each outlet, with caps, shall be furnished. The finish coat shall be DRYVIT color number 112 sandalwood beige. Hydrants shall be Waterous-Pacer or equal.

2.8 DISINFECTION

Chlorinating materials shall conform to the following:

Chlorine, Liquid: AWWA B301.

Hypochlorite, Calcium and Sodium: AWWA B300.

2.9 GALVANIZED COATINGS

Repair shall conform to ASTM A 780 for damaged and uncoated areas of hot-dip galvanized coating.

2.10 MASTIC

Mastic shall conform to ASTM D 4586, Type I.

2.11 INSULATION AND JACKETING

2.11.1 Insulation for Piping in Utilidors

Insulation for piping, fittings, and valves shall be closed cell cellular glass. Insulation for piping, fittings, and valves in manholes and to a point 5 feet into the utilidors shall be calcium silicate. Insulation shall be factory or field applied. Laminated construction shall not be used. Insulation on piping in utilidor shall be covered with aluminum or nonmetallic jacket and insulation in manholes shall be covered with an aluminum jacket.

2.11.2 Aluminum Jacket

Jacket shall be smooth sheet, 0.016" nominal thickness; ASTM B 209, Type 3003, 3105, or 5005.

2.11.3 Nonmetallic Jacket

Nonmetallic jackets shall be of the AWJ (All Weather Jacket) type. Nonmetallic jacket shall consist of a 0.042 pounds per square foot fiberglass fabric impregnated with chlorosulfonated polyethylene (Hypalon) and a 0.0015" (1.5 mils) polyvinyl fluoride film (Tedlar) bonded to it. Overall thickness of the composite shall be 0.01" and weigh approximately 0.073 pounds per square foot. Jacket may be either field or factory applied to the insulation.

2.11.4 Bands

Bands for aluminum jacket shall be 3/8" wide and 32 gauge thickness made of aluminum or annealed stainless steel. Bands for insulation shall be 1/2" wide and 32 gauge thickness made of annealed stainless steel.

2.11.5 Insulation for Flanges, Unions, and Fittings

Flanges, unions, and fittings shall be insulated with removable and reusable jackets. The insulation shall have essentially the same thermal characteristics and thickness as the adjoining piping. Removable valve blankets shall be secured with nylon straps and buckles.

2.11.6 Insulation Thickness

Provide pipe insulation thicknesses as specified on the drawings.

2.11.7 Water Valve and Equipment Insulation Cover

a. Removable, one-piece sewn cover construction with Velcro fasteners.

b. Thread: High temperature bonded multi-filament, Teflon coated. Rated for 475 degrees F maximum.

c. Seams: Double sewn, 8 stitches per inch minimum.

d. Closures: 2" minimum flap. Provide end closures with drawstrings.

e. Jacket: Silicon coated fiberglass fabric, 16 ounce/square yard minimum.

f. Insulation: 2" thick Owens Corning thermal insulation wool or equal.

2.12 COAL-TAR COATING

Coal-tar coating shall be as specified in SECTION 02560 UTILIDOR SYSTEM.

2.13 SERVICE CLAMPS

Service clamps shall have a pressure rating not less than that of the pipe to be connected and shall be either the single or double flattened strap type. Clamps shall have a galvanized malleable iron body with cadmium plated straps and nuts. Clamps shall have rubber gasket cemented to the body.

2.14 PIPE ALIGNMENT GUIDES

Pipe alignment guide type shall conform to SECTION 02559 HEAT DISTRIBUTION SYSTEMS IN UTILIDORS AND MANHOLES. Alignment Guides shall not require lubrication. The alignment guide shall not be affected by high humidity or mildly corrosive atmosphere. The sliding surfaces shall be protected from accumulation of dirt and other foreign matter.

2.14.1 Insulation Inserts at Pipe Supports and Pipe Carriers

Insulation inserts at pipe supports or carriers shall be a pre-manufactured system consisting of calcium silicate pipe insulation, an ultra-high density insulation insert with a minimum compressive strength of 900 psi, a vapor barrier and jacket to match the adjacent insulation system, and a galvanized steel shield. Insert and metal shield dimensions shall be appropriate for calculated loads.

2.14.2 Expansion Joints

The Expansion joints shall be either a flange by flange laminated bellows expansion joint: Hyspan Series 1500 or approved equal.

2.14.3 Structural Epoxy Adhesive

The structural epoxy adhesive for attaching pre-cast concrete block pipe supports to the utilidor floor shall be a 2-component, 100 percent solids, moisture insensitive, high modules, high strength paste conforming to ASTM C 881, Type 4, Grade 3.

PART 3 EXECUTION

3.1 INSTALLATION

Piping shall be installed as indicated on the drawings. Piping in manholes is shown in general configuration. Dimensions and lengths may vary slightly depending on pipe and fitting dimensions, location of supports and anchors, and fabrication. It shall be the Contractor's responsibility to insure that the final piping arrangement fits and conforms to the general configuration shown on the drawings. Pipe shall be cut accurately to measurements established at the site by the Contractor and shall be worked into place without springing or forcing. Care shall be taken not to weaken structural portions of the utilidor or manholes. Changes in pipe sizes shall be made with reducing fittings. Use of long screws and bushings will not be permitted. Tapping into existing systems shall be accomplished with as little system down time as possible. The Contractor shall submit his plan of action for tapping into existing systems for each tap.

3.2 HANDLING

Pipe and accessories shall be handled so as to insure delivery to the utilidor in sound, undamaged condition. Particular care shall be taken not to injure the pipe coating or lining. If the coating or lining of any pipe or fitting is damaged, the repair shall be made by the Contractor at his expense in a satisfactory manner. No other pipe or material of any kind shall be placed inside a pipe or fitting after the coating has been applied. Pipe shall be carried into position and not dragged. Use of pinch bars and tongs for aligning or turning pipe will be permitted only on the bare ends of the pipe. The interior of pipe and accessories shall be thoroughly cleaned of foreign matter before being lowered into the utilidor and shall be kept clean during laying operations by plugging or other acceptable method. Before installation, the pipe shall be inspected for defects. Material found to be defective before or after laying shall be replaced with sound material without additional expense to the Government. Rubber gaskets that are not to be installed immediately shall be stored in a cool and dark place. Storage facilities shall be classified and marked in accordance with NFPA 704, with classification as indicated in NFPA 49 and NFPA 325M.

3.3 CUTTING OF PIPE

Cutting of pipe shall be done in a neat and workmanlike manner without damage to the pipe. Unless otherwise recommended by the manufacturer and authorized by the Contracting Officer, cutting shall be done with a mechanical type cutter. Wheel cutter shall be used when practicable. Squeeze type mechanical cutters shall not be used for ductile iron.

3.4 PIPE SUPPORTS

Pipe and supports shall be spaced not over 5 feet apart at heavy fittings and valves. Pipe shall be supported near each coupling and at multiple fittings as required. A support shall be installed not over 1 foot from each change in direction of piping. Brackets for support for piping hangers shall be Type 34. No supports shall be suspended from manhole or utilidor tops, except as shown on the drawings. Pipes shall be supported near each coupling or joint to prevent vertical deflection of the coupling or joint, as recommended by the pipe manufacturer. Pipes shall be secured to each horizontal support in utilidors to limit side-to-side and vertical movement but not axial movement (U-bolts or equal shall be used). Supports shall be hot dipped galvanized.

3.4.1 Pre-Cast Concrete Block Pipe Support

Concrete blocks can be used for support within the fire hydrant utilidor. The pre-cast concrete block pipe supports shall be attached to the floor using structural epoxy adhesive. Apply the adhesive to the full footprint of the block per adhesive manufacturer's instructions. The bonding surfaces must be clean and sound. The surface may be dry or damp, but free of standing water. Remove dust, laitance, grease, curing compounds, impregnations, waxes, foreign particles, and disintegrated materials. Prepare the utilidor floor for the adhesive by sandblasting.

3.5 JOINT DEFLECTION

The maximum allowable deflection will be 15 minutes, unless a lesser amount is recommended by the manufacturer. If the alignment requires deflection in excess of the above limitations, special bends or a sufficient number of shorter lengths of pipe shall be furnished to provide angular deflections within the limit set forth. Under no circumstances shall pipes or fittings be forced into position, with or without heat.

3.6 PLACING AND LAYING

Pipe and accessories shall be carefully lowered into the utilidor by means of derrick, ropes, belt slings, or other authorized equipment. Under no circumstances shall any of the waterline materials be dropped or dumped into the utilidor. Care shall be taken to avoid abrasion of the pipe coating. When work is not in progress, open ends of pipe, fittings, and valves shall be securely closed so that no water, earth or other substance will enter the pipes or fittings. Where any part of the coating or lining is damaged, the repair shall be made by the Contractor at his expense in a satisfactory manner. Pipe ends left for future connections shall be valved, plugged or capped, and anchored, as shown.

3.6.1 Connections

Where connections are made between new work and existing mains, the connections shall be made by using specials and fittings to suit the actual conditions. Standard methods are available for making connections to various types of pipe, either under pressure or in the dewatered condition. Where made under pressure, these connections shall be installed as required by the Contracting Officer.

3.7 JOINTING

Unrestrained sleeve type couplings shall not be used on fire or water lines.

3.7.1 Ductile-Iron Pipe

Split sleeve joints shall be installed in accordance with AWWA C606 for cut grooved and shouldered pipe. Mechanical and restrained push-on joints shall be installed in accordance with the applicable portions of AWWA C600.

3.7.2 Galvanized-Steel Pipe

3.7.2.1 Screw Joints

Screw joints shall be made tight with a stiff mixture of graphite and oil, inert filler and oil, or with an equivalent graphite compound, applied with a brush to the male threads only. Compounds shall not contain lead. Unions shall be provided where required for disconnection of piping.

3.7.3 Isolation Joints

Isolation joints shall be installed in accordance with details specified in paragraph ISOLATION JOINTS.

3.7.4 Transition Fittings

Connections between different types of pipe and accessories shall be made with transition fittings as required.

3.8 INSTALLATION OF SERVICE LINES

Services lines shall include the pipeline connecting water distribution lines to the connections with the building service as shown on the drawings. Where building services are not installed, the Contractor shall terminate the service lines inside the appropriate manhole on the main utilidor. Such service lines shall be closed with plugs or caps. Service lines shall be connected to the main by a rigid connection and shall have a gate valve.

3.9 FIELD COATING AND LINING OF PIPE

3.9.1 Pipe 3" and Larger

3.9.1.1 Cement-Mortar Coating and Lining

Field jointing shall conform to Appendix, AWWA C205. Any defective area found in the coating and/or lining of pipe and joints shall be removed to the pipe wall, and the area shall be repaired in a manner such that the repaired areas will be at least equal in thickness to the minimum coating and/or lining required for the pipe. Steel reinforcement in the coating shall be repaired or replaced as necessary to assure a complete and soundly reinforced coating.

3.9.1.2 Galvanized-Steel Pipe

Field joints shall be given one coat of coal-tar primer and two coats of coal-tar enamel conforming to AWWA C203, and any flaws or holidays found in the coating of pipe and joints shall be repaired by patching or other approved means; the repaired areas shall be at least equal in thickness to the minimum coating required for the pipe.

3.10 SETTING OF FIRE HYDRANTS

3.10.1 Fire Hydrants

Fire hydrants shall be located and installed as shown. Each hydrant shall be connected to the main with a 6" branch line. This branch shall contain one gate valve. Hydrants shall be set plumb with pumper nozzle facing the taxiway and with the center of the lowest outlet not less than 18" above the finished surrounding grade and the operating nut not more than 30" above the finished surrounding grade.

3.10.2 Hydrants, After Delivery

Hydrants, after delivery, shall be drained to prevent freezing and shall have the interior cleaned of all foreign matter before installation. Stuffing boxes shall be tightened and the hydrant shall be fully opened and fully closed to insure that all parts are in working condition.

3.11 THRUST RESTRAINT

Plugs, caps, tees and bends on all waterlines 4" in diameter or larger, and on fire hydrants, shall be provided with concrete or structural steel thrust blocking, anchors or metal tie rods and clamps or lugs. Valves shall be securely anchored or shall be provided with thrust blocking to prevent movement. Blocking shall be placed between solid surface and the hydrant, valve, or fitting to be anchored. Blocking shall be placed so that the fitting joints will be accessible for repair. Steel rods and clamps shall be protected by coating with asphalt varnish or by galvanized coating.

3.12 EXPANSION JOINTS

Expansion joints shall be designed for a minimum working pressure of 150 psi. Installation shall be per manufacturer's installation instructions. The length of the piping section where the expansion joint is to be installed shall be adjusted for the temperature of the pipe at the time of installation. The Contractor shall submit a table showing, for each 10 degrees F above and below the design temperature of 50 degrees F, the amount the center-to-end dimension of the joint shall be decreased or increased per each 100 feet of pipe length in the run (joint at mid-length when temperature of pipe section is 70 degrees F).

3.12.1 Bellows Type Joints

Joints shall be packless and flexible with no internal sleeves. Expansion elements shall be of stainless steel. Joints shall be equipped with limit rods to prevent the expansion joint from exceeding the rated travel.

3.13 ALIGNMENT GUIDES

3.13.1 General

Alignment Guides shall be cast-iron or steel and shall be so constructed that the axial movement of the pipe caused by thermal expansion will be guided in a straight line only and movement in any other direction will be adequately restrained. The guide may be a guiding cylinder attached to an anchor base or a clamp type attached to a flanged slide, moveable in guide bars attached to an anchor base. Guiding surfaces shall be machine finished and properly lubricated. The anchor base shall be correctly

designed, adequately supported, and properly aligned to prevent distortion and binding of the pipe in the guide. The upper half of the clamp or guiding cylinder must be removable. All types must be designed for a pipe movement of not less than 12". Guides shall be securely anchored against pipe movement. In no case will pipe rollers, racks, or hangers be considered substitutes for guides. Alignment guides that are supported from the floor of manholes or utilidors shall have the bottom 6" protected with two coats of coal-tar coating.

3.14 ANCHORS

All steel shapes shall conform to ASTM A 36/A 36M. Bolts and nuts shall conform to ASTM A 307 and ASTM A 563, as applicable. The type and class shall be the Contractor's option. For finishing, see SECTION 02560 UTILID0R/FUELIDOR SYSTEM, paragraph PAINTING AND FINISHING. Additionally, any anchor that is supported from the manhole or utilidor bottom shall have the lower 6" of the anchor protected with two layers of coal-tar coating. Anchors shall be attached to pipes by welding.

3.15 INSULATION

3.15.1 General Requirements

Cold water lines, including valves and fittings, throughout utilidors shall be covered with insulation. As a part of the installation, the insulation shall have the joints buttered with mastic in such a manner as to fill all insulation joints and to prevent any future passage of vapor to the cold water pipe after the assembly is complete. Special care shall be exercised to insure that joint sealer material does not drip on the utilidor floor or become smeared on the outer surface of the insulation or adjacent piping. The insulation shall be adequately secured to the pipe with 3/4" lacquered steel or other rust-resistant type bands, placed not over 12" on centers. Protection sleeves shall be provided at each support to protect the insulation. Sleeves shall be made up from a 12" wide strip of 20 gauge galvanized sheet metal cut to provide a 1" minimum overlap. Sleeves shall be secured to the insulation by 2 bands located approximately 1-1/2" from each end of the sleeve. Bands shall be the same type as used to secure insulation to pipe.

3.15.2 Insulation

Pipe insulation shall be closed cell fiber glass.

Insulation shall be at least 1" thick. Application shall be as described in General Requirements except that a positive vapor barrier shall be provided on the outside surface of all insulation, including that protected by an aluminum jacket. Joints or fittings requiring routing out of more than 1/4" of insulation to secure proper insulation fit shall be covered with oversize insulation of sufficient thickness to obtain a minimum thickness of 1".

3.15.3 Aluminum-Jacket

Aluminum-jacket shall be provided over insulation on cold water lines in the manholes and to a distance of 5 feet into the new utilidors including valves and fittings. Aluminum-jacket material shall be of the best grade suitable for service. Aluminum-jackets shall be not less than 0.016" thick and shall be secured with aluminum bands not less than 3/8" wide and not more than 8" apart. Jacket sections shall have 1" hem turned along one

longitudinal edge and shall be applied with the hemmed edge over the unhemmed edge. The longitudinal and circumferential seams shall be lapped not less than 2". Jackets on horizontal lines shall be installed so that the longitudinal seams are on the bottom side of the pipe with the seam of each jacket slightly offset from the seam of the adjacent jackets. The seams of jackets installed on vertical lines shall be slightly offset as on horizontal lines. The jackets on vertical lines and lines pitched from the horizontal shall be installed from low point to high point so that the lower circumferential edge of each jacket overlaps the jacket below it. Special fitting jackets conforming to the above, with the exception of longitudinal lapping dimensions and location of seams, may be used for fittings, valves, and flanges. Jackets for fittings, valves, and flanges shall be properly overlapped and secured. Under no conditions shall the jacketing be allowed to become electrically coupled to the piping or be installed vapor tight.

3.16 HYDROSTATIC TESTS

Where any section of a water line is provided with concrete thrust blocking for fittings or hydrants, the hydrostatic tests shall not be made until at least 5 days after installation of the concrete thrust blocking unless otherwise approved. The method proposed for disposal of waste water from hydrostatic tests and disinfection shall be submitted to the Contracting Officer prior to performing hydrostatic tests.

3.16.1 Hydrostatic Test

After the pipe is laid, the joints completed, and the fire hydrants permanently installed, the newly laid piping or any valved section of water distribution, or water service piping, or fire line shall, unless otherwise specified, be subjected for 2 hours to a hydrostatic pressure test of 200 psi. Each valve shall be opened and closed several times during the test. Exposed pipe, joints, fittings, valves and hydrants shall be carefully examined during the test. No leakage will be allowed. Joints showing visible leakage shall be replaced or remade as necessary. Cracked or defective pipe, joints, fittings, valves, or hydrants discovered in consequence of this pressure test shall be removed and replaced with sound material, and the test shall be repeated until the test results are satisfactory.

3.16.2 Time for Making Test

Except for joint material setting or where concrete thrust blocking necessitates a 5-day delay, pipelines may be subjected to hydrostatic pressure, inspected, and tested at any time after the line is secured. Cement-mortar lined pipe may be filled with water as recommended by the manufacturer before being subjected to the hydrostatic test.

3.16.3 Concurrent Hydrostatic Tests

The Contractor may elect to conduct the hydrostatic tests using the following procedures. Regardless of the sequence of tests employed, the results of hydrostatic tests and disinfection shall be satisfactory as specified. All replacement, repair or retesting required shall be accomplished by the Contractor at no additional cost to the Government.

3.16.3.1 Hydrostatic Tests and Disinfection

Hydrostatic tests and disinfection may be conducted concurrently, using the

water treated for disinfection to accomplish the hydrostatic tests. If water is lost when treated for disinfection and air is admitted to the unit being tested, or if any repair procedure results in contamination of the unit, disinfection shall be reaccomplished.

3.17 DISINFECTI0N

Before acceptance of potable water operation, each unit of completed water and fire line shall be disinfected as prescribed by AWWA C651. Disinfection shall be repeated until tests indicate the absence of pollution for at least 2 full days. The unit will not be accepted until satisfactory results have been obtained from water samples submitted by the Contractor to a laboratory certified by the State of Alaska to perform testing for coliform bacteria.

3.18 CLEANUP

Upon completion of the installation of the water distribution lines and water service lines, fire lines, and appurtenances, all debris and surplus materials resulting from the work shall be removed.

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SECTION 02533

SEWERS IN UTILIDORS

PART 1 GENERAL

1.1 REFERENCES

The publication listed below form a part of this specification to the extent referenced. The publication are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI B18.2.1	(1996) Square and Hex Bolts and Screws Inch Series

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 123	(2000) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 536	(1999el) Ductile Iron Castings

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C111	(2000) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings

1.2 GENERAL

This section covers sewage lines, both gravity and force mains.

Recommendations of the Manufacturer: The Contractor shall, as a part of the shop drawings, submit to the Contracting Officer the manufacturer's recommendations for each material or procedure to be utilized which is required to be in accordance with such recommendations. The Contractor shall have a copy of the manufacturer's instructions available at the construction site at all times and shall follow these instructions unless otherwise directed by the Contracting Officer.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with SECTION 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Materials; G-AO.

SD-06 Test Reports

Hydrostatic tests; G-AO.

SD-08 Manufacturer's Instructions

Manufacturer's Recommendations.

1.4 SUBMITTALS SUPPLEMENTAL

See paragraphs below for further descriptions of submittals required by paragraph SUBMITTALS:

1.4.1 Materials

Manufacturer's descriptive data, catalog cuts, and brochures for each type and size of the following:

a. Couplings and gaskets

b. Pipe

1.4.2 Hydrostatic tests

Submit a hydrostatic test procedure describing method including method proposed for disposal of wastewater, see SECTION 02560 UTILIDOR/FUELIDOR SYSTEM.

1.4.3 Manufacturer's Recommendations

Manufacturer's recommendations for each material or procedure to be utilized which is required to be in accordance with such recommendations. The Contractor shall have a copy of the manufacturer's instructions available at the construction site at all times and shall follow these instructions unless otherwise directed by the Contracting Officer.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

Products shall be in accordance with the applicable provisions of PART 2 - PRODUCTS of SECTION 02511 WATER DISTRIBUTION SYSTEMS IN UTILIDORS except as modified herein.

2.1.1 Pipe

Pipe 4" and larger shall be ductile iron pipe as specified in SECTION 02511 WATER DISTRIBUTION SYSTEMS IN UTILIDORS. Sewer pipe less than 4"shall be Schedule 40 galvanized steel pipe as specified in SECTION 02511 WATER DISTRIBUTION SYSTEMS IN UTILIDORS. Pipe for sewer force main shall have a working pressure of 150 psi. Pipe for the gravity sewer line shall have a working pressure of 50 psi.

2.1.2 Expansion Joints

Expansion joints shall be designed for a minimum working pressure of 150 psi. Installation shall be per manufacturer's installation instructions. The length of the piping section where the expansion joint is to be installed shall be adjusted for the temperature of the pipe at the time of

installation. The Contractor shall submit a table showing, for each 10 degrees F above or below the design temperature of 50 degrees F, the amount the center-to-end dimension of the joint shall be decreased or increased per each 100 feet of pipe length in the run (joint at mid-length when temperature of pipe section is 20 degrees F).

2.1.3 Quick Disconnect Couplings

Cleanout caps shall be secured in place with quick disconnect couplings. Couplings shall be split ring type with hinged, single unit housing assembly and quick disconnect toggle housing assembly, Victaulic Style 78 Snap Joint or equal.

2.1.4 Clean Out Cap

Caps for the sanitary sewer clean outs shall be grooved ductile or gray cast iron disks. The caps shall be manufactured to mate with the quick disconnect couplings. At flanged fitting cleanouts use a flange adapter nipple. Cap: Victaulic part no. 60 or equal. Flanged Adapter Nipple: Victaulic part no. 41 or equal.

2.1.5 Pipe Clamp Restraining System

The pipe restraining system shall consist of pipe clamps, clamping bolts and nuts, restraining rods, T-bolts, and nuts. The clamps shall be cast from ductile iron meeting or exceeding ASTM A 536, Grade 65-45-12. The clamping bolts shall meet ANSI B18.2.1 and the rods, T-bolts, and nuts shall be high strength low alloy steel per AWWA C111. Hot dip galvanize all parts per ASTM A 123. Romac Industries Series 600 pipe restraining system or equal.

2.1.6 Valves

The force main gate valve and the sump gate valves shall use the same valves as specified in SECTION 02511 WATER DISTRIBUTION SYSTEMS IN UTILIDORS for their respective pipe material and diameter.

PART 3 EXECUTION

3.1 INSTALLATION REQUIREMENTS

Execution shall be in accordance with the applicable provisions of PART 3 - EXECUTION of SECTION 02511 WATER DISTRIBUTION SYSTEMS IN UTILIDORS, except as modified herein.

a. The sewer lines shall not be disinfected.

b. The sewer lines shall not be insulated.

c. The sewer line shall have a hydrostatic pressure test of 150 psi.

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SECTION 02559

HEAT DISTRIBUTION SYSTEMS IN UTILIDORS AND MANHOLES

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designations only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 36/A 36M	(2001) Carbon Structural Steel
ASTM A 47/A 47M	(1999) Ferritic Malleable Iron Castings
ASTM A 53/A 53M	(2002) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 106	(2002a) Seamless Carbon Steel Pipe for High-Temperature Service
ASTM A 123/A 123M	(2002) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 234/A 234M	(2002) Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service
ASTM A 733	(2001) Welded and Seamless Carbon Steel and Austenitic Stainless Steel Pipe Nipples
ASTM B 209	(2002a) Aluminum and Aluminum-Alloy Sheet and Plate
ASTM C 533	(1995; R 2001) Calcium Silicate Block and Pipe Thermal Insulation
ASTM C 552	(2000) Cellular Glass Thermal Insulation
ASTM F 1139	(1988; R 1998) Standard Specification for Steam Traps and Drains

ASME INTERNATIONAL (ASME)

ASME B1.20.1	(1983; R 2001) Pipe Threads, General Purpose (Inch)
ASME B16.3	(1998) Malleable Iron Threaded Fittings
ASME B16.5	(2003) Pipe Flanges and Flanged Fittings NPS 1/2 thru NPS 24

ASME B16.9	(2001) Factory-Made Wrought Steel Buttwelding Fittings
ASME B16.11	(2001) Forged Fittings, Socket-Welding and Threaded
ASME B16.34	(1996) Valves - Flanged, Threaded, and Welding End
ASME B16.39	(1998) Malleable Iron Threaded Pipe Unions Classes 150, 250, and 300
ASME B31.1	(2001) Power Piping
ASME B40.1	(1991) Gauges - Pressure Indicating Dial Type - Elastic Element
ASME BPVC SEC IX	(2001) Boiler and Pressure Vessel Code; Section IX, Welding and Brazing Qualifications

EXPANSION JOINT MANUFACTURERS ASSOCIATION (EJMA)

EJMA Stds	(1998; 7th Edition; Addenda 2000) EJMA Standards

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-25	(1998) Standard Marking System for Valves, Fittings, Flanges and Unions
MSS SP-45	(1998) Bypass and Drain Connections
MSS SP-80	(1997) Bronze Gate, Globe, Angle and Check Valves

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2002) National Electrical Code

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC SP 10	(2000) White Metal Blast Cleaning

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with SECTION 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Materials.

Spare Parts.

SD-04 Samples

Insulation.

SD-06 Test Reports

Tests.

Performance test reports in booklet form showing all field tests performed to adjust each component and all field tests performed to prove compliance with the specified performance criteria, upon completion and testing of the installed system. Each test report shall indicate the final position of controls and valves.

SD-07 Certificates

Flange Gaskets

Certificate from the material supplier of the electrically insulating flange gasket kits stating that the supplied material meets specified requirements and that provides evidence that satisfactory operating requirements have been met, before the materials are delivered. Certificate shall be signed by an official authorized to certify in behalf of material supplier or product manufacturer and shall identify quantity and date or dates of shipment or delivery to which the certificates apply.

SD-10 Operation and Maintenance Data

Steam Distribution System; G-AO.

Six copies of operation and six copies of maintenance manuals for the equipment furnished. One complete set, prior to performance testing and the remainder upon acceptance. Manuals shall be provided prior to the field training course.

1.3 SUBMITTALS SUPPLEMENTAL

See paragraphs below for further descriptions of submittals required by paragraph SUBMITTALS:

1.3.1 Materials

Manufacturer's descriptive and technical literature, performance charts and curves, catalog cuts, and installation instructions.

1.3.2 Spare Parts

Spare parts data for each different item of material and equipment specified, after approval of the related submittals and not later than the start of the field tests. The data shall include a complete list of parts and supplies and source of supply.

1.3.3 Insulation

Display sample sections for insulation of pipe, elbow, tee, valve, support point, and terminating points. After approval of material and prior to insulation of piping, a display shall be prepared of insulated sections showing compliance with specifications, including showing fastening,

sealing, jacketing, straps, waterproofing, supports, hangers, anchors, and saddles. Display sample sections shall remain on display at the jobsite during the construction period until no longer needed.

1.4 DELIVERY AND STORAGE

All materials and equipment delivered and placed in storage shall be stored with protection from the weather; excessive humidity and excessive temperature variation; and dirt, dust, or other contaminants.

1.5 FIELD MEASUREMENTS

The Contractor shall become familiar with all details of the work, verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing the work.

1.6 OPERATION AND MAINTENANCE MANUALS

1.6.1 Steam Distribution System

Operation manuals shall detail the step-by-step procedures required for system start up, operation, and shutdown. Operation manuals shall include the manufacturer's name, model number, parts list, and brief description of all equipment and their basic operating features. Maintenance manuals shall list routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guides. Maintenance manuals shall include piping and equipment layout and simplified wiring and control diagrams indicating location of electrical components with terminals designated for wiring, as installed.

PART 2 PRODUCTS

2.1 GENERAL MATERIALS AND EQUIPMENT REQUIREMENTS

2.1.1 Standard Products

Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Equipment shall be supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the site.

2.1.2 Nameplates

Each major item of equipment such as sump pumps, motors, steam traps, and pressure reducing valves shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a plate secured to the item of equipment.

2.1.3 Asbestos Prohibition

Asbestos and asbestos-containing products shall not be used.

2.1.4 Electrical Work

Motors, manual or automatic motor control equipment, and protective or signal devices required for the operation specified shall be provided under this section in accordance with NFPA 70 and Division 16.

2.2 PIPING AND FITTINGS

Unless otherwise specified, all pipe, fittings, valves, and piping accessories shall conform to the requirements of ASME B31.1, and shall be the proper type, class, and grade for pressure and temperature of the heating medium.

2.2.1 Steel Pipe

Steel pipe 2" in diameter and larger shall be seamless or electric-resistance welded conforming to ASTM A 53/A 53M, Grade B, Type E or S; or to ASTM A 106, Grade B. Steel pipe 1-1/2" in diameter and smaller shall be seamless conforming to ASTM A 106, Grade B. Condensate piping, gauge piping, fire hydrant heat trace, and piping 3/4" in diameter and smaller shall be schedule 80. All other pipe shall be schedule 40.

2.2.1.1 Nipples

Nipples shall conform to ASTM A 733, schedule 40 or schedule 80, as required to match adjacent piping.

2.2.1.2 Steel Flanges

Steel flanges shall conform to ASME B16.5 Class 150 and shall match valves or flanged fittings on which used. Flanges shall be raised face type except that flat faced type shall be used where mated to flatfaced flanges. Flanges shall have the manufacturer's trademark affixed in accordance with MSS SP-25 so as to permanently identify the manufacturer.

2.2.1.3 Flange Gaskets

Flange gaskets shall be metal composition, spiral wound type at steam and condensate service and shall have steel centering rings. Gasket materials shall be suitable for the media carried and the maximum service temperature of each location, as indicated on the drawings.

2.2.1.4 Pipe Threads

Pipe threads shall conform to ASME B1.20.1. Pipe threads may be used only on pipe 3/4" or smaller.

2.2.2 Fittings

Fittings shall have the manufacturer's trademark affixed in accordance with MSS SP-25 so as to permanently identify the manufacturer.

2.2.2.1 Welded Fittings

Welded fittings shall conform to ASTM A 234/A 234M, butt-welded or socket-welded, schedule 40 or schedule 80, as required to match connecting piping. Butt welded fittings shall conform to ASME B16.9, and socket welded fittings shall conform to ASME B16.11.

2.2.2.2 Malleable Iron Fittings

Fittings shall conform to ASME B16.3, ASTM A 47/A 47M, class as required to match connecting piping.

2.2.2.3 Unions

Unions shall conform to ASME B16.39, schedule 40 or schedule 80, as required to match adjacent piping.

2.3 VALVES

Unless otherwise specified, valves shall comply with the material, fabrication, and operating requirements of ASME B31.1. Valves shall be suitable for the temperature and pressure requirements of the system on which used. Valves 2" and smaller shall be bronze. Valves 2-1/2" and larger shall be steel. Valves shall have the manufacturer's trademark.

2.3.1 Steel Valves

Globe, gate, angle, and check valves shall conform to the requirements of ASME B16.34 and ASME B31.1 for the temperature and pressure requirements of the system. Valves shall be Class 150, cast steel, rising stem OS&Y (Outside Screw and Yoke) with raised face flanges. Adjoining flanges at piping or piping accessories shall also be raised faced type. Valves for steam service 6" and larger shall have a 1" minimum gate or globe bypass valve sized in conformance with MSS SP-45.

2.3.2 Bronze Valves

2.3.2.1 Globe, Gate, and Angle Valves

Globe, gate, and angle valves shall conform to requirements of MSS SP-80. Valves shall be Class 300, bronze body, rising stem with threaded connections.

2.3.2.2 Check Valves

Check valves shall conform to the requirements of MSS SP-80. Valves shall be Class 300, bronze body with threaded connections.

2.3.3 Packing

Packing used with valves shall not contain asbestos. Valve stem packing shall be die-formed, ring type specifically designated as suitable for the temperature and pressure of the service and compatible with the fluid in the system. Packing rings shall be polytetrafluoroethylene with minimum 50 percent graphite filament top and bottom rings. Valves 1-1/2" and smaller shall have four or five packing rings and valves 2" and larger shall have at least six packing rings. Spiral or continuous packing will not be acceptable. A metal insert shall be provided having proper clearance around the valve stem at the bottom of the stuffing box and acting as a base for the packing material. Packing glands shall be furnished with a liner of noncorrosive material and shall be of one piece construction with provisions for not less than two bolts for packing adjustment.

2.3.4 Pilot Operated Temperature Regulating Valves

Cast iron body, NPT pipe connections, 15' capillary tube length, single seat, stainless steel trim. 30 to 90 degrees F temperature range.

2.4 STEAM TRAPS

Class of trap bodies shall be suitable for a working pressure of not less

than 1.5 times the steam supply pressure, but not less than 200 psi, and traps shall be capable of operation under a steam-supply pressure as indicated. Traps shall be sized for the operating load and shall have capacities as shown when operating under the specified working conditions. Traps shall fail open.

2.4.1 Thermostatic Traps

Traps shall be thermostatic type with bimetallic element automatic air discharge conforming to ASTM F 1139 with integral cage unit, strainer and check valve.

2.5 STRAINERS

Strainers shall be basket or Y-type with connections the same size as the pipe lines in which the connections are installed. Strainer shall be suitable for the temperature and pressure requirements of the system. The strainer bodies shall be of cast steel with bottoms drilled and plugged. The bodies shall have arrows clearly cast on the sides to indicate the direction of flow. Each strainer shall be equipped with an easily removable cover and sediment basket. The body or bottom opening shall be equipped with nipple and gate valve for blowdown. The basket shall be of not less than 0.025" thick stainless steel, or monel with small perforations of sufficient number to provide a net free area through the basket of at least 2.5 times that of the entering pipe. The flow shall be into the basket and out through the perforations.

2.6 PRESSURE GAUGES

Gauges shall conform to ASME B40.1 and shall be provided with a pig-tail snubber for steam lines or a pulsation dampener for condensate lines. All gauges shall be provided with a shut-off isolation valve. Minimum dial size shall be 4-1/4".

2.7 THERMOMETERS

2.7.1 Dial

Dial type thermometer shall be 3-1/2" in diameter chromium plated case, remote-type bulb or direct-type bulb as required, plus or minus 2 degree F accuracy, white face with black digits graduated in 2 degree F increments.

2.8 INSULATION AND JACKETING

Insulation shall comply with EPA requirements in accordance with SECTION 01670 RECYCLED/RECOVERED MATERIALS.

2.8.1 Insulation for Piping in Utilidors and Valve Manholes

Insulation for all piping, fittings, and valves in manholes (and extending 5 feet into the utilidors) shall be molded calcium silicate conforming to ASTM C 533, Type I, asbestos free with an aluminum jacket covering. Insulation for all piping, fittings, and valves in utilidors shall be cellular glass insulation conforming to ASTM C 552. Insulation shall be factory or field applied.

2.8.2 Aluminum Jacket

Jacket shall be smooth sheet, 0.016" nominal thickness; ASTM B 209, Type

3003, 3105, or 5005. Aluminum jacket shall be used over calcium silicate insulation.

2.8.3 Nonmetallic Jacket

Nonmetallic jackets shall be of the AWJ (All Weather Jacket) type. Nonmetallic jacket shall consist of a 6 ounce per square yard fiberglass fabric impregnated with chlorosulfonated polyethylene (Hypalon) and a 1.5 mils polyvinyl fluoride film (Tedlar) bonded to it. Overall thickness of the composite shall be 0.010" and weigh approximately 10.5 ounces per square yard. Jacket may be either field or factory applied to the insulation. Nonmetallic jacket shall be used with molded mineral fiber insulation. This jacket shall not be used with any calcium silicate insulation.

2.8.4 Bands

Bands for aluminum jacket shall be 3/8" wide and 32 gauge thickness made of aluminum or annealed stainless steel. Bands for insulation shall be 1/2" wide and 32 gauge thickness made of annealed stainless steel.

2.8.5 Insulation for Flanges, Unions, and Fittings

Flanges, unions, and fittings shall be insulated with premolded prefabricated, or field fabricated segments of insulation. Insulation shall be removable and reusable and shall have essentially the same thermal characteristics and thickness as the adjoining piping.

2.8.6 Insulation for Valves and Expansion Joints

Valves and expansion joints shall be insulated with premanufactured blankets with heavy fabric covers. Products shall be manufactured for the purpose intended here and shall be suitable for the temperatures encountered. Insulation shall be removable and reusable and shall have essentially the same thermal characteristics and thickness as the adjoining piping. Insulation shall be secured with nylon buckles and straps or with Velcro straps on the outside of the insulation. Insulation secured with wire or rope lacing systems shall not be acceptable.

2.8.7 Insulation Inserts at Pipe Supports and Pipe Carriers

Insulation inserts at pipe supports or carriers shall be a steel protection saddle welded to the pipe. Saddle dimensions shall be appropriate for calculated loads. Insulate cavity between pipe and saddle and insulate that portion of the pipe that is not covered by the saddle to provide a continuous insulation system matching the adjacent pipe insulation.

2.9 EXPANSION JOINTS

Expansion joints shall be designed with a permanent packless seal. Expansion joints for steam service and condensate shall be injection packed (Hyspan 6500 or equal). Expansion joints shall provide for either single or double slip of connected pipes, as required or indicated, and for not less than the traverse indicated. Joints shall be designed for steam working pressure not less than 100 psi and shall be in accordance with applicable requirements of EJMA Stds and ASME B31.1. End connections shall be flanged unless specified otherwise on the drawings. Joints shall be provided with anchor base where required or indicated. Joint components shall be fabricated from material equivalent to that of the pipeline.

Expansion joint travels shall be as specified on the drawings. These travels were designed to compensate for the differences between an installation temperature of 50 degrees F to a potential operating temperature as indicated on the drawings. Initial preset extension or compression of the expansion joints shall be made in accordance with manufacturer's recommendations to compensate for the difference between ambient temperature at time of installation and a design installation temperature of 50 degrees F. Pipe alignment guides shall be the cylinder type with a guide spider attached to the pipe. Pipe alignment guides using a slide plate shall not be acceptable. Pipe alignment guides shall be installed as recommended by joint manufacturer.

2.10 MISCELLANEOUS METAL

Miscellaneous metal not otherwise specified shall conform to SECTION 05500 MISCELLANEOUS METAL. Miscellaneous metal bolted together, shop welded, or assembled in the field, and pipe supports including structural cross support members and anchors shall be hot-dip galvanized in accordance with SECTION 05500 MISCELLANEOUS METAL.

PART 3 EXECUTION

3.1 SITE WORK

3.1.1 Electric Work

Any wiring required for the operation of the equipment specified, but not shown on the electrical drawings, shall be provided under this section in accordance with NFPA 70 and Division 16.

3.1.2 Painting

The heat affected zone of field welded galvanized surfaces and other galvanized surfaces damaged during installation shall be cleaned in compliance with SSPC SP 10 and painted in accordance with SECTION 09900 PAINTS AND COATINGS.

3.2 INSTALLATION

Piping shall be installed as indicated on the drawings. Piping in manholes is shown in general configuration. Dimensions and lengths may vary slightly depending on pipe and fitting dimensions, location of supports and anchors, and fabrication. The Contractor shall ensure that the final piping arrangement fits and conforms to the general configuration shown on the drawings. Pipe shall be cut accurately to measurements established at the site by the Contractor and shall be worked into place without springing or forcing. Care shall be taken not to weaken structural portions of the utilidor or manholes.

3.3 PIPING

3.3.1 General Piping Requirements

Pipe shall be accurately cut to measurements established at the site and shall be worked into place without springing or forcing. Pipe shall clear all openings and equipment. Any cutting or other weakening of structural members to facilitate piping installation will not be permitted, without the prior approval of the Contracting Officer's representative. Burrs shall be removed from ends of pipe by reaming. Installation shall permit

free expansion and contraction without damage to joints or hangers. Piping shall be installed in accordance with ASME B31.1. Joints for piping in utilidors and valve manholes shall be welded, except joints at valves and expansion joints which shall be flanged, unless otherwise indicated on the drawings. Joints at traps, strainers, and at valves 3/4" and smaller in steam, condensate, and drip lines, shall use unions and be threaded. Unions shall not be installed between branch block valves and man lines. Supports, anchors, or stays shall not be attached where either expansion or the weight of the pipe will cause damage to permanent construction. Noninsulated ferrous parts of the piping, piping support system, or equipment shall be hot-dip galvanized after fabrication in conformance with ASTM A 123/A 123M. The supports shall not rest in any drainage trenches in the utilidor floors.

a. Expansion of piping shall be provided for by expansion joints, by changes in the direction of the run of pipe, or by expansion loops as indicated on the drawings.

b. Changes in direction shall not be made by bending the pipe.

c. All piping, unless otherwise indicated, shall be pitched with a grade the same as the utilidor. The slope shall be maintained throughout the system, including through each leg of each expansion loop, each change of direction of the piping and each expansion joint.

d. Open ends of pipe lines and equipment shall be properly capped or plugged during installation to keep dirt and other foreign matter out of the system.

3.3.2 Welded Joints

Joints between sections of pipe and between pipe and fittings shall be welded. The welding shall conform to the requirements specified in paragraph WELDING. Branch connections shall be made with welding tees and reducers at all connections of building service laterals to main distribution lines, regardless of size. Forged branch outlet fittings may be used for connection of smaller miscellaneous piping. However, no forged branch outlet fittings larger than 2" shall be permitted to be used for connections, even where the connection is not between a building service lateral and a main distribution line. Forged branch outlet fittings shall be flared for improved flow where attached to the run, reinforced against external strains, and designed to withstand full pipe bursting strength.

3.3.3 Flanged and Threaded Joints

3.3.3.1 Flanged Joints

Joints shall be faced true, provided with gaskets, and made perfectly square and tight. Electrically isolated flange joints shall be provided at all connections to building underground systems and between dissimilar metals.

3.3.3.2 Threaded Joints

Joints shall have graphite or inert filler and oil, graphite compound, or polytetrafluoroethylene tape applied to the male threads only. Dielectric waterways shall be used at connections of dissimilar metals in 3/4" and smaller piping.

3.3.4 Reducing Fittings

Changes in horizontal piping sizes shall be made through eccentric reducing fittings. Eccentric reducers in horizontal runs shall be installed with the straight side down for steam lines to maintain condensate drainage. Eccentric reducers in horizontal runs shall be installed with the straight side up for condensate lines to maintain air venting.

3.3.5 Branch Connections

Branches from mains shall branch off top of mains, as indicated or as approved. Connections shall insure unrestricted circulation, elimination of air pockets, and shall permit the complete drainage of the system. Branch connections providing service to and from buildings shall use standard tee fittings with standard reducers as needed for connections larger than 1".

3.4 PIPE HANGERS, INSERTS AND SUPPORTS

3.4.1 Pipe Supports in Utilidors and Valve Manholes

Horizontal and vertical runs of pipe in utilidors and valve manholes shall be securely supported. All pipe supports including the structural cross support member shall be hot-dip galvanized in accordance with SECTION 05500 MISCELLANEOUS METAL.

3.4.2 Pipe Supports and Hangers

Pipe supports shall be spaced not over 5 feet apart at heavy fittings and valves. Pipe shall be supported near each coupling and at multiple fittings as required. A support shall be installed not over 1 foot from each change in direction of piping. Hangers and turnbuckles for piping shall be Type 6, 9, 11, 13, or 15. Brackets for support for piping hangers shall be Type 34. Hangers for pipe 1" in size and smaller shall be steel straps. No hangers or supports shall be suspended from removable manhole tops or removable utilidor lids, except as shown on the drawings. Pipes shall be supported near each coupling or joint to prevent vertical deflection of the coupling or joint, as recommended by the pipe manufacturer. Pipes shall be secured to each horizontal support in utilidors to limit side-to-side and vertical movement but not axial movement (U-bolts or equal shall be used). All pipe hangers and supports shall be hot-dip galvanized after fabrication to provide a Coating Grade of 65 (average zinc coating of 1.5 ounces/square foot) in accordance with ASTM A 123/A 123M.

3.5 WELDING

Piping shall be welded in accordance with qualified procedures using performance-qualified welders and welding operators. Procedures and welders shall be qualified in accordance with ASME BPVC SEC IX. Welding procedures qualified by others, and welders and welding operators qualified by another employer may be accepted as permitted by ASME B31.1. The Contracting Officer shall be notified 24 hours in advance of tests and the tests shall be performed at the work site if practical. The welder or welding operator shall apply his assigned symbol near each weld he makes as a permanent record.

3.6 RADIOGRAPHIC TESTING

Radiographic examination of field welds in the steel carrier piping of the heat distribution system shall be in accordance with ASME B31.1. An approved independent testing firm or firms regularly engaged in radiographic testing shall perform the radiographic examination of field welds in the steel carrier piping of the heat distribution system in accordance with ASME B31.1. The Contractor shall furnish a set of films showing each weld inspected, a reading report evaluating the quality of each weld, and a location plan showing the physical location where each weld is to be found in the completed project, prior to backfilling and hydrostatic testing. All radiographs shall be reviewed and interpreted by a Certified Level III Radiographer employed by the testing firm whose signature shall appear on the reading report. The Contracting Officer reserves the right to review all inspection records, and if any welds inspected are found unacceptable they will be removed, rewelded, and radiographically examined at no cost to the Government.

3.7 INSULATION

The insulation shall be installed in such a manner that it will not be damaged by pipe expansion or contraction. Insulation installed over welds shall be grooved to assure a snug fit. Where, applicable, insulation shall be held in place with aluminum jackets and stainless steel straps. A minimum of 2 bands shall be installed on each individual length of insulation and maximum spacing shall not exceed 18" centers.

3.7.1 Installation

Material shall be installed in accordance with published installation instructions of the manufacturer. Insulation materials shall not be applied until piping tests are completed.

3.7.1.1 Preparation

Prior to application, surfaces shall be thoroughly cleaned of moisture, grease, dirt, rust, and scale. Insulation manufacturer's published installation instructions shall be followed.

3.7.1.2 Thickness

The minimum thickness of insulation for the heat distribution system and condensate return system shall be as indicated on the drawings.

3.7.2 Insulation on Pipes Passing Through Sleeves

Insulation shall be continuous through sleeves as shown. Aluminum jackets shall be provided over the insulation. When penetrating building or utilidor walls, the aluminum jacket shall extend not less than 2" beyond the sleeve on each side of the wall and shall be secured with an aluminum band on each side of the wall. Where flashing is provided, the jacket shall be secured with one band not more than 1" from the end of the jacket. When penetrating valve manhole tops, pipe shall be insulated as required for valve manhole service as indicated.

3.7.3 Covering of Insulation in Utilidors and Valve Manholes

The insulation for pipe, flanges, and fittings in utilidors and manholes shall be covered with aluminum or nonmetallic jackets as required for the

insulation type in the paragraph INSULATION AND JACKETING.

3.8 VALVE MANHOLES AND ACCESSORIES

Valve manholes shall be field constructed, reinforced concrete type with access hatches.

3.8.1 Valve Manhole Construction and Accessories

Manhole dimensions shall be as indicated, and in all cases shall provide sufficient room for maintenance. Covers and accesses shall be as shown. The valve manholes shall be constructed of reinforced concrete conforming to SECTION 03300 CAST-IN-PLACE STRUCTURAL CONCRETE and in accordance with SECTION 02560 UTILIDOR/FUELIDOR SYSTEM. The top shall consist of an easily removable cover as detailed on the drawings.

3.9 UTILIDOR SYSTEM

3.9.1 Piping Support System

Piping shall have supports as indicated. No pipes, pipe supports, or other related items shall be permitted on the floor of the utilidor system. Pipe support members spanning traversely across the tunnel shall allow a minimum of 4" clearance between structural member and the utilidor floor. Additional minimum clearances required from the pipe insulation surface shall be as follows: 8" to the utilidor floor, 6" to side walls, 6" to the utilidor cover, and 6" between adjoining pipes.

3.9.2 Pipe Expansion

The expansion of pipes shall be provided for by expansion joints, as indicated. Pipe alignment guides shall be installed as recommended by the joint manufacturer, but in any case shall be not more than 5 feet from expansion joint, except in lines 4" or smaller where guides shall be installed not more that 2 feet from the joint.

3.9.3 Pipe Anchors

Pipe anchors in manholes and utilidors shall be of welded construction, designed by the Contractor. The number and approximate location of anchors is indicated on the contract drawings. Shop drawings indicating anchor locations and details of design, including calculations, shall be submitted for Government Approval. Shop drawing approval shall be obtained prior to placing any piping. The range of anticipated pipe temperatures, which shall be used to determine the design forces on anchors, is from 10 degrees F to a potential operating temperature as indicated on the drawings. Pressures for calculating forces are as follows: Working pressure of 84 psig and a test pressure of 200 psig. If expansion anchors are used in lieu of cast in place anchor bolts, an additional safety factor of 1.5 shall be used in sizing the anchor bolts. No supports, anchors, or stays shall be attached in places where they may cause damage during installation or by the weight or expansion of the pipe. All steel shapes shall conform to ASTM A 36/A 36M. The type and class shall be the Contractor's option. For finishing, see SECTION 02560 UTILIDOR/FUELIDOR SYSTEM, paragraph PAINTING AND FINISHING. Additionally, any anchor that is supported from the manhole or utilidor bottom shall have the lower 6" of the anchor protected with two layers of coal-tar coating. Anchors shall be attached to pipes by welding. Pipe anchors shall be as indicated on the drawings.

3.10 TESTS

Tests shall be conducted before, during, and after the installation of the system. All instruments, equipment, facilities, and labor required to properly conduct the tests shall be provided by the Contractor. Test pressure gauges for a specific test shall be approved by the Contracting Officer and shall have dials indicating not less than 1-1/2 times, nor more than 3 times the test pressure.

3.10.1 Cleaning of Piping

Prior to the hydrostatic and operating tests, the interior of the piping shall be flushed with clean water until the piping is free of all foreign materials. Flushing and cleaning out of system pipe, equipment, and components shall not be considered completed until witnessed and accepted by the Contracting Officer. After flushing the system is completed, the system shall be drained and filled with clean water. Temporary strainers shall be provided for all equipment and control valves to prevent clogging in accordance with the previous paragraph.

3.10.2 Field Tests

The following field tests shall be conducted when applicable to the system involved. If any failures occur, the Contractor shall make such adjustments or replacements as the Contracting Officer may direct, and the tests shall be repeated until satisfactory tests are completed.

3.10.2.1 Hydrostatic Tests of Piping

Steam and steam condensate piping shall be tested hydrostatically before insulation is applied at field joints, and shall be proved tight at 150 psig. Hydrostatic test pressure shall not exceed 200 psig. Hydrostatic test pressures shall be held for a minimum of 4 hours. If the hydrostatic test pressure cannot be held, the Contractor shall make such adjustments or replacements and the tests repeated until satisfactory results are achieved.

3.10.2.2 Equipment Tests

All pumps, valves, traps, alarms, controls, and any other operable item of equipment shall be operated to verify proper operation and compliance with the specifications. Pump voltage, current, and discharge readings shall be recorded and submitted for approval in accordance with submittal Tests.

3.10.2.3 Operational Tests

After installation of the utilidor system, or testable portion thereof, operational tests shall be conducted. The utilidor covers shall not be placed prior to completion of operational tests. Operational tests shall consist of operating the system at the pressure and temperature expected for the system when in normal service, and shall demonstrate satisfactory operating effectiveness. The test on each system, or portion thereof, shall last a minimum of 24 hours.

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SECTION 02560

UTILIDOR/FUELIDOR SYSTEM

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 36/A 36M	(2001) Carbon Structural Steel
ASTM A 123/A 123M	(2002) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 153	(2000) Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A 780	(2001) Repair of Damaged and Uncoated Areas of Hot-Dipped Galvanized Coatings
ASTM B 633	(1998) Electrodeposited Coatings of Zinc on Iron and Steel
ASTM C 501	(1984; R 1996) Relative Resistance to Wear of Unglazed Ceramic Tile by the Taber Abraser
ASTM C 578	(2000) Rigid, Cellular Polystyrene Thermal Insulation
ASTM C 920	(2002) Elastomeric Joint Sealants
ASTM D 36	(1995; R 2000) Softening Point of Bitumen (Ring-and-Ball Apparatus)
ASTM D 41	(1984; R 2000) Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
ASTM D 43	(2000) Coal Tar Primer Used in Roofing, Dampproofing, and Waterproofing
ASTM D 412	(1998a) Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomer - Tension
ASTM D 449	(1989; R 1999el) Asphalt Used in Dampproofing and Waterproofing
ASTM D 450	(1996; R 2000) Coal-Tar Pitch Used in Roofing, Dampproofing and Waterproofing

ASTM D 624	(2000) Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers
ASTM D 648	(2000a) Deflection Temperature of Plastics Under Flexural Load
ASTM D 751	(2000) Coated Fabrics
ASTM D 1777	(1996) Thickness of Textile Materials
ASTM D 2240	(2002) Rubber Property - Durometer Hardness
ASTM D 5034	(1995) Breaking Force and Elongation of Textile Fabrics (Grab Test)
ASTM E 96	(2000) Water Vapor Transmission of Materials

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC Paint 25	(1997) Oxide, Zinc Oxide, Raw Linseed Oil and Alkyd Primer (Without Lead and Chromate Pigments)

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

CID A-A-1632	(Basic) Varnish, Asphalt
FS TT-S-001543	(Rev. A) Sealing Compound: Silicone Rubber Base (For Calking, Sealing, and Glazing in Buildings and Other Structures)

1.2 GENERAL REQUIREMENTS

1.2.1 Winter Heating Requirement

When the ambient air temperature is below 32 degrees F, the utilidor sections and manholes shall be heated (No heating in fuelidors is required). All temperatures shall be constantly and adequately monitored. The Contractor shall submit its heating and monitoring plan as detailed in paragraphs QUALITY PROVISIONS and SUBMITTALS. For the purposes of this paragraph, "backfilled" shall mean that insulation, if required, has been installed and backfill has been placed as directed by contract plans and specifications up to within 3 inches of the top of the structure's walls. This requirement shall apply to both new utilidors and manholes, and existing utilidors and manholes that have work under this contract.

a. When the utilidor sections or manholes are insulated and backfilled, the structures shall be heated such that the minimum inside air temperature at all locations is 41 degrees F.

b. When the utilidor sections or manholes are not backfilled, the entire structure, to include air spaces and all external surfaces and unbackfilled trench areas within 3 lineal feet of the structure's walls, shall be heated to 41 degrees F minimum.

c. Any utilidor system not included in this contract but connected to

utilidors having work under this contract shall be heated as described above. The extent of this heating shall include all areas that are disturbed under this contract. "Disturbed" shall include excavation or any other work that alters the thermal regime and exposes the utilidor and/or manholes to freezing temperatures.

1.2.2 Nameplates

Each major item of equipment shall have the manufacturer's name, address, type or style, and model or serial number on a plate secured to the item of equipment.

1.2.3 Verification of Dimensions

The Contractor shall become familiar with all details of the work, verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing any work.

1.2.4 Internal Piping and Components

1.2.4.1 Steam, Water, and Sewerage Facilities

All steam, water and sewerage facilities and all other work required to be installed in the completed utilidors as called for by the drawings or specifications shall be furnished and installed in accordance with the applicable provisions of other sections of these Specifications.

1.2.4.2 Fuel Piping

All fuel piping, supports and other work required to be installed in the completed fuelidors as called for by the drawings or specifications shall be furnished and installed in accordance with the applicable previsions of other sections of these Specifications.

1.2.5 Site Work

1.2.5.1 Excavation, Trenching, Filling and Backfilling

Excavation, trenching, filling and backfilling shall be as hereinbefore specified in SECTION 02314 EARTHWORK FOR UTILITIES of these specifications. The utilidors and fuelidors shall be constructed to the grades as required by the drawings.

1.2.5.2 Relocation of Interferences

Interferences as indicated, or as found during construction, shall be removed or relocated as necessary. Relocations shall be as indicated or as approved by the Contracting Officer. Examples of interferences are:

a. Power and Communication lines;

b. Fences and sidewalks;

c. Utilidors.

1.2.5.3 Modifications to Existing Facilities

Modifications shall be made as indicated. Examples of modifications are:

a. Removal and replacement of street or parking area pavements.

b. Re-construction of existing manholes.

c. New utility distribution piping entrances to buildings, manholes, or utilidors.

Any other modifications shall be made as required for complete installation of the utilidor and fuelidor systems as indicated.

1.2.6 Standard Products

The equipment to be furnished under this specification shall be essentially the standard product of the manufacturer. Where two or more units of the same class of equipment are required, these units shall be the products of a single manufacturer; however, the component parts of the system need not be the products of the same manufacturer. The products of any reputable manufacturer regularly engaged in the commercial production of required equipment will not be excluded on the basis of minor differences, provided all essential requirements of this specification relative to materials, capacity and performance are met.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with SECTION 01330 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Utilidor Heating and Temperature Monitoring Plan; G-AO.

SD-02 Shop Drawings

Detail Drawings; G-AO.

Fabrication and Erection Drawings; G-AO.

SD-03 Product Data

Schedules of Work and Tests Required for Installation.

Manufacturer's Catalog Data.

SD-04 Samples

Materials.

SD-08 Manufacturer's Instructions

Waterproofing Material.

Waterstops.

1.4 SUBMITTALS SUPPLEMENTAL

See paragraphs below for further descriptions (when available) of

submittals required by paragraph SUBMITTALS:

1.4.1 Detail Drawings

Fabrication and assembly drawings of work in sufficient detail to verify compliance with the contract for the following:

a. Precast or Site-Cast Concrete Utilidor/Fuelidor Lids

b. Manholes to include Sumps

c. Utilidor/Fuelidor Construction

d. Manhole expansion and reconstruction

e. Steel pipe support, seismic bracing, and anchorage system

1.4.2 Fabrication and Erection Drawings

At least 30 days prior to casting any units, the Contractor shall submit complete fabrication and erection drawings and placement diagrams, and shall submit such other descriptive data as the Contracting Officer may require to demonstrate compliance with the contract requirements. The submittal shall also include the Contractor's proposed methods of curing and storing the units in the casting yard and complete details of its method of casting, handling, transporting, and erecting the units, including type and location of lifting devices. Fabrication and erection drawings shall contain plans showing the size and location of every blockout required for any opening in each unit. Openings include those necessary for mechanical or electrical work, or any other major physical interference. Fabrication and erection drawings shall include drawings showing placement of pipe supports, seismic bracing, alignment guides and anchors for manholes and utilidor/fuelidor sections. Fabrication and erection drawings and placement diagrams for all units shall be submitted at one time. No casting operations shall commence at a permanent or temporary on- or off-site fabrication plant until fabrication and erection drawings and placement diagrams have been received by the Contracting Officer.

1.4.3 Schedules of Work and Tests Required for Installation

1.4.4 Manufacturer's Catalog Data

Catalog cuts, brochures, and product data verifying compliance with the contract for the following:

a. Insulation adhesive.

b. Insulation material.

c. Sealants

1.4.5 Materials

Representative samples in the following quantities:

a. Urethane Membrane: 1 gallon

b. Construction Fabric: 1 square yard

1.4.6 Waterproofing Material

Manufacturer's installation instructions and certificate of compliance shall be submitted before delivery of materials to the site. For bitumen, instructions shall specify acceptable range of bitumen application temperatures and the maximum temperature for holding bitumen in a heated condition.

1.4.7 Operation and Maintenance Manuals

Manufacturers, installations instructions for manhole access hatches and other pre-fabricated items.

1.5 CONCRETE WORK

1.5.1 Concrete

Concrete shall be as specified in SECTION 03300 CAST-IN-PLACE STRUCTURAL CONCRETE.

1.5.2 Waterstops

Waterstops shall conform to SECTION 03150 EXPANSION JOINTS, CONTRACTION JOINTS, AND WATERSTOPS.

1.6 PIPE INSERTS, ANCHORS AND SUPPORTS

Pipe inserts, anchors and supports for all systems shall be as specified in SECTION 02511 WATER DISTRIBUTION SYSTEMS IN UTILIDORS except that those for the steam system are specified in SECTION 02559 HEAT DISTRIBUTION SYSTEMS IN UTILIDORS AND MANHOLES. The steel strut support system for the piping shown in the plans is generic only.

PART 2 PRODUCTS

2.1 COATINGS AND SEALANTS

2.1.1 Coal Tar Coating

The coal tar coating shall be a self-priming, heavy duty, cold-applied, water resistant coating made from pitch derived from suitable tars, selected solvents, mineral fillers and special additives. The material shall be able to protect against the deteriorating effects of raw and industrial waste materials and hydrogen sulfide gas, and be suitable for application to all metal, concrete and board insulation surfaces which will be buried, immersed, or exposed. The coating shall be applied in accordance with the manufacturer's recommendations to include, but not limited to, priming and top coats. The coal tar coating shall be Bitumastic Super Service Black as manufactured by Carboline Company, or equal.

2.1.2 Asphalt Varnish

Asphalt varnish shall conform to Federal Specification CID A-A-1632.

2.1.3 Utilidor/Fuelidor Lid Seal

Surfaces of joints to be in contact with mastic shall be dry and free of

oil, grease, dirt, loose concrete particles, or other foreign substances. Trowel on a generous layer of "Fibered Roof Coating", ACE Hardware product #11975 or approved equal. Lay two runs of "Oakum" type filler material on top of wall, into the mastic as shown on the drawings. All lifting loops, hooks, or eyes shall be nondeformed, ASTM A 36/A 36M galvanized steel unless a stronger steel or superior finish is shown on the drawings

2.1.4 Sealant

Sealant for pipe sleeves shall conform to Federal Specification FS TT-S-001543. Sealant for utilidor shall conform to ASTM C 920, Type II, Class A. The compound shall be supplied in pre-measured kit form for on-the-job mixing.

2.1.4.1 Primer

Primer for sealant shall be as recommended by the sealant manufacturer. Primer shall have been tested for durability with the sealant to be used and on samples of the surfaces to be sealed.

2.1.4.2 Backstop Material

Backstop materials shall be resilient urethane or polyvinyl chloride foam, closed-cell polyethylene foam, closed-cell sponge of vinyl or rubber, polychloroprene tubes or beads, polyisobutylene extrusions, oilless dry jute, or rope yarn. Backstop material shall be nonabsorbent, nonstaining, and compatible with the sealant used. Tube or rod stock shall be rolled into the joint cavity.

2.1.5 Zinc Oxide Primer

Zinc oxide primer shall conform to SSPC Paint 25.

2.1.6 Galvanized Coating

Repair shall conform to ASTM A 780 for damaged and uncoated areas of hot-dip galvanized coating.

2.2 INSULATION

2.2.1 Extruded Polystyrene Blueboard for Utilidor

Extruded polystyrene shall conform to ASTM C 578, Type IV.

2.3 WATERPROOFING

2.3.1 Asphalt

ASTM D 449, Type II.

2.3.2 Coal-Tar

ASTM D 450, Type II.

2.3.3 Primer

ASTM D 41 for asphalt and ASTM D 43 for coal-tar pitch.

2.3.4 Urethane Industrial Membrane

Urethane industrial membrane shall have the following properties:

PROPERTY	DATA	TEST METHOD
Tensile strength, psi., min.	400	ASTM D 412
Extension to break, 96 min.	350	ASTM D 412, 100 mil sheet
Tear Strength, min.	90	ASTM D 624, Die "C"
Softening Point, Ring & Ball, degrees F min.	143	ASTM D 36
Brittleness Temp, degrees F min.	46	ASTM D 648
Hardness, Shore A, min.	50	ASTM D 2240 @ 77 degrees F
Permeability to Water Vapor, (100 Perms)	0.06	ASTM E 96-Method E mil sheet, 100 degrees F)
Abrasion Resistance - Wt. Loss, mg., max. Wheel, 1000 gr/1000 rev,	1.5	Taber Abraser, CS-17 ASTM C 501

2.4 CONSTRUCTION FABRIC

Construction fabric shall meet the following requirements:

PROPERTY	DATA	TEST METHOD
Thickness, mils, min.	100	ASTM D 1777
Mullen Burst Strength, psi, min.	400	ASTM D 751 Diaphragm Method
Trapezoidal Tear Strength, lbs., min.	90	ASTM D 751
Puncture Resistance, lbs., min.	120	ASTM D 751
Elongation at 250 lb. Load, percent, max.	150	ASTM D 5034

2.5 STEEL AND MISCELLANEOUS METAL

Steel and miscellaneous metal not otherwise specified shall conform to SECTION 05500, MISCELLANEOUS METAL.

PART 3 EXECUTION

3.1 MANHOLES AND ACCESSORIES

3.1.1 General

New manholes shall be field constructed, reinforced concrete type. Existing manholes shall be modified as shown on the drawings. Where connections to existing utilidors or manholes are required, the Contractor shall break open the utilidor or manhole to the minimum extent necessary for adequate tying of the new construction to the old. All steel bars

shall be thoroughly cleaned before placing any concrete. Before any new concrete is placed against the old concrete, the surface of the latter shall be cleaned of all debris and loose material and a coating of neat cement grout applied just prior to placing the new concrete. No structures and/or appurtenances shall be supported from manhole tops other than the access ladder, electrical hardware, and any structure specifically shown on the drawings as being supported from the manhole tops.

3.1.2 Manhole Construction and Accessories

The manholes shall be constructed of reinforced concrete. Manhole side walls shall be constructed by one monolithic pour.

3.1.2.1 Dimensions

Manhole dimensions shall be as indicated and in all cases shall provide sufficient room for maintenance. The pipe sump shall be coated with a coal tar coating.

3.1.2.2 Manhole Ladders

Access ladders shall be as indicated on the drawings.

3.1.2.3 Fire Hydrant Manhole Frames and Covers

Cover shall be pre-cast concrete panels split to allow removal of fire hydrants as indicated on the drawings.

3.1.2.4 Manhole Doors

Door Lids with frames shall be Aluminum "Bilco Type J-AL or JD-AL" vault doors or approved equal, dimensioned as shown on drawings. The vault access shall be single leaf, pre-assembled from the manufacturer. Doors shall fit into the existing access hatch and shall be fastened with 3/8 inch expansion anchors drilled and fastened into existing frame and concrete.

a. Lifting mechanisms: Doors shall have the required number and size of compression spring operators enclosed in telescopic tubes to provide, smooth, easy and controlled cover operation though the entire arc of opening and to act as a check in retarding downward motion of the cover when closing. The upper tube shall be the outer tube to prevent accumulation of moisture, grit, and debris inside the lower tube assembly.

b. A removable exterior turn/lift handle with a spring loaded ball detent shall be provided to open the cover and the latch release protected by a flush, gasketed, removable screw plug.

c. Cover shall be equipped with a steel hold open arm which automatically locks the cover in the open position.

d. Compression spring tubes shall be an anti-corrosive composite material, hinges and steel snap lock shall be Type 316 stainless steel.

3.2 CONCRETE UTILIDOR/FUELIDOR SYSTEMS

3.2.1 General

Concrete utilidor/fuelidor systems shall be provided and installed with

removable lids as shown in detail on the drawings. Lids for utilidors and fuelidors in general shall be precast. The walls and floor slabs shall be either monolithic construction, placed with construction joints between bottom and sides or placed with construction joints between sides and a starter wall cast into the bottom. No structures and/or appurtenances shall be supported from the utilidor lids.

3.2.2 Concrete Lids

Concrete lids shall be flat and true at all locations where contact on wall is to be made. Concrete lids with defects which affect the strength of the cover unit, or which are warped, honeycombed, contain visible air pockets, exposed aggregate or other surface defects such as spalled, chipped or broken edges shall not be installed. Handling and conveying before curing shall be reduced to a minimum by use of methods designed to prevent bending or shock likely to produce incipient cracks or other deformities. All lifting loops or eyes shall be nondeformed, ASTM A 36/A 36M galvanized steel unless a stronger steel or superior finish is shown on the drawings.

The joint where the sides of the utilidor top meets the utilidor lid shall be thoroughly cleaned, dry, free of oil, grease, dirt, loose concrete particles, or other foreign substances. Trowel on a generous (approximately 3/4" high by 4" wide) layer of "fibered Roof Coating", ACE Hardware product #11975, or equal. Lay two runs of "Oakum" type filler material on top of wall, into the mastic.

3.2.3 Concrete Utilidor/Fuelidor Construction

The concrete system shall be of various sizes to accommodate the different piping arrangements as indicated. The concrete wall top dimensions are critical to provide a tight fitting system. Contractor shall use extreme caution when forming and placing inside edge and top of walls to provide smooth even surfaces to accommodate concrete lids.

3.2.4 Final Elevations

The concrete utilidor/fuelidor floors shall slope continuously and drain toward manholes. The Contractor shall set the concrete utilidor/fuelidor at the elevation shown on the drawings and shall grade the adjacent areas. Any cut or fill areas adjacent to the concrete utilidor/fuelidor shall be graded back to the existing grade as indicated. There shall be no surface depressions which might prevent free surface drainage away from the utilidor/fuelidor. Final elevations shall be approved by the Contracting Officer. Once the final elevation is set, the concrete utilidor/fuelidor floors and piping must maintain constant slope to drain toward a manhole.

3.2.5 Coordination With Existing Utilities

Before beginning work in a given area, the Contractor shall become familiar with all known utility locations shown and expose those existing underground utilities to verify existing conditions to determine any conflicts with the work, and to plan his work accordingly. The actual concrete utilidor/fuelidor routing may be offset or changed if approved by the Contracting Officer in order to reduce conflicts, interruptions, expedite the work, or for any other reason to the mutual benefit of the Contractor and the Government.

3.2.6 Utilidor Cut-Off Wall

The utilidor shall be completely blocked off (flush with the interior surface of the Mechanical Room) where the utilidor enters a building. The wall shall be constructed of concrete block or poured-in-place concrete. Pipes shall pass through cut-off walls with pipe sleeves. No weep holes or open spaces shall pass through the cut-off wall.

3.3 PIPE SLEEVE REQUIREMENTS

Pipes and conduits passing through concrete walls, floors, or tops shall be provided with pipe sleeves fitted into place at the time of construction. The space between the pipe and sleeve shall be filled with back-up material and sealed flush with both inside and outside surfaces with a 3/8-inchdeep bead of sealant. Sleeves shall not be installed in structural members, except where indicated or approved. Each sleeve shall extend through its respective wall, floor or top, and shall be cut flush with each surface, except for special circumstances. Unless otherwise indicated, sleeves shall be of size to provide a minimum of 1/4-inch clearance all-around between bare pipe and inside of sleeve or between jacket over insulation and sleeves. Sleeves shall be steel pipe, cast-iron pipe, or ductile iron pipe as indicated.

3.4 WATERPROOFING

The below ground exterior of all concrete manhole and utilidor side and lids shall be waterproofed in accordance with this paragraph. Waterproofing shall extend a minimum of 2 feet beyond construction joints with existing utilidor and manholes. Waterproof all existing below ground manhole exposed in the course of constructing new access shafts, ceilings, and expanding existing manhole chambers. The utilidor/fuelidor walls exposed in the course of removing lids to access utilidor piping shall not be waterproofed as described in this paragraph.

3.4.1 Delivery and Storage

Materials shall be delivered to the job site in their original unopened packages, clearly marked with the manufacturer's name, brand name, and description of contents. Materials shall be stored in clean, dry areas, away from excessive heat, sparks, and open flame. Storage area shall be ventilated to prevent build-up of flammable gases. Materials shall be maintained at not less than 50 degrees F for at least 24 hours before use.

3.4.2 Preparation

Preparation of surfaces to be waterproofed shall be as specified in SECTION 03300 CAST-IN-PLACE STRUCTURAL CONCRETE. Items that penetrate the membrane shall be installed before waterproofing is applied. Surfaces shall be smooth and swept thoroughly to remove foreign materials immediately before waterproofing is applied.

3.4.3 Waterproofing

Waterproofing shall consist of the appropriate number of coatings of either bitumen or urethane membrane as specified herein.

3.4.3.1 Bituminous Waterproofing

a. Application: Waterproofing shall not be applied if frothing or

bubbling occurs when hot bitumen is applied to the surface. The hot bitumen must stick tightly to the surface. When waterproofing in an enclosed space, adequate ventilation shall be provided. Waterproofing shall be one layer of primer and one layer of asphalt or coal-tar, applied in solid moppings. Waterproofing shall be applied when the ambient temperature is 40 degrees F or above. Asphalt shall not be heated above 450 degrees F nor coal tar above 375 degrees F. Heating kettles and tanks shall be provided with automatic thermostatic control capable of maintaining bitumen temperature. Temperature of bitumen at time of application shall be in accordance with the bitumen manufacturer's recommendation. Temperature shall be measured with portable thermometer at the point of application immediately before its use. Bitumen with a temperature not conforming to the manufacturer's recommendations shall be returned to the kettle. Bitumen overheated by more than 50 degrees F for more than 1 hour shall be removed from the site.

b. Priming: Surfaces shall be coated uniformly with primer at the rate recommended by the manufacturer.

c. Projections and Flashing: All pipes, pipe sleeves, and other similar projections through the membrane shall be made watertight, and all flashings and similar construction shall be mopped thoroughly in place.

d. Coating: Coating shall be applied uniformly at the rate of not less than 60 pounds of asphalt or 70 pounds of coal-tar per square. Brooms shall have soft bristles and shall be discarded when bitumen buildup on the fibers prevents application of equal pressure across the broom width.

e. Protection: Waterproofing against which backfill is to be placed shall be protected by a single thickness of insulation board, unless insulated with polystyrene or cellular glass in accordance with other sections of this specification. The insulation board shall be pressed into the final mopping while the bitumen is still hot, with edges of boards brought into moderate contact and joints staggered. Where surfaced insulation board is used, the surfaced side shall face outward. Boards shall be carefully and neatly fitted around projections and shall cover the entire surface of the waterproofing. Waterproofing not covered with insulation fiberboards shall be protected as necessary to prevent damage from subsequent building operations.

3.4.3.2 Urethane Industrial Membrane System

Installation shall comply with the manufacturer's instructions, except as otherwise specified. The membrane shall bond to concrete. Application shall be in two coats minimum with successive coats applied at right angles to the preceeding coat. Finished thickness of the membrane shall be 40 mils, minimum.

a. Projections and Flashings: All pipes, pipe sleeves, and other similar projections through the membrane shall be made watertight, and all flashings and similar construction shall be secured thoroughly in place.

b. Protection: Waterproofing against which backfill is to be placed shall be protected by a single layer of construction fabric.

Construction fabric shall be carefully and neatly fitted around projections and shall cover the entire surface of the waterproofing.

3.5 PAINTING AND FINISHING

3.5.1 Ferrous Metal Surfaces Inside Utilidors/Fuelidors and Manholes

All ferrous metal surfaces in utilidors/fuelidors and manholes, excluding piping, but including racks, supports, hangers, and covers, shall be treated by the following method unless specifically directed otherwise in the project specifications:

Items shall be galvanized coated with ASTM B 633, Type I, Class Fe/Zn 25; or ASTM A 153, Class A.

Racks, hangers, and support system shall be galvanized by the following method.

All pipe hangers and supports shall be hot-dip galvanized after fabrication to provide a Coating Grade of 65 (average zinc coating of 1.5 ounces/square foot) in accordance with ASTM A 123/A 123M.

Ladders shall be hot dipped galvanized.

If surfaces have been shop-coated, the shop coat shall be thoroughly cleaned and touched-up at corroded, scarred, abraded surfaces, cut edges, exposed threads, or welded areas as follows: areas shall be given two coats (minimum) of cold galvanizing compound in accordance with manufacturer's recommendations.

3.5.2 Ferrous Metal Surfaces Outside Manholes

All ferrous metal surfaces outside manholes shall be painted in accordance with SECTION 09900 PAINTS AND COATINGS.

3.6 INSULATION

The utilidors and manholes shall be insulated as shown and as hereinafter specified. Insulation shall be kept dry at all times and protected from weather and moisture before and after installation. Polystyrene insulation shall not be left exposed to direct sunlight for a combined period greater than 24 hours.

3.6.1 Requirements

The surfaces to be insulated shall be covered with extruded polystyrene. Exterior insulation for utilidors with traffic lids shall have the added requirement of 60 psi minimum compressive strength.

3.6.2 Installation of Insulation

3.6.2.1 Exterior Surfaces

Insulation shall be attached to exterior surfaces with an adhesive as recommended by the insulation manufacturer. If bituminous waterproofing is used, it shall be still hot during insulation installation.

a. Finish: Joints between blocks shall be buttered with insulation manufacturer's recommended mastic compatible with the waterproofing

material, and blocks shall be butted snugly together. The insulation shall be protected during backfill operations to prevent any damage. Damaged insulation shall be replaced at no cost to the Government.

b. Openings: Openings in insulation around lifting loops, vents, and other protrusions shall be filled and cemented flush with the face of the insulation, with mastic as specified above.

3.6.2.2 Interior Surfaces

Insulation shall be attached to interior surfaces, where indicated on the drawings, with an adhesive as recommended by the insulation manufacturer. Insulation shall also be attached with mechanical fasteners as recommended by the insulation manufacturer. Mechanical fasteners shall include a washer with a minimum surface area of 5 square inches. Mechanical fasteners shall be placed one per every 6 square feet of insulation (minimum).

3.7 QUALITY PROVISIONS

3.7.1 General

Tests shall be conducted before, during and after the installation of the system. All instruments, equipment, facilities, and labor required to properly conduct the tests shall be provided by the Contractor.

3.7.2 Field Tests

The following field test shall be conducted when applicable to the system involved. If any failures occur, the Contractor shall make adjustments or replacements as the Contracting Officer may direct, and the tests shall be repeated until satisfactory installation and operation are achieved.

3.7.3 Utilidor Heating and Temperature Monitoring Plan

The Contractor shall submit his plan for heating and temperature monitoring for the utilidor system. This plan shall include, but not be limited to: heater types and locations, monitor types and locations, inspection schedule, and contingency plan.

3.8 CLEANING OF UTILIDOR/FUELIDOR SYSTEM

After tests are completed, and before utilidor covers are placed, the utilidors/fuelidors, sumps, and manholes shall be broom-cleaned of dirt and debris to the satisfaction of the Contracting Officer. Utilidor/fuelidor lids shall be placed and sealed immediately after approval by the Contracting Officer.

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SECTION 02630

STORM-DRAINAGE SYSTEM

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO M 190	(1995) Bituminous Coated Corrugated Metal Culvert Pipe and Pipe Arches
AASHTO M 243	(1996) Field Applied Coating of Corrugated Metal Structural Plate for Pipe, Pipe-Arches, and Arches

ASME INTERNATIONAL (ASME)

ASME B16.1	(1998) Cast Iron Pipe Flanges and Flanged Fittings Classes 25, 125, and 250

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C104	(1995) Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
AWWA C110	(1998) Ductile-Iron and Gray-Iron Fittings, 3 in. Through 48 in. (75 mm Through 1200 mm), for Water
AWWA C111	(2000) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C115	(1999) Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges
AWWA C151	(1996) Ductile-Iron Pipe, Centrifugally Cast, for Water
AWWA C153	(1994; Errata Nov 1996) Ductile-Iron Compact Fittings, 3 In. Through 24 In. (76 mm through 610 mm) and 54 In. through 64 In. (1,400 mm through 1,600 mm) for Water Service

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 48	(2000) Gray Iron Castings

ASTM A 536	(1999el) Ductile Iron Castings
ASTM A 760/A 760M	(1997) Corrugated Steel Pipe, Metallic-Coated for Sewers and Drains
ASTM A 798/A 798M	(1997a) Installing Factory-Made Corrugated Steel Pipe for Sewers and Other Applications
ASTM C 828	(1998) Low-Pressure Air Test of Vitrified Clay Pipe Lines
ASTM C 924	(1998) Concrete Pipe Sewer Lines by Low-Pressure Air Test Method
ASTM D 1418	(2001a) Rubber and Rubber Latices - Nomenclature

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with SECTION 01330 SUBMITTAL PROCEDURES:

SD-07 Certificates

Pipeline Testing.

Certified copies of test results demonstrating conformance to applicable specifications within 48 hours after pipe installation.

1.3 DELIVERY, STORAGE, AND HANDLING

1.3.1 Delivery and Storage

Materials delivered to site shall be inspected for damage, unloaded, and stored with a minimum of handling. Materials shall not be stored directly on the ground. The inside of pipes and fittings shall be kept free of dirt and debris. Before, during, and after installation, plastic pipe and fittings shall be protected from any environment that would result in damage or deterioration to the material.

1.3.2 Handling

Materials shall be handled in a manner that ensures delivery to the trench in sound, undamaged condition. Pipe shall be carried to the trench, not dragged.

PART 2 PRODUCTS

2.1 PIPE FOR CULVERTS AND STORM DRAINS

Pipe for culverts and storm drains shall be of the sizes indicated and shall conform to the requirements specified.

2.1.1 Corrugated Steel Pipe

a. Pipe: ASTM A 760/A 760M, zinc coated pipe Type I with helical 2-2/3 by 1/2 inch corrugations.

b. Joint Material for Corrugated Steel Piping: Coupling bands shall have the same size and shape corrugations as the piping to which the bands are connected and shall conform to ASTM A 760/A 760M.

2.1.2 Ductile-Iron Dike Drain Pipe

2.1.2.1 Ductile-Iron Pipe and Fittings

Pipe and Fittings: Pipe AWWA C151, Pressure Class 50. Fittings, AWWA C110 or AWWA C153; mechanical joints or push-on locking joint ends conforming to the same requirements as fittings with mechanical joint ends except that the bell design shall be modified, as approved, for push-on joint. Fittings shall have pipe and fittings shall be suitable for the specified joints. Pipe and fittings shall have cement-mortar lining. AWWA C104, standard thickness. Provide flanged joints only where indicated.

2.1.2.2 Flanged Joints

Flanged Joints: Bolts, nuts, and gaskets for flanged connections as recommended in the Appendix to AWWA C115. Flange for set screwed flanged shall be of ductile iron, ASTM A 536, Grade 65-45-12, and conform to the applicable requirements of ASME B16.1, Class 250. Setscrews for setscrewed flanges shall be 1.31×10^6 kPa tensile strength, heat treated and zinc-coated steel. Gasket for setscrewed flanges, in accordance with applicable requirements for mechanical-joint gaskets specified in AWWA C111. Design of setscrewed gasket shall provide for confinement and compression of gasket when joint to adjoining flange is made.

2.1.2.3 Jointing Materials for Ductile-Iron Piping

Gaskets shall be compression-type nitrile-butadiene gaskets conforming to ASTM D 1418, Class NBR.

2.2 MISCELLANEOUS MATERIALS

2.2.1 Frame and Cover for Gratings

Frame and cover for gratings shall be cast gray iron, ASTM A 48, Class 35B; cast ductile iron, ASTM A 536, Grade 65-45-12; Weight, shape, size, and waterway openings for grates and curb inlets shall be as indicated on the plans.

PART 3 EXECUTION

3.1 EXCAVATION FOR PIPE CULVERTS, STORM DRAINS, AND DRAINAGE STRUCTURES

Excavation of trenches, and for appurtenances and backfilling for culverts and storm drains, shall be in accordance with the applicable portions of SECTION 02314 "Earthwork for Utilities" and the requirements specified below.

3.1.1 Trenching

The width of trenches at any point below the top of the pipe shall be not

greater than the outside diameter of the pipe plus 12 inches to permit satisfactory jointing and thorough tamping of the bedding material under and around the pipe. Sheeting and bracing, where required, shall be placed within the trench width as specified. Contractor shall not overexcavate. Where trench widths are exceeded, special installation procedures may be necessary and the cost of special installation shall be borne by the Contractor without additional cost to the Government.

3.1.2 Removal of Unstable Material

Where wet or otherwise unstable soil that is incapable of properly supporting the pipe, is unexpectedly encountered in the bottom of a trench, such material shall be removed to the depth required and replaced to the proper grade with select granular material, compacted as provided in paragraph BACKFILLING determined by the Contracting Officer. When removal of unstable material is due to the fault or neglect of the Contractor in his performance of shoring and sheeting, water removal, or other specified requirements, such removal and replacement shall be performed at no additional cost to the government.

3.2 BEDDING

The bedding surface for the pipe shall provide a firm foundation of uniform density throughout the entire length of the pipe. Bedding material shall be as specified in SECTION 02314 "EARTHWORK FOR UTILITIES".

3.3 PLACING PIPE

Each pipe shall be thoroughly examined before being laid; defective or damaged pipe shall not be used. Pipelines shall be laid to the grades and alignment indicated. Proper facilities shall be provided for lowering sections of pipe into trenches. Lifting lugs in vertically elongated metal pipe shall be placed in the same vertical plane as the major axis of the pipe. Pipe shall not be laid when trench conditions or weather are unsuitable for such work. Diversion of drainage into trenches during construction shall be provided as necessary. Deflection of installed pipe shall not exceed the following limits:

TYPE OF PIPE	MAXIMUM ALLOWABLE DEFLECTION (%)
Corrugated Steel	5
Ductile Iron Culvert	3

3.3.1 Ductile Iron Pipe

Laying shall proceed upgrade with spigot ends of bell-and-spigot pipe and tongue ends of tongue-and-groove pipe pointing in the direction of the flow.

3.3.2 Corrugated Metal Pipe

Laying shall be with the separate sections joined firmly together, with the outside laps of circumferential joints pointing upstream, and with longitudinal laps on the sides. Any unprotected metal in the joints shall be coated with bituminous material as specified in AASHTO M 190 or AASHTO M 243. Interior coating shall be protected against damage from insertion or

removal of struts or tie wires. Lifting lugs shall be used to facilitate moving pipe without damage to exterior or interior coatings. During transportation and installation, pipe and coupling bands shall be handled with care to preclude damage to the coating, paving or lining. Damaged coatings, shall be repaired in accordance with the manufacturer's recommendations prior to placing backfill. Pipe on which coating, has been damaged to such an extent that satisfactory field repairs cannot be made shall be removed and replaced.

3.3.3 Multiple Culverts

Where multiple lines of pipe are installed, adjacent sides of pipe shall be at least half the nominal pipe diameter or 3 feet apart, whichever is less.

3.4 JOINTING

3.4.1 Corrugated Metal Pipe

3.4.1.1 Field Joints

Transverse field joints shall be designed so that the successive connection of pipe sections will form a continuous line free of appreciable irregularities in the flow line. In addition, the joints shall meet the general performance requirements described in ASTM A 798/A 798M. Suitable transverse field joints which satisfy the requirements for one or more of the joint performance categories can be obtained with the following types of connecting bands furnished with suitable band-end fastening devices: corrugated bands, bands with projections, flat bands, and bands of special design that engage factory reformed ends of corrugated pipe. The space between the pipe and connecting bands shall be kept free from dirt and grit so that corrugations fit snugly. The connecting band, while being tightened, shall be tapped with a soft-head mallet of wood, rubber or plastic, to take up slack and ensure a tight joint. The annular space between abutting sections of part paved, and fully paved pipe and pipe arch, in sizes 30 inches or larger, shall be filled with a bituminous material after jointing. Field joints for each type of corrugated metal pipe shall maintain pipe alignment during construction and prevent infiltration of fill material during the life of the installations. The type, size, and sheet thickness of the band and the size of angles or lugs and bolts shall be as indicated or where not indicated, shall be as specified in the applicable standards or specifications for the pipe.

3.5 BACKFILLING

3.5.1 Backfilling Pipe in Trenches

After the pipe has been properly bedded, selected material from excavation or borrow, at a moisture content that will facilitate compaction, shall be placed along both sides of pipe in layers not exceeding 6 inches in compacted depth. The backfill shall be brought up evenly on both sides of pipe for the full length of pipe. The fill shall be thoroughly compacted under the haunches of the pipe. Each layer shall be thoroughly compacted with mechanical tampers or rammers. This method of filling and compacting shall continue until the fill has reached an elevation of at least 12 inches above the top of the pipe. The remainder of the trench shall be backfilled and compacted by spreading and rolling or compacted by mechanical rammers or tampers in layers not exceeding 12 inches. Tests for density shall be made as necessary to ensure conformance to the compaction requirements specified below. Where it is necessary, in the opinion of the

Contracting Officer, that sheeting or portions of bracing used be left in place, the contract will be adjusted accordingly. Untreated sheeting shall not be left in place beneath structures or pavements.

3.5.2 Backfilling Pipe in Fill Sections

For pipe placed in fill sections, backfill material and the placement and compaction procedures shall be as specified below. The fill material shall be uniformly spread in layers longitudinally on both sides of the pipe, not exceeding 6 inches in compacted depth, and shall be compacted by rolling parallel with pipe or by mechanical tamping or ramming. Prior to commencing normal filling operations, the crown width of the fill at a height of 12 inches above the top of the pipe shall extend a distance of not less than twice the outside pipe diameter on each side of the pipe or 12 feet, whichever is less. After the backfill has reached at least 12 inches above the top of the pipe, the remainder of the fill shall be placed and thoroughly compacted in layers not exceeding 12 inches.

3.5.3 Movement of Construction Machinery

When compacting by rolling or operating heavy equipment parallel with the pipe, displacement of or injury to the pipe shall be avoided. Movement of construction machinery over a culvert or storm drain at any stage of construction shall be at the Contractor's risk. Any damaged pipe shall be repaired or replaced.

3.5.4 Compaction

Compact fill, backfill and bedding and perform density tests as specified in SECTION 02314 "EARTHWORK FOR UTILITIES".

3.6 PIPELINE TESTING

3.6.1 Ductile-Iron Dike Drain Pipe

Lines shall be tested for leakage by low pressure air or water testing. Low pressure air testing procedures shall use the pressures and testing times prescribed in ASTM C 828 or ASTM C 924, after consultation with the pipe manufacturer. When leakage exceeds the maximum amount specified, satisfactory correction shall be made and retesting accomplished. Testing, correcting, and retesting shall be made at no additional cost to the Government.

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SECTION 02722

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SECTION 02722

GRADED-CRUSHED AGGREGATE BASE COURSE

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 88	(1999a) Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM C 117	(1995) Materials Finer than 75 micrometer (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C 127	(2001) Specific Gravity and Absorption of Course Aggregate
ASTM C 128	(2001) Specific Gravity and Absorption of Fine Aggregate
ASTM C 131	(2001) Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C 136	(2001) Sieve Analysis of Fine and Coarse Aggregates
ASTM D 75	(2003) Sampling Aggregates
ASTM D 422	(1963; R 1998) Particle-Size Analysis of Soils
ASTM D 1556	(2000) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 1557	(2000) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu. m.))
ASTM D 2167	(1994) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D 2487	(2000) Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 2922	(2001) Density of Soil and Soil-Aggregate

	in Place by Nuclear Methods (Shallow Depth)
ASTM D 3017	(2001) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
ASTM E 11	(2001) Wire Cloth Sieves for Testing Purposes

1.2 DEFINITIONS

For the purposes of this specification, the following definitions apply.

1.2.1 Graded-crushed Aggregate Base Course

Graded-crushed aggregate base course is well graded, crushed, durable aggregate uniformly moistened and mechanically stabilized by compaction.

1.2.2 Degree of Compaction

Degree of compaction shall be expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D 1557, Method C.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Plant, Equipment, and Tools.

List of proposed equipment to be used in performance of construction work, including descriptive data.

SD-09 Manufacturer's Field Reports

Sampling and testing. Field Density Tests.

Calibration curves and related test results prior to using the device or equipment being calibrated. Copies of field test results, including precise location, within 24 hours after the tests are performed. Certified copies of test results for approval not less than 7 days before material is required for the work.

1.4 SAMPLING AND TESTING

Sampling and testing shall be the responsibility of the Contractor. Sampling and testing shall be performed by a Corps of Engineers approved laboratory. Work requiring testing will not be permitted until the testing laboratory has been approved. The materials shall be tested prior to placement to establish anticipated compliance with the specified requirements. Actual compliance will be based on samples obtained from the placed and compacted graded crushed aggregate base course. Testing shall be performed at the specified frequency. The Contracting Officer may specify the time and location of the tests. Copies of test results, including

precise location of the tests shall be furnished to the Contracting Officer within 24 hours of completion of the tests.

1.4.1 Sampling

Samples for laboratory testing shall be taken in conformance with ASTM D 75. When deemed necessary, the sampling will be observed by the Contracting Officer.

1.4.2 Tests

The following tests shall be performed in conformance with the applicable standards listed.

1.4.2.1 Sieve Analysis

Sieve analysis shall be made in conformance with ASTM C 117, ASTM C 136, and ASTM D 422. Sieves shall conform to ASTM E 11.

1.4.2.2 Moisture-Density Determinations

The maximum density and optimum moisture content shall be determined in accordance with ASTM D 1557, Method C.

1.4.2.3 Field Density Tests

Density shall be field measured in accordance with ASTM D 1556, ASTM D 2167, or ASTM D 2922. For the method presented in ASTM D 1556 the base plate as shown in the drawing shall be used. Tests performed in accordance with ASTM D 2922 result in a wet unit weight of soil and when using this method, ASTM D 3017 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall also be checked along with density calibration checks as described in ASTM D 3017.

1.4.2.4 Wear Test

Wear tests shall be made on graded crushed aggregate material in conformance with ASTM C 131.

1.4.2.5 Soundness

Soundness tests shall be made on graded crushed aggregate material in accordance with ASTM C 88.

1.4.3 Testing Frequency

1.4.3.1 Initial Tests

One of each of the following tests shall be performed on the proposed material prior to commencing construction to demonstrate that the proposed material will meet all specified requirements after placement and compaction. If materials from more than one source are going to be utilized, this testing shall be completed for each source.

a. Sieve Analysis including No. 200 size material.

b. Moisture-density relationship.

c. Wear.

d. Soundness.

e. Determination of percent of double face fractures.

1.4.3.2 In Place Tests

One of each of the following tests shall be performed on samples taken from the placed and compacted graded crushed aggregate base course. Samples shall be taken and tested at the rates indicated.

a. Density tests shall be performed on every lift of material placed and at a frequency of one test for every 10,000 square feet, or portion thereof, of completed area.

b. Sieve Analysis shall be performed for every 20,000 square yards, or portion thereof, of material placed.

c. Perform one moisture density relationship by ASTM D 1557, Method C and determine the percent of double face fractures at the same frequency as indicated for sieve analysis.

1.4.4 Approval of Material

The source of the material shall be selected 60 days prior to the time the material will be required in the work. Tentative approval of material will be based on initial test results. Final approval of the materials will be based on sieve analysis performed on samples taken from the completed and fully compacted graded crushed aggregate base course.

1.5 WEATHER LIMITATIONS

Construction shall be done when the atmospheric temperature is above 35 degrees F. When the temperature falls below 35 degrees F, the Contractor shall protect all completed areas by approved methods against detrimental effects of freezing. Completed areas damaged by freezing, rainfall, or other weather conditions shall be corrected to meet specified requirements.

1.6 PLANT, EQUIPMENT, AND TOOLS

All plant, equipment, and tools used in the performance of the work will be subject to approval before the work is started and shall be maintained in satisfactory working condition at all times. The equipment shall be adequate and shall have the capability of producing the required compaction, meeting grade controls, thickness control, and smoothness requirements as set forth herein.

PART 2 PRODUCTS

2.1 AGGREGATES

The graded crushed aggregate base course shall consist of clean, sound, durable particles of crushed stone or crushed gravel. Graded crushed aggregate base course shall be free of silt and clay as defined by ASTM D 2487, organic matter, and other objectionable materials or coatings. The portion retained on the No. 4 sieve shall be known as coarse aggregate; that portion passing the No. 4 sieve shall be known as fine aggregate.

2.1.1 Coarse Aggregate

Coarse aggregates shall be angular particles of uniform density. When the coarse aggregate is supplied from more than one source, aggregate from each source shall meet the specified requirements and shall be stockpiled separately.

a. Crushed Gravel: Crushed gravel shall be manufactured by crushing gravels, and shall meet all the requirements specified below.

b. Crushed Stone: Crushed stone shall consist of freshly mined quarry rock, and shall meet all the requirements specified below.

2.1.1.1 Graded-Crushed Aggregate Base Course

Coarse aggregate shall not show more than 40 percent loss when subjected to the Los Angeles abrasion test in accordance with ASTM C 131. Coarse aggregate shall not exhibit a loss greater than 18 percent weighted average, at five cycles, when tested for soundness in magnesium sulfate in accordance with ASTM C 88. The amount of flat and elongated particles shall not exceed 20 percent for the fraction retained on the 1/2 inch sieve nor more than 20 percent for the fraction passing the 1/2 inch sieve. A flat particle is one having a ratio of width to thickness greater than 3; an elongated particle is one having a ratio of length to width greater than 3. In the portion retained on each sieve specified, the crushed aggregate shall contain at least 90 percent by weight of crushed pieces having two or more freshly fractured faces with the area of each face being at least equal to 75 percent of the smallest midsectional area of the piece. When two fractures are contiguous, the angle between planes of the fractures must be at least 30 degrees in order to count as two fractured faces. Crushed gravel shall be manufactured from gravel particles 90 percent of which by weight are retained on the maximum size sieve listed in TABLE 1.

2.1.2 Fine Aggregate

Fine aggregates shall be angular particles of uniform density. When the fine aggregate is supplied from more than one source, aggregate from each source shall meet the specified requirements.

2.1.2.1 Graded-Crushed Aggregate Base Course

Fine aggregate shall consist of angular particles produced by crushing stone or gravel that meets the requirements for wear and soundness specified for coarse aggregate. Fine aggregate shall be produced by crushing only particles larger than No. 4 sieve in size. The fine aggregate shall contain at least 90 percent by weight of particles having two or more freshly fractured faces in the portion passing the No. 4 sieve and retained on the No. 10 sieve, and in the portion passing the No. 10 sieve and retained on the No. 40 sieve.

2.1.3 Gradation Requirements

The specified gradation requirements shall apply to the completed base course. The aggregates shall have a maximum size of 1.5 inches and shall be continuously well graded within the limits specified in TABLE 1. No Variation outside a gradation band will be tolerated. Sieves shall conform to ASTM E 11.

TABLE I. GRADATION OF AGGREGATES

Percentage by Weight Passing Square-Mesh Sieve

Sieve Designation	
1-1/2 inch	100
1 inch	60-100
1/2 inch	30-65
No. 4	20-50
No. 10	5-40
No. 40	5-25
No. 200	0-2

NOTE 2: The values are based on aggregates of uniform specific gravity. If materials from different sources are used for the coarse and fine aggregates, they shall be tested in accordance with ASTM C 127 and ASTM C 128 to determine their specific gravities. If the specific gravities vary by more than 10 percent, the percentages passing the various sieves shall be corrected as directed by the Contracting Officer.

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

When graded crushed aggregate base course is constructed in more than one layer, the previously constructed layer shall be cleaned of loose and foreign matter by sweeping with power sweepers or power brooms, except that hand brooms may be used in areas where power cleaning is not practicable. Adequate drainage shall be provided during the entire period of construction to prevent water from collecting or standing on the working area. Line and grade stakes shall be provided as necessary for control. Grade stakes shall be in lines parallel to the centerline of the area under construction and suitably spaced for string lining.

3.2 OPERATION OF AGGREGATE SOURCES

Aggregate sources shall be managed in accordance with the Eielson Air Force Base Borrow Pit Plan and as required to obtain material conforming to the specified requirements. Upon completion of the work, aggregate sources shall be conditioned to drain readily and be left in a satisfactory condition.

3.3 STOCKPILING MATERIAL

Prior to stockpiling of material, storage sites shall be cleared and leveled by the Contractor. All materials, including approved material available from excavation and grading, shall be stockpiled in the manner and at the locations designated. Aggregates shall be stockpiled on the cleared and leveled areas designated by the Contracting Officer to prevent segregation. Materials obtained from different sources shall be stockpiled separately.

3.4 PREPARATION OF UNDERLYING COURSE

Prior to constructing the graded crushed aggregate base course, the

underlying course or subgrade shall be cleaned of all foreign substances. At the time of construction of the graded crushed aggregate base course, the underlying course shall contain no frozen material. The surface of the underlying course or subgrade shall meet specified compaction and surface tolerances. Ruts or soft yielding spots in the underlying courses, areas having inadequate compaction, and deviations of the surface from the requirements set forth herein shall be corrected by loosening and removing soft or unsatisfactory material and by adding approved material, reshaping to line and grade, and recompacting to specified density requirements. The finished underlying course shall not be disturbed by traffic or other operations and shall be maintained by the Contractor in a satisfactory condition until the graded crushed aggregate base course is placed.

3.5 INSTALLATION

3.5.1 Mixing the Materials

The coarse and fine aggregates shall be mixed in a stationary plant. The Contractor shall make adjustments in mixing procedures or in equipment as required to obtain true grades, to minimize segregation or degradation, to obtain the required water content, and to insure a satisfactory graded crushed aggregate base course meeting all requirements of this specification.

3.5.2 Placing

The mixed material shall be placed on the classified material, or geotextile fabric in the event option item 0004 is awarded, in layers of uniform thickness with an asphalt paving machine. When a compacted layer 6 inches or less in thickness is required, the material shall be placed in a single layer. When a compacted layer in excess of 6 inches is required, the material shall be placed in layers of equal thickness. No layer shall exceed 6 inches or less than 3 inches when compacted. The layers shall be so placed that when compacted they will be true to the grades or levels required with the least possible surface disturbance. Where the graded crushed aggregate is placed in more than one layer, the previously constructed layers shall be cleaned of loose and foreign matter by sweeping with power sweepers, power brooms, or hand brooms, as directed. Such adjustments in placing procedures or equipment shall be made as required to obtain true grades, to minimize segregation and degradation, to adjust the water content, and to insure an acceptable graded crushed aggregate base course.

3.5.3 Grade Control

The finished and completed graded crushed aggregate base course shall conform to the lines, grades, and cross sections shown. Underlying material(s) shall be excavated and prepared at sufficient depth for the required graded crushed aggregate base course thickness so that the finished graded crushed aggretae base course with the subsequent surface course will meet the designated grades.

3.5.4 Compaction

Each layer of the graded crushed aggregate base course shall be compacted as specified with approved compaction equipment. Water content shall be maintained during the compaction procedure to within plus or minus 2 percent of the optimum water content determined from laboratory tests as specified in paragraph SAMPLING AND TESTING. Rolling shall begin at the

outside edge of the surface and proceed to the center, overlapping on successive trips at least one-half the width of the roller. Alternate trips of the roller shall be slightly different lengths. Speed of the roller shall be such that displacement of the aggregate does not occur. In all places not accessible to the rollers, the mixture shall be compacted with hand-operated power tampers. Compaction shall continue until each layer has a degree of compaction that is at least 100 percent of laboratory maximum density through the full depth of the layer. The Contractor shall make such adjustments in compacting or finishing procedures as may be directed to obtain true grades, to minimize segregation and degradation, to reduce or increase water content, and to ensure a satisfactory graded crushed aggregate. Any materials that are found to be unsatisfactory shall be removed and replaced with satisfactory material or reworked, as directed, to meet the requirements of this specification.

3.5.5 Thickness

Compacted thickness of the graded crushed aggregate base course shall be as indicated. The total compacted thickness of the graded crushed aggregate base course shall be within 1/2 inch of the thickness indicated. Where the measured thickness is more than 1/2 inch deficient, such areas shall be corrected by scarifying, adding new material of proper gradation, or removing excess material, and recompacting as required. Average job thickness shall be the average of all thickness measurements taken for the job, but shall be within 1/4 inch of the thickness indicated. The total thickness of the graded crushed aggregate base course shall be measured at intervals in such a manner as to ensure one measurement for each 1000 square yards of graded crushed aggregate base course placed. Measurements shall be made in 3 inch diameter test holes penetrating the base course.

3.5.6 Proof Rolling

Proof rolling of the areas indicated shall be in addition to the compaction specified and shall consist of the application of the indicated number of coverages with a heavy pneumatic-tired roller having four or more tires, each loaded to a minimum of 30,000 pounds and inflated to a minimum of 125 psi. Water content of each layer of the graded crushed aggregate base course shall be maintained at the optimum percentage directed from start of compaction to completion of proof rolling. Any graded crushed aggregate base course materials or any underlying materials that produce unsatisfactory results by proof rolling shall be removed and replaced with satisfactory materials, recompacted and proof rolled to meet these specifications.

3.5.7 Finishing

The surface of the top layer of graded crushed aggregate base course shall be finished after final compaction and proof rolling by cutting any overbuild to grade and rolling with a steel-wheeled roller. Thin layers of material shall not be added to the top layer of base course to meet grade. If the elevation of the top layer of graded crushed aggregate base course is 1/2 inch or more below grade, then the top layer should be scarified to a depth of at least 3 inches and new material shall be blended in, compacted and proof rolled to bring to grade. Adjustments to rolling and finishing procedures shall be made as required to minimize segregation and degradation, obtain grades, maintain moisture content, and insure an acceptable base course. Should the surface become rough, corrugated, uneven in texture, or traffic marked prior to completion, the unsatisfactory portion shall be scarified, reworked and recompacted or it

shall be replaced as directed.

3.5.8 Smoothness

The surface of the top layer shall show no deviations in excess of 3/8 inch when tested with a 12 foot straightedge. Measurements shall be taken in successive positions parallel to the centerline of the area to be paved. Measurements shall also be taken perpendicular to the centerline at 50 foot intervals. Deviations exceeding this amount shall be corrected by removing material and replacing with new material, or by reworking existing material and compacting it to meet these specifications.

3.6 TRAFFIC

Completed portions of the graded crushed aggregate base course may be opened to limited traffic, provided there is no marring or distorting of the surface by the traffic. Heavy equipment shall not be permitted except when necessary to construction, and then the area shall be protected against marring or damage to the completed work.

3.7 MAINTENANCE

The graded crushed aggregate base course shall be maintained in a satisfactory condition until the full pavement section is completed and accepted. Maintenance shall include immediate repairs to any defects and shall be repeated as often as necessary to keep the area intact. Any graded crushed aggregate base course that is not paved over prior to the onset of winter, shall be retested to verify that it still complies with the requirements of this specification. Any area of graded crushed aggregate base course that is damaged shall be reworked or replaced as necessary to comply with this specification.

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SECTION 02740

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SECTION 02740

BASE COURSE AND BITUMINOUS PAVING FOR VEHICLE TRAFFIC AREAS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 2397	(1998) Cationic Emulsified Asphalt

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO M 226-80	(1986) Viscosity Graded Asphalt Cement
AASHTO T 230-68	(1986) Determining Degree of Pavement Compaction of Bituminous Aggregate Mixtures
AASHTO T 245-90	(Rev. 1991; T 245-91I) Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus

STATE OF ALASKA DEPARTMENT OF TRANSPORTATION AND PUBLIC FACILITIES (ADOT&PF)

ADOT&PF Specifications	(1998) Standard Specifications for Highway Construction
ADOT&PF T-17	Standard Method of Test of Bituminous Mix Design by the Marshall Method

1.2 GENERAL

Work shall conform to the applicable sections of ADOT&PF specifications in their entirety, except as otherwise specified herein.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with SECTION 01330 SUBMITTAL PROCEDURES:

SD-09 Manufacturer's Field Reports

Job Mix Design.

The mix design shall conform to the criteria listed herein, and shall utilize the same materials sources, aggregate gradations, and asphalt grade as will be used in the pavement. The mix design shall have been prepared by an independent commercial laboratory or by a State of Alaska laboratory no earlier than two years prior to the start of placement of pavement. The mix design shall have been prepared by ADOT&PF T-17, using the criteria listed under paragraph E.4 therein (50 blows/face).

Aggregate Base Course.

Test results on current materials and in-place density.

Bituminous Pavement.

Test results on current plant mix and materials, and in-place density and smoothness.

SD-07 Certificates

Prime Coat.

Asphalt Cement.

Tack Coat.

1.4 MEASUREMENT AND PAYMENT

As specified in SECTION 01271 MEASUREMENT, PAYMENT AND CONTRACT COST BREAKDOWN.

PART 2 PRODUCTS

2.1 AGGREGATE BASE COURSE MATERIAL

Gradation shall conform to ADOT&PF Specifications, Table 703-2, Grading D-1, except the percentage of particles by weight having diameters less than 0.02 mm shall be 0 to 3 percent.

2.2 PRIME COAT

Emulsified asphalt shall conform to ASTM D 2397 Grade, CSS-1.

2.3 ASPHALT MATERIAL

Asphalt material shall conform to AASHTO M 226-80, Grade AC-5. A single source of asphalt material shall be used for the entire job. Aggregate gradation shall meet ADOT&PF Specifications, Table 703-3, Type II or III.

2.4 TACK COAT MATERIAL

Tack coat material shall be emulsified asphalt conforming to ASTM D 2397, Type CSS-1.

PART 3 EXECUTION

3.1 AGGREGATE BASE COURSE INSTALLATION

Compaction shall be 98 percent.

3.2 PRIME COAT APPLICATION

The rate of application of the prime coat shall be from 0.1 to 0.3 gallons per square yard.

3.3 ASPHALT-CONCRETE PAVEMENT INSTALLATION

Rolling shall be continued until a density of not less than 96.5 percent is obtained. Compaction shall be determined in accordance with AASHTO T 230-68 except that the standard specimen shall be prepared in accordance with AASHTO T 245-90. Density tests shall be conducted at a rate of one test for every 10,000 square feet of pavement. Core holes shall be filled with hot mix asphalt conforming to the job mix formula and compacted to the specified density.

3.4 TACK COAT APPLICATION

The tack coat shall be applied at a rate that will result in an asphalt residual covering of 0.015 to 0.045 gallons per square yard.

3.5 CLEANING UP

The Contractor shall at all times keep the construction area free from accumulations of waste materials or rubbish and, prior to completion of the work, remove any rubbish from and about the premises and all tools, equipment and materials not the property of the Government. Upon completion of the construction, the Contractor shall leave the work and premises in a clean, neat and satisfactory condition.

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SECTION 02748

BITUMINOUS TACK AND PRIME COATS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO T 40	(1978; R 1996) Sampling Bituminous Materials

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 140	(2001) Sampling Bituminous Materials
ASTM D 2397	(1998) Cationic Emulsified Asphalt
ASTM D 2995	(1999) Determining Application Rate of Bituminous Distributors

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with SECTION 01330 SUBMITTAL PROCEDURES:

SD-09 Manufacturer's Field Reports

Field Tests.

Copies of all test results for bituminous materials, within 24 hours of completion of tests. Certified copies of the manufacturer's test reports indicating compliance with applicable specified requirements, not less than 30 days before the material is required in the work.

1.3 PLANT, EQUIPMENT, MACHINES AND TOOLS

1.3.1 General Requirements

Plant, equipment, machines and tools used in the work shall be subject to approval and shall be maintained in a satisfactory working condition at all times.

1.3.2 Bituminous Distributor

The distributor shall have pneumatic tires of such size and number to prevent rutting, shoving or otherwise damaging the base surface or other layers in the pavement structure. The distributor shall be designed and equipped to spray the bituminous material in a uniform coverage at the specified temperature, at readily determined and controlled rates with an allowable variation from the specified rate of not more than plus or minus 5 percent, and at variable widths. Distributor equipment shall include a separate power unit for the bitumen pump, full-circulation spray bars, tachometer, pressure gauges, volume-measuring devices, adequate heaters for heating of materials to the proper application temperature, a thermometer for reading the temperature of tank contents, and a hand hose attachment suitable for applying bituminous material manually to areas inaccessible to the distributor. The distributor shall be equipped to circulate and agitate the bituminous material during the heating process.

1.3.3 Power Brooms and Power Blowers

Power brooms and power blowers shall be suitable for cleaning the surfaces to which the bituminous coat is to be applied.

1.4 WEATHER LIMITATIONS

Bituminous coat shall be applied only when the surface to receive the bituminous coat is dry. Bituminous coat shall be applied only when the atmospheric temperature in the shade is 50 degrees F or above and when the temperature has not been below 35 degrees F for the 12 hours prior to application.

PART 2 PRODUCTS

2.1 TACK COAT

Emulsified asphalt shall conform to ASTM D 2397 Grade, CSS-1.

2.2 PRIME COAT

Emulsified asphalt shall conform to ASTM D 2397, Grade CSS-1.

PART 3 EXECUTION

3.1 PREPARATION OF SURFACE

Immediately before applying the bituminous coat, all loose material, dirt, clay, or other objectionable material shall be removed from the surface to be treated. The surface shall be dry and clean at the time of treatment.

3.2 APPLICATION RATE

The exact quantities within the range specified, which may be varied to suit field conditions, will be determined by the Contracting Officer.

3.2.1 Tack Coat

Bituminous material for the tack coat shall be applied in quantities of not less than 0.05 gallon nor more than 0.15 gallon per square yard of pavement surface.

3.2.2 Prime Coat

Bituminous material for the prime coat shall be applied in quantities of not less than 0.15 gallon nor more than 0.40 gallon per square yard of pavement surface.

3.3 APPLICATION TEMPERATURE

3.3.1 Viscosity Relationship

Asphalt application temperature shall provide an application viscosity between 10 and 60 seconds, Saybolt Furol, or between 20 and 120 centistokes,kinematic. The temperature viscosity relation shall be furnished to the Contracting Officer.

3.3.2 Temperature Ranges

The viscosity requirements shall determine the application temperature to be used. The normal range of application temperatures for CSS-1 is 70 and 160 degrees F.

*These temperature ranges may exceed the flash point of the material and care should be taken in their heating.

3.4 APPLICATION

Following preparation and subsequent inspection of the surface, the bituminous coat shall be applied at the specified rate with uniform distribution over the surface to be treated. All areas and spots missed by the distributor shall be properly treated with the hand spray. Until the succeeding layer of pavement is placed, the surface shall be maintained by protecting the surface against damage and by repairing deficient areas at no additional cost to the Government. If required, clean dry sand shall be spread to effectively blot up any excess bituminous material. No smoking, fires, or flames other than those from the heaters that are a part of the equipment shall be permitted within 25 feet of heating, distributing, and transferring operations of bituminous material other than bituminous emulsions. To obtain uniform application of the prime coat on the surface treated at the junction of previous and subsequent applications, building paper shall be spread on the surface for a sufficient distance back from the ends of each application to start and stop the prime coat on the paper. Immediately after application, the building paper shall be removed and destroyed.

3.5 CURING PERIOD

Following application of the bituminous material and prior to application of the succeeding layer of pavement, the bituminous coat shall be allowed to cure and to obtain evaporation of any volatiles or moisture. Prime coat shall be allowed to cure without being disturbed for a period of at least 48 hours or longer, as may be necessary to attain penetration into the treated course.

3.6 FIELD QUALITY CONTROL

Samples of the bituminous material shall be tested for compliance with the applicable specified requirements. A sample shall be obtained and tested by the Contractor for every 20,000 gallons of bituminous material used.

3.7 SAMPLING AND TESTING

Sampling and testing shall be performed by a Corps of Engineers approved commercial testing laboratory or by facilities furnished by the supplier.

3.7.1 Sampling

The samples of bituminous material, unless otherwise specified, shall be in accordance with ASTM D 140 or AASHTO T 40. Sources from which bituminous materials are to be obtained shall be selected and notification furnished the Contracting Officer within 15 days after the award of the contract.

3.7.2 Calibration Test

The Contractor shall furnish all equipment, materials, and labor necessary to calibrate the bituminous distributor. Calibration shall be made with the approved job material and prior to applying the bituminous coat material to the prepared surface. Calibration of the bituminous distributor shall be in accordance with ASTM D 2995.

3.7.3 Trial Applications

Before providing the complete bituminous coat, three lengths of at least 100 feet for the full width of the distributor bar shall be applied to evaluate the amount of bituminous material that can be satisfactorily applied.

3.7.3.1 Tack Coat Trial Application Rate

Unless otherwise authorized, the trial application rate of bituminous tack coat materials shall be applied in the amount of 0.05 gallons per square yard. Other trial applications shall be made using various amounts of material as may be deemed necessary.

3.7.3.2 Prime Coat Trial Application Rate

Unless otherwise authorized, the trial application rate of bituminous materials shall be applied in the amount of 0.25 gallon per square yard. Other trial applications shall be made using various amounts of material as may be deemed necessary.

3.7.4 Sampling and Testing During Construction

Quality control sampling and testing shall be performed as required in paragraph FIELD QUALITY CONTROL.

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SECTION 02749

HOT-MIX ASPHALT (HMA) FOR AIRFIELDS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO TP53	(2000) Determining Asphalt Content of Hot Mix Asphalt by the Ignition Method

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 88	(1999a) Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM C 117	(1995) Materials Finer than 75 micrometer (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C 131	(2001) Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C 136	(2001) Sieve Analysis of Fine and Coarse Aggregates
ASTM C 566	(1997) Total Evaporable Moisture Content of Aggregate by Drying
ASTM C 1252	(1998) Uncompacted Void Content of Fine Aggregate (as Influenced by Particle Shape, Surface Texture, and Grading)
ASTM D 5	(1997) Penetration of Bituminous Materials
ASTM D 36	(1995; R 2000) Softening Point of Bitumen (Ring-and-Ball Apparatus)
ASTM D 92	(2002) Flash and Fire Points by Cleveland Open Cup Tester-IP Designation
ASTM D 113	(1999) Ductility of Bituminous Materials
ASTM D 140	(2001) Sampling Bituminous Materials
ASTM D 242	(1995) Mineral Filler for Bituminous Paving Mixtures

ASTM D 995	(1995b) Mixing Plants for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures
ASTM D 1461	(1985; R 1994) Moisture or Volatile Distillates in Bituminous Paving Mixtures
ASTM D 1559	(1989) Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus \N(deleted; continued use without replacement.)
ASTM D 2041	(1995) Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures
ASTM D 2042	(2001) Solubility of Asphalt Materials in Trichloroethylene
ASTM D 2170	(2001) Kinematic Viscosity of Asphalts (Bitumens)
ASTM D 2171	(2001) Viscosity of Asphalts by Vacuum Capillary Viscometer
ASTM D 2172	(1995) Quantitative Extraction of Bitumen from Bituminous Paving Mixtures
ASTM D 2419	(1995) Sand Equivalent Value of Soils and Fine Aggregate
ASTM D 2489	(2000) Degree of Particle Coating of Bituminous-Aggregate Mixtures
ASTM D 2726	(2000) Bulk Specific Gravity and Density of Non-Absorptive Compacted Bituminous Mixture
ASTM D 2950	(1997) Density of Bituminous Concrete in Place by Nuclear Method
ASTM D 3203	(1994; R 2000) Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures
ASTM D 3549	(1993a) Standard Test Method for Thickness or Height of Compacted Bituminous Paving Mixture Specimens
ASTM D 3665	(1999) Random Sampling of Construction Materials
ASTM D 3666	(2000) Minimum Requirements for Agencies Testing and Inspecting Bituminous Paving Materials
ASTM D 4125	(1994el) Asphalt Content of Bituminous Mixtures by the Nuclear Method

ASTM D 4791	(1999) Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate
ASTM D 4867/D 4867M	(1996) Effect of Moisture on Asphalt Concrete Paving Mixtures
ASTM D 5444	(1998) Mechanical Size Analysis of Extracted Aggregate
ASTM D 6307	(1998) Asphalt Content of Hot Mix Asphalt by Ignition Method

ASPHALT INSTITUTE (AI)

AI MS-2	(1997) Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types

STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION (CDT)

CDT Test 526	(1978) Operation of California Profilograph and Evaluation of Profiles

U.S. ARMY CORPS OF ENGINEERS (USACE)

COE CRD-C 171	(1995) Test Method for Determining Percentage of Crushed Particles in Aggregate

1.2 DESCRIPTION OF WORK

The work shall consist of pavement courses composed of mineral aggregate and asphalt material heated and mixed in a central mixing plant and placed on a prepared course. HMA designed and constructed in accordance with this section shall conform to the lines, grades, thicknesses, and typical cross sections shown on the drawings. Each course shall be constructed to the depth, section, or elevation required by the drawings and shall be rolled and finished as a lot and the pay factor computed and approved before the placement of the next course.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with SECTION 01330 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Mix Design; G, ED.

Proposed JMF.

Contractor Quality Control; G, RE.

Quality control plan for asphalt concrete paving and testing.

SD-03 Product Data

Mix Design; G, ED.

Proposed JMF.

Contractor Quality Control; G, RE.

Quality control plan.

SD-06 Test Reports

Aggregates; G, ED.

QC Monitoring; G, RE.

Aggregate and QC test results.

SD-07 Certificates

Asphalt Cement Binder; G, ED.

Copies of certified test data.

Testing Laboratory; G, RE.

Certification of compliance.

Aggregate and QC test results.

SD-07 Certificates

Asphalt Cement Binder.

Copies of certified test data.

Testing Laboratory.

Certification of compliance.

1.4 METHOD OF MEASUREMENT

Measurement of the quantity of hot-mix asphalt, per square yard placed and accepted, shall be made for the purposes of assessing the pay factors stipulated in this section.

The measured quantity of hot-mixed asphalt will be paid for and included in the lump-sum contract price. If less than 100 percent payment is due based on the pay factors stipulated in paragraph MATERIAL ACCEPTANCE AND PERCENT PAYMENT, a unit price computed in accordance with SECTION 01271 per square yard shall be used for purposes of calculating the payment reduction.

1.5 ASPHALT MIXING PLANT

Plants used for the preparation of hot-mix asphalt shall conform to the requirements of ASTM D 995 with the following changes:

a. Testing Facilities. The Contractor shall obtain the services of a Corps of Engineers Approved Laboratory to provide and operate

laboratory facilities at the plant, or at the paving site, for acceptance testing and the Contractor's quality control testing.

b. Inspection of Plant. The Contracting Officer shall have access at all times, to all areas of the plant for checking adequacy of equipment; inspecting operation of the plant; verifying weights, proportions, and material properties; checking the temperatures maintained in the preparation of the mixtures and for taking samples. The Contractor shall provide assistance as requested, for the Government to procure any desired samples.

c. Storage Bins. The asphalt mixture may be stored in non-insulated storage bins for a period of time not exceeding 3 hours. The asphalt mixture may be stored in insulated storage bins for a period of time not exceeding 8 hours. The mixture drawn from bins shall meet the same requirements as mixture loaded directly into trucks.

1.6 HAULING EQUIPMENT

Trucks used for hauling hot-mix asphalt shall have tight, clean, and smooth metal beds. To prevent the mixture from adhering to them, the truck beds shall be lightly coated with a minimum amount of paraffin oil, lime solution, or other approved material. Petroleum based products shall not be used as a release agent. Each truck shall have a suitable cover to protect the mixture from adverse weather. When necessary to ensure that the mixture will be delivered to the site at the specified temperature, truck beds shall be insulated or heated and covers (tarps) shall be securely fastened.

1.7 ASPHALT PAVERS

Asphalt pavers shall be self-propelled, with an activated screed, heated as necessary, and shall be capable of spreading and finishing courses of hot-mix asphalt which will meet the specified thickness, smoothness, and grade. The paver shall have sufficient power to propel itself and the hauling equipment without adversely affecting the finished surface.

1.7.1 Receiving Hopper

The paver shall have a receiving hopper of sufficient capacity to permit a uniform spreading operation. The hopper shall be equipped with a distribution system to place the mixture uniformly in front of the screed without segregation. The screed shall effectively produce a finished surface of the required evenness and texture without tearing, shoving, or gouging the mixture.

1.7.2 Automatic Grade Controls

If an automatic grade control device is used, the paver shall be equipped with a control system capable of automatically maintaining the specified screed elevation. The control system shall be automatically actuated from either a reference line and/or through a system of mechanical sensors or sensor-directed mechanisms or devices which will maintain the paver screed at a predetermined transverse slope and at the proper elevation to obtain the required surface. The transverse slope controller shall be capable of maintaining the screed at the desired slope within plus or minus 0.1 percent. A transverse slope controller shall not be used to control grade. The controls shall be capable of working in conjunction with any of the following attachments:

a. Ski-type device of not less than 30 feet in length.

b. Taut stringline (wire) set to grade.

c. Short ski or shoe for joint matching.

d. Laser control.

1.8 ROLLERS

Rollers shall be in good condition and shall be operated at slow speeds to avoid displacement of the asphalt mixture. The number, type, and weight of rollers shall be sufficient to compact the mixture to the required density while it is still in a workable condition. Equipment which causes excessive crushing of the aggregate shall not be used.

1.9 INFRARED HEAT GUN

The Contractor shall provide a new infrared heat gun suitable for measuring the asphalt temperature from the range of 65 degrees F to 550 degrees F with a sensitivity of 1 degree F. The infrared heat gun shall be readily available for Government use at all times. The Contractor shall use the infrared heat gun to determine the asphalt mix temperatures at the point of laydown for each truckload of hot mix asphalt that is dumped into the mechanical spreader and at the point of asphalt compaction.

1.10 CELLULAR TELEPHONES

The QC and the project superintendent shall have an operational cellular telephone. The Contractor shall provide an operational cellular telephone to the Government's Quality Assurance representative at least five days prior to construction of the test strip. The Contractor shall pay all fees and charges associated with the cellular phones including all monthly charges and usage fees throughout the duration of the project.

1.11 WEATHER LIMITATIONS

The hot-mix asphalt shall not be placed upon a wet surface or when the surface temperature of the underlying course is less than specified in Table 1. The temperature requirements may be waived by the Contracting Officer, if requested; however, all other requirements, including compaction, shall be met.

Table 1. Surface Temperature Limitations of Underlying Course

Mat Thickness, inches	Degrees F
3 or greater	40
Less than 3	45

PART 2 PRODUCTS

2.1 AGGREGATES

Aggregates shall consist of crushed stone, crushed gravel, screenings, natural sand and mineral filler, as required. The portion of material

retained on the No. 4 sieve is coarse aggregate. The portion of material passing the No. 4 sieve and retained on the No. 200 sieve is fine aggregate. The portion passing the No. 200 sieve is defined as mineral filler. All aggregate test results shall be submitted to the Contracting Officer at least 14 days prior to start of construction. All aggregate samples shall be submitted to the Contracting Officer at least 14 days prior to start of construction, if requested by the Contracting Officer.

2.1.1 Coarse Aggregate

Coarse aggregate shall consist of sound, tough, durable particles, free from films of material that would prevent thorough coating and bonding with the asphalt material and free from organic matter and other deleterious substances. The coarse aggregate particles shall meet the following requirements:

a. The percentage of loss shall not be greater than 40 percent after 500 revolutions when tested in accordance with ASTM C 131.

b. The percentage of loss shall not be greater than 18 percent after five cycles when tested in accordance with ASTM C 88 using magnesium sulfate.

c. At least 75 percent by weight of coarse aggregate shall have at least two or more freshly fractured faces when tested in accordance with COE CRD-C 171. Fractured faces shall be produced by crushing.

d. The particle shape shall be essentially cubical and the aggregate shall not contain more than 20 percent, by weight, of flat and elongated particles (3:1 ratio of maximum to minimum) when tested in accordance with ASTM D 4791.

2.1.2 Fine Aggregate

Fine aggregate shall consist of clean, sound, tough, durable particles. The aggregate particles shall be free from coatings of clay, silt, or any objectionable material and shall contain no clay balls. The fine aggregate particles shall meet the following requirements:

a. The quantity of natural sand (noncrushed material) added to the aggregate blend shall not exceed 15 percent by weight of total aggregate.

b. The fine aggregate shall have a sand equivalent value greater than 45 when tested in accordance with ASTM D 2419.

c. The fine aggregate portion of the blended aggregate shall have an uncompacted void content greater than 45.0 percent when tested in accordance with ASTM C 1252 Method A.

2.1.3 Mineral Filler

Mineral filler shall be nonplastic material meeting the requirements of ASTM D 242.

2.1.4 Aggregate Gradation

The combined aggregate gradation shall conform to the gradation specified in Table 2, when tested in accordance with ASTM C 136 and ASTM C 117, and

shall not vary from the low limit on one sieve to the high limit on the adjacent sieve or vice versa, but graded uniformly from coarse to fine.

Table 2. Aggregate Gradations

Sieve Size, inch	Gradation 1/2 inch Nominal Percent Passing by Mass
1	---
3/4	100
1/2	76-96
3/8	69-89
No. 4	53-73
No. 8	38-60
No. 16	26-48
No. 30	18-38
No. 50	11-27
No. 100	6-18
No. 200	3-6

2.2 ASPHALT CEMENT BINDER

Asphalt cement binder shall be modified with 3 percent styrene-butadiene-styrene (SBS) and shall conform to Table 3. Test data shall be provided by the supplier at the time of delivery of each load to the mix plant. The supplier is defined as the last source of any modification to the binder. Copies of test data shall be submitted to the Contracting Officer. The Contracting Officer may sample and test the binder at any time before or during mix production. In addition, if requested by the Contracting Officer, samples shall be obtained by the Contractor in accordance with ASTM D 140 and in the presence of the Contracting Officer and shall be furnished to the Contracting Officer for possible verification testing, which shall be at no cost to the Contractor.

TABLE 3
Asphalt Cement Requirements (3% SBS)

Property	ASTM Test Method	SBS Modified Asphalt
1. Viscosity, 60 deg C	ASTM D 2171	----
2. Viscosity, 135 deg C min.cSt	ASTM D 2170	450
3. Penetration, 25 deg C 100 g, 5 s, min	ASTM D 5	50
4. Penetration, 4 deg C 200 g, 60 sec dmn, min	ASTM D 5	25
5. Flash Point, (Cleveland open cup)	ASTM D 92	232
6. Solubility in trichloro-ethylene, min, percent	ASTM D 2042	99.0
7. Ductility, 25 deg C 5cm/min; min, cm	ASTM D 113	60
8. Ductility, 4 deg C cm/min; cm, min	ASTM D 113	40
9. Pen-Vis Number (PVN), Min	See Note Below	-0.1
10. Ring and Ball Softening Point, deg C, min	ASTM D 36	54
11. Synthetic Rubber		3.0

Asphalt Cement Requirements (3% SBS)

Property	ASTM Test Method	SBS Modified Asphalt
Tests on Residue/Rolling Thin Film Oven (ASTM D 2872):		
12. Viscosity, 135 deg C min, cSt	ASTM D 2170	550
13. Penetration, 4 C 200g, 60 sec; dmn, Min	ASTM D 5	15
14. Ductility, 4 C, cm/min; Min	ASTM D 113	30

Note: The Pen-Vis number (PVN) is a measure of temperature susceptibility proposed by McLeod. The general PVN equation is as follows:

$$PVN = \frac{(L-X)\ (-1.5)}{(L-M)}$$

where
L= 4.25800 - .79674 Log (Penetration @ 25 deg C, 0.1 mm)
X= Log of (Viscosity in cSt @ 135 deg C)
M= 3.46289 - .61094 Log (Pentration @ 25 deg C, 0.1 mm)

McLeod, N. W., "Using Paving Asphalt Rheology to Repair or Improve Asphalt Pavement Design and Performance"

2.2.1 Mixing

SBS modifier shall be added to the asphalt cement in an approved mixer according to the manufacturer's requirements under supervised and controlled plant conditions, such as the asphalt refinery or the asphalt cement manufacturing plant to produce a uniform homogeneous mixture. Field mixing is prohibited.

2.3 MIX DESIGN

The Contractor's Corps of Engineer's approved laboratory shall develop the mix design. The asphalt mix shall be composed of a mixture of well-graded aggregate, mineral filler if required, a minimum of .75% (by weight of the asphalt material) antistripping agent, and SBS modified asphalt material. The aggregate fractions shall be sized, handled in separate size groups, and combined in such proportions that the resulting mixture meets the grading requirements of the job mix formula (JMF). No hot-mix asphalt for payment shall be produced until a JMF has been approved. The hot-mix asphalt shall be designed using procedures contained in AI MS-2 and the criteria shown in Table 4.

2.3.1 Antistripping Agent

The Tensile Strength Ratio (TSR) of the composite mixture, as determined by ASTM D 4867/D 4867M shall be greater than 75. Non-strip additive shall be added in the amount of .75% of the total weight of the asphalt at the refinery or more as necessary to meet the required TSR. The amount of anti-stripping agent added, in addition to the .75% required, shall be sufficient to produce a TSR of not less than 75. If additional antistrip agent is required, it shall be provided by the Contractor at no additional cost.

2.3.2 JMF Requirements

The job mix formula (JMF) shall be submitted in writing by the Contractor for approval at least 14 days prior to the start of the test section and shall include as a minimum:

a. Percent passing each sieve size.

b. Percent of asphalt cement.

c. Percent of each aggregate and mineral filler to be used.

d. Asphalt test data indicating compliance with the requirements of Table 3.

e. Number of blows of hammer per side of molded specimen.

f. Laboratory mixing temperature.

g. Lab compaction temperature.

h. Temperature-viscosity relationship of the asphalt cement.

i. Plot of the combined gradation on the 0.45 power gradation chart, stating the nominal maximum size.

j. Graphical plots of stability, flow, air voids, voids in the mineral aggregate, and unit weight versus asphalt content as shown in AI MS-2.

k. Specific gravity and absorption of each aggregate.

l. Percent natural sand.

m. Percent particles with two or more fractured faces (in coarse aggregate).

n. Fine aggregate angularity.

o. Percent flat or elongated particles (in coarse aggregate).

p. Tensile Strength Ratio.

q. Antistrip agent and amount.

r. List of all modifiers and amount.

s. Results of aggregate quality tests.

Table 4. Marshall Design Criteria

Test Property	75 Blow Mix
Stability, pounds minimum	*2150
Flow, 0.01 inch	8-16
Air voids, percent	3-5

Table 4. Marshall Design Criteria

Test Property	75 Blow Mix
Percent Voids in mineral aggregate (minimum)	14**
TSR, minimum percent	75

* This is a minimum requirement. The average during construction shall be significantly higher than this number to ensure compliance with the specifications.

** Calculate VMA in accordance with AI MS-2, based on ASTM D 2726 bulk specific gravity for the aggregate.

2.3.3 Adjustments to JMF

The JMF for each mixture shall be in effect until a new formula is approved in writing by the Contracting Officer. Should a change in sources of any materials be made, a new mix design shall be performed and a new JMF approved before the new material is used. The Contractor will be allowed to adjust the JMF within the limits specified below to optimize mix volumetric properties, however all criteria shown in Table 4 shall be met. Adjustments to the JMF shall be limited to plus or minus 3 percent on the 1/2 inch, No. 4, and No. 8 sieves; plus or minus 1.0 percent on the No. 200 sieve; and plus or minus 0.25 percent binder content. If adjustments are needed that exceed these limits, a new mix design shall be developed. Tolerances given above may permit the aggregate grading to be outside the limits shown in Table 2; this is acceptable.

PART 3 EXECUTION

3.1 PREPARATION OF ASPHALT BINDER MATERIAL

The asphalt cement material shall be heated avoiding local overheating and providing a continuous supply of the asphalt material to the mixer at a uniform temperature. The temperature of modified asphalts shall be no more than 350 degrees F when added to the aggregates.

3.2 PREPARATION OF MINERAL AGGREGATE

The aggregate for the mixture shall be heated and dried prior to mixing. No damage shall occur to the aggregates due to the maximum temperature and rate of heating used. The temperature of the aggregate and mineral filler shall not exceed 350 degrees F when the asphalt cement is added. The temperature shall not be lower than is required to obtain complete coating and uniform distribution on the aggregate particles and to provide a mixture of satisfactory workability.

3.3 PREPARATION OF HOT-MIX ASPHALT MIXTURE

The aggregates and the asphalt cement shall be weighed or metered and introduced into the mixer in the amount specified by the JMF. The combined materials shall be mixed until the aggregate obtains a uniform coating of asphalt binder and is thoroughly distributed throughout the mixture. Wet

mixing time shall be the shortest time that will produce a satisfactory mixture, but no less than 25 seconds for batch plants. The wet mixing time for all plants shall be established by the Contractor, based on the procedure for determining the percentage of coated particles described in ASTM D 2489, for each individual plant and for each type of aggregate used. The wet mixing time will be set to at least achieve 95 percent of coated particles. The moisture content of all hot-mix asphalt upon discharge from the plant shall not exceed 0.5 percent by total weight of mixture as measured by ASTM D 1461.

3.4 PREPARATION OF THE UNDERLYING SURFACE

Immediately before placing the hot mix asphalt, the underlying course shall be cleaned of dust and debris. A prime coat shall be applied to graded crushed aggregate base course and a tack coat shall be applied to the surface of all AC courses in accordance with the contract drawings and specifications.

3.5 TEST SECTION

Prior to full production, the Contractor shall place a test section for each JMF used. The contractor shall construct a test section 250 - 500 feet long and two paver passes wide placed in two lanes, with a longitudinal cold joint. The test section shall be of the same depth as the course which it represents. The underlying grade or pavement structure upon which the test section is to be constructed shall be the same as the remainder of the course represented by the test section. The equipment used in construction of the test section shall be the same equipment to be used on the remainder of the course represented by the test section. The test section shall be placed as part of the project pavement as approved by the Contracting Officer.

3.5.1 Sampling and Testing for Test Section

One random sample shall be taken at the plant. Three specimens from the sample shall be compacted and tested for laboratory unit weight, stability, flow, and laboratory air voids. A portion of the same sample shall be tested for aggregate gradation and asphalt content. Four randomly selected cores shall be taken from the finished pavement mat, and four from the longitudinal joint, and tested for density. Random sampling shall be in accordance with procedures contained in ASTM D 3665. The test results shall be within the tolerances shown in Table 5 for work to continue. If all test results meet the specified requirements, the test section shall remain as part of the project pavement. If any test result exceeds the tolerances shown, the test section shall be removed and replaced at no cost to the Government and another test section shall be constructed.

Table 5. Test Section Requirements for Material and Mixture Properties

Property	Specification Limit
Aggregate Gradation-Percent Passing (Individual Test Result)	
No. 4 and larger	JMF plus or minus 8
No. 8, No. 16, No. 30, and No. 50	JMF plus or minus 6
No. 100 and No. 200	JMF plus or minus 2.0

Table 5. Test Section Requirements for Material and Mixture Properties

Property	Specification Limit
Asphalt Content, Percent (Individual Test Result)	JMF plus or minus 0.5
Laboratory Air Voids, Percent (Average of 3 specimens)	JMF plus or minus 1.0
VMA, Percent (Average of 3 specimens)	14 minimum
Stability, pounds (Average of 3 specimens)	2150 minimum
Flow, 0.01 inches (Average of 3 specimens)	8 - 16
Mat Density, Percent of Marshall (Average of 4 Random Cores)	97.0 - 100.5
Mat Density, Percent of TMD (Average of 4 Random Cores)	93.0 - 96.5
Joint Density, Percent of Marshall (Average of 4 Random Cores)	95.5 - 100.5
Joint Density, Percent of TMD (Average of 4 Random Cores)	91.5 - 96.5

3.5.2 Additional Test Sections

If the initial test section should prove to be unacceptable, the necessary adjustments to the JMF, plant operation, placing procedures, and/or rolling procedures shall be made. A second test section shall then be placed. Additional test sections, as required, shall be constructed and evaluated for conformance to the specifications. Full production shall not begin until an acceptable section has been constructed and accepted in writing by the Contracting Officer.

3.6 TESTING LABORATORY

The laboratory used to develop the JMF and the laboratory used for acceptance testing shall meet the requirements of ASTM D 3666 and be a Corps of Engineers Approved Laboratory. A certification signed by the manager of the laboratory stating that it meets these requirements or clearly listing all deficiencies shall be submitted to the Contracting Officer prior to the start of construction. The certification shall contain as a minimum:

a. Qualifications of personnel; laboratory manager, supervising technician, and testing technicians.

b. A listing of equipment to be used in developing the job mix.

c. A copy of the laboratory's quality control system.

3.7 TRANSPORTING AND PLACING

3.7.1 Transporting

The hot-mix asphalt shall be transported from the mixing plant to the site in clean, tight vehicles. Deliveries shall be scheduled so that placing and compacting of mixture is uniform with minimum stopping and starting of the paver. Adequate artificial lighting shall be provided for night placements. Hauling over freshly placed material will not be permitted until the material has been compacted as specified, and allowed to cool to 140 degrees F.

3.7.2 Placing

The mix shall be placed and compacted at a temperature suitable for obtaining density, surface smoothness, and other specified requirements. Upon arrival, the mixture shall be placed to the full width by an asphalt paver; it shall be struck off in a uniform layer of such depth that, when the work is completed, it shall have the required thickness and conform to the grade and contour indicated. The speed of the paver shall be regulated to eliminate pulling and tearing of the asphalt mat. Unless otherwise permitted, placement of the mixture shall begin along the centerline of a crowned section or on the high side of areas with a one-way slope. The mixture shall be placed in consecutive adjacent strips having a minimum width of 10 feet. The longitudinal joint in one course shall offset the longitudinal joint in the course immediately below by at least 1 foot. Transverse joints in one course shall be offset by at least 10 feet from transverse joints in the previous course. Transverse joints in adjacent lanes shall be offset a minimum of 10 feet. On isolated areas where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing equipment impractical, the mixture may be spread and luted by hand tools.

3.8 COMPACTION OF MIXTURE

After placing, the mixture shall be thoroughly and uniformly compacted by rolling. The surface shall be compacted as soon as possible without causing displacement, cracking or shoving. The sequence of rolling operations and the type of rollers used shall be at the discretion of the Contractor, with the exception that the Contractor shall not apply more than three passes with a vibratory roller in the vibrating mode. The speed of the roller shall, at all times, be sufficiently slow to avoid displacement of the hot mixture and be effective in compaction. Any displacement occurring as a result of reversing the direction of the roller, or from any other cause, shall be corrected at once. Sufficient rollers shall be furnished to handle the output of the plant. Rolling shall continue until the surface is of uniform texture, true to grade and cross section, and the required field density is obtained. To prevent adhesion of the mixture to the roller, the wheels shall be kept properly moistened but excessive water will not be permitted. In areas not accessible to the roller, the mixture shall be thoroughly compacted with hand tampers. Any mixture that becomes loose and broken, mixed with dirt, contains check-cracking, or is in any way defective shall be removed full depth, replaced with fresh hot mixture and immediately compacted to conform to the surrounding area. This work shall be done at the Contractor's expense. Skin patching will not be allowed.

3.9 JOINTS

The formation of joints shall be made ensuring a continuous bond between the courses and to obtain the required density. All joints shall have the same texture as other sections of the course and meet the requirements for smoothness and grade.

3.9.1 Transverse Joints

The roller shall not pass over the unprotected end of the freshly laid mixture, except when necessary to form a transverse joint. When necessary to form a transverse joint, it shall be made by means of placing a bulkhead or by tapering the course. The tapered edge shall be cut back to its full depth and width on a straight line to expose a vertical face prior to placing the adjacent lane. The cutback material shall be removed from the project. In both methods, all contact surfaces shall be given a light tack coat of asphalt material before placing any fresh mixture against the joint.

3.9.2 Longitudinal Joints

Longitudinal joints, unless paving in tandem and the joint is 175 degrees F or hotter, shall be cut back a minimum of 2 inches from the edge with a cutting wheel to expose a clean, sound vertical surface for the full depth of the course. All cutback material shall be removed from the project. All contact surfaces shall be given a light tack coat of asphalt material prior to placing any fresh mixture against the joint.

3.10 CONTRACTOR QUALITY CONTROL

3.10.1 General Quality Control Requirements

The Contractor shall develop an approved Quality Control Plan for placing and testing hot-mix asphalt. Hot-mix asphalt for payment shall not be produced until the quality control plan has been approved. The plan shall address all elements which affect the quality of the pavement including, but not limited to:

a. Mix Design

b. Aggregate Grading

c. Quality of Materials

d. Stockpile Management

e. Proportioning

f. Mixing and Transportation

g. Mixture Volumetrics

h. Moisture Content of Mixtures

i. Placing and Finishing

j. Joints

k. Compaction

l. Surface Smoothness

m. Testing

3.10.2 Testing Laboratory

The Contractor shall obtain the services of a Corps of Engineers Approved Commercial Laboratory to provide and operate a fully equipped asphalt laboratory located at the plant or job site. The effective working area of the laboratory shall be a minimum of 150 square feet with a ceiling height of not less than 7.5 feet. Lighting shall be adequate to illuminate all working areas. It shall be equipped with heating and air conditioning units to maintain a temperature of 75 degrees F plus or minus 5 degrees F. Laboratory facilities shall be kept clean and all equipment shall be maintained in proper working condition. The Contracting Officer and any agents under his direction shall be permitted unrestricted access to inspect the Contractor's laboratory facility, to witness quality control activities, and to perform any check testing desired. The Contracting Officer will advise the Contractor in writing of any noted deficiencies concerning the laboratory facility, equipment, supplies, or testing personnel and procedures. When the deficiencies are serious enough to adversely affect test results, the incorporation of the materials into the work shall be suspended immediately and will not be permitted to resume until the deficiencies are corrected.

3.10.3 Quality Control Testing

The Contractor shall perform all quality control tests applicable to these specifications and as set forth in the Quality Control Program. The testing program shall include, but shall not be limited to, tests for the control of asphalt content, aggregate gradation, temperatures, aggregate moisture, moisture in the asphalt mixture, laboratory air voids, stability, flow, in-place density, grade and smoothness. A Quality Control Testing Plan shall be developed as part of the Quality Control Program.

3.10.3.1 Asphalt Content

A minimum of two tests to determine asphalt content will be performed per lot (a lot is defined in paragraph MATERIAL ACCEPTANCE AND PERCENT PAYMENT) by one of the following: the extraction method in accordance with ASTM D 2172, Method A or B, the ignition method in accordance with the AASHTO TP53, ASTM D 6307or the nuclear method in accordance with ASTM D 4125, provided the nuclear gauge is calibrated for the specific mix being used. For the extraction method, the weight of ash, as described in ASTM D 2172, shall be determined as part of the first extraction test performed at the beginning of plant production; and as part of every tenth extraction test performed thereafter, for the duration of plant production. The last weight of ash value obtained shall be used in the calculation of the asphalt content for the mixture.

3.10.3.2 Gradation

Aggregate gradations shall be determined a minimum of twice per lot from mechanical analysis of recovered aggregate in accordance with ASTM D 5444. When asphalt content is determined by the nuclear method, aggregate gradation shall be determined from hot bin samples on batch plants, or from the cold feed on drum mix plants. For batch plants, aggregates shall be tested in accordance with ASTM C 136 using actual batch weights to determine the combined aggregate gradation of the mixture.

3.10.3.3 Temperatures

Temperatures shall be checked at least four times per lot, at necessary locations, to determine the temperature at the dryer, the asphalt cement in the storage tank, the asphalt mixture at the plant, and the asphalt mixture at the job site.

3.10.3.4 Aggregate Moisture

The moisture content of aggregate used for production shall be determined a minimum of once per lot in accordance with ASTM C 566.

3.10.3.5 Moisture Content of Mixture

The moisture content of the mixture shall be determined at least once per lot in accordance with ASTM D 1461 or an approved alternate procedure.

3.10.3.6 Laboratory Air Voids, Marshall Stability, Density and Flow

Mixture samples shall be taken at least four times per lot and compacted into specimens, using 75 blows per side with the Marshall hammer as described in ASTM D 1559. After compaction, the laboratory air voids of each specimen shall be determined, as well as the Marshall stability, Density and flow.

3.10.3.7 In-Place Density

The Contractor shall conduct any necessary testing to ensure the specified density is achieved. A nuclear gauge may be used to monitor pavement density in accordance with ASTM D 2950.

3.10.3.8 Grade and Smoothness

The Contractor shall conduct the necessary checks to ensure the grade and smoothness requirements are met in accordance with paragraph MATERIAL ACCEPTANCE AND PERCENT PAYMENT.

3.10.3.9 Additional Testing

Any additional testing, which the Contractor deems necessary to control the process, may be performed at the Contractor's option.

3.10.3.10 QC Monitoring

The Contractor shall submit all QC test results to the Contracting Officer on a daily basis as the tests are performed. The Contracting Officer reserves the right to monitor any of the Contractor's quality control testing and to perform duplicate testing as a check to the Contractor's quality control testing.

3.10.4 Sampling

When directed by the Contracting Officer, the Contractor shall sample and test any material which appears inconsistent with similar material being produced, unless such material is voluntarily removed and replaced or deficiencies corrected by the Contractor. All sampling shall be in accordance with standard procedures specified.

3.10.5 Control Charts

For process control, the Contractor shall establish and maintain linear control charts on both individual samples and the running average of last four samples for the parameters listed in Table 6, as a minimum. These control charts shall be posted as directed by the Contracting Officer and shall be kept current at all times. The control charts shall identify the project number, the test parameter being plotted, the individual sample numbers, the Action and Suspension Limits listed in Table 6 applicable to the test parameter being plotted, and the Contractor's test results. Target values from the JMF shall also be shown on the control charts as indicators of central tendency for the cumulative percent passing, asphalt content, and laboratory air voids parameters. When the test results exceed either applicable Action Limit, the Contractor shall take immediate steps to bring the process back in control. When the test results exceed either applicable Suspension Limit, the Contractor shall halt production until the problem is solved. The Contractor shall use the control charts as part of the process control system for identifying trends so that potential problems can be corrected before they occur. Decisions concerning mix modifications shall be made based on analysis of the results provided in the control charts. The Quality Control Plan shall indicate the appropriate action which shall be taken to bring the process into control when certain parameters exceed their Action Limits.

Table 6. Action and Suspension Limits for the Parameters to be Plotted on Individual and Running Average Control Charts

	Individual Samples		Running Average of Last Four Samples	
Parameter to be Plotted	Action Limit	Suspension Limit	Action Limit	Suspension Limit
No. 4 sieve, Cumulative % Passing, deviation from JMF target; plus or minus values	6	8	4	5
No. 30 sieve, Cumulative % Passing, deviation from JMF target; plus or minus values	4	6	3	4
No. 200 sieve, Cumulative % Passing, deviation from JMF target; plus or minus values	1.4	2.0	1.1	1.5
Stability, pounds (minimum)	1760	1640	2150	2030
Flow, 0.01 inches	8 min. 16 max.	7 min. 17 max.	9 min. 15 max.	8 min. 16 max.
Asphalt content, % deviation from JMF target; plus or minus value	0.4	0.5	0.2	0.3
Laboratory Air Voids, % deviation from JMF target value	No specific action and suspension limits set since this parameter is used to determine percent payment			

Table 6. Action and Suspension Limits for the Parameters to be Plotted on Individual and Running Average Control Charts

	Individual Samples		Running Average of Last Four Samples	
Parameter to be Plotted	Action Limit	Suspension Limit	Action Limit	Suspension Limit
In-place Mat Density, % of Marshall density	No specific action and suspension limits set since this parameter is used to determine percent payment			
In-place Joint Density, % of Marshall density	No specific action and suspension limits set since this parameter is used to determine percent payment			

3.11 MATERIAL ACCEPTANCE AND PERCENT PAYMENT

Testing for acceptability of work will be separate and distinct from the Contractor's Quality Control testing and will be performed by an independent Corps of Engineers Approved laboratory hired by the Contractor, except for smoothness testing which shall be performed by the Contractor. Acceptance of the plant produced mix and in-place requirements will be on a lot to lot basis. A standard lot will be equal to approximately 10,000 square yards of 2-inch thick asphalt concrete. The 2-inch thick bottom course and the 2-inch thick surface course in areas requiring 4-inch thick asphalt shall be separate lots. Lots comprising the 2-inch thick bottom course will only be evaluated for in-place density and laboratory air voids. Lots comprising the 2-inch thick surface course, including those of the shoulders, will be evaluated for in-place density, laboratory air voids, grade, smoothness and thickness. Thickness measurements will be based on the entire thickness (including the bottom 2-inch course, where applicable) of new asphalt concrete. Where appropriate, adjustment in payment for individual lots comprising the bottom 2-inch course will be based on in-place density and laboratory air voids. Adjustments in payment for individual lots comprising all surface courses of 2-inch asphalt concrete, including the 2-inch thick shoulder pavement, will be based on in-place density, laboratory air voids, grade, smoothness, and thickness. Thickness measurements shall be based on the total thickness of new asphalt concrete, however, the pay factor for thickness, shall only be applied to the surface lots. In order to evaluate laboratory air voids and, in-place (field) density, each lot will be divided into four equal sublots. In order to evaluate thickness, each of the surface lots will be divided into four equal sublots. Grade and surface smoothness determinations will be made on each of the surface lots as a whole.

3.11.1 Percent Payment

When a lot of material fails to meet the specification requirements for 100 percent pay as outlined in the following paragraphs, that lot shall be removed and replaced, or accepted at a reduced price which will be computed by multiplying the unit price by the lot's pay factor. The lot pay factor is determined by taking the lowest computed pay factor based on either laboratory air voids, in-place density, grade, smoothness or thickness (each discussed below). Pay factors based on different criteria (i.e.,

laboratory air voids and in-place density) of the same lot will not be multiplied together to get a lower lot pay factor. At the end of the project, an average of all lot pay factors will be calculated. If this average lot pay factor exceeds 95.0 percent, and no individual lot has a pay factor less than 75.1 percent, then the percent payment for the entire project will be 100 percent of the unit bid price. If the average lot pay factor is equal to or less than 95.0 percent, then each lot will be paid for at the unit price multiplied by the lot's pay factor. For any lots which are less than or larger than the standard lot size a weighted lot pay factor will be used to calculate the average lot pay factor.

3.11.2 Sublot Sampling

One random mixture sample for determining laboratory air voids, theoretical maximum density, aggregate gradation, asphalt content, stability, and flow will be taken from a loaded truck delivering mixture to each sublot, or other appropriate location for each sublot. All samples will be selected randomly, using commonly recognized methods of assuring randomness conforming to ASTM D 3665 and employing tables of random numbers or computer programs. Laboratory air voids will be determined from three laboratory compacted specimens of each sublot sample compacted in accordance with ASTM D 1559 using 75 blows per side. The specimens will be compacted within 2 hours of the time the mixture was loaded into trucks at the asphalt plant. Samples will not be reheated prior to compaction and insulated containers will be used as necessary to maintain the temperature.

3.11.3 Additional Sampling and Testing

The Contracting Officer reserves the right to direct additional samples and tests for any area which appears to deviate from the specification requirements. The cost of any additional testing will be paid for by the Contractor. Testing in these areas will be in addition to the lot testing, and the requirements for these areas will be the same as those for a lot.

3.11.4 Laboratory Air Voids

Laboratory air voids will be calculated in accordance with ASTM D 3203 by determining the Marshall density of each lab compacted specimen using ASTM D 2726 and determining the theoretical maximum density of every other sublot sample using ASTM D 2041. Laboratory air void calculations for each sublot will use the latest theoretical maximum density values obtained, either for that sublot or the previous sublot. The mean absolute deviation of the four laboratory air void contents (one from each sublot) from the JMF air void content will be evaluated and a pay factor determined from Table 7. All laboratory air void tests will be completed and reported within 24 hours after completion of construction of each lot. The TMD is also used for computation of compaction, as required in paragraph: Mat and Joint Densities.

3.11.5 Mean Absolute Deviation

An example of the computation of mean absolute deviation for laboratory air voids is as follows: Assume that the laboratory air voids are determined from 4 random samples of a lot (where 3 specimens were compacted from each sample). The average laboratory air voids for each sublot sample are determined to be 3.5, 3.0, 4.0, and 3.7. Assume that the target air voids from the JMF is 4.0. The mean absolute deviation is then:

Mean Absolute Deviation = (|3.5 - 4.0| + |3.0 - 4.0| + |4.0 - 4.0| + |3.7 -

4.0|)/4

= (0.5 + 1.0 + 0.0 + 0.3)/4 = (1.8)/4 = 0.45

The mean absolute deviation for laboratory air voids is determined to be 0.45. It can be seen from Table 7 that the lot's pay factor based on laboratory air voids, is 100 percent.

Table 7. Pay Factor Based on Laboratory Air Voids

Mean Absolute Deviation of Lab Air Voids from JMF	Pay Factor, %
0.60 or less	100
0.61 - 0.80	98
0.81 - 1.00	95
1.01 - 1.20	90
Above 1.20	reject (0)

3.11.6 In-place Density

3.11.6.1 General Density Requirements

For determining in-place density, one random core will be taken by the Contractor from the mat (interior of the lane) of each sublot, and one random core will be taken from the joint (immediately over joint) of each sublot. Each random core will be full thickness of the course being placed. If a random core is less than 1 inch thick, it will not be included in the analysis. In this case, another random core will be taken. After air drying in accordance with ASTM D 2726 for laboratory-prepared, thoroughly dry specimens, cores obtained from the mat and from the joints will be used for in-place density determination.

3.11.6.2 Mat and Joint Densities

The average in-place mat and joint densities are expressed as a percentage of the average TMD for the lot. The average TMD for each lot will be determined as the average TMD of the two random samples per lot. The TMD for each lot will be determined as the average TMD of the two random samples (3 specimens compacted per sample). The average in-place mat density and joint density for a lot are determined and compared with Table 8 to calculate a single pay factor per lot based on in-place density, as described below. First, a pay factor for both mat density and joint density are determined from Table 8. The area associated with the joint is then determined and will be considered to be 10 feet wide times the length of completed longitudinal construction joint in the lot. This area will not exceed the total lot size. The length of joint to be considered will be that length where a new lane has been placed against an adjacent lane of hot-mix asphalt pavement, either an adjacent freshly paved lane or one paved at any time previously. The area associated with the joint is expressed as a percentage of the total lot area. A weighted pay factor for the joint is determined based on this percentage (see example below). The pay factor for mat density and the weighted pay factor for joint density is compared and the lowest selected. This selected pay factor is the pay factor based on density for the lot. When the TMD on both sides of a longitudinal joint is different, the average of these two TMD will be used as the TMD needed to calculate the percent joint density. All density results for a lot will be completed and reported within 24 hours after the construction of that lot.

Table 8. Pay Factor Based on In-place Density

Average Mat Density (4 Cores)	Pay Factor, %	Average Joint Density (4 Cores)
94.0 - 96.0	100.0	Above 92.5
93.9	100.0	92.4
93.8 or 96.1	99.9	92.3
93.7	99.8	92.2
93.6 or 96.2	99.6	92.1
93.5	99.4	92.0
93.4 or 96.3	99.1	91.9
93.3	98.7	91.8
93.2 or 96.4	98.3	91.7
93.1	97.8	91.6
93.0 or 96.5	97.3	91.5
92.9	96.3	91.4
92.8 or 96.6	94.1	91.3
92.7	92.2	91.2
92.6 or 96.7	90.3	91.1
92.5	87.9	91.0
92.4 or 96.8	85.7	90.9
92.3	83.3	90.8
92.2 or 96.9	80.6	90.7
92.1	78.0	90.6
92.0 or 97.0	75.0	90.5
below 92.0, above 97.0	0.0 (reject)	below 90.5

3.11.6.3 Pay Factor Based on In-place Density

An example of the computation of a pay factor (in I-P units only) based on in-place density, is as follows: Assume the following test results for field density made on the lot: (1) Average mat density = 97.2 percent (of lab density). (2) Average joint density = 95.5 percent (of lab density). (3) Total area of lot = 30,000 square feet. (4) Length of completed longitudinal construction joint = 2000 feet.

a. Step 1: Determine pay factor based on mat density and on joint density, using Table 8:

Mat density of 97.2 percent = 98.3 pay factor.

Joint density of 95.5 percent = 97.3 pay factor.

b. Step 2: Determine ratio of joint area (length of longitudinal joint x 10 ft) to mat area (total paved area in the lot): Multiply the length of completed longitudinal construction joint by the specified 10 ft. width and divide by the mat area (total paved area in the lot).

(2000 ft. x 10 ft.)/30000 sq.ft. = 0.6667 ratio of joint area to mat area (ratio).

c. Step 3: Weighted pay factor (wpf) for joint is determined as indicated below:

wpf = joint pay factor + (100 - joint pay factor) (1 - ratio) wpf = 97.3 + (100-97.3) (1-.6667) = 98.2%

d. Step 4: Compare weighted pay factor for joint density to pay factor for mat density and select the smaller:

Pay factor for mat density: 98.3%. Weighted pay factor for joint density: 98.2%

Select the smaller of the two values as pay factor based on density: 98.2%

3.11.7 Grade

Within 5 working days after completion of a particular lot incorporating the final wearing course, the Contractor shall test the final wearing surface of the pavement for conformance with specified plan grade requirements. All testing shall be performed in the presence of the Contracting Officer Engineer. The final wearing surface of pavement shall conform to the elevations and cross sections shown and shall vary not more than 0.03 foot from the plan grade. Finished surfaces at juncture with other pavements shall coincide with finished surfaces of abutting pavements within plus 1/16" and minus 0.00". Deviation from the plan elevation will not be permitted in areas of pavements where closer conformance with planned elevation is required for the proper functioning of drainage and other appurtenant structures involved. The final wearing surface of the pavement will be tested for conformance with specified plan grade requirements. The grade will be determined by running lines of levels at intervals of 25 feet, or less, longitudinally and transversely, to determine the elevation of the completed pavement surface. Within 5 working days, after the completion of a particular lot incorporating the final wearing surface, the Contractor will inform the Contracting Officer in writing, of the results of the grade-conformance tests. When more than 5 percent of all measurements made within a lot are outside the 0.03 foot tolerance, the pay factor based on grade for that lot will be 95 percent. In areas where the grade exceeds the tolerance by more than 50 percent, the Contractor shall remove the surface lift full depth; the Contractor shall then replace the lift with hot-mix asphalt to meet specification requirements, at no additional cost to the Government. Diamond grinding may be used to remove high spots to meet grade requirements. Skin patching for correcting low areas or planing or milling for correcting high areas will not be permitted.

3.11.8 Thickness

Each of the final wearing surface lots of pavement will be evaluated for acceptance and payment adjustment in accordance with the following procedure. The Contractor shall be responsible for drilling the cores, measuring the cores in the presence of the Contracting Officer, and for filling the core holes as directed.

3.11.8.1 Drilling, Measuring, and Computations

One core, per sublot, 4-inches in diameter and for the full thickness of the new asphalt concrete (theoretically 4-inches for taxiway and aprons and 2-inches for shoulders) shall be drilled from the pavement. The cores shall be evaluated for thickness of the asphalt concrete in accordance with ASTM D 3549. The pavement thickness from the four cores for the lot shall be averaged.

3.11.8.2 Pay Factor Based on Thickness (4-inch Thick Asphalt Concrete)

Using the average thickness of the four cores, the pay factor based on thickness for the apron and taxiway surface lots (4-inch asphalt concrete placed in two 2-inch courses) shall be determined in accordance with Table 9.

Table 9. Pay factor Based on Thickness (4-inch Thick Asphalt Concrete)

Average Thickness Determined by Cores mm	Pay Factor %
Greater than 4-inch	100
3-13/16 to 4-inches	100
3-11/16 to 3-12/16	95
3-10/16 to 3-11/16	90
3-7/16 to 3-9/16	75
Less than 3-7/16	Reject (0)

3.11.8.3 Pay Factor Based on Thickness (2-inch Thick Asphalt Concrete)

Using the average thickness of the four cores, the pay factor based on thickness for the apron and taxiway shoulders (2-inch thick new asphalt concrete) shall be determined in accordance with Table 10.

Table 10. Pay factor Based on Thickness (2-inch Thick Asphalt Concrete)

Average Thickness Determined by Cores mm	Pay Factor %
Greater than 2-inch	100
1-13/16 to 2-inch	100
1-11/16 to 1-12/16	90
1-9/16 to 1-10/16	75
Less than 1-9/16	Reject (0)

3.11.9 Surface Smoothness

The Contractor shall use both of the following methods to test and evaluate surface smoothness of the pavement. All testing shall be performed in the presence of the Contracting Officer. Detailed notes of the results of the testing shall be kept and a copy furnished to the Government immediately after each day's testing. The profilograph method shall be used for all longitudinal testing, except where the runs would be less than 200 feet in length and the ends where the straightedge shall be used. Where drawings show required deviations from a plane surface (crowns, drainage inlets, etc.), the surface shall be finished to meet the approval of the Contracting Officer.

3.11.9.1 Smoothness Requirements

a. Straightedge Testing: The finished surfaces of the pavements shall have no abrupt change of 1/8 inch or more, and all pavements shall be within the tolerances specified in Table 11 when checked with an approved 12 foot straightedge.

Table 11. Straightedge Surface Smoothness--Pavements

Pavement Category	Direction of Testing	Tolerance, inches
Aprons and taxiways	Longitudinal	1/8
	Transverse	1/4
Airfield Shoulders	Longitudinal	1/4
	Transverse	1/4

b. Profilograph Testing: The finished surfaces of the pavements shall have no abrupt change of 1/8 inch or more, and all pavement shall have a Profile Index not greater than specified in Table 12 when tested with an approved California-type profilograph. If the extent of the pavement in either direction is less than 200 feet, that direction shall be tested by the straightedge method and shall meet requirements specified above.

Table 12. Profilograph Surface Smoothness--Pavements

Pavement Category	Direction of Testing	Maximum Specified Profile Index (inch/mile)
Aprons and Taxiways	Longitudinal	9
	Transverse	(Use Straightedge)
Airfield Shoulders	Longitudinal	9
	Transverse	(Use Straightedge)

3.11.9.2 Testing Method

After the final rolling, but not later than 24 hours after placement, the final wearing surface lots shall be tested by the Contractor in such a manner as to reveal all surface irregularities exceeding the tolerances specified above. Separate testing of individual sublots is not required. If any pavement areas are ground, these areas shall be retested immediately after grinding. The entire area of the pavement shall be tested in both a longitudinal and a transverse direction on parallel lines. The transverse lines shall be 15 feet or less apart, as directed. The longitudinal lines shall be at the centerline of each paving lane for lanes less than 20 feet and at the third points for lanes 20 feet or greater. Other areas having obvious deviations shall also be tested. Longitudinal testing lines shall be continuous across all joints.

a. Straightedge Testing. The straightedge shall be held in contact with the surface and moved ahead one-half the length of the straightedge for each successive measurement. The amount of surface irregularity shall be determined by placing the freestanding (unleveled) straightedge on the pavement surface and allowing it to rest upon the two highest spots covered by its length, and measuring the maximum gap between the straightedge and the pavement surface in the area between these two high points.

b. Profilograph Testing. Profilograph testing shall be performed using approved equipment and procedures described in CDT Test 526. The equipment shall utilize electronic recording and automatic computerized

reduction of data to indicate "must-grind" bumps and the Profile Index for the pavement. The "blanking band" shall be 0.2 inches wide and the "bump template" shall span 1 inch with an offset of 0.4 inch. The profilograph shall be operated by an approved, factory-trained operator on the alignments specified above. A copy of the reduced tapes shall be furnished the Government at the end of each day's testing.

3.11.9.3 Payment Adjustment for Smoothness

a. Straightedge Testing. Location and deviation from straightedge for all measurements shall be recorded. When between 5.0 and 10.0 percent of all measurements made within a lot exceed the tolerance specified in paragraph Smoothness Requirements above, after any reduction of high spots or removal and replacement, the computed pay factor for that lot based on surface smoothness, will be 95 percent. When more than 10.0 percent of all measurements exceed the tolerance, the computed pay factor will be 90 percent. When between 15.0 and 20.0 percent of all measurements exceed the tolerance, the computed pay factor will be 75 percent. When 20.0 percent or more of the measurements exceed the tolerance, the lot shall be removed and replaced at no additional cost to the Government. Regardless of the above, any small individual area with surface deviation which exceeds the tolerance given above by more than 50 percent, shall be corrected by diamond grinding to meet the specification requirements above or shall be removed and replaced at no additional cost to the Government.

b. Profilograph Testing. Location and data from all profilograph measurements shall be recorded. When the Profile Index of a lot exceeds the tolerance specified in paragraph Smoothness Requirements above by 1.0 inch/mile, but less than 2.0 inches/mile, after any reduction of high spots or removal and replacement, the computed pay factor for that lot based on surface smoothness will be 95 percent. When the Profile Index exceeds the tolerance by 2.0 inches/mile, but less than 3.0 inches/mile, the computed pay factor will be 90 percent. When the Profile Index exceeds the tolerance by 3.0 inches/mile, but less than 4.0 inches/mile, the computed pay factor will be 75 percent. When the Profile Index exceeds the tolerance by 4.0 inches/mile or more, the lot shall be removed and replaced at no additional cost to the Government. Regardless of the above, any small individual area with surface deviation which exceeds the tolerance given above by more than 5.0 inches/mile or more, shall be corrected by grinding to meet the specification requirements above or shall be removed and replaced at no additional cost to the Government.

c. Bumps ("Must Grind" Areas). Any bumps ("must grind" areas) shown on the profilograph trace which exceed 0.4 inch in height shall be reduced by diamond grinding until they do not exceed 0.3 inch when retested. Such grinding shall be tapered in all directions to provide smooth transitions to areas not requiring grinding. The following will not be permitted: (1) skin patching for correcting low areas, (2) planing or milling for correcting high areas. At the Contractor's option, pavement areas, including ground areas, may be rechecked with the profilograph in order to record a lower Profile Index.

-- End of Section --

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SECTION 02753

CONCRETE PAVEMENT FOR AIRFIELDS AND OTHER HEAVY-DUTY PAVEMENTS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ACI INTERNATIONAL (ACI)

ACI 211.1	(1991) Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
ACI 214.3R	(1988; R 1997) Simplified Version of the Recommended Practice for Evaluation of Strength Test Results of Concrete
ACI 305R	(1999) Hot Weather Concreting

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO M 182	(1991; R 1996) Burlap Cloth Made from Jute or Kenaf

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 53/A 53M	(2002) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 184/A 184M	(2001) Fabricated Deformed Steel Bar Mats for Concrete Reinforcement
ASTM A 615/A 615M	(2001b) Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM A 616/A 616M	(1996) Rail-Steel Deformed and Plain Bars for Concrete Reinforcement
ASTM A 617/A 617M	(1996) Axle-Steel Deformed and Plain Bars for Concrete Reinforcement
ASTM C 31/C 31M	(2000e1) Making and Curing Concrete Test Specimens in the Field
ASTM C 33	(1999ae1) Concrete Aggregates
ASTM C 39/C 39M	(2001) Compressive Strength of Cylindrical Concrete Specimens

ASTM C 78	(1994) Flexural Strength of Concrete (Using Simple Beam With Third-Point Loading)
ASTM C 94/C 94M	(2000e2) Ready-Mixed Concrete
ASTM C 117	(1995) Materials Finer than 75 micrometer (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C 123	(1998) Lightweight Particles in Aggregate
ASTM C 131	(2001) Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C 136	(2001) Sieve Analysis of Fine and Coarse Aggregates
ASTM C 142	(1997) Clay Lumps and Friable Particles in Aggregates
ASTM C 143/C 143M	(2000) Slump of Hydraulic Cement Concrete
ASTM C 150	(1999a) Portland Cement
ASTM C 172	(1999) Sampling Freshly Mixed Concrete
ASTM C 174/C 174M	(1997) Measuring Thickness of Concrete Elements Using Drilled Concrete Cores
ASTM C 192/C 192M	(2000) Making and Curing Concrete Test Specimens in the Laboratory
ASTM C 231	(1997el) Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C 260	(2000) Air-Entraining Admixtures for Concrete
ASTM C 295	(1998) Petrographic Examination of Aggregates for Concrete
ASTM C 470/C 470M	(1998) Molds for Forming Concrete Test Cylinders Vertically
ASTM C 494/C 494M	(1999ae1) Chemical Admixtures for Concrete
ASTM C 618	(2000) Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete
ASTM C 881	(1999) Epoxy-Resin-Base Bonding Systems for Concrete
ASTM C 1064/C 1064M	(1999) Temperature of Freshly Mixed Portland Cement Concrete
ASTM C 1077	(1998) Laboratories Testing Concrete and

	Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation
ASTM C 1260	(1994) Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)
ASTM D 1751	(1999) Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D 1752	(1984; R 1996el) Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction
ASTM D 3665	(1999) Random Sampling of Construction Materials

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST)

NIST HB 44	(1997) NIST Handbook 44: Specifications, Tolerances, and other Technical Requirements for Weighing and Measuring Devices

NATIONAL READY-MIXED CONCRETE ASSOCIATION (NRMCA)

NRMCA CPMB 100	(1996) Concrete Plant Standards \n/c\X

STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION (CDT)

CDT Test 526	(1978) Operation of California Profilograph and Evaluation of Profiles

U.S. ARMY CORPS OF ENGINEERS (USACE)

COE CRD-C 100	(1975) Method of Sampling Concrete Aggregate and Aggregate Sources, and Selection of Material for Testing
COE CRD-C 104	(1980) Method of Calculation of the Fineness Modulus of Aggregate
COE CRD-C 114	(1997) Test Method for Soundness of Aggregates by Freezing and Thawing of Concrete Specimens
COE CRD-C 119	(1991) Standard Test Method for Flat or Elongated Particles in Coarse Aggregate
COE CRD-C 130	(1989) Scratch Hardness of Coarse Aggregate Particles
COE CRD-C 300	(1990) Specifications for Membrane-Forming Compounds for Curing Concrete
COE CRD-C 400	(1963) Requirements for Water for Use in Mixing or Curing Concrete

COE CRD-C 521	(1981) Standard Test Method for Frequency and Amplitude of Vibrators for Concrete
COE CRD-C 55	(1992) Test Method for Within-Batch Uniformity of Freshly Mixed Concrete

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-DTL-24441/20	(Rev. A) Paint, Epoxy-Polyamide, Green Primer, Formula 150, Type III

1.2 SYSTEM DESCRIPTION

This section is intended to stand alone for construction of concrete (rigid) pavement. However, where the construction covered herein interfaces with other sections, the construction at each interface shall conform to the requirements of both this section and the other section, including tolerances for both.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with SECTION 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Equipment.

a. Details and data on the batching and mixing plant prior to plant assembly including manufacturer's literature showing that the equipment meets all requirements specified herein.

b. A description of the equipment proposed for transporting concrete mixture from the central mixing plant to the paving equipment at least 7 days prior to start of paving unless otherwise specified.

c. At the time the materials are furnished for the mixture proportioning study, a description of the equipment proposed for the placing of the concrete mixture, method of control, and manufacturer's literature on the paver and finisher, together with the manufacturer's written instructions on adjustments and operating procedures necessary to assure a tight, smooth surface on the concrete pavement, free of tears and other surface imperfections, including excessive paste on the surface. The literature shall show that the equipment meets all details of these specifications.

Proposed Techniques; G, ED.

a. A description of the placing and protection methods proposed prior to construction of the test section, if concrete is to be placed in or exposed to hot or cold weather conditions.

b. A detailed plan of the proposed paving pattern showing all

planned construction joints. No deviation from the jointing pattern shown on the drawings shall be made without written approval of the District Engineering Services Branch.

c. Data on the curing media and methods to be used.

SD-06 Test Reports

Sampling and Testing; G, RE.

a. Certified copies of laboratory test reports, including all test data, for cement, pozzolan, aggregate, admixtures, and curing compound proposed for use on this project. These tests shall be made by a Corps of Engineers approved commercial laboratory or by a laboratory maintained by the manufacturers of the materials. No material shall be used until notice of acceptance has been given. Materials may be subjected to check testing by the Government from samples obtained at the manufacturer, at transfer points, or at the project site.

b. The results of the Contractor's mixture proportioning studies along with a statement giving the maximum nominal coarse aggregate size and the proportions of all ingredients that will be used in the manufacture of concrete at least 14 days prior to commencing concrete placing operations. Aggregate quantities shall be based on the mass in a saturated surface dry condition. The statement shall be accompanied by test results from a Corps of Engineers approved independent commercial testing laboratory, showing that mixture proportioning studies have been made with materials proposed for the project and that the proportions selected will produce concrete of the qualities indicated. No substitutions shall be made in the materials used in the mixture proportions without additional tests to show that the quality of the concrete is satisfactory.

1.4 ACCEPTABILITY OF WORK AND PAYMENT ADJUSTMENTS

Concrete samples shall be taken by the Contractor in the field to determine the slump, air content, and strength of the concrete. Test beams and test cylinders shall be made for determining conformance with the strength requirements of these specifications and, when required, for determining the time at which pavements may be placed into service. Any pavement not meeting the requirement for 'specified strength' shall be removed and replaced at no additional cost to the Government. The air content shall be determined in accordance with ASTM C 231. Slump tests shall be made in accordance with ASTM C 143/C 143M. Test beams and cylinders shall be molded and cured in accordance with ASTM C 31/C 31M and as specified below. Steel molds shall be used for molding the beams specimens. Molds for cylinder test specimens shall conform to ASTM C 470/C 470M. The Contractor shall furnish all materials, labor, and facilities required for molding, curing, testing, and protecting test specimens at the site and in the laboratory. Laboratory curing facilities for test specimens shall include furnishing and operating water tanks equipped with temperature-control devices that will automatically maintain the temperature of the water at 73 plus or minus 5 degrees F. The Contractor shall furnish and maintain at the site boxes or other facilities suitable for storing the specimens while in the mold at a temperature of 73 plus or minus 10 degrees F. Tests of the fresh concrete and of the hardened concrete specimens shall be made by and at the expense of the Contractor.

1.4.1 Pavement Lots

Appropriate adjustment in payment for individual lots of concrete pavement will be made in accordance with the following paragraphs. No such adjustment in payment will be made for any material other than concrete. A lot will be that quantity of construction that will be evaluated for compliance with specification requirements. A lot will be equal to 2133.33 square yards of concrete (48 slabs). In order to evaluate thickness, each lot will be divided into four equal sublots. Grade and surface smoothness (and condition) determinations will be made on the lot as a whole. However, any pavement not meeting the required 'specified strength' shall be removed and replaced at no additional cost to the Government. Strength will be evaluated, but will not be considered for payment adjustment. Edge slump requirements will be applied to each individual slab into which the primary paving lanes are divided by transverse joints, and will not be considered for payment adjustment. Samples for determining aggregate grading for fine aggregate and each size of coarse aggregate shall be taken as the aggregate bins discharge into the weigh hoppers. Results of tests on aggregates shall be used to control aggregate production and concreting operations, as specified in paragraph TESTING AND INSPECTION FOR CONTRACTOR QUALITY CONTROL, but will not be used for payment adjustment. Samples for determining air content and slump and for fabricating strength specimens shall be taken in accordance with ASTM C 172 during or immediately following delivery of the concrete at the paving site and deposition of the concrete immediately in front of the paver or transfer spreader. Results of strength tests shall be used to control concreting operations, but will not be used for payment adjustment. Cores for thickness determination shall be drilled and evaluated as specified. Location of all samples shall be as directed and will be deliberately selected on a truly random basis, not haphazard, using commonly recognized methods of assuring randomness, employing randomizing tables or computer programs, in accordance with ASTM D 3665.

1.4.2 Acceptance of Lots

When a lot of material fails to meet the specification requirements, that lot will be accepted at a reduced price or shall be removed and replaced. The lowest computed percent payment determined for any pavement characteristic (i.e., thickness, grade, and surface smoothness) discussed below shall be the actual percent payment for that lot. The actual percent payment will be applied to the price per square yard and the quantity of concrete placed in the lot to determine actual payment.

1.4.3 Evaluation

The Contractor shall provide facilities for and, where directed, personnel to assist in obtaining samples for any Government testing, all at no additional cost to the Government. Such testing will in no way relieve the Contractor of any specified testing responsibilities. The Contractor shall provide all sampling and testing required for acceptance and payment adjustment at its expense. Such sampling and testing shall be performed by a Corps of Engineers approved commercial testing laboratory inspected by the Government and approved in writing. The laboratory performing the tests shall conform with ASTM C 1077. The individuals who sample and test concrete or the constituents of concrete as required in this specification shall be certified as American Concrete Institute (ACI) Concrete Field Testing Technicians, Grade I, or shall have otherwise demonstrated to the satisfaction of the Contracting Officer other training providing knowledge

and ability equivalent to the ACI minimum requirements for certification. The individuals who perform the inspection of concrete shall be certified as ACI Concrete Construction Inspector, Level II, or have otherwise demonstrated to the satisfaction of the Contracting Officer other training providing knowledge and ability equivalent to the ACI minimum requirements for certification. The Government may inspect the laboratory, equipment, and test procedures for conformance with ASTM C 1077.

1.4.4 Additional Sampling and Testing

The Contracting Officer reserves the right to direct additional samples and tests for any area which appears to deviate from the specification requirements. Testing in these areas will be in addition to the sublot or lot testing, and the requirements for these areas will be the same as those for a sublot or lot, but shall be at no additional cost to the Government.

1.4.5 Air Content Tests

Air content of the concrete shall be controlled as specified in paragraph TESTING AND INSPECTION FOR CONTRACTOR QUALITY CONTROL and will not be considered for payment adjustment.

1.4.6 Slump Tests

Slump of the concrete shall be controlled as specified in paragraph TESTING AND INSPECTION FOR CONTRACTOR QUALITY CONTROL and will not be considered for payment adjustment.

1.4.7 Surface Smoothness

The Contractor shall use both of the following methods to test and evaluate surface smoothness of the pavement. All testing shall be performed in the presence of the Contracting Officer's representative. Detailed notes shall be kept of the results of the testing and a copy furnished to the Government immediately after each day's testing. The profilograph method shall be used for all testing in the longitudinal direction of the apron and the straightedge method shall be used in the transverse direction, and at the ends in the longitudinal direction. Where drawings show required deviations from a plane surface (crowns, drainage inlets, etc.), the surface shall be finished to meet the approval of the Contracting Officer.

1.4.7.1 Smoothness Requirements

a. Straightedge Testing: The finished surfaces of the pavements shall have no abrupt change of 1/8 inch or more, and all pavements shall be within the limits specified in Table 1 when checked with an approved 12 foot straightedge

TABLE 1
STRAIGHTEDGE SURFACE SMOOTHNESS--PAVEMENTS

Pavement Category	Direction of Testing	Limits Inches
Aprons & Hardstands	Longitudinal	1/8
	Transverse	1/8

b. Profilograph Testing: The finished surfaces of the pavements shall have no abrupt change of 1/8 inch or more, and all pavement shall have a Profile Index not greater than specified in Table 2 when tested with an approved California-type profilograph. If the extent of the pavement in either direction is less than 200 feet, that direction shall be tested by the straightedge method and shall meet requirements specified for such.

TABLE 2
PROFILOGRAPH SURFACE SMOOTHNESS--PAVEMENTS

Pavement Category	Direction of Testing	Maximum Specified Profile Index Inch per mile
Aprons & Hardstands	Longitudinal	9
	Transverse	9

1.4.7.2 Testing Method

After the concrete has hardened sufficiently to permit walking thereon, but not later than 36 hours after placement, the surface of the pavement in each entire lot shall be tested by the Contractor in such a manner as to reveal all surface irregularities exceeding the tolerances specified above. However, transverse profilograph testing of multiple paving lanes shall be performed at the timing directed. Separate testing of individual sublots is not required. If any pavement areas are ground, these areas shall be retested immediately after grinding. The entire area of the pavement shall be tested in both a longitudinal and a transverse direction on parallel lines. The transverse lines shall be 15 feet or less apart, as directed. The longitudinal lines shall be at the centerline of each paving lane shown on the drawings, regardless of whether the Contractor is allowed to pave two lanes at a time, and at the 1/8th point in from each side of the lane. Other areas having obvious deviations shall also be tested. Longitudinal testing lines shall be continuous across all joints. Transverse testing lines for pilot lanes shall be carried to construction joint lines and for fill-in lanes shall be carried 24 inches across construction joints, and the readings in this area applied to the fill-in lane. Straightedge testing of the longitudinal edges of slipformed pilot lanes shall also be performed before paving fill-in lanes as specified in paragraph "Edge Slump and Joint Face Deformation".

a. Straightedge Testing: The straightedge shall be held in contact with the surface and moved ahead one-half the length of the straightedge for each successive measurement. The amount of surface irregularity shall be determined by placing the freestanding (unleveled) straightedge on the pavement surface and allowing it to rest upon the two highest spots covered by its length and measuring the maximum gap between the straightedge and the pavement surface, in the area between these two high points.

b. Profilograph Testing: Profilograph testing shall be performed using approved equipment and procedures described in CDT Test 526. The equipment shall utilize electronic recording and automatic computerized reduction of data to indicate "must-grind" bumps and the Profile Index for the pavement. The "blanking band" shall be 0.2 inches wide and the "bump template" shall span 1 inch with an offset of 0.4 inch. The profilograph shall be operated by an approved, factory-trained operator

on the alignments specified above. A copy of the reduced tapes shall be furnished the Government at the end of each day's testing.

1.4.7.3 Payment Adjustment for Smoothness

a. Straightedge Testing: Location and deviation from straightedge for all measurements shall be recorded. When between 5.0 and 10.0 percent and less than 15.0 percent of all measurements made within a lot exceed the tolerance specified in paragraph "Smoothness Requirements" above, after any reduction of high spots or removal and replacement, the computed percent payment based on surface smoothness will be 95 percent. When more than 10.0 percent and less than 15.0 percent of all measurements exceed the tolerance, the computed percent payment will be 90 percent. When between 15.0 and 20.0 percent of all measurements exceed the tolerance, the computed percent payment will be 75 percent. When 20.0 percent or more of the measurements exceed the tolerance, the lot shall be removed and replaced at no additional cost to the Government. Regardless of the above, any small individual area with surface deviation which exceeds the tolerance given above by more than 50 percent shall be corrected by grinding to meet the specification requirements above or shall be removed and replaced at no additional cost to the Government.

b. Profilograph Testing: Location and data from all profilograph measurements shall be recorded. When the Profile Index of a lot exceeds the tolerance specified in paragraph "Smoothness Requirements" above by 1.0 inch per mile but less than 2.0 inches per mile, after any reduction of high spots or removal and replacement, the computed percent payment based on surface smoothness will be 95 percent. When the Profile Index exceeds the tolerance by 2.0 inches per mile but less than 3.0 inches per mile, the computed percent payment will be 90 percent. When the Profile Index exceeds the tolerance by 3.0 inches per mile but less than 4.0 inches per mile, the computed percent payment will be 75 percent. When the Profile Index exceeds the tolerance by 4.0 inches per mile or more, the lot shall be removed and replaced at no additional cost to the Government. Regardless of the above, any small individual area with surface deviation which exceeds the tolerance given above by more than 5.0 inches per mile or more, shall be corrected by grinding to meet the specification requirements above or shall be removed and replaced at no additional cost to the Government.

c. Bumps ("Must Grind" Areas): Any bumps ("must grind" areas) shown on the profilograph trace which exceed 0.4 inch in height shall be reduced by grinding in accordance with subparagraph "Areas Defective In Plan Grade Or Smoothness" until they do not exceed 0.3 inch when retested. Such grinding shall be tapered in all directions to provide smooth transitions to areas not requiring grinding. Areas of textured pavement shall be retextured in accordance with the subparagraph listed above. At the Contractor's option, pavement areas including ground areas may be rechecked with the profilograph in order to record a lower Profile Index.

1.4.8 Edge Slump and Joint Face Deformation

The following requirements on testing and evaluation of edge slump and joint face deformation apply only to pavements 10 inches or more in thickness. Use of slip-form paving equipment and procedures that fail to consistently provide edges within the specified tolerances on edge slump

and joint face deformation shall be discontinued and the pavements shall be constructed by means of standard paving procedures using fixed forms. Slabs having more than the allowable edge slump shall be removed and replaced as specified in subparagraph "Excessive Edge Slump" before the adjacent lane is placed. Edge slump and joint face deformation will not be applied to payment adjustment.

1.4.8.1 Edge Slump

When slip-form paving is used, not more than 15.0 percent of the total free edge of any slab of the pavement, as originally constructed, shall have an edge slump exceeding 1/4 inch, and no slab shall have an edge slump exceeding 3/8 inch as determined in accordance with the measurements as specified in paragraph "Determination of Edge Slump". (The total free edge of the pavement will be considered to be the cumulative total linear measurement of pavement edge originally constructed as non-adjacent to any existing pavement; i.e., 100 feet of pilot lane, a paving lane originally constructed as a separate lane, will have 200 feet of free edge; 100 feet of fill-in lane will have no free edge, etc.,). The area affected by the downward movement of the concrete along the pavement edge shall not exceed 18 inches back from the edge.

1.4.8.2 Joint Face Deformation

In addition to the edge slump limits specified above, the vertical joint face shall have a surface within the maximum limits shown below:

Offset from Straightedge Applied Longitudinally To Pavement Surface 1 Inch Back From Joint Line	Offset From Straightedge Applied Longitudinally to Vertical Face	Offset From Straightedge Applied Top to Bottom Against the Joint Face	Abrupt Offset in Any Direction	Offset of Joint Face From True Vertical
1/8 inch	1/4 inch	3/8 inch	1/8	1 inch per 12 inches

1.4.8.3 Determination of Edge Slump

Immediately after the concrete has hardened sufficiently to permit walking thereon, the pavement surface shall be tested by the Contractor in the presence of a representative of the Contracting Officer. Testing shall be performed with a straightedge to reveal irregularities exceeding the edge slump tolerance specified above. The edge slump shall be determined at each free edge of each slipformed paving lane constructed. The straightedge shall be placed transverse to the direction of paving and the end of the straightedge located at the edge of the paving lane. Measurements shall be made at 5 to 15 foot spacings, as directed, commencing at the header where paving was started. Initially measurements shall be made at 5 foot intervals in each lane. When no deficiencies are present, the Contracting Officer may approve an increase in the interval. When any deficiencies exist, the interval will be returned to 5 feet. In no case shall the interval exceed 15 feet. In addition to the transverse edge slump determination above, the Contractor, at the same time, shall check the longitudinal surface smoothness of the joint on a continuous line

1 inch back from the joint line using the straightedge advanced one-half its length for each reading. Other tests of the exposed joint face shall be made as directed to ensure that a uniform, true vertical joint face is attained. These tests shall include longitudinal straightedge testing of the vertical face and vertical testing of the face for both smoothness and angle. The measurements shall be made by the Contractor, shall be properly referenced in accordance with paving lane identification and stationing, and a report given to the Contracting Officer within 24 hours after measurement is made. The report shall also identify areas requiring replacement in accordance with paragraph "Excessive Edge Slump" as well as the cumulative percentage of total free edge of pavement constructed to date which has an edge slump exceeding 1/4 inch.

1.4.8.4 Excessive Edge Slump

When edge slump exceeding the limits specified above is encountered on either side of the paving lane, additional straightedge measurements shall be made, if required, to define the linear limits of the excessive slump. The concrete for the entire width of the paving lane within these limits of excessive edge slump or joint deformation shall be removed and replaced in conformance with paragraph REPAIR, REMOVAL, REPLACEMENT OF SLABS. Partial slabs removed and replaced shall extend across the full width of the pavement lane, parallel to the transverse joints, and both the section of the slab removed and the section remaining in place shall have a minimum length of 10 feet to the nearest scheduled transverse joint. If less than 10 feet remains, the entire slab shall be removed and replaced. Adding concrete or paste to the edge or otherwise manipulating the plastic concrete after the sliding form has passed, or patching the hardened concrete, shall not be used as a method for correcting excessive edge slump.

1.4.9 Plan Grade

1.4.9.1 Plan Grade Tolerances

The finished surfaces of pavements shall conform, within the tolerances shown below, to the lines, grades, and cross sections shown. The finished surfaces of the apron pavements shall vary not more than 1/2 inch above or below the plan grade line or elevation indicated. Plan grade shall be checked on the lot as a whole and when more than 5.0 and less than 10.0 percent of all measurements made within a lot are outside the specified tolerance, the computed percent payment for that lot will be 95 percent. When more than 10.0 percent are outside the specified tolerances, the computed percent payment for the lot will be 75 percent. However, in any areas where the deviation from grade exceeds the specified tolerances by 50 percent or more, the deficient area shall be removed and replaced at no additional cost to the Government. However, the above deviations from the approved grade line and elevation will not be permitted in areas where closer conformance with the planned grade and elevation is required for the proper functioning of appurtenant structures. The finished surfaces of new abutting pavements shall coincide at their juncture.

1.4.9.2 Grade Conformance Tests

Each pavement category shall be checked by the Contractor for conformance with plan grade requirements. For the purpose of making grade conformance tests, the pavements will be subdivided into the same lots used for all other payment adjustment items. Within 5 days after paving of each lot, the finished surface of the pavement area in each lot shall be tested by the Contractor, in the presence of a representative of the Contracting

Officer, by running lines of levels at intervals corresponding with every longitudinal and transverse joint to determine the elevation at each joint intersection. The results of this survey shall be recorded and a copy given to the Government at the completion of the survey of each lot.

1.4.10 Flexural Strength

Each lot of pavement will be evaluated for acceptance in accordance with the following procedures. The Contractor shall be responsible for all testing required herein. Testing shall be performed by a Corps of Engineers approved commercial laboratory. Results of strength tests will not be used for payment adjustment.

1.4.10.1 Sampling and Testing

One composite sample of concrete from each sublot shall be obtained in accordance with ASTM C 172 from one batch or truckload. A minumum of 6 test cylinders, 6 x 12 in., shall be fabricated and cured in accordance with ASTM C 31/C 31M; and tested in accordance with ASTM C 39/C 39M. Two test cylinders per sublot (8 per lot) shall be tested for compressive strength, and tested at 14-day age. Two test cylindars per sublot shall be held in reserve and tested at ages directed. The remaining two test are cylindars per sublot to be used for CQC tests; and tested as specified in paragraph TESTING AND INSPECTION FOR CONTRACTOR QUALITY CONTROL. Two beams for flexural strength shall be fabricated and cured in accordance with ASTM C 31/C 31M and tested in accordance with ASTM C 78 for every 2,500 cubic yards of concrete. These shall be tested at 28-days, unless directed otherwise to test earlier than 28 days.

1.4.10.2 Computations

The following computations shall be performed:

a. Average the eight 14-day compressive strength tests for the lot and also compute the standard deviation(s) for the eight tests.

b. Convert the 14-day average compressive strength for the lot to equivalent 28-day average flexural strength for the lot, using the Correlation Ratio determined during mixture design studies.

c. Report results of strength tests to the Contracting Officer daily. These values will be used for acceptance, but will not be used for payment adjustment.

1.4.11 Thickness

Each lot of pavement will be evaluated for acceptance and payment adjustment in accordance with the following procedure. The Contractor shall be responsible for drilling the cores, measuring the cores in the presence of the Contracting Officer's representative, and for filling the core holes as directed.

1.4.11.1 Drilling, Measuring, and Computations

Two cores, between 3 and 6 inch in diameter, shall be drilled from the pavement, per sublot (8 per lot). The Contractor shall fill the core holes with concrete containing an expanding admixture, as directed. The cores shall be evaluated for thickness of the pavement in accordance with ASTM C 174/C 174M. The pavement thickness from the 8 cores for the lot shall be

averaged and the standard deviation for the 8 thickness measurements shall be computed.

1.4.11.2 Evaluation and Payment Adjustment for Thickness

Using the Average Thickness of the lot, the computed percent payment for thickness shall be determined by entering the following table:

Deficiency in Thickness Determined by Cores Inches	Computed Percent Payment for Thickness
0.00 to 0.24	100
0.25 to 0.49	75
0.50 to 0.74	50
0.75 or greater	0

Where 0 percent payment is indicated, the entire lot shall be removed and replaced at no additional cost to the Government. Where either of the two cores from a sublot show a thickness deficiency of 0.75 inch or greater, two more cores shall be drilled in the sublot and the average thickness of the four cores computed. If this average shows a thickness deficiency of 0.75 inch or more the entire sublot shall be removed.

1.4.12 Partial Lots

When operational conditions cause a lot to be terminated before the specified four sublots have been completed, the following procedure shall be used to adjust the lot size and number of tests for the lot. Where three sublots have been completed, they shall constitute a lot and acceptance criteria adjusted accordingly. Where one or two sublots have been completed, they shall be incorporated into the next lot or the previous lot, as directed, and the total number of sublots shall be used and acceptance criteria adjusted accordingly.

1.4.13 Areas Defective in Plan Grade or Smoothness

In areas not meeting the specified limits for surface smoothness and plan grade, high areas shall be reduced to attain the required smoothness and grade, except as depth is limited below. High areas shall be reduced either by hand rubbing the freshly finished concrete with a silicon carbide brick and water when the concrete is less than 36 hours old or by grinding the hardened concrete with an approved surface grinding machine after the concrete is 14 days or more old. Rubbing with a silicon carbide brick and water shall be discontinued as soon as contact with the coarse aggregate is made, and all further necessary reduction shall be accomplished by grinding the hardened concrete with a surface-grinding machine after it is 14 days old. The area corrected by grinding the surface of the hardened concrete shall not exceed 5 percent of the area of any integral slab, and shall not exceed 1 percent of the total area of any sublot. The depth of grinding shall not exceed 1/4 inch. All pavement areas requiring plan grade or surface smoothness corrections in excess of the limits specified above, shall be removed and replaced in conformance with paragraph REPAIR, REMOVAL, REPLACEMENT OF SLABS. All areas in which rubbing or grinding has been performed will be subject to the thickness tolerances specified in paragraph Thickness. Any rubbing or grinding performed on individual slabs with excessive deficiencies shall be performed at the Contractor's own decision without entitlement to additional compensation if eventual removal

of the slab is required.

1.5 ACCEPTABILITY OF WORK

The materials and the pavement itself will be accepted on the basis of tests made by the Government and by the Contractor's Corps of Engineers approved commercial laboratory as specified herein. The Government may, at its discretion, make check tests to validate the results of the Contractor's testing. If the results of the Government and Contractor tests vary by less than 2.0 percent, of the Government's test results, the results of the Contractor's tests will be used. If the results of the Government and Contractor tests vary by 2.0 percent or more, but less than 4.0 percent, the average of the two will be considered the value to be used. If these vary by 4.0 percent or more, each sampling and testing procedure shall be carefully evaluated and both the Government and the Contractor shall take another series of tests on duplicate samples of material. If these vary by 4.0 percent or more, the results of the tests made by the Government shall be used and the Government will continue check testing of this item on a continuous basis until the two sets of tests agree within less than 4.0 percent on a regular basis. Testing performed by the Government will in no way at any time relieve the Contractor from the specified testing requirements.

1.6 PRECONSTRUCTION TESTING OF MATERIALS

The Contractor shall not be entitled to any additional payment or extension of time because of delays caused by sampling and testing additional sources, or samples, necessitated by failure of any samples.

1.6.1 Aggregates

Aggregates shall be sampled by the Contractor in the presence of a Government representative. Samples shall be obtained in accordance with COE CRD-C 100 and of the size indicated therein, or larger if specified in paragraph Testing Sequence Deleterious Materials -- Airfields Only and shall be representative of the materials to be used for the project. Testing of samples shall be the responsibility of the Contractor and shall be performed by a Corps of Engineers approved commercial laboratory. Test results shall be submitted 30 days before commencing paving. No material shall be used unless test results show that it meets all requirements of these specifications.

1.6.2 Chemical Admixtures

The Contractor shall provide satisfactory facilities for ready procurement of adequate test samples. All sampling and testing of an admixture will be by and at the expense of the Contractor. Tests will be conducted with materials proposed for the project. An air-entraining admixture that has been in storage at the project site for longer than 6 months or that has been subjected to freezing will be retested at the expense of the Contractor when considered appropriate and shall be rejected if test results are not satisfactory.

1.6.3 Curing Compound

The Contractor shall provide satisfactory facilities for ready procurement of adequate test samples. The sampling and testing will be by and at the expense of the Contractor.

1.6.4 Epoxy-Resin Material

At least 30 days before the material is used, the Contractor shall submit certified copies of test results showing that the specific lots or batches from which the material will be furnished to this project have been tested by the manufacturer and that the material conforms to the requirements of these specifications. When epoxy resin arrives at the job site, the Contractor, if directed shall assist the Government to sample the material. The Government may test the sample or may retain it in storage for possible future testing, as considered appropriate.

1.6.5 Cements and Pozzolans

Preconstruction sampling and testing of cement and pozzolan shall conform to the requirements specified for sampling and testing during construction except that test results showing that each material meets specification requirements shall be available at least 5 days before start of paving operations.

1.7 TESTING BY CONTRACTOR DURING CONSTRUCTION

1.7.1 Contractor's Testing Requirements

During construction, the Contractor shall be responsible for sampling and testing aggregates, cementitious materials (cement and pozzolan), and concrete to determine compliance with the specifications. All sampling and testing shall be performed by a Corps of Engineers approved commercial laboratory, or for cementitious materials, the manufacturer's laboratory. Samples of aggregate shall be obtained as the bins discharge into the weigh hopper. Samples of concrete shall be obtained at the point of delivery to the paver. The Government will sample and test concrete and ingredient materials as considered appropriate. The Contractor shall provide facilities and labor as may be necessary for procurement of representative test samples. Testing by the Government will in no way relieve the Contractor of the specified testing requirements.

1.7.2 Cementitious Materials

Cement and pozzolan will be accepted on the basis of manufacturer's certification of compliance, accompanied by mill test reports showing that the material in each shipment meets the requirements of the specification under which it is furnished. No cementitious material shall be used until notice of acceptance has been given by the Contracting Officer. Cementitious material may be subjected to check testing by the Government from samples obtained at the mill, at transfer points, or at the project site.

1.8 TESTING BY GOVERNMENT DURING CONSTRUCTION

1.8.1 Mill Tests for Cementitious Materials

Cement and pozzolan will be accepted on the basis of manufacturer's certification of compliance accompanied by mill test reports showing that the material in each shipment used meets the requirements of the specification under which it is furnished. No cementitious material shall be used until notice of acceptance has been given by the Contracting Officer. Cementitious material may be subjected to check testing by the Government on samples obtained at the mill, at transfer points, or at the project site.

1.9 QUALIFICATIONS

All Contractor Quality Control personnel assigned to concrete construction shall be American Concrete Institute (ACI) Certified Workmen in one of the following grades (or shall have approved written evidence of having completed similar qualification programs):

Concrete Field Testing Technician, Grade I
Concrete Laboratory Testing Technician, Grade I or II
Concrete Construction Inspector, Level II

The foreman or lead journeyman of the finishing crew shall have similar qualification for ACI Concrete Flatwork Technician/Finisher, or equal. Written documentation shall be furnished for each workman in the above groups.

1.10 TEST SECTION

At least 10 days but not more than 60 days prior to construction of the concrete pavement, a test section shall be constructed as part of the production paving area at an outer edge of the airfield apron. The test section will be allowed to remain in place, if it meets all specification requirements and will be paid for as part of the production pavement. There will be no separate payment for the test section or sections and the cost of the materials, and the construction will be considered a subsidiary cost of constructing the project. The Contractor shall notify the Contracting Officer at least 5 days in advance of the date of test section construction. The test section shall consist of one paving lane at least 100 feet long and shall be constructed to the indicated thickness. The lane width shall be the same as that required for use in the project. The test section shall contain at least one transverse construction joint. If keyed or doweled longitudinal construction joints are required in any of the production pavements, they shall be installed full length along one side of the test strip throughout the test section. If both keys and dowels are required, each shall be installed in half of the test section. Two separate days shall be used for construction of the test section. The Contractor shall use the test section to develop and demonstrate to the satisfaction of the Contracting Officer the proposed techniques of mixing, hauling, placing, consolidating, finishing, curing, start-up procedures, testing methods, plant operations, and the preparation of the construction joints. Variations in mixture proportions other than water shall be made if required. The test section shall be placed as approved by the Government. The Contractor shall vary the water content, as necessary, to arrive at the appropriate content. The mixing plant shall be operated and calibrated prior to start of placing the test section. The Contractor shall use the same equipment, materials, and construction techniques on the test section as will be used in all subsequent work. Base course preparation, concrete production, placing, consolidating, curing, construction of joints, and all testing shall be in accordance with applicable provisions of this specification. The Contractor shall construct the test section meeting all specification requirements and being acceptable to the Contracting Officer in all aspects, including surface texture. Failure to construct an acceptable test section will necessitate construction of additional test sections at no additional cost to the Government. Test sections allowed to be constructed as part of the production paving which do not meet specification requirements shall be removed at the Contractor's expense. If the Contractor proposes to use slipform paving and is unable to construct an acceptable test section, or

if the slipform paving equipment and procedures are found to be unable to produce acceptable pavement at any time, the slipform paving equipment shall be removed from the job and the construction completed using stationary side forms and equipment compatible with them.

1.11 DELIVERY, STORAGE, AND HANDLING OF MATERIALS

1.11.1 Bulk Cementitious Materials

All cementitious material shall be furnished in bulk. The temperature of the cementitious material, as delivered to storage at the site, shall not exceed 150 degrees F.

1.11.1.1 Transportation

When bulk cementitious material is not unloaded from primary carriers directly into weather-tight hoppers at the batching plant, transportation from the railhead, mill, or intermediate storage to the batching plant shall be accomplished in adequately designed weather-tight trucks, conveyors, or other means that will protect the cementitious material from exposure to moisture.

1.11.1.2 Storage Requirements

Immediately upon receipt at the site of the work, cementitious materials shall be stored in a dry and properly ventilated structure. All storage facilities shall be subject to approval and shall allow easy access for inspection and identification. Sufficient cementitious materials shall be in storage to sustain continuous operation of the concrete mixing plant while the pavement is being placed. To prevent cement from becoming unduly aged after delivery, any cement that has been stored at the site for 60 days or more shall be used before using cement of lesser age.

1.11.1.3 Separation of Materials

Separate facilities shall be provided which will prevent any intermixing during unloading, transporting, storing, and handling of each type of cementitious material.

1.11.2 Aggregate Materials

1.11.2.1 Storage

Aggregate shall be stored at the site of the batching and mixing plant avoiding breakage, segregation, or contamination by foreign materials. Each size of aggregate from each source shall be stored separately in free-draining stockpiles. Fine aggregate and the smallest size coarse aggregate shall remain in free-draining storage for at least 24 hours immediately prior to use. Sufficient aggregate shall be maintained at the site at all times to permit continuous uninterrupted operation of the mixing plant at the time concrete pavement is being placed.

1.11.2.2 Handling

Aggregate shall be handled avoiding segregation or degradation. Vehicles used for stockpiling or moving aggregate shall be kept clean of foreign materials. Tracked equipment shall not be allowed on coarse aggregate stockpiles. Stockpiles shall be built up and worked avoiding segregation in the piles and preventing different sizes of aggregate from being mixed

during storage or batching. Aggregate shall not be stored directly on ground unless a sacrificial layer is left undisturbed and unused.

1.11.3 Other Materials

Reinforcing bars and accessories shall be stored above the ground on platforms, skids, or other supports. Other materials shall be stored avoiding contamination and deterioration. Chemical admixtures which have been in storage at the project site for longer than 6 months or which have been subjected to freezing shall not be used unless retested and proven to meet the specified requirements. The Contractor shall ensure that materials can be accurately identified after bundles or containers are opened.

1.12 EQUIPMENT

All plant, equipment, tools, and machines used in the work shall be maintained in satisfactory working conditions at all times.

1.12.1 Batching and Mixing Plant

1.12.1.1 Location of Batching and Mixing Plant

The batching and mixing plant shall be located no more than 30 minutes haul time from the placing site. There shall be operable telephonic or radio communication between the batching plant and the placing site at all times concreting is taking place.

1.12.1.2 Type and Capacity of Batching and Mixing Plant

The batching and mixing plant shall be a stationary-type plant. The plant shall be designed and operated to produce concrete within the specified tolerances, and shall have a capacity of at least 200 cu. yd. per hour. The batching plant shall conform to the requirements of NRMCA CPMB 100 and as specified; however, rating plates attached to batch plant equipment are not required.

1.12.1.3 Equipment Requirements

The batching controls shall be either semiautomatic or automatic. Semiautomatic batching system shall be provided with interlocks. Separate bins or compartments shall be provided for each size group of aggregate and each cementitious material. Aggregates shall be weighed either in separate weigh batchers with individual scales or cumulatively in one weigh batcher on one scale, provided the fine aggregate is weighed first. Aggregate shall not be weighed in the same batcher with cementitious material. If both cement and pozzolan are used, they may be batched cumulatively, provided portland cement is batched first. Water shall not be weighed or measured cumulatively with another ingredient. Water batcher filling and discharging valves shall be so interlocked that the discharge valve cannot be opened before the filling valve is fully closed. An accurate mechanical device for measuring and dispensing each chemical admixture shall be provided. Each dispenser shall be interlocked with the batching cycle and discharged automatically to obtain uniform distribution throughout the batch in the specified mixing period. Different chemical admixtures shall not be combined before introduction in water and cement. The plant shall be arranged to facilitate the inspection of all operations at all times. Suitable facilities shall be provided for obtaining representative samples of aggregates from each bin or compartment.

1.12.1.4 Scales

Adequate facilities shall be provided for the accurate measurement and control of each of the materials entering each batch of concrete. The weighing equipment shall conform to the applicable requirements of NIST HB 44, except that the accuracy shall be within 0.2 percent of scale capacity. The Contractor shall provide standard test weights and any other auxiliary equipment required for checking the operating performance of each scale or other measuring device. Each weighing unit shall include a visible springless dial, which shall indicate the scale load at all stages of the weighing operation or shall include a beam scale with a beam balance indicator that will show the scale in balance at zero load and at any beam setting. The indicator shall have an over and under travel equal to at least 5 percent of the capacity of the beam. Approved electronic digital indicators and load cells may also be used. The weighing equipment shall be arranged to allow the concrete plant operator to conveniently observe the dials or indicators.

1.12.1.5 Batching Tolerances

The following tolerances shall apply.

Materials	Percentage of Required Mass
Cement (and Pozzolan)	plus or minus 1
Aggregate	plus or minus 2
Water	plus or minus 1
Admixture	plus or minus 3

For volumetric batching equipment for water and admixtures, the above numeric tolerances shall apply to the required volume of material being batched. Concentrated admixtures shall be uniformly diluted, if necessary, to provide sufficient volume per batch to ensure that the batchers will consistently operate within the above tolerance.

1.12.1.6 Moisture Control

The plant shall be capable of ready adjustment to compensate for the varying moisture contents of the aggregates and to change the quantities of the materials being batched.

1.12.1.7 Recorders

A graphic or digital recorder conforming to the requirements of NRMCA CPMB 100 shall be furnished and kept operational at the batching plant.

1.12.2 Concrete Mixers

Mixers shall be stationary mixers. Truck mixers shall not be used for mixing or transporting paving concrete unless steel forms are being utilized. Mixers shall be capable of combining the materials into a uniform mixture and of discharging this mixture without segregation. The mixers shall not be charged in excess of the capacity recommended by the manufacturer. The mixers shall be operated at the drum or mixing blade speed designated by the manufacturer. The mixers shall be maintained in satisfactory operating condition, and the mixer drums shall be kept free of

hardened concrete. Mixer blades or paddles shall be replaced when worn down more than 10 percent of their depth when compared with the manufacturer's dimension for new blades or paddles.

1.12.2.1 Stationary, Central Plant, Mixers

Stationary mixers shall be drum mixers of tilting or nontilting, horizontal-shaft, or vertical-shaft type . Mixers shall be provided with an acceptable device to lock the discharge mechanism until the required mixing time has elapsed.

1.12.2.2 Truck Mixers

Truck mixers shall only be allowed if paving with steel forms. The only truck mixers used for mixing or transporting paving concrete shall be those designed with extra large blading and rear opening specifically for low-slump paving concrete. Truck mixers, the mixing of concrete therein, and concrete uniformity and testing thereof shall conform to the requirements of ASTM C 94/C 94M. A truck mixer may be used either for complete mixing (transit-mixed) or to finish the partial mixing done in a stationary mixer (shrink-mixed). Each truck shall be equipped with two counters which will show the number of revolutions at mixing speed and the number of revolutions at agitating speed. Concrete completely mixed in a truck mixer shall be mixed 70 to 100 revolutions at the designated mixing speed after all ingredients, including mixing water, have been charged into the drum. Concrete first partially mixed in a concrete plant mixer (shrink-mixed) a minimum time, as required to combine the ingredients, shall then be completely mixed in a truck mixer. The number of revolutions between 70 to 100 for truck-mixed concrete and the number of revolutions for shrink-mixed concrete shall be determined by uniformity tests as specified in ASTM C 94/C 94M and in requirements for mixer performance stated in paragraph TESTING AND INSPECTION FOR CONTRACTOR QUALITY CONTROL. If requirements for the uniformity of concrete are not met with 100 revolutions of mixing after all ingredients including water are in the truck mixer drum, the mixer shall not be used until the condition is corrected. Additional revolutions beyond the number determined to produce the required uniformity shall be at the designated agitating speed. Water shall not be added after the initial introduction of mixing water except, when on arrival at the job site, the slump is less than specified and the water-cement ratio is less than that given as a maximum in the approved mixture. Additional water may be added to bring the slump within the specified range provided the approved water-cement ratio is not exceeded. Water shall be injected into the head of the mixer (end opposite the discharge opening) drum under pressure, and the drum or blades shall be turned a minimum of 30 additional revolutions at mixing speed. Water shall not be added to the batch at any later time.

1.12.2.3 Mixing Time and Uniformity

a. Stationary Mixers: For stationary mixers, before uniformity data are available, the mixing time for each batch after all solid materials are in the mixer, provided that all of the mixing water is introduced before one-fourth of the mixing time has elapsed, shall be 1 minute for mixers having a capacity of 1 cubic yard. For mixers of greater capacity, this minimum time shall be increased 20 seconds for each additional 1.33 cubic yard or fraction thereof. After results of uniformity tests are available, the mixing time may be reduced to the minimum time required to meet uniformity requirements; but if uniformity requirements are not being met, the mixing time shall be

increased as directed. Mixer performance tests at new mixing times shall be performed immediately after any change in mixing time. When regular testing is performed, the concrete shall meet the limits of any five of the six uniformity requirements listed in Table 4, below. When abbreviated testing is performed, the concrete shall meet only those requirements listed for abbreviated testing. The concrete proportions used for uniformity tests shall be as used on the project. Regular testing shall consist of performing all six tests on three batches of concrete. The range for regular testing shall be the average of the ranges of the three batches. Abbreviated testing shall consist of performing the three required tests on a single batch of concrete. The range for abbreviated testing shall be the range for one batch. If more than one mixer is used and all are identical in terms of make, type, capacity, condition, speed of rotation, etc., the results of tests on one of the mixers shall apply to the others, subject to the approval of the Contracting Officer. All mixer performance (uniformity) testing shall be performed by the Contractor in accordance with COE CRD-C 55 and with paragraph titled TESTING AND INSPECTION FOR CONTRACTOR QUALITY CONTROL.

TABLE 4
UNIFORMITY REQUIREMENTS--STATIONARY MIXERS

Parameter	Regular Tests Allowable Maximum Range for Average of 3 Batches	Abbreviated Tests Allowable Maximum Range for 1 Batch
Unit weight of air-free mortar, lb/cubic ft	2.0	2.0
Air content, percent	1.0	--
Slump, inches	25	--
Coarse aggregate, percent	6.0	6.0
Compressive strength at 7 days, percent	10.0	10.0
Water content, percent	1.5	--

b. Truck Mixers: Mixer performance (uniformity) tests for truck mixers shall be made by the Contractor in accordance with ASTM C 94/C 94M.

1.12.3 Transporting Equipment

Concrete shall be transported to the paving site in nonagitating equipment conforming to ASTM C 94/C 94M or in approved truck mixers designed with extra large blading and rear opening specifically for low slump concrete or in approved agitators. All transporting equipment shall be designed and operated to deliver and discharge the required concrete mixture completely without segregation.

1.12.4 Transfer and Spreading Equipment

Equipment for transferring concrete from the transporting equipment to the

paving lane in front of the paver shall be specially manufactured, self-propelled transfer equipment which will accept the concrete outside the paving lane and will transfer and spread it evenly across the paving lane in front of the paver and strike off the surface evenly to a depth which permits the paver to operate efficiently. The travelling surge hopper shall be a specially manufactured, self-propelled transfer-placer which will operate in front of the paver and accept the concrete from the transporting equipment outside the paving lane, store it as necessary, and feed it out evenly across the lane in front of the paver at a depth which permits the paver to operate efficiently. The capacity shall be such that concrete is always available in front of the paver, to prevent the need for stopping the paver. It shall be designed to always discharge the oldest concrete remaining in the hopper before the fresher concrete.

1.12.5 Paver-Finisher

The paver-finisher shall be a heavy-duty, self-propelled machine designed specifically for paving and finishing high quality pavement. The paver-finisher shall weigh at least 2200 lb. per foot of lane width, and shall be powered by an engine having at least 6.0 horsepower per foot of lane width. The paver-finisher shall spread, consolidate, and shape the plastic concrete to the desired cross section in one pass. The mechanisms for forming the pavement shall be easily adjustable in width and thickness and for required crown. In addition to other spreaders required by paragraph Transfer and Spreading Equipment, the paver-finisher shall be equipped with a full width knock-down auger or paddle mechanism, capable of operating in both directions, which will evenly spread the fresh concrete in front of the screed or extrusion plate. Immersion vibrators shall be gang mounted at the front of the paver on a frame equipped with suitable controls so that all vibrators can be operated at any desired depth within the slab or completely withdrawn from the concrete, as required. The vibrators shall be automatically controlled so that they will be immediately stopped as forward motion of the paver ceases. The spacing of the immersion vibrators across the paving lane shall be as necessary to properly consolidate the concrete, but the clear distance between vibrators shall not exceed 30 inches. Spud vibrators shall operate at a frequency of not less than 8000 impulses per minute and an amplitude of not less than 0.03 inch and tube vibrators at a frequency of not less than 5000 impulses per minute and an amplitude of not less than 0.03 inch, as determined by COE CRD-C 521. The paver-finisher shall be equipped with a transversely oscillating screed or an extrusion plate to shape, compact, and smooth the surface and shall so finish the surface that no significant amount of hand finishing, except use of cutting straightedges, is required. The screed or extrusion plate shall be constructed to provide adjustment for crown in the pavement. The entire machine shall provide adjustment for variation in lane width or thickness and to prevent more than 8 inches of the screed or extrusion plate extending over previously placed concrete on either end when paving fill-in lanes. Machines that cause displacement of properly installed forms or cause ruts or indentations in the prepared underlying materials and machines that cause frequent delays due to mechanical failures shall be replaced as directed.

1.12.5.1 Paver-Finisher with Fixed Forms

The paver-finisher shall be equipped with wheels designed to keep it aligned with the forms and to spread the load so as to prevent deformation of the forms.

1.12.5.2 Slipform Paver-Finisher

The slipform paver-finisher shall be automatically controlled and crawler mounted with four padded tracks so as to be completely stable under all operating conditions. The paver-finisher shall finish the surface and edges so that no edge slump beyond allowable tolerance occurs. Horizontal alignment shall be electronically referenced to a taut wire guideline. Vertical alignment shall be electronically referenced on both sides of the paver to a taut wire guideline, to an approved laser control system, or, only where permitted by paragraph Slipform Paving, to a ski operating on a completed lane. Suitable moving side forms shall be provided that are adjustable and will produce smooth, even edges, perpendicular to the top surface and meeting specification requirements for alignment and freedom from edge slump.

1.12.5.3 Longitudinal Mechanical Float

A longitudinal mechanical float shall be specially designed and manufactured to smooth and finish the pavement surface without working excess paste to the surface. It shall be rigidly attached to the rear of the paver-finisher or to a separate self-propelled frame spanning the paving lane. The float plate shall be at least 5 feet long by 8 inches wide and shall automatically be oscillated in the longitudinal direction while slowly moving from edge to edge of the paving lane, with the float plate in contact with the surface at all times.

1.12.5.4 Nonrotating Pipe Float

A pipe float if used, shall be a nonrotating pipe 6 to 10 inches in diameter and sufficiently long to span the full paving width when oriented at an angle of approximately 60 degrees with the centerline. The pipe float shall be mounted on a self-propelled frame that spans the paving lane. No means of applying water to the surface shall be incorporated in the pipe float.

1.12.5.5 Other Types of Finishing Equipment

Clary screeds or other rotating tube floats, or bridge deck finishers, shall not be allowed on the project. Concrete finishing equipment of types other than specified above may be demonstrated on a test section outside the production pavement if approved in writing. If the Contracting Officer's representative decides from evaluation of the test section that the equipment is better than the specified finishing equipment, its use will be permitted as long as it continues to perform better than the specified equipment.

1.12.6 Curing Equipment

Equipment for applying membrane-forming curing compound shall be mounted on a self-propelled frame that spans the paving lane. The reservoir for curing compound shall be constantly mechanically (not air) agitated during operation and shall contain means for completely draining the reservoir. The spraying system shall consist of a mechanically powered pump which will maintain constant pressure during operation, an operable pressure gauge, and either a series of spray nozzles evenly spaced across the lane to give uniformly overlapping coverage or a single spray nozzle which is mounted on a carriage which automatically traverses the lane width at a speed correlated with the forward movement of the overall frame. All spray nozzles shall be protected with wind screens. Any hand-operated sprayers

allowed by paragraph Membrane Curing shall be compressed air supplied by a mechanical air compressor. If the curing machine fails to apply an even coating of compound at the specified rate, it shall immediately be replaced.

1.12.7 Texturing Equipment

Before use, the texturing equipment shall be demonstrated on a test section, and the equipment shall be modified as necessary to produce a moderate broom finish. The broom finish may be applied using hand operated tools if satisfactorily demonstrated during construction of the test section.

1.12.8 Sawing Equipment

Equipment for sawing joints and for other similar sawing of concrete shall be standard diamond-type concrete saws mounted on a wheeled chassis which can be easily guided to follow the required alignment. Blades shall be diamond tipped. If demonstrated to operate properly, abrasive blades may be used. All saws shall be capable of sawing to the full depth required.

1.12.9 Straightedge

The Contractor shall furnish and maintain at the job site, in good condition, one 12 foot straightedge for each paving train for testing the hardened portland cement concrete surfaces. These straightedges shall be constructed of aluminum or magnesium alloy and shall have blades of box or box-girder cross section with flat bottom, adequately reinforced to insure rigidity and accuracy. Straightedges shall have handles for operation on the pavement.

1.12.10 Profilograph

The Contractor shall furnish a 25 foot profilograph for testing the finished pavement surface. The profilograph shall produce a record on tape of the results of testing the pavement surface and shall automatically mark the Profile Index of each section tested as well as indicate and measure each "must grind" point, all in accordance with CDT Test 526 and as required by paragraph Surface Smoothness.

PART 2 PRODUCTS

2.1 CEMENTITIOUS MATERIALS

Cementitious materials shall be portland cement in combination with pozzolan and shall conform to appropriate specifications listed below. Temperature of cementitious materials as supplied to the project shall not exceed 150 degrees F.

2.1.1 Portland Cement

Portland cement shall conform to ASTM C 150, Type I,low-alkali except that the maximum amount of C3A shall be 15 percent including false set requirements.

2.1.2 Pozzolan (Fly Ash)

2.1.2.1 Fly Ash

Fly ash shall conform to ASTM C 618, Class F, including the optional

requirements in Tables 1A and 2A. Loss on ignition shall not exceed 3 percent. Class F fly ash shall have a Calcium Oxide (CaO) content of less than 12 percent. Fly ash shall be used only at a rate between 15 and 35 percent of the total cementitious material by mass. The Contractor shall comply with EPA requirements in accordance with SECTION 01670 RECYCLED / RECOVERED MATERIALS.

2.2 AGGREGATES

In addition to the grading requirements specified for coarse aggregate and for fine aggregate, the combined aggregate grading shall meet the following requirements.

a. If necessary, a blending aggregate shall be used to meet the required combined grading. This blending aggregate shall be batched separately. The combined grading of all aggregates used, in the proportions selected, shall be computed on the basis of cumulative percent retained on each sieve specified for fine and coarse aggregate.

b. The materials selected and the proportions used shall be such that when the Coarseness Factor (CF) and the Workability Factor (W) are plotted on a diagram as described in d. below, the point thus determined shall fall within the parallelogram described therein.

c. The Coarseness Factor (CF) shall be determined from the following equation:

CF = (cumulative percent retained on the 3/8 in. sieve)(100)/(cumulative percent retained on the No. 8 sieve)

The Workability Factor (W) is defined as the cumulative percent passing the No. 8 sieve. However, W shall be adjusted, upwards only, by 2.5 percentage points for each 94 pounds of cementitious material per cubic yard greater than 564 pounds per cubic yard.

d. A diagram shall be plotted using a rectangular scale with W on the Y-axis with units from 20 (bottom) to 45 (top), and with CF on the X-axis with units from 80 (left side) to 30 (right side). On this diagram a parallelogram shall be plotted with corners at the following coordinates (CF-75, W-28), (CF-75, W-40), (CF-45, W-32.5), and (CF-45, W-41). If the point determined by the intersection of the computed CF and W does not fall within the above parallelogram, the grading of each size of aggregate used and the proportions selected shall be changed as necessary.

e. In addition, the individual percent retained on each sieve shall be plotted for the combined aggregate grading, on either rectangular or semi-log graph paper. The graph shall show a relative smooth transition between coarse and fine aggregate and shall have no major valleys or peaks in the area smaller than the No. 8 sieve. If this plot does not meet the above criteria, the grading of each size aggregate used and the proportions selected shall be changed as necessary.

2.2.1 Aggregate Sources

Fine and coarse aggregates to be used in all concrete shall be evaluated and tested by the Contractor for alkali-aggregate reactivity in accordance with ASTM C 1260. Both coarse aggregate size groups shall be tested if

from different sources. Test results shall have a measured expansion equal to or less than 0.08 percent at 16 days after casting. Should the test data indicate an expansion greater than 0.08 percent, the aggregate(s) shall be rejected, or additional testing, using a modified version of ASTM C 1260, shall be performed by the Contractor as described below. ASTM C 1260 shall be modified as follows to include one of the following options:

a. Utilize the Contractor's proposed low alkali portland cement and Class F fly ash in combination for the test proportioning. Class F fly ash shall contain less than 12 percent Calcium Oxide (CaO) and shall be used in the range of 25 to 40 percent of the total cementitious material by mass. The quantity shall be determined that will meet all the requirements of these specifications and which will lower the expansion equal to or less than 0.08 percent at 16 days after casting.

If any of the above options does not lower the expansion equal to or less than 0.08 percent at 16 days after casting, the aggregate(s) shall be rejected and the Contractor shall submit new aggregate sources for retesting. The results of the testing shall be submitted to the Contracting Officer for evaluation and acceptance.

2.2.2 Coarse Aggregate

Coarse aggregate shall have a satisfactory service record of at least 5 years successful service in three paving projects or, if a new source is used, shall meet the requirements when tested for resistance to freezing and thawing.

2.2.2.1 Material Composition

Coarse aggregate shall consist of crushed or uncrushed gravel, or crushed stone.

2.2.2.2 Quality

Aggregates as delivered to the mixers shall consist of clean, hard, uncoated particles meeting the requirements of ASTM C 33 and other requirements specified herein. Coarse aggregate shall be washed. Washing shall be sufficient to remove dust and other coatings.

2.2.2.3 Particle Shape Characteristics

Particles of the coarse aggregate shall be generally spherical or cubical in shape. The quantity of flat and elongated particles in any size group shall not exceed 20 percent by weight as determined by COE CRD-C 119. A flat particle is defined as one having a ratio of width to thickness greater than 3; an elongated particle is one having a ratio of length to width greater than 3.

2.2.2.4 Size and Grading

The nominal maximum size of the coarse aggregate shall be 1 inches and shall meet the size groups below. When the nominal maximum coarse size is greater than 1 inch, the aggregates shall be furnished in two size groups as follows:

Nominal Maximum Size Inches	Size Group
3/4	ASTM C 33 --No.67 (No. 4 to 3/4 inch)
1-1/2	ASTM C 33 --No. 4 (3/4 to 1-1/2 inch

The grading of the coarse aggregate within the separated size groups shall conform to the requirements of ASTM C 33, Sizes 67 and 4 as delivered to the mixer.

2.2.2.5 Deleterious Materials - Airfield Pavements

The amount of deleterious material in each sieve size of coarse aggregate shall not exceed the limits shown in Table 5 below, determined in accordance with the test methods shown.

TABLE 5
LIMITS OF DELETERIOUS MATERIALS IN COARSE AGGREGATE
FOR AIRFIELD PAVEMENTS
Percentage by Mass

Materials	
Clay lumps and friable particles (ASTM C 142)	2.0
Shale (a) (ASTM C 295)	1.0
Material finer than 0.075 mm (No. 200 sieve) (b) (ASTM C 117)	1.0
Lightweight particles (c) (ASTM C 123)	0.5
Clay ironstone (d) (ASTM C 295)	1.0
Chert and cherty stone (less than 2.40 Mg/cubic meter density SSD (2.40 Sp. Gr.)) (e) (ASTM C 295)	1.0
Claystone, mudstone, and siltstone (f) (ASTM C 295)	1.0
Shaly and argillaceous limestone (g) (ASTM C 295)	1.0
Other soft particles COE CRD-C 130	1.0
Total of all deleterious substances exclusive of material	3.0

TABLE 5
LIMITS OF DELETERIOUS MATERIALS IN COARSE AGGREGATE
FOR AIRFIELD PAVEMENTS
Percentage by Mass

Materials	
finer than 0.075 mm (No. 200 sieve)	

a. Shale is defined as a fine-grained, thinly laminated or fissile sedimentary rock. It is commonly composed of clay or silt or both. It has been indurated by compaction or by cementation, but not so much as to have become slate.

b. Limit for material finer than 0.075 mm (No. 200 sieve) will be increased to 1.5 percent for crushed aggregates if the fine material consists of crusher dust that is essentially free from clay or shale.

c. The separation medium shall have a density of 2.0 Mg/cubic meter (Sp. Gr. of 2.0). This limit does not apply to coarse aggregate manufactured from blast-furnace slag unless contamination is evident.

d. Clay ironstone is defined as an impure variety of iron carbonate, iron oxide, hydrous iron oxide, or combinations thereof, commonly mixed with clay, silt, or sand. It commonly occurs as dull, earthy particles, homogeneous concretionary masses, or hard-shell particles with soft interiors. Other names commonly used for clay ironstone are "chocolate bars" and limonite concretions.

e. Chert is defined as a rock composed of quartz, chalcedony or opal, or any mixture of these forms of silica. It is variable in color. The texture is so fine that the individual mineral grains are too small to be distinguished by the unaided eye. Its hardness is such that it scratches glass but is not scratched by a knife blade. It may contain impurities such as clay, carbonates, iron oxides, and other minerals. Other names commonly applied to varieties of chert are: flint, jasper, agate, onyx, hornstone, porcellanite, novaculite, sard, carnelian, plasma, bloodstone, touchstone, chrysoprase, heliotrope, and petrified wood. Cherty stone is defined as any type of rock (generally limestone) that contains chert as lenses and nodules, or irregular masses partially or completely replacing the original stone.

f. Claystone, mudstone, or siltstone, is defined as a massive fine-grained sedimentary rock that consists predominantly of indurated clay or silt without laminations or fissility. It may be indurated either by compaction or by cementation.

g. Shaly limestone is defined as limestone in which shale occurs as one or more thin beds or laminae. These laminae may be regular or very irregular and may be spaced from a few inches down to minute fractions of an inch. Argillaceous limestone is defined as a limestone in which clay minerals occur disseminated in the stone in the amount of 10 to 50 percent by weight of the rock; when these make up from 50 to 90 percent, the rock is known as calcareous (or dolomitic) shale (or claystone, mudstone, or siltstone).

2.2.2.6 Testing Sequence Deleterious Materials -- Airfields Only

The size of the sample shall be at least 200 pounds for the 3/4 to 1-1/2 inch size and 25 pounds for the No. 4 to 3/4 inch coarse aggregate and 10 pounds for the fine aggregate. The Contractor shall provide facilities for the ready procurement of representative test samples. Samples shall be taken and tested by and at the expense of the Contractor, using an appropriate Corps of Engineers approved laboratory and ASTM test methods. Additional tests and analyses of aggregates at various stages in the processing and handling operations may be made by the Government at the discretion of the Contracting Officer. Such Government testing will not relieve the Contractor of any of its testing responsibilities. The testing procedure on each sample of coarse aggregate for compliance with limits on deleterious materials shall be as follows:

Step 1: Test approximately one-fifth of sample for material finer than the No. 200 sieve.

Step 2: Wash off material finer than No. 200 sieve from the remainder of the sample and recombine the remainder with material retained on the No. 200 sieve from Step 1.

Step 3: Test remaining full sample for clay lumps and friable particles and remove.

Step 4: Test remaining full sample for lightweight particles and remove, and then for chert and/or cherty stone with SSD density of less than 2.40 Mg/cubic meter (Sp. Gr. 2.40) and remove.

Step 5: Test remaining sample for clay-ironstone, shale, claystone, mudstone, siltstone, shaly and/or argillaceous limestone, and remove.

Step 6: Test approximately one-fifth of remaining full sample for other soft particles.

Determination of deleterious materials listed in Steps 4 and 5 shall be performed by an individual specifically trained in petrographic identification. The individual selected to perform the identification of these deleterious materials shall be subject to approval and, at least 10 days before any individual is proposed to commence this type of work, the Contractor shall submit a written resume, of the individual's training and experience for approval by the Contracting Officer. The Contractor will not be entitled to any extension of time or additional payment due to any delays caused by the testing, evaluation, or personnel requirements.

2.2.2.7 Resistance to Freezing and Thawing

Coarse aggregate not having a satisfactory demonstrable service record shall have a durability factor of 50 or more when subjected to freezing and thawing in concrete in accordance with COE CRD-C 114.

2.2.2.8 Resistance to Abrasion

Coarse aggregate shall not show more than 40 percent loss when subjected to the Los Angeles abrasion test in accordance with ASTM C 131.

2.2.3 Fine Aggregate

Fine aggregate shall have a service record of at least 5 years satisfactory

service in three paving projects or, if a new source is used, shall meet the requirements for resistance to freezing and thawing.

2.2.3.1 Composition

Fine aggregate shall consist of natural sand, manufactured sand, or a combination of the two, and shall be composed of clean, hard, durable particles. Irrespective of the source from which it is obtained, all fine aggregate shall be composed of clean, hard, durable particles meeting the requirements of ASTM C 33. Each type of fine aggregate shall be stockpiled and batched separately. Any degree of contamination will be cause for the rejection of the entire stockpile.

2.2.3.2 Particle Shape

Particles of the fine aggregate shall be generally spherical or cubical in shape.

2.2.3.3 Grading

Grading of the fine aggregate, as delivered to the mixer, shall conform to the requirements of ASTM C 33. In addition, the fine aggregate, as delivered to the mixer, shall have a fineness modulus of not less than 2.50 nor more than 3.00. The grading of the fine aggregate also shall be controlled so that the fineness moduli of at least nine of every set of ten consecutive samples of the fine aggregate, as delivered to the mixer, will not vary more than 0.15 from the average fineness moduli of all samples previously taken. The fineness modulus shall be determined by COE CRD-C 104.

2.2.3.4 Deleterious Material

The amount of deleterious material in the fine aggregate shall not exceed the following limits by mass:

Material	Percentage by Mass
Clay lumps and friable particles ASTM C 142	1.0
Material finer than 0.075 mm (No. 200 sieve) ASTM C 117	3.0
Lightweight particles ASTM C 123 using a medium with a density of 2.0 Mg/cubic meter (Sp. Gr. of 2.0))	0.5
Total of all above	3.0

2.2.3.5 Resistance to Freezing and Thawing

Fine aggregate not having a satisfactory demonstrable service record shall have a durability factor of 50 or more when subjected to freezing and thawing in concrete in accordance with COE CRD-C 114.

2.3 CHEMICAL ADMIXTURES

2.3.1 Air-Entraining Admixtures

The air-entraining admixture shall conform to ASTM C 260 and shall consistently entrain the air content in the specified ranges under field conditions. The air-entraining admixture shall be in a solution of

suitable concentration for field use.

2.3.2 Accelerator

An accelerator shall be used only when specified in paragraph SPECIFIED CONCRETE STRENGTH AND OTHER PROPERTIES and shall not be used to reduce the amount of cementitious material used. Accelerator shall conform to ASTM C 494/C 494M, Type C. Calcium chloride and admixtures containing calcium chloride shall not be used.

2.3.3 Retarder

A retarding admixture shall meet the requirements of ASTM C 494/C 494M, Type B, except that the 6-month and 1-year compressive strength tests are waived. The use of the admixture is at the option of the Contractor, but shall not be used to reduce the amount of cementitious material.

2.3.4 Water-Reducer

A water-reducing admixture shall meet the requirements of ASTM C 494/C 494M, Type A or D except that the 6-month and 1-year compressive strength tests are waived. The admixture may be added to the concrete mixture only when its use is approved or directed, and only when it has been used in mixture proportioning studies to arrive at approved mixture proportions.

2.4 CURING MATERIALS

2.4.1 Membrane Forming Curing Compound

Membrane forming curing compound shall be a white pigmented compound conforming to COE CRD-C 300.

2.4.2 Burlap

Burlap used for curing shall conform to AASHTO M 182, Class 3 or 4. Materials shall be new or shall be clean materials never used for anything other than curing concrete.

2.4.3 Impervious Sheet Materials

Impervious polyethylene sheet shall not be used.

2.5 WATER

Water for mixing and curing shall be fresh, clean, potable, and free of injurious amounts of oil, acid, salt, or alkali, except that non-potable water may be used if it meets the requirements of COE CRD-C 400.

2.6 JOINT MATERIALS

2.6.1 Expansion Joint Material

Expansion joint filler shall be a preformed material conforming to ASTM D 1751 or ASTM D 1752 Type I, II, or III. Expansion joint filler shall be 3/4 inch thick.

2.7 REINFORCING

All reinforcement shall be free from loose, flaky rust, loose scale, oil,

grease, mud, or other coatings that might reduce the bond with concrete. Removal of thin powdery rust and tight rust is not required. However, reinforcing steel which is rusted to the extent that it does not conform to the required dimensions or mechanical properties shall not be used.

2.7.1 Reinforcing Bars and Bar Mats

Reinforcing bars shall conform to ASTM A 615/A 615M, billet-steel,ASTM A 616/A 616M, rail-steel, or ASTM A 617/A 617M, axle-steel, Grade 60. Bar mats shall conform to ASTM A 184/A 184M. The bar members shall be billet, rail, or axle steel.

2.8 DOWELS

2.8.1 Dowels

Dowels shall be single piece bars fabricated or cut to length at the shop or mill before delivery to the site. Dowels shall be free of loose, flaky rust and loose scale and shall be clean and straight. Dowels may be sheared to length provided that the deformation from true shape caused by shearing does not exceed 0.04 inch on the diameter of the dowel and does not extend more than 0.04 inch from the end of the dowel. Dowels shall be plain (non-deformed) steel bars conforming to ASTM A 615/A 615M, Grade 40 or 60; ASTM A 616/A 616M, Grade 50 or 60; or ASTM A 617/A 617M, Grade 40 or 60; or shall be steel pipe conforming to ASTM A 53/A 53M, extra strong, as indicated. If split dowels are proposed for use, a complete description of the materials and installation procedures shall be submitted for approval at least 15 days before start of construction. Paint for dowels shall conform to MIL-DTL-24441/20.

2.9 EPOXY RESIN

All epoxy-resin materials shall be two-component materials conforming to the requirements of ASTM C 881, Class as appropriate for each application temperature to be encountered, except that in addition, the materials shall meet the following requirements:

a. Material for use for embedding dowels and anchor bolts shall be Type IV, Grade 3.

b. Material for use as patching materials for complete filling of spalls, wide cracks, and other voids and for use in preparing epoxy resin mortar shall be Type III, Grade as approved.

c. Material for use for injecting cracks shall be Type IV, Grade 1.

d. Material for bonding freshly mixed portland cement concrete or mortar or freshly mixed epoxy resin concrete or mortar to hardened concrete shall be Type V, Grade as approved.

2.10 SPECIFIED CONCRETE STRENGTH AND OTHER PROPERTIES

2.10.1 Specified Flexural Strength

Specified flexural strength, R, for concrete is 625 psi at 28 days, as determined by tests made in accordance with ASTM C 78 of beams fabricated and cured in accordance with ASTM C 192/C 192M or as determined by equivalent flexural strength for acceptance as specified in paragraph, Flexural Strength. Maximum allowable water-cementitious material ratio is

0.45. The water-cementitious material ratio will be the equivalent water-cement ratio as determined by conversion from the weight ratio of water to cement plus pozzolan by the mass equivalency method described in ACI 211.1. The concrete shall be air-entrained with a total air content of 6 plus or minus 1.5 percentage points, at the point of placement. Air content shall be determined in accordance with ASTM C 231. The maximum allowable slump of the concrete at the point of placement shall be 2 inches for pavement constructed with fixed forms. For slipformed pavement, at the start of the project, the Contractor shall select a maximum allowable slump which will produce in-place pavement meeting the specified tolerances for control of edge slump.

2.10.2 Concrete Temperature

The temperature of the concrete as delivered shall conform to the requirements of paragraphs, Paving in Hot Weather and Paving in Cold Weather. Temperature of concrete shall be determined in accordance with ASTM C 1064/C 1064M.

2.10.3 Concrete Strength for Final Acceptance

The strength of the concrete will be considered acceptable when the average equivalent 28-day Flexural strengths for each lot are above the 'Specified Flexural Strength' as determined by correlation with 14-day compressive strength tests specified in paragraph MIXTURE PROPORTIONS BY CONTRACTOR for 28-day flexural Strength, and no individual set (2 cylinders per sublot) in the lot are 25 psi or more below the equivalent 'Specified Flexural Strength'. If any lot or sublot, respectively, fails to meet the above criteria, the lot or sublot shall be removed and replaced at no additional cost to the Government. This is in addition to and does not replace the average strength required for day-to-day CQC operations as specified in paragraph Average Flexural Strength Required for Mixtures.

2.11 MIXTURE PROPORTIONS BY CONTRACTOR

2.11.1 Composition

Concrete shall be composed of cementitious material, water, fine and coarse aggregates, and admixtures. The cementitious material shall be portland cement, in combination with pozzolan. Fly ash, if used with non alkali-reactive aggregates, shall consist of not less than 15 percent of the cementitious material by mass and not more than 35 percent. If Class F fly ash is required to mitigate potential alkali-aggregate reactivity, the percentage by mass determined from the modified ASTM C 1260 testing shall be used in the mixture proportioning studies. Admixtures shall consist of air entraining admixture and may also include, as approved a water-reducing admixture. If water-reducer is used, it shall be used only at the dosage determined during mixture proportioning studies.

2.11.2 Concrete Proportioning Studies, Pavement Concrete

Trial design batches, mixture proportioning studies, and testing requirements shall be the responsibility of the Contractor and shall have been performed not more than six months prior to placement of concrete for this project. Mixture proportioning studies shall be performed by a Corps of Engineers approved commercial laboratory, inspected by the Government, and approved in writing. The laboratory performing the mixture proportioning shall conform with ASTM C 1077. Strength requirements during mixture proportioning studies shall be based on flexural strength as

determined by test specimens fabricated in accordance with ASTM C 192/C 192M and tested in accordance with ASTM C 78. Samples of all materials used in mixture proportioning studies shall be representative of those proposed for use on the project and shall be accompanied by the manufacturer's or producer's test reports indicating compliance with these specifications. Trial mixtures having proportions, slumps, and air content suitable for the work shall be based on methodology described in ACI 211.1, modified as necessary to accommodate flexural strength.

2.11.2.1 Water-Cement Ratio

At least three different water-cement ratios, which will produce a range of strength encompassing that required on the project, shall be used. The maximum allowable water-cement ratio required in paragraph Maximum Water-Cement Ratio will be the equivalent water-cement ratio as determined by conversion from the mass ratio of water to cement plus pozzolan by the weight equivalency method as described in ACI 211.1. Laboratory trial mixtures shall be proportioned for maximum permitted slump and air content.

2.11.2.2 Trial Mixture Studies

Separate sets of trial mixture studies shall be made for each combination of cementitious materials and each combination of admixtures proposed for use. No combination of either shall be used until proven by such studies. Separate trial mixture studies shall also be made for concrete for any placing method proposed which requires special properties. The temperature of concrete in each trial batch shall be reported. Each mixture shall be designed to promote easy and suitable concrete placement, consolidation and finishing, and to prevent segregation and excessive bleeding. Concrete proportioning studies shall be performed using the following procedures:

2.11.2.3 Mixture Proportioning for 28-day Flexural Strength

The following step by step procedure shall be followed:

a. Fabricate all beams and cylinders for each mixture from the same batch or blend of batches. Fabricate and cure all beams and cylinders in accordance with ASTM C 192/C 192M, using 6 x 6 inch beams and 6 x 12 inch cylinders.

b. Test beams in accordance with ASTM C 78, cylinders in accordance with ASTM C 39/C 39M.

c. Fabricate and cure test beams from each mixture for 7, 14, and 28-day flexural tests; 6 beams to be tested per age.

d. Fabricate and cure test cylinders from each mixture for 7, 14, and 28 -day compressive strength tests; 6 cylinders to be tested per age.

e. Using the average strength for each w/c at each age, plot all results from each of the three mixtures on separate graphs for w/c versus:

7-day flexural strength
14-day flexural strength
28-day flexural strength

7-day compressive strength
14-day compressive strength

28-day compressive strength

f. From these graphs select a w/c that will produce a mixture giving a 28-day flexural strength equal to the required strength determined in accordance with paragraph "Average Flexural Strength Required for Mixtures".

g. Using the above selected w/c, select from the graphs the expected 7, 14, and 28-day flexural strengths and the expected 7, 14, and 28-day compressive strengths for the mixture.

h. From the above expected strengths for the selected mixture determine the following Correlation Ratios:

1. Ratio of the 14-day compressive strength of the selected mixture to the 28-day flexural strength of the mixture (for acceptance).

2. Ratio of the 7-day compressive strength of the selected mixture to the 28-day flexural strength of the mixture (for CQC control).

i. If there is a change in materials, additional mixture design studies shall be made using the new materials and new Correlation Ratios shall be determined.

j. No concrete pavement shall be placed until the Contracting Officer has approved the Contractor's mixture proportions.

2.11.3 Contractor Quality Control for Average Flexural Strength

The Contractor's day to day production shall be Controlled (CQC) in accordance with the criteria herein, in the following subparagraphs, and in par. 'Concrete Strength Testing for CQC'. This is entirely different from the acceptance requirements of par. 'Concrete Strength for Final Acceptance', and it is mandatory that both sets of requirements must be met. If at any time, the 'equivalent average 28-day flexural strength', for any lot, as determined by correlation with results of 7-day compressive test specimens, is 69 psi or more below the 'required equivalent average 28-day flexural strength', as specified below, the paving operation shall be stopped and the Contractor shall take necessary steps to improve the mixture proportioning, materials, or the batching and mixing to increase the strength. The paving operations shall not recommence until the Contracting Officer has approved the Contractor's Proposed changes in writing.

2.11.3.1 Average CQC Flexural Strength Required for Mixtures

In order to ensure meeting, the strength requirements specified in paragraph SPECIFIED CONCRETE STRENGTH AND OTHER PROPERTIES, during production, the mixture proportions selected during mixture proportioning studies and used during construction shall produce a required average CQC flexural strength exceeding the specified strength, R, by the amount indicated below. This required average CQC flexural strength, Ra, will be used only for CQC operations as specified in paragraph TESTING AND INSPECTION FOR CONTRACTOR QUALITY CONTROL and as specified in the previous paragraph. During production, the required Ra shall be adjusted (increased or decreased), as appropriate and as approved, based on the standard deviation of equivalent 28-day strengths being attained during paving.

a. From Previous Test Records: Where a concrete production facility has previous test records, a standard deviation shall be established in accordance with the applicable provisions of ACI 214.3R. Test records from which a standard deviation is calculated shall represent materials, quality control procedures, and conditions similar to those expected, shall represent concrete produced to meet a specified flexural strength or strengths within 150 psi of the 28-day flexural strength specified for the proposed work, and shall consist of at least 30 consecutive tests. A strength test shall be the average of the strengths of two specimens made from the same sample of concrete and tested at 28 days. Required average CQC flexural strength, Ra, used as the basis for selection of concrete proportions shall be the value from the equation that follows, using the standard deviation as determined above:

$$Ra = R + 1.34S$$

Where: S = standard deviation
R = specified flexural strength
Ra = required average flexural strength

Where a concrete production facility does not have test records meeting the requirements above but does have a record based on 15 to 29 consecutive tests, a standard deviation shall be established as the product of the calculated standard deviation and a modification factor from the following table:

NUMBER OF TESTS	MODIFICATION FACTOR FOR STANDARD DEVIATION
15	1.16
20	1.08
25	1.03
30 or more	1.00

b. Without Previous Test Records: When a concrete production facility does not have sufficient field strength test records for calculation of the standard deviation, the required average strength, Ra, shall be determined by adding 15 percent to the specified flexural strength, R.

PART 3 EXECUTION

3.1 PREPARATION FOR PAVING

Before commencing paving, the following shall be performed. Surfaces to receive concrete shall be prepared as specified below. If used, forms shall be in place, cleaned, coated, and adequately supported. Any reinforcing steel needed shall be at the paving site. All transporting and transfer equipment shall be ready for use, clean, and free of hardened concrete and foreign material. Equipment for spreading, consolidating, screeding, finishing, and texturing concrete shall be at the paving site, clean and in proper working order. All equipment and material for curing and for protecting concrete from weather or mechanical damage shall be at the paving site, in proper working condition, and in sufficient amount for the entire placement. When hot, windy conditions during paving appear probable, equipment and material shall be at the paving site to provide windbreaks, shading, fogging, or other action to prevent plastic shrinkage cracking or other damaging drying of the concrete.

3.2 CONDITIONING OF UNDERLYING MATERIAL

3.2.1 General Procedures

Underlying material, upon which concrete is to be placed shall be clean, damp, and free from debris, waste concrete or cement, frost, ice, and standing or running water. Prior to setting forms or placement of concrete, the underlying material shall be well drained and shall have been satisfactorily graded and uniformly compacted in accordance with the applicable Section of these specifications. The surface shall be tested as to crown, elevation, and density in advance of setting forms or of concrete placement using slip-form techniques. High areas shall be trimmed to proper elevation. Low areas shall be filled and compacted to a condition similar to that of surrounding grade, or filled with concrete monolithically with the pavement. Where low areas are filled with concrete, the areas shall be marked, as approved, and cores for thickness determinations as required by paragraph, Flexural Strength and Thickness shall not be drilled in those areas. Any underlying material disturbed by construction operations shall be reworked and recompacted to specified density immediately in front of the paver. If a slipform paver is permitted and is used, the same underlying material under the paving lane shall be continued beyond the edge of the lane a sufficient distance and shall be thoroughly compacted and true to grade to provide a suitable trackline for the slipform paver and firm support for the edge of the paving lane. Where an open-graded granular base is required under the concrete, the Contractor shall select paving equipment and procedures which will operate properly on the base course without causing displacement or other damage.

3.2.2 Traffic on Underlying Material

After the underlying material has been prepared for concrete placement, no equipment shall be permitted thereon. Subject to specific approval, crossing of the underlying material at specified intervals for construction purposes may be permitted, provided rutting or indentations do not occur; however, if traffic has been allowed to use the underlying material, the surface shall be reworked and reprepared to the satisfaction of the Contracting Officer before concrete is placed.

3.3 WEATHER LIMITATIONS

3.3.1 Placement and Protection During Inclement Weather

The Contractor shall not commence placing operations when heavy rain or other damaging weather conditions appear imminent. At all times when placing concrete, the Contractor shall maintain on-site sufficient waterproof cover and means to rapidly place it over all unhardened concrete or concrete that might be damaged by rain. Placement of concrete shall be suspended whenever rain or other damaging weather commences to damage the surface or texture of the placed unhardened concrete, washes cement out of the concrete, or changes the water content of the surface concrete. All unhardened concrete shall be immediately covered and protected from the rain or other damaging weather. Any pavement damaged by rain or other weather shall be completely removed and replaced at the Contractor's expense as specified in paragraph, Repair, Removal, Replacement of Slabs.

3.3.2 Paving in Hot Weather

When the ambient temperature during paving is expected to exceed 90 degrees F, the concrete shall be properly placed and finished in accordance with procedures previously submitted and as specified herein. The concrete temperature at time of delivery to the forms shall not exceed the temperature shown in the table below when measured in accordance with ASTM C 1064/C 1064M. Cooling of the mixing water or aggregates or placing in the cooler part of the day may be required to obtain an adequate placing temperature. An approved retarder may be used to facilitate placing and finishing. Steel forms and reinforcing shall be cooled as approved prior to concrete placement when steel temperatures are greater than 120 degrees F. Transporting and placing equipment shall be cooled or protected if necessary to maintain proper concrete-placing temperature. Concrete shall be placed continuously and rapidly at a rate of not less than 100 feet of paving lane per hour. The finished surfaces of the newly laid pavement shall be kept damp by applying a fog spray (mist) with approved spraying equipment until the pavement is covered by the curing medium. If necessary, wind screens shall be provided to protect the concrete from an evaporation rate in excess of 0.2 lb./square foot per hour, as determined by method shown in Figure 2.1.5 of ACI 305R.

Maximum Allowable Concrete Placing Temperature

Relative Humidity, Percent, During Time of Concrete Placement	Maximum Allowable Concrete Temperature in Degrees F
Greater than 60	90
40-60	85
Less than 40	80

3.3.3 Prevention of Plastic Shrinkage Cracking

During hot weather with low humidity, and particularly with appreciable wind, the Contractor shall develop and institute measures to prevent plastic shrinkage cracks from developing. Particular care shall be taken if plastic shrinkage cracking is potentially imminent and especially if it has developed during a previous placement. Periods of high potential for plastic shrinkage cracking can be anticipated by use of Fig. 2.1.5 of ACI 305R. In addition to the protective measures specified in the previous paragraph, the concrete placement shall be further protected by erecting shades and windbreaks and by applying fog sprays of water, sprinkling, ponding, or wet covering. When such water treatment is stopped, curing procedures shall be immediately commenced. Plastic shrinkage cracks that occur shall be filled by injection of epoxy resin as directed, after the concrete hardens. Plastic shrinkage cracks shall never be troweled over or filled with slurry.

3.3.4 Paving in Cold Weather

Special protection measures, as submitted and approved, and as specified herein, shall be used if freezing temperatures are anticipated before the expiration of the specified curing period. The ambient temperature of the air at the placing site and the temperature of surfaces to receive concrete shall be not less 40 degrees F. However, placement may begin when both the ambient temperature and the temperature of the underlying material are at least 35 degrees F and rising. When the ambient temperature is less than

50 degrees F, the temperature of the concrete when placed shall be not less than 50 degrees F nor more than 75 degrees F. Heating of the mixing water or aggregates will be required to regulate the concrete placing temperature. Materials entering the mixer shall be free from ice, snow, or frozen lumps. Salt, chemicals or other materials shall not be incorporated in the concrete to prevent freezing. Calcium chloride shall not be used at any time. Covering and other means shall be provided for maintaining the concrete at a temperature of at least 50 degrees F for not less than 72 hours after placing, and at a temperature above freezing for the remainder of the curing period. Pavement damaged by freezing shall be completely removed and replaced at the Contractor's expense as specified in paragraph REPAIR, REMOVAL, REPLACEMENT OF SLABS.

3.4 CONCRETE PRODUCTION

Batching, mixing, and transporting equipment shall have a capacity sufficient to maintain a continuous, uniform forward movement of the paver of not less than 2.5 feet per minute. Concrete shall be deposited in front of the paver within 45 minutes from the time cement has been charged into the mixing drum, except that if the ambient temperature is above 90 degrees F, the time shall be reduced to 30 minutes. No water shall be added to the concrete after it is batched except that, if truck mixers are permitted, water may be added at the paving site to adjust the slump as approved, provided the maximum allowable w/c is not exceeded. Such water shall be injected under pressure as described in subparagraph, Truck Mixers. Every load of concrete delivered to the paving site shall be accompanied by a batch ticket from the operator of the batching plant. Tickets shall be on approved forms and shall show at least the mass, or volume, of all ingredients in each batch delivered, the water meter and revolution meter reading on truck mixers and the time of day. Tickets shall be delivered to the placing foreman who shall keep them on file and deliver them to the Government on request.

3.4.1 Batching and Mixing Concrete

The batching and mixing equipment and the operation thereof shall conform to the requirements of paragraph EQUIPMENT and as specified herein. All equipment shall be kept clean and in operable condition at all times. Scale pivots and bearings shall be kept clean and free of rust. Any equipment which fails to perform as specified shall immediately be removed from use until properly repaired and adjusted, or replaced.

3.4.2 Transporting and Transfer - Spreading Operations

The transporting and transfer equipment and the operation thereof shall conform to the requirements of paragraph EQUIPMENT and as specified herein. All equipment shall be kept clean and in operable condition at all times. Non-agitating equipment shall be used only on smooth roads and for haul time less than 30 minutes at all times during the work day. No transporting equipment shall be allowed to operate on the prepared and compacted underlying material in front of the paver-finisher. An approved transfer spreader shall be used to transfer the concrete from hauling equipment outside the paving lane and to spread it evenly and strike it off to approximate grade in front of the paver-finisher. Concrete shall be deposited as close as possible to its final position in the paving lane. All equipment shall be operated to discharge and transfer concrete without segregation. In no case shall dumping of concrete in discrete piles be permitted. No transfer or spreading operation which requires the use of front-end loaders, dozers, or similar equipment to

distribute the concrete will be permitted. All batching and mixing, transporting, transferring, paving, and finishing shall be properly coordinated and controlled such that the paver-finisher has a continuous forward movement at a reasonably uniform speed from beginning to end of each paving lane, except for inadvertent equipment breakdown. Failure to achieve this shall require the Contractor to halt operations, regroup, and modify operations to achieve this requirement.

3.5 PAVING

3.5.1 General Requirements

The paving and finishing equipment and the operation thereof shall conform to the requirements of paragraph EQUIPMENT and as specified herein. All equipment shall be kept clean and properly operable at all times. Pavement shall be constructed with paving and finishing equipment utilizing rigid fixed forms or by use of slipform paving equipment. Paving and finishing equipment and procedures shall be capable of constructing paving lanes of the required width at a rate of at least 100 feet of paving lane per hour on a routine basis. Paving equipment and its operation shall be controlled, and coordinated with all other operations, such that the paver-finisher has a continuous forward movement, at a reasonably uniform speed, from beginning to end of each paving lane, except for inadvertent equipment breakdown. Workmen with foreign material on their footwear or construction equipment that might deposit foreign material shall not be permitted to walk or operate in the plastic concrete.

3.5.2 Consolidation

Concrete shall be consolidated with the specified type of lane-spanning, gang-mounted, mechanical, immersion type vibrating equipment mounted in front of the paver, supplemented, in rare instances as specified, by hand-operated vibrators. Gang-mounted vibrator spuds shall be spaced so as to thoroughly consolidate the entire paving lane, but not more than 30 inch spacing, and with the outside vibrators not more than 12 inches from the edge of the lane. The vibrators shall be inserted into the concrete to a depth that will provide the best full-depth consolidation but not closer to the underlying material than 2 inches. The vibrators or any tamping units in front of the paver shall be automatically controlled so that they shall be stopped immediately as forward motion ceases. Excessive vibration shall not be permitted. If the vibrators cause visible tracking in the paving lane, the paving operation shall be stopped and equipment and operations modified to prevent it. Concrete in small, odd-shaped slabs or in isolated locations inaccessible to the gang-mounted vibration equipment shall be vibrated with an approved hand-operated immersion vibrator. Vibrators shall not be used to transport or spread the concrete. Hand-operated vibrators shall not be operated in the concrete at one location for more than 20 seconds. For each paving train, at least one additional vibrator spud, or sufficient parts for rapid replacement and repair of vibrators shall be maintained at the paving site at all times. Any evidence of inadequate consolidation (honeycomb along the edges, large air pockets, or any other evidence) shall require the immediate stopping of the paving operation and approved adjustment of the equipment or procedures.

3.5.3 Operation

When the paver approaches a header at the end of a paving lane, a sufficient amount of concrete shall be maintained ahead of the paver to provide a roll of concrete which will spill over the header. The amount of

extra concrete shall be sufficient to prevent any slurry that is formed and carried along ahead of the paver from being deposited adjacent to the header. The spud vibrators in front of the paver shall be brought as close to the header as possible before they are lifted. Additional consolidation shall be provided adjacent to the headers by hand-manipulated vibrators. When the paver is operated between or adjacent to previously constructed pavement (fill-in lanes), provisions shall be made to prevent damage to the previously constructed pavement. Transversely oscillating screeds and extrusion plates shall overlap the existing pavement the minimum possible, but in no case more than 8 inches. These screeds or extrusion plates shall be electronically controlled from the previously placed pavement so as to prevent them from applying pressure to the existing pavement and to prevent abrasion of the pavement surface. The overlapping area of existing pavement surface shall at all times be kept completely free of any loose or bonded foreign material as the paver-finisher operates across it. When the paver travels on existing pavement, approved provisions shall be made to prevent damage to the existing pavement. Pavers using transversely oscillating screeds shall not be used to form fill-in lanes that have widths less than a full width for which the paver was designed or adjusted.

3.5.4 Required Results

The paver-finisher, and its gang-mounted vibrators, together with its operating procedures shall be adjusted and operated and coordinated with the concrete mixture being used to produce a thoroughly consolidated slab throughout, true to line and grade within specified tolerances. The screed or the extrusion plate shall be properly adjusted to produce a pavement surface true to line and grade. Any necessary adjustment to compensate for surging behind the screed or for inadequate height of surface after paving shall be carefully made and checked frequently. The paver-finishing operation shall produce a surface finish free of irregularities, tears, voids of any kind, and any other discontinuities. It shall produce only a very minimum of paste at the surface; never more than 3/32 inch cover over the top layer of coarse aggregate. The paver-finisher shall make only one pass across the pavement; multiple passes will not be permitted. The equipment and its operation shall produce a finished surface requiring no hand finishing other than the use of cutting straightedges, except in very infrequent instances. If any equipment or operation fails to produce the above results, the paving shall be stopped, the equipment shall be replaced or properly adjusted, the operation shall be appropriately modified, or the mixture proportions modified, in order to produce the required results before recommencing paving. No water, other than true fog sprays (mist) as specified in paragraph, Prevention of Plastic Shrinkage Cracking, shall be applied to the concrete or the concrete surface during paving and finishing.

3.5.5 Fixed Form Paving

Paving equipment for fixed-form paving and the operation thereof shall conform to the requirements of paragraph EQUIPMENT, all requirements specified above under paragraph PAVING and as specified herein.

3.5.5.1 Forms for Fixed-Form Paving

a. Forms shall be steel, except that wood forms may be used for curves having a radius of 150 feet or less, and for fillets. Forms shall be equal in depth to the edge thickness of the slab as shown on the drawings. Forms shall be in one piece for the full depth required, except as permitted below. Under no conditions shall forms be adjusted by filling or excavating under the forms

to an elevation other than the bottom of the pavement slab. Where the project requires several different slab thicknesses, forms may be built up with metal or wood to provide an increase in depth of not more than 25 percent. The required form depth may be obtained by securely bolting or welding to the bottom of the form a tubular metal section of the proper thickness or by securely bolting wood planks to the bottom of the form. The tubular metal section or wood planks shall completely cover the underside of the base of the form and shall extend beyond the edge of the base a sufficient distance to provide the necessary stability. The base width of the one-piece form, or built-up form, shall be not less than eight-tenths of the vertical height of the form, except that forms 8 inches or less in vertical height shall have a base width not less than the vertical height of the form. Forms shall not be built-up by adding to the top. The top surface of each form section shall not vary more than 1/16 inch in 12 feet from a true line. The face of the form shall not vary more than 3/16 inch in 12 feet from a true plane. Forms with battered top surfaces or distorted faces or bases shall be removed from the project.

b. Steel forms shall be furnished in sections not less than 10 feet in length, except that on curves having a radius of 150 feet or less, the length of the sections shall be 5 feet unless the sections are flexible or curved to the proper radius. Each 10 foot length of form shall be provided with at least three form braces and pin sockets so spaced that the form will be rigidly braced throughout its length. Lock joints between form sections shall be free from play or movement. Forms shall be free of warps, bends, or kinks.

c. Wood forms for curves and fillets shall be made of well-seasoned, surfaced plank or plywood, straight, and free from warp or bend. Wood forms shall be adequate in strength and rigidly braced.

d. The forms shall be set on firm material cut true to grade so that each form section when placed will be firmly in contact with the underlying layer for its entire length and base width. Underlying material shall be thoroughly compacted and trimmed to grade before forms are set in place. Setting forms on blocks or on built-up spots of underlying material will be not permitted under any condition. The form sections shall be staked into position and tightly locked together. The length of pins and quantity provided in each section shall be sufficient to hold the form at the correct line and grade. When tested with a straightedge, the top of the installed form shall conform to the requirements specified for the finished surface of the concrete, and the longitudinal axis of the upstanding leg shall not vary more than 1/4 inch from the straightedge. Conformity to the alignment and grade elevations shown on the drawings shall be checked and necessary corrections shall be made immediately prior to placing the concrete. Forms shall be set well in advance of concrete placement. The forms shall be cleaned and oiled each time before concrete is placed. No concrete shall be placed until setting of forms has been checked and approved by the CQC team.

3.5.5.2 Form Removal

Forms shall remain in place at least 12 hours after the concrete has been

placed. When conditions are such that the early strength gain of the concrete is delayed, the forms shall be left in place for a longer time, as directed. Forms shall be removed by procedures that do not injure the concrete. Bars or heavy metal tools shall not be used directly against the concrete in removing the forms. Any concrete found to be defective after form removal shall be repaired promptly, using procedures specified hereinafter or as directed.

3.5.6 Slipform Paving

3.5.6.1 General

Paving equipment for slipform paving and the operation thereof shall conform to the requirement of paragraph EQUIPMENT, all requirements specified above in subparagraphs, General, Consolidation, Operation, and Required Results, and as specified herein. The slipform paver shall shape the concrete to the specified and indicated cross section, meeting all tolerances, in one pass. The slipform paver shall finish the surface and edges so that only a very minimum isolated amount of hand finishing is required. If the paving operation does not meet the above requirements and the specified tolerances, the operation shall be immediately stopped, and the Contractor shall regroup and replace or modify any equipment as necessary, modify paving procedures or modify the concrete mix, in order to resolve the problem. The slipform paver shall be automatically electronically controlled from a taut wire guideline for horizontal alignment and on both sides from a taut wire guideline for vertical alignment, except that electronic control from a ski operating on a previously constructed adjoining lane shall be used where applicable for either or both sides. Automatic, electronic controls for vertical alignment shall always be used on both sides of the lane. Control from a slope-adjustment control or control operating from the underlying material shall never be used. If approved by the Contracting Officer after a preconstruction demonstration, automatic laser controls may be used in lieu of or to supplement the taut wire guidelines. Side forms on slipform pavers shall be properly adjusted so that the finished edge of the paving lane meets all specified tolerances. Dowels in longitudinal construction joints shall be installed as specified below. The installation of these dowels by dowel inserters attached to the paver or by any other means of inserting the dowels into the plastic concrete shall not be permitted.

3.5.6.2 Guideline for Slipform Paving

Guidelines shall be accurately and securely installed well in advance of concrete placement. Supports shall be provided at necessary intervals to eliminate all sag in the guideline when properly tightened. The guideline shall be high strength wire set with sufficient tension to remove all sag between supports. Supports shall be securely staked to the underlying material or other provisions made to ensure that the supports will not be displaced when the guideline is tightened or when the guideline or supports are accidentally touched by workmen or equipment during construction. The appliances for attaching the guideline to the supports shall be capable of easy adjustment in both the horizontal and vertical directions. When it is necessary to leave gaps in the guideline to permit equipment to use or cross underlying material, provisions shall be made for quickly and accurately replacing the guideline without any delay to the forward progress of the paver. Supports on either side of the gap shall be secured in such a manner as to avoid disturbing the remainder of the guideline when the portion across the gap is positioned and tightened. The guideline across the gap and adjacent to the gap for a distance of 200 feet shall be

checked for horizontal and vertical alignment after the guideline across the gap is tightened. Vertical and horizontal positioning of the guideline shall be such that the finished pavement shall conform to the alignment and grade elevations shown on the drawings within the specified tolerances for grade and smoothness. The specified tolerances are intended to cover only the normal deviations in the finished pavement that may occur under good supervision and do not apply to setting of the guideline. The guideline shall be set true to line and grade.

3.5.6.3 Laser Controls

If the Contractor proposes to use any type of automatic laser controls, a detailed description of the system shall be submitted and a trial field demonstration shall be performed in the presence of the Contracting Officer at least one week prior to start of paving. Approval of the control system will be based on the results of the demonstration and on continuing satisfactory operation during paving.

3.5.7 Placing Reinforcing Steel

The type and amount of steel reinforcement shall be as shown on the drawings. For pavement thickness of 12 inches or more, the reinforcement steel shall be installed by the strike-off method wherein a layer of concrete is deposited on the underlying material, consolidated, and struck to the indicated elevation of the steel reinforcement. The reinforcement shall be laid upon the prestruck surface, and the remaining concrete shall then be placed and finished in the required manner. When placement of the second lift causes the steel to be displaced horizontally from its original position, provisions shall be made for increasing the thickness of the first lift and depressing the reinforcement into the unhardened concrete to the required elevation. The increase in thickness shall be only as necessary to permit correct horizontal alignment to be maintained. Any portions of the bottom layer of concrete that have been placed more than 30 minutes without being covered with the top layer shall be removed and replaced with newly mixed concrete without additional cost to the Government. For pavements less than 12 inches thick, the reinforcement shall be positioned on suitable chairs securely fastened to the subgrade prior to concrete placement. Concrete shall be vibrated after the steel has been placed. Regardless of placement procedure, the reinforcing steel shall be free from coatings which could impair bond between the steel and concrete, and laps in the reinforcement shall be as indicated. In lieu of the above, automatic reinforcement depressing attachments may be used to position the reinforcement, either bar mats or welded wire fabric, provided the entire operation is approved by the Contracting Officer. Regardless of the equipment or procedures used for installing reinforcement, the Contractor shall ensure that the entire depth of concrete is adequately consolidated.

3.5.8 Placing Dowels

The method used in installing and holding dowels in position shall ensure that the error in alignment of any dowel from its required alignment after the pavement has been completed will not be greater than 1/8 in. per ft. Except as otherwise specified below, location of dowels shall be within a horizontal tolerance of plus or minus 5/8 inch. The Contractor shall furnish an approved template for checking the alignment and position of the dowels. The portion of each dowel intended to move within the concrete or expansion cap shall be painted with one coat of the specified paint. When dry, the painted portion shall be wiped clean and coated with a thin, even

film of lubricating oil before the concrete is placed. Pipe used as dowels shall be filled with a stiff sand-asphalt mixture or portland-cement mortar. Dowels in joints shall be omitted when the center of the dowel is located within a horizontal distance from an intersecting joint equal to or less than one-fourth of the slab thickness. Dowels shall be installed as specified in the following subparagraphs.

3.5.8.1 Contraction Joints

Dowels in longitudinal and transverse contraction joints within the paving lane shall be held securely in place, as indicated, by means of rigid metal frames or basket assemblies of an approved type. The assemblies shall consist of a framework of metal bars or wires arranged to provide rigid support for the dowels throughout the paving operation, with a minimum of four continuous bars or wires extending along the joint line. The dowels shall be welded to the assembly or held firmly by mechanical locking arrangements that will prevent them from rising, sliding out, or becoming distorted during paving operations. The basket assemblies shall be held securely in the proper location by means of suitable pins or anchors. At the Contractor's option, in lieu of the above, dowels in contraction joints shall be installed near the front of the paver by insertion into the plastic concrete using approved equipment and procedures. Approval will be based on the results of a preconstruction demonstration which the Contractor shall conduct, showing that the dowels are installed within specified tolerances.

3.5.8.2 Construction Joints-Fixed Form Paving

Installation of dowels shall be by the bonded-in-place method. Installation by removing and replacing in preformed holes will not be permitted. Dowels shall be prepared and placed across joints where indicated, correctly aligned, and securely held in the proper horizontal and vertical position during placing and finishing operations, by means of devices fastened to the forms. If split dowels are approved and used, the female portion of the split dowel shall be bonded in the initially placed pavement lane. The female portion of the split dowel shall be securely fastened to the pavement form and shall maintain the proper position and alignment of the dowel during concrete placement so that no mortar or other foreign material will enter the socket or coupling. Before the split dowels are assembled, the external and internal threads shall be cleaned thoroughly to remove all cement, cement mortar, grit, dirt, and other foreign matter. In the final assembly, a minimum torque of 200 ft-lbs shall be applied. The spacing of dowels in construction joints shall be as indicated, except that, where the planned spacing cannot be maintained because of form length or interference with form braces, closer spacing with additional dowels shall be used.

3.5.8.3 Dowels Installed in Hardened Concrete

Dowels installed in hardened concrete, such as in longitudinal construction joints for slipform paving, in joints between new and existing pavement, and similar locations, shall be installed by bonding the dowels into holes drilled into the hardened concrete. The installation of dowels in longitudinal construction joints by dowel inserters attached to a slipform paver or by any other means of inserting the dowels into the plastic concrete shall not be permitted. Holes approximately 1/8 inch greater in diameter than the dowels shall be drilled into the hardened concrete with rotary core drills to receive the dowels. In lieu of rotary drills, the contractor may use percussion drills, provided that spalling at the collar

of the hole does not occur. Regardless of the type of drill used, the drill shall be held rigidly in exact alignment by means of a stable jig or framework, solidly supported; gang drills meeting this are acceptable. Any damage to the concrete face during drilling shall be repaired as directed; continuing damage shall require modification of the equipment and operation. Dowels shall be bonded in the drilled holes using epoxy resin. Epoxy resin shall be injected at the back of the hole before installing the dowel and extruded to the collar during insertion of the dowel so as to completely fill the void around the dowel. Application by buttering the dowel shall not be permitted. The dowels shall be held in alignment at the collar of the hole, after insertion and before the grout hardens, by means of a suitable metal or plastic collar fitted around the dowel. The vertical alignment of the dowels shall be checked by placing a straightedge on the surface of the pavement over the top of the dowel and measuring the vertical distance between the straightedge and the beginning and ending point of the exposed part of the dowel. The horizontal alignment shall be checked with a framing square. Dowels required to be installed in any joints between new and existing concrete shall be grouted in holes drilled in the existing concrete, all as specified above.

3.5.8.4 Expansion Joints

Dowels in expansion joints shall be installed as shown using appropriate procedures specified above.

3.6 FINISHING

The finishing machine, or paver-finisher, shall meet all requirements specified in paragraph EQUIPMENT and herein. Finishing operations shall be a continuing part of placing operations starting immediately behind the strike-off of the paver and the machines shall be designed and operated to strike off, screed, and consolidate the concrete. Initial finishing shall be provided by the transverse screed or extrusion plate. The sequence of operations shall be transverse finishing, longitudinal machine floating if used, straightedge finishing, texturing, and then edging of joints. Finishing shall be by the machine method. The hand method shall be used only infrequently and only on isolated areas of odd slab widths or shapes and in the event of a breakdown of the mechanical finishing equipment. When approved, the hand finishing method may also be used for separate, isolated slabs during removal and replacement type repair operations. Supplemental hand finishing for machine finished pavement shall be kept to an absolute minimum. Equipment to be used for supplemental hand finishing shall primarily be 10 to 12 feet cutting straightedges; only very sparing use of bull floats shall be allowed. Any machine finishing operation which requires appreciable hand finishing, other than a moderate amount of straightedge finishing, shall be immediately stopped and proper adjustments made or the equipment replaced. Every effort shall be made to prevent bringing excess paste to the surface and any operations which produce more than 3/32 inch of paste (mortar, water, laitance, etc.) over the top layer of coarse aggregate shall be halted immediately and the equipment, mixture, or procedures modified as necessary. Compensation shall be made for surging behind the screeds or extrusion plate and settlement during hardening and care shall be taken to ensure that paving and finishing machines are properly adjusted so that the finished surface of the concrete (not just the cutting edges of the screeds) will be at the required line and grade. Surface checks shall be made regularly and paving operations immediately halted and adjustments made whenever compensation is inadequate. Screed and float adjustments of the machines shall be checked at the start of each day's paving operations and more often if required.

Machines that cause frequent delays due to mechanical failure shall be replaced. When machines ride the edge of a previously constructed slab, the edge shall be kept clean and provision shall be made to protect the surface of the slab. Clary screeds, "bridge deck" finishers, or other rotating pipe or tube type equipment will not be permitted. Finishing equipment and tools shall be maintained clean and in an approved condition. At no time shall water be added to the surface of the slab with the finishing equipment or tools, or in any other way, except for fog (mist) sprays specified to prevent plastic shrinkage cracking.

3.6.1 Longitudinal Floating

When the equipment contains a mechanical, longitudinal, oscillating float, the float shall be operated to smooth and finish the pavement immediately behind the transverse screed or extrusion plate. The float shall be operated maintaining contact with the surface at all times. Care shall be taken to prevent working paste to the surface in excess of the amount specified above.

3.6.2 Other Types of Finishing Equipment

Concrete finishing equipment of types other than those specified above may be used on a trial basis, when specifically approved, except that rotating pipe or tubes or bridge deck finishers will not be permitted. Approval will be given after demonstration on a test section prior to start of construction, and provided the Contracting Officer determines that the pavement produced is better than that produced by the specified equipment. The use of equipment that fails to produce finished concrete of the required quality, using concrete proportions and slump as specified, shall be discontinued, and the concrete shall be finished with specified equipment and in the manner specified above. Vibrating screeds or pans shall be used only for isolated slabs where hand finishing is permitted as specified, and only where specifically approved. Slipform paving equipment shall not be operated on fixed forms unless approved in writing prior to use.

3.6.3 Machine Finishing With Fixed Forms

The machine shall be designed to ride the forms and shall be operated to screed and consolidate the concrete. Machines that cause displacement of the forms shall be replaced. The machine shall make only one pass over each area of pavement. If the equipment and procedures do not produce a surface of uniform texture, true to grade, in one pass, the operation shall be immediately stopped and the equipment, mixture, and procedures adjusted as necessary.

3.6.4 Machine Finishing With Slipform Pavers

The slipform paver shall be operated so that only a very minimum of additional finishing work is required to produce pavement surfaces and edges meeting the specified tolerances. Any equipment or procedure that fails to meet these specified requirements shall immediately be replaced or modified as necessary. A self-propelled nonrotating pipe float may be used if the Contractor desires while the concrete is still plastic, to remove minor irregularities and score marks. The pipe float shall be 6 to 10 inches in diameter and sufficiently long to span the full paving width when oriented at an angle of approximately 60 degrees with the center line. Only one pass of the pipe float shall be allowed. If there is sufficient concrete slurry or fluid paste on the surface that it runs over the edge of

the pavement, the paving operation shall be immediately stopped and the equipment, mixture, or operation modified to prevent formation of such slurry. Any slurry which does run down the vertical edges shall be immediately removed by hand, using stiff brushes or scrapers. No slurry, concrete or concrete mortar shall be used to build up along the edges of the pavement to compensate for excessive edge slump, either while the concrete is plastic or after it hardens. Slabs having areas of edge slump in excess of the specified tolerances shall be removed and replaced in accordance with paragraph, REPAIR, REMOVAL, REPLACEMENT OF SLABS; repair operations on such areas will not be permitted.

3.6.5 Surface Correction and Testing

After all other finishing is completed but while the concrete is still plastic, minor irregularities and score marks in the pavement surface shall be eliminated by means of cutting straightedges. Such straightedges shall be 12 feet in length and shall be operated from the sides of the pavement and from bridges. A straightedge operated from the side of the pavement shall be equipped with a handle 3 feet longer than one-half the width of the pavement. The surface shall then be tested for trueness with a straightedge held in successive positions parallel and at right angles to the center line of the pavement, and the whole area covered as necessary to detect variations. The straightedge shall be advanced along the pavement in successive stages of not more than one-half the length of the straightedge. Depressions shall be immediately filled with freshly mixed concrete, struck off, consolidated, and refinished. Projections above the required elevation shall also be struck off and refinished. The straightedge testing and finishing shall continue until the entire surface of the concrete is free from observable departure from the straightedge and conforms to the surface requirements specified in paragraph ACCEPTABILITY OF WORK AND PAYMENT ADJUSTMENTS. Long-handled, flat bull floats shall be used very sparingly and only as necessary to correct minor, scattered surface defects. If frequent use of bull floats is necessary, the paving operation shall be stopped and the equipment, mixture or procedures adjusted to eliminate the surface defects. Finishing with hand floats and trowels shall be held to the absolute minimum necessary. Extreme care shall be taken to prevent overfinishing joints and edges. The surface finish of the pavement shall be produced essentially by the finishing machine and not by subsequent hand finishing operations. All hand finishing operations shall be subject to approval and shall be modified when directed. No water shall be added to the pavement surface during these operations.

3.6.6 Hand Finishing

Hand finishing operations shall be used only as specified above.

3.6.6.1 Equipment

In addition to approved mechanical internal vibrators for consolidating the concrete, a strike-off and tamping template and a longitudinal float shall be provided for hand finishing. The template shall be at least 1 foot longer than the width of pavement being finished, of an approved design, and sufficiently rigid to retain its shape, and shall be constructed of metal or other suitable material shod with metal. The longitudinal float shall be at least 10 feet long, of approved design, and rigid and substantially braced, and shall maintain a plane surface on the bottom . Grate tampers (jitterbugs) shall not be used.

3.6.6.2 Finishing and Floating

As soon as placed and vibrated, the concrete shall be struck off and screeded to the crown and cross section and to such elevation above grade that when consolidated and finished, the surface of the pavement will be at the required elevation. In addition to previously specified complete coverage with handheld immersion vibrators, the entire surface shall be tamped with the strike-off and tamping template, and the tamping operation continued until the required compaction and reduction of internal and surface voids are accomplished (grate tampers shall not be used). Immediately following the final tamping of the surface, the pavement shall be floated longitudinally from bridges resting on the side forms and spanning but not touching the concrete. If necessary, additional concrete shall be placed and screeded, and the float operated until a satisfactory surface has been produced. The floating operation shall be advanced not more than half the length of the float and then continued over the new and previously floated surfaces. Long-handled, flat bull floats shall be used very sparingly and only as necessary to correct minor, scattered surface defects. If frequent use of bull floats is necessary, the operation shall be stopped and adjusted to eliminate the surface defects. Finishing with hand floats and trowels shall be held to the absolute minimum necessary. Extreme care shall be taken to prevent overfinishing joints and edges. No water shall be added to the pavement during finishing operations.

3.6.7 Texturing

Before the surface sheen has disappeared and before the concrete hardens, the surface of the pavement shall be given a texture as described herein. After curing is complete, all textured surfaces shall be thoroughly power broomed to remove all debris.

3.6.7.1 Broom Texturing

Surface texture shall be applied using an approved mechanical stiff bristle broom drag of a type that will uniformly score the surface. The broom shall be operated to score the surface transverse to the pavement center line. The broom shall be capable of traversing the full width of the pavement in a single pass at a uniform speed and with a uniform pressure. Successive passes of the broom shall be overlapped the minimum necessary to obtain a uniformly textured surface. Brooms shall be washed thoroughly at frequent intervals during use. Worn or damaged brooms shall be removed from the job site. Brooming should be completed before the concrete has hardened to the point where the surface will be unduly torn or roughened, but after hardening has progressed enough so that the mortar will not flow and reduce the sharpness of the scores. Specific requirements for the texturing will be given on the drawings, but, if not given, the scores shall be uniform in appearance and approximately 1/16 inchin depth but not more than 1/8 inch in depth. Hand brooming will be permitted only on isolated odd shaped slabs or slabs where hand finishing is permitted. For hand brooming, the brooms shall have handles longer than half the width of slab to be finished. The hand brooms shall be drawn transversely across the surface from the center line to each edge with slight overlapping strokes.

3.6.8 Edging

After texturing has been completed, the edge of the slabs along the forms, along the edges of slipformed lanes, and at the joints shall be carefully finished with an edging tool to form a smooth rounded surface of 1/8 inch

radius. Tool marks shall be eliminated, and the edges shall be smooth and true to line. No water shall be added to the surface during edging. Extreme care shall be taken to prevent overworking the concrete.

3.6.9 Outlets in Pavement

Recesses for the tie-down anchors, lighting fixtures, and other outlets in the pavement shall be constructed to conform to the details and dimensions shown. The concrete in these areas shall be carefully finished to provide a surface of the same texture as the surrounding area that will be within the requirements for plan grade and surface smoothness.

3.7 CURING

3.7.1 Protection of Concrete

Concrete shall be continuously protected against loss of moisture and rapid temperature changes for at least 7 days from the completion of finishing operations. Unhardened concrete shall be protected from rain and flowing water. All equipment needed for adequate curing and protection of the concrete shall be on hand and ready for use before actual concrete placement begins. Sufficient sheet material to protect unhardened concrete from rain shall be at the paver at all times. Protection shall be provided as necessary to prevent cracking of the pavement due to temperature changes during the curing period. If any selected method of curing does not afford the proper curing and protection against concrete cracking, the damaged pavement shall be removed and replaced, and another method of curing shall be employed as directed. Curing shall be accomplished by one of the following methods.

3.7.2 Membrane Curing

A uniform coating of white-pigmented, membrane-forming, curing compound shall be applied to the entire exposed surface of the concrete as soon as the free water has disappeared from the surface after finishing. If evaporation is high and no moisture is present on the surface even though bleeding has not stopped, fog sprays shall be used to keep the surface moist until setting of the cement occurs and bleeding is complete. Curing compound shall then be immediately applied. Along the formed edge faces, it shall be applied immediately after the forms are removed. Concrete shall not be allowed to dry before the application of the membrane. If any drying has occurred, the surface of the concrete shall be moistened with a fine spray of water, and the curing compound applied as soon as the free water disappears. The curing compound shall be applied to the finished surfaces by means of an approved automatic spraying machine. The spraying machine shall be self-propelled and shall span the newly paved lane. The machine shall have one or more spraying nozzles that can be controlled and operated to completely and uniformly cover the pavement surface with the required amount of curing compound. The curing compound in the drum used for the spraying operation shall be thoroughly and continuously agitated mechanically throughout the full depth of the drum during the application. Air agitation may be used only to supplement mechanical agitation. Spraying pressure shall be sufficient to produce a fine spray as necessary to cover the surface thoroughly and completely with a uniform film. Spray equipment shall be kept clean and properly maintained and the spray nozzle or nozzles shall have adequate wind shields. The curing compound shall be applied with an overlapping coverage that will give a two-coat application at a coverage of 400 square feet per gallon, plus or minus 5.0 percent for each coat. A one-coat application may be applied provided a uniform

application and coverage of 200 square feet per gallon, plus or minus 5.0 percent is obtained. The application of curing compound by hand-operated, mechanical powered pressure sprayers will be permitted only on odd widths or shapes of slabs where indicated and on concrete surfaces exposed by the removal of forms. When the application is made by hand-operated sprayers, the second coat shall be applied in a direction approximately at right angles to the direction of the first coat. The compound shall form a uniform, continuous, cohesive film that will not check, crack, or peel and that will be free from pinholes and other discontinuities. If pinholes, abrasions, or other discontinuities exist, an additional coat shall be applied to the affected areas within 30 minutes. Concrete surfaces that are subjected to heavy rainfall within 3 hours after the curing compound has been applied shall be resprayed by the method and at the coverage specified above. Areas where the curing compound is damaged by subsequent construction operations within the curing period shall be immediately resprayed. The surfaces adjacent to joint sawcuts shall be cleaned and resprayed with curing compound immediately after cutting. Approved standby facilities for curing concrete pavement shall be provided at an accessible location at the job site for use in the event of mechanical failure of the spraying equipment or other conditions that might prevent correct application of the membrane-curing compound at the proper time. Concrete surfaces to which membrane-curing compounds have been applied shall be adequately protected during the entire curing period from pedestrian and vehicular traffic, except as required for joint-sawing operations and surface tests, and from any other possible damage to the continuity of the membrane.

3.7.3 Moist Curing

Concrete to be moist-cured shall be maintained continuously wet for the entire curing period, or until curing compound is applied, commencing immediately after finishing. If forms are removed before the end of the curing period, curing shall be carried out as on unformed surfaces, using suitable materials. Surfaces shall be cured by ponding, by continuous sprinkling, by continuously saturated burlap or cotton mats, or by continuously saturated plastic coated burlap. Burlap and mats shall be clean and free from any contamination and shall be completely saturated before being placed on the concrete. The Contractor shall have an approved work system to ensure that moist curing is continuous 24 hours per day and that the entire surface is wet.

3.8 JOINTS

3.8.1 General Requirements for Joints

Joints shall conform to the details indicated and shall be perpendicular to the finished grade of the pavement. All joints shall be straight and continuous from edge to edge or end to end of the pavement with no abrupt offset and no gradual deviation greater than 1/2 inch.. Before commencing construction, the Contractor shall submit for approval a control plan and equipment to be used for ensuring that all joints are straight from edge to edge of the pavement within the above tolerances. Where any joint fails to meet these tolerances, the slabs adjacent to the joint shall be removed and replaced at no additional cost to the Government. No change from the jointing pattern shown on the drawings shall be made without written approval of the Contracting Officer. Sealing of joints shall be in accordance with SECTION 02762 COMPRESSION JOINT SEALS FOR CONCRETE PAVEMENTS.

3.8.2 Longitudinal Construction Joints

Longitudinal construction joints between paving lanes shall be located as indicated. Dowels shall be installed in the longitudinal construction joints as indicated. Dowels shall be installed in conformance with paragraph, Placing Dowels. After the end of the curing period, longitudinal construction joints shall be sawed to provide a groove at the top for sealant conforming to the details and dimensions indicated.

3.8.3 Transverse Construction Joints

Transverse construction joints shall be installed at the end of each day's placing operations and at any other points within a paving lane when concrete placement is interrupted for 30 minutes or longer. When concrete placement cannot be continued, the transverse construction joint shall be installed at a planned transverse joint. Stopping paving at other than a planned transverse joint shall not be allowed. Transverse construction joints shall be constructed by utilizing headers and the very minimum amount of hand placement and finishing techniques. Pavement shall be constructed with the paver as close to the header as possible, and the paver shall be run out completely past the header. Transverse construction joints installed at a planned transverse joint shall be constructed in accordance with the construction joint detail (JT-1) shown on reference sheet C-28.

3.8.4 Expansion Joints

Expansion joints shall be formed where indicated, and about any structures and features that project through or into the pavement, using joint filler of the type, thickness, and width indicated, and shall be installed to form a complete, uniform separation between the structure and the pavement. The filler shall be attached to the original concrete placement with adhesive or other fasteners and shall extend the full slab depth. Adjacent sections of filler shall be fitted tightly together, and the filler shall extend across the full width of the paving lane or other complete distance in order to prevent entrance of concrete into the expansion space. Edges of the concrete at the joint face shall be finished with an edger with a radius of 1/8 inch. The joint filler strips shall be installed 3/4 inch below the pavement surface with a slightly tapered, dressed-and-oiled wood strip or other approved material temporarily secured to the top of the filler to form a recess to be filled with joint sealant. The wood strip shall be removed soon after the concrete has set and the reservoir temporarily filled with an approved material to protect the reservoir until the joint sealer is installed. Expansion joints shall be constructed with thickened edges for load transfer.

3.8.5 Contraction Joints

Transverse and longitudinal contraction joints shall be of the weakened-plane or dummy type and shall be constructed as indicated. Longitudinal contraction joints shall be constructed by sawing a groove in the hardened concrete with a power-driven saw in conformance with requirements for sawed joints, unless otherwise approved in writing. Transverse contraction joints shall be constructed in conformance with requirements for sawed joints.

3.8.5.1 Sawed Joints

Sawed contraction joints shall be constructed by sawing an initial groove

in the concrete with a 1/8 inch blade to the indicated depth. During sawing of joints, and again 24 hours later, the CQC team shall inspect all exposed lane edges for development of cracks below the saw cut, and shall immediately report results to the Contracting Officer. If the Contracting Officer determines that there are more uncracked joints than desired, the Contractor will be directed to saw succeeding joints 25 percent deeper than originally indicated at no additional cost to the Government. After expiration of the curing period, the upper portion of the groove shall be widened by sawing to the width and depth indicated for the joint sealer. The time of initial sawing shall vary depending on existing and anticipated weather conditions and shall be such as to prevent uncontrolled cracking of the pavement. Sawing of the joints shall commence as soon as the concrete has hardened sufficiently to permit cutting the concrete without chipping, spalling, or tearing. The sawed faces of joints will be inspected for undercutting or washing of the concrete due to the early sawing, and sawing shall be delayed if undercutting is sufficiently deep to cause structural weakness or excessive roughness in the joint. The sawing operation shall be carried on as required during both day and night regardless of weather conditions. The joints shall be sawed at the required spacing consecutively in the sequence of the concrete placement. A chalk line or other suitable guide shall be used to mark the alinement of the joint. Before sawing a joint, the concrete shall be examined closely for cracks, and the joint shall not be sawed if a crack has occurred near the planned joint location. Sawing shall be discontinued when a crack develops ahead of the saw cut. Workmen and inspectors shall wear clean, rubber-soled footwear, and the number of persons walking on the pavement shall be limited to those actually performing the sawing operation. Immediately after the joint is sawed, the saw cut and adjacent concrete surface shall be thoroughly flushed with water until all waste from sawing is removed from the joint. The surface shall be resprayed with curing compound as soon as free water disappears. Necessary precautions shall be taken to insure that the concrete is properly cured at sawed joints. The sawing equipment shall be adequate in the number of units and the power to complete the sawing at the required rate. An ample supply of saw blades shall be available on the job before concrete placement is started and at all times during sawing. At least one standby sawing unit in good working order shall be available at the jobsite at all times during the sawing operation.

3.8.6 Thickened Edge Joints

Thickened edge joints shall be constructed as indicated on the drawings. Underlying material in the transition area shall be graded as shown and shall meet the requirements for smoothness and compaction specified for all other areas of the underlying material.

3.8.7 Sealing Joints

Joints shall be sealed immediately following curing of the concrete or as soon thereafter as weather conditions permit. Joints shall be sealed as specified SECTION 02762 COMPRESSION JOINT SEALS FOR CONCRETE PAVEMENTS, as indicated.

3.9 REPAIR, REMOVAL, REPLACEMENT OF SLABS

3.9.1 General Criteria

New pavement slabs that are broken or contain cracks shall be removed and replaced or repaired, as specified hereinafter at no cost to the

Government. Spalls along joints shall be repaired as specified. Where removal of partial slabs is permitted, as specified, removal and replacement shall be full depth, shall be full width of the paving lane, and the limit of removal shall be normal to the paving lane and not less than 10 feet from each original transverse joint (i.e., removal portion shall be at least 10 feet longitudinally, and portion to remain in place shall be at least longitudinally; thus, if original slab length is less than 20 feet, the entire slab shall be removed). The Contracting Officer will determine whether cracks extend full depth of the pavement and may require cores to be drilled on the crack to determine depth of cracking. Such cores shall be at least 6 inch diameter, shall be drilled by the Contractor and shall be filled by the Contractor with a well consolidated concrete mixture bonded to the walls of the hole with epoxy resin, using approved procedures. Drilling of cores and refilling holes shall be at no expense to the Government. All epoxy resin used in this work shall conform to paragraph EPOXY RESIN, Type and Grade as specified.

3.9.2 Slabs with Cracks Thru Interior Areas

Interior area is defined as that area more than 24 inchesfrom either adjacent original transverse joint. Slabs with any cracks that extend into the interior area, regardless of direction, shall be treated by one of the following procedures.

3.9.2.1 Cracks That Do Not Extend Full Depth of Slab

These cracks, and similar cracks within the areas 24 inches each side of transverse joints, shall be cleaned and then pressure injected with epoxy resin, Type IV, Grade 1, using procedures as approved. The procedure shall not widen the crack during epoxy resin injection. All epoxy resin injection shall take place in the presence of a representative of the Contracting Officer.

3.9.2.2 Cracks That Extend Full Depth of Slab

Where there is any full depth crack at any place within the interior area, the full slab shall be removed. However, if the cracked area all lies within 10 feet of one original transverse joint, only a partial slab need be removed provided all criteria specified above for distance from each original transverse joint is met.

3.9.3 Cracks close to and Parallel to Transverse Joints

All cracks essentially parallel to original transverse joints, extending full depth of the slab, and lying wholly within 24 inches either side of the joint shall be treated as specified hereinafter. Any crack extending more than 24 inches from the transverse joint shall be treated as specified above for Slabs With Cracks Through Interior Areas. Any cracks which do not extend full depth of the slab shall be treated as specified above in subparagraph, Cracks That Do Not Extend Full Depth Of Slab, and the original transverse joint constructed as originally designed.

3.9.3.1 Full Depth Cracks Present, Original Joint Not Opened

When the original transverse joint has not opened, the crack shall be routed and sealed, and the original transverse joint filled with epoxy resin. The crack shall be routed with an easily guided, wheel mounted, vertical shaft, powered rotary router designed so the routing spindle will caster as it moves along the crack, or with a small diameter saw designed

for this use. The reservoir for joint sealant in the crack shall be formed by routing to a depth of 3/4 inch, plus or minus 1/16 inch and to a width of 5/8 inch, plus or minus 1/8 inch. Any equipment or procedure which causes ravelling or spalling along the crack shall be modified or replaced to prevent such ravelling or spalling. The joint sealant shall be a liquid sealant as specified for rigid pavement joints. Installation of joint seal shall be as specified for sealing joints or as directed. The uncracked transverse joint shall be filled with epoxy resin. If the joint sealant reservoir has been sawed out, the reservoir and as much of the lower saw cut as possible shall be filled with epoxy resin, Type IV, Grade 2, thoroughly tooled into the void using approved procedures. If only the original narrow saw cut has been made, it shall be cleaned and pressure injected with epoxy resin, Type IV, Grade 1, using approved procedures. If filler material (joint insert) has been used to form a weakened plane in the transverse joint, it shall be completely sawed out and the saw cut pressure injected with epoxy resin, Type IV, Grade 1, using approved procedures. Where a parallel crack goes part way across the paving lane and then intersects and follows the original transverse joint which is cracked only for the remainder of the width, it shall be treated as follows: The area with the separate crack shall be treated as specified above for a parallel crack, and the cracked original joint shall be prepared and sealed as originally designed.

3.9.3.2 Full Depth Cracks, Original Joint Also Cracked

At a transverse joint, if there is any place in the lane width where a parallel crack and a cracked portion of the original joint overlap, a section of the slab containing the crack shall be removed and replaced for the full lane width and at least 10 feet long. If this partial slab removal places the limit of removal less than 10 feet from the next transverse joint, the entire slab shall be removed. If the parallel crack crosses the transverse joint line, a similar area shall be removed and replaced in both slabs.

3.9.4 Removal and Replacement of Full Slabs

Where it is necessary to remove full slabs, unless there are keys or dowels present, all edges of the slab shall be cut full depth with a concrete saw. All saw cuts shall be perpendicular to the slab surface. If keys, dowels, or tie bars are present along any edges, these edges shall be sawed full depth 6 inches from the edge if only keys are present, or just beyond the end of dowels or tie bars if they are present. These joints shall then be carefully sawed on the joint line to within 1 inch of the depth of the dowel or key. The main slab shall be further divided by sawing full depth, at appropriate locations, and each piece lifted out and removed. Suitable equipment shall be used to provide a truly vertical lift, and approved safe lifting devices used for attachment to the slabs. The narrow strips along keyed or doweled edges shall be carefully broken up and removed using light, hand-held jackhammers, 30 lb or less, or other approved similar equipment. Care shall be taken to prevent damage to the dowels, tie bars, or keys or to concrete to remain in place. The joint face below keys or dowels shall be suitably trimmed so that there is no abrupt offset in any direction greater than 1/2 inch and no gradual offset greater than 1 inch when tested in a horizontal direction with a straightedge. No mechanical impact breakers, other than the above hand-held equipment shall be used for any removal of slabs. If underbreak between 1-1/2 and 4 inches deep occurs at any point along any edge, the area shall be repaired as directed before replacing the removed slab. Procedures directed will be similar to those specified for surface spalls, modified as necessary. If underbreak over 4

inches deep occurs, the entire slab containing the underbreak shall be removed and replaced. Where there are no dowels, tie bars, or keys on an edge, or where they have been damaged, dowels of the size and spacing as specified for other joints in similar pavement shall be installed by epoxy grouting them into holes drilled into the existing concrete using procedures as specified in paragraph, Placing Dowels and Tie Bars. Original damaged dowels or tie bars shall be cut off flush with the joint face. Protruding portions of dowels shall be painted and lightly oiled. All four edges of the new slab shall thus contain dowels or original keys or original tie bars. Placement of concrete shall be as specified for original construction. Prior to placement of new concrete, the underlying material shall be recompacted and shaped as specified in the appropriate section of these specifications, and the surfaces of all four joint faces shall be cleaned of all loose material and contaminants and coated with a double application of membrane forming curing compound as bond breaker. Care shall be taken to prevent any curing compound from contacting dowels or tie bars. The resulting joints around the new slab shall be prepared and sealed as specified for original construction.

3.9.5 Removal and Replacement of Partial Slabs

Where the above criteria permits removal of partial slabs, removal and replacement operations shall be as specified for full slabs, except that the joint between the removed area and the partial slab to remain in place shall consist of a full depth saw cut across the full lane width and perpendicular to the centerline of the paving lane. Replacement operations shall be the same as specified above, except that, at the joint between the removed area and the partial slab to remain, deformed tie bars shall be epoxy resin grouted into holes drilled into the slab to remain in place. Size and spacing of the tie bars shall be as specified for dowels. Drilling of holes and installation of tie bars shall be as specified for dowels in paragraph, Placing Dowels and Tie Bars, except that no portion of the tie bars shall be painted or oiled. No curing compound shall be used on this joint face and, immediately before placing new concrete, the joint surface of the partial slab remaining in place shall be coated with epoxy resin, Type V, Grade 2.

3.9.6 Repairing Spalls Along Joints

Where directed, spalls along joints of new slabs, along edges of adjacent existing concrete, and along parallel cracks shall be repaired by first making a vertical saw cut at least 1 inch outside the spalled area and to a depth of at least 2 inches. Saw cuts shall be straight lines forming rectangular areas. The concrete between the saw cut and the joint, or crack, shall be chipped out to remove all unsound concrete and at least a depth of 1/2 inch of visually sound concrete. The cavity thus formed shall be thoroughly cleaned with high pressure water jets supplemented with compressed air to remove all loose material. Immediately before filling the cavity, a prime coat shall be applied to the dry cleaned surface of all sides and bottom of the cavity, except any joint face. The prime coat shall be applied in a thin coating and scrubbed into the surface with a stiff-bristle brush. Prime coat for portland cement repairs shall be a neat cement grout and for epoxy resin repairs shall be epoxy resin, Type III, Grade 1. The cavity shall be filled with low slump portland cement concrete or mortar or with epoxy resin concrete or mortar. Portland cement concrete shall be used for larger spalls, those more than 1/3 cu. ft. in size after removal operations; portland cement mortar shall be used for spalls between 0.03 cu. ft. and 1/3 cu. ft; and epoxy resin mortar or Type III, Grade 3 epoxy resin for those spalls less than 0.03 cu. ft. in size

after removal operations. Portland cement concretes and mortars shall be very low slump mixtures, 1/2 inch slump or less, proportioned, mixed, placed, consolidated by tamping, and cured, all as directed. If the materials and procedures are approved in writing, latex modified concrete mixtures may be used for repairing spalls less than 1/3 cu. ft. in size. Epoxy resin mortars shall be made with Type III, Grade 1, epoxy resin, using proportions and mixing and placing procedures as recommended by the manufacturer and approved by the Contracting Officer. The epoxy resin materials shall be placed in the cavity in layers not over 2 inches thick. The time interval between placement of additional layers shall be such that the temperature of the epoxy resin material does not exceed 140 degrees F at any time during hardening. Mechanical vibrators and hand tampers shall be used to consolidate the concrete or mortar. Any repair material on the surrounding surfaces of the existing concrete shall be removed before it hardens. Where the spalled area abuts a joint, an insert or other bond-breaking medium shall be used to prevent bond at the joint face. A reservoir for the joint sealant shall be sawed to the dimensions required for other joints, or as required to be routed for cracks. The reservoir shall be thoroughly cleaned and then sealed with the sealer specified for the joints. If any spall penetrates half the depth of the slab or more, the entire slab, or 10 foot portion thereof, shall be removed and replaced as previously specified. In lieu of sawing, spalls not adjacent to joints, and popouts, both less than 6 inches in maximum dimension, may be prepared by drilling a core 2 inches in diameter greater than the size of the defect, centered over the defect, and 2 inches deep or 1/2 inch into sound concrete, whichever is greater. The core hole shall be repaired as specified above for other spalls.

3.10 PAVEMENT PROTECTION

The Contractor shall protect the pavement against all damage prior to final acceptance of the work by the Government. Aggregates rubble, or other similar construction materials shall not be piled on airfield pavements. Traffic shall be excluded from the new pavement by erecting and maintaining barricades and signs until the concrete is at least 14 days old, or for a longer period if so directed. As a construction expedient in paving intermediate lanes between newly paved pilot lanes, operation of the hauling equipment will be permitted on the new pavement after the pavement has been cured for 7 days and the joints have been sealed or otherwise protected. Also, the subgrade planer, concrete paving and finishing machines, and similar equipment may be permitted to ride upon the edges of previously constructed slabs when the concrete has attained a minimum flexural strength of 400 psi and approved means are furnished to prevent damage to the slab edge. All new and existing pavement carrying construction traffic or equipment shall be continuously kept completely clean, and spillage of concrete or other materials shall be cleaned up immediately upon occurrence. Special care shall be used where Contractor's traffic uses or crosses active airfield pavement. In these areas, if necessary in order to accomplish this, full-time workmen with hand brooms shall be used at anytime there is traffic. Other existing pavements used by the Contractor shall be power broomed at least daily when traffic operates. For fill-in lanes, equipment shall be used that will not damage or spall the edges or joints of the previously constructed pavement.

3.11 TESTING AND INSPECTION FOR CONTRACTOR QUALITY CONTROL

3.11.1 Testing and Inspection by Contractor

The Contractor shall perform the inspection and tests described below, and

based upon the results of these inspections and tests, shall take the action required and submit reports as required. When, in the opinion of the Contracting Officer, the paving operation is out of control, concrete placement shall cease. The laboratory performing the tests shall be a Corps of Engineers approved laboratory and shall conform with ASTM C 1077. The individuals who sample and test concrete or the constituents of concrete as required in this specification shall have demonstrated a knowledge and ability to perform the necessary test procedures equivalent to the ACI minimum guidelines for certification of Concrete Field Testing Technicians, Grade I. The individuals who perform the inspection of concrete shall have demonstrated a knowledge and ability equivalent to the ACI minimum guidelines for certification of Concrete Construction Inspector, Level II. The Government may inspect the laboratory, equipment, and test procedures prior to start of concreting operations for conformance with ASTM C 1077. This testing shall be performed by the Contractor regardless of any other testing performed by the Government, either for pay adjustment purposes or for any other reason.

3.11.2 Testing and Inspection Requirements

3.11.2.1 Fine Aggregate

a. Grading. At least once during each shift when the concrete plant is operating, there shall be one sieve analysis and fineness modulus determination in accordance with ASTM C 136 and COE CRD-C 104 for the fine aggregate or for each fine aggregate if it is batched in more than one size or classification. The location at which samples are taken may be selected by the Contractor as the most advantageous for control. However, the Contractor is responsible for delivering fine aggregate to the mixer within specification limits.

b. Corrective Action for Fine Aggregate Grading. When the amount passing on any sieve is outside the specification limits, the fine aggregate shall be immediately resampled and retested. If there is another failure on any sieve, the fact shall be immediately reported to the Contracting Officer, paving shall be stopped, and immediate steps taken to correct the grading.

3.11.2.2 Coarse Aggregate

a. Grading. At least once during each shift in which the concrete plant is operating, there shall be a sieve analysis in accordance with ASTM C 136 for each size of coarse aggregate. The location at which samples are taken may be selected by the Contractor as the most advantageous for production control. However, the Contractor shall be responsible for delivering the aggregate to the mixer within specification limits. A test record of samples of aggregate taken at the same locations shall show the results of the current test as well as the average results of the five most recent tests including the current test. The Contractor may adopt approved limits for control coarser than the specification limits for samples taken other than as delivered to the mixer to allow for degradation during handling.

b. Corrective Action for Grading. When the amount passing any sieve is outside the specification limits, the coarse aggregate shall be immediately resampled and retested. If the second sample fails on any sieve, that fact shall be reported to the Contracting Officer, and steps taken to correct the grading. Where two consecutive averages of 5 tests are outside specification limits, the operation shall be

considered out of control and shall be reported to the Contracting Officer, paving shall be stopped, and immediate steps shall be taken to correct the grading.

3.11.2.3 Quality of Aggregates

Thirty days prior to the start of concrete placement, the Contractor shall perform all tests specified for aggregate quality, including deleterious materials. In addition, after the start of paving, the Contractor shall perform similar tests for aggregate quality at least once every month, and when the source of aggregate or aggregate quality changes. Testing interval may be increased to three months when the previous two tests indicate the aggregate meets all quality requirements. Samples tested after the start of concrete placement shall be taken immediately prior to entering the concrete mixer.

3.11.2.4 Scales, Batching and Recording

a. Weighing Accuracy. The accuracy of the scales shall be checked by test weights prior to start of concrete operations and at least once every month for conformance with specified requirements. Such tests shall also be made as directed whenever there are variations in properties of the fresh concrete that could result from batching errors.

b. Batching and Recording Accuracy. Once a week the accuracy of each batching and recording device shall be checked during a weighing operation by noting and recording the required mass, recorded mass, and the actual mass batched. The Contractor shall test and ensure that the devices for dispensing admixtures are operating properly and accurately.

c. Corrective Action. When either the weighing accuracy or batching accuracy does not comply with specification requirements, the plant shall not be operated until necessary adjustments or repairs have been made. Discrepancies in recording accuracies shall be corrected immediately.

3.11.2.5 Batch-Plant Control

The measurement of all constituent materials including cementitious materials, each size of aggregate, water, and admixtures shall be continuously controlled. The aggregate masses and amount of added water shall be adjusted as necessary to compensate for free moisture in the aggregates. The amount of air-entraining agent shall be adjusted to control air content within specified limits. A report shall be prepared indicating type and source of cement used, type and source of pozzolan or slag used, amount and source of admixtures used, aggregate source, the required aggregate and water masses per cubic yard, amount of water as free moisture in each size of aggregate, and the batch aggregate and water masses per cubic yard for each class of concrete batched during each day's plant operation.

3.11.2.6 Concrete Mixture

a. Air Content Testing. Air content tests shall be made when test specimens are fabricated. In addition, at least two other tests for air content shall be made on randomly selected batches of each separate concrete mixture produced during each 8-hour period of paving. Additional tests shall be made when excessive variation in workability is reported by the placing foreman or Government inspector. Tests

shall be made in accordance with ASTM C 231. Test results shall be plotted on control charts which are kept current and shall, at all times, be readily available to the Government and shall be submitted weekly. Copies of the current control charts shall be kept in the field by testing crews and results plotted as tests are made. When a single test result reaches either the upper or lower action limit, a second test shall immediately be made. The results of the two tests shall be averaged and this average used as the air content of the batch to plot on both the air content and the control chart for range, and for determining need for any remedial action. The result of each test, or average as noted in the previous sentence, shall be plotted on a separate control chart for each mixture on which an average line is set at the midpoint of the specified air content range from paragraph SPECIFIED CONCRETE STRENGTH AND OTHER PROPERTIES. An upper warning limit and a lower warning limit line shall be set 1.0 percentage point above and below the average line, respectively. An upper action limit and a lower action limit line shall be set 1.5 percentage points above and below the average line, respectively. The range between each two consecutive tests shall be plotted on a secondary control chart for range where an upper warning limit is set at 2.0 percentage points and an upper action limit is set at 3.0 percentage points. Samples for air content shall be taken at the paving site. The Contractor shall deliver the concrete to the paving site at the stipulated air content. If the Contractor's materials or transportation methods cause air content loss between the mixer and the paving site, correlation samples shall be taken at the paving site as required by the Contracting Officer, and the air content at the mixer controlled as directed.

b. Air Content Corrective Action. Whenever points on the control chart for percent air reach either warning limit, an adjustment shall immediately be made in the amount of air-entraining admixture batched. As soon as practical after each adjustment, another test shall be made to verify the result of the adjustment. Whenever a point on the secondary control chart for range reaches the warning limit, the admixture dispenser shall be recalibrated to insure that it is operating accurately and with good reproducibility. Whenever a point on either control chart (single test or result of two tests made concurrently, as specified above) reaches an action limit line, the air content shall be considered out of control and the paving operation shall immediately be halted until the air content is under control. Additional air content tests shall be made when paving is restarted.

c. Slump Testing. Slump tests shall be made when test specimens are fabricated. In addition, at least four other slump tests shall be made on randomly selected batches in accordance with ASTM C 143/C 143M for each separate concrete mixture produced during each 8-hour or less period of concrete production each day. Also, additional tests shall be made when excessive variation in workability is reported by the placing foreman or Government inspector. Test results shall be plotted on control charts which shall at all times be readily available to the Government and shall be submitted weekly. Copies of the current control charts shall be kept in the field by testing crews and results plotted as tests are made. When a single slump test reaches or goes beyond the upper action limit, a second test shall immediately be made. The results of the two tests shall be averaged and this average used as the slump of the batch to plot on both the control chart for slump and the chart for range, and for determining need for any remedial action. An upper warning limit shall be set at 1/2 inch below the maximum allowable slump on separate control charts for slump used for

each type of mixture as specified in paragraph, SPECIFIED CONCRETE STRENGTH AND OTHER PROPERTIES, and an upper action limit line shall be set at the maximum allowable slump, as specified in the same paragraph for fixed form paving or as selected by the Contractor at the start of the project for slipform paving. The range between each consecutive slump test for each type of mixture shall be plotted on a single control chart for range on which an upper action limit is set at 1-1/2 inches. Samples for slump shall be taken at the paving site. The Contractor is responsible for delivering the concrete to the paving site at the stipulated slump. If the Contractor's materials or transportation methods cause slump loss between the mixer and the paving site, correlation samples shall be taken at the paving site as required by the Contracting Officer, and the slump at the mixer controlled as directed.

d. Slump Corrective Action. Whenever points on the control charts for slump reach the upper warning limit, an approved adjustment shall immediately be made in the batch masses of water and fine aggregate. The adjustments are to be made so that the total water content does not exceed that amount allowed by the maximum w/c specified, based on aggregates which are in a saturated surface dry condition. When a slump result (average of two tests made concurrently, as specified above) exceeds the upper action limit, no further concrete shall be delivered to the paving site until proper adjustments have been made. Immediately after each adjustment, another test shall be made to verify the correctness of the adjustment. Whenever two consecutive individual slump tests, made during a period when there was no adjustment of batch masses, produce a point on the control chart for range at or above the upper action limit, the paving operation shall immediately be halted, and the Contractor shall take approved steps to bring the slump under control. Additional slump tests shall be made as directed.

e. Temperature. The temperature of the concrete shall be measured when compressive strength specimens are fabricated. Measurement shall be in accordance with ASTM C 1064/C 1064M. The temperature shall be reported along with the compressive strength data.

3.11.2.7 Concrete Strength Testing for CQC

Contractor Quality Control operations for concrete strength shall consist of the following steps:

a. Take samples for strength tests at the paving site. Fabricate and cure test cylinders in accordance with ASTM C 31/C 31M; test them in accordance with ASTM C 39/C 39M.

b. Fabricate and cure 2 test cylinders per sublot from the same batch or truckload and at the same time acceptance cylinders are fabricated and test them for compressive strength at 7-day age.

c. Average all 8 compressive tests per lot. Convert this average 7-day compressive strength per lot to equivalent 28-day flexural strength using the Correlation Ratio determined during mixture proportioning studies.

d. Compare the equivalent 28-day flexural strength from the conversion to the Average Flexural Strength Required for Mixtures from paragraph of same title.

e. If the equivalent average 28-day strength for the lot is below the Average Flexural Strength Required for Mixtures by 20 psi flexural strength or more, at any time, adjust the mixture to increase the strength, as approved.

f. If the equivalent average 28-day strength is above the Average Flexural Strength Required for Mixtures by 20 psi flexural strength or more for 2 consecutive days, the Contractor will be permitted to adjust the mixture to decrease the strength, as approved.

g. The Contractor's CQC testing agency shall maintain up-to-date control charts for strength, showing the 7-day CQC compressive strength, the 14-day compressive strength (from acceptance tests) and the 28-day equivalent flexural strength of each of these for each lot.

3.11.2.8 Inspection Before Placing

Underlying materials, construction joint faces, forms, reinforcing, dowels, and embedded items shall be inspected by the Contractor in sufficient time prior to each paving operation in order to certify to the Contracting Officer that they are ready to receive concrete. The results of each inspection shall be reported in writing.

3.11.2.9 Paving

a. Paving Inspection. The placing foreman shall supervise all placing and paving operations, shall determine that the correct quality of concrete is placed in each location as shown and that finishing is performed as specified; shall be responsible for measuring and recording concrete temperatures and ambient temperature hourly during placing operations, weather conditions, time of placement, volume of concrete placed, and method of paving and any problems encountered.

b. Placing and Paving Corrective Action. The paving foreman shall not permit batching and paving to begin until it has been verified that an adequate number of vibrators in working order and with competent operators are available. Paving shall not be continued if piles of concrete exist or if the concrete is inadequately consolidated or if surface finish is not satisfactory. If any batch of concrete fails to meet the temperature requirements, immediate steps shall be taken to improve temperature controls.

3.11.2.10 Vibrators

a. Vibrator Testing and Use. The frequency and amplitude of each vibrator shall be determined in accordance with COE CRD-C 521 prior to initial use and at least once a month when paving is in progress. Additional tests shall be made as directed when a vibrator does not appear to be adequately consolidating the concrete. The frequency shall be determined while the vibrator is operating in concrete with the tachometer being held against the upper end of the vibrator head while almost submerged and just before the vibrator is withdrawn from the concrete. The amplitude shall be determined with the head vibrating in air. Two measurements shall be taken, one near the tip and another near the upper end of the vibrator head, and these results averaged. The make, model, type, and size of the vibrator and frequency and amplitude results shall be reported in writing.

b. Vibrator Corrective Action. Any vibrator not meeting the

requirements of subparagraphs, Paver-Finisher and Consolidation, shall be immediately removed from service and repaired or replaced.

3.11.2.11 Curing Inspection

a. Moist Curing Inspections. At least twice each shift, and not less than four times per day (never more than 7 hours apart) on both work and non-work days, an inspection shall be made of all areas subject to moist curing. The surface moisture condition shall be noted and recorded.

b. Moist Curing Corrective Action. When any inspection finds an area of inadequate curing, immediate corrective action shall be taken, and the required curing period for the area shall be extended by 1 day.

c. Membrane Curing Inspection. No curing compound shall be applied until the Contractor has verified that the compound is properly mixed and ready for spraying. At the end of each day's operation, the quantity of compound used shall be determined by measurement of the container and the area of concrete surface covered; the Contractor shall then compute the rate of coverage in square feet per gallon and shall also note whether or not coverage is uniform. All this shall be reported daily.

d. Membrane Curing Corrective Action. When the coverage rate of the curing compound is less than that specified or when the coverage is not uniform, the entire surface shall be sprayed again.

3.11.2.12 Cold-Weather Protection

At least once each shift and once per day on non-work days, an inspection shall be made of all areas subject to cold-weather protection. Any deficiencies shall be noted, corrected, and reported.

3.11.2.13 Mixer Uniformity

a. Stationary Mixers. Prior to the start of concrete placing and once every 4 months when concrete is being placed, or once for every 50,000 cubic yards of concrete placed, whichever results in the longest time interval, uniformity of concrete mixing shall be determined in accordance with COE CRD-C 55. The original test shall be a Regular Test. After the mixing operation has been tested and approved, subsequent tests shall be Abbreviated Tests.

b. Truck Mixers. Prior to the start of concrete placing and at least once every 4 months when concrete is being placed, uniformity of concrete mixing shall be determined in accordance with ASTM C 94/C 94M. The truck mixers shall be selected randomly for testing. When satisfactory performance is found in one truck mixer, the performance of mixers of substantially the same design and condition of the blades may be regarded as satisfactory.

c. Mixer Uniformity Corrective Action. When a mixer fails to meet mixer uniformity requirements, either the mixing time shall be increased, batching sequence changed, batch size reduced, or adjustments shall be made to the mixer until compliance is achieved. After adjustments have been made, another uniformity test shall be made.

3.11.2.14 Reports

All results of tests or inspections conducted shall be reported informally as they are completed and in writing daily. A weekly report shall be prepared for the updating of control charts covering the entire period from the start of the construction season through the current week. During periods of cold-weather protection, reports of pertinent temperatures shall be made daily. These requirements do not relieve the Contractor of the obligation to report certain failures immediately as required in preceding paragraphs. Such reports of failures and the action taken shall be confirmed in writing in the routine reports. The Contracting Officer has the right to examine all contractor quality control records.

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SECTION 02762

COMPRESSION JOINT SEALS FOR CONCRETE PAVEMENTS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in this text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 2628	(1991, R 1998) Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements
ASTM D 2835	(1989; R 1998) Lubricant for Installation of Preformed Compression Seals in Concrete Pavements

U.S. ARMY CORPS OF ENGINEERS (USACE)

COE CRD-C 548	(1988) Jet-Fuel and Heat Resistant Preformed Polychloroprene Elastomeric Joint Seals for Rigid Pavements

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with SECTION 01330 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Test Results.

Certified copies of test results, 30 days prior to use of material on the project.

Equipment List.

List of proposed equipment to be used in the performance of construction work, including descriptive data, 30 days prior to use on the project.

Manufacturer's Instructions.

Where installation procedures are required in accordance with the manufacturer's recommendations, printed copies of manufacturers' instructions, 30 days prior to use on the project.

SD-04, Samples

Compression Seals; G..

4 foot long samples of the materials, 30 days prior to use on the project. Printed directions from the manufacturer on recommended installation criteria shall be furnished with the samples plus the manufacturer's certification that the selected seal is recommended for the installation on this project.

1.3 TEST REQUIREMENTS

The compression joint seal and lubricant/adhesive shall be sampled, identified, and tested for conformance with the applicable material specification. Testing of the compression joint seal and lubricant/adhesive material shall be the responsibility of the Contractor and shall be performed in an approved independent laboratory, and certified copies of the test reports shall be submitted for approval 30 days prior to the use of the materials at the jobsite. Samples of each of the materials shall also be submitted and will be retained by the Government for possible future testing should the materials appear defective during or after application. The Contractor shall furnish additional samples of materials, in sufficient quantity to be tested, upon request. Final acceptance will be based on conformance to the specified test requirements and the performance of the in-place materials.

1.4 EQUIPMENT

Machines, tools, and equipment used in the performance of the work required by this section shall be approved before the work is started and shall be maintained in satisfactory condition at all times.

1.4.1 Joint Cleaning Equipment

1.4.1.1 Concrete Saw

A self-propelled power saw with water-cooled diamond saw blades shall be provided for cutting joints to the depths and widths specified.

1.4.1.2 Sandblasting Equipment

Sandblasting equipment shall include an air compressor, hose, and a long-wearing venturi-type nozzle of proper size, shape, and opening. The maximum nozzle opening should not exceed 1/4 inch. The air compressor shall be portable and shall be capable of furnishing not less than 150 cubic feet per minute and maintaining a line pressure of not less than 90 psi at the nozzle while in use. The compressor shall be equipped with traps that will maintain the compressed air free of oil and water. The nozzle shall have an adjustable guide that will hold the nozzle aligned with the joint about 1 inch above the pavement surface and will direct the blast to clean the joint walls. The height, angle of inclination, and the size of the nozzle shall be adjusted as necessary to ensure satisfactory results.

1.4.1.3 Waterblasting Equipment

Waterblasting equipment shall include a trailer-mounted water tank, pumps, high-pressure hose, a wand with safety release cutoff controls, nozzle, and

auxiliary water resupply equipment. The water tank and auxiliary water resupply equipment shall be of sufficient capacity to permit continuous operations. The pumps, hoses, wand, and nozzle shall be of sufficient capacity to permit the cleaning of both walls of the joint and the pavement surface for a width of at least 1/2 inch on either side of the joint. A pressure gauge mounted at the pump shall show at all times the pressure in psi at which the equipment is operating.

1.4.2 Sealing Equipment

Equipment used to install the compression seal shall place the compression seal to the prescribed depths within the specified tolerances without cutting, nicking, twisting, or otherwise damaging the seal. The equipment shall be capable of placing the seal with not more than two percent longitudinal stretch or compression of the seal during installation. The machine shall be an automatic self-propelled joint seal application equipment and engine powered. The machine shall include a reservoir for the lubricant/adhesive, a device for conveying the lubricant/adhesive in the proper quantities to the sides of the compression seal or the sidewalls of the joints, a reel capable of holding one full spool of compression seal, and a power-driven apparatus for feeding the joint seal through a compression device and inserting the seal into the joint. The equipment shall also include a guide to maintain the proper course along the joint being sealed. The machine shall at all times be operated by an experienced operator.

1.5 TRIAL JOINT SEAL AND LUBRICANT/ADHESIVE INSTALLATION

Prior to the cleaning and sealing of the joints for the entire project, a test section at least 200 feet long shall be prepared at a designated location in the project pavement, using the specified materials and the approved equipment to demonstrate the proposed joint preparation and sealing of all types of joints in the project. Following the completion of the trial length and before any other joint is sealed, the trial joints will be inspected by the Government to determine that the materials and installation meet the requirements specified. If materials or installation do not meet requirements, the materials shall be removed, and the joints shall be recleaned and resealed at no cost to the Government. No other joints shall be sealed until the test installation has been approved. If the trial section is approved, it may be incorporated into the permanent work. Other joints shall be sealed in the manner approved for sealing the trial joint.

1.6 DELIVERY AND STORAGE

Materials delivered to the jobsite shall be inspected for defects, unloaded, and stored with a minimum of handling to avoid damage. Storage facilities shall protect materials from weather and shall maintain materials at temperatures recommended by the manufacturer.

1.7 ENVIRONMENTAL CONDITIONS

The ambient temperature and the pavement temperature within the joint wall shall be at least 35 degrees F and rising at the time of installation of the materials. Sealant installation will not be allowed if moisture or foreign material is observed in the joint.

PART 2 PRODUCTS

2.1 COMPRESSION SEALS

Compression joint seal materials shall be a vulcanized elastomeric compound using polychloroprene as the only base polymer. The material and manufactured seal shall conform to ASTM D 2628 and COE CRD-C 548. The joint seal shall be a labyrinth type seal. The uncompressed depth of the face of the compression seal (that is to be bonded to the joint wall) shall be greater than the uncompressed width of the seal, except that for seals 1 inch or greater in width, the depth need be only 1 inch or greater. The actual width of the uncompressed seal shall be 1 inch with a tolerance of plus 1/8 inch or minus 1/16 inch.

2.2 LUBRICANT/ADHESIVE

Lubricant/adhesive used for the compression elastomeric joint seal shall be a one-component compound conforming to ASTM D 2835.

PART 3 EXECUTION

3.1 PREPARATION OF JOINTS

Immediately before installation of the compression joint seal, the joints shall be thoroughly cleaned to remove laitance, filler, existing sealer, foreign material and protrusions of hardened concrete from the sides and upper edges of the joint space to be sealed. Cleaning shall be by sandblasting or waterblasting and shall extend along pavement surfaces at least 1/2 inch on either side of the joint. After final cleaning and immediately prior to sealing, the joints shall be blown out with compressed air and left completely free of debris and water. The Contractor shall demonstrate that the selected cleaning operation meets the cleanliness requirements. Any irregularity in the joint face which would prevent uniform contact between the joint seal and the joint face shall be corrected prior to the installation of the joint seal.

3.1.1 Sawing

Joints shall be cleaned and opened to the specified width and depth by sawing. Immediately following the sawing operation, the joint faces and opening shall be thoroughly cleaned using a water jet to remove saw cuttings or debris remaining on the faces or in the joint opening. Compression seal shall be installed within 3 calendar days of the time the joint cavity is sawed. Depth of the joint cavity shall be as recommended by the seal manufacturer. The saw cut for the joint seal cavity shall be centered over the joint line. The nominal width of the sawed joint seal cavity shall be as shown on the drawings when the pavement temperature at the time of sawing is between 60 and 160 degrees F; the actual width shall be within a tolerance of plus or minus 1/16 inch. If the pavement temperature at the time of sawing is above this range, the nominal width of the saw cut shall be decreased 1/16 inch. If the pavement temperature at the time of sawing is below this range, the nominal width of the saw cut shall be increased 1/16 inch. The pavement temperature shall be measured in the presence of the Contracting Officer. Measurement shall be made each day before commencing sawing and at any other time during the day when the temperature appears to be varying from the allowable sawing range.

3.1.2 Sandblast Cleaning

A multiple pass sandblasting technique shall be used until the surfaces are free of dust, dirt, curing compound, or any residue that might prevent ready insertion or uniform contact of the seal and bonding of the lubricant/adhesive to the concrete.

3.1.3 Waterblast Cleaning

A multiple pass waterblast technique shall be used until the surfaces are free of dust, dirt, curing compound, or any residue that might prevent ready insertion or uniform contact of the seal and bonding of the lubricant/adhesive to the concrete.

3.1.4 Rate of Progress

Sandblasting or waterblasting of joint faces shall be limited to the length of joint that can be sealed during the same workday.

3.2 INSTALLATION OF THE COMPRESSION SEAL

3.2.1 Time of Installation

Joints shall be sealed immediately within 3 calendar days of sawing the joint seal cavity and following concrete cure and the final cleaning of the joint walls. Open joints ready for sealing that cannot be sealed under the specified conditions shall be provided with an approved temporary seal to prevent infiltration of foreign material. When rain interrupts the sealing operations, the joints shall be washed, air pressure cleaned, and allowed to dry prior to installing the lubricant/adhesive and compression seal.

3.2.2 Sequence of Installation

Longitudinal joints shall be sealed first, followed by transverse joints. Seals in longitudinal joints shall be notched so that all transverse joint seals will be intact from edge to edge of the pavement. Intersections shall be made monolithic by use of joint seal adhesive and care in fitting the intersection parts together. Extender pieces of seal shall not be used at intersections. Any seal falling short at the intersection shall be removed and replaced with new seal at no additional cost to the Government. Seals that are required to change direction by more than 20 degrees, may require a poured sealant at the intersection. Poured sealant shall be as recommended by the compression seal manufacturer.

3.3 SEALING OF JOINTS

The sides of the joint seal or the sides of the joint shall be covered with a coating of lubricant/adhesive and the seal installed as specified. Butt joints and seal intersections shall be coated with liberal applications of lubricant/ adhesive. Lubricant/adhesive spilled on the pavement shall be removed immediately to prevent setting on the pavement. The in-place joint seal shall be in an upright position and free from twisting, distortion, and cuts. Adjustments shall be made to the installation equipment and procedure, if the stretch exceeds 1 percent. Any seal exceeding 2 percent stretch shall be removed and replaced. The joint seal shall be placed at a uniform depth within the tolerances specified. In-place joint seal which fails to meet the specified requirements shall be removed and replaced with new joint seal at no cost to the Government. The compression joint seal shall be placed to a depth of 1/8 inch, plus or minus 1/16 inch, below the

bottom of the edge of the bevel. No part of the seal shall be allowed to project above the bottom edge of the bevel. The seal shall be installed in the longest practicable lengths in longitudinal joints and shall be cut at the joint intersections to provide continuous installation of the seal in the transverse joints. The lubricant/adhesive in the longitudinal joints shall be allowed to set for 1 hour prior to cutting at the joint intersections to reduce the possibility of shrinkage. For all transverse joints, the minimum length of the compression joint seal shall be the pavement width from edge to edge.

3.4 CLEAN-UP

Upon completion of the project, all unused materials shall be removed from the site, any lubricant/adhesive on the pavement surface shall be removed, and the pavement shall be left in clean condition.

3.5 QUALITY CONTROL PROVISIONS

3.5.1 Application Equipment

The application equipment shall be inspected to assure uniform application of lubricant/adhesive to the sides of the compression joint seal or the walls of the joint. If any equipment causes cutting, twisting, nicking, excessive stretching or compressing of the seal, or improper application of the lubricant/adhesive, the operation shall be suspended until causes of the deficiencies are determined and corrected.

3.5.2 Procedures

3.5.2.1 Quality Control Inspection

Quality control provisions shall be provided during the joint cleaning process to prevent or correct improper equipment and cleaning techniques that damage the concrete in any manner. Cleaned joints shall be approved by the Government prior to installation of the lubricant/adhesive and compression joint seal.

3.5.2.2 Conformance to Stretching and compression Limitations

Conformance to stretching and compression limitations shall be determined. The top surface of the compression seal shall be marked at 1 foot intervals in a manner clear and durable to enable length determinations of the seal. After installation, the distance between the marks shall be measured on the seal. If the stretching or compression exceeds 2 percent, the seal shall be removed and replaced with new joint at no additional cost to the Government. The seal shall be removed up to the last correct measurement. The seal shall be inspected a minimum of once per 400 feet of seal for compliance to the shrinkage or compression requirements. Measurements shall also be made at the same interval to determine conformance with depth and width of installation requirements. Compression seal that is not in conformance with specification requirements shall be removed and replaced with new joint seal at no additional cost to the Government.

3.5.2.3 Pavement Temperature

The pavement temperature shall be determined by placing a thermometer in the initial saw cut for the joint and the reading shall be recorded. The thermometer shall remain in the joint for an adequate time to provide a control reading.

3.5.3 Product

The joint sealing system (compression seal and lubricant/adhesive) shall be inspected for proper rate of cure and bonding to the concrete, cuts, twists, nicks and other deficiencies. Seals exhibiting any defects, at any time prior to final acceptance of the project, shall be removed from the joint, wasted, and replaced in a satisfactory manner.

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SECTION 02763

PAVEMENT MARKINGS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO M 247	(1981; R 1996) Glass Beads Used in Traffic Paint

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS TT-B-1325	(Rev C; Notice 1; Canc. Notice 2) Beads (Glass Spheres) Retro-Reflective (Metric)
FS TT-P-1952	(Rev D; Canc. Notice 1) Paint, Traffic and Airfield Marking, Waterborne (Metric)

1.2 UNIT PRICES

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with SECTION 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Equipment.

Lists of proposed equipment, including descriptive data, and notifications of proposed Contractor actions as specified in this section. List of removal equipment shall include descriptive data indicating area of coverage per pass, pressure adjustment range, tank and flow capacities, and safety precautions required for the equipment operation.

Composition Requirements.

Manufacturer's current printed product description and Material Safety Data Sheets (MSDS) for each type paint/color proposed for use.

Qualifications for Equipment.

Document certifying that personnel are qualified for equipment operation and handling of chemicals.

SD-06 Test Reports

Sampling and Testing.

Certified copies of the test reports, prior to the use of the materials at the jobsite. Testing shall be performed in an approved independent laboratory.

SD-07 Certificates

Volatile Organic Compound (VOC) - Marking.

Certificate stating that the proposed pavement marking paint meets the VOC regulations of the local Air Pollution Control District having jurisdiction over the geographical area in which the project is located.

1.4 DELIVERY AND STORAGE

All materials shall be delivered and stored in sealed containers that plainly show the designated name, formula or specification number, batch number, color, date of manufacture, manufacturer's name, and directions, all of which shall be plainly legible at time of use.

1.5 EQUIPMENT

All machines, tools and equipment used in the performance of the work shall be approved and maintained in satisfactory operating condition. Equipment operating on roads and runways shall display low speed traffic markings and traffic warning lights.

1.5.1 Paint Application Equipment

The equipment to apply paint to pavements shall be a self-propelled or mobile-drawn pneumatic spraying machine with suitable arrangements of atomizing nozzles and controls to obtain the specified results. The machine shall have a speed during application not less than 5 mph, and shall be capable of applying the stripe widths indicated, at the paint coverage rate specified in paragraph APPLICATION, and of even uniform thickness with clear-cut edges. The equipment used to apply the paint binder to airfield pavements shall be a self-propelled or mobile-drawn pneumatic spraying machine with an arrangement of atomizing nozzles capable of applying a line width at any one time in multiples of 6 inches, from 6 inches to 36 inches. The paint applicator shall have paint reservoirs or tanks of sufficient capacity and suitable gauges to apply paint in accordance with requirements specified. Tanks shall be equipped with suitable air-driven mechanical agitators. The spray mechanism shall be equipped with quick-action valves conveniently located, and shall include necessary pressure regulators and gauges in full view and reach of the operator. Paint strainers shall be installed in paint supply lines to ensure freedom from residue and foreign matter that may cause malfunction of the spray guns. The paint applicator shall be readily adaptable for attachment of an air-actuated dispenser for the reflective media approved for use. Pneumatic spray guns shall be provided for hand application of paint in areas where the mobile paint applicator cannot be used.

1.5.2 Surface Preparation Equipment

1.5.2.1 Sandblasting Equipment

Sandblasting equipment shall include an air compressor, hoses, and nozzles of proper size and capacity as required for cleaning surfaces to be painted. The compressor shall be capable of furnishing not less than 150 cfm of air at a pressure of not less than 90 psi at each nozzle used, and shall be equipped with traps that will maintain the compressed air free of oil and water.

1.5.2.2 Waterblast Equipment

The water pressure shall be specified at 2600 psi at 140 degrees F in order to adequately clean the surfaces to be marked.

1.5.3 Marking Removal Equipment

Equipment shall be mounted on rubber tires and shall be capable of removing markings from the pavement without damaging the pavement surface or joint sealant. Waterblasting equipment shall be capable of producing an adjustable, pressurized stream of water. Sandblasting equipment shall include an air compressor, hoses, and nozzles. The compressor shall be equipped with traps to maintain the air free of oil and water.

1.5.3.1 Shotblasting Equipment

Shotblasting equipment shall be capable of producing an adjustable depth of removal of marking and pavement. Each unit shall be self-cleaning and self-contained, shall be able to confine dust and debris from the operation, and shall be capable of recycling the abrasive for reuse.

1.5.3.2 Chemical Equipment

Chemical equipment shall be capable of application and removal of chemicals from the pavement surface, and shall leave only non-toxic biodegradeable residue.

1.5.4 Traffic Controls

Suitable warning signs shall be placed near the beginning of the worksite and well ahead of the worksite for alerting approaching traffic from both directions. Small markers shall be placed along newly painted lines or freshly placed raised markers to control traffic and prevent damage to newly painted surfaces or displacement of raised pavement markers. Painting equipment shall be marked with large warning signs indicating slow-moving painting equipment in operation.

1.6 HAND-OPERATED, PUSH-TYPE MACHINES

All machines, tools, and equipment used in performance of the work shall be approved and maintained in satisfactory operating condition. Hand-operated push-type machines of a type commonly used for application of paint to pavement surfaces will be acceptable for marking small streets and parking areas. Applicator machine shall be equipped with the necessary paint tanks and spraying nozzles, and shall be capable of applying paint uniformly at coverage specified. Sandblasting equipment shall be provided as required for cleaning surfaces to be painted. Hand-operated spray guns shall be provided for use in areas where push-type machines cannot be used.

1.7 MAINTENANCE OF TRAFFIC

1.7.1 Airfield

The performance of work in the controlled zones of airfields shall be coordinated with the Contracting Officer and with the Flight Operations Officer. Verbal communications shall be maintained with the control tower before and during work in the controlled zones of the airfield. The control tower shall be advised when the work is completed. A radio for this purpose shall be provided by the Contractor and approved by the Contracting Officer.

1.7.2 Roads, Streets, and Parking Areas

When traffic must be rerouted or controlled to accomplish the work, the necessary warning signs, flagpersons, and related equipment for the safe passage of vehicles shall be provided.

1.8 WEATHER LIMITATIONS FOR REMOVAL

Pavement surface shall be free of snow, ice, or slush. Surface temperature shall be at least 40 degrees F and rising at the beginning of operations, except those involving shot or sand blasting. Operation shall cease during thunderstorms. Operation shall cease during rainfall, except for waterblasting and removal of previously applied chemicals. Waterblasting shall cease where surface water accumulation alters the effectiveness of material removal.

PART 2 PRODUCTS

2.1 PAINT

The paint shall be homogeneous, easily stirred to smooth consistency, and shall show no hard settlement or other objectionable characteristics during a storage period of 6 months. Paints for airfields, roads, and streets shall conform to FS TT-P-1952, color as indicated. Pavement marking paints shall comply with applicable state and local laws enacted to ensure compliance with Federal Clean Air Standards. Paint materials shall conform to the restrictions of the local Air Pollution Control District.

2.2 REFLECTIVE MEDIA

Reflective media for airfields shall conform to FS TT-B-1325, Type I, Gradation A. Reflective media for roads and streets shall conform to FS TT-B-1325, Type I, Gradation A or AASHTO M 247, Type I.

2.3 SAMPLING AND TESTING

Materials proposed for use shall be stored on the project site in sealed and labeled containers, or segregated at source of supply, sufficiently in advance of needs to allow 60 days for testing. Upon notification by the Contractor that the material is at the site or source of supply, a sample shall be taken by random selection from sealed containers by the Contractor in the presence of a representative of the Contracting Officer. Samples shall be clearly identified by designated name, specification number, batch number, manufacturer's formulation number, project contract number, intended use, and quantity involved. Testing shall be performed in an approved independent laboratory. If materials are approved based on

reports furnished by the Contractor, samples will be retained by the Government for possible future testing should the material appear defective during or after application.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

Surfaces to be marked shall be thoroughly cleaned before application of the pavement marking material. Dust, dirt, and other granular surface deposits shall be removed by sweeping, blowing with compressed air, rinsing with water or a combination of these methods as required. Rubber deposits, surface laitance, existing paint markings, and other coatings adhering to the pavement shall be completely removed with scrapers, wire brushes, sandblasting, approved chemicals, or mechanical abrasion as directed. Areas of old pavement affected with oil or grease shall be scrubbed with several applications of trisodium phosphate solution or other approved detergent or degreaser, and rinsed thoroughly after each application. After cleaning, oil-soaked areas shall be sealed with cut shellac to prevent bleeding through the new paint. Pavement surfaces shall be allowed to dry, when water is used for cleaning, prior to striping or marking. Surfaces shall be recleaned, when work has been stopped due to rain.

3.1.1 Pretreatment for Early Painting

Where early painting is required on rigid pavements, a pretreatment with an aqueous solution containing 3 percent phosphoric acid and 2 percent zinc chloride shall be applied to prepared pavement areas prior to painting.

3.1.2 Cleaning Existing Pavement Markings

In general, markings shall not be placed over existing pavement marking patterns. Existing pavement markings, which are in good condition but interfere or conflict with the newly applied marking patterns, shall be removed. Deteriorated or obscured markings that are not misleading or confusing or interfere with the adhesion of the new marking material do not require removal. New preformed and thermoplastic pavement markings shall not be applied over existing preformed or thermoplastic markings. Whenever grinding, scraping, sandblasting or other operations are performed the work must be conducted in such a manner that the finished pavement surface is not damaged or left in a pattern that is misleading or confusing. When these operations are completed the pavement surface shall be blown off with compressed air to remove residue and debris resulting from the cleaning work.

3.1.3 Cleaning Concrete Curing Compounds

On new Portland cement concrete pavements, cleaning operations shall not begin until a minimum of 30 days after the placement of concrete. All new concrete pavements shall be cleaned by either sandblasting or water blasting. When water blasting is performed, thermoplastic and preformed markings shall be applied no sooner than 24 hours after the blasting has been completed. The extent of the blasting work shall be to clean and prepare the concrete surface as follows:

a. There is no visible evidence of curing compound on the peaks of the textured concrete surface.

b. There are no heavy puddled deposits of curing compound in the

valleys of the textured concrete surface.

c. All remaining curing compound is intact; all loose and flaking material is removed.

d. The peaks of the textured pavement surface are rounded in profile and free of sharp edges and irregularities.

e. The surface to be marked is dry.

3.2 APPLICATION

All pavement markings and patterns shall be placed as shown on the plans.

3.2.1 Paint

Paint shall be applied to clean, dry surfaces, and only when air and pavement temperatures are above 40 degrees F and less than 95 degrees F. Paint temperature shall be maintained within these same limits. New asphalt pavement surfaces and new Portland concrete cement shall be allowed to cure for a period of not less than 30 days before applications of paint. Paint shall be applied pneumatically with approved equipment at rate of coverage specified . The Contractor shall provide guide lines and templates as necessary to control paint application. Special precautions shall be taken in marking numbers, letters, and symbols. Edges of markings shall be sharply outlined.

3.2.1.1 Rate of Application

a. Reflective Markings: Pigmented binder shall be applied evenly to the pavement area to be coated at a rate of 105 plus or minus 5 square feet per gallon. Glass spheres shall be applied uniformly to the wet paint on airfield pavement at a rate of 8 plus or minus 0.5 pounds of glass spheres per gallon of paint.

b. Nonreflective Markings: Paint shall be applied evenly to the pavement surface to be coated at a rate of 105 plus or minus 5 square feet per gallon.

3.2.1.2 Drying

The maximum drying time requirements of the paint specifications will be strictly enforced to prevent undue softening of bitumen, and pickup, displacement, or discoloration by tires of traffic. If there is a delay in drying of the markings, painting operations shall be discontinued until cause of the slow drying is determined and corrected.

3.2.2 Reflective Media

Application of reflective media shall immediately follow application of pigmented binder. Drop-on application of glass spheres shall be accomplished to insure that reflective media is evenly distributed at the specified rate of coverage. Should there be malfunction of either paint applicator or reflective media dispenser, operations shall be discontinued immediately until deficiency is corrected.

3.3 MARKING REMOVAL

Pavement marking, shall be removed in the areas shown on the drawings.

Removal of marking shall be as complete as possible without damage to the surface. Aggregate shall not be exposed by the removal process. After the markings are removed, the cleaned pavement surfaces shall exhibit adequate texture for remarking as specified in paragraph SURFACE PREPARATION. Contractor shall demonstrate removal of pavement marking in an area designated by the Contracting Officer. The demonstration area will become the standard for the remainder of the work.

3.3.1 Equipment Operation

Equipment shall be controlled and operated to remove markings from the pavement surface, prevent dilution or removal of binder from underlying pavement, and prevent emission of blue smoke from asphalt or tar surfaces.

3.3.2 Cleanup and Waste Disposal

The worksite shall be kept clean of debris and waste from the removal operations. Cleanup shall immediately follow removal operations in areas subject to air traffic. Debris shall be disposed of at approved sites.

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SECTION 02921

TOPSOIL AND SEEDING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

U.S. DEPARTMENT OF AGRICULTURE (USDA)

AMS-01	(Aug 95) Federal Seed Act Regulations Part 201

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 602	(1995a; R 2001) Agricultural Liming Materials
ASTM D 4972	(2001) pH of Soils
ASTM D 5268	(1992; R 1997) Topsoil Used for Landscaping Purposes

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with SECTION 01330 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Equipment.

A listing of equipment to be used for the seeding operation.

SD-04 Samples

Delivered Topsoil.

Samples taken from several locations at the source.

Soil Amendments.

A 10 pound sample.

Mulch.

A 10 pound sample.

SD-06 Test Reports

Soil Test.

Certified reports of inspections and laboratory tests, prepared by an independent testing agency, including analysis and interpretation of test results. Each report shall be properly identified. Test methods used and compliance with recognized test standards shall be described.

SD-07 Certificates

Delivery.

Delivery schedule.

Topsoil.

Availability of topsoil from the stripping and stock piling operation.

Seed.

Fertilizer.

Prior to the delivery of materials, certificates of compliance attesting that materials meet the specified requirements. Certified copies of the material certificates shall include the following:

a. Seed. Classification, botanical name, common name, percent pure live seed, minimum percent germination and hard seed, maximum percent weed seed content, and date tested.

b. Topsoil. Particle size, pH, organic matter content, textural class, soluble salts, chemical and mechanical analyses.

c. pH Adjuster. Calcium carbonate equivalent and sieve analysis.

d. Fertilizer. Chemical analysis and composition percent.

e. Organic Material: Composition and source.

SD-11 Closeout Submittals

Quantity Check.

Bag count or bulk weight measurements of material used compared with area covered to determine the application rate and quantity installed.

Seed Establishment Period.

Calendar time period for the seed establishment period. When there is more than one seed establishment period, the boundaries of the seeded area covered for each period shall be described.

Maintenance Record.

Maintenance work performed, area repaired or reinstalled, diagnosis for unsatisfactory stand of grass plants.

1.3 SOURCE INSPECTION

The source of delivered topsoil shall be subject to inspection.

1.4 DELIVERY, INSPECTION, STORAGE, AND HANDLING

1.4.1 Delivery

A Delivery schedule shall be provided at least 10 calendar days prior to the first day of delivery.

1.4.1.1 Delivered Topsoil

Prior to the delivery of any topsoil, its availability shall be verified in accordance with paragraph TOPSOIL. A soil test shall be provided for topsoil delivered to the site.

1.4.1.2 Soil Amendments

Soil amendments shall be delivered to the site in the original, unopened containers bearing the manufacturer's chemical analysis. In lieu of containers, soil amendments may be furnished in bulk. A chemical analysis shall be provided for bulk deliveries.

1.4.2 Inspection

Seed shall be inspected upon arrival at the job site for conformity to species and quality. Seed that is wet, moldy, or bears a test date five months or older, shall be rejected. Other materials shall be inspected for compliance with specified requirements. The following shall be rejected: open soil amendment containers or wet soil amendments; topsoil that contains slag, cinders, stones, lumps of soil, sticks, roots, trash or other material over a minimum 1-1/2 inch diameter; and topsoil that contains viable plants and plant parts. Unacceptable materials shall be removed from the job site.

1.4.3 Storage

Materials shall be stored in designated areas. Seed, lime, and fertilizer shall be stored in cool, dry locations away from contaminants.

1.4.4 Handling

Except for bulk deliveries, materials shall not be dropped or dumped from vehicles.

1.4.5 Time Limitation

Hydroseeding time limitation for holding seed in the slurry shall be a maximum 24 hours.

PART 2 PRODUCTS

2.1 SEED

2.1.1 Seed Classification

State-approved seed of the latest season's crop shall be provided in

original sealed packages bearing the producer's guaranteed analysis for percentages of mixture, purity, germination, hard seed, weed seed content, and inert material. Labels shall be in conformance with AMS-01 and applicable state seed laws.

2.1.2 Permanent Seed Species and Mixtures

Permanent Seed species and mixtures shall be proportioned by weight as follows:

Common Name	Mixture Percent by Weight	Percent Pure Live Seed
Wheetgrass	80	90
Hairgrass	20	90

2.1.3 Quality

Weed seed shall be a maximum 1 percent by weight of the total mixture. Wet, moldy, or otherwise damaged seed shall be rejected.

2.1.4 Seed Mixing

The mixing of seed may be done by the seed supplier prior to delivery, or on site as directed.

2.1.5 Substitutions

Substitutions will not be allowed without written request and approval from the Contracting Officer.

2.2 TOPSOIL

Topsoil shall be as defined in ASTM D 5268. When available, the topsoil shall be the existing surface soil stripped and stockpiled onsite in accordance with SECTION 02300 EARTHWORK. When additional topsoil is required beyond the available topsoil from the stripping operation, Delivered Topsoil shall be brought on site and amended as recommended by the soil test for the seed specified. Topsoil shall be free from slag, cinders, stones, lumps of soil, sticks, roots, trash or other material over a minimum 1-1/2 inch diameter. Topsoil shall be free from viable plants and plant parts.

2.3 SOIL AMENDMENTS

Soil Amendments shall consist of pH adjuster, fertilizer, organic material and soil conditioners meeting the following requirements.

2.3.1 pH Adjuster

The pH adjuster shall be an agricultural liming material in accordance with ASTM C 602. These materials may be burnt lime, hydrated lime, ground limestone, sulfur, or shells. The pH adjuster shall be used to create a favorable soil pH for the plant material specified.

2.3.1.1 Limestone

Limestone material shall contain a minimum calcium carbonate equivalent of 80 percent. Gradation: A minimum 95 percent shall pass through a No. 8 sieve and a minimum 55 percent shall pass through a No. 60sieve. To raise soil pH, ground limestone shall be used.

2.3.2 Fertilizer

It shall be as recommended by the Soil Test. Fertilizer shall be controlled release commercial grade, free flowing, uniform in composition, and consist of a nitrogen-phosphorus-potassium ratio. The fertilizer shall be derived from sulphur coated urea, urea formaldehyde, plastic or polymer coated pills, or isobutylenediurea (IBDU). Fertilizer shall be balanced with the inclusion of trace minerals and micro-nutrients.

2.4 MULCH

Mulch shall be free from weeds, mold, and other deleterious materials. Mulch materials shall be native to the region.

2.4.1 Straw

Straw shall be stalks from oats, wheat, rye, barley, or rice, furnished in air-dry condition and with a consistency for placing with commercial mulch-blowing equipment.

2.4.2 Hay

Hay shall be native hay, sudan-grass hay, broomsedge hay, or other herbaceous mowings, furnished in an air-dry condition suitable for placing with commercial mulch-blowing equipment.

2.4.3 Wood Cellulose Fiber

Wood cellulose fiber shall not contain any growth or germination-inhibiting factors and shall be dyed an appropriate color to facilitate placement during application. Composition on air-dry weight basis: 9 to 15 percent moisture, pH range from 4.5 to 6.0.

2.4.4 Paper Fiber

Paper fiber mulch shall be recycled news print that is shredded for the purpose of mulching seed.

2.5 WATER

Water shall be the responsibility of the Contractor. Water shall not contain elements toxic to plant life.

2.6 SURFACE EROSION CONTROL MATERIAL

Surface erosion control material shall conform to the following:

2.6.1 Surface Erosion Control Blanket

Blanket shall be machine produced mat of wood excelsior formed from a web of interlocking wood fibers; covered on one side with either knitted straw blanket-like mat construction; covered with biodegradable plastic mesh; or

interwoven biodegradable thread, plastic netting, or twisted kraft paper cord netting.

2.6.2 Surface Erosion Control Fabric

Fabric shall be knitted construction of polypropylene yarn with uniform mesh openings 3/4 to 1 inch square with strips of biodegradable paper. Filler paper strips shall have a minimum life of 6 months.

2.6.3 Surface Erosion Control Net

Net shall be heavy, twisted jute mesh, weighing approximately 1.22 pounds per linear yard and 4 feet wide with mesh openings of approximately 1 inch square.

2.6.4 Erosion Control Material Anchors

Erosion control anchors shall be as recommended by the manufacturer.

PART 3 EXECUTION

3.1 INSTALLING SEED TIME AND CONDITIONS

3.1.1 Seeding Time

Seed shall be installed from May 15th to September 1st.

3.1.2 Seeding Conditions

Seeding operations shall be performed only during periods when beneficial results can be obtained. When drought, excessive moisture, or other unsatisfactory conditions prevail, the work shall be stopped when directed. When special conditions warrant a variance to the seeding operations, proposed alternate times shall be submitted for approval.

3.1.3 Equipment Calibration

Immediately prior to the commencement of seeding operations, calibration tests shall be conducted on the Equipment to be used. These tests shall confirm that the equipment is operating within the manufacturer's specifications and will meet the specified criteria. The equipment shall be calibrated a minimum of once every day during the operation. The calibration test results shall be provided within 1 week of testing.

3.1.4 Soil Test

Delivered topsoil, existing soil in smooth graded areas, and stockpiled topsoil shall be tested in accordance with ASTM D 5268 and ASTM D 4972 for determining the particle size, pH, organic matter content, textural class, chemical analysis, soluble salts analysis, and mechanical analysis. Sample collection on site shall be random over the entire site. Sample collection for stockpiled topsoil shall be at different levels in the stockpile. The soil shall be free from debris, noxious weeds, toxic substances, or other materials harmful to plant growth. The test shall determine the quantities and type of soil amendments required to meet local growing conditions for the seed species specified, if not already specified in this specification.

3.2 SITE PREPARATION

3.2.1 Finished Grade and Topsoil

The Contractor shall verify that finished grades are as indicated on drawings, and the placing of topsoil, smooth grading, and compaction requirements have been completed in accordance with SECTION 02300 EARTHWORK, prior to the commencement of the seeding operation.

3.2.2 Application of Soil Amendments

3.2.2.1 Applying Fertilizer

The fertilizer shall be applied as recommended by the soil test. Fertilizer shall be incorporated into the soil to a maximum 4 inch depth or may be incorporated as part of the tillage or hydroseeding operation.

3.2.2.2 Applying Soil Conditioner

The soil conditioner shall be spread uniformly over the soil a minimum 1 inch depth and thoroughly incorporated by tillage into the soil to a maximum 4 inch depth.

3.2.3 Tillage

Soil on slopes up to a maximum 3-horizontal-to-1-vertical shall be tilled to a minimum 4 inch depth. On slopes between 3-horizontal-to-1-vertical and 1-horizontal-to-1 vertical, the soil shall be tilled to a minimum 2 inch depth by scarifying with heavy rakes, or other method. Rototillers shall be used where soil conditions and length of slope permit. On slopes 1-horizontal-to-1 vertical and steeper, no tillage is required. Drainage patterns shall be maintained as indicated on drawings. Areas compacted by construction operations shall be completely pulverized by tillage. Soil used for repair of surface erosion or grade deficiencies shall conform to topsoil requirements. The pH adjuster, fertilizer, and soil conditioner may be applied during this procedure.

3.2.4 Prepared Surface

3.2.4.1 Preparation

The prepared surface shall be a maximum 1 inch below the adjoining grade of any surfaced area. New surfaces shall be blended to existing areas. The prepared surface shall be completed with a light raking to remove debris.

3.2.4.2 Field Area Debris

Debris and stones over a minimum 3 inch in any dimension shall be removed from the surface.

3.2.4.3 Protection

Areas with the prepared surface shall be protected from compaction or damage by vehicular or pedestrian traffic and surface erosion.

3.3 INSTALLATION

Prior to installing seed, any previously prepared surface compacted or damaged shall be reworked to restore the ground condition previously

specified. Seeding operations shall not take place when the wind velocity will prevent uniform seed distribution.

3.3.1 Installing Seed

Seeding method shall be Broadcast Seeding or Hydroseeding. Seeding procedure shall ensure even coverage. Gravity feed applicators, which drop seed directly from a hopper onto the prepared soil, shall not be used because of the difficulty in achieving even coverage, unless otherwise approved. Absorbent polymer powder shall be mixed with the dry seed at the rate recommended by the manufacturer.

3.3.1.1 Broadcast Seeding

Seed shall be uniformly broadcast at the rate of 2 pounds per 1000 square feet using broadcast seeders. Half the total rate of seed application shall be broadcast in 1 direction, with the remainder of the seed rate broadcast at 90 degrees from the first direction. Seed shall be covered a maximum 1/4 inch depth by disk harrow, steel mat drag, cultipacker, or other approved device.

3.3.1.2 Rolling

The entire area shall be firmed with a roller not exceeding 90 pounds per foot roller width. Slopes over a maximum 3-horizontal-to-1 vertical shall not be rolled.

3.3.2 Hydroseeding

Seed and fertilizer shall be added to water and thoroughly mixed to meet the rates specified for broadcast seeding. Slurry shall be uniformly applied under pressure over the entire area. The hydroseeded area shall not be rolled.

3.3.3 Mulching

3.3.3.1 Hay or Straw Mulch

Hay or straw mulch shall be spread uniformly at the rate of 2 tons per acre. Mulch shall be spread by hand, blower-type mulch spreader, or other approved method. Mulching shall be started on the windward side of relatively flat areas or on the upper part of steep slopes, and continued uniformly until the area is covered. The mulch shall not be bunched or clumped. Sunlight shall not be completely excluded from penetrating to the ground surface. All areas installed with seed shall be mulched on the same day as the seeding. Mulch shall be anchored immediately following spreading.

3.3.3.2 Mechanical Anchor

Mechanical anchor shall be a V-type-wheel land packer; a scalloped-disk land packer designed to force mulch into the soil surface; or other suitable equipment.

3.3.3.3 Wood Cellulose Fiber, Paper Fiber, and Recycled Paper

Wood cellulose fiber, paper fiber, or recycled paper shall be applied as part of the hydroseeding operation. The mulch shall be mixed and applied in accordance with the manufacturer's recommendations.

3.3.4 Watering Seed

Watering shall be started immediately after completing the seeding of an area. Water shall be applied to supplement rainfall at a rate sufficient to ensure moist soil conditions to a minimum 1 inch depth. Run-off and puddling shall be prevented. Watering trucks shall not be driven over turf areas, unless otherwise directed. Watering of other adjacent areas or plant material shall be prevented.

3.4 SURFACE EROSION CONTROL

3.4.1 Surface Erosion Control Material

Where directed, surface erosion control material shall be installed in accordance with manufacturer's instructions. Placement of the material shall be accomplished without damage to installed material or without deviation to finished grade.

3.5 QUANTITY CHECK

A Quantity Check for materials provided in bags, the empty bags shall be retained for recording the amount used. For materials provided in bulk, the weight certificates shall be retained as a record of the amount used. The amount of material used shall be compared with the total area covered to determine the rate of application used. Differences between the quantity applied and the quantity specified shall be adjusted as directed.

3.6 RESTORATION AND CLEAN UP

3.6.1 Restoration

Existing turf areas, pavements, and facilities that have been damaged from the seeding operation shall be restored to original condition at Contractor's expense.

3.6.2 Clean Up

Excess and waste material shall be removed from the seeded areas and shall be disposed offsite. Adjacent paved areas shall be cleaned.

3.7 PROTECTION OF INSTALLED AREAS

Immediately upon completion of the seeding operation in an area, the area shall be protected against traffic or other use by erecting barricades and providing signage as required, or as directed.

3.8 SEED ESTABLISHMENT PERIOD

3.8.1 Commencement

The Seed Establishment Period, to obtain a healthy stand of grass plants, shall begin on the first day of work under this contract. Written calendar time period shall be furnished for the seed establishment period. When there is more than 1 seed establishment period, the boundaries of the seeded area covered for each period shall be described.

3.8.2 Satisfactory Stand of Grass Plants

Grass plants shall be evaluated for species and health when the grass plants are a minimum 1 inch high.

3.8.2.1 Seeded Area

A satisfactory stand of grass plants from the seeding operation for a seeded area shall be a minimum 10 grass plants per square foot. The total bare spots shall not exceed 2 percent of the total seeded area.

3.8.3 Maintenance During Establishment Period

Maintenance of the seeded areas shall include; protecting embankments and ditches from surface erosion; maintaining erosion control materials and mulch; protecting installed areas from traffic; watering; and post-fertilization and protecting turfed areas from traffic.

3.8.3.1 Mowing

Seeded Areas: Seeded areas shall be mowed once during the season to a minimum 3 inch height. Clippings shall be removed when the amount cut prevents sunlight from reaching the ground surface.

3.8.3.2 Post-Fertilization

A maximum 1/2 pound per 1000 square feet of actual available nitrogen shall be provided to the grass plants. The application shall be timed prior to the advent of winter dormancy and shall be made without burning the installed grass plants.

3.8.3.3 Repair or Reinstall

Unsatisfactory stand of grass plants shall be repaired or reinstalled, and eroded areas shall be repaired in accordance with this specification.

3.8.3.4 Maintenance Record

A Maintenance Record of each site visit shall be furnished, describing the maintenance work performed; areas repaired or reinstalled; and diagnosis for unsatisfactory stand of grass plants.

3.9 FINAL ACCEPTANCE

3.9.1 Preliminary Inspection

Prior to the completion of the Turf Establishment Period, a preliminary inspection shall be held by the Contracting Officer. Time for the inspection shall be established in writing. The acceptability of the turf in accordance with the Turf Establishment Period shall be determined. An unacceptable stand of turf shall be repaired as soon as turfing conditions permit.

3.9.2 Final Inspection

A final inspection shall be held by the Contracting Officer to determine that deficiencies noted in the preliminary inspection have been corrected. Time for the inspection shall be established in writing.

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SECTION 02975

FIELD MOLDED SEALANTS FOR SEALING OF PCC/AC JOINTS AND EXPANSION JOINTS IN AIRFIELD PAVEMENTS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in this text by the basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 789	(1998) Determination of Relative Viscosity, Melting Point, and Moisture Content of Polyamide (PA)
ASTM D 3569	(2000) Joint Sealant, Hot Applied, Elastomeric, Jet-Fuel-Resistant Type for Concrete Pavements
ASTM D 6690	(2001) Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements

1.2 SYSTEM DESCRIPTION

Machines, tools, and equipment used in the performance of the work required by this section shall be approved before the work is started and shall be maintained in satisfactory condition at all times.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with SECTION 01330 SUBMITTAL PROCEDURES:

SD-06 Test Reports

Installation of Sealant.

Manufacturer's instructions 30 days prior to the use of the material on the project. Installation of the material will not be allowed until the instructions are received.

SD-09 Manufacturer's Field Reports

Test Requirements; G.

Reports of all tests. Testing of the backup materials and joint sealants shall be performed in an approved independent laboratory and certified

copies of the test reports shall be submitted 30 days prior to the use of the materials at the job site. Samples will be retained by the Government for possible future testing should the materials appear defective during or after application.

SD-04 Samples

Materials;

Samples of the backup materials and joint sealants 30 days prior to their use on the project.

1.4 TEST REQUIREMENTS

The joint sealants and backup material shall be tested for conformance with the referenced applicable material specification. Conformance with the requirements of the laboratory tests specified will not constitute final acceptance of the materials. Final acceptance will be based on the performance of the in-place materials.

1.5 EQUIPMENT

Machines, tools, and equipment used in the performance of the work required by this section shall be maintained in satisfactory condition at all times.

1.5.1 Equipment

1.5.1.1 Concrete Saw

A self-propelled power saw with water-cooled diamond or abrasive saw blades shall be provided for cutting Asphalt concrete to the depths and widths specified.

1.5.1.2 Waterblasting Equipment

Waterblasting equipment shall include a trailer-mounted water tank, pumps, high-pressure hose, wand with safety release cutoff control, nozzle, and auxiliary water resupply equipment. The water tank and auxiliary resupply equipment shall be of sufficient capacity to permit continuous operations. The hose, wand, and nozzle shall be capable of cleaning the sawcut faces and the pavement surface on both sides of the sawcut for a width of at least 1/2 inch. A pressure gauge mounted at the pump shall show at all times the pressure in pounds per square inch at which the equipment is operating.

1.5.2 Sealing Equipment

The unit applicators used for heating and installing the hot-poured joint sealant materials shall be mobile and shall be equipped with a double-boiler, agitator-type kettle with an oil medium in the outer space for heat transfer; a direct-connected pressure-type extruding device with a nozzle shaped for inserting in the sawcut to be filled; positive temperature devices for controlling the temperature of the transfer oil and sealant; and a recording type thermometer for indicating the temperature of the sealant. The applicator unit design shall allow the sealant to circulate through the delivery hose and return to the inner kettle when not in use.

1.6 DELIVERY AND STORAGE

Materials delivered to the job site shall be inspected for defects, unloaded, and stored with a minimum of handling to avoid damage. Storage facilities shall be provided at the job site to protect materials from weather and to maintain them at the temperatures recommended by the manufacturer.

1.7 ENVIRONMENTAL CONDITIONS

The ambient air temperature and the pavement temperature within the walls of the joint shall be a minimum of 50 degrees F and rising at the time of application of the materials. Sealant shall not be applied if moisture is observed in the joint sealant reservoir or on the expansion joint filler.

PART 2 PRODUCTS

2.1 SEALANTS

2.1.1 PCC/AC Joints

Sealants used for sealing PCC/AC joints shall conform to ASTM D 6690, Type IV.

2.1.2 Expansion Joints

Sealants used for sealing expansion joints shall conform to ASTM D 3569.

2.2 BOND BREAKING TAPES

The bond breaking tape or separating material shall be a flexible, nonshrinkable, nonabsorbing, nonstaining, and nonreacting adhesive-backed tape. The material shall have a melting point at least 5 degrees F greater than the pouring temperature of the sealant being used when tested in accordance with ASTM D 789. The bond breaker tape shall be approximately 1/8 inch wider than the nominal width of the joint and shall not bond to the joint sealant.

PART 3 EXECUTION

3.1 PREPARATION OF SEALANT RESERVOIR

Immediately before the installation of the joint sealant, the joint shall be thoroughly cleaned to remove loose aggregate and foreign debris. The preparation shall be as follows:

3.1.1 Joints

Joints shall be waterblasted and cleaned using compressed air.

3.1.2 Sawing

Sawing of the joint sealant reservoir shall be accomplished using a power-driving concrete saw as specified in paragraph EQUIPMENT. The blade shall be stiffened as necessary with suitable dummy (or used) blades or washers. Immediately following the sawing operation, the joint opening shall be cleaned using a water jet to remove all saw cuttings and debris.

3.1.3 Waterblasting

The joint faces and the pavement surfaces extending a minimum of 1/2 inch from the sawcut edges shall be waterblasted clean. A multiple-pass technique shall be used until the surfaces are free of dust, dirt, or foreign debris that might prevent the sealant material from bonding to the pavement. After final cleaning and immediately prior to sealing, the sawcuts and expansion joints shall be blown out with compressed air and left completely free of debris and water. The Contractor shall ensure that water blasting does not damage the pavement.

3.1.4 Backup Material

The backup material shall be inserted into the lower portion of the joint sealant reservoir as shown on the drawings. The Contractor shall ensure that the backup material is placed at the specified depth and is not stretched or twisted during installation.

3.1.5 Rate of Progress of joint Preparation

The stages of joint preparation which include waterblasting of the joint faces, air pressure cleaning and placing of the backup material shall be limited to only that linear footage that can be sealed during the same day.

3.2 PREPARATION OF SEALANT

Hot-poured sealants shall not be heated in excess of the safe heating temperature recommended by the manufacturer as shown on the sealant containers. Sealant that has been overheated or subjected to application temperatures for over 4 hours or that has remained in the applicator at the end of the day's operation shall be withdrawn and wasted.

3.3 INSTALLATION OF SEALANT

3.3.1 Time of Application

Joints shall be sealed immediately following final cleaning of the joint cavity walls and following the placement of the backup material. Joints that cannot be sealed under the conditions specified, or when rain interrupts sealing operations, shall be recleaned and allowed to dry prior to installing the sealant.

3.3.2 Sealing the Joints

Immediately preceding, but not more than 50 feet ahead of the joint sealing operations, a final cleaning with compressed air shall be performed. The joints shall be filled from the bottom up to 3/16 inch, plus or minus 1/16 inch below the pavement surface. Excess or spilled sealant shall be removed from the pavement by approved methods and shall be discarded. The sealant shall be installed in a manner which prevents the formation of voids and entrapped air. Several passes with the applicator wand may be necessary to obtain the specified sealant depth from the pavement surface. Gravity methods or pouring pots shall not be used to install the sealant material. Traffic shall not be permitted over newly sealed pavement until authorized by the Contracting Officer. Joints shall be checked frequently to ensure that the newly installed sealant is cured to a tack-free condition within 3 hours.

3.4 JOINT SEALANT INSTALLATION TEST SECTION

Prior to the cleaning and sealing of the joints for the entire project, a test section at least 200 feet long for the PCC/AC joints and at least 50 lineal feet of expansion joint shall be prepared using the specified materials and approved equipment, to demonstrate the proposed sealing of all PCC/AC and expansion joints of the project. Following the completion of the test sections and before any other joints are sealed, the test sections will be inspected to determine that the materials and installation meet the requirements specified. If materials or installation do not meet requirements, the materials shall be removed and the joints recleaned and resealed at no cost to the Government. When the test section meets the requirements, it may be incorporated into the permanent work. All other joints shall be sealed in the manner approved for sealing each of the test sections.

3.5 CLEANUP

Upon completion of the project, unused materials shall be removed from the site and the pavement shall be left in a clean condition.

3.6 QUALITY CONTROL PROVISIONS

3.6.1 Joint Cleaning

Quality control provisions shall be provided during the joint cleaning process to correct improper equipment and cleaning techniques that damage the pavement in any manner. Cleaned joints shall be approved prior to installation of the joint sealant.

3.6.2 Sealant Application Equipment

The application equipment shall be inspected to ensure conformance to temperature requirements and proper installation. Evidences of bubbling, improper installing, and failing to cure or set shall be cause to suspend operations until causes of the deficiencies are determined and corrected.

3.6.3 Sealant

The sealants shall be inspected for proper cure and set rating, bonding to the pavement, cohesive separation within the sealant, reversion to liquid, and entrapped air and voids. Sealants exhibiting any of these deficiencies at any time prior to the final acceptance of the project shall be removed from the joint, wasted, and replaced as specified herein at no additional cost to the Government.

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SECTION 03100

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SECTION 03100

STRUCTURAL CONCRETE FORMWORK

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ACI INTERNATIONAL (ACI)

ACI 347R	(1994) Guide to Formwork for Concrete

AMERICAN HARDBOARD ASSOCIATION (AHA)

AHA A135.4	(1995) Basic Hardboard

U.S. DEPARTMENT OF COMMERCE (DOC)

PS1	(1996) Voluntary Product Standard - Construction and Industrial Plywood

1.2 DESIGN

Formwork shall be designed in accordance with methodology of ACI 347R for anticipated loads, lateral pressures, and stresses. Forms shall be capable of producing a surface which meets the requirements of the class of finish specified in SECTION 03300 CAST-IN-PLACE STRUCTURAL CONCRETE. Forms shall be capable of withstanding the pressures resulting from placement and vibration of concrete.

PART 2 PRODUCTS

2.1 FORM MATERIALS

2.1.1 Forms For Class B Finish

Forms for Class B finished surfaces shall be plywood panels conforming to PS1, Grade B-B concrete form panels, Class I or II. Other form materials or liners may be used provided the smoothness and appearance of concrete produced will be equivalent to that produced by the plywood concrete form panels. Forms for round columns shall be the prefabricated seamless type.

2.1.2 Forms For Class C Finish

Forms for Class C finished surfaces shall be shiplap lumber; plywood conforming to PS1, Grade B-B concrete form panels, Class I or II; tempered concrete form hardboard conforming to AHA A135.4; other approved concrete form material; or steel, except that steel lining on wood sheathing shall not be used. Forms for round columns may have one vertical seam.

2.1.3 Forms For Class D Finish

Forms for Class D finished surfaces, except where concrete is placed against earth, shall be wood or steel or other approved concrete form material.

2.1.4 Retain-In-Place Metal Forms

Retain-in-place metal forms for concrete slabs and roofs shall be as specified in SECTION 05300 STEEL DECKING.

2.1.5 Form Ties

Form ties shall be factory-fabricated metal ties, shall be of the removable or internal disconnecting or snap-off type, and shall be of a design that will not permit form deflection and will not spall concrete upon removal. Solid backing shall be provided for each tie. Except where removable tie rods are used, ties shall not leave holes in the concrete surface less than 1/4 inch nor more than 1 inch deep and not more than 1 inchin diameter. Removable tie rods shall be not more than 1-1/2 inches in diameter.

2.1.6 Form Releasing Agents

Form releasing agents shall be commercial formulations that will not bond with, stain or adversely affect concrete surfaces. Agents shall not impair subsequent treatment of concrete surfaces depending upon bond or adhesion nor impede the wetting of surfaces to be cured with water or curing compounds.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Formwork

Forms shall be mortar tight, properly aligned and adequately supported to produce concrete surfaces meeting the surface requirements specified in SECTION 03300 CAST-IN-PLACE STRUCTURAL CONCRETE and conforming to construction tolerance given in TABLE 1. Where concrete surfaces are to have a Class B finish, joints in form panels shall be arranged as approved. Where forms for continuous surfaces are placed in successive units, the forms shall fit over the completed surface to obtain accurate alignment of the surface and to prevent leakage of mortar. Forms shall not be reused if there is any evidence of surface wear and tear or defects which would impair the quality of the surface. Surfaces of forms to be reused shall be cleaned of mortar from previous concreting and of all other foreign material before reuse. Form ties that are to be completely withdrawn shall be coated with a nonstaining bond breaker.

3.2 CHAMFERING

Except as otherwise shown, external corners that will be exposed shall be chamfered, beveled, or rounded by moldings placed in the forms.

3.3 COATING

Forms for Class B finished surfaces shall be coated with a form releasing agent before the form or reinforcement is placed in final position. The

coating shall be used as recommended in the manufacturer's printed or written instructions. Forms for Class C and D finished surfaces may be wet with water in lieu of coating immediately before placing concrete, except that in cold weather with probable freezing temperatures, coating shall be mandatory. Surplus coating on form surfaces and coating on reinforcing steel and construction joints shall be removed before placing concrete.

3.4 REMOVAL OF FORMS

Forms shall be removed preventing injury to the concrete and ensuring the complete safety of the structure. Formwork for columns, walls, side of beams and other parts not supporting the weight of concrete may be removed when the concrete has attained sufficient strength to resist damage from the removal operation but not before at least 24 hours has elapsed since concrete placement. Supporting forms and shores shall not be removed from beams, floors and walls until the structural units are strong enough to carry their own weight and any other construction or natural loads. Supporting forms or shores shall not be removed before the concrete strength has reached 70 percent of design strength, as determined by field cured cylinders or other approved methods. This strength shall be demonstrated by job-cured test specimens, and by a structural analysis considering the proposed loads in relation to these test strengths and the strength of forming and shoring system. The job-cured test specimens for form removal purposes shall be provided in numbers as directed and shall be in addition to those required for concrete quality control. The specimens shall be removed from molds at the age of 24 hours and shall receive, insofar as possible, the same curing and protection as the structures they represent.

TABLE 1

TOLERANCES FOR FORMED SURFACES

1. Variations from the plumb:	In any 10 feet of length ---------- 1/4 inch
a. In the lines and surfaces of columns, piers, walls and in arises	Maximum for entire length ---------- 1 inch
b. For exposed corner columns,control-joint grooves, and other conspicuous lines	In any 20 feet of length ---------- ---- 1/4 inch Maximum for entire length---------- 1/2 inch
2. Variation from the level or from the grades indicated on the drawings:	In any 10 feet of length ----------1/4 inch In any bay or in any 20 feet of length---------- 3/8 inch
a. In slab soffits, ceilings, beam soffits, and in arises, measured before removal of supporting shores	Maximum for entire length ---------- 3/4 inch
b. In exposed lintels,	In any bay or in any 20 feet of

TABLE 1

TOLERANCES FOR FORMED SURFACES

	sills, parapets, horizontal grooves, and other conspicuous lines	length ---------- ----- 1/4 inch Maximum for entire length---------- 1/2 inch
3.	Variation of the linear building lines from established position in plan	In any 20 feet --------- 1/2 inch Maximum ----------1 inch
4.	Variation of distance between walls, columns, partitions	1/4 inch per 10 feet of distance, but not more than 1/2 inch in any one bay,and not more than 1 inch total variation
5.	Variation in the sizes and locations of sleeves, floor openings, and wall opening	Minus ---------- 1/4 inch Plus ---------- 1/2 inch
6.	Variation in cross-sectional dimensions of columns and beams and in the thickness of slabs and walls	Minus ---------- 1/4 inch Plus ---------- 1/2 inch
7.	Footings:	
	a. Variation of dimensions in plan	Minus ---------- 1/2 inch Plus ---------- 2 inches when formed or plus 3 inches when placed against unformed excavation
	b. Misplacement of eccentricity	2 percent of the footing width in the direction of misplacement but not more than 2 inches
	c. Reduction in thickness of specified thickness	Minus ---------- 5 percent
8.	Variation in steps:	Riser ---------- 1/8 inch
	a. In a flight of stairs	Tread ---------- 1/4 inch
	b. In consecutive steps	Riser ---------- 1/16 inch Tread ---------- 1/8 inch

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SECTION 03150

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SECTION 03150

EXPANSION JOINTS, CONTRACTION JOINTS, AND WATERSTOPS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN HARDBOARD ASSOCIATION (AHA)

AHA A135.4	(1995) Basic Hardboard

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 920	(2002) Elastomeric Joint Sealants
ASTM D 471	(1998e1) Rubber Property - Effect of Liquids
ASTM D 1751	(1999) Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D 1752	(1984; R 1996el) Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction
ASTM D 5249	(1995; R 2000) Backer Material for Use with Cold- and Hot-Applied Joint Sealants
ASTM D 5893	(1996) Cold Applied, Single Component Chemically Curing Silicon Joint Sealant for Portland Cement Concrete Pavement

U.S. ARMY CORPS OF ENGINEERS (USACE)

COE CRD-C 513	(1974) Corps of Engineers Specifications for Rubber Waterstops
COE CRD-C 572	(1974) Corps of Engineers Specifications for Polyvinylchloride Waterstop

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with SECTION 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Waterstops.

Shop drawings and fabrication drawings provided by the manufacturer or prepared by the Contractor.

SD-03 Product Data

Preformed Expansion Joint Filler.

Sealant.

Waterstops.

Manufacturer's literature, including safety data sheets, for preformed fillers and the lubricants used in their installation; field-molded sealants and primers (when required by sealant manufacturer); and waterstops.

Manufacturer's recommended instructions for installing preformed fillers, field-molded sealants, waterstops, and for splicing non-metallic waterstops.

SD-04 Samples

Field-Molded Type.

One gallon of field-molded sealant and one quart of primer (when primer is recommended by the sealant manufacturer) identified to indicate manufacturer, type of material, quantity, and shipment or lot represented.

Non-metallic Materials.

Specimens identified to indicate manufacturer, type of material, size, quantity of material, and shipment or lot represented. Each sample shall be a piece not less than 12 inch long cut from each 200 ft of finished waterstop furnished, but not less than a total of 4 ft of each type, size, and lot furnished. One splice sample of each size and type for every 50 splices made in the factory and every 10 splices made at the job site. The splice samples shall be made using straight run pieces with the splice located at the mid-length of the sample and finished as required for the installed waterstop. The total length of each splice shall be not less than 12 inches long.

SD-07 Certificates

Preformed Expansion Joint Filler.

Sealant.

Waterstops.

Certificates of compliance stating that the joint filler and sealant materials and waterstops conform to the requirements specified.

1.3 DELIVERY AND STORAGE

Material delivered and placed in storage shall be stored off the ground and protected from moisture, dirt, and other contaminants. Sealants shall be delivered in the manufacturer's original unopened containers. Sealants whose shelf life has expired shall be removed from the site.

PART 2 PRODUCTS

2.1 CONTRACTION JOINT STRIPS

Contraction joint strips shall be 1/8 inch thick tempered hardboard conforming to AHA A135.4, Class 1. In lieu of hardboard strips, rigid polyvinylchloride (PVC) or high impact polystyrene (HIPS) insert strips specifically designed to induce controlled cracking in slabs on grade may be used. Such insert strips shall have removable top section.

2.2 PREFORMED EXPANSION JOINT FILLER

Expansion joint filler shall be preformed material conforming to ASTM D 1751 or ASTM D 1752. Unless otherwise indicated, filler material shall be 3/8 inch thick and of a width applicable for the joint formed. Backer material, when required, shall conform to ASTM D 5249.

2.3 SEALANT

Joint sealant shall conform to the following:

2.3.1 Field-Molded Type

ASTM C 920, Type M for horizontal joints or Type NS for vertical joints, Class 25, and Use NT. Bond breaker material shall be polyethylene tape, coated paper, metal foil or similar type materials. The back-up material shall be compressible, non-shrink, nonreactive with sealant, and non-absorptive material type such as extruded butyl or polychloroprene rubber.

2.3.2 Hot-Applied Jet-Fuel Resistant Type

ASTM D 5893, Single Component Silicon Sealant.

2.4 WATERSTOPS

Intersection and change of direction waterstops shall be shop fabricated.

2.4.1 Non-Metallic Materials`

Non-metallic waterstops shall be manufactured from a prime virgin resin; reclaimed material is not acceptable. The compound shall contain plasticizers, stabilizers, and other additives to meet specified requirements. Rubber waterstops shall conform to COE CRD-C 513. Polyvinylchloride waterstops shall conform to COE CRD-C 572. Thermoplastic elastomeric rubber waterstops shall conform to ASTM D 471.

PART 3 EXECUTION

3.1 JOINTS

Joints shall be installed at locations indicated and as authorized.

3.1.1 Contraction Joints

Contraction joints may be constructed by inserting tempered hardboard strips or rigid PVC or HIPS insert strips into the plastic concrete using a steel parting bar, when necessary, or by cutting the concrete with a saw after concrete has set. Joints shall be approximately 1/8 inch wide and shall extend into the slab one-fourth the slab thickness, minimum, but not less than 1 inch.

3.1.1.1 Joint Strips

Strips shall be of the required dimensions and as long as practicable. After the first floating, the concrete shall be grooved with a tool at the joint locations. The strips shall be inserted in the groove and depressed until the top edge of the vertical surface is flush with the surface of the slab. The slab shall be floated and finished as specified. Working of the concrete adjacent to the joint shall be the minimum necessary to fill voids and consolidate the concrete. Where indicated, the top portion of the strip shall be sawed out after the curing period to form a recess for sealer. The removable section of PVC or HIPS strips shall be discarded and the insert left in place. True alignment of the strips shall be maintained during insertion.

3.1.1.2 Sawed Joints

Joint sawing shall be early enough to prevent uncontrolled cracking in the slab, but late enough that this can be accomplished without appreciable spalling. Concrete sawing machines shall be adequate in number and power, and with sufficient replacement blades to complete the sawing at the required rate. Joints shall be cut to true alignment and shall be cut in sequence of concrete placement. Sludge and cutting debris shall be removed.

3.1.2 Expansion Joints

Preformed expansion joint filler shall be used in expansion and isolation joints in slabs around columns and between slabs on grade and vertical surfaces where indicated. The filler shall extend the full slab depth, unless otherwise indicated. The edges of the joint shall be neatly finished with an edging tool of 1/8 inchradius, except where a resilient floor surface will be applied. Where the joint is to receive a sealant, the filler strips shall be installed at the proper level below the finished floor with a slightly tapered, dressed and oiled wood strip temporarily secured to the top to form a recess to the size shown on the drawings. The wood strip shall be removed after the concrete has set. Contractor may opt to use a removable expansion filler cap designed and fabricated for this purpose in lieu of the wood strip. The groove shall be thoroughly cleaned of laitance, curing compound, foreign materials, protrusions of hardened concrete, and any dust which shall be blown out of the groove with oil-free compressed air.

3.1.3 Joint Sealant

Sawed contraction joints and expansion joints in slabs shall be filled with joint sealant, unless otherwise shown. Joint surfaces shall be clean, dry, and free of oil or other foreign material which would adversely affect the bond between sealant and concrete. Joint sealant shall be applied as recommended by the manufacturer of the sealant.

3.1.3.1 Joints With Field-Molded Sealant

All joints in the Pump Room (104) and Pantograph Storage Room (105) of the Pumphouse and all joints in the Fill Stand shall receive Single Component Silicon Sealant conforming to ASTM D 5893. All other joints shall receive sealant conforming to ASTM C 920. Joints shall not be sealed when the sealant material, ambient air, or concrete temperature is less than 40 degrees F. Joints requiring a bond breaker shall be coated with curing compound or with bituminous paint. Bond breaker and back-up material shall be installed where required. Joints shall be primed and filled flush with joint sealant in accordance with the manufacturer's recommendations.

3.1.4 Perimeter Felt Joints

Number 30 asphalt-saturated felt, extending for the full depth of the slab shall be used in construction joints between interior slabs-on-gradse and vertical surfaces where indicated. The perimeters of the slabs shall be free of fins, rough edges, spalling, or other unsightly appearance.

3.2 WATERSTOPS, INSTALLATION AND SPLICES

Waterstops shall be installed at the locations shown to form a continuous water-tight diaphragm. Adequate provision shall be made to support and completely protect the waterstops during the progress of the work. Any waterstop punctured or damaged shall be repaired or replaced. Exposed waterstops shall be protected during application of form release agents to avoid being coated. Suitable guards shall be provided to protect exposed projecting edges and ends of partially embedded waterstops from damage when concrete placement has been discontinued. Splices shall be made by certified trained personnel using approved equipment and procedures.

3.2.1 Non-Metallic

Fittings shall be shop made using a machine specifically designed to mechanically weld the waterstop. A miter guide, proper fixturing (profile dependant), and portable power saw shall be used to miter cut the ends to be joined to ensure good alignment and contact between joined surfaces. The splicing of straight lengths shall be done by squaring the ends to be joined. Continuity of the characteristic features of the cross section of the waterstop (ribs, tabular center axis, protrusions, etc.) shall be maintained across the splice.

3.2.1.1 Rubber Waterstop

Splices shall be vulcanized or shall be made using cold bond adhesive as recommended by the manufacturer. Splices for TPE-R shall be as specified for PVC.

3.2.1.2 Polyvinyl Chloride Waterstop

Splices shall be made by heat sealing the adjacent waterstop edges together using a thermoplastic splicing iron utilizing a non-stick surface specifically designed for waterstop welding. The correct temperature shall be used to sufficiently melt without charring the plastic. The spliced area, when cooled, shall show no signs of separation, holes, or other imperfections when bent by hand in as sharp an angle as possible.

3.2.1.3 Quality Assurance

Edge welding will not be permitted. Centerbulbs shall be compressed or closed when welding to non-centerbulb type. Waterstop splicing defects which are unacceptable include, but are not limited to the following: 1) Tensile strength less than 80 percent of parent section. 2) Free lap joints. 3) Misalignment of centerbulb, ribs, and end bulbs greater than 1/16 inch. 4) Misalignment which reduces waterstop cross section more than 15 percent. 5) Bond failure at joint deeper than 1/16 inch or 15 percent of material thickness. 6) Misalignment of waterstop splice resulting in misalignment of waterstop in excess of 1/2 inch in 10 feet. 7) Visible porosity in the weld area, including pin holes. 8) Charred or burnt material. 9) Bubbles or inadequate bonding. 10) Visible signs of splice separation when cooled splice is bent by hand at a sharp angle.

3.3 CONSTRUCTION JOINTS

Construction joints are specified in SECTION 03300 CAST-IN-PLACE STRUCTURAL CONCRETE except that construction joints coinciding with expansion and contraction joints shall be treated as expansion or contraction joints as applicable.

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SECTION 03200

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SECTION 03200

CONCRETE REINFORCEMENT

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ACI INTERNATIONAL (ACI)

ACI 318/318R	(1999) Building Code Requirements for Structural Concrete and Commentary
ACI 318M/318RM	(1999) Building Code Requirements for Structural Concrete and Commentary (Metric)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 53/A 53M	(2002) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 184/A 184M	(2001) Fabricated Deformed Steel Bar Mats for Concrete Reinforcement
ASTM A 185	(1997) Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
ASTM A 615/A 615M	(2001b) Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM A 675/A 675M	(1990a; R 1995e1) Steel Bars, Carbon, Hot-Wrought, Special Quality, Mechanical Properties
ASTM A 706/A 706M	(1998) Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement

CONCRETE REINFORCING STEEL INSTITUTE (CRSI)

CRSI 1 MSP	(1996) Manual of Standard Practice

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with SECTION 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Reinforcement; G-AE.

Detail drawings showing reinforcing steel placement, schedules, sizes, grades, and splicing and bending details. Drawings shall show support details including types, sizes and spacing.

SD-07 Certificates

Reinforcing Steel.

Certified copies of mill reports attesting that the reinforcing steel furnished contains no less than 25 percent recycled scrap steel and meets the requirements specified herein, prior to the installation of reinforcing steel.

1.3 DELIVERY AND STORAGE

Reinforcement and accessories shall be stored off the ground on platforms, skids, or other supports.

PART 2 PRODUCTS

2.1 DOWELS

Dowels shall conform to ASTM A 675/A 675M, Grade 80. Steel pipe conforming to ASTM A 53/A 53M, Schedule 80, may be used as dowels provided the ends are closed with metal or plastic inserts or with mortar.

2.2 FABRICATED BAR MATS

Fabricated bar mats shall conform to ASTM A 184/A 184M.

2.3 REINFORCING STEEL

Reinforcing steel shall be deformed bars conforming to ASTM A 615/A 615M or ASTM A 706/A 706M, grade 60 and sizes as indicated.

2.4 WELDED WIRE FABRIC

Welded wire fabric shall conform to ASTM A 185 .

2.5 WIRE TIES

Wire ties shall be 16 gauge or heavier black annealed steel wire.

2.6 SUPPORTS

Bar supports for formed surfaces shall be designed and fabricated in accordance with CRSI 1 MSP and shall be steel or precast concrete blocks. Precast concrete blocks shall have wire ties and shall be not less than 4 inches square when supporting reinforcement on ground. Precast concrete block shall have compressive strength equal to that of the surrounding concrete. Where concrete formed surfaces will be exposed to weather or where surfaces are to be painted, steel supports within 1/2 inch of concrete surface shall be galvanized, plastic protected or of stainless steel. Concrete supports used in concrete exposed to view shall have the same color and texture as the finish surface. For slabs on grade, supports shall be precast concrete blocks, plastic coated steel fabricated with bearing plates, or specifically designed wire-fabric supports fabricated of

plastic.

PART 3 EXECUTION

3.1 REINFORCEMENT

Reinforcement shall be fabricated to shapes and dimensions shown and shall conform to the requirements of ACI 318M/318RM ACI 318/318R. Reinforcement shall be cold bent unless otherwise authorized. Bending may be accomplished in the field or at the mill. Bars shall not be bent after embedment in concrete. Safety caps shall be placed on all exposed ends of vertical concrete reinforcement bars that pose a danger to life safety. Wire tie ends shall face away from the forms.

3.1.1 Placement

Reinforcement shall be free from loose rust and scale, dirt, oil, or other deleterious coating that could reduce bond with the concrete. Reinforcement shall be placed in accordance with ACI 318M/318RM ACI 318/318R at locations shown plus or minus one bar diameter. Reinforcement shall not be continuous through expansion joints and shall be as indicated through construction or contraction joints. Concrete coverage shall be as indicated or as required by ACI 318M/318RM ACI 318/318R. If bars are moved more than one bar diameter to avoid interference with other reinforcement, conduits or embedded items, the resulting arrangement of bars, including additional bars required to meet structural requirements, shall be approved before concrete is placed.

3.1.2 Splicing

Splices of reinforcement shall conform to ACI 318M/318RM ACI 318/318R and shall be made only as required or indicated. Splicing shall be by lapping Lapped bars shall be placed in contact and securely tied or spaced transversely apart to permit the embedment of the entire surface of each bar in concrete. Lapped bars shall not be spaced farther apart than one-fifth the required length of lap or 6 inches.

3.2 WELDED-WIRE FABRIC PLACEMENT

Welded-wire fabric shall be placed in slabs as indicated. Fabric placed in slabs on grade shall be continuous between expansion, construction, and contraction joints. Fabric placement at joints shall be as indicated.

Lap splices shall be made in such a way that the overlapped area equals the distance between the outermost crosswires plus 2 inches. Laps shall be staggered to avoid continuous laps in either direction. Fabric shall be wired or clipped together at laps at intervals not to exceed 4 feet. Fabric shall be positioned by the use of supports.

3.3 DOWEL INSTALLATION

Dowels shall be installed in slabs on grade at locations indicated and at right angles to joint being doweled. Dowels shall be accurately positioned and aligned parallel to the finished concrete surface before concrete placement. Dowels shall be rigidly supported during concrete placement. One end of dowels shall be coated with a bond breaker.

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-- End of Section Table of Contents --

SECTION 03300

CAST-IN-PLACE STRUCTURAL CONCRETE

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ACI INTERNATIONAL (ACI)

ACI 117/117R	(1990; Errata) Standard Tolerances for Concrete Construction and Materials
ACI 211.1	(1991) Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
ACI 214.3R	(1988; R 1997) Simplified Version of the Recommended Practice for Evaluation of Strength Test Results of Concrete
ACI 301	(1999) Standard Specifications for Structural Concrete
ACI 305R	(1999) Hot Weather Concreting
ACI 318/318R	(1999) Building Code Requirements for Structural Concrete and Commentary

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO M 182	(1991; R 1996) Burlap Cloth Made from Jute or Kenaf

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 31/C 31M	(2000e1) Making and Curing Concrete Test Specimens in the Field
ASTM C 33	(1999ae1) Concrete Aggregates
ASTM C 39/C 39M	(2001) Compressive Strength of Cylindrical Concrete Specimens
ASTM C 42/C 42M	(1999) Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
ASTM C 94/C 94M	(2000e2) Ready-Mixed Concrete

ASTM C 143/C 143M	(2000) Slump of Hydraulic Cement Concrete
ASTM C 150	(1999a) Portland Cement
ASTM C 171	(1997a) Sheet Materials for Curing Concrete
ASTM C 172	(1999) Sampling Freshly Mixed Concrete
ASTM C 192/C 192M	(2000) Making and Curing Concrete Test Specimens in the Laboratory
ASTM C 231	(1997el) Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C 260	(2000) Air-Entraining Admixtures for Concrete
ASTM C 309	(1998a) Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C 494/C 494M	(1999ae1) Chemical Admixtures for Concrete
ASTM C 552	(2000) Cellular Glass Thermal Insulation
ASTM C 578	(2000) Rigid, Cellular Polystyrene Thermal Insulation
ASTM C 591	(2001) Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation
ASTM C 618	(2000) Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete
ASTM C 940	(1998a) Expansion and Bleeding of Freshly Mixed Grouts for Preplaced-Aggregate Concrete in the Laboratory
ASTM C 1064/C 1064M	(1999) Temperature of Freshly Mixed Portland Cement Concrete
ASTM C 1077	(1998) Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation
ASTM D 75	(2003) Sampling Aggregates

NATIONAL READY-MIXED CONCRETE ASSOCIATION (NRMCA)

NRMCA CPMB 100	(1996) Concrete Plant Standards \n/c\X
NRMCA QC 3	(1984) Quality Control Manual: Section 3, Plant Certifications Checklist: Certification of Ready Mixed Concrete Production Facilities
NRMCA TMMB 100	(1994) Truck Mixer Agitator and Front Discharge Concrete Carrier Standards

U.S. ARMY CORPS OF ENGINEERS (USACE)

COE CRD-C 400	(1963) Requirements for Water for Use in Mixing or Curing Concrete
COE CRD-C 521	(1981) Standard Test Method for Frequency and Amplitude of Vibrators for Concrete

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with SECTION 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Mixture Proportions; G-AE

The results of trial mixture design studies along with a statement giving the maximum nominal coarse aggregate size and the proportions of ingredients that will be used in the manufacture of each strength or class of concrete, at least 14 days prior to commencing concrete placing operations. Aggregate weights shall be based on the saturated surface dry condition. The statement shall be accompanied by test results from an approved independent commercial testing laboratory, showing that mixture design studies have been made with materials proposed for the project and that the proportions selected will produce concrete of the qualities indicated. No substitutions shall be made in the materials used in the mixture design studies without additional tests to show that the quality of the concrete is satisfactory.

SD-06 Test Reports

Testing and Inspection for Contractor Quality Control

Certified copies of laboratory test reports, including mill tests and all other test data, for portland cement pozzolan, admixtures, and curing compound proposed for use on this project.

SD-07 Certificates

Qualifications

Written documentation for Contractor Quality Control personnel.

1.3 QUALIFICATIONS

Contractor Quality Control personnel assigned to concrete construction shall be American Concrete Institute (ACI) Certified Workmen in one of the following grades or shall have written evidence of having completed similar qualification programs:

Concrete Field Testing Technician, Grade I

Concrete Laboratory Testing Technician, Grade I or II
Concrete Construction Inspector, Level II

The foreman or lead journeyman of the flatwork finishing crew shall have similar qualification for ACI Concrete Flatwork Technician/Finisher or equal, with written documentation.

1.4 GENERAL REQUIREMENTS

1.4.1 Tolerances

Except as otherwise specified herein, tolerances for concrete batching, mixture properties, and construction as well as definition of terms and application practices shall be in accordance with ACI 117/117R. Level and grade tolerance measurements of slabs shall be made as soon as possible after finishing; when forms or shoring are used, the measurements shall be made prior to removal.

1.4.1.1 Floors

For the purpose of this Section the following terminology correlation between ACI 117/117R and this Section shall apply:

Floor Profile Quality Classification From ACI 117/117R	This Section
Conventional Bullfloated	Same
Conventional Straightedged	Same
Flat	Float Finish or Trowel Finish

Levelness tolerance shall not apply where design requires floors to be sloped to drains or sloped for other reasons.

1.4.1.2 Floors by the Straightedge System

The flatness of the floors shall be carefully controlled and the tolerances shall be measured by the straightedge system as specified in paragraph 4.5.7 of ACI 117/117R, using a 10 foot straightedge, within 72 hours after floor slab installation and before shores and/or forms are removed. The listed tolerances shall be met at any and every location at which the straightedge can be placed. See paragraph "FINISHING UNFORMED SURFACES" for slab finish requirements.

Bullfloated	1/2 inch
Straightedged	5/16 inch
Float Finish	3/16 inch
Trowel Finish	3/16 inch

1.4.2 Strength Requirements and w/c Ratio

1.4.2.1 Strength Requirements

Specified compressive strength (f'c) shall be as follows:

COMPRESSIVE STRENGTH	STRUCTURE OR PORTION OF STRUCTURE
4000 psi at 28 days	Fuel Pits
3000 psi at 28 days	All other work

a. Evaluation of Concrete Compressive Strength. Compressive strength specimens (6 by 12 inch cylinders) shall be fabricated by the Contractor and laboratory cured in accordance with ASTM C 31/C 31M and tested in accordance with ASTM C 39/C 39M. The strength of the concrete will be considered satisfactory so long as the average of all sets of three consecutive test results equals or exceeds the specified compressive strength f'c and no individual test result falls below the specified strength f'c by more than 500 psi. A "test" is defined as the average of two companion cylinders, or if only one cylinder is tested, the results of the single cylinder test. Additional analysis or testing, including taking cores and/or load tests may be required at the Contractor's expense when the strength of the concrete in the structure is considered potentially deficient.

b. Investigation of Low-Strength Compressive Test Results. When any strength test of standard-cured test cylinders falls below the specified strength requirement by more than 500 psi or if tests of field-cured cylinders indicate deficiencies in protection and curing, steps shall be taken to assure that the load-carrying capacity of the structure is not jeopardized. When the strength of concrete in place is considered potentially deficient, cores shall be obtained and tested in accordance with ASTM C 42/C 42M. At least three representative cores shall be taken from each member or area of concrete in place that is considered potentially deficient. The location of cores will be determined by the Contracting Officer to least impair the strength of the structure. Concrete in the area represented by the core testing will be considered adequate if the average strength of the cores is equal to at least 85 percent of the specified strength requirement and if no single core is less than 75 percent of the specified strength requirement. Non-destructive tests (tests other than test cylinders or cores) shall not be used as a basis for acceptance or rejection. The Contractor shall perform the coring and repair the holes. Cores will be tested by the Government.

c. Load Tests. If the core tests are inconclusive or impractical to obtain or if structural analysis does not confirm the safety of the structure, load tests may be directed by the Contracting Officer in accordance with the requirements of ACI 318/318R. Concrete work evaluated by structural analysis or by results of a load test as being understrength shall be corrected in a manner satisfactory to the Contracting Officer. All investigations, testing, load tests, and correction of deficiencies shall be performed by and at the expense of the Contractor and must be approved by the Contracting Officer, except that if all concrete is found to be in compliance with the drawings and specifications, the cost of investigations, testing, and load tests will be at the expense of the Government.

1.4.2.2 Water-Cement Ratio

Maximum water-cement ratio (w/c) for normal weight concrete shall be 0.45.

These w/c's may cause higher strengths than that required above for compressive or flexural strength. The maximum w/c required will be the equivalent w/c as determined by conversion from the weight ratio of water to cement plus pozzolan by the weight equivalency method as described in ACI 211.1.

1.4.3 Air Entrainment

All normal weight concrete shall be air entrained to contain between 4 and 7 percent total air, except that when the nominal maximum size coarse aggregate is 3/4 inch or smaller it shall be between 4.5 and 7.5 percent. Specified air content shall be attained at point of placement into the forms. Air content for normal weight concrete shall be determined in accordance with ASTM C 231.

1.4.4 Slump

Slump of the concrete, as delivered to the point of placement into the forms, shall be within the following limits. Slump shall be determined in accordance with ASTM C 143/C 143M.

Structural Element	Slump Minimum	Slump Maximum
Walls, columns and beams	2 in.	4 in.
Foundation walls, substructure walls, footings, slabs	1 in.	3 in.
Any structural concrete approved for placement by pumping:		
At pump	2 in.	6 in.
At discharge of line	1 in.	4 in.

1.4.5 Concrete Temperature

The temperature of the concrete as delivered shall not exceed 90 degrees F. When the ambient temperature during placing is 40 degrees F or less, or is expected to be at any time within 6 hours after placing, the temperature of the concrete as delivered shall be between 55 and 75 degrees F.

1.4.6 Size of Coarse Aggregate

The largest feasible nominal maximum size aggregate (NMSA) specified in paragraph AGGREGATES shall be used in each placement. However, nominal maximum size of aggregate shall not exceed any of the following: three-fourths of the minimum cover for reinforcing bars, three-fourths of the minimum clear spacing between reinforcing bars, one-fifth of the narrowest dimension between sides of forms, or one-third of the thickness of slabs or toppings.

1.5 MIXTURE PROPORTIONS

Concrete shall be composed of portland cement, other cementitious and pozzolanic materials as specified, aggregates, water and admixtures as specified.

1.5.1 Proportioning Studies for Normal Weight Concrete

Trial design batches, mixture proportioning studies, and testing requirements for various classes and types of concrete specified shall be the responsibility of the Contractor. Mixture proportions shall be based on compressive strength as determined by test specimens fabricated in accordance with ASTM C 192/C 192M and tested in accordance with ASTM C 39/C

39M. Samples of all materials used in mixture proportioning studies shall be representative of those proposed for use in the project and shall be accompanied by the manufacturer's or producer's test reports indicating compliance with these specifications. Trial mixtures having proportions, consistencies, and air content suitable for the work shall be made based on methodology described in ACI 211.1, using at least three different water-cement ratios for each type of mixture, which will produce a range of strength encompassing those required for each class and type of concrete required on the project. The maximum water-cement ratios required in subparagraph Water-Cement Ratio will be the equivalent water-cement ratio as determined by conversion from the weight ratio of water to cement plus pozzolan by the weight equivalency method as described in ACI 211.1. If pozzolan is used in the concrete mixture, the minimum pozzolan content shall be 15 percent by weight of the total cementitious material, and the maximum shall be 35 percent. Laboratory trial mixtures shall be designed for maximum permitted slump and air content. Separate sets of trial mixture studies shall be made for each combination of cementitious materials and each combination of admixtures proposed for use. No combination of either shall be used until proven by such studies, except that, if approved in writing and otherwise permitted by these specifications, an accelerator or a retarder may be used without separate trial mixture study. Separate trial mixture studies shall also be made for concrete for any conveying or placing method proposed which requires special properties and for concrete to be placed in unusually difficult placing locations. The temperature of concrete in each trial batch shall be reported. For each water-cement ratio, at least three test cylinders for each test age shall be made and cured in accordance withASTM C 192/C 192M. They shall be tested at 7 and 28 days in accordance with ASTM C 39/C 39M. From these test results, a curve shall be plotted showing the relationship between water-cement ratio and strength for each set of trial mix studies. In addition, a curve shall be plotted showing the relationship between 7 day and 28 day strengths. Each mixture shall be designed to promote easy and suitable concrete placement, consolidation and finishing, and to prevent segregation and excessive bleeding.

1.5.2 Average Compressive Strength Required for Mixtures

The mixture proportions selected during mixture design studies shall produce a required average compressive strength (f'cr) exceeding the specified compressive strength (f'c) by the amount indicated below. This required average compressive strength, f'cr, will not be a required acceptance criteria during concrete production. However, whenever the daily average compressive strength at 28 days drops below f'cr during concrete production, or daily average 7-day strength drops below a strength correlated with the 28-day f'cr, the mixture shall be adjusted, as approved, to bring the daily average back up to f'cr. During production, the required f'cr shall be adjusted, as appropriate, based on the standard deviation being attained on the job.

1.5.2.1 Computations from Test Records

Where a concrete production facility has test records, a standard deviation shall be established in accordance with the applicable provisions of ACI 214.3R. Test records from which a standard deviation is calculated shall represent materials, quality control procedures, and conditions similar to those expected; shall represent concrete produced to meet a specified strength or strengths (f'c) within 1,000 psi of that specified for proposed work; and shall consist of at least 30 consecutive tests. A strength test shall be the average of the strengths of two cylinders made from the same

sample of concrete and tested at 28 days. Required average compressive strength f'cr used as the basis for selection of concrete proportions shall be the larger of the equations that follow using the standard deviation as determined above:

f'cr = f'c + 1.34S where units are in psi

f'cr = f'c + 2.33S - 500 where units are in psi

Where S = standard deviation

Where a concrete production facility does not have test records meeting the requirements above but does have a record based on 15 to 29 consecutive tests, a standard deviation shall be established as the product of the calculated standard deviation and a modification factor from the following table:

NUMBER OF TESTS	MODIFICATION FACTOR FOR STANDARD DEVIATION
15	1.16
20	1.08
25	1.03
30 or more	1.00

1.5.2.2 Computations without Previous Test Records

When a concrete production facility does not have sufficient field strength test records for calculation of the standard deviation, the required average strength f'cr shall be determined as follows:

a. If the specified compressive strength f'c is less than 3,000 psi,

   f'cr = f'c + 1000 psi

b. If the specified compressive strength f'c is 3,000 to 5,000 psi,

   f'cr = f'c + 1,200 psi

c. If the specified compressive strength f'c is over 5,000 psi,

   f'cr = f'c + 1,400 psi

1.6 STORAGE OF MATERIALS

Cement and other cementitious materials shall be stored in weathertight buildings, bins, or silos which will exclude moisture and contaminants and keep each material completely separated. Aggregate stockpiles shall be arranged and used in a manner to avoid excessive segregation and to prevent contamination with other materials or with other sizes of aggregates. Aggregate shall not be stored directly on ground unless a sacrificial layer is left undisturbed. Reinforcing bars and accessories shall be stored above the ground on platforms, skids or other supports. Other materials shall be stored in such a manner as to avoid contamination and deterioration. Admixtures which have been in storage at the project site for longer than 6 months or which have been subjected to freezing shall not be used unless retested and proven to meet the specified requirements. Materials shall be capable of being accurately identified after bundles or containers are opened.

1.7 GOVERNMENT ASSURANCE INSPECTION AND TESTING

Day-to day inspection and testing shall be the responsibility of the Contractor Quality Control (CQC) staff. However, representatives of the Contracting Officer can and will inspect construction as considered appropriate and will monitor operations of the Contractor's CQC staff. Government inspection or testing will not relieve the Contractor of any of his CQC responsibilities.

1.7.1 Materials

The Government will sample and test aggregates, cementitious materials, other materials, and concrete to determine compliance with the specifications as considered appropriate. The Contractor shall provide facilities and labor as may be necessary for procurement of representative test samples. Samples of aggregates will be obtained at the point of batching in accordance with ASTM D 75. Other materials will be sampled from storage at the jobsite or from other locations as considered appropriate. Samples may be placed in storage for later testing when appropriate.

1.7.2 Fresh Concrete

Fresh concrete will be sampled as delivered in accordance with ASTM C 172 and tested in accordance with these specifications, as considered necessary.

1.7.3 Hardened Concrete

Tests on hardened concrete will be performed by the Government when such tests are considered necessary.

1.7.4 Inspection

Concrete operations may be tested and inspected by the Government as the project progresses. Failure to detect defective work or material will not prevent rejection later when a defect is discovered nor will it obligate the Government for final acceptance.

PART 2 PRODUCTS

2.1 CEMENTITIOUS MATERIALS

Cementitious Materials shall be portland cement, or portland cement in combination with pozzolan and shall conform to appropriate specifications listed below. Use of cementitious materials in concrete which will have surfaces exposed in the completed structure shall be restricted so there is no change in color, source, or type of cementitious material.

2.1.1 Portland Cement

ASTM C 150, Type I low alkali with a maximum 15 percent amount of tricalcium aluminate, or Type II low alkali including false set requirements.

2.1.2 Pozzolan (Fly Ash)

ASTM C 618, Class C or F with the optional requirements for multiple factor, drying shrinkage, and uniformity from Table 2A of ASTM C 618.

Requirement for maximum alkalies from Table 1A of ASTM C 618 shall apply. If pozzolan is used, it shall never be less than 15 percent nor more than 35 percent by weight of the total cementitious material. The Contractor shall comply with EPA requirements in accordance with SECTION 01670 RECYCLED / RECOVERED MATERIALS.

2.2 AGGREGATES

Aggregates shall conform to the following.

2.2.1 Fine Aggregate

Fine aggregate shall conform to the quality and gradation requirements of ASTM C 33.

2.2.2 Coarse Aggregate

Coarse aggregate shall conform to ASTM C 33, Class 5S, size designation 67.

2.3 CHEMICAL ADMIXTURES

Chemical admixtures, when required or permitted, shall conform to the appropriate specification listed. Admixtures shall be furnished in liquid form and of suitable concentration for easy, accurate control of dispensing.

2.3.1 Air-Entraining Admixture

ASTM C 260 and shall consistently entrain the air content in the specified ranges under field conditions.

2.3.2 Water-Reducing or Retarding Admixture

ASTM C 494/C 494M, Type A, B, or D, except that the 6-month and 1-year compressive and flexural strength tests are waived.

2.4 CURING MATERIALS

2.4.1 Impervious-Sheet

Impervious-sheet materials shall conform to ASTM C 171, type optional, except, that polyethylene sheet shall not be used.

2.4.2 Membrane-Forming Compound

Membrane-Forming curing compound shall conform to ASTM C 309, Type 1-D or 2, except that only a styrene acrylate or chlorinated rubber compound meeting Class B requirements shall be used for surfaces that are to be painted or are to receive bituminous roofing, or waterproofing, or floors that are to receive adhesive applications of resilient flooring. The curing compound selected shall be compatible with any subsequent paint, roofing, waterproofing, or flooring specified. Nonpigmented compound shall contain a fugitive dye, and shall have the reflective requirements in ASTM C 309 waived.

2.4.3 Burlap and Cotton Mat

Burlap and cotton mat used for curing shall conform to AASHTO M 182.

2.5 WATER

Water for mixing and curing shall be fresh, clean, potable, and free of injurious amounts of oil, acid, salt, or alkali, except that non-potable water may be used if it meets the requirements of COE CRD-C 400.

2.6 EMBEDDED ITEMS

Embedded items shall be of the size and type indicated or as needed for the application.

2.7 FLOOR HARDENER

Floor hardener shall be a colorless aqueous solution containing zinc silicofluoride, magnesium silicofluoride, or sodium silicofluoride. These silicofluorides can be used individually or in combination. Proprietary hardeners may be used if approved in writing by the Contracting Officer.

2.8 PERIMETER INSULATION

Perimeter insulation shall be polystyrene conforming to ASTM C 578, Type II; polyurethane conforming to ASTM C 591, Type II; or cellular glass conforming to ASTM C 552, Type I or IV. The Contractor shall comply with EPA requirements in accordance with SECTION 01670 RECYCLED / RECOVERED MATERIALS.

2.9 JOINT MATERIALS

2.9.1 Joint Fillers and Sealers

Materials for joint fillers and sealers shall be in accordance with SECTION 03150 EXPANSION JOINTS, CONTRACTION JOINTS, AND WATERSTOPS.

2.9.2 Contraction Joints in Slabs

Materials for joint fillers and sealers shall be in accordance with SECTION 03150 EXPANSION JOINTS, CONTRACTION JOINTS, AND WATERSTOPS.

PART 3 EXECUTION

3.1 PREPARATION FOR PLACING

Before commencing concrete placement, the following shall be performed. Surfaces to receive concrete shall be clean and free from frost, ice, mud, and water. Forms shall be in place, cleaned, coated, and adequately supported, in accordance with SECTION 03100 STRUCTURAL CONCRETE FORMWORK. Reinforcing steel shall be in place, cleaned, tied, and adequately supported, in accordance with SECTION 03200 CONCRETE REINFORCEMENT. Transporting and conveying equipment shall be in-place, ready for use, clean, and free of hardened concrete and foreign material. Equipment for consolidating concrete shall be at the placing site and in proper working order. Equipment and material for curing and for protecting concrete from weather or mechanical damage shall be at the placing site, in proper working condition and in sufficient amount for the entire placement. When hot, windy conditions during concreting appear probable, equipment and material shall be at the placing site to provide windbreaks, shading, fogging, or other action to prevent plastic shrinkage cracking or other damaging drying of the concrete.

3.1.1 Foundations

3.1.1.1 Concrete on Earth Foundations

Earth (subgrade, base, or subbase courses) surfaces upon which concrete is to be placed shall be clean, damp, and free from debris, frost, ice, and standing or running water. Prior to placement of concrete, the foundation shall be well drained and shall be satisfactorily graded and uniformly compacted.

3.1.1.2 Excavated Surfaces in Lieu of Forms

Concrete for footings may be placed directly against the soil provided the earth or rock has been carefully trimmed, is uniform and stable, and meets the compaction requirements of SECTION 02319, EARTHWORK FOR VEHICLE TRAFFIC AREAS, STRUCTURES, SIDEWALKS AND CURBS, AND AREA GRADING. The concrete shall be placed without becoming contaminated by loose material, and the outline of the concrete shall be within the specified tolerances.

3.1.2 Previously Placed Concrete

3.1.2.1 Preparation of Previously Placed Concrete

Concrete surfaces to which other concrete is to be bonded shall be abraded in an approved manner that will expose sound aggregate uniformly without damaging the concrete. Laitance and loose particles shall be removed. Surfaces shall be thoroughly washed and shall be moist but without free water when concrete is placed.

3.1.3 Perimeter Insulation

Perimeter insulation shall be installed at locations indicated. Adhesive shall be used where insulation is applied to the interior surface of foundation walls and may be used for exterior application.

3.1.4 Embedded Items

Before placement of concrete, care shall be taken to determine that all embedded items are firmly and securely fastened in place as indicated on the drawings, or required. Conduit and other embedded items shall be clean and free of oil and other foreign matter such as loose coatings or rust, paint, and scale. The embedding of wood in concrete will be permitted only when specifically authorized or directed. Voids in sleeves, inserts, and anchor slots shall be filled temporarily with readily removable materials to prevent the entry of concrete into voids. Welding shall not be performed on embedded metals within 1 feet of the surface of the concrete. Tack welding shall not be performed on or to embedded items.

3.2 CONCRETE PRODUCTION

Batch-type equipment shall be used for producing concrete. Ready-mixed concrete shall be batched, mixed, and transported in accordance with ASTM C 94/C 94M, except as otherwise specified. Truck mixers shall comply with NRMCA TMMB 100. Ready-mix plant equipment and facilities shall be certified in accordance with NRMCA QC 3. Approved batch tickets shall be furnished for each load of ready-mixed concrete. Site-mixed concrete shall be produced in accordance with ACI 301, and plant shall conform to NRMCA CPMB 100.

3.3 TRANSPORTING CONCRETE TO PROJECT SITE

Concrete shall be transported to the placing site in truck mixers.

3.4 CONVEYING CONCRETE ON SITE

Concrete shall be conveyed from mixer or transporting unit to forms as rapidly as possible and within the time interval specified by methods which will prevent segregation or loss of ingredients using following equipment. Conveying equipment shall be cleaned before each placement.

3.4.1 Buckets

The interior hopper slope shall be not less than 58 degrees from the horizontal, the minimum dimension of the clear gate opening shall be at least 5 times the nominal maximum-size aggregate, and the area of the gate opening shall not be less than 2 square feet. The maximum dimension of the gate opening shall not be greater than twice the minimum dimension. The bucket gates shall be essentially grout tight when closed and may be manually, pneumatically, or hydraulically operated except that buckets larger than 2 cubic yards shall not be manually operated. The design of the bucket shall provide means for positive regulation of the amount and rate of deposit of concrete in each dumping position.

3.4.2 Transfer Hoppers

Concrete may be charged into nonagitating hoppers for transfer to other conveying devices. Transfer hoppers shall be capable of receiving concrete directly from delivery vehicles and shall have conical-shaped discharge features. The transfer hopper shall be equipped with a hydraulically operated gate and with a means of external vibration to effect complete discharge. Concrete shall not be held in nonagitating transfer hoppers more than 30 minutes.

3.4.3 Trucks

Truck mixers operating at agitating speed shall conform to the requirements of ASTM C 94/C 94M.

3.4.4 Chutes

When concrete can be placed directly from a truck mixer the chutes normally attached to this equipment by the manufacturer may be used. A discharge deflector shall be used when required by the Contracting Officer. Separate chutes and other similar equipment will not be permitted for conveying concrete.

3.4.5 Belt Conveyors

Belt conveyors shall be designed and operated to assure a uniform flow of concrete from mixer to final place of deposit without segregation of ingredients or loss of mortar and shall be provided with positive means, such as discharge baffle or hopper , for preventing segregation of the concrete at the transfer points and the point of placing. Belt conveyors shall be constructed such that the idler spacing shall not exceed 36 inches. The belt speed shall be a minimum of 300 feet per minute and a maximum of 750 feet per minute. If concrete is to be placed through installed horizontal or sloping reinforcing bars, the conveyor shall discharge concrete into a pipe or elephant truck that is long enough to extend

through the reinforcing bars.

3.4.6 Concrete Pumps

Concrete may be conveyed by positive displacement pump when approved. The pumping equipment shall be piston or squeeze pressure type; pneumatic placing equipment shall not be used. The pipeline shall be rigid steel pipe or heavy-duty flexible hose. The inside diameter of the pipe shall be at least 3 times the nominal maximum-size coarse aggregate in the concrete mixture to be pumped but not less than 4 inches. Aluminum pipe shall not be used.

3.5 PLACING CONCRETE

Mixed concrete shall be discharged within 1-1/2 hours or before the mixer drum has revolved 300 revolutions, whichever comes first after the introduction of the mixing water to the cement and aggregates. When the concrete temperature exceeds 85 degrees F, the time shall be reduced to 45 minutes. Concrete shall be placed within 15 minutes after it has been discharged from the transporting unit. Concrete shall be handled from mixer or transporting unit to forms in a continuous manner until the approved unit of operation is completed. Adequate scaffolding, ramps and walkways shall be provided so that personnel and equipment are not supported by in-place reinforcement. Placing will not be permitted when the sun, heat, wind, or limitations of facilities furnished by the Contractor prevent proper consolidation, finishing and curing. Sufficient placing capacity shall be provided so that concrete can be kept free of cold joints.

3.5.1 Depositing Concrete

Concrete shall be deposited as close as possible to its final position in the forms, and there shall be no vertical drop greater than 5 feet except where suitable equipment is provided to prevent segregation and where specifically authorized. Depositing of the concrete shall be so regulated that it will be effectively consolidated in horizontal layers not more than 12 inches thick, except that all slabs shall be placed in a single layer. Concrete to receive other construction shall be screeded to the proper level. Concrete shall be deposited continuously in one layer or in layers so that fresh concrete is deposited on in-place concrete that is still plastic. Fresh concrete shall not be deposited on concrete that has hardened sufficiently to cause formation of seams or planes of weakness within the section. Concrete that has surface dried, partially hardened, or contains foreign material shall not be used. When temporary spreaders are used in the forms, the spreaders shall be removed as their service becomes unnecessary.

3.5.2 Consolidation

Immediately after placing, each layer of concrete shall be consolidated by internal vibrators, except for slabs 4 inches thick or less. The vibrators shall at all times be adequate in effectiveness and number to properly consolidate the concrete; a spare vibrator shall be kept at the jobsite during all concrete placing operations. The vibrators shall have a frequency of not less than 10,000 vibrations per minute, an amplitude of at least 0.025 inch, and the head diameter shall be appropriate for the structural member and the concrete mixture being placed. Vibrators shall be inserted vertically at uniform spacing over the area of placement. The distance between insertions shall be approximately 1-1/2 times the radius

of action of the vibrator so that the area being vibrated will overlap the adjacent just-vibrated area by a reasonable amount. The vibrator shall penetrate rapidly to the bottom of the layer and at least 6 inches into the preceding layer if there is such. Vibrator shall be held stationary until the concrete is consolidated and then vertically withdrawn slowly while operating. Form vibrators shall not be used unless specifically approved and unless forms are constructed to withstand their use. Vibrators shall not be used to move concrete within the forms. Slabs 4 inches and less in thickness shall be consolidated by properly designed vibrating screeds or other approved technique. Frequency and amplitude of vibrators shall be determined in accordance with COE CRD-C 521. Grate tampers ("jitterbugs") shall not be used.

3.5.3 Cold Weather Requirements

Special protection measures, approved by the Contracting Officer, shall be used if freezing temperatures are anticipated before the expiration of the specified curing period. The ambient temperature of the air where concrete is to be placed and the temperature of surfaces to receive concrete shall be not less than 40 degrees F, The temperature of the concrete when placed shall be not less than 50 degrees F nor more than 75 degrees F. Heating of the mixing water or aggregates will be required to regulate the concrete placing temperature. Materials entering the mixer shall be free from ice, snow, or frozen lumps. Salt, chemicals or other materials shall not be incorporated in the concrete to prevent freezing. Upon written approval, an accelerating admixture conforming to ASTM C 494/C 494M, Type C or E may be used, provided it contains no calcium chloride.

3.5.4 Hot Weather Requirements

When the ambient temperature during concrete placing is expected to exceed 85 degrees F, the concrete shall be placed and finished with procedures previously submitted and as specified herein. The concrete temperature at time of delivery to the forms shall not exceed the temperature shown in the table below when measured in accordance with ASTM C 1064/C 1064M. Cooling of the mixing water or aggregates or placing concrete in the cooler part of the day may be required to obtain an adequate placing temperature. A retarder may be used, as approved, to facilitate placing and finishing. Steel forms and reinforcements shall be cooled as approved prior to concrete placement when steel temperatures are greater than 120 degrees F. Conveying and placing equipment shall be cooled if necessary to maintain proper concrete-placing temperature.

Maximum Allowable Concrete Placing Temperature

Relative Humidity, Percent, During Time of Concrete Placement	Maximum Allowable Concrete Temperature Degrees
Greater than 60	90 F
40-60	85 F
Less than 40	80 F

3.5.5 Prevention of Plastic Shrinkage Cracking

During hot weather with low humidity, and particularly with appreciable wind, as well as interior placements when space heaters produce low

humidity, the Contractor shall be alert to the tendency for plastic shrinkage cracks to develop and shall institute measures to prevent this. Particular care shall be taken if plastic shrinkage cracking is potentially imminent and especially if it has developed during a previous placement. Periods of high potential for plastic shrinkage cracking can be anticipated by use of Fig. 2.1.5 of ACI 305R. In addition the concrete placement shall be further protected by erecting shades and windbreaks and by applying fog sprays of water, sprinkling, ponding or wet covering. Plastic shrinkage cracks that occur shall be filled by injection of epoxy resin as directed, after the concrete hardens. Plastic shrinkage cracks shall never be troweled over or filled with slurry.

3.5.6 Placing Concrete in Congested Areas

Special care shall be used to ensure complete filling of the forms, elimination of all voids, and complete consolidation of the concrete when placing concrete in areas congested with reinforcing bars, embedded items, and other tight spacing. An appropriate concrete mixture shall be used, and the nominal maximum size of aggregate (NMSA) shall meet the specified criteria when evaluated for the congested area. Vibrators with heads of a size appropriate for the clearances available shall be used, and the consolidation operation shall be closely supervised to ensure complete and thorough consolidation at all points. Where necessary, splices of reinforcing bars shall be alternated to reduce congestion. Where two mats of closely spaced reinforcing are required, the bars in each mat shall be placed in matching alignment to reduce congestion. Reinforcing bars may be temporarily crowded to one side during concrete placement provided they are returned to exact required location before concrete placement and consolidation are completed.

3.6 JOINTS

Joints shall be located and constructed as indicated or approved. Joints not indicated on the drawings shall be located and constructed to minimize the impact on the strength of the structure. Joints shall be perpendicular to the main reinforcement. All reinforcement shall be continued across joints; except that reinforcement or other fixed metal items shall not be continuous through expansion joints, or through construction or contraction joints in slabs on grade. Reinforcement shall be 2 inches clear from each joint. Except where otherwise indicated, construction joints between interior slabs on grade and vertical surfaces shall consist of 30 pound asphalt-saturated felt, extending for the full depth of the slab. The perimeters of the slabs shall be free of fins, rough edges, spalling, or other unsightly appearance. Reservoir for sealant for construction and contraction joints in slabs shall be formed to the dimensions shown on the drawings by removing snap-out joint-forming inserts, by sawing sawable inserts, or by sawing to widen the top portion of sawed joints. Joints to be sealed shall be cleaned and sealed as indicated and in accordance with SECTION 03150 EXPANSION JOINTS, CONTRACTION JOINTS, AND WATERSTOPS.

3.6.1 Construction Joints

For concrete other than slabs on grade, construction joints shall be located so that the unit of operation does not exceed 60 feet. Concrete shall be placed continuously so that each unit is monolithic in construction. Fresh concrete shall not be placed against adjacent hardened concrete until it is at least 24 hours old. Construction joints shall be located as indicated or approved. Where concrete work is interrupted by weather, end of work shift or other similar type of delay, location and

type of construction joint shall be subject to approval of the Contracting Officer. Unless otherwise indicated and except for slabs on grade, reinforcing steel shall extend through construction joints. Construction joints in slabs on grade shall be keyed or doweled as shown. Concrete shall be in place at least 2 hours, or until the concrete begins to lose its plasticity, before placing additional concrete. Prior to placing additional concrete, horizontal construction joints shall be prepared as specified in paragraph Previously Placed Concrete.

3.6.2 Contraction Joints in Slabs on Grade

Contraction joints shall be located and detailed as shown on the drawings. Contraction Joints shall be produced by forming a weakened plane in the concrete slab by use of rigid inserts impressed in the concrete during placing operations, use of snap-out plastic joint forming inserts or sawing a continuous slot with a concrete saw. Regardless of method used to produce the weakened plane, it shall be 1/4 the depth of the slab thickness and between 1/8 and 3/16 inch wide unless otherwise indicated on the drawings. For saw-cut joints, cutting shall be timed properly with the set of the concrete. Cutting shall be started as soon as the concrete has hardened sufficiently to prevent ravelling of the edges of the saw cut. Cutting shall be completed before shrinkage stresses become sufficient to produce cracking. Reservoir for joint sealant shall be formed as previously specified.

3.6.3 Expansion Joints

Installation of expansion joints and sealing of these joints shall conform to the requirements of SECTION 03150 EXPANSION JOINTS, CONTRACTION JOINTS, AND WATERSTOPS.

3.6.4 Waterstops

Waterstops shall be installed in conformance with the locations and details shown on the drawings using materials and procedures specified in SECTION 03150 EXPANSION JOINTS, CONTRACTION JOINTS, AND WATERSTOPS.

3.6.5 Dowels

Dowels shall be installed at the locations shown on the drawings and to the details shown, using materials and procedures specified in SECTION 03200 CONCRETE REINFORCEMENT and herein. Conventional smooth "paving" dowels shall be installed in slabs using approved methods to hold the dowel in place during concreting within a maximum alignment tolerance of 1/8 inch in 12 inches. Care shall be taken during placing adjacent to and around dowels and tie bars to ensure there is no displacement of the dowel or tie bar and that the concrete completely embeds the dowel and is thoroughly consolidated.

3.7 FINISHING FORMED SURFACES

Forms, form materials, and form construction are specified in SECTION 03100 STRUCTURAL CONCRETE FORMWORK. Finishing of formed surfaces shall be as specified herein. Unless another type of architectural or special finish is specified, surfaces shall be left with the texture imparted by the forms except that defective surfaces shall be repaired. Unless painting of surfaces is required, uniform color of the concrete shall be maintained by use of only one mixture without changes in materials or proportions for any structure or portion of structure that requires a Class A or B finish.

Except for major defects, as defined hereinafter, surface defects shall be repaired as specified herein within 24 hours after forms are removed. Repairs of the so-called "plaster-type" will not be permitted in any location. Tolerances of formed surfaces shall conform to the requirements of ACI 117/117R. These tolerances apply to the finished concrete surface, not to the forms themselves; forms shall be set true to line and grade. Form tie holes requiring repair and other defects whose depth is at least as great as their surface diameter shall be repaired as specified in paragraph Damp-Pack Mortar Repair. Defects whose surface diameter is greater than their depth shall be repaired as specified in paragraph Repair of Major Defects. Repairs shall be finished flush with adjacent surfaces and with the same surface texture. The cement used for all repairs shall be a blend of job cement with white cement proportioned so that the final color after curing and aging will be the same as the adjacent concrete. Concrete with excessive honeycomb, or other defects which affect the strength of the member, will be rejected. Repairs shall be demonstrated to be acceptable and free from cracks or loose or drummy areas at the completion of the contract and, for Class B Finishes, shall be inconspicuous. Repairs not meeting these requirements will be rejected and shall be replaced.

3.7.1 Class B Finish

Class B finish is required in the following areas: the concrete pipe supports in the Pumphouse pump room. Fins, ravelings, and loose material shall be removed, all surface defects over 1/2 inch in diameter or more than 1/2 inch deep, shall be repaired and, except as otherwise indicated or as specified in SECTION 03100 STRUCTURAL CONCRETE FORMWORK, holes left by removal of form ties shall be reamed and filled. Defects more than 1/2 inch in diameter shall be cut back to sound concrete, but in all cases at least 1 inch deep.

3.7.2 Class C and Class D Finish

Class C finish is required on concrete surfaces permanently exposed to view that do not require a Class B finish. Class D finish is required on concrete surfaces not permanently exposed to view. Fins, ravelings, and loose material shall be removed, and, except as otherwise indicated or as specified in SECTION 03100 STRUCTURAL CONCRETE FORMWORK, holes left by removal of form ties shall be reamed and filled. Honeycomb and other defects more than 1/2 inch deep or more than 2 inches in diameter shall be repaired. Defects more than 2 inches in diameter shall be cut back to sound concrete, but in all cases at least 1 inch deep.

3.8 REPAIRS

3.8.1 Damp-Pack Mortar Repair

Form tie holes requiring repair and other defects whose depth is at least as great as their surface diameter but not over 4 inchesshall be repaired by the damp-pack mortar method. Form tie holes shall be reamed and other similar defects shall be cut out to sound concrete. The void shall then be thoroughly cleaned, thoroughly wetted, brush-coated with a thin coat of neat cement grout and filled with mortar. Mortar shall be a stiff mix of 1 part portland cement to 2 parts fine aggregate passing the No. 16 mesh sieve, and minimum amount of water. Only sufficient water shall be used to produce a mortar which, when used, will stick together on being molded into a ball by a slight pressure of the hands and will not exude water but will leave the hands damp. Mortar shall be mixed and allowed to stand for 30 to

45 minutes before use with remixing performed immediately prior to use. Mortar shall be thoroughly tamped in place in thin layers using a hammer and hardwood block. Holes passing entirely through walls shall be completely filled from the inside face by forcing mortar through to the outside face. All holes shall be packed full. Damp-pack repairs shall be moist cured for at least 48 hours.

3.8.2 Repair of Major Defects

Major defects will be considered to be those more than 1/2 inch deep or, for Class A and B finishes, more than 1/2 inch in diameter and, for Class C and D finishes, more than 2 inches in diameter. Also included are any defects of any kind whose depth is over 4 inches or whose surface diameter is greater than their depth. Major defects shall be repaired as specified below.

3.8.2.1 Surface Application of Mortar Repair

Defective concrete shall be removed, and removal shall extend into completely sound concrete. Approved equipment and procedures which will not cause cracking or microcracking of the sound concrete shall be used. If reinforcement is encountered, concrete shall be removed so as to expose the reinforcement for at least 2 inches on all sides. All such defective areas greater than 12 square inches shall be outlined by saw cuts at least 1 inch deep. Defective areas less than 12 square inches shall be outlined by a 1 inch deep cut with a core drill in lieu of sawing. All saw cuts shall be straight lines in a rectangular pattern in line with the formwork panels. After concrete removal, the surface shall be thoroughly cleaned by high pressure washing to remove all loose material. Surfaces shall be kept continually saturated for the first 12 of the 24 hours immediately before placing mortar and shall be damp but not wet at the time of commencing mortar placement. The Contractor, at his option, may use either hand-placed mortar or mortar placed with a mortar gun. If hand-placed mortar is used, the edges of the cut shall be perpendicular to the surface of the concrete. The prepared area shall be brush-coated with a thin coat of neat cement grout. The repair shall then be made using a stiff mortar, preshrunk by allowing the mixed mortar to stand for 30 to 45 minutes and then remixed, thoroughly tamped into place in thin layers. If hand-placed mortar is used, the Contractor shall test each repair area for drumminess by firm tapping with a hammer and shall inspect for cracks, both in the presence of the Contracting Officer's representative, immediately before completion of the contract, and shall replace any showing drumminess or cracking. If mortar placed with a mortar gun is used, the gun shall be a small compressed air-operated gun to which the mortar is slowly hand fed and which applies the mortar to the surface as a high-pressure stream, as approved. Repairs made using shotcrete equipment will not be accepted. The mortar used shall be the same mortar as specified for damp-pack mortar repair. If gun-placed mortar is used, the edges of the cut shall be beveled toward the center at a slope of 1:1. All surface applied mortar repairs shall be continuously moist cured for at least 7 days. Moist curing shall consist of several layers of saturated burlap applied to the surface immediately after placement is complete and covered with polyethylene sheeting, all held closely in place by a sheet of plywood or similar material rigidly braced against it. Burlap shall be kept continually wet.

3.8.2.2 Repair of Deep and Large Defects

Deep and large defects will be those that are more than 6 inches deep and

also have an average diameter at the surface more than 18 inches or that are otherwise so identified by the Project Office. Deep and large defects shall be reported to the Contracting Officer. Such defects shall be repaired as specified herein or directed, except that defects which affect the strength of the structure shall not be repaired and that portion of the structure shall be completely removed and replaced. Deep and large defects shall be repaired by procedures approved in advance including forming and placing special concrete using applied pressure during hardening. Preparation of the repair area shall be as specified for surface application of mortar. In addition, the top edge (surface) of the repair area shall be sloped at approximately 20 degrees from the horizontal, upward toward the side from which concrete will be placed. The special concrete shall be a concrete mixture with low water content and low slump, and shall be allowed to age 30 to 60 minutes before use. Concrete containing a specified expanding admixture may be used in lieu of the above mixture; the paste portion of such concrete mixture shall be designed to have an expansion between 2.0 and 4.0 percent when tested in accordance with ASTM C 940. A full width "chimney" shall be provided at the top of the form on the placing side to ensure filling to the top of the opening. A pressure cap shall be used on the concrete in the chimney with simultaneous tightening and revibrating the form during hardening to ensure a tight fit for the repair. The form shall be removed after 24 hours and immediately the chimney shall be carefully chipped away to avoid breaking concrete out of the repair; the surface of the repair concrete shall be dressed as required.

3.9 FINISHING UNFORMED SURFACES

The finish of all unformed surfaces shall meet the requirements of paragraph Tolerances in PART 1, when tested as specified herein.

3.9.1 General

The ambient temperature of spaces adjacent to unformed surfaces being finished and of the base on which concrete will be placed shall be not less than 50 degrees F. In hot weather all requirements of paragraphs Hot Weather Requirements and Prevention of Plastic Shrinkage Cracking shall be met. Unformed surfaces that are not to be covered by additional concrete or backfill shall have a float finish, with additional finishing as specified below, and shall be true to the elevation shown on the drawings. Surfaces to receive additional concrete or backfill shall be brought to the elevation shown on the drawings, properly consolidated, and left true and regular. Unless otherwise shown on the drawings, exterior surfaces shall be sloped for drainage, as directed. Where drains are provided, interior floors shall be evenly sloped to the drains. Joints shall be carefully made with a jointing or edging tool. The finished surfaces shall be protected from stains or abrasions. Grate tampers or "jitterbugs" shall not be used for any surfaces. The dusting of surfaces with dry cement or other materials or the addition of any water during finishing shall not be permitted. If bleedwater is present prior to finishing, the excess water shall be carefully dragged off or removed by absorption with porous materials such as burlap. During finishing operations, extreme care shall be taken to prevent over finishing or working water into the surface; this can cause "crazing" (surface shrinkage cracks which appear after hardening) of the surface. Any slabs with surfaces which exhibit significant crazing shall be removed and replaced. During finishing operations, surfaces shall be checked with a 10 foot straightedge, applied in both directions at regular intervals while the concrete is still plastic, to detect high or low areas.

3.9.2 Rough Slab Finish

As a first finishing operation for unformed surfaces the surface shall receive a rough slab finish prepared as follows. The concrete shall be uniformly placed across the slab area, consolidated as previously specified, and then screeded with straightedge strikeoffs immediately after consolidation to bring the surface to the required finish level with no coarse aggregate visible. Side forms and screed rails shall be provided, rigidly supported, and set to exact line and grade. Allowable tolerances for finished surfaces apply only to the hardened concrete, not to forms or screed rails. Forms and screed rails shall be set true to line and grade. "Wet screeds" shall not be used.

3.9.3 Floated Finish

Slabs to receive more than a rough slab finish shall next be given a wood float finish. The screeding shall be followed immediately by darbying or bull floating before bleeding water is present, to bring the surface to a true, even plane. Then, after the concrete has stiffened so that it will withstand a man's weight without imprint of more than 1/4 inch and the water sheen has disappeared, it shall be floated to a true and even plane free of ridges. Floating shall be performed by use of suitable hand floats or power driven equipment. Sufficient pressure shall be used on the floats to bring a film of moisture to the surface. Hand floats shall be made of wood, magnesium, or aluminum. Lightweight concrete or concrete that exhibits stickiness shall be floated with a magnesium float. Care shall be taken to prevent over-finishing or incorporating water into the surface.

3.9.4 Troweled Finish

All interior slabs except the ramp at door 104B in the Pumphouse shall be given a trowel finish. After floating is complete and after the surface moisture has disappeared, unformed surfaces shall be steel-troweled to a smooth, even, dense finish, free from blemishes including trowel marks. In lieu of hand finishing, an approved power finishing machine may be used in accordance with the directions of the machine manufacturer. Additional trowelings shall be performed, either by hand or machine until the surface has been troweled 2 times, with waiting period between each. Care shall be taken to prevent blistering and if such occurs, troweling shall immediately be stopped and operations and surfaces corrected. A final hard steel troweling shall be done by hand, with the trowel tipped, and using hard pressure, when the surface is at a point that the trowel will produce a ringing sound. The finished surface shall be thoroughly consolidated and shall be essentially free of trowel marks and be uniform in texture and appearance. The concrete mixture used for troweled finished areas shall be adjusted, if necessary, in order to provide sufficient fines (cementitious material and fine sand) to finish properly.

3.9.5 Non-Slip Finish

Non-slip floors shall be constructed in accordance with the following subparagraphs.

3.9.5.1 Broomed

The interior ramp at door 104B in the Pump room and The Fill Stand slab and all exterior stoops shall be given a broomed finish. After floating, the surface shall be lightly steel troweled, and then carefully scored by

pulling a hair or coarse fiber push-type broom across the surface. Brooming shall be transverse to traffic or at right angles to the slope of the slab. After the end of the curing period, the surface shall be vigorously broomed with a coarse fiber broom to remove all loose or semi-detached particles.

3.10 FLOOR HARDENER

The Pumphouse pump room slab and pantograph storage slab shall be treated with floor hardener. Floor hardener shall be applied after the concrete has been cured and then air dried for 14 days. Three coats shall be applied, each the day after the preceding coat was applied. For the first application, one pound of the silocofluoride shall be dissolved in one gallon of water. For subsequent applications, the solution shall be two pounds of silicofluoride to each gallon of water. Floor should be mopped with clear water shortly after the preceding application has dried to remove encrusted salts. Proprietary hardeners shall be applied in accordance with the manufacturer's instructions. During application, area should be well ventilated. Precautions shall be taken when applying silicofluorides due to the toxicity of the salts. Any compound that contacts glass or aluminum should be immediately removed with clear water.

3.11 CURING AND PROTECTION

3.11.1 General

Concrete shall be cured by an approved method for the period of time given below:

All concrete	7 days

Immediately after placement, concrete shall be protected from premature drying, extremes in temperatures, rapid temperature change, mechanical injury and damage from rain and flowing water for the duration of the curing period. Air and forms in contact with concrete shall be maintained at a temperature above 50 degrees F for the first 3 days and at a temperature above 32 degrees F for the remainder of the specified curing period. Exhaust fumes from combustion heating units shall be vented to the outside of the enclosure, and heaters and ducts shall be placed and directed so as not to cause areas of overheating and drying of concrete surfaces or to create fire hazards. Materials and equipment needed for adequate curing and protection shall be available and at the site prior to placing concrete. No fire or excessive heat, including welding, shall be permitted near or in direct contact with the concrete at any time. Except as otherwise permitted by paragraph Membrane Forming Curing Compounds, moist curing shall be provided for any areas to receive floor hardener, any paint or other applied coating, or to which other concrete is to be bonded.

3.11.2 Moist Curing

Concrete to be moist-cured shall be maintained continuously wet for the entire curing period, commencing immediately after finishing. If water or curing materials used stain or discolor concrete surfaces which are to be permanently exposed, the concrete surfaces shall be cleaned as approved. When wooden forms are left in place during curing, they shall be kept wet at all times. If steel forms are used in hot weather, nonsupporting vertical forms shall be broken loose from the concrete soon after the concrete hardens and curing water continually applied in this void. If the forms are removed before the end of the curing period, curing shall be

carried out as on unformed surfaces, using suitable materials. Surfaces shall be cured by ponding, by continuous sprinkling, by continuously saturated burlap or cotton mats, or by continuously saturated plastic coated burlap. Burlap and mats shall be clean and free from any contamination and shall be completely saturated before being placed on the concrete. The Contractor shall have an approved work system to ensure that moist curing is continuous 24 hours per day.

3.11.3 Membrane Forming Curing Compounds

Concrete may be cured with a nonpigmented curing compound containing a fugitive dye in lieu of moist curing. Membrane curing shall not be used on surfaces that are to receive any subsequent treatment depending on adhesion or bonding to the concrete, including surfaces to which a smooth finish is to be applied or other concrete to be bonded. However, a styrene acrylate or chlorinated rubber compound meeting ASTM C 309, Class B requirements, may be used for surfaces which are to be painted or are to receive bituminous roofing or waterproofing, or floors that are to receive adhesive applications of resilient flooring. The curing compound selected shall be compatible with any subsequent paint, roofing, waterproofing or flooring specified. Membrane curing compound shall not be used on surfaces that are maintained at curing temperatures with free steam. Curing compound shall be applied to formed surfaces immediately after the forms are removed and prior to any patching or other surface treatment except the cleaning of loose sand, mortar, and debris from the surface. All surfaces shall be thoroughly moistened with water. Curing compound shall be applied to slab surfaces as soon as the bleeding water has disappeared, with the tops of joints being temporarily sealed to prevent entry of the compound and to prevent moisture loss during the curing period. The curing compound shall be applied in a two-coat continuous operation by approved motorized power-spraying equipment operating at a minimum pressure of 75 psi, at a uniform coverage of not more than 400 square feet per gallon for each coat, and the second coat shall be applied perpendicular to the first coat. Concrete surfaces which have been subjected to rainfall within 3 hours after curing compound has been applied shall be resprayed by the method and at the coverage specified. Surfaces on which clear compound is used shall be shaded from direct rays of the sun for the first 3 days. Surfaces coated with curing compound shall be kept free of foot and vehicular traffic, and from other sources of abrasion and contamination during the curing period.

3.11.4 Impervious Sheeting

Except for plastic coated burlap, impervious sheeting alone shall not be used for curing. Impervious-sheet curing shall only be used on horizontal or nearly horizontal surfaces. Surfaces shall be thoroughly wetted and be completely covered with the sheeting. Sheeting shall be at least 18 inches wider than the concrete surface to be covered. Covering shall be laid with light-colored side up. Covering shall be lapped not less than 12 inches and securely weighted down or shall be lapped not less than 4 inches and taped to form a continuous cover with completely closed joints. The sheet shall be weighted to prevent displacement so that it remains in contact with the concrete during the specified length of curing. Coverings shall be folded down over exposed edges of slabs and secured by approved means. Sheets shall be immediately repaired or replaced if tears or holes appear during the curing period.

3.11.5 Ponding or Immersion

Concrete shall be continually immersed throughout the curing period. Water shall not be more than 20 degrees F less than the temperature of the concrete.

3.11.6 Cold Weather Curing and Protection

When the daily ambient low temperature is less than 32 degrees F the temperature of the concrete shall be maintained above 40 degrees F for the first seven days after placing. During the period of protection removal, the air temperature adjacent to the concrete surfaces shall be controlled so that concrete near the surface will not be subjected to a temperature differential of more than 25 degrees F as determined by suitable temperature measuring devices furnished by the Contractor, as required, and installed adjacent to the concrete surface and 2 inches inside the surface of the concrete. The installation of the thermometers shall be made by the Contractor as directed.

3.12 SETTING BASE PLATES AND BEARING PLATES

After being properly positioned, column base plates, bearing plates for beams and similar structural members, and machinery and equipment base plates shall be set to the proper line and elevation with damp-pack bedding mortar. The thickness of the mortar or grout shall be approximately 1/24 the width of the plate, but not less than 3/4 inch. Concrete and metal surfaces in contact with grout shall be clean and free of oil and grease, and concrete surfaces in contact with grout shall be damp and free of laitance when grout is placed.

3.12.1 Damp-Pack Bedding Mortar

Damp-pack bedding mortar shall consist of 1 part cement and 2-1/2 parts fine aggregate having water content such that a mass of mortar tightly squeezed in the hand will retain its shape but will crumble when disturbed. The space between the top of the concrete and bottom of the bearing plate or base shall be packed with the bedding mortar by tamping or ramming with a bar or rod until it is completely filled.

3.13 TESTING AND INSPECTION FOR CONTRACTOR QUALITY CONTROL

The Contractor shall perform the inspection and tests described below and, based upon the results of these inspections and tests, shall take the action required and shall submit specified reports. When, in the opinion of the Contracting Officer, the concreting operation is out of control, concrete placement shall cease and the operation shall be corrected. The laboratory performing the tests shall be onsite and shall conform with ASTM C 1077. Materials may be subjected to check testing by the Government from samples obtained at the manufacturer, at transfer points, or at the project site.

3.13.1 Concrete Mixture

a. Air Content Testing. Air content tests shall be made when test specimens are fabricated. In addition, at least two tests for air content shall be made on randomly selected batches of each separate concrete mixture produced during each 8-hour period of concrete production. Additional tests shall be made when excessive variation in workability is reported by the placing foreman or Government inspector.

Tests shall be made in accordance with ASTM C 231 for normal weight concrete. Test results shall be plotted on control charts which shall at all times be readily available to the Government and shall be submitted weekly. Copies of the current control charts shall be kept in the field by testing crews and results plotted as tests are made. When a single test result reaches either the upper or lower action limit, a second test shall immediately be made. The results of the two tests shall be averaged and this average used as the air content of the batch to plot on both the air content and the control chart for range, and for determining need for any remedial action. The result of each test, or average as noted in the previous sentence, shall be plotted on a separate control chart for each mixture on which an "average line" is set at the midpoint of the specified air content range from paragraph Air Entrainment. An upper warning limit and a lower warning limit line shall be set 1.0 percentage point above and below the average line, respectively. An upper action limit and a lower action limit line shall be set 1.5 percentage points above and below the average line, respectively. The range between each two consecutive tests shall be plotted on a secondary control chart for range where an upper warning limit is set at 2.0 percentage points and an upper action limit is set at 3.0 percentage points. Samples for air content may be taken at the mixer, however, the Contractor is responsible for delivering the concrete to the placement site at the stipulated air content. If the Contractor's materials or transportation methods cause air content loss between the mixer and the placement, correlation samples shall be taken at the placement site as required by the Contracting Officer, and the air content at the mixer controlled as directed.

b. Air Content Corrective Action. Whenever points on the control chart for percent air reach either warning limit, an adjustment shall immediately be made in the amount of air-entraining admixture batched. As soon as practical after each adjustment, another test shall be made to verify the result of the adjustment. Whenever a point on the secondary control chart for range reaches the warning limit, the admixture dispenser shall be recalibrated to ensure that it is operating accurately and with good reproducibility. Whenever a point on either control chart reaches an action limit line, the air content shall be considered out of control and the concreting operation shall immediately be halted until the air content is under control. Additional air content tests shall be made when concreting is restarted.

c. Slump Testing. In addition to slump tests which shall be made when test specimens are fabricated, at least four slump tests shall be made on randomly selected batches in accordance with ASTM C 143/C 143M for each separate concrete mixture produced during each 8-hour or less period of concrete production each day. Also, additional tests shall be made when excessive variation in workability is reported by the placing foreman or Government inspector. Test results shall be plotted on control charts which shall at all times be readily available to the Government and shall be submitted weekly. Copies of the current control charts shall be kept in the field by testing crews and results plotted as tests are made. When a single slump test reaches or goes beyond either the upper or lower action limit, a second test shall immediately be made. The results of the two tests shall be averaged and this average used as the slump of the batch to plot on both the control charts for slump and the chart for range, and for determining need for any remedial action. Limits shall be set on separate control charts for slump for each type of mixture. The upper warning limit shall be set at 1/2 inch below the maximum allowable slump specified in

paragraph Slump in PART 1 for each type of concrete and an upper action limit line and lower action limit line shall be set at the maximum and minimum allowable slumps, respectively, as specified in the same paragraph. The range between each consecutive slump test for each type of mixture shall be plotted on a single control chart for range on which an upper action limit is set at 2 inches. Samples for slump shall be taken at the mixer. However, the Contractor is responsible for delivering the concrete to the placement site at the stipulated slump. If the Contractor's materials or transportation methods cause slump loss between the mixer and the placement, correlation samples shall be taken at the placement site as required by the Contracting Officer, and the slump at the mixer controlled as directed.

d. Slump Corrective Action. Whenever points on the control charts for slump reach the upper warning limit, an adjustment shall immediately be made in the batch weights of water and fine aggregate. The adjustments are to be made so that the total water content does not exceed that amount allowed by the maximum w/c ratio specified, based on aggregates which are in a saturated surface dry condition. When a single slump reaches the upper or lower action limit, no further concrete shall be delivered to the placing site until proper adjustments have been made. Immediately after each adjustment, another test shall be made to verify the correctness of the adjustment. Whenever two consecutive individual slump tests, made during a period when there was no adjustment of batch weights, produce a point on the control chart for range at or above the upper action limit, the concreting operation shall immediately be halted, and the Contractor shall take appropriate steps to bring the slump under control. Additional slump tests shall be made as directed.

e. Temperature. The temperature of the concrete shall be measured when compressive strength specimens are fabricated. Measurement shall be in accordance with ASTM C 1064/C 1064M. The temperature shall be reported along with the compressive strength data.

f. Strength Specimens. At least one set of test specimens shall be made, for compressive strength, on each different concrete mixture placed during the day for each 500 cubic yards or portion thereof of that concrete mixture placed each day. Additional sets of test specimens shall be made, as directed by the Contracting Officer, when the mixture proportions are changed or when low strengths have been detected. A truly random (not haphazard) sampling plan shall be developed by the Contractor and approved by the Contracting Officer prior to the start of construction. The plan shall assure that sampling is done in a completely random and unbiased manner. A set of test specimens for concrete with a 28-day specified strength per paragraph Strength Requirements in PART 1 shall consist of four specimens, two to be tested at 7 days and two at 28 days. Test specimens shall be molded and cured in accordance with ASTM C 31/C 31M and tested in accordance with ASTM C 39/C 39M for test cylinders . Results of all strength tests shall be reported immediately to the Contracting Officer. Quality control charts shall be kept for individual strength "tests", ("test" as defined in paragraph Strength Requirements in PART 1) moving average of last 3 "tests" for strength, and moving average for range for the last 3 "tests" for each mixture. The charts shall be similar to those found in ACI 214.3R.

3.13.2 Inspection Before Placing

Foundations, construction joints, forms, and embedded items shall be

inspected by the Contractor in sufficient time prior to each concrete placement in order to certify to the Contracting Officer that they are ready to receive concrete. The results of each inspection shall be reported in writing.

3.13.3 Placing

The placing foreman shall supervise placing operations, shall determine that the correct quality of concrete or grout is placed in each location as specified and as directed by the Contracting Officer, and shall be responsible for measuring and recording concrete temperatures and ambient temperature hourly during placing operations, weather conditions, time of placement, volume placed, and method of placement. The placing foreman shall not permit batching and placing to begin until it has been verified that an adequate number of vibrators in working order and with competent operators are available. Placing shall not be continued if any pile of concrete is inadequately consolidated. If any batch of concrete fails to meet the temperature requirements, immediate steps shall be taken to improve temperature controls.

3.13.4 Curing Inspection

a. Moist Curing Inspections. At least once each shift, and not less than twice per day on both work and non-work days, an inspection shall be made of all areas subject to moist curing. The surface moisture condition shall be noted and recorded.

b. Moist Curing Corrective Action. When a daily inspection report lists an area of inadequate curing, immediate corrective action shall be taken, and the required curing period for those areas shall be extended by 1 day.

c. Membrane Curing Inspection. No curing compound shall be applied until the Contractor has verified that the compound is properly mixed and ready for spraying. At the end of each operation, the Contractor shall estimate the quantity of compound used by measurement of the container and the area of concrete surface covered, shall compute the rate of coverage in square feet per gallon, and shall note whether or not coverage is uniform.

d. Membrane Curing Corrective Action. When the coverage rate of the curing compound is less than that specified or when the coverage is not uniform, the entire surface shall be sprayed again.

e. Sheet Curing Inspection. At least once each shift and once per day on non-work days, an inspection shall be made of all areas being cured using impervious sheets. The condition of the covering and the tightness of the laps and tapes shall be noted and recorded.

f. Sheet Curing Corrective Action. When a daily inspection report lists any tears, holes, or laps or joints that are not completely closed, the tears and holes shall promptly be repaired or the sheets replaced, the joints closed, and the required curing period for those areas shall be extended by 1 day.

3.13.5 Cold-Weather Protection

At least once each shift and once per day on non-work days, an inspection shall be made of all areas subject to cold-weather protection. Any

deficiencies shall be noted, corrected, and reported.

3.13.6 Reports

All results of tests or inspections conducted shall be reported informally as they are completed and in writing daily. A weekly report shall be prepared for the updating of control charts covering the entire period from the start of the construction season through the current week. During periods of cold-weather protection, reports of pertinent temperatures shall be made daily. These requirements do not relieve the Contractor of the obligation to report certain failures immediately as required in preceding paragraphs. Such reports of failures and the action taken shall be confirmed in writing in the routine reports. The Contracting Officer has the right to examine all contractor quality control records.

-- End of Section --

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DIVISION 04 - MASONRY

SECTION 04200

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SECTION 04200

MASONRY

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ACI INTERNATIONAL (ACI)

ACI SP-66	(1994) ACI Detailing Manual

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 82	(1997a) Steel Wire, Plain, for Concrete Reinforcement
ASTM A 153/A 153M	(2001a) Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A 615/A 615M	(2001b) Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM C 90	(2000) Loadbearing Concrete Masonry Units
ASTM C 91	(1999) Masonry Cement
ASTM C 140	(1999b) Sampling and Testing Concrete Masonry Units
ASTM C 270	(2000) Mortar for Unit Masonry
ASTM C 476	(1999) Grout for Masonry
ASTM C 494/C 494M	(1999ae1) Chemical Admixtures for Concrete
ASTM C 578	(2000) Rigid, Cellular Polystyrene Thermal Insulation
ASTM C 780	(2000) Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry
ASTM C 1019	(2000) Sampling and Testing Grout
ASTM C 1072	(2000) Measurement of Masonry Flexural Bond Strength
ASTM C 1289	(1998) Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with SECTION 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Masonry Work; G-AE.

Drawings including plans, elevations, and details of wall reinforcement; details of reinforcing bars at corners and wall intersections; offsets; tops, bottoms, and ends of walls; control joints; and wall openings. Bar splice locations shall be shown. Bent bars shall be identified on a bending diagram and shall be referenced and located on the drawings. Wall dimensions, bar clearances, and wall openings greater than one masonry unit in area shall be shown. No approval will be given to the shop drawings until the Contractor certifies that all openings, including those for mechanical and electrical service, are shown. If, during construction, additional masonry openings are required, the approved shop drawings shall be resubmitted with the additional openings shown along with the proposed changes. Location of these additional openings shall be clearly highlighted. The minimum scale for wall elevations shall be 1/4 inch per foot. Reinforcement bending details shall conform to the requirements of ACI SP-66.

SD-03 Product Data

Insulation.

Cold Weather Installation; G-AO.

Cold weather construction procedures.

SD-04 Samples

Concrete Masonry Units (CMU); G-AO.

Ties and Bar Positioners; G-AO.

Two of each type used.

Insulation; G-AO.

One piece of board type insulation, not less than 16 by 24 inches in size, containing the label indicating the rated permeance and R-values.

Joint Reinforcement; G-AO

One piece of each type used, including corner and wall intersection pieces, showing at least two cross wires.

SD-06 Test Reports

Field Testing of Mortar; G-AO.

Field Testing of Grout; G-AO.

Masonry Cement; G-AO.

Fire-rated CMU; G-AO.

Test reports from an approved independent laboratory. Test reports on a previously tested material shall be certified as the same as that proposed for use in this project.

Special Inspection; G-AO.

Copies of masonry inspector reports.

SD-07 Certificates

Concrete Masonry Units (CMU).

Ties and Bar Positioners.

Joint Reinforcement.

Reinforcing Steel Bars and Rods.

Masonry Cement.

Precast Concrete Items.

Mortar Admixtures.

Grout Admixtures.

Insulation.

Certificates of compliance stating that the materials meet the specified requirements.

Insulation

Certificate attesting that the polyurethane or polyisocyanurate insulation furnished for the project contains recovered material, and showing an estimated percent of such recovered material.

1.3 DELIVERY, HANDLING, AND STORAGE

Materials shall be delivered, handled, stored, and protected to avoid chipping, breakage, and contact with soil or contaminating material.

1.3.1 Masonry Units

Concrete masonry units shall be covered or protected from inclement weather.

1.3.2 Reinforcement

Steel reinforcing bars and joint reinforcement shall be stored above the ground. Steel reinforcing bars and uncoated ties shall be free of loose mill scale and rust.

1.3.3 Cementitious Materials, Sand and Aggregates

Cementitious and other packaged materials shall be delivered in unopened containers, plainly marked and labeled with manufacturers' names and brands. Cementitious material shall be stored in dry, weathertight enclosures or be completely covered. Cement shall be handled in a manner that will prevent the inclusion of foreign materials and damage by water or dampness. Sand and aggregates shall be stored in a manner to prevent contamination or segregation.

1.3.4 SPECIAL INSPECTION

A qualified masonry inspector approved by the Contracting Officer shall perform inspection of the masonry work. Minimum qualifications for the masonry inspector shall be 5 years of reinforced masonry inspection experience or acceptance by a State, municipality, or other governmental body having a program of examining and certifying inspectors for reinforced masonry construction. The masonry inspector shall be present during preparation of masonry prisms, sampling and placing of masonry units, placement of reinforcement (including placement of dowels in footings and foundation walls), inspection of grout space, immediately prior to closing of cleanouts, and during grouting operations. The masonry inspector shall assure Contractor compliance with the drawings and specifications. The masonry inspector shall keep a complete record of all inspections and shall submit daily written reports to the Quality Control Supervisory Representative reporting the quality of masonry construction.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

The source of materials which will affect the appearance of the finished work shall not be changed after the work has started except with Contracting Officer's approval.

2.2 CONCRETE MASONRY UNITS (CMU)

Hollow and solid concrete masonry units shall conform to ASTM C 90. Cement shall have a low alkali content and be of one brand.

2.2.1 Kinds and Shapes

Units shall be modular in size and shall include closer, jamb, header, lintel, and bond beam units and special shapes and sizes to complete the work as indicated. Units used in exposed masonry surfaces in any one building shall have a uniform fine to medium texture and a uniform color.

2.2.2 Fire-Rated CMU

Concrete masonry units used in fire-rated construction shown on the drawings shall be of minimum equivalent thickness for the fire rating indicated and the corresponding type of aggregates indicated in TABLE I. Units containing more than one of the aggregates listed in TABLE I will be rated on the aggregate requiring the greater minimum equivalent thickness to produce the required fire rating.

TABLE I

FIRE-RATED CONCRETE MASONRY UNITS

See note (a) below

Aggregate Type	Minimum equivalent thickness inches for fire rating of: 4 hours	3 hours	2 hours
Pumice	4.7	4.0	3.0
Expanded slag	5.0	4.2	3.3
Expanded clay, shale, or slate	5.7	4.8	3.7
Limestone, scoria, cinders or unexpanded slag	5.9	5.0	4.0
Calcareous gravel	6.2	5.3	4.2
Siliceous gravel	6.7	5.7	4.5

(a) Minimum equivalent thickness shall equal net volume as determined in conformance with ASTM C 140 divided by the product of the actual length and height of the face shell of the unit in inches. Where walls are to receive plaster or be faced with brick, or otherwise form an assembly; the thickness of plaster or brick or other material in the assembly will be included in determining the equivalent thickness.

2.3 PRECAST CONCRETE ITEMS

Trim, copings, and splashblocks shall be factory-made units from a plant regularly engaged in producing precast concrete units. Unless otherwise indicated, concrete shall be 4,000 psi minimum conforming to SECTION 03300 CAST-IN-PLACE STRUCTURAL CONCRETE using 1/2 inch to No. 4 nominal-size coarse aggregate, and minimum reinforcement shall be the reinforcement required for handling of the units. Clearance of 3/4 inch shall be maintained between reinforcement and faces of units. Unless precast-concrete items have been subjected during manufacture to saturated-steam pressure of at least 120 psi for at least 5 hours, the items, after casting, shall be either damp-cured for 24 hours or steam-cured and shall then be aged under cover for 28 days or longer. Cast-concrete members weighing over 80 pounds shall have built-in loops of galvanized wire or other approved provisions for lifting and anchoring. Units shall have beds and joints at right angles to the face, with sharp true arises. Exposed-to-view surfaces shall be free of surface voids, spalls, cracks, and chipped or broken edges. Precast units exposed-to-view shall be of uniform appearance and color. Unless otherwise specified, units shall have a smooth dense finish. Prior to use, each item shall be wetted and inspected for crazing. Items showing evidence of dusting, spalling, crazing, or having surfaces treated with a protective coating will be rejected.

2.5.2 Sills and Copings

Sills and copings shall be cast with washes. Sills for windows having mullions shall be cast in sections with head joints at mullions and a 1/4 inch allowance for mortar joints. The ends of sills, except a 3/4 inch wide margin at exposed surfaces, shall be roughened for bond.

2.4 MORTAR

Mortar shall be Type S in accordance with the proportion specification of ASTM C 270 except Type S cement-lime mortar proportions shall be 1 part cement, 1/2 part lime and 4-1/2 parts aggregate; when masonry cement ASTM C 91 is used the maximum air content shall be limited to 12 percent and performance equal to cement-lime mortar shall be verified. Verification of masonry cement performance shall be based on ASTM C 780 and ASTM C 1072. Cement shall have a low alkali content and be of one brand. Aggregates shall be from one source.

2.4.1 Admixtures

In cold weather, a non-chloride based accelerating admixture may be used subject to approval. Accelerating admixture shall be non-corrosive, shall contain less than 0.2 percent chlorides, and shall conform to ASTM C 494/C 494M, Type C.

2.5 GROUT

Grout shall conform to ASTM C 476. Cement used in grout shall have a low alkali content. Grout slump shall be between 8 and 10 inches. Grout shall be used subject to the limitations of Table III. Proportions shall not be changed and materials with different physical or chemical characteristics shall not be used in grout for the work unless additional evidence is furnished that the grout meets the specified requirements.

2.5.1 Admixtures

In cold weather, a non-chloride based accelerating admixture may be used subject to approval. Accelerating admixture shall be non-corrosive, shall contain less than 0.2 percent chlorides, and shall conform to ASTM C 494/C 494M, Type C.

2.5.2 Grout Barriers

Grout barriers for vertical cores shall consist of fine mesh wire, fiberglass, or expanded metal.

2.6 TIES AND BAR POSITIONERS

2.6.1 Wall Ties

Wall ties shall be rectangular-shaped or Z-shaped fabricated of 3/16 inch diameter zinc-coated steel wire. Rectangular wall ties shall be no less than 4 inches wide. Wall ties may also be of a continuous type conforming to paragraph JOINT REINFORCEMENT.

2.6.2 Bar Positioners

Bar positioners, used to prevent displacement of reinforcing bars during the course of construction, shall be factory fabricated from 9 gauge steel

wire or equivalent, and coated with a hot-dip galvanized finish. Not more than one wire shall cross the cell.

2.7 JOINT REINFORCEMENT

Joint reinforcement shall be factory fabricated from steel wire conforming to ASTM A 82, welded construction. Tack welding will not be acceptable in reinforcement used for wall ties. Wire shall have zinc coating conforming to ASTM A 153/A 153M, Class B-2. All wires shall be a minimum of 9 gauge. Reinforcement shall be ladder type design, having one longitudinal wire in the mortar bed of each face shell for hollow units and one wire for solid units. Joint reinforcement shall be placed a minimum of 5/8 inch cover from either face. The distance between crosswires shall not exceed 16 inches. Joint reinforcement for straight runs shall be furnished in flat sections not less than 10 feet long. Joint reinforcement shall be provided with factory formed corners and intersections.

2.8 REINFORCING STEEL BARS AND RODS

Reinforcing steel bars and rods shall conform to ASTM A 615/A 615M, Grade 60.

2.8.1 EXPANSION-JOINT MATERIALS

Backer rod and sealant shall be adequate to accommodate joint compression equal to 50 percent of the width of the joint. The backer rod shall be compressible rod stock of polyethylene foam, polyurethane foam, butyl rubber foam, or other flexible, nonabsorptive material as recommended by the sealant manufacturer. Sealant shall conform to SECTION 07900 JOINT SEALING.

2.9 INSULATION

2.9.1 Rigid Board-Type Insulation

Rigid board-type insulation shall be extruded polystyrene, polyurethane, or polyisocyanurate. Polystyrene shall conform to ASTM C 578. Polyisocyanurate shall conform to ASTM C 1289, Type I, Class 1 or 2, faced with aluminum foil on both sides of the foam. The insulation shall be a standard product and shall be marked with not less than the manufacturer's trademark or name, the specification number, the permeance and R-values.

2.9.1.1 Insulation Thickness and Air Space

The cavity space shall allow for a maximum insulation thickness of 2 inches, and a minimum air space of 3/4 inch.

2.9.1.2 Aged R-Value

The insulation shall provide a minimum aged R-value of 11 for the overall thickness. The aged R-value shall be determined at 75 degrees F in accordance with the appropriate referenced specification. The stated R-value of the insulation shall be certified by an independent testing laboratory or certified by an independent Registered Professional Engineer if tests are conducted in the manufacturer's laboratory.

2.9.1.3 Recovered Material

Recyclable materials shall conform to EPA requirements in accordance with

SECTION 01670 RECYCLED / RECOVERED MATERIALS. The polyurethane or polyisocyanurate foam shall have a minimum recovered material content of 9 percent by weight of the core material.

2.9.2 Supplemental Vapor Retarding Membrane

Vapor retarder material shall be a special vapor control laminate consisting of multiple layers of polyethylene sheeting and aluminum or mylar manufactured and marketed specifically for the control of moisture vapor. The laminate product shall have a tested perm rating of 0.0 in a flat condition and less than 0.02 in a creased or folded condition. The product shall also maintain its composition through 10,000 cycles of flexing and provide a tensile strength of at least 2,000 psi.

2.9.3 Insulation Adhesive

Insulation adhesive shall be specifically prepared to adhere the insulation to the masonry and, where applicable, to the thru-wall flashing. The adhesive shall not deleteriously affect the insulation, and shall have a record of satisfactory and proven performance for the conditions under which to be used.

2.10 FLASHING

Flashing shall be as specified in SECTION 07600 SHEET METALWORK, GENERAL.

PART 3 EXECUTION

3.1 ENVIRONMENTAL REQUIREMENTS

3.1.1 Hot Weather Installation

The following precautions shall be taken if masonry is erected when the ambient air temperature is more than 99 degrees F in the shade and the relative humidity is less than 50 percent. All masonry materials shall be shaded from direct sunlight; mortar beds shall be spread no more than 4 feet ahead of masonry; masonry units shall be set within one minute of spreading mortar; and after erection, masonry shall be protected from direct exposure to wind and sun for 48 hours.

3.1.2 Cold Weather Installation

Before erecting masonry when ambient temperature or mean daily air temperature falls below 40 degrees F, a written statement of proposed cold weather construction procedures shall be submitted for approval. The following precautions shall be taken during all cold weather erection.

3.1.2.1 Preparation

Ice or snow formed on the masonry bed shall be thawed by the application of heat. Heat shall be applied carefully until the top surface of the masonry is dry to the touch. Sections of masonry deemed frozen and damaged shall be removed before continuing construction of those sections.

a. Air Temperature 40 to 32 Degrees F. Sand or mixing water shall be heated to produce mortar temperatures between 40 and 120 degrees F.

b. Air Temperature 32 to 25 Degrees F. Sand and mixing water shall be heated to produce mortar temperatures between 40 and 120 degrees F.

Temperature of mortar on boards shall be maintained above freezing.

c. Air Temperature 25 to 20 Degrees F. Sand and mixing water shall be heated to provide mortar temperatures between 40 and 120 degrees F. Temperature of mortar on boards shall be maintained above freezing. Sources of heat shall be used on both sides of walls under construction. Windbreaks shall be employed when wind is in excess of 15 mph.

d. Air Temperature 20 Degrees F and below. Sand and mixing water shall be heated to provide mortar temperatures between 40 and 120 degrees F. Enclosure and auxiliary heat shall be provided to maintain air temperature above 32 degrees F. Temperature of units when laid shall not be less than 20 degrees F.

3.1.2.2 Completed Masonry and Masonry Not Being Worked On

a. Mean daily air temperature 40 to 32 degrees F. Masonry shall be protected from rain or snow for 24 hours by covering with weather-resistive membrane.

b. Mean daily air temperature 32 to 25 degrees F. Masonry shall be completely covered with weather-resistant membrane for 24 hours.

c. Mean Daily Air Temperature 25 to 20 degrees F. Masonry shall be completely covered with insulating blankets or equally protected for 24 hours.

d. Mean Daily Temperature 20 degrees F and Below. Masonry temperature shall be maintained above 32 degrees F for 24 hours by enclosure and supplementary heat, by electric heating blankets, infrared heat lamps, or other approved methods.

3.2 LAYING MASONRY UNITS

Masonry units shall be laid in running bond pattern. Each unit shall be adjusted to its final position while mortar is still soft and plastic. Units that have been disturbed after the mortar has stiffened shall be removed, cleaned, and relaid with fresh mortar. Air spaces, cavities, chases, and spaces to be grouted shall be kept free from mortar and other debris. Units used in exposed masonry surfaces shall be selected from those having the least amount of chipped edges or other imperfections detracting from the appearance of the finished work. Vertical joints shall be kept plumb. Units being laid and surfaces to receive units shall be free of water film and frost. Solid units shall be laid in a nonfurrowed full bed of mortar. Units shall be shoved into place so that the vertical joints are tight. Vertical face shells of concrete masonry units, except where indicated at control, shall be completely filled with mortar. Mortar will be permitted to protrude up to 1/2 inch into the space or cells to be grouted. Means shall be provided to prevent mortar from dropping into the space below.

3.2.1 Surface Preparation

Surfaces upon which masonry is placed shall be cleaned of laitance, dust, dirt, oil, organic matter, or other foreign materials and shall be slightly roughened to provide a surface texture with a depth of at least 1/8 inch. Sandblasting shall be used, if necessary, to remove laitance from pores and to expose the aggregate.

3.2.2 Forms and Shores

Forms and shores shall be sufficiently rigid to prevent deflections which may result in cracking or other damage to supported masonry and sufficiently tight to prevent leakage of mortar and grout. Supporting forms and shores shall not be removed in less than 10 days.

3.2.3 Concrete Masonry Units

Units in pilasters, starting courses on footings, solid foundation walls, lintels, and beams, and where cells are to be filled with grout shall be full bedded in mortar under both face shells and webs. Other units shall be full bedded under both face shells. Head joints shall be filled solidly with mortar for a distance in from the face of the unit not less than the thickness of the face shell. Jamb units shall be of the shapes and sizes to conform with wall units. Solid units may be incorporated in the masonry work where necessary to fill out at corners, gable slopes, and elsewhere as approved.

3.2.4 Tolerances

Masonry shall be laid plumb, true to line, with courses level. Bond pattern shall be kept plumb throughout. Corners shall be square unless noted otherwise. Masonry shall be laid within the following tolerances (plus or minus unless otherwise noted):

TABLE II

TOLERANCES

Variation from the plumb in the lines and surfaces of columns, walls and arises	
In adjacent masonry units	1/8 inch
In 10 feet	1/4 inch
In 20 feet	3/8 inch
In 40 feet or more	1/2 inch
Variations from the plumb for external corners, expansion joints, and other conspicuous lines	
In 20 feet	1/4 inch
In 40 feet or more	1/2 inch
Variations from the level for exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines	
In 20 feet	1/4 inch
In 40 feet or more	1/2 inch
Variation from level for bed joints and top surfaces of bearing walls	

TOLERANCES

In 10 feet	1/4 inch
In 40 feet or more	1/2 inch

Variations from horizontal lines

In 10 feet	1/4 inch
In 20 feet	3/8 inch
In 40 feet or more	1/2 inch

Variations in cross sectional dimensions of columns and in thickness of walls

Minus	1/4 inch
Plus	1/2 inch

3.2.5 Cutting and Fitting

Full units of the proper size shall be used wherever possible, in lieu of cut units. Cutting and fitting, including that required to accommodate the work of others, shall be done by masonry mechanics using power masonry saws. Concrete masonry units may be wet or dry cut. Wet cut units, before being placed in the work, shall be dried to the same surface-dry appearance as uncut units being laid in the wall. Cut edges shall be clean, true and sharp. Openings in the masonry shall be made carefully so that wall plates, cover plates or escutcheons required by the installation will completely conceal the openings and will have bottoms parallel with the masonry bed joints. Reinforced masonry lintels shall be provided above openings over 12 inches wide for pipes, ducts, cable trays, and other wall penetrations, unless steel sleeves are used.

3.2.6 Jointing

Joints shall be tooled when the mortar is thumbprint hard. Horizontal joints shall be tooled last. Joints shall be brushed to remove all loose and excess mortar. Mortar joints shall be finished as follows:

3.2.6.1 Flush Joints

Joints in concealed masonry surfaces and joints at electrical outlet boxes in wet areas shall be flush cut. Flush cut joints shall be made by cutting off the mortar flush with the face of the wall. Joints in unparged masonry walls below grade shall be pointed tight.

3.2.6.2 Tooled Joints

Joints in exposed exterior and interior masonry surfaces shall be tooled slightly concave. Joints shall be tooled with a jointer slightly larger than the joint width so that complete contact is made along the edges of the unit. Tooling shall be performed so that the mortar is compressed and the joint surface is sealed. Jointer of sufficient length shall be used to obtain a straight and true mortar joint.

3.2.6.3 Door and Window Frame Joints

On the exposed interior side of exterior frames, joints between frames and

abutting masonry walls shall be raked to a depth of 3/8 inch. On the exterior side of exterior frames, joints between frames and abutting masonry walls shall be raked to a depth of 3/8 inch.

3.2.7 Joint Widths

Joint widths shall be as follows:

3.2.7.1 Concrete Masonry Units

Concrete masonry units shall have 3/8 inch joints.

3.2.8 Embedded Items

Spaces around built-in items shall be filled with mortar. Openings around flush-mount electrical outlet boxes in wet locations shall be pointed with mortar. Wall plugs, accessories, flashing, pipe sleeves and other items required to be built-in shall be embedded as the masonry work progresses. Joint reinforcement shall be fully embedded in the mortar. Cells receiving anchor bolts and cells of the first course below bearing plates shall be filled with grout.

3.2.9 Unfinished Work

Unfinished work shall be stepped back for joining with new work. Toothing may be resorted to only when specifically approved. Loose mortar shall be removed and the exposed joints shall be thoroughly cleaned before laying new work.

3.2.10 Masonry Wall Intersections

Each course shall be masonry bonded at corners and elsewhere as shown. Masonry walls shall be anchored or tied together at corners and intersections with bond beam reinforcement and prefabricated corner or tee pieces of joint reinforcement as shown.

3.3 ANCHORED VENEER CONSTRUCTION

The inner and outer wythes shall be completely separated by a continuous airspace as shown on the drawings. Both the inner and the outer wythes shall be laid up together except when adjustable joint reinforcement assemblies are approved for use. When both wythes are not brought up together, through-wall flashings shall be protected from damage until they are fully enclosed in the wall. The airspace between the wythes shall be kept clear and free of mortar droppings by temporary wood strips laid on the wall ties and carefully lifted out before placing the next row of ties. A coarse gravel or drainage material shall be placed behind the weep holes in the cavity to a minimum depth of 4 inches of coarse aggregate or 10 inches of drainage material to keep mortar droppings from plugging the weep holes.

3.4 WEEP HOLES

Weep holes shall be provided not more than 24 inches on centers in mortar joints of the exterior wythe above wall flashing, over foundations, bond beams, and any other horizontal interruptions of the cavity. Weep holes shall be formed by placing short lengths of well-greased No. 10, 5/16 inch nominal diameter, braided cotton sash cord in the mortar and withdrawing the cords after the wall has been completed. Other approved methods may be

used for providing weep holes. Weep holes shall be kept free of mortar and other obstructions.

3.5 MORTAR

Mortar shall be mixed in a mechanically operated mortar mixer for at least 3 minutes, but not more than 5 minutes. Measurement of ingredients for mortar shall be by volume. Ingredients not in containers, such as sand, shall be accurately measured by the use of measuring boxes. Water shall be mixed with the dry ingredients in sufficient amount to provide a workable mixture which will adhere to the vertical surfaces of masonry units. Mortar that has stiffened because of loss of water through evaporation shall be retempered by adding water to restore the proper consistency and workability. Mortar that has reached its initial set or that has not been used within 2-1/2 hours after mixing shall be discarded.

3.6 REINFORCING STEEL

Reinforcement shall be cleaned of loose, flaky rust, scale, grease, mortar, grout, or other coating which might destroy or reduce its bond prior to placing grout. Bars with kinks or bends not shown on the drawings shall not be used. Reinforcement shall be placed prior to grouting. Unless otherwise indicated, vertical wall reinforcement shall extend to within 2 inches of tops of walls.

3.6.1 Positioning Bars

Vertical bars shall be accurately placed within the cells at the positions indicated on the drawings. A minimum clearance of 1/2 inch shall be maintained between the bars and masonry units. Minimum clearance between parallel bars shall be one diameter of the reinforcement. Vertical reinforcing may be held in place using bar positioners located near the ends of each bar and at intermediate intervals of not more than 192 diameters of the reinforcement. Column and pilaster ties shall be wired in position around the vertical steel. Ties shall be in contact with the vertical reinforcement and shall not be placed in horizontal bed joints.

3.6.2 Splices

Bars shall be lapped a minimum of 48 diameters of the reinforcement. Welded or mechanical connections shall develop at least 125 percent of the specified yield strength of the reinforcement.

3.7 JOINT REINFORCEMENT

Joint reinforcement shall be installed at 16 inches on center or as indicated. Reinforcement shall be lapped not less than 6 inches. Prefabricated sections shall be installed at corners and wall intersections. The longitudinal wires of joint reinforcement shall be placed to provide not less than 5/8 inch cover to either face of the unit.

3.8 PLACING GROUT

Cells containing reinforcing bars shall be filled with grout. Hollow masonry units in walls or partitions supporting plumbing, heating, or other mechanical fixtures, voids at door and window jambs, and other indicated spaces shall be filled solid with grout. Cells under lintel bearings on each side of openings shall be filled solid with grout for full height of openings. Walls below grade, lintels, and bond beams shall be filled solid

with grout. Units other than open end units may require grouting each course to preclude voids in the units. Grout not in place within 1-1/2 hours after water is first added to the batch shall be discarded. Sufficient time shall be allowed between grout lifts to preclude displacement or cracking of face shells of masonry units. If blowouts, flowouts, misalignment, or cracking of face shells should occur during construction, the wall shall be torn down and rebuilt.

3.8.1 Vertical Grout Barriers for Fully Grouted Walls

Grout barriers shall be provided not more than 30 feet apart, or as required, to limit the horizontal flow of grout for each pour.

3.8.2 Horizontal Grout Barriers

Grout barriers shall be embedded in mortar below cells of hollow units receiving grout.

3.8.3 Cleanouts

3.8.3.1 Cleanouts for Hollow Unit Masonry Construction

Cleanout holes shall be provided at the bottom of every pour in cores containing vertical reinforcement when the height of the grout pour exceeds 5 feet. Where all cells are to be grouted, cleanout courses shall be constructed using bond beam units in an inverted position to permit cleaning of all cells. Cleanout holes shall be provided at a maximum spacing of 32 inches where all cells are to be filled with grout. A new series of cleanouts shall be established if grouting operations are stopped for more than 4 hours. Cleanouts shall not be less than 3 by 4 inch openings cut from one face shell. Manufacturer's standard cutout units may be used at the Contractor's option. Cleanout holes shall not be closed until masonry work, reinforcement, and final cleaning of the grout spaces have been completed and inspected. For walls which will be exposed to view, cleanout holes shall be closed in an approved manner to match surrounding masonry.

3.8.4 Grouting Equipment

3.8.4.1 Grout Pumps

Pumping through aluminum tubes will not be permitted. Pumps shall be operated to produce a continuous stream of grout without air pockets, segregation, or contamination. Upon completion of each day's pumping, waste materials and debris shall be removed from the equipment, and disposed of outside the masonry.

3.8.4.2 Vibrators

Internal vibrators shall maintain a speed of not less than 5,000 impulses per minute when submerged in the grout. At least one spare vibrator shall be maintained at the site at all times. Vibrators shall be applied at uniformly spaced points not further apart than the visible effectiveness of the machine. Duration of vibration shall be limited to time necessary to produce satisfactory consolidation without causing segregation.

3.8.5 Grout Placement

Masonry shall be laid to the top of a pour before placing grout. Grout

shall not be placed in two-wythe solid unit masonry cavity until mortar joints have set for at least 3 days during hot weather and 5 days during cold damp weather. Grout shall not be placed in hollow unit masonry until mortar joints have set for at least 24 hours. Grout shall be placed using a hand bucket, concrete hopper, or grout pump to completely fill the grout spaces without segregation of the aggregates. Vibrators shall not be inserted into lower pours that are in a semi-solidified state. The height of grout pours and type of grout used shall be limited by the dimensions of grout spaces as indicated in Table III. Low-lift grout methods may be used on pours up to and including 5 feet in height. High-lift grout methods shall be used on pours exceeding 5 feet in height.

3.8.5.1 Low-Lift Method

Grout shall be placed at a rate that will not cause displacement of the masonry due to hydrostatic pressure of the grout. Mortar protruding more than 1/2 inch into the grout space shall be removed before beginning the grouting operation. Grout pours 12 inches or less in height shall be consolidated by mechanical vibration or by puddling. Grout pours over 12 inches in height shall be consolidated by mechanical vibration and reconsolidated by mechanical vibration after initial water loss and settlement has occurred. Vibrators shall not be inserted into lower pours that are in a semi-solidified state. Low-lift grout shall be used subject to the limitations of Table III.

3.8.5.2 High-Lift Method

Mortar droppings shall be cleaned from the bottom of the grout space and from reinforcing steel. Mortar protruding more than 1/4 inch into the grout space shall be removed by dislodging the projections with a rod or stick as the work progresses. Reinforcing, bolts, and embedded connections shall be rigidly held in position before grouting is started. CMU units shall not be pre-wetted. Grout, from the mixer to the point of deposit in the grout space shall be placed as rapidly as practical by pumping and placing methods which will prevent segregation of the mix and cause a minimum of grout splatter on reinforcing and masonry surfaces not being immediately encased in the grout lift. The individual lifts of grout shall be limited to 4 feet in height. The first lift of grout shall be placed to a uniform height within the pour section and vibrated thoroughly to fill all voids. This first vibration shall follow immediately behind the pouring of the grout using an approved mechanical vibrator. After a waiting period sufficient to permit the grout to become plastic, but before it has taken any set, the succeeding lift shall be poured and vibrated 12 to 18 inches into the preceding lift. If the placing of the succeeding lift is going to be delayed beyond the period of workability of the preceding, each lift shall be reconsolidated by reworking with a second vibrator as soon as the grout has taken its settlement shrinkage. The waiting, pouring, and reconsolidation steps shall be repeated until the top of the pour is reached. The top lift shall be reconsolidated after the required waiting period. The high-lift grouting of any section of wall between vertical grout barriers shall be completed to the top of a pour in one working day unless a new series of cleanout holes is established and the resulting horizontal construction joint cleaned. High-lift grout shall be used subject to the limitations in Table III.

TABLE III

POUR HEIGHT AND TYPE OF GROUT FOR VARIOUS GROUT SPACE DIMENSIONS

Maximum Grout Pour Height (feet) (4)	Grout Type	Grouting Procedure	Minimum Dimensions of the Total Clear Areas Within Grout Spaces and Cells (in.) (1,2) Multiwythe Masonry (3)	Hollow-unit Masonry
1	Fine	Low Lift	3/4	1-1/2 x 2
5	Fine	Low Lift	2	2 x 3
8	Fine	High Lift	2	2 x 3
12	Fine	High Lift	2-1/2	2-1/2 x 3
24	Fine	High Lift	3	3 x 3
1	Coarse	Low Lift	1-1/2	1-1/2 x 3
5	Coarse	Low Lift	2	2-1/2 x 3
8	Coarse	High Lift	2	3 x 3
12	Coarse	High Lift	2-1/2	3 x 3
24	Coarse	High Lift	3	3 x 4

Notes:
1. The actual grout space or cell dimension must be larger than the sum of the following items:

a. The required minimum dimensions of total clear areas given in the table above;

b. The width of any mortar projections within the space;

c. The horizontal projections of the diameters of the horizontal reinforcing bars within a cross section of the grout space or cell.

2. The minimum dimensions of the total clear areas shall be made up of one or more open areas, with at least one area being 3/4 inch or greater in width.

3. For grouting spaces between masonry wythes.

4. Where only cells of hollow masonry units containing reinforcement are grouted, the maximum height of the pour shall not exceed the distance between horizontal bond beams.

3.9 BOND BEAMS

Bond beams shall be filled with grout and reinforced as indicated on the drawings. Grout barriers shall be installed under bond beam units to retain the grout as required. Reinforcement shall be continuous, including around corners, except through control joints, unless otherwise indicated on the drawings. Where splices are required for continuity, reinforcement shall be lapped 48 bar diameters. A minimum clearance of 1/2 inch shall be maintained between reinforcement and interior faces of units.

3.10 CONTROL JOINTS

Control joints shall be provided as indicated and shall be constructed by

using mortar to fill the head joint in accordance with the details shown on the drawings. The vertical mortar joint at control joint locations shall be continuous, including through all bond beams. This shall be accomplished by utilizing half blocks in alternating courses on each side of the joint. Exposed interior control joints shall be raked to a depth of 1/4 inch. Concealed control joints shall be flush cut.

3.11 LINTELS

3.11.1 Masonry Lintels

Masonry lintels shall be constructed with lintel units filled solid with grout in all courses and reinforced with a minimum of two No. 4 bars in the bottom course unless otherwise indicated on the drawings. Lintel reinforcement shall extend beyond each side of masonry opening 40 bar diameters or 24 inches, whichever is greater. Reinforcing bars shall be supported in place prior to grouting and shall be located 1/2 inch above the bottom inside surface of the lintel unit.

3.12 SILLS AND COPINGS

Sills and copings shall be set in a full bed of mortar with faces plumb and true.

3.13 INSULATION

Anchored veneer walls shall be insulated, where shown, by installing board-type insulation on the cavity side of the inner wythe. Board type insulation shall have a supplemental vapor control membrane layer cut to the size of the board being installed and adhesively applied to the building facing face of the insulation board. The composite shall then be applied directly to the masonry or thru-wall flashing with adhesive. Insulation shall be neatly fitted between obstructions without impaling of insulation on ties or anchors. The insulation shall be applied in parallel courses with vertical joints breaking midway over the course below and shall be applied in moderate contact with adjoining units without forcing, and shall be cut to fit neatly against adjoining surfaces.

3.14 POINTING AND CLEANING

After mortar joints have attained their initial set, but prior to hardening, mortar and grout daubs or splashings shall be completely removed from masonry-unit surfaces that will be exposed or painted. Before completion of the work, defects in joints of masonry to be exposed or painted shall be raked out as necessary, filled with mortar, and tooled to match existing joints. Immediately after grout work is completed, scum and stains which have percolated through the masonry work shall be removed using a high pressure stream of water and a stiff bristled brush. Masonry surfaces shall not be cleaned, other than removing excess surface mortar, until mortar in joints has hardened. Masonry surfaces shall be left clean, free of mortar daubs, dirt, stain, and discoloration, including scum from cleaning operations, and with tight mortar joints throughout. Metal tools and metal brushes shall not be used for cleaning.

3.14.1 Concrete Masonry Unit and

Exposed concrete masonry unit and shall be dry-brushed at the end of each day's work and after any required pointing, using stiff-fiber bristled brushes.

3.15 BEARING PLATES

Bearing plates for beams, joists, and similar structural members shall be set to the proper line and elevation with damp-pack bedding mortar. Bedding mortar shall be as specified in SECTION 03300 CAST-IN-PLACE STRUCTURAL CONCRETE.

3.16 PROTECTION

Facing materials shall be protected against staining. Top of walls shall be covered with nonstaining waterproof covering or membrane when work is not in progress. Covering of the top of the unfinished walls shall continue until the wall is waterproofed with a complete roof or parapet system. Covering shall extend a minimum of 2 feet down on each side of the wall and shall be held securely in place. Before starting or resuming, top surface of masonry in place shall be cleaned of loose mortar and foreign material.

3.17 TEST REPORTS

3.17.1 Field Testing of Mortar

At least three specimens of mortar shall be taken each day. A layer of mortar 1/2 to 5/8 inch thick shall be spread on the masonry units and allowed to stand for one minute. The specimens shall then be prepared and tested for compressive strength in accordance with ASTM C 780.

3.17.2 Field Testing of Grout

Field sampling and testing of grout shall be in accordance with the applicable provisions of ASTM C 1019. A minimum of three specimens of grout per day shall be sampled and tested. Each specimen shall have a minimum ultimate compressive strength of 2000 psi at 28 days.

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SECTION 05120

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SECTION 05120

STRUCTURAL STEEL

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC FCD	(1995a) Quality Certification Program
AISC 810	(1989) Erection Bracing of Low-Rise Structural Steel Frames
AISC 316	(1989) ASD Manual of Steel Construction
AISC 317	(1992; Errata 1994) Connections
AISC 326	(1983) Detailing for Steel Construction
AISC 303	(2000) Steel Buildings and Bridges
AISC 348	(2000) Structural Joints Using ASTM A325 or A490 Bolts
AISC 335	(1989) Structural Steel Buildings Allowable Stress Design and Plastic Design
AISC S340	(1992) Metric Properties of Structural Shapes with Dimensions According to ASTM A6M

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 36/A 36M	(2001) Carbon Structural Steel
ASTM A 53/A 53M	(2002) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 307	(2002) Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
ASTM A 325	(2002) Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
ASTM A 500	(1999) Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes

ASTM A 563	(2000) Carbon and Alloy Steel Nuts
ASTM F 436	(1993) Hardened Steel Washers
ASTM F 844	(1998) Washers, Steel, Plain (Flat), Unhardened for General Use

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M	(2000) Structural Welding Code - Steel

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC SP 3	(1982; Rev. Sep 2000) Power Tool Cleaning
SSPC SP 6	(1994) Commercial Blast Cleaning
SSPC Paint 25	(1997) Oxide, Zinc Oxide, Raw Linseed Oil and Alkyd Primer (Without Lead and Chromate Pigments)
SSPC PA 1	(2000) Shop, Field, and Maintenance Painting

1.2 SYSTEM DESCRIPTION

Provide the structural steel system, including shop primer, complete and ready for use. Structural steel systems including design, materials, installation, workmanship, fabrication, assembly, erection, inspection, quality control, and testing shall be provided in accordance with AISC 316 and AISC 317 except as modified in this contract.

1.3 MODIFICATIONS TO REFERENCES

In AISC 316, AISC 317, AISC 335, AISC 303, AISC 348, and AISC S340, except as modified in this section, shall be considered a part of AISC 316 and AISC 317 and is referred to in this section as AISC 316 and AISC 317.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with SECTION 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Erection plan, including description of temporary supports; G-AE.

Fabrication drawings, including description of connections; G-AE.

SD-03 Product Data

Shop primer.

SD-06 Test Reports

Bolts, nuts, and washers.

Supply the certified manufacturer's mill reports which clearly show the applicable ASTM mechanical and chemical requirements together with the actual test results for the supplied fasteners.

SD-07 Certificates

Steel.

Bolts, nuts, and washers.

Shop primer.

Welding electrodes and rods.

Welding procedures and qualifications.

1.5 QUALITY ASSURANCE

1.5.1 Drawing Requirements

Submit fabrication drawings for approval prior to fabrication. Prepare in accordance with AISC 326, AISC 316 and AISC 317. Drawings shall not be reproductions of contract drawings. Include complete information for the fabrication and erection of the structure's components, including the location, type, and size of bolts, welds, member sizes and lengths, connection details, blocks, copes, and cuts. Use AWS standard welding symbols.

1.5.2 Certifications

1.5.2.1 Erection Plan

Submit for record purposes. Indicate the sequence of erection, temporary shoring and bracing, and a detailed sequence of welding, including each welding procedure required.

1.5.2.2 Welding Procedures and Qualifications

Prior to welding, submit certification for each welder stating the type of welding and positions qualified for, the code and procedure qualified under, date qualified, and the firm and individual certifying the qualification tests. If the qualification date of the welding operator is more than one-year old, the welding operator's qualification certificate shall be accompanied by a current certificate by the welder attesting to the fact that he has been engaged in welding since the date of certification, with no break in welding service greater than 6 months.

PART 2 PRODUCTS

2.1 STEEL

2.1.1 Structural Steel

ASTM A 36/A 36M.

2.1.2 Structural Steel Tubing

ASTM A 500, Grade B.

2.1.3 Steel Pipe

ASTM A 53/A 53M, Type E or S, Grade B, weight class as indicated.

2.2 BOLTS, NUTS, AND WASHERS

Provide the following unless indicated otherwise.

2.2.1 Structural Steel

2.2.1.1 Bolts

ASTM A 325, Type 1. The bolt heads and the nuts of the supplied fasteners must be marked with the manufacturer's identification mark, the strength grade and type specified by ASTM specifications.

2.2.1.2 Nuts

ASTM A 563, Grade and Style for applicable ASTM bolt standard recommended.

2.2.1.3 Washers

ASTM F 436 washers for ASTM A 325 bolts.

2.2.2 Foundation Anchorage

2.2.2.1 Bolts

ASTM A 307.

2.2.2.2 Nuts

ASTM A 563, Grade A, hex style.

2.2.2.3 Washers

ASTM F 844.

2.3 STRUCTURAL STEEL ACCESSORIES

2.3.1 Welding Electrodes and Rods

AWS D1.1/D1.1M.

2.3.2 Welded Shear Stud Connectors

AWS D1.1/D1.1M.

2.4 SHOP PRIMER

SSPC Paint 25, (alkyd primer). Primer shall conform to Federal, State, and local VOC regulations. If flash rusting occurs, re-clean the surface prior to application of primer.

2.5 FABRICATION

2.5.1 Markings

Prior to erection, members shall be identified by a painted erection mark. Connecting parts assembled in the shop for reaming holes in field connections shall be match marked with scratch and notch marks. Do not locate erection markings on areas to be welded. Do not locate match markings in areas that will decrease member strength or cause stress concentrations.

2.5.2 Shop Primer

Shop prime structural steel, except as modified herein, in accordance with SSPC PA 1. Do not prime steel surfaces embedded in concrete, or surfaces within 0.5 inch of the toe of the welds prior to welding (except surfaces on which metal decking is to be welded). Prior to assembly, prime surfaces which will be concealed or inaccessible after assembly. Do not apply primer in foggy or rainy weather; when the ambient temperature is below 45 degrees F or over 95 degrees F; or when the primer may be exposed to temperatures below 40 degrees F within 48 hours after application, unless approved otherwise by the Contracting Officer.

2.5.2.1 Cleaning

SSPC SP 6, except steel exposed in spaces above ceilings, attic spaces, furred spaces, and chases that will be hidden to view in finished construction may be cleaned to SSPC SP 3 when recommended by the shop primer manufacturer. Maintain steel surfaces free from rust, dirt, oil, grease, and other contaminants through final assembly.

2.5.2.2 Primer

Apply primer to a minimum dry film thickness of 2.0 mil except provide the Class B coating for slip critical joints in accordance with the coating manufacturer's recommendations. Repair damaged primed surfaces with an additional coat of primer.

PART 3 EXECUTION

3.1 FABRICATION

Fabrication shall be in accordance with the applicable provisions of AISC 316. Fabrication and assembly shall be done in the shop to the greatest extent possible. Structural steelwork, except surfaces of steel to be encased in concrete, surfaces to be field welded, shall be prepared for painting in accordance with endorsement "P" of AISC FCD.

3.2 INSTALLATION

3.3 ERECTION

a. Erection of structural steel, except as indicated in item b. below, shall be in accordance with the applicable provisions of AISC 316. Erection plan shall be reviewed, stamped and sealed by a licensed structural engineer.

b. For low-rise structural steel buildings (60 feet tall or less and a maximum of 2 stories), the erection plan shall conform to AISC 303

and the structure shall be erected in accordance withAISC 810.

Provide for drainage in structural steel. After final positioning of steel members, provide full bearing under base plates and bearing plates using damp-pack bedding mortar. Bedding mortar shall be as specified in SECTION 03300 CAST-IN-PLACE STRUCTURAL CONCRETE.

3.3.1 STORAGE

Material shall be stored out of contact with the ground in such manner and location as will minimize deterioration.

3.4 CONNECTIONS

Except as modified in this section, connections not detailed shall be designed in accordance with AISC 335. Build connections into existing work. Do not tighten anchor bolts set in concrete with impact torque wrenches. Punch, subpunch and ream, or drill bolt holes. Bolts, nuts, and washers shall be clean of dirt and rust, and lubricated immediately prior to installation.

3.4.1 High-Strength Bolts

ASTM A 325 bolts shall be fully tensioned to 70 percent of their minimum tensile strength. Bolts shall be installed in connection holes and initially brought to a snug tight fit. After the initial tightening procedure, bolts shall then be fully tensioned, progressing from the most rigid part of a connection to the free edges.

3.5 WELDING

AWS D1.1/D1.1M. Grind exposed welds smooth as indicated. Provide AWS D1.1/D1.1M qualified welders, welding operators, and tackers.

The contractor shall develop and submit the Welding Procedure Specifications (WPS) for all welding, including welding done using prequalified procedures. Prequalified procedures may be submitted for information only; however, procedures that are not prequalified shall be submitted for approval.

3.5.1 Removal of Temporary Welds, Run-Off Plates, and Backing Strips

Removal is not required.

3.6 SHOP PRIMER REPAIR

Repair shop primer in accordance with the paint manufacturer's recommendation for surfaces damaged by handling, transporting, cutting, welding, or bolting.

3.6.1 Field Priming

Field priming of steel exposed to the weather, or located in building areas without HVAC for control of relative humidity. After erection, the field bolt heads and nuts, field welds, and any abrasions in the shop coat shall be cleaned and primed with paint of the same quality as that used for the shop coat.

3.7 FIELD QUALITY CONTROL

Perform field tests, and provide labor, equipment, and incidentals required for testing, except that electric power for field tests will be furnished as set forth in Division 1. The Contracting Officer shall be notified in writing of defective welds, bolts, nuts, and washers within 7 working days of the date of weld inspection.

3.7.1 Welds

3.7.1.1 Visual Inspection

AWS D1.1/D1.1M. Furnish the services of AWS-certified welding inspectors for fabrication and erection inspection and testing and verification inspections. Welding inspectors shall visually inspect and mark welds, including fillet weld end returns.

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SECTION 05210

STEEL JOISTS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

STEEL JOIST INSTITUTE (SJI)

SJI Specs & Tables	(1994) Standard Specifications Load Tables and Weight Tables for Steel Joists and Joist Girders

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with SECTION 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Steel Joists; G-AE.

Detail drawings shall include fabrication and erection details, specifications for shop painting, and identification markings of joists.

SD-07 Certificates

Steel Joists; G-AE.

Certificates stating that the steel joists have been designed and manufactured in accordance with SJI Specs & Tables. Complete engineering design computations may be submitted in lieu of the certification.

1.3 GENERAL REQUIREMENTS

Steel joists are designated on the drawings in accordance with the standard designations of the Steel Joist Institute. Joists of other standard designations or joists with properties other than those shown may be substituted for the joists designated provided the structural properties are equal to or greater than those of the joists shown and provided all other specified requirements are met.

1.4 DELIVERY AND STORAGE

Materials shall be delivered to the site in undamaged condition and stored

off the ground in a well drained location, protected from damage, and easily accessible for inspection and handling.

PART 2 PRODUCTS

2.1 OPEN WEB STEEL JOISTS

Open web steel joists shall conform to SJI Specs & Tables, KCS-Series. Joists shall be designed for the shear and moment capacities as listed in the KCS Joist Load Table of the SJI Specs & Tables.

2.2 ACCESSORIES AND FITTINGS

Accessories and fittings, including end supports and bridging, shall be in accordance with the standard specifications under which the members were designed.

2.3 SHOP PAINTING

Joists and accessories shall be shop painted with a rust-inhibiting primer paint. For joists which will be finish painted under SECTION 09900 PAINTS AND COATINGS, the primer paint shall be limited to a primer which is compatible with the specified finish paint.

PART 3 EXECUTION

3.1 ERECTION

Installation of joists shall be in accordance with the standard specification under which the member was produced. Joists shall be handled in a manner to avoid damage. Damaged joists shall be removed from the site, except when field repair is approved and such repairs are satisfactorily made in accordance with the manufacturer's recommendations. Joists shall be accurately set, and end anchorage shall be in accordance with the contract drawings. Joist bridging shall be provided as required by SJI Specs and Tables. For spans over 40 ft through 60 ftone row of bridging nearest midspan shall be bolted diagonal bridging; for spans over 60 ft bolted diagonal bridging shall be used instead of welded horizontal bridging. Joist bridging and anchoring shall be secured in place prior to the application of any construction loads. Any temporary loads shall be distributed so that the carrying capacity of any joist is not exceeded. Loads shall not be applied to bridging during construction or in the completed work. Abraded, corroded, and field welded areas shall be cleaned and touched up with the same type of paint used in the shop painting.

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SECTION 05300

STEEL DECKING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI SG-973	(1996) Cold-Formed Steel Design Manual

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 611	(1997) Structural Steel (SS), Sheet, Carbon, Cold-Rolled
ASTM A 653/A 653M	(2001a) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

AMERICAN WELDING SOCIETY (AWS)

AWS D1.3	(1998) Structural Welding Code - Sheet Steel

STEEL DECK INSTITUTE (SDI)

SDI 30	(1995) Design Manual for Composite Decks, Form Decks, Roof Decks, and Cellular Metal Floor Deck with Electrical Distribution

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with SECTION 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Deck Units; G-AE
Accessories; G-AE
Attachments; G-AE
Holes and Openings; G-AE

Drawings shall include type, configuration, structural properties, location, and necessary details of deck units, accessories, and

supporting members; size and location of holes to be cut and reinforcement to be provided; location and sequence of welded and fastener connections; and the manufacturer's erection instructions.

SD-03 Product Data

Deck Units; G-AE.

Design computations for the structural properties of the deck units or SDI certification that the units are designed in accordance with SDI specifications.

Attachments; G-AO.

Prior to welding operations, copies of qualified procedures and lists of names and identification symbols of qualified welders and welding operators.

SD-07 Certificates

Deck Units.

Attachments.

Manufacturer's certificates attesting that the decking material meets the specified requirements. Manufacturer's certificate attesting that the operators are authorized to use the low-velocity piston tool.

1.3 DELIVERY, STORAGE, AND HANDLING

Deck units shall be delivered to the site in a dry and undamaged condition, stored off the ground with one end elevated, and stored under a weathertight covering permitting good air circulation. Finish of deck units shall be maintained at all times by using touch-up paint whenever necessary to prevent the formation of rust.

PART 2 PRODUCTS

2.1 DECK UNITS

Deck units shall conform to SDI 30. Panels of maximum possible lengths shall be used to minimize end laps. Deck units shall be fabricated in lengths to span 3 or more supports with flush, telescoped, or nested 2 inch laps at ends, and interlocking, or nested side laps, unless otherwise indicated. Deck with cross-sectional configuration differing from the units indicated may be used, provided that the properties of the proposed units, determined in accordance with AISI SG-973, are equal to or greater than the properties of the units indicated and that the material will fit the space provided without requiring revisions to adjacent materials or systems.

2.1.1 Composite Deck

Deck to receive concrete as a filler or for composite deck assembly shall conform to ASTM A 653/A 653M or ASTM A 611. Deck used as the tension reinforcing in composite deck shall be fabricated of the design thickness indicated on the contract drawings and shall be zinc-coated in conformance with ASTM A 653/A 653M, G60 coating class. Deck units used in composite

deck shall have adequate embossment to develop mechanical shear bond to provide composite action between the deck and the concrete.

2.2 TOUCH-UP PAINT

Touch-up paint for zinc-coated units shall be an approved galvanizing repair paint with a high-zinc dust content . Finish of deck units and accessories shall be maintained by using touch-up paint whenever necessary to prevent the formation of rust.

2.3 ADJUSTING PLATES

Adjusting plates or segments of deck units shall be provided in locations too narrow to accommodate full-size units. As far as practical, the plates shall be the same thickness and configuration as the deck units.

2.4 CLOSURE PLATES

2.4.1 Closure Plates for Composite Deck

The concrete shall be supported and retained at each floor level. Provide edge closures at all edges of the slab of sufficient strength and stiffness to support the wet concrete. Metal closures shall be provided for all openings in composite steel deck 1/4 inch and over, including but not limited to:

2.4.1.1 Cover Plates to Close Panels

Cover plates to close panel edge and end conditions and where panels change direction or abut. Butt joints in composite steel deck may receive a tape joint cover.

2.4.1.2 Column Closures to Close Openings

Column closures to close openings between steel deck and structural steel columns.

2.4.1.3 Sheet Metal

Where deck is cut for passage of pipes, ducts, columns, etc., and deck is to remain exposed, provide a neatly cut sheet metal collar to cover edges of deck. Do not cut deck until after installation of supplemental supports.

2.5 ACCESSORIES

The manufacturer's standard accessories shall be furnished as necessary to complete the deck installation. Metal accessories shall be of the same material as the deck and have minimum design thickness as follows: saddles, 0.0474 inch; welding washers, 0.0598 inch; cant strip, 0.0295 inch; other metal accessories, 0.0358 inch; unless otherwise indicated. Accessories shall include but not be limited to saddles, welding washers, cant strips, butt cover plates, underlapping sleeves, and ridge and valley plates.

PART 3 EXECUTION

3.1 ERECTION

Erection of deck and accessories shall be in accordance with SDI 30 and the approved detail drawings. Damaged deck and accessories including material

which is permanently stained or contaminated, with burned holes or deformed shall not be installed. The deck units shall be placed on secure supports, properly adjusted, and aligned at right angles to supports before being permanently secured in place. The deck shall not be filled with concrete, used for storage or as a working platform until the units have been secured in position. Loads shall be distributed by appropriate means to prevent damage during construction and to the completed assembly. The maximum uniform distributed storage load shall not exceed the design live load. There shall be no loads suspended from the composite concrete slab.

3.2 SHORING

Shoring of composite deck is not required.

3.3 ATTACHMENTS

All fasteners shall be installed in accordance with the manufacturer's recommended procedure, except as otherwise specified. The deck units shall be welded with nominal 5/8 inch diameter puddle welds to supports as indicated on the design drawings and in accordance with requirements of SDI 30. All welding of steel deck shall be in accordance with AWS D1.3 using methods and electrodes as recommended by the manufacturer of the steel deck being used. Welds shall be made only by operators previously qualified by tests prescribed in AWS D1.3 to perform the type of work required. Welding washers shall not be used at the connections of the deck to supports. Welding washers shall not be used at sidelaps. Holes and similar defects will not be acceptable. Deck ends shall be lapped 2 inches.

3.4 HOLES AND OPENINGS

All holes and openings required shall be coordinated with the drawings, specifications, and other trades. Holes and openings shall be drilled or cut, reinforced and framed as indicated on the drawings or described in the specifications and as required for rigidity and load capacity. Holes and openings less than 6 inches across require no reinforcement. Holes and openings 6 to 12 inches across shall be reinforced by 0.0474 inch thick steel sheet at least 12 inches wider and longer than the opening and be fastened to the steel deck at each corner of the sheet and at a maximum of 6 inches on center. Holes and openings larger than 12 inches shall be reinforced by steel angles installed perpendicular to the steel joists and supported by the adjacent steel joists. Steel angles shall be installed perpendicular to the deck ribs and shall be fastened to the angles perpendicular to the steel joists. Openings must not interfere with seismic members such as chords and drag struts.

-- End of Section --

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SECTION 05500

MISCELLANEOUS METAL

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ALUMINUM ASSOCIATION (AA)

AA DAF-45	(1997) Designation System for Aluminum Finishes

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A14.3	(1992) Ladders - Fixed - Safety Requirements

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 36/A 36M	(2001) Carbon Structural Steel
ASTM A 53/A 53M	(2002) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 123/A 123M	(2002) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 325	(2002) Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
ASTM A 500	(1999) Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM E 814	(2000) Fire Tests of Through-Penetration Fire Stops

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1	(2000) Structural Welding Code - Steel

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

CID A-A-344	(Rev B) Lacquer, Clear Gloss, Exterior, Interior

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM MBG 531	(1994) Metal Bar Grating Manual

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 10	(1998; Errata 10-98-1) Portable Fire Extinguishers

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with SECTION 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Miscellaneous Metal Items; G-AE.

Detail drawings indicating material thickness, type, grade, and class; dimensions; and construction details. Drawings shall include catalog cuts, erection details, manufacturer's descriptive data and installation instructions, and templates. Detail drawings for the following items: Steel Bar Grating and Supports, Handrails, Ladders, Steel Stairs, Floor Bridge, Access Doors and Miscellaneous Shapes

SD-04 Samples

Miscellaneous Metal Items.

Samples of the following items: Samples shall be full size, taken from manufacturer's stock, and shall be complete as required for installation in the structure. Samples may be installed in the work, provided each sample is clearly identified and its location recorded.

1.3 GENERAL REQUIREMENTS

The Contractor shall verify all measurements and shall take all field measurements necessary before fabrication. Welding to or on structural steel shall be in accordance with AWS D1.1. Items specified to be galvanized, when practicable and not indicated otherwise, shall be hot-dip galvanized after fabrication. Galvanizing shall be in accordance with ASTM A 123/A 123M Exposed fastenings shall be compatible materials, shall generally match in color and finish, and shall harmonize with the material to which fastenings are applied. Materials and parts necessary to complete each item, even though such work is not definitely shown or specified, shall be included. Poor matching of holes for fasteners shall be cause for rejection. Fastenings shall be concealed where practicable. Thickness of metal and details of assembly and supports shall provide strength and stiffness. Joints exposed to the weather shall be formed to exclude water.

1.4 DISSIMILAR MATERIALS

Where dissimilar metals are in contact, or where aluminum is in contact with concrete, mortar, masonry, wet or pressure-treated wood, or absorptive materials subject to wetting, the surfaces shall be protected with a coat of bituminous paint or asphalt varnish.

1.5 WORKMANSHIP

Miscellaneous metalwork shall be well formed to shape and size, with sharp lines and angles and true curves. Drilling and punching shall produce clean true lines and surfaces. Welding shall be continuous along the entire area of contact except where tack welding is permitted. Exposed connections of work in place shall not be tack welded. Exposed welds shall be ground smooth. Exposed surfaces of work in place shall have a smooth finish, and unless otherwise approved, exposed riveting shall be flush. Where tight fits are required, joints shall be milled. Corner joints shall be coped or mitered, well formed, and in true alignment. Work shall be accurately set to established lines and elevations and securely fastened in place. Installation shall be in accordance with manufacturer's installation instructions and approved drawings, cuts, and details.

1.6 ANCHORAGE

Anchorage shall be provided where necessary for fastening miscellaneous metal items securely in place. Anchorage not otherwise specified or indicated shall include slotted inserts made to engage with the anchors, expansion shields, and power-driven fasteners when approved for concrete; toggle bolts and through bolts for masonry; machine and carriage bolts for steel; and lag bolts and screws for wood.

1.7 ALUMINUM FINISHES

Unless otherwise specified, aluminum items shall have standard mill finish. The thickness of the coating shall be not less than that specified for protective and decorative type finishes for items used in interior locations or architectural Class I type finish for items used in exterior locations in AA DAF-45. Items to be anodized shall receive a polished satin finish. Aluminum surfaces to be in contact with plaster or concrete during construction shall be protected with a field coat conforming to CID A-A-344.

1.8 SHOP PAINTING

Surfaces of ferrous metal except galvanized surfaces, shall be cleaned and shop coated with the manufacturer's standard protective coating unless otherwise specified. Surfaces of items to be embedded in concrete shall not be painted. Items to be finish painted shall be prepared according to manufacturer's recommendations or as specified.

PART 2 PRODUCTS

2.1 PIPE GUARDS

Pipe guards shall be heavy duty steel pipe conforming to ASTM A 53/A 53M, Type E or S, weight STD, black finish.

2.2 FLOOR GRATINGS AND FRAMES

Carbon steel grating shall be fabricated in accordance with NAAMM MBG 531. Edges shall be banded. Banding at supports shall be with bars 1/4 inch less in height than bearing bars for grating sizes above 3/4 inch. Banding at penetrations and cut-outs shall be with full depth bars. Banding at cut-outs and penetrations shall be welded to every bearing bar. Banding bars shall be flush with the top of bearing grating. Grating shall be anchored to supports with removable saddle clips. Support frames and

anchorage shall be as indicated. Floor gratings and frames shall be galvanized after fabrication.

2.3 HANDRAILS

Handrails shall be designed to resist a concentrated load of 200 pounds in any direction at any point of the top of the rail or 20 pounds per foot applied horizontally to top of the rail, whichever is more severe.

2.3.1 Steel Handrails, Including Carbon Steel Inserts

Steel handrails, shall be steel pipe conforming to ASTM A 53/A 53M. Steel railings shall be 1-1/2 inch nominal size. Railings shall be hot-dip galvanized. Pipe collars shall be hot-dip galvanized steel.

Joint posts, rail, and corners shall be fabricated by one of the following methods:

1. Mitered and welded joints by fitting post to top rail and intermediate rail to post, mitering corners, groove welding joints, and grinding smooth. Railing splices shall be butted and reinforced by a tight fitting interior sleeve not less than 6 inches long.

2. Railings may be bent at corners in lieu of jointing, provided bends are made in suitable jigs and the pipe is not crushed.

2.4 LADDERS

2.4.1 Ladders

Ladders shall be galvanized steel, fixed rail type in accordance with ANSI A14.3. Rungs shall be 3/4-inch steel rods, fitted into punched holes in rails, welded, and ground smooth. All splices and connections shall have a smooth transition with original members without projections that are sharp or more extension than required for joint strength. Rails shall be fitted with brackets at the spacing indicated for anchorage to the structure.

Ship ladders shall have serrated steps no less than 1-1/4 inches high with tread spacing at 1 foot apart. Ladder shall have an angle rise of 75 degrees. Handrails shall be not less than 1-1/2-inch in diameter with safety end caps.

2.5 MISCELLANEOUS

Miscellaneous plates and shapes for items that do not form a part of the structural steel framework, such as lintels, sill angles, miscellaneous mountings, and frames, shall be provided to complete the work.

2.5.1 Carbon Grade Steel

Carbon grade steel shall conform to ASTM A 36/A 36M

2.5.2 Structural Tubing

Structural tubing shall conform to ASTM A 500, Grade B.

2.5.3 High-Strength Bolts

High-strength bolts shall conform to ASTM A 325, unless otherwise indicated. Nuts and washers for high-strength bolts shall be as specified in ASTM A 325.

2.6 FIRE EXTINGUISHER CABINETS

Cabinets to be located in fire-rated walls shall be fire-rated type, fabricated in accordance with ASTM E 814, and shall be listed by an approved testing agency for 1- and 2-hour combustible and non-combustible wall systems. The testing agency's seal shall be affixed to each fire-rated cabinet. Cabinets shall be of the recessed type suitable for 10 pound extinguishers. Box and trim shall be of heavy gage rolled steel. Door shall be a rigid frame with full length piano type hinge and double strength (DSA) glass panel. Door and panel shall have the manufacturer's standard white baked enamel finish inside and out.

2.7 FLOOR BRIDGE

Provide prefabricated floor bridge where indicated in Pump Room over 2 inches drain line to product recovery tank. Contractor shall verify height of top of drain line and provide 1/2 inch clearance (minimum) over pipe. Floor bridge shall be 48 inches wide and shall have a capacity of 2000 lbs. Plates shall have a nonskid safety tread surfaces and edges shall be beveled. Floor bridge shall be constructed of aluminum or steel at the option of the contractor. Steel floor bridge shall be galvanized after fabrication. Aluminum surfaces shall have a standard mill finish.

2.8 PRODUCT RECOVERY TANK ACCESS DOOR AND FRAME

Product Recovery Tank access door and frame shall be of aluminum construction. The cover shall be of the single leaf type as indicated and shall be designed to withstand a live load of 150 pounds per square foot (minimum) and a maximum deflection of 1/150th of the span. The frame shall be constructed of 1/4-inch thick extruded aluminum with anchorage as recommended by the cover manufacturer. The cover shall be of 1/4-inch thick aluminum reinforced with aluminum stiffeners. The door shall open to 90 degrees and shall be equipped with heavy duty aluminum hinges, stainless steel pins, compensating springs, hold open arm and snap lock with release handle on the underside and removable key handle for releasing lock from above. Number and size of compression springs shall be designed to provide smooth, easy and controlled cover operation throughout the entire arc of opening and to act as a check in retarding downward motion of the cover when closing. Doors shall drain to the channel frame to prevent rain water from entering the pit. A 1-1/2 inch drainage coupling shall be provided to allow drainage from the channel frame onto the surrounding surfaces. Pit and vault doors shall be a product of a company regularly engaged in the manufacture of such doors.

2.9 STEEL STAIRS

Steel stairs shall be complete with structural or formed channel stringers, grating treads, handrails, and necessary bolts and other fastenings as indicated. Structural steel shall conform to ASTM A 36/A 36M. Stairs and accessories shall be galvanized. Gratings for treads and landings shall conform to NAAMM MBG 531. Grating treads shall have slip-resistant nosings.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

All items shall be installed at the locations shown and according to the manufacturer's recommendations. Items listed below require additional procedures as specified.

3.2 INSTALLATION OF PIPE GUARDS

Pipe guards shall be set vertically in concrete piers. Piers shall be constructed of, and the hollow cores of the pipe filled with, concrete specified in SECTION 03300 CAST-IN-PLACE STRUCTURAL CONCRETE.

3.3 ATTACHMENT OF HANDRAILS

Toeboards and brackets shall be installed where indicated. Splices, where required, shall be made at expansion joints. Removable sections shall be installed as indicated.

3.3.1 Installation of Steel Handrails

Installation shall be by means of bolting base plates to concrete and/or masonry with expansion anchors in concrete and/or masonry as indicated on the drawings.

3.4 INSTALLATION OF FIRE EXTINGUISHER CABINETS

Metal fire extinguisher cabinets shall be furnished and installed in accordance with NFPA 10 where shown on the drawings or specified.

3.5 TOUCH-UP PAINT

After installation, field bolt heads and nuts, field welds, and any abrasions in finishes shall be cleaned and primed with paint to the same quality as that used for shop coating. Touch-up paint for zinc-coated items shall be an approved galvanizing repair paint with a high zinc dust content.

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DIVISION 07 - THERMAL AND MOISTURE PROTECTION

SECTION 07416

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SECTION 07416

STRUCTURAL STANDING SEAM METAL ROOF (SSSMR) SYSTEM

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC 335	(1989) Structural Steel Buildings Allowable Stress Design and Plastic Design

AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI SG-973	(1996) Cold-Formed Steel Design Manual

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 463/A 463M	(2000) Steel Sheet, Aluminum-Coated, by the Hot-Dip Process
ASTM A 653/A 653M	(2001a) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A 792/A 792M	(2002) Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process
ASTM C 1177/C 1177M	(1999) Glass Mat Gypsum Substrate for Use as Sheathing
ASTM C 1289	(1998) Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
ASTM C 518	(1998) Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
ASTM C 991	(1998) Flexible Glass Fiber Insulation for Pre-Engineered Metal Buildings
ASTM D 1308	(1987; R 1998) Effect of Household Chemicals on Clear and Pigmented Organic Finishes
ASTM D 1654	(1992; R 2000) Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
ASTM D 2244	(1995) Calculation of Color Differences

	from Instrumentally Measured Color Coordinates
ASTM D 2247	(1999) Testing Water Resistance of Coatings in 100% Relative Humidity
ASTM D 2794	(1993; R 1999el) Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
ASTM D 3359	(1997) Measuring Adhesion by Tape Test
ASTM D 4214	(1998) Evaluating the Degree of Chalking of Exterior Paint Films
ASTM D 4397	(1996) Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications
ASTM D 522	(1993a) Mandrel Bend Test of Attached Organic Coatings
ASTM D 523	(1989; R 1999) Specular Gloss
ASTM D 5894	(1996) Standard Practice for Cyclic Salt Fog/UV Exposure of Painted Metal, (Alternating Exposures in a Fog/Dry Cabinet and a UV/Condensation Cabinet)
ASTM D 610	(1995) Evaluating Degree of Rusting on Painted Steel Surfaces
ASTM D 714	(1987; R 1994el) Evaluating Degree of Blistering of Paints
ASTM D 968	(1993) Abrasion Resistance of Organic Coatings by Falling Abrasive
ASTM E 1592	(1998) Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference
ASTM E 84	(2001) Surface Burning Characteristics of Building Materials
ASTM E 96	(2000) Water Vapor Transmission of Materials
ASTM G 154	(2000ael) Standard Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7	(1998) Minimum Design Loads for Buildings and Other Structures

1.2 GENERAL REQUIREMENTS

The Contractor shall furnish a commercially available roofing system which satisfies all requirements contained herein and has been verified by load testing and independent design analyses to meet the specified design requirements.

1.2.1 Structural Standing Seam Metal Roof (SSSMR) System

The SSSMR system covered under this specification shall include the entire roofing system; the standing seam metal roof panels, fasteners, connectors, roof securement components, and assemblies tested and approved in accordance with ASTM E 1592. In addition, the system shall consist of panel finishes, slip sheet, insulation, vapor retarder, all accessories, components, and trim and all connections with roof panels. This includes roof penetration items such as vents, curbs, eaves, ridge, rake, gable, wall, or other roof system flashings installed and any other components specified within this contract to provide a weathertight roof system.

1.2.2 Manufacturer

The SSSMR system shall be the product of a manufacturer who has been in the practice of manufacturing and designing SSSMR systems for a period of not less than 3 years and has been involved in at least five projects similar in size and complexity to this project.

1.2.3 Installer

The installer shall be certified by the SSSMR system manufacturer to have experience in installing at least three projects that are of comparable size, scope and complexity as this project for the particular roof system furnished. The installer may be either employed by the manufacturer or be an independent installer.

1.3 DESIGN REQUIREMENTS

The design of the SSSMR system shall be provided by the Contractor as a complete system. Members and connections not indicated on the drawings shall be designed by the Contractor. Roof panels, components, transitions, accessories, and assemblies shall be supplied by the same roofing system manufacturer.

1.3.1 Design Criteria

Design criteria shall be in accordance with ASCE 7.

1.3.2 Dead Loads

The dead load shall be the weight of the SSSMR system. Collateral loads such as sprinklers, mechanical and electrical systems, and ceilings shall not be attached to the panels.

1.3.3 Live Loads

1.3.3.1 Concentrated Loads

The panels and anchor clips shall be capable of supporting a 300 pound concentrated load. The concentrated load shall be applied at the panel midspan and will be resisted by a single standing seam metal roof panel

assumed to be acting as a beam. The undeformed shape of the panel shall be used to determine the section properties.

1.3.4 Roof Snow Loads

The design roof snow loads shall be determined and applied in accordance with ASCE 7 using a ground snow load of 70 psf, a thermal factor of 1.1 for the Pumphouse and 1.2 for the Fill Stand, and an importance factor of 1.2. Drifting, sliding, and unbalanced snow loads shall be considered.

1.3.5 Wind Loads

The design wind uplift pressure for the roof system shall be as shown on the contract drawings. The design uplift force for each connection assembly shall be that pressure given for the area under consideration, multiplied by the tributary load area of the connection assembly. The safety factor listed below shall be applied to the design force and compared against the ultimate capacity. Prying shall be considered when figuring fastener design loads.

a. Single fastener in each connection.....3.0

b. Two or more fasteners in each connection...2.25

1.3.6 Thermal Loads

Roof panels shall be free to move in response to the expansion and contraction forces resulting from a total temperature range of 220 degrees F during the life of the structure.

1.3.7 Framing Members Supporting the SSSMR System

Any additions/revisions to framing members supporting the SSSMR system to accommodate the manufacturer/fabricator's design shall be the Contractor's responsibility and shall be submitted for review and approval. New or revised framing members and their connections shall be designed in accordance with AISC 335orAISI SG-973 . Maximum deflection under applied live load, snow, or wind load shall not exceed 1/180 of the span length.

1.3.8 Roof Panels Design

Steel panels shall be designed in accordance with AISI SG-973. The structural section properties used in the design of the panels shall be determined using the unloaded shape of the roof panels. The calculated panel deflection from concentrated loads shall not exceed 1/180 of the span length. The calculated panel deflection under applied live load, snow, or wind load shall not exceed 1/180 times the span length. Deflections shall be based on panels being continuous across three or more supports. Deflection shall be calculated and measured along the major ribs of the panels.

1.3.9 Accessories and Their Fasteners

Accessories and their fasteners shall be capable of resisting the specified design wind uplift forces and shall allow for thermal movement of the roof panel system. Exposed fasteners shall not restrict free movement of the roof panel system resulting from thermal forces. There shall be a minimum of two fasteners per clip. Single fasteners with a minimum diameter of 3/8 inch will be allowed when the supporting structural members are prepunched

or predrilled.

1.4 PERFORMANCE REQUIREMENTS

The SSSMR shall be tested for wind uplift resistance in accordance with ASTM E 1592; SSSMR systems previously tested and approved by the Corps of Engineers' STANDARD TEST METHOD FOR STRUCTURAL PERFORMANCE OF SSMRS BY UNIFORM STATIC AIR PRESSURE DIFFERENCE may be acceptable. Two tests shall be performed. Test 1 shall simulate the edge condition with one end having crosswise restraint and other end free of crosswise restraint. The maximum span length for the edge condition shall be 30 inches. Test 2 shall simulate the interior condition with both ends free of crosswise restraint. The maximum span length for the interior condition shall be 5.0 feet. External reinforcement, such as clamps on the ribs, shall not be installed to improve uplift resistance. Bolts through seams shall not be installed.

1.5 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with SECTION 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Structural Standing Seam Metal Roof System; G-AE.

Metal roofing drawings and specifications and erection drawings; shop coating and finishing specifications; and other data as necessary to clearly describe design, materials, sizes, layouts, standing seam configuration, construction details, provisions for thermal movement, line of panel fixity, fastener sizes and spacings, sealants and erection procedures. Drawings shall reflect the intent of the architectural detailing using the manufacturer's proprietary products and fabricated items as required. The SSSMR system shop drawings shall be provided by the metal roofing manufacturer.

SD-03 Product Data

Design Analysis; G-AE,.

Design analysis signed by a Registered Professional Engineer employed by the SSSMR manufacturer. The design analysis shall include a list of the design loads, and complete calculations for the support system (when provided by the Contractor), roofing system and its components; valley designs, gutter/downspout calculations, screw pullout test results, and shall indicate how expected thermal movements are accommodated.

Qualifications of the Manufacturer; G-AO.

Qualifications of the manufacturer and installer.

SD-04 Samples

Roof Panels; G-AE.

One piece of each type to be used, 9 inches long, full width.

Factory Color Finish; G-AE.

Three 3 by 5 inches samples of each type and color.

Insulation; G-AE.

One piece, 12 by 12 inches, of each type and thickness to be used, with a label indicating the rated permeance (if faced) and R-values. The flame spread, and smoke developed rating shall be shown on the label or provided in a letter of certification.

EPDM Rubber Boots.

One piece of each type.

SD-06 Test Reports

Test Report for Uplift Resistance of the SSSMR; G-AE.

The report shall include the following information:

a. Details of the SSSMR system showing the roof panel cross-section with dimensions and thickness.

b. Details of the anchor clip, dimensions, and thickness.

c. Type of fasteners, size, and the number required for each connection.

d. Purlins/subpurlins size and spacing used in the test.

e. Description of the seaming operation including equipment used.

f. Maximum allowable uplift pressures. These pressures are determined from the ultimate load divided by a factor of safety equal to 1.65.

g. Any additional information required to identify the SSSMR system tested.

h. Signature and seal of an independent registered engineer who witnessed the test.

SD-07 Certificates

Structural Standing Seam Metal Roof System; G-AO.

a. Certification that the actual thickness of uncoated sheets used in SSSMRS components including roofing panels, subpurlins, and concealed anchor clips complies with specified requirements.

b. Certification that materials used in the installation are mill certified.

c. Previous certification of SSSMR system tested under the

Corps of Engineers' Standard Test Method in lieu of ASTM E 1592 testing.

d. Certification that the sheets to be furnished are produced under a continuing quality control program and that a representative sample consisting of not less than three pieces has been tested and has met the quality standards specified for factory color finish.

e. Certification of installer. Installer certification shall be furnished.

f. Warranty certificate. At the completion of the project the Contractor shall furnish signed copies of the 5-year Warranty for Structural Standing Seam Metal Roof (SSSMR) System, a sample copy of which is attached to this section, and the 20-year Manufacturer's Material Warranties.

Insulation;

Certificate attesting that the polyisocyanurate insulation furnished for the project contains recovered material, and showing an estimated percent of such recovered material.

1.6 DELIVERY AND STORAGE

Materials shall be delivered to the site in a dry and undamaged condition and stored out of contact with the ground. Materials shall be covered with weathertight coverings and kept dry. Storage conditions shall provide good air circulation and protection from surface staining.

1.7 WARRANTIES

The SSSMR system shall be warranted as outlined below. Any emergency temporary repairs conducted by the owner shall not negate the warranties.

1.7.1 Contractor's Weathertightness Warranty

The SSSMR system shall be warranted by the Contractor on a no penal sum basis for a period of five years against material and workmanship deficiencies; system deterioration caused by exposure to the elements and/or inadequate resistance to specified service design loads, water leaks, and wind uplift damage. The SSSMR system covered under this warranty shall include the entire roofing system including, but not limited to, the standing seam metal roof panels, fasteners, connectors, roof securement components, and assemblies tested and approved in accordance with ASTM E 1592. In addition, the system shall consist of panel finishes, slip sheet, insulation, vapor retarder, all accessories, components, and trim and all connections with roof panels. This includes roof penetration items such as vents, curbs, and skylights; interior or exterior gutters and downspouts; eaves, ridge, hip, valley, rake, gable, wall, or other roof system flashings installed and any other components specified within this contract to provide a weathertight roof system; and items specified in other sections of these specifications that are part of the SSSMR system. All material and workmanship deficiencies, system deterioration caused by exposure to the elements and/or inadequate resistance to specified design loads, water leaks and wind uplift damage shall be repaired as approved by the Contracting Officer. See the attached Contractor's required warranty for issue resolution of warrantable defects. This warranty shall warrant

and cover the entire cost of repair or replacement, including all material, labor, and related markups. The Contractor shall supplement this warranty with written warranties from the installer and system manufacturer, which shall be submitted along with Contractor's warranty; however, the Contractor shall be ultimately responsible for this warranty. The Contractor's written warranty shall be as outlined in attached WARRANTY FOR STRUCTURAL STANDING SEAM METAL ROOF (SSSMR) SYSTEM, and shall start upon final acceptance of the facility. It is required that the Contractor provide a separate bond in an amount equal to the installed total roofing system cost in favor of the owner (Government) covering the Contractor's warranty responsibilities effective throughout the five year Contractor's warranty period for the entire SSSMR system as outlined above.

1.7.2 Manufacturer's Material Warranties.

The Contractor shall furnish, in writing, the following manufacturer's material warranties which cover all SSSMR system components such as roof panels, anchor clips and fasteners, flashing, accessories, and trim, fabricated from coil material:

a. A manufacturer's 20 year material warranty warranting that the aluminum, zinc-coated steel, aluminum-zinc alloy coated steel or aluminum-coated steel as specified herein will not rupture, structurally fail, fracture, deteriorate, or become perforated under normal design atmospheric conditions and service design loads. Liability under this warranty shall be limited exclusively to the cost of either repairing or replacing nonconforming, ruptured, perforated, or structurally failed coil material.

b. A manufacturer's 20 year exterior material finish warranty on the factory colored finish warranting that the finish, under normal atmospheric conditions at the site, will not crack, peel, or delaminate; chalk in excess of a numerical rating of eight, as determined by ASTM D 4214 test procedures; or change color in excess of five CIE or Hunter Lab color difference (delta E) units in accordance with ASTM D 2244. Liability under this warranty is exclusively limited to refinishing with an air-drying version of the specified finish or replacing the defective coated material.

PART 2 PRODUCTS

2.1 ROOF PANELS

Panels shall be steel and shall have a factory color. Length of sheets shall be sufficient to cover the entire length of any unbroken roof slope for slope lengths that do not exceed 30 feet. When length of run exceeds 30 feet and panel laps are provided, each sheet in the run shall extend over three or more supports. Sheets longer than 100 feet may be furnished if approved by the Contracting Officer. Width of sheets shall provide not more than 24 inches of coverage in place. SSSMR system with roofing panels greater than 12 inches in width shall have standing seams rolled during installation by an electrically driven seaming machine. Height of standing seams shall be not less than 2-1/2 inches for rolled seam.

2.1.1 Steel Panels

Steel panels shall be zinc-coated steel conforming to ASTM A 653/A 653M; aluminum-zinc alloy coated steel conforming to ASTM A 792/A 792M, AZ 55 or50 coating; or aluminum-coated steel conforming to ASTM A 463/A 463M,

Type 2, coating designation T2 65. Zinc, zinc-aluminum alloy or aluminum coated panels shall be 0.023 inch thick minimum. Panels shall be within 95 percent of reported tested thickness as noted in wind uplift resistance testing required in paragraph PERFORMANCE REQUIREMENTS. Prior to shipment, mill finish panels shall be treated with a passivating chemical to inhibit the formation of oxide corrosion products. Panels that have become wet during shipment and have started to oxidize shall be rejected.

2.2 CONCEALED ANCHOR CLIPS

Concealed anchor clips shall be the same as the tested roofing system. Clip bases shall have factory punched or drilled holes for attachment. Clips shall be made from multiple pieces with the allowance for the total thermal movement required to take place within the clip. Single piece clips may be acceptable when the manufacturer can substantiate that the system can accommodate the thermal cyclic movement under sustained live or snow loads.

2.3 ACCESSORIES

Flashing, trim, metal closure strips, caps and similar metal accessories shall be the manufacturer's standard products. Exposed metal accessories shall be finished to match the panels furnished. Molded closure strips shall be bituminous-saturated fiber, closed-cell or solid-cell synthetic rubber or neoprene, or polyvinyl chloride premolded to match configuration of the panels and shall not absorb or retain water.Die cast metal closures shall be installed with double bead tape sealant and fasteners that stitch the panel to a 16 gage preformed backer plate to ensure a positive compression of the tape sealant. The use of a continuous angle butted to the panel ends to form a closure will not be allowed.

2.4 FASTENERS

Fasteners for steel roof panels shall be zinc-coated steel, aluminum, corrosion resisting steel, or nylon capped steel, type and size specified below or as otherwise approved for the applicable requirements. Fasteners for aluminum roof panels shall be aluminum or corrosion resisting steel. Fasteners for structural connections shall provide both tensile and shear ultimate strengths of not less than 750 pounds per fastener. Fasteners for accessories shall be the manufacturer's standard. Exposed roof fasteners shall be sealed or have sealed washers on the exterior side of the roof to waterproof the fastener penetration. Washer material shall be compatible with the roofing; have a minimum diameter of 3/8 inch for structural connections; and gasketed portion of fasteners or washers shall be neoprene or other equally durable elastomeric material approximately 1/8 inch thick. Exposed fasteners for factory color finished panels shall be factory finished to match the color of the panels.

2.4.1 Screws

Screws for attaching anchor devices shall be not less than No. 14. Actual screw pull out test results shall be performed for the actual material gage and yield strength of the structural purlins or subpurlins to which the clip is to be anchored/attached. Other screws shall be as recommended by the manufacturer to meet the strength design requirements of the panels.

2.4.2 Bolts

Bolts shall be not less than 1/4 inch diameter, shouldered or plain shank

as required, with locking washers and nuts.

2.4.3 Structural Blind Fasteners

Blind screw-type expandable fasteners shall be not less than 1/4 inch diameter. Blind (pop) rivets shall be not less than 9/32 inch minimum diameter.

2.5 SUBPURLINS

Cold formed supporting structural members/subpurlins shall have a minimum thickness of 0.059 inches and a minimum tensile yield strength of 50000 psi. Hot rolled structural members shall have a minimum thickness of 0.25 inches and a minimum tensile yield strength of 36000 psi. Subpurlins shall be galvanized or shop painted.

2.6 FACTORY COLOR FINISH

Panels shall have a factory applied polyvinylidene fluoride finish on the exposed side. The exterior finish shall consist of a baked-on topcoat with an appropriate prime coat. Color shall match the color indicated on the drawings. The exterior coating shall be a nominal 2 mil thickness consisting of a topcoat of not less than 0.7 mil dry film thickness and the paint manufacturer's recommended primer of not less than 1.0 mil thickness. The interior color finish shall consist of the same coating and dry film thickness as the exterior. The exterior color finish shall meet the test requirements specified below.

2.6.1 Salt Spray Test

A sample of the sheets shall withstand a cyclic corrosion test for a minimum of 2016 hours in accordance with ASTM D 5894, including the scribe requirement in the test. Immediately upon removal of the panel from the test, the coating shall receive a rating of not less than 10, no blistering, as determined by ASTM D 714; 10, no rusting, as determined by ASTM D 610; and a rating of 6, over 2 1/16 to 1/8 inch failure at scribe, as determined by ASTM D 1654.

2.6.2 Formability Test

When subjected to testing in accordance with ASTM D 522 Method B, 1/8 inch diameter mandrel, the coating film shall show no evidence of cracking to the naked eye.

2.6.3 Accelerated Weathering, Chalking Resistance and Color Change

A sample of the sheets shall be tested in accordance with ASTM G 154, test condition UVA-340 lamp, 4h UV at 60 degrees C followed by 4h CON at 50 degrees C. The coating shall withstand the weathering test without cracking, peeling, blistering, loss of adhesion of the protective coating, or corrosion of the base metal. Protective coating with an adhesion rating less than 4B when tested in accordance with ASTM D 3359, Test Method B, shall be considered as an area indicating loss of adhesion. Following the accelerated weathering test, the coating shall have a chalk rating not less than No. 8 in accordance with ASTM D 4214 test procedures, and the color change shall not exceed 5 CIE or Hunter Lab color difference (delta E) units in accordance with ASTM D 2244. For sheets required to have a low gloss finish, the chalk rating shall be not less than No. 6 and the color difference shall be not greater than 7 units.

2.6.4 Humidity Test

When subjected to a humidity cabinet test in accordance with ASTM D 2247 for 1000 hours, a scored panel shall show no signs of blistering, cracking, creepage or corrosion.

2.6.5 Impact Resistance

Factory-painted sheet shall withstand direct and reverse impact in accordance with ASTM D 2794 0.500 inch diameter hemispherical head indenter, equal to 1.5 times the metal thickness in mils, expressed in inch-pounds, with no cracking.

2.6.6 Abrasion Resistance Test

When subjected to the falling sand test in accordance with ASTM D 968, Method A, the coating system shall withstand a minimum of 80 liters of sand before the appearance of the base metal. The term "appearance of base metal" refers to the metallic coating on steel or the aluminum base metal.

2.6.7 Specular Gloss

Finished roof surfaces shall have a specular gloss value of 10 or less at an angle of 85 degrees when measured in accordance with ASTM D 523.

2.6.8 Pollution Resistance

Coating shall show no visual effects when covered spot tested in a 10 percent hydrochloric acid solution for 24 hours in accordance with ASTM D 1308.

2.7 INSULATION

Thermal resistance of insulation shall be not less than the R-values shown on the contract drawings. R-values shall be determined at a mean temperature of 75 degrees F in accordance with ASTM C 518. Insulation shall be a standard product with the insulation manufacturer, factory marked or identified with insulation manufacturer's name or trademark and R-value. Identification shall be on individual pieces or individual packages. . Insulation shall have a flame spread not in excess of 25 and a smoke developed rating not in excess of 50 when tested in accordance with ASTM E 84. The stated R-value of the insulation shall be certified by an independent Registered Professional Engineer if tests are conducted in the insulation manufacturer's laboratory. Contractor shall comply with EPA requirements in accordance with SECTION 01670 RECYCLED / RECOVERED MATERIALS.

2.7.1 Polyisocyanurate Rigid Board Insulation for Use Above a Roof Deck

Polyisocyanurate insulation shall conform to ASTM C 1289, Type II, (having a minimum recovered material content of 9 percent by weight of core material in the polyisocyanurate portion). For impermeable faced polyisocyanurate (Ex: aluminum foil), the maximum design R-value per 1 inch of insulation used shall be 7.2. Facings shall be non-asphaltic, glass fiber reinforced.

2.7.2 Blanket Insulation

Blanket insulation shall conform to ASTM C 991.

2.7.3 Glass Mat Gypsum Roof Board

Glass mat gypsum roof board for use above the deck or insulation for thermal protection shall have a flame spread - 0, smoke developed - 0, shall be water resistant and have a compressive strength of 500 psi. Glass mat gypsum roof board shall conform to ASTM C 1177/C 1177M.

2.8 SEALANT

Sealants shall be elastomeric type containing no oil or asphalt. Exposed sealant shall be colored to match the applicable building color and shall cure to a rubberlike consistency. Sealant placed in the roof panel standing seam ribs shall be provided in accordance with the manufacturer's recommendations.

2.9 GASKETS AND INSULATING COMPOUNDS

Gaskets and insulating compounds shall be nonabsorptive and suitable for insulating contact points of incompatible materials. Insulating compounds shall be nonrunning after drying.

2.10 VAPOR RETARDER

2.10.1 Vapor Retarders as Integral Facing

Insulation facing shall have a permeability of 0.02 perm or less when tested in accordance with ASTM E 96. Facing shall be white reinforced polypropylene kraft laminate (PSK). Facings and finishes shall be factory applied.

2.10.2 Vapor Retarders Separate from Insulation

Vapor retarder material shall be polyethylene sheeting conforming to ASTM D 4397. A single ply of 10 mil polyethylene sheet; or, at the Contractor's option, a double ply of 6 mil polyethylene sheet shall be used. A fully compatible polyethylene tape which has equal or better water vapor control characteristics than the vapor retarder material shall be provided. A cloth industrial duct tape in a utility grade shall also be provided to use as needed to protect the vapor retarder from puncturing.

2.10.3 Slip Sheet for Use With Vapor Retarder

Slip sheet for use with vapor retarder shall be a 5 lb. per 100 square feet rosin-sized, unsaturated building paper.

2.11 EPDM RUBBER BOOTS

Flashing devices around pipe penetrations shall be flexible, one-piece devices molded from weather-resistant EPDM rubber. Rubber boot material shall be as recommended by the manufacturer. The boots shall have base rings made of aluminum or corrosion resisting steel that conform to the contours of the roof panel to form a weather-tight seal.

2.12 PREFABRICATED CURBS AND EQUIPMENT SUPPORTS

Prefabricated curbs and equipment supports shall be of structural quality, hot-dipped galvanized or galvanized sheet steel, factory primed and prepared for painting with mitered and welded joints. Integral base plates and water diverter crickets shall be provided. Minimum height of curb shall be 8 inches above finish roof. Curbs shall be constructed to match roof slope and to provide a level top surface for mounting of equipment. Curb flange shall be constructed to match configuration of roof panels. Curb size shall be coordinated, prior to curb fabrication, with the mechanical equipment to be supported. Strength requirements for equipment supports shall be coordinated to include all anticipated loads. Flashings shall not be rigidly attached to underline structure.

PART 3 EXECUTION

3.1 INSTALLATION

Installation shall be in accordance with the manufacturer's erection instructions and drawings. Dissimilar materials which are not compatible when contacting each other shall be insulated by means of gaskets or insulating compounds. Molded closure strips shall be installed wherever roofing sheets terminate in open-end configurations, exclusive of flashings. The closure strip installation shall be weather-tight and sealed. Screws shall be installed with a clutching screw gun, to assure screws are not stripped. Field test shall be conducted on each gun prior to starting installation and periodically thereafter to assure it is adjusted properly to install particular type and size of screw as recommended by manufacturer's literature. Improper or mislocated drill holes shall be plugged with an oversize screw fastener and gasketed washer; however, sheets with an excess of such holes or with such holes in critical locations shall not be used. Exposed surfaces and edges shall be kept clean and free from sealant, metal cuttings, hazardous burrs, and other foreign material. Stained, discolored, or damaged sheets shall be removed from the site.

3.1.1 Subpurlins

Unless otherwise shown, subpurlins shall be anchored through the roof deck to the purlins, steel joists, trusses, beams or other structural framing members with bolts or screws. Attachment to the substrate (when provided) or to the panels is not permitted. The subpurlin spacing shall not exceed 30 inches on centers at the corner, edge and ridge zones, and 5 foot maximum on centers for the remainder of the roof. Corner, edge, and ridge zones are as defined in ASCE 7.

3.1.2 Roof Panel Installation

Roof panels shall be installed with the standing seams in the direction of the roof slope. The side seam connections for installed panels shall be completed at the end of each day's work. Method of applying joint sealant shall conform to the manufacturer's recommendation to achieve a complete weather-tight installation. End laps of panels shall be provided in accordance with the manufacturer's instructions. Closures, flashings, EPDM rubber boots, roof curbs, and related accessories shall be installed according to the manufacturer's drawings. Fasteners shall not puncture roofing sheets except as provided for in the manufacturer's instructions for erection and installation. Expansion joints for the standing seam roof system shall be installed at locations indicated on the contract drawings

and other locations indicated on the manufacturer's drawings.

3.1.3 Concealed Anchor Clips

Concealed anchor clips shall be fastened directly to the structural framing members. Attachment to the substrate (when provided) or to the metal deck is not permitted. The maximum distance, parallel to the seams, between clips shall be 30 inches on center at the corner, edge, and ridge zones, and 5 feet maximum on centers for the remainder of the roof.

3.2 INSULATION INSTALLATION

Insulation shall be continuous over entire roof surface. Where terminations, and other connections are made, the cavity shall be filled with batt insulation with vapor retarder providing equivalent R-value and perm rating as remaining insulation. Insulation shall be installed as indicated and in accordance with manufacturer's instructions.

3.2.1 Board Insulation with Blanket Insulation

Rigid or semirigid board insulation shall be laid in close contact. Board shall be attached to the metal roof deck with bearing plates and fasteners, as recommended by the insulation manufacturer, so that the insulation joints are held tight against each other, and shall have a minimum of 1 fastener per 4 square feet. Layout and joint pattern of insulation and fasteners shall be indicated on the shop drawings. If more than one layer of insulation is required, joints in the second layer shall be offset from joints in the first layer. A layer of blanket insulation shall be placed over the rigid or semirigid board insulation to be compressed against the underside of the metal roofing to reduce thermal bridging, dampen noise, and prevent roofing flutter. This layer of blanket insulation shall be compressed a minimum of 50 percent.

3.2.2 Blanket Insulation

Blanket insulation shall be installed between and parallel to the purlins with tabs of a facer lapping on the top face of the purlins. Thermal blocks shall be provided over purlins, between clips. A second layer of unfaced insulation shall be added between purlins to provide full R-value. Blanket insulation shall be supported by an integral facing or other commercially available support system.

3.3 PROTECTION OF VAPOR RETARDER FROM ROOF DECK

A cloth industrial duct tape shall be applied over the seams of metal roof decks, at penetration edges, and at surface areas exhibiting sharp burrs or similar protrusions. For other types of roof decks, cloth industrial duct tape shall be applied over irregularities which could potentially puncture polyethylene membrane.

3.4 VAPOR RETARDER INSTALLATION

3.4.1 Integral Facing on Blanket Insulation

Integral facing on blanket insulation shall have the facing lapped and sealed with a compatible tape to provide a vapor tight membrane.

3.4.2 Polyethylene Vapor Retarder

The polyethylene vapor retarder membrane shall be installed over the entire surface. A fully compatible polyethylene tape shall be used to seal the edges of the sheets to provide a vapor tight membrane. Sheet edges shall be lapped not less than 6 inches. Sufficient material shall be provided to avoid inducing stresses in the sheets due to stretching or binding. All tears or punctures that are visible in the finished surface at any time during the construction process shall be sealed with polyethylene tape.

3.5 SLIP SHEET INSTALLATION

A slip sheet shall be laid over the blanket insulation facing to prevent the vinyl facing from adhering to the metal roofing.

3.6 CLEANING AND TOUCH-UP

Exposed SSSMR systems shall be cleaned at completion of installation. Debris that could cause discoloration and harm to the panels, flashings, closures and other accessories shall be removed. Grease and oil films, excess sealants, and handling marks shall be removed and the work shall be scrubbed clean. Exposed metal surfaces shall be free of dents, creases, waves, scratch marks, and solder or weld marks. Immediately upon detection, abraded or corroded spots on shop-painted surfaces shall be wire brushed and touched up with the same material used for the shop coat. Factory color finished surfaces shall be touched up with the manufacturer's recommended touch up paint.

CONTRACTOR'S FIVE (5) YEAR NO PENAL SUM WARRANTY
FOR
STRUCTURAL STANDING SEAM METAL ROOF (SSSMR) SYSTEM

FACILITY DESCRIPTION_____

BUILDING NUMBER:_____

CORPS OF ENGINEERS CONTRACT NUMBER:_____

CONTRACTOR

CONTRACTOR:_____

ADDRESS:_____

POINT OF CONTACT:_____

TELEPHONE NUMBER:_____

OWNER

OWNER:_____

ADDRESS:_____

POINT OF CONTACT:_____

TELEPHONE NUMBER:_____

CONSTRUCTION AGENT

CONSTRUCTION AGENT:_____

ADDRESS:_____

POINT OF CONTACT:_____

TELEPHONE NUMBER:_____

CONTRACTOR'S FIVE (5) YEAR NO PENAL SUM WARRANTY
FOR
STRUCTURAL STANDING SEAM METAL ROOF (SSSMR) SYSTEM
(continued)

THE SSSMR SYSTEM INSTALLED ON THE ABOVE NAMED BUILDING IS WARRANTED BY _____ FOR A PERIOD OF FIVE (5) YEARS AGAINST WORKMANSHIP AND MATERIAL DEFICIENCIES, WIND DAMAGE, STRUCTURAL FAILURE, AND LEAKAGE. THE SSSMR SYSTEM COVERED UNDER THIS WARRANTY SHALL INCLUDE, BUT SHALL NOT BE LIMITED TO, THE FOLLOWING: THE ENTIRE ROOFING SYSTEM, MANUFACTURER SUPPLIED FRAMING AND STRUCTURAL MEMBERS, METAL ROOF PANELS, FASTENERS, CONNECTORS, ROOF SECUREMENT COMPONENTS, AND ASSEMBLIES TESTED AND APPROVED IN ACCORDANCE WITH ASTM E 1592. IN ADDITION, THE SYSTEM PANEL FINISHES, SLIP SHEET, INSULATION, VAPOR RETARDER, ALL ACCESSORIES, COMPONENTS, AND TRIM AND ALL CONNECTIONS ARE INCLUDED. THIS INCLUDES ROOF PENETRATION ITEMS SUCH AS VENTS, CURBS, SKYLIGHTS; INTERIOR OR EXTERIOR GUTTERS AND DOWNSPOUTS; EAVES, RIDGE, HIP, VALLEY, RAKE, GABLE, WALL, OR OTHER ROOF SYSTEM FLASHINGS INSTALLED AND ANY OTHER COMPONENTS SPECIFIED WITHIN THIS CONTRACT TO PROVIDE A WEATHERTIGHT ROOF SYSTEM; AND ITEMS SPECIFIED IN OTHER SECTIONS OF THE SPECIFICATIONS THAT ARE PART OF THE SSSMR SYSTEM.

ALL MATERIAL DEFICIENCIES, WIND DAMAGE, STRUCTURAL FAILURE, AND LEAKAGE ASSOCIATED WITH THE SSSMR SYSTEM COVERED UNDER THIS WARRANTY SHALL BE REPAIRED AS APPROVED BY THE CONTRACTING OFFICER. THIS WARRANTY SHALL COVER THE ENTIRE COST OF REPAIR OR REPLACEMENT, INCLUDING ALL MATERIAL, LABOR, AND RELATED MARKUPS. THE ABOVE REFERENCED WARRANTY COMMENCED ON THE DATE OF FINAL ACCEPTANCE ON _____ AND WILL REMAIN IN EFFECT FOR STATED DURATION FROM THIS DATE.

SIGNED, DATED, AND NOTARIZED (BY COMPANY PRESIDENT)

_____

(Company President) (Date)

CONTRACTOR'S FIVE (5) YEAR NO PENAL SUM WARRANTY
FOR
STRUCTURAL STANDING SEAM METAL ROOF (SSSMR) SYSTEM
(continued)

THE CONTRACTOR SHALL SUPPLEMENT THIS WARRANTY WITH WRITTEN WARRANTIES FROM THE MANUFACTURER AND/OR INSTALLER OF THE SSSMR SYSTEM, WHICH SHALL BE SUBMITTED ALONG WITH THE CONTRACTOR'S WARRANTY. HOWEVER, THE CONTRACTOR WILL BE ULTIMATELY RESPONSIBLE FOR THIS WARRANTY AS OUTLINED IN THE SPECIFICATIONS AND AS INDICATED IN THIS WARRANTY EXAMPLE.

EXCLUSIONS FROM COVERAGE

1. NATURAL DISASTERS, ACTS OF GOD (LIGHTNING, FIRE, EXPLOSIONS, SUSTAINED WIND FORCES IN EXCESS OF THE DESIGN CRITERIA, EARTHQUAKES, AND HAIL).

2. ACTS OF NEGLIGENCE OR ABUSE OR MISUSE BY GOVERNMENT OR OTHER PERSONNEL, INCLUDING ACCIDENTS, VANDALISM, CIVIL DISOBEDIENCE, WAR, OR DAMAGE CAUSED BY FALLING OBJECTS.

3. DAMAGE BY STRUCTURAL FAILURE, SETTLEMENT, MOVEMENT, DISTORTION, WARPAGE, OR DISPLACEMENT OF THE BUILDING STRUCTURE OR ALTERATIONS MADE TO THE BUILDING.

4. CORROSION CAUSED BY EXPOSURE TO CORROSIVE CHEMICALS, ASH OR FUMES GENERATED OR RELEASED INSIDE OR OUTSIDE THE BUILDING FROM CHEMICAL PLANTS, FOUNDRIES, PLATING WORKS, KILNS, FERTILIZER FACTORIES, PAPER PLANTS, AND THE LIKE.

5. FAILURE OF ANY PART OF THE SSSMR SYSTEM DUE TO ACTIONS BY THE OWNER TO INHIBIT FREE DRAINAGE OF WATER FROM THE ROOF AND GUTTERS AND DOWNSPOUTS OR ALLOW PONDING WATER TO COLLECT ON THE ROOF SURFACE. CONTRACTOR'S DESIGN SHALL INSURE FREE DRAINAGE FROM THE ROOF AND NOT ALLOW PONDING WATER.

6. THIS WARRANTY APPLIES TO THE SSSMR SYSTEM. IT DOES NOT INCLUDE ANY CONSEQUENTIAL DAMAGE TO THE BUILDING INTERIOR OR CONTENTS WHICH IS COVERED BY THE WARRANTY OF CONSTRUCTION CLAUSE INCLUDED IN THIS CONTRACT.

7. THIS WARRANTY CANNOT BE TRANSFERRED TO ANOTHER OWNER WITHOUT WRITTEN CONSENT OF THE CONTRACTOR; AND THIS WARRANTY AND THE CONTRACT PROVISIONS WILL TAKE PRECEDENCE OVER ANY CONFLICTS WITH STATE STATUTES.

**

CONTRACTOR'S FIVE (5) YEAR NO PENAL SUM WARRANTY
FOR
STRUCTURAL STANDING SEAM METAL ROOF (SSSMR) SYSTEM
(continued)

**REPORTS OF LEAKS AND SSSMR SYSTEM DEFICIENCIES SHALL BE RESPONDED TO WITHIN 48 HOURS OF RECEIPT OF NOTICE, BY TELEPHONE OR IN WRITING, FROM EITHER THE OWNER OR CONTRACTING OFFICER. EMERGENCY REPAIRS TO PREVENT FURTHER ROOF LEAKS SHALL BE INITIATED IMMEDIATELY; A WRITTEN PLAN SHALL BE SUBMITTED FOR APPROVAL TO REPAIR OR REPLACE THIS SSSMR SYSTEM WITHIN SEVEN (7) CALENDAR DAYS. ACTUAL WORK FOR PERMANENT REPAIRS OR REPLACEMENT SHALL BE STARTED WITHIN 30 DAYS AFTER RECEIPT OF NOTICE, AND COMPLETED WITHIN A REASONABLE TIME FRAME. IF THE CONTRACTOR FAILS TO ADEQUATELY RESPOND TO THE WARRANTY PROVISIONS, AS STATED IN THE CONTRACT AND AS CONTAINED HEREIN, THE CONTRACTING OFFICER MAY HAVE THE SSSMR SYSTEM REPAIRED OR REPLACED BY OTHERS AND CHARGE THE COST TO THE CONTRACTOR.

IN THE EVENT THE CONTRACTOR DISPUTES THE EXISTENCE OF A WARRANTABLE DEFECT, THE CONTRACTOR MAY CHALLENGE THE OWNER'S DEMAND FOR REPAIRS AND/OR REPLACEMENT DIRECTED BY THE OWNER OR CONTRACTING OFFICER EITHER BY REQUESTING A CONTRACTING OFFICER'S DECISION UNDER THE CONTRACT DISPUTES ACT, OR BY REQUESTING THAT AN ARBITRATOR RESOLVE THE ISSUE. THE REQUEST FOR AN ARBITRATOR MUST BE MADE WITHIN 48 HOURS OF BEING NOTIFIED OF THE DISPUTED DEFECTS. UPON BEING INVOKED, THE PARTIES SHALL, WITHIN TEN (10) DAYS, JOINTLY REQUEST A LIST OF FIVE (5) ARBITRATORS FROM THE FEDERAL MEDIATION AND CONCILIATION SERVICE. THE PARTIES SHALL CONFER WITHIN TEN (10) DAYS AFTER RECEIPT OF THE LIST TO SEEK AGREEMENT ON AN ARBITRATOR. IF THE PARTIES CANNOT AGREE ON AN ARBITRATOR, THE CONTRACTING OFFICER AND THE PRESIDENT OF THE CONTRACTOR'S COMPANY WILL STRIKE ONE (1) NAME FROM THE LIST ALTERNATIVELY UNTIL ONE (1) NAME REMAINS. THE REMAINING PERSON SHALL BE THE DULY SELECTED ARBITRATOR. THE COSTS OF THE ARBITRATION, INCLUDING THE ARBITRATOR'S FEE AND EXPENSES, COURT REPORTER, COURTROOM OR SITE SELECTED, ETC., SHALL BE BORNE EQUALLY BETWEEN THE PARTIES. EITHER PARTY DESIRING A COPY OF THE TRANSCRIPT SHALL PAY FOR THE TRANSCRIPT. A HEARING WILL BE HELD AS SOON AS THE PARTIES CAN MUTUALLY AGREE. A WRITTEN ARBITRATOR'S DECISION WILL BE REQUESTED NOT LATER THAN 30 DAYS FOLLOWING THE HEARING. THE DECISION OF THE ARBITRATOR WILL NOT BE BINDING; HOWEVER, IT WILL BE ADMISSIBLE IN ANY SUBSEQUENT APPEAL UNDER THE CONTRACT DISPUTES ACT.

A FRAMED COPY OF THIS WARRANTY SHALL BE POSTED IN THE MECHANICAL ROOM OR OTHER APPROVED LOCATION DURING THE ENTIRE WARRANTY PERIOD.

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SECTION 07600

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SECTION 07600

SHEET METALWORK, GENERAL

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 167	(1999) Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM B 32	(2000) Solder Metal
ASTM B 209	(2002a) Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B 221	(2000) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM B 370	(1998) Copper Sheet and Strip for Building Construction
ASTM D 226	(1997a) Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
ASTM D 2822	(1991; R 1997el) Asphalt Roof Cement
ASTM D 4022	(1994) Coal Tar Roof Cement, Asbestos Containing
ASTM D 4586	(2000) Asphalt Roof Cement, Asbestos Free

INSECT SCREENING WEAVERS ASSOCIATION (ISWA)

ISWA IWS 089	(1990) Recommended Standards and Specifications for Insect Wire Screening (Wire Fabric)

SHEET METAL & AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA Arch. Manual	(1993; Errata; Addenda Oct 1997) Architectural Sheet Metal Manual

1.2 GENERAL REQUIREMENTS

Sheet metalwork shall be accomplished to form weathertight construction

without waves, warps, buckles, fastening stresses or distortion, and shall allow for expansion and contraction. Cutting, fitting, drilling, and other operations in connection with sheet metal required to accommodate the work of other trades shall be performed by sheet metal mechanics. Installation of sheet metal items used in conjunction with roofing shall be coordinated with roofing work to permit continuous roofing operations.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with SECTION 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Materials; G-AO.

Drawings of sheet metal items showing weights, gauges or thicknesses; types of materials; expansion-joint spacing; fabrication details; and installation procedures.

1.4 DELIVERY, STORAGE, AND HANDLING

Materials shall be adequately packaged and protected during shipment and shall be inspected for damage, dampness, and wet-storage stains upon delivery to the jobsite. Materials shall be clearly labeled as to type and manufacturer. Sheet metal items shall be carefully handled to avoid damage. Materials shall be stored in dry, ventilated areas until immediately before installation.

PART 2 PRODUCTS

2.1 MATERIALS

Lead, lead-coated metal, and galvanized steel shall not be used. Any metal listed by SMACNA Arch. Manual for a particular item may be used, unless otherwise specified or indicated. Materials shall conform to the requirements specified below and to the thicknesses and configurations established in SMACNA Arch. Manual. Different items need not be of the same metal, except that if copper is selected for any exposed item, all exposed items shall be copper.

2.1.1 Accessories

Accessories and other items essential to complete the sheet metal installation, though not specifically indicated or specified, shall be provided.

2.1.2 Aluminum Extrusions

ASTM B 221, Alloy 6063, Temper T5.

2.1.3 Bituminous Cement

Type I asphalt cement conforming to ASTM D 2822 or ASTM D 4586. For coal tar roofing; coal tar cement conforming to ASTM D 4022.

2.1.4 Sealant

Unless otherwise specified, sealant shall be an elastomeric weather resistant sealant as specified in SECTION 07900 JOINT SEALING.

2.1.5 Fasteners

Fasteners shall be compatible with the fastened material and shall be the type best suited for the application.

2.1.6 Felt

ASTM D 226, Type I.

2.1.7 Aluminum Alloy Sheet and Plate

ASTM B 209, anodized clear clad, form, alloy, and temper appropriate for use.

2.1.8 Copper

ASTM B 370, Temper H 00.

2.1.9 Stainless Steel

ASTM A 167, Type 302 or 304; fully annealed, dead soft temper.

2.1.10 Solder

ASTM B 32, 95-5 tin-antimony.

2.1.11 Through-Wall Flashing

a. Electro-sheet copper not less than 5 ounces, factory coated both sides with acid- and alkali-resistant bituminous compound not less than 6 ounces per square foot or factory covered both sides with asphalt-saturated cotton fabric, asphalt saturated glass-fiber fabric, or with 40 pound reinforced kraft paper bonded with asphalt.

b. Stainless steel, Type 304, not less than 0.003 inch thick, completely encased by and permanently bonded on both sides to 50 pound high strength bituminized crepe kraft paper, using hot asphalt, heat, and pressure.

c. Three ounce copper sheet, with 2 mils of dense, clear, polyethylene sheet bonded to each side of the copper.

2.1.12 Louver Screen

Type I commercial bronze or Type III aluminum alloy insect screening conforming to ISWA IWS 089.

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

Louvers shall be fabricated in conformance with SMACNA Arch. Manual and as indicated. Unless otherwise specified or indicated, exposed edges shall be folded back to form a 1/2 inch hem on the concealed side, and bottom edges

of exposed vertical surfaces shall be angled to form drips. Bituminous cement shall not be placed in contact with roofing membranes other than built-up roofing.

3.2 EXPANSION JOINTS

Expansion joints shall be provided as specified in SMACNA Arch. Manual. Expansion joints in continuous sheet metal shall be provided at 40 foot intervals for copper and stainless steel and at 32 foot intervals for aluminum. Joints shall be evenly spaced. An additional joint shall be provided where the distance between the last expansion joint and the end of the continuous run is more than half the required interval spacing.

3.3 PROTECTION OF ALUMINUM

Aluminum shall not be used where it will be in contact with copper or where it will contact water which flows over copper surfaces. Aluminum that will be in contact with wet or pressure-treated wood, mortar, concrete, masonry, or ferrous metals shall be protected against galvanic or corrosive action by one of the following methods:

3.3.1 Paint

Aluminum surfaces shall be solvent cleaned and given one coat of zinc-molybdate primer and one coat of aluminum paint as specified in SECTION 09900 PAINTS AND COATINGS.

3.3.2 Nonabsorptive Tape or Gasket

Nonabsorptive tape or gasket shall be placed between the adjoining surfaces and cemented to the aluminum surface using a cement compatible with aluminum.

3.4 CONNECTIONS AND JOINTING

3.4.1 Soldering

Soldering shall apply to copper, and stainless steel items. Edges of sheet metal shall be pretinned before soldering is begun. Soldering shall be done slowly with well heated soldering irons so as to thoroughly heat the seams and completely sweat the solder through the full width of the seam. Edges of stainless steel to be pretinned shall be treated with soldering acid flux. Soldering shall follow immediately after application of the flux. Upon completion of soldering, the acid flux residue shall be thoroughly cleaned from the sheet metal with a water solution of washing soda and rinsed with clean water.

3.4.2 Riveting

Joints in aluminum sheets 0.040 inch or less in thickness shall be mechanically made.

3.4.3 Seaming

Flat-lock and soldered-lap seams shall finish not less than 1 inch wide. Unsoldered plain-lap seams shall lap not less than 3 inches unless otherwise specified. Flat seams shall be made in the direction of the flow.

3.5 CLEATS

A continuous cleat shall be provided where indicated or specified to secure loose edges of the sheet metalwork. Butt joints of cleats shall be spaced approximately 1/8 inch apart. The cleat shall be fastened to supporting wood construction with nails evenly spaced not over 12 inches on centers. Where the fastening is to be made to concrete or masonry, screws shall be used and shall be driven in expansion shields set in concrete or masonry.

3.6 FLASHINGS

Flashings shall be installed at locations indicated and as specified below. Sealing shall be according to the flashing manufacturer's recommendations. Flashings shall be installed at intersections of roof with vertical surfaces and at projections through roof, except that flashing for heating and plumbing, including piping, roof, and floor drains, and for electrical conduit projections through roof or walls are specified in other sections. Except as otherwise indicated, counter flashings shall be provided over base flashings. Perforations in flashings made by masonry anchors shall be covered up by an application of bituminous plastic cement at the perforation. Flashing shall be installed on top of joint reinforcement. Flashing shall be formed to direct water to the outside of the system.

3.6.1 Through-Wall Flashing

Through-wall flashing includes sill, lintel, and spandrel flashing. The flashing shall be laid with a layer of mortar above and below the flashing so that the total thickness of the two layers of the mortar and flashing are the same thickness as the regular mortar joints. Flashing shall not extend further into the masonry backup wall than the first mortar joint. Joints in flashing shall be lapped and sealed. Flashing shall be one piece for lintels and sills.

3.6.1.1 Lintel Flashing

Lintel flashing shall extend the full length of lintel. Flashing shall extend through the wall one masonry course above the lintels and shall be bent down over the vertical leg of the outer steel lintel angle not less than 2 inches, or shall be applied over top of masonry and precast concrete lintels. Bedjoints of lintels at control joints shall be underlaid with sheet metal bond breaker.

3.6.1.2 Sill Flashing

Sill flashing shall extend the full width of the sill and not less than 4 inches beyond ends of sill except at control joint where the flashing shall be terminated at the end of the sill.

3.7 INSTALLATION OF LOUVERS

Louvers shall be rigidly attached to the supporting construction. The installation shall be rain-tight. Louver screen shall be installed as indicated.

3.8 CONTRACTOR QUALITY CONTROL

The Contractor shall establish and maintain a quality control procedure for sheet metal used in conjunction with roofing to assure compliance of the installed sheet metalwork with the contract requirements. Any work found

not to be in compliance with the contract shall be promptly removed and replaced or corrected in an approved manner. Quality control shall include, but not be limited to, the following:

a. Observation of environmental conditions; number and skill level of sheet metal workers; condition of substrate.

b. Verification of compliance of materials before, during, and after installation.

c. Inspection of sheet metalwork for proper size and thickness, fastening and joining, and proper installation.

The actual quality control observations and inspections shall be documented and a copy of the documentation furnished to the Contracting Officer at the end of each day.

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SECTION 07840

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SECTION 07840

FIRESTOPPING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM E 84	(2001) Surface Burning Characteristics of Building Materials
ASTM E 119	(2000) Fire Tests of Building Construction and Materials
ASTM E 814	(2000) Fire Tests of Through-Penetration Fire Stops
ASTM E 1399	(1997; R 2000) Cyclic Movement and Measuring the Minimum and Maximum Joint Widths of Architectural Joint Systems

UNDERWRITERS LABORATORIES (UL)

UL 723	(1996; Rev thru Dec 2001) Test for Surface Burning Characteristics of Building Materials
UL 1479	(1994; Rev thru Feb 1998) Fire Tests of Through-Penetration Firestops
UL 2079	(1998) Tests for Fire Resistance of Building Joint Systems
UL Fire Resist Dir	(2001) Fire Resistance Directory (2 Vol.)

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with SECTION 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Firestopping Materials..

Detail drawings including manufacturer's descriptive data, typical details conforming to UL Fire Resist Dir or other details

certified by another nationally recognized testing laboratory, installation instructions or UL listing details for a firestopping assembly in lieu of fire-test data or report. For those firestop applications for which no UL tested system is available through a manufacturer, a manufacturer's engineering judgement, derived from similar UL system designs or other tests, shall be submitted for review and approval prior to installation. Submittal shall indicate the firestopping material to be provided for each type of application. When more than 5 penetrations or construction joints are to receive firestopping, drawings shall indicate location and type of application.

SD-07 Certificates

Firestopping Materials..

Certificates attesting that firestopping material complies with the specified requirements. In lieu of certificates, drawings showing UL classified materials as part of a tested assembly may be provided. Drawings showing evidence of testing by an alternate nationally recognized independent laboratory may be substituted.

Installer Qualifications..

Documentation of training and experience.

Inspection..

Manufacturer's representative certification stating that firestopping work has been inspected and found to be applied according to the manufacturer's recommendations and the specified requirements.

1.3 GENERAL REQUIREMENTS

Firestopping shall consist of furnishing and installing tested and listed firestop systems, combination of materials, or devices to form an effective barrier against the spread of flame, smoke and gases, and maintain the integrity of fire resistance rated walls, partitions, floors, and ceiling-floor assemblies, including through-penetrations and construction joints and gaps. Through-penetrations include the annular space around pipes, tubes, conduit, wires, cables and vents. Construction joints include those used to accommodate expansion, contraction, wind, or seismic movement; firestopping material shall not interfere with the required movement of the joint. Gaps requiring firestopping include gaps between the curtain wall and the floor slab and between the top of the fire-rated walls and the roof or floor deck above.

1.4 STORAGE AND DELIVERY

Materials shall be delivered in the original unopened packages or containers showing name of the manufacturer and the brand name. Materials shall be stored off the ground and shall be protected from damage and exposure to elements. Damaged or deteriorated materials shall be removed from the site.

1.5 INSTALLER QUALIFICATIONS

The Contractor shall engage an experienced Installer who is certified,

licensed, or otherwise qualified by the firestopping manufacturer as having the necessary staff, training, and a minimum of 3 years experience in the installation of manufacturer's products per specified requirements. A manufacturer's willingness to sell its firestopping products to the Contractor or to an installer engaged by the Contractor does not in itself confer qualification on the buyer. The Installer shall have been trained by a direct representative of the manufacturer (not distributor or agent) in the proper selection and installation procedures.

1.6 COORDINATION

The specified work shall be coordinated with other trades. Firestopping materials, at penetrations of pipes and ducts, shall be applied prior to insulating, unless insulation meets requirements specified for firestopping. Firestopping materials at building joints and construction gaps shall be applied prior to completion of enclosing walls or assemblies. Cast-in-place firestop devices shall be located and installed in place before concrete placement. Pipe, conduit or cable bundles shall be installed through cast-in-place device after concrete placement but before area is concealed or made inaccessible.

PART 2 PRODUCTS

2.1 FIRESTOPPING MATERIALS

Firestopping materials shall consist of commercially manufactured, asbestos-free products complying with the following minimum requirements:

2.1.1 Fire Hazard Classification

Material shall have a flame spread of 25 or less, and a smoke developed rating of 50 or less, when tested in accordance with ASTM E 84 or UL 723. Material shall be an approved firestopping material as listed in UL Fire Resist Dir or by a nationally recognized testing laboratory.

2.1.2 Toxicity

Material shall be nontoxic to humans at all stages of application.

2.1.3 Fire Resistance Rating

Firestopping will not be required to have a greater fire resistance rating than that of the assembly in which it is being placed.

2.1.3.1 Through-Penetrations

Firestopping materials for through-penetrations, as described in paragraph GENERAL REQUIREMENTS, shall provide "F" and "T" fire resistance ratings in accordance with ASTM E 814 or UL 1479. Fire resistance ratings shall be as follows:

a. Penetrations of Fire Resistance Rated Walls and Partitions: F Rating = Rating of wall or partition being penetrated.

b. Penetrations of Fire Resistance Rated Ceiling Assemblies : F Rating = 1 hour, T Rating = 1 hour, at the control room concrete deck.

2.1.3.2 Construction Joints and Gaps

Fire resistance ratings of construction joints, as described in paragraph GENERAL REQUIREMENTS, and gaps such as those between floor slabs or roof decks and curtain walls shall be the same as the construction in which they occur. Construction joints and gaps shall be provided with firestopping materials and systems that have been tested per ASTM E 119 or UL 2079 to meet the required fire resistance rating. Systems installed at construction joints shall meet the cycling requirements of ASTM E 1399 or UL 2079.

PART 3 EXECUTION

3.1 PREPARATION

Areas to receive firestopping shall be free of dirt, grease, oil, or loose materials which may affect the fitting or fire resistance of the firestopping system. For cast-in-place firestop devices, formwork or metal deck to receive device prior to concrete placement shall be sound and capable of supporting device.

3.2 INSTALLATION

Firestopping material shall completely fill void spaces regardless of geometric configuration, subject to tolerance established by the manufacturer. Firestopping systems for filling floor voids 4 inches or more in any direction shall be capable of supporting the same load as the floor is designed to support or shall be protected by a permanent barrier to prevent loading or traffic in the firestopped area. Firestopping shall be installed in accordance with manufacturer's written instructions. Tested and listed firestop systems shall be provided in the following locations, except in floor slabs on grade:

a. Penetrations of duct, conduit, tubing, cable and pipe through through fire-resistance rated walls, partitions, and ceiling assemblies.

b. Gaps at perimeter of fire-resistance rated walls and partitions, such as between the top of the walls and the bottom of roof decks.

c. Construction joints in fire rated walls and partitions.

d. Other locations where required to maintain fire resistance rating of the construction.

3.2.1 Insulated Pipes and Ducts

Thermal insulation shall be cut and removed where pipes or ducts pass through firestopping, unless insulation meets requirements specified for firestopping. Thermal insulation shall be replaced with a material having equal thermal insulating and firestopping characteristics.

3.2.2 Fire Dampers

Fire dampers shall be installed and firestopped in accordance with SECTION 15895 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEM.

3.3 INSPECTION

Firestopped areas shall not be covered or enclosed until inspection is

complete and approved. A manufacturer's representative shall inspect the applications initially to ensure adequate preparations (clean surfaces suitable for application, etc.) and periodically during the work to assure that the completed work has been accomplished according to the manufacturer's written instructions and the specified requirements.

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SECTION 07900

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SECTION 07900

JOINT SEALING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 509	(2000) Elastomeric Cellular Preformed Gasket and Sealing Material
ASTM C 570	(1995) Oil- and Resin-Base Caulking Compound for Building Construction
ASTM C 834	(1995) Latex Sealants
ASTM C 920	(2002) Elastomeric Joint Sealants
ASTM D 1056	(1998) Flexible Cellular Materials - Sponge or Expanded Rubber

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with SECTION 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Backing; G-AO.

Bond-Breaker; G-AO.

Sealant; G-AO.

Manufacturer's descriptive data including storage requirements, shelf life, curing time, instructions for mixing and application, and primer data (if required). A copy of the Material Safety Data Sheet shall be provided for each solvent, primer or sealant material.

SD-07 Certificates

Sealant.

Certificates of compliance stating that the materials conform to the specified requirements.

1.3 ENVIRONMENTAL REQUIREMENTS

The ambient temperature shall be within the limits of 40 to 90 degrees F when the sealants are applied.

1.4 DELIVERY AND STORAGE

Materials shall be delivered to the job in the manufacturer's original unopened containers. The container label or accompanying data sheet shall include the following information as applicable: manufacturer, name of material, formula or specification number, lot number, color, date of manufacture, mixing instructions, shelf life, and curing time at the standard conditions for laboratory tests. Materials shall be handled and stored to prevent inclusion of foreign materials. Materials shall be stored at temperatures between 40 and 90 degrees F unless otherwise specified by the manufacturer.

PART 2 PRODUCTS

2.1 BACKING

Backing shall be 25 to 33 percent oversize for closed cell and 40 to 50 percent oversize for open cell material, unless otherwise indicated.

2.1.1 Rubber

Cellular rubber sponge backing shall be ASTM D 1056,Type 1, open cell, Class B, Grade 0, round cross section.

2.1.2 Synthetic Rubber

Synthetic rubber backing shall be ASTM C 509, Option I, Type I preformed rods or tubes.

2.2 BOND-BREAKER

Bond-breaker shall be as recommended by the sealant manufacturer to prevent adhesion of the sealant to backing or to bottom of the joint.

2.3 PRIMER

Primer shall be non-staining type as recommended by sealant manufacturer for the application.

2.4 CAULKING

Oil- and resin-based caulking shall be ASTM C 570, Type 1, Use .

2.5 SEALANT

2.5.1 LATEX

Latex Sealant shall be ASTM C 834.

2.5.2 ELASTOMERIC

Elastomeric sealants shall conform to ASTM C 920 and the following:

a. Polyurethane sealant: Grade NS, Class 25, Use NT.

b. Silicone sealant: Type S, Grade NS, Class 25, Use NT.

2.6 SOLVENTS AND CLEANING AGENTS

Solvents, cleaning agents, and accessory materials shall be provided as recommended by the manufacturer.

PART 3 EXECUTION

3.1 GENERAL

3.1.1 Surface Preparation

The surfaces of joints to receive sealant or caulk shall be free of all frost, condensation and moisture. Oil, grease, dirt, chalk, particles of mortar, dust, loose rust, loose mill scale, and other foreign substances shall be removed from surfaces of joints to be in contact with the sealant. Oil and grease shall be removed with solvent and surfaces shall be wiped dry with clean cloths. For surface types not listed below, the sealant manufacturer shall be contacted for specific recommendations.

3.1.2 Concrete and Masonry Surfaces

Where surfaces have been treated with curing compounds, oil, or other such materials, the materials shall be removed by sandblasting or wire brushing. Laitance, efflorescence and loose mortar shall be removed from the joint cavity.

3.1.3 Steel Surfaces

Steel surfaces to be in contact with sealant shall be sandblasted or, if sandblasting would not be practical or would damage adjacent finish work, the metal shall be scraped and wire brushed to remove loose mill scale. Protective coatings on steel surfaces shall be removed by sandblasting or by a solvent that leaves no residue.

3.1.4 Aluminum Surfaces

Aluminum surfaces to be in contact with sealants shall be cleaned of temporary protective coatings. When masking tape is used for a protective cover, the tape and any residual adhesive shall be removed just prior to applying the sealant. Solvents used to remove protective coating shall be as recommended by the manufacturer of the aluminum work and shall be non-staining.

3.2 APPLICATION

3.2.1 Masking Tape

Masking tape shall be placed on the finish surface on one or both sides of a joint cavity to protect adjacent finish surfaces from primer or sealant smears. Masking tape shall be removed within 10 minutes after joint has been filled and tooled.

3.2.2 Backing

Backing shall be installed to provide the indicated sealant depth. The installation tool shall be shaped to avoid puncturing the backing.

3.2.3 Bond-Breaker

Bond-breaker shall be applied to fully cover the bottom of the joint without contaminating the sides where sealant adhesion is required.

3.2.4 Primer

Primer shall be used on concrete masonry units, wood, or other porous surfaces in accordance with instructions furnished with the sealant. Primer shall be applied to the joint surfaces to be sealed. Surfaces adjacent to joints shall not be primed.

3.2.5 Sealant

Sealant shall be used before expiration of shelf life. Multi-component sealants shall be mixed according to manufacturer's printed instructions. Sealant in guns shall be applied with a nozzle of proper size to fit the width of joint. Joints shall be sealed as detailed in the drawings. Sealant shall be forced into joints with sufficient pressure to expel air and fill the groove solidly. Sealant shall be installed to the indicated depth without displacing the backing. Unless otherwise indicated, specified, or recommended by the manufacturer, the installed sealant shall be dry tooled to produce a uniformly smooth surface free of wrinkles and to ensure full adhesion to the sides of the joint; the use of solvents, soapy water, etc., will not be allowed. Sealants shall be installed free of air pockets, foreign embedded matter, ridges and sags. Sealer shall be applied over the sealant when and as specified by the sealant manufacturer.

3.3 CLEANING

The surfaces adjoining the sealed joints shall be cleaned of smears and other soiling resulting from the sealant application as work progresses.

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SECTION 08110

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SECTION 08110

STEEL DOORS AND FRAMES

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A250.4	(1994) Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors and Hardware Reinforcings
ANSI A250.6	(1997) Hardware on Standard Steel Doors (Reinforcement - Application)
ANSI A250.8	(1998) SDI-100 Recommended Specifications for Standard Steel Doors and Frames

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 591	(1998) Steel Sheet, Electrolytic Zinc-Coated, for Light Coating Mass Applications
ASTM A 653/A 653M	(2001a) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A 924/A 924M	(1999) General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
ASTM C 578	(2000) Rigid, Cellular Polystyrene Thermal Insulation
ASTM C 591	(2001) Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation
ASTM C 612	(2000a) Mineral Fiber Block and Board Thermal Insulation
ASTM D 2863	(1997) Measuring the Minimum Oxygen Concentration to Support Candle-Like Combustion of Plastics (Oxygen Index)

DOOR AND HARDWARE INSTITUTE (DHI)

ANSI/DHI A115	(1991) Steel Door Preparation Standards (Consisting of A115.1 through A115.6 and

A115.12 through A115.18)

STEEL DOOR INSTITUTE (SDI)

SDI 105	(1998) Recommended Erection Instructions for Steel Frames
SDI 113	(1979) Apparent Thermal Performance of STEEL DOOR and FRAME ASSEMBLIES

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with SECTION 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Doors; G-AE.

Frames; G-AE.

Accessories.

Weatherstripping.

Show elevations, construction details, metal gages, hardware provisions, method of glazing, and installation details.

Schedule of doors; G-AE.

Schedule of frames; G-AE.

Submit door and frame locations.

SD-03 Product Data

Doors; G-AE.

Frames; G-AE.

Accessories.

Weatherstripping.

Submit manufacturer's descriptive literature for doors, frames, and accessories. Include data and details on door construction, panel (internal) reinforcement, insulation, and door edge construction. When "custom hollow metal doors" are provided in lieu of "standard steel doors," provide additional details and data sufficient for comparison to ANSI A250.8 requirements.

1.3 DELIVERY, STORAGE, AND HANDLING

Deliver doors, frames, and accessories undamaged and with protective wrappings or packaging. Strap knock-down frames in bundles. Provide temporary steel spreaders securely fastened to the bottom of each welded frame. Store doors and frames on platforms under cover in clean, dry, ventilated, and accessible locations, with 1/4 inch airspace between doors. Remove damp or wet packaging immediately and wipe affected surfaces dry. Replace damaged materials with new.

PART 2 PRODUCTS

2.1 STANDARD STEEL DOORS

ANSI A250.8, except as specified otherwise. Prepare doors to receive hardware specified in SECTION 08710, DOOR HARDWARE. Undercut where indicated. Exterior doors shall have top edge closed flush and sealed to prevent water intrusion. Doors shall be 1 3/4 inches thick, unless otherwise indicated.

2.1.1 Classification - Level, Performance, Model

2.1.1.1 Extra Heavy Duty Doors

ANSI A250.8, Level 3, physical performance Level A, Model 1 with core construction as required by the manufacturer for interior doors, of size(s) and design(s) indicated. Where vertical stiffenercores are required, the space between the stiffeners shall be filled with mineral board insulation. Close tops of all exterior doors flush with an additional channel and seal to prevent wall intrusion.

2.2 INSULATED STEEL DOOR SYSTEMS

Insulated steel doors shall have a core of polyurethane foam and an R factor of 10.0 or more (based on a k value of 0.16); face sheets, edges, and frames of galvanized steel not lighter than 23 gage, 16 gage, and 16 gage respectively; magnetic weatherstripping; nonremovable-pin hinges; thermal-break aluminum threshold; and vinyl door bottom. Doors and frames shall receive phosphate treatment, rust-inhibitive primer, and baked acrylic enamel finish. Doors shall have been tested in accordance with ANSI A250.4 and shall have met the requirements for Level C. Prepare doors to receive hardware specified in SECTION 08710, DOOR HARDWARE. Doors shall be 1 3/4 inches thick. Provide insulated steel doors and frames at all exterior door locations.

2.3 ACCESSORIES

2.3.1 Moldings

Provide moldings around glass of interior and exterior doors and louvers of interior doors. Provide nonremovable moldings on outside of exterior doors and on corridor side of interior doors. Other moldings may be stationary or removable. Secure inside moldings to stationary moldings, or provide snap-on moldings. Muntins shall interlock at intersections and shall be fitted and welded to stationary moldings.

2.4 INSULATION CORES

Insulated cores shall be of type specified, and provide an apparent

U-factor of .48 in accordance with SDI 113 and shall conform to:

a. Rigid Polyurethane Foam: ASTM C 591, Type 1 or 2, foamed-in-place or in board form, with oxygen index of not less than 22 percent when tested in accordance with ASTM D 2863; or

b. Rigid Polystyrene Foam Board: ASTM C 578, Type I or II; or

c. Mineral board: ASTM C 612, Type I.

2.5 STANDARD STEEL FRAMES

ANSI A250.8, except as otherwise specified. Form frames to sizes and shapes indicated, with welded corners or knock-down field-assembled corners. Provide steel frames for doors, sidelights,cased openings, and interior glazed panels, unless otherwise indicated.

2.5.1 Welded Frames

Continuously weld frame faces at corner joints. Mechanically interlock or continuously weld stops and rabbets. Grind welds smooth.

2.5.2 Knock-Down Frames

Design corners for simple field assembly by concealed tenons, splice plates, or interlocking joints that produce square, rigid corners and a tight fit and maintain the alignment of adjoining members. Provide locknuts for bolted connections.

2.5.3 Stops and Beads

Form stops and beads from 20 gage steel. Provide for glazed and other openings in standard steel frames. Secure beads to frames with oval-head, countersunk Phillips self-tapping sheet metal screws or concealed clips and fasteners. Space fasteners approximately 12 to 16 inches on centers. Miter molded shapes at corners. Butt or miter square or rectangular beads at corners.

2.5.4 Anchors

Provide anchors to secure the frame to adjoining construction. Provide steel anchors, zinc-coated or painted with rust-inhibitive paint, not lighter than 18 gage.

2.5.4.1 Wall Anchors

Provide at least three anchors for each jamb. For frames which are more than 7.5 feet in height, provide one additional anchor for each jamb for each additional 2.5 feet or fraction thereof.

a. Masonry: Provide anchors of corrugated or perforated steel straps or 3/16 inch diameter steel wire, adjustable or T-shaped;

b. Stud partitions: Weld or otherwise securely fasten anchors to backs of frames. Design anchors to be fastened to wood studs with nails;

2.5.4.2 Floor Anchors

Provide floor anchors drilled for 3/8 inch anchor bolts at bottom of each jamb member. Where floor fill occurs, terminate bottom of frames at the indicated finished floor levels and support by adjustable extension clips resting on and anchored to the structural slabs.

2.6 WEATHERSTRIPPING

As specified in SECTION 08710, DOOR HARDWARE.

2.7 HARDWARE PREPARATION

Provide minimum hardware reinforcing gages as specified in ANSI A250.6. Drill and tap doors and frames to receive finish hardware. Prepare doors and frames for hardware in accordance with the applicable requirements of ANSI A250.8 and ANSI A250.6. For additional requirements refer to ANSI/DHI A115. Drill and tap for surface-applied hardware at the project site. Build additional reinforcing for surface-applied hardware into the door at the factory. Locate hardware in accordance with the requirements of ANSI A250.8, as applicable. Punch door frames , with the exception of frames that will have weatherstripping gasketing, to receive a minimum of two rubber or vinyl door silencers on lock side of single doors and one silencer for each leaf at heads of double doors. Set lock strikes out to provide clearance for silencers.

2.8 FINISHES

2.8.1 Factory-Primed Finish

All surfaces of doors and frames shall be thoroughly cleaned, chemically treated and factory primed with a rust inhibiting coating as specified in ANSI A250.8, or paintable A25 galvannealed steel without primer. Where coating is removed by welding, apply touchup of factory primer.

2.8.2 Hot-Dip Zinc-Coated and Factory-Primed Finish

Fabricate exterior doors and frames from hot dipped zinc coated steel, alloyed type, that complies with ASTM A 924/A 924M and ASTM A 653/A 653M. The Coating weight shall meet or exceed the minimum requirements for coatings having 0.4 ounces per square foot, total both sides, i.e., A40. Repair damaged zinc-coated surfaces by the application of zinc dust paint. Thoroughly clean and chemically treat to insure maximum paint adhesion. Factory prime as specified in ANSI A250.8.

2.8.3 Electrolytic Zinc-Coated Anchors and Accessories

Provide electrolytically deposited zinc-coated steel in accordance with ASTM A 591, Commercial Quality, Coating Class A. Phosphate treat and factory prime zinc-coated surfaces as specified in ANSI A250.8.

2.9 FABRICATION AND WORKMANSHIP

Finished doors and frames shall be strong and rigid, neat in appearance, and free from defects, waves, scratches, cuts, dents, ridges, holes, warp, and buckle. Molded members shall be clean cut, straight, and true, with joints coped or mitered, well formed, and in true alignment. Dress exposed welded and soldered joints smooth. Design door frame sections for use with the wall construction indicated. Corner joints shall be well formed and in

true alignment. Conceal fastenings where practicable. On wraparound frames for masonry partitions, provide a throat opening 1/8 inch larger than the actual masonry thickness. Design other frames in exposed masonry walls or partitions to allow sufficient space between the inside back of trim and masonry to receive calking compound.

2.9.1 Grouted Frames

For frames to be installed in exterior walls and to be filled with mortar or grout, fill the stops with strips of rigid insulation to keep the grout out of the stops and to facilitate installation of stop-applied head and jamb seals.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Frames

Set frames in accordance with SDI 105. Plumb, align, and brace securely until permanent anchors are set. Anchor bottoms of frames with expansion bolts or powder-actuated fasteners. Build in or secure wall anchors to adjoining construction. Backfill frames with mortar. When an additive is provided in the mortar, coat inside of frames with corrosion-inhibiting bituminous material. For frames in exterior walls, ensure that stops are filled with rigid insulation before grout is placed.

3.1.2 Doors

Hang doors in accordance with clearances specified in ANSI A250.8. After erection and glazing, clean and adjust hardware.

3.2 PROTECTION

Protect doors and frames from damage. Repair damaged doors and frames prior to completion and acceptance of the project or replace with new, as directed. Wire brush rusted frames until rust is removed. Clean thoroughly. Apply an all-over coat of rust-inhibitive paint of the same type used for shop coat.

3.3 CLEANING

Upon completion, clean exposed surfaces of doors and frames thoroughly. Remove mastic smears and other unsightly marks.

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DIVISION 08 - DOORS AND WINDOWS

SECTION 08331

METAL ROLLING COUNTER DOORS

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SECTION 08331

METAL ROLLING COUNTER DOORS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 240/A 240M	(1999b) Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 80	(1999) Fire Doors and Fire Windows

1.2 GENERAL

Rolling counter doors shall be of the type, size, and design indicated on the drawings, and shall be the standard product of a manufacturer regularly engaged in the production of rolling counter doors. Each door shall be provided with a permanent label showing the manufacturer's name and address and the model number of the door.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with SECTION 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Approved Detail Drawings; G-AE.

Drawings showing elevations of each door type, details of anchorage, details of construction, location and description of hardware, shape and thickness of materials, details of joints and connections, and details of guides and fittings. A schedule showing the location of each counter door shall be included with the drawings.

SD-03 Product Data

Rolling Counter Doors; G-AE.

Manufacturer's descriptive data and catalog cuts.

Installation.

Cleaning.

Manufacturer's preprinted installation and cleaning instructions.

SD-10 Operation and Maintenance Data

Operation.

Two complete copies of maintenance instructions listing routine maintenance procedures, possible breakdowns and repairs, troubleshooting guides, and simplified diagrams for the equipment as installed. Spare parts data for each different item of material and equipment specified shall be supplied not later than two months prior to the date of beneficial occupancy. The data shall include a complete list of parts and supplies, with current unit prices and source of supply, and a list of the parts recommended by the manufacturer to be replaced after 1 year and 3 years of service.

1.4 DELIVERY AND STORAGE

Rolling counter doors shall be delivered to the jobsite wrapped in a protective covering with the brands and names clearly marked thereon. Rolling counter doors shall be stored in accordance with the manufacturer's instructions in a dry location that is adequately ventilated and free from dust, water, or other contaminants, and in a manner that permits easy access for inspecting and handling. Doors shall be handled carefully to prevent damage. Damaged items that cannot be restored to like-new condition shall be replaced.

1.5 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period shall be provided.

PART 2 PRODUCTS

2.1 BASIC COMPONENTS

2.1.1 Curtain

The curtain shall be fabricated of Alloy 6063, 22 gauge Type 304 stainless steel slats conforming to ASTM A 240/A 240M, . Thickness of slat material shall be as required by width of opening or as required by specified fire-rating. Slats shall be approximately 1-1/4 to 1-1/2 inch wide with a depth of crown of 1/2 inch. Alternate slats shall be fitted with end locks to maintain curtain alignment. Bottom of curtain shall be provided with angle or tubular bar reinforcement matching the curtain, and fitted with a resilient bottom seal.

2.1.2 Jamb Guides

Guides shall be of 13 gauge minimum thickness stainless steel conforming to ASTM A 240/A 240M, Type 304 or Type 430.

2.1.3 Counterbalance Shaft Assembly

The curtain shall be coiled around a steel tube of sufficient thickness and diameter to prevent deflection exceeding 0.03 inch per foot. The barrel shall contain oil tempered helical steel torsion springs capable of sufficient torque to counterbalance the weight of the curtain. Springs shall be calculated to provide a minimum of 7,500 operating cycles (one complete cycle of door operation will begin with the door in the closed position, move to the full open position and return to the closed position).

2.1.4 Brackets

Brackets shall be a minimum 12 gauge thickness steel if flat plate, or 16 gauge thickness if there are a minimum of 3 returns of 3/4 inch width.

2.1.5 Hood

The hood shall be of 24 gauge stainless steel conforming to ASTM A 240/A 240M, Type 304 or Type 430.

2.2 FIRE-RATED ROLLING COUNTER DOOR

Fire-rated rolling counter doors shall be Class B (1-1/2 hr.) and shall conform to the requirements specified and to NFPA 80 for the class indicated. Doors shall bear the labels of a recognized testing agency indicating the applicable fire resistance rating. The construction details necessary for labeled rolling counter doors shall take precedence over details indicated or specified herein. Door curtains, guides and hood shall be stainless steel. Fire-rated rolling counter doors shall be complete with hardware, accessories, and automatic closing device. Rolling counter doors in exit corridor walls shall be provided with perimeter smoke and draft control gasketing.

2.3 INTEGRAL FRAME ROLLING COUNTER DOOR (RATED OR NON-RATED)

Integral frame rolling counter door shall be stainless steel Class B (1-1/2 hr.), stainless steel. Fire-rated doors shall conform to the requirements of NFPA 80 for the Class indicated and shall bear the labels of a recognized testing agency indicating the applicable fire resistance rating. Jambs shall be formed to create guides for the curtain. Head and jambs shall be 16 gauge thickness. Counter shall be 14 gauge thickness. Rolling counter doors in exit corridor walls shall be provided with perimeter smoke and draft control gasketing.

2.4 OPERATION

2.4.1 Manual Operation

The curtain shall be operated by means of manual push-up with lift handles or continuous full width lift bar.

2.5 AUTOMATIC CLOSING DEVICE

Fire-rated counter doors shall be equipped with an automatic closing device which shall operate upon the fusing of a 165 degree F fusible link . Resetting the door shall not require the use of special tools.

2.6 FINISH

Exposed parts of the counter door, including the curtain, bottom rail, guides, and hood shall be of uniform finish and appearance. Stainless steel shall have a No. 4 finish. All other steel parts shall be given a shop coat of primer paint standard with the manufacturer.

PART 3 EXECUTION

3.1 INSTALLATION

Doors shall be installed in accordance with approved detail drawings and manufacturer's instructions. Anchors and inserts for guides, brackets, hardware, and other accessories shall be accurately located. Upon completion, doors shall be free from warp, twist, or distortion. Doors shall be lubricated, properly adjusted, and demonstrated to operate freely. Fire-door installation shall be in conformance with NFPA 80 for the class indicated and the manufacturer's instructions.

3.2 FIELD FINISHING

Doors to receive field finishing shall be factory primed, as required, and then shall be finished in accordance with SECTION 09900 PAINTS AND COATINGS. Color shall match the window frame.

3.3 CLEANING

Aluminum and stainless steel doors shall be cleaned in accordance with manufacturer's approved instructions.

3.4 TESTS

The fire doors shall be drop tested in accordance with NFPA 80 to show proper operation and full automatic closure and shall be reset in accordance with the manufacturer's instructions. A written record of initial test shall be provided to the Contracting Officer.

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SECTION 08361

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SECTION 08361

SECTIONAL OVERHEAD DOORS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 36/A 36M	(2001) Carbon Structural Steel
ASTM A 123/A 123M	(2002) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 227/A 227M	(1993) Steel Wire, Cold-Drawn for Mechanical Springs
ASTM A 229/A 229M	(1993) Steel Wire, Oil-Tempered for Mechanical Springs
ASTM A 653/A 653M	(2001a) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM B 209	(2002a) Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B 221	(2000) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM C 236	(1989; R 1993) Steady-State Thermal Performance of Building Assemblies by Means of a Guarded Hot Box
ASTM E 330	(1997el) Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference

DOOR AND ACCESS SYSTEM MANUFACTURERS ASSOCIATION (DASMA)

DASMA 102	(1988) Sectional Overhead Type Doors

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2002) National Electrical Code

1.2 SUBMITTALS

Submit the following in accordance with SECTION 01330, "Submittal

Procedures."

SD-02 Shop Drawings

Doors; G-AO.

Show types, sizes, locations, metal gages including minimum metal decimal thickness, hardware provisions, installation details, and other details of construction.

SD-03 Product Data

Doors; G-AE.

SD-08 Manufacturer's Instructions

Doors.

SD-10 Operation and Maintenance Data

Doors; G-AO.

Submit Data Package 2 in accordance with SECTION 01781, OPERATION AND MAINTENANCE DATA.

1.3 DELIVERY, STORAGE, AND HANDLING

Protect doors and accessories from damage during delivery, storage, and handling. Clearly mark manufacturer's brand name. Store doors in dry locations with adequate ventilation, free from dust and water. Storage shall permit easy access for inspection and handling. Remove damaged items and provide new.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Hard-Drawn Springwire

ASTM A 227/A 227M.

2.1.2 Oil-Tempered Springwire

ASTM A 229/A 229M.

2.1.3 Steel Sheet

ASTM A 653/A 653M.

2.1.4 Steel Shapes

ASTM A 36/A 36M.

2.1.5 Aluminum Extrusions

ASTM B 221, Alloy 6063-T5.

2.1.6 Aluminum Sheets and Strips

ASTM B 209, alloy and temper best suited for the purpose.

2.2 DOORS

DASMA 102. Industrial doors. Metal doors shall be horizontal sections hinged together which operate in a system of tracks to completely close the door opening in the closed position and make the full width and height of the door opening available for use in the open position. Provide a permanent label on the door indicating the name and address of the manufacturer. Doors shall be of the standard lift type designed to slide up and back into a horizontal overhead position and requiring a maximum of 21 inches of headroom for 3 inch tracks. Doors shall be operated by hand chain with gear or sprocket reduction.

2.3 DESIGN REQUIREMENTS

DASMA 102 except that design wind load shall be 42 pounds per square foot. Doors shall remain operable and undamaged after conclusion of tests conducted in accordance with ASTM E 330 using the design wind load.

2.4 FABRICATION

2.4.1 Steel Overhead Doors

Form door sections of hot-dipped galvanized steel not lighter than 16 gage with flush surface without ribs or grooves. Sections shall be not less than 2 inches in thickness. Meeting rails shall have interlocking joints to ensure a weathertight closure and alignment for full width of the door. Sections shall be of the height indicated or the manufacturer's standard, except the height of an intermediate section shall not exceed 24 inches. Bottom sections may be varied to suit door height, but shall not exceed 30 inches in height.

2.4.1.1 Insulated Sections

Insulate door sections with fibrous glass or plastic foam to provide a "U" factor of 0.14 or less when tested in accordance with ASTM C 236. Cover interior of door sections with steel sheets of not lighter than 24 gage to completely enclose the insulating material.

2.4.2 Tracks

Provide galvanized steel tracks not lighter than 12 gage for 3 inch tracks. Provide vertical tracks with continuous steel angle not lighter than 13 gage for installation to walls. Incline vertical track through use of adjustable brackets to obtain a weathertight closure at jambs. Reinforce horizontal track with galvanized steel angle; support from track ceiling construction with galvanized steel angle and cross bracing to provide a rigid installation.

2.4.3 Hardware

Provide hinges, brackets, rollers, locking devices, and other hardware required for complete installation. Roller brackets and hinges shall be 14 gage galvanized steel. Rollers shall have ball bearings and case-hardened races. Provide reinforcing on doors where roller hinges are connected. Provide a positive locking device and cylinder lock with two keys on

manually operated doors.

2.4.4 Counterbalancing

Counterbalance doors with an oil-tempered, helical-wound torsional spring mounted on a steel shaft. Spring tension shall be adjustable; connect spring to doors with cable through cable drums. Cable safety factor shall be at least 7 to 1.

2.5 MANUAL OPERATORS

2.5.1 Pushup Operators

Provide lifting handles on both sides of door. The force required to operate the door shall not exceed 25 pounds. Provide pulldown straps or ropes at bottom of doors over 7 feet high.

2.5.2 Chain Hoist Operators

Provide a galvanized, endless chain operating over a sprocket. Extend chain to within 4 feet of the floor and mount on inside of building. Obtain reduction by use of roller chain and sprocket drive or gearing. Provide chain cleat and pin for securing operator chain. Hoist shall allow for future installation of power operators. The force required to operate the door shall not exceed 35 pounds.

2.6 WEATHER SEALS

Provide exterior doors with weatherproof joints between sections by means of tongue-and-groove joints, rabbetted joints, shiplap joints, or wool pile, vinyl or rubber weatherstripping; a rubber, wool pile, or vinyl, adjustable weatherstrip at the top and jambs; and a compressible neoprene, rubber, wool pile, or vinyl weather seal attached to the bottom of the door.

2.7 FINISHES

Concealed ferrous metal surfaces and tracks shall be hot-dip galvanized. Other ferrous metal surfaces, except rollers and lock components, shall be hot-dip galvanized and shop primed.

2.7.1 Galvanized and Shop Primed

Surfaces specified shall have a zinc coating, a phosphate treatment, and a shop prime coat of rust-inhibitive paint. The galvanized coating shall conform to ASTM A 653/A 653M, coating designation G60, for steel sheets, and ASTM A 123/A 123M for assembled steel products. The weight of coatings for assembled products shall be as designated in Table I of ASTM A 123/A 123M for the class of material to be coated. The prime coat shall be a type especially developed for materials treated by phosphates and adapted to application by dipping or spraying. Repair damaged zinc-coated surfaces with galvanizing repair paint and spot prime. At the Contractor's option, a two-part system including bonderizing, baked-on epoxy primer, and baked-on enamel topcoat may be applied in lieu of prime coat specified.

PART 3 EXECUTION

3.1 INSTALLATION

NFPA 70. Install doors in accordance with approved shop drawings and manufacturer's instructions. Upon completion, doors shall be weathertight and free from warp, twist, or distortion. Lubricate and adjust doors to operate freely.

3.2 ELECTRICAL WORK

NFPA 70. Conduit, wiring, and mounting of controls are specified in SECTION 16415, ELECTRICAL WORK, INTERIOR.

3.3 TESTING

After installation is complete, operate doors to demonstrate installation and function of operators, safety features, and controls. Correct deficiencies.

-- End of Section --

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SECTION 08520

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SECTION 08520

ALUMINUM AND ENVIRONMENTAL CONTROL ALUMINUM WINDOWS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ALUMINUM ASSOCIATION (AA)

AA DAF-45	(1997) Designation System for Aluminum Finishes

AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

AAMA 101	(1997) Voluntary Specifications for Aluminum, Vinyl (PVC) and Wood Windows and Glass Doors
AAMA 603	(1998) Voluntary Performance Requirements and Test Procedures for Pigmented Organic Coatings on Extruded Aluminum
AAMA 605	(1998) voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM E 283	(1991) Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
ASTM E 330	(1997el) Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference
ASTM E 547	(1996) Water Penetration of Exterior Windows, Curtain Walls, and Doors by Cyclic Static Air Pressure Differential

NATIONAL FENESTRATION RATING COUNCIL (NFRC)

NFRC 100	(1997) Procedure for Determing Fenestration Product U-factors

NFRC 200 (1997) Procedure for Determining Fenestration Product Solar Heat Gain Coefficients at Normal Incidence

1.2 WINDOW PERFORMANCE

Aluminum windows shall meet the following performance requirements. Testing requirements shall be performed by an independent testing laboratory or agency.

1.2.1 Structural Performance

Structural test pressures on window units shall be for positive load (inward) and negative load (outward) in accordance with ASTM E 330. After testing, there shall be no glass breakage, permanent damage to fasteners, hardware parts, support arms or actuating mechanisms or any other damage which could cause window to be inoperable. There shall be no permanent deformation of any main frame, sash or ventilator member in excess of the requirements established by AAMA 101 for the window types and classification specified in this section.

1.2.2 Air Infiltration

Air infiltration shall not exceed the amount established by AAMA 101 for each window type when tested in accordance with ASTM E 283.

1.2.3 Water Penetration

Water penetration shall not exceed the amount established by AAMA 101 for each window type when tested in accordance with ASTM E 547.

1.2.4 Thermal Performance

Thermal transmittance for thermally broken aluminum windows with insulating glass shall not exceed a U-factor of 0.75 Btu/hr-ft^2-F determined according to NFRC 100, and a solar heat gain coefficient (SHGC) of 0.40 Btu/hr-ft^2-F determined according to NFRC 200. Window units shall comply with the U.S. Department of Energy, Energy Star Window Program for the Southern Climate Zone.0.40 Btu/hr-ft^2-F determined according to NFRC 100, and a solar heat gain coefficient (SHGC) of 0.55 Btu/hr-ft^2-F determined according to NFRC 200. Window units shall comply with the U.S. Department of Energy, Energy Star Window Program for the Central Climate Zone.

1.2.5 Condensation Index Rating

The condensation index rating shall be 85 as determined using NFRC approved software THERM.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office

that will review the submittal for the Government. The following shall be submitted in accordance with SECTION 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Aluminum Windows; G-AE.

Drawings indicating elevations of window, rough-opening dimensions for each type and size of window, full-size sections, thicknesses of metal, fastenings, methods of installation and anchorage, connections with other work, type of wall construction, size and spacing of anchors, method of glazing, types and locations of operating hardware, weatherstripping details.

SD-03 Product Data

Aluminum Windows; G-AE.

Manufacturer's descriptive data and catalog cut sheets.

Manufacturer's preprinted installation instructions and cleaning instructions.

SD-04 Samples

Aluminum Windows; G-AE.

Manufacturer's standard color samples of the specified finishes.

SD-06 Test Reports

Aluminum Windows; G-AE.

Reports for each type of aluminum window attesting that identical windows have been tested and meet all performance requirements established under paragraph WINDOW PERFORMANCE.

SD-07 Certificates

Aluminum Windows;

Certificates stating that the aluminum windows are AAMA certified conforming to requirements of this section. Labels or markings permanently affixed to the window will be accepted in lieu of certificates. Product ratings determined using NFRC 100 and NFRC 200 shall be authorized for certification and properly labeled by the manufacturer.

1.4 QUALIFICATION

Window manufacturer shall specialize in designing and manufacturing the type of aluminum windows specified in this section, and shall have a minimum of 5 years of documented successful experience. Manufacturer shall have the facilities capable of meeting contract requirements, single-source responsibility and warranty.

1.5 MOCK-UPS

Before fabrication, full-size mock-up of each type of aluminum window

complete with glass and AAMA certification label for structural purposes and NFRC Temporary and Permanent Label for certification of thermal performance rating will be required for review of window construction and quality of hardware operation.

1.6 DELIVERY AND STORAGE

Aluminum windows shall be delivered to project site and stored in accordance with manufacturer's recommendations. Damaged windows shall be replaced with new windows.

1.7 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period shall be provided.

PART 2 PRODUCTS

2.1 ALUMINUM WINDOW TYPES

Aluminum windows shall consist of complete units including sash, glass, frame, weatherstripping, and hardware. Windows shall conform to AAMA 101. Windows shall be thermal break type double-glazed. Thermal barrier shall be neoprene, rigid vinyl, or polyurethane and shall be resistant to weather. Window members shall be heli-arc welded or angle-reinforced and mechanically joined and sealed. Exposed welded joints shall be dressed and finished. Joints shall be permanent and weathertight. Frames shall be constructed to provide a minimum 1/4 inch thermal break between the exterior and interior frame surfaces. Sash corners shall be internally sealed to prevent air and water leaks.

2.2 WEATHERSTRIPPING

Weatherstrips shall be factory-applied and easily replaced in the field. Neoprene or polyvinylchloride weatherstripping are not acceptable where exposed to direct sunlight.

2.3 ACCESSORIES

2.3.1 Fasteners

Fastening devices shall be window manufacturer's standard design made from aluminum, non-magnetic stainless steel, cadmium-plated steel, nickel/chrome-plated steel in compliance with AAMA 101. Self-tapping sheet metal screws will not be acceptable for material thicker than 1/16 inch.

2.3.2 Hardware

Hardware shall be as specified for each window type and shall be fabricated of aluminum, stainless steel, cadmium-plated steel, zinc-plated steel or nickel/chrome-plated steel in accordance with requirements established by AAMA 101.

2.3.3 Window Anchors

Anchoring devices for installing windows shall be made of aluminum, cadmium-plated steel, stainless steel, or zinc-plated steel conforming to AAMA 101.

2.4 GLASS AND GLAZING

Aluminum windows shall be designed for inside glazing, field glazing, and for glass types scheduled on drawings and specified in SECTION 08810 GLASS AND GLAZING. Units shall be complete with glass and glazing provisions to meet AAMA 101. Glazing material shall be compatible with aluminum, and shall not require painting.

2.5 FINISH

2.5.1 Anodized Aluminum Finish

Exposed surfaces of aluminum windows shall be finished with anodic coating conforming to AA DAF-45: Architectural Class I, AA-M10-C22-A44, color anodic coating, 0.7 mil or thicker. Finish shall be free of scratches and other blemishes.

2.5.2 Baked-Acrylic Resin-Based Coating

Exposed surfaces of aluminum windows shall be finished with acrylic resin-based coating conforming to AAMA 603, total dry thickness of 1.0 mils. Finish shall be free of scratches and other blemishes.

2.5.3 High-Performance Coating

Exposed surfaces of aluminum windows shall be finished with a two-coat fluoropolymer coating system containing at least 70 percent by weight polyvinylidene fluoride, PVF2 resin, factory-applied, oven-baked, conforming to AAMA 605, with a primer coat of 0.20 to 0.30 mils and a color coat of minimum 1.0 mil, total dry film thickness of 1.20 to 1.3 mils. Finish shall be free of scratches and other blemishes.

2.5.4 Color

Color shall be as indicated on the drawings.

PART 3 EXECUTION

3.1 INSTALLATION

Aluminum windows shall be installed in accordance with approved shop drawings and manufacturer's published instructions. Aluminum surfaces in contact with masonry, concrete, wood and dissimilar metals other than stainless steel, zinc, cadmium or small areas of white bronze, shall be protected from direct contact using protective materials recommended by AAMA 101. The completed window installation shall be watertight in accordance with SECTION 07900 JOINT SEALING. Glass and glazing shall be installed in accordance with requirements of this section and SECTION 08810 GLASS AND GLAZING.

3.2 ADJUSTMENTS AND CLEANING

3.2.1 Hardware Adjustments

Final operating adjustments shall be made after glazing work is complete. Operating sash or ventilators shall operate smoothly and shall be weathertight when in locked position.

3.2.2 Cleaning

Aluminum window finish and glass shall be cleaned on exterior and interior sides in accordance with window manufacturer's recommendations. Alkaline or abrasive agents shall not be used. Precautions shall be taken to avoid scratching or marring window finish and glass surfaces.

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DIVISION 08 - DOORS AND WINDOWS

SECTION 08710

DOOR HARDWARE

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SECTION 08710

DOOR HARDWARE

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM E 283	(1991) Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen

BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

BHMA A156.1	(1997) Butts and Hinges (BHMA 101)
BHMA A156.2	(1996) Bored and Preassembled Locks and Latches (BHMA 601)
BHMA A156.3	(1994) Exit Devices (BHMA 701)
BHMA A156.4	(1992) Door Controls - Closers (BHMA 301)
BHMA A156.6	(1994) Architectural Door Trim (BHMA 1001)
BHMA A156.7	(1988) Template Hinge Dimensions
BHMA A156.13	(1994) Mortise Locks & Latches (BHMA 621)
BHMA A156.16	(1997) Auxiliary Hardware
BHMA A156.18	(1993) Materials and Finishes (BHMA 1301)
BHMA A156.21	(1996) Thresholds
BHMA A156.22	(1996) Door Gasketing Systems

STEEL DOOR INSTITUTE (SDI)

SDI 100	(1991) Standard Steel Doors and Frames

1.2 SUBMITTALS

Submit the following in accordance with SECTION 01330, SUBMITTAL PROCEDURES.

SD-02 Shop Drawings

Hardware schedule; G-AE.

Keying system.

SD-03 Product Data

Hardware items; G-AE.

SD-08 Manufacturer's Instructions

Installation.

SD-10 Operation and Maintenance Data

Hardware Schedule items, Data Package 1; G-AE.

Submit data package in accordance with SECTION 01781, OPERATION AND MAINTENANCE DATA.

SD-11 Closeout Submittals

Key bitting

1.3 HARDWARE SCHEDULE

Prepare and submit hardware schedule in the following form:

Hardware Item	Quantity	Size	Reference Publication Type No.	Finish	Mfr. Name and Catalog No.	Key Control Symbols	UL Mark (If fire rated and listed)	BHMA Finish Designation

1.4 KEY BITTING CHART REQUIREMENTS

Submit key bitting charts to the Contracting Officer prior to completion of the work. Include:

a. Complete listing of all keys (AA1, AA2, etc.).

b. Complete listing of all key cuts (AA1-123456, AA2-123458).

c. Tabulation showing which key fits which door.

d. Copy of floor plan showing doors and door numbers.

e. Listing of 20 percent more key cuts than are presently required in each master system.

1.5 QUALITY ASSURANCE

1.5.1 Hardware Manufacturers and Modifications

Provide, as far as feasible, locks, hinges, and closers of one lock, hinge, or closer manufacturer's make. Modify hardware as necessary to provide features indicated or specified.

1.6 DELIVERY, STORAGE, AND HANDLING

Deliver hardware in original individual containers, complete with necessary appurtenances including fasteners and instructions. Mark each individual container with item number as shown in hardware schedule. Deliver permanent keys and removable cores to the Contracting Officer, either directly or by certified mail. Deliver construction master keys with the locks.

PART 2 PRODUCTS

2.1 TEMPLATE HARDWARE

Hardware to be applied to metal shall be made to template. Promptly furnish template information or templates to door and frame manufacturers. Template hinges shall conform to BHMA A156.7. Coordinate hardware items to prevent interference with other hardware.

2.2 HARDWARE ITEMS

Hinges, locks, latches, exit devices, bolts, and closers shall be clearly and permanently marked with the manufacturer's name or trademark where it will be visible after the item is installed. For closers with covers, the name or trademark may be beneath the cover.

2.2.1 Hinges

BHMA A156.1, 4 1/2 by 4 1/2 inches unless otherwise specified. Construct loose pin hinges for exterior doors and reverse-bevel interior doors so that pins will be nonremovable when door is closed. Other antifriction bearing hinges may be provided in lieu of ball-bearing hinges.

2.2.2 Locks and Latches

2.2.2.1 Mortise Locks and Latches

BHMA A156.13, Series 1000, Operational Grade 1, Security Grade 2. Provide mortise locks with escutcheons not less than 7 by 2 1/4 inches with a bushing at least 1/4 inch long. Cut escutcheons to suit cylinders and provide trim items with straight, beveled, or smoothly rounded sides, corners, and edges. Knobs and roses of mortise locks shall have screwless shanks and no exposed screws.

2.2.3 Exit Devices

BHMA A156.3, Grade 1. Provide adjustable strikes for rim type and vertical rod devices. Provide open back strikes for pairs of doors with mortise and vertical rod devices. Provide escutcheons, not less than 7 by 2 1/4 inches.

2.2.4 Cylinders and Cores

Cylinders and cores shall have six pin tumblers. Cylinders shall be products of one manufacturer, and cores shall be the products of one manufacturer. Mortise cylinders shall have interchangeable cores which are removable by special control keys. Stamp each interchangeable core with a key control symbol in a concealed place on the core.

2.2.5 Keying System

Provide grand master keying system Provide a construction master keying system and construction interchangeable cores.

2.2.6 Lock Trim

Cast, forged, or heavy wrought construction and commercial plain design.

2.2.6.1 Knobs and Roses

In addition to meeting test requirements of BHMA A156.2 and BHMA A156.13, knobs, roses, and escutcheons shall be 0.050 inch thick if unreinforced. If reinforced, outer shell shall be 0.035 inch thick and combined thickness shall be 0.070 inch, except knob shanks shall be 0.060 inch thick.

2.2.7 Keys

Furnish one file key, one duplicate key, and one working key for each key change and for each master keying system. Furnish one additional working key for each lock of each keyed-alike group. 5 construction master keys,and 3 control keys for removable cores. Stamp each key with appropriate key control symbol and "U.S. property - Do not duplicate." Do not place room number on keys.

2.2.8 Closers

BHMA A156.4, Series C02000, Grade 1, with PT 4C. Provide with brackets, arms, mounting devices, fasteners, and other features necessary for the particular application. Size closers in accordance with manufacturer's recommendations, or provide multi-size closers, Sizes 1 through 6, and list sizes in the Hardware Schedule. Provide manufacturer's 10 year warranty.

2.2.8.1 Identification Marking

Engrave each closer with manufacturer's name or trademark, date of manufacture, and manufacturer's size designation located to be visible after installation.

2.2.9 Door Protection Plates

BHMA A156.6.

2.2.9.1 Sizes of Kick Plates

Width for single doors shall be 2 inches less than door width; width for pairs of doors shall be one inch less than door width. Height of kick plates shall be 10 inches for flush doors.

2.2.10 Door Stops and Silencers

BHMA A156.16. Silencers Type L03011. Provide three silencers for each single door, two sets of 3 for each pair.

2.2.11 Thresholds

BHMA A156.21. Use J32190, with vinyl or silicone rubber insert in face of stop, for exterior doors opening out, unless specified otherwise.

2.2.12 Weather Stripping Gasketing

BHMA A156.22. Provide the type and function designation where specified in paragraph entitled "Hardware Schedule". A set shall include head and jamb seals, sweep strips, and, for pairs of doors, astragals. Air leakage of weather stripped doors shall not exceed 0.5 cubic feet per minute of air per square foot of door area when tested in accordance with ASTM E 283. Weather stripping shall be one of the following:

2.2.12.1 Extruded Aluminum Retainers

Extruded aluminum retainers not less than 0.050 inch wall thickness with vinyl, neoprene, silicone rubber, or polyurethane inserts. Aluminum shall be clear (natural) anodized.

2.2.12.2 Interlocking Type

Zinc or bronze not less than 0.018 inch thick.

2.2.12.3 Spring Tension Type

Spring bronze or stainless steel not less than 0.008 inch thick.

2.2.13 Special Tools

Provide special tools, such as spanner and socket wrenches and dogging keys, required to service and adjust hardware items.

2.3 FASTENERS

Provide fasteners of proper type, quality, size, quantity, and finish with hardware. Fasteners exposed to weather shall be of nonferrous metal or stainless steel. Provide fasteners of type necessary to accomplish a permanent installation.

2.4 FINISHES

BHMA A156.18. Hardware shall have BHMA 630 finish (satin stainless steel), unless specified otherwise. Provide items not manufactured in stainless steel in BHMA 626 finish (satin chromium plated) over brass or bronze, except surface door closers which shall have prime coat finish, and except steel hinges which shall have BHMA 652 finish (satin chromium plated). Hinges for exterior doors shall be stainless steel with BHMA 630 finish or chromium plated brass or bronze with BHMA 626 finish. Exit devices may be provided in BHMA 626 finish in lieu of BHMA 630 finish

PART 3 EXECUTION

3.1 INSTALLATION

Install hardware in accordance with manufacturers' printed instructions. Fasten hardware to wood surfaces with full-threaded wood screws or sheet metal screws. Provide machine screws set in expansion shields for fastening hardware to solid concrete and masonry surfaces. Provide toggle bolts where required for fastening to hollow core construction. Provide through bolts where necessary for satisfactory installation.

3.1.1 Weather Stripping Installation

Handle and install weather stripping so as to prevent damage. Provide full contact, weather-tight seals. Doors shall operate without binding.

3.1.1.1 Stop-Applied Weather Stripping

Fasten in place with color-matched sheet metal screws not more than 9 inches o.c. after doors and frames have been finish painted.

3.1.1.2 Interlocking Type Weather Stripping

Provide interlocking, self-adjusting type on heads and jambs and flexible hook type at sills. Nail weather stripping to door one inch o.c. and to heads and jambs at 4 inches o.c.

3.1.1.3 Spring Tension Type Weather Stripping

Provide spring tension type on heads and jambs. Provide bronze nails with bronze, stainless steel nails with stainless steel. Space nails not more than 1 1/2 inches o.c.

3.1.2 Threshold Installation

Extend thresholds the full width of the opening and notch end for jamb stops. Set thresholds in a full bed of sealant and anchor to floor with cadmium-plated, countersunk, steel screws.

3.2 HARDWARE LOCATIONS

SDI 100, unless indicated or specified otherwise.

a. Kick and Armor Plates: Push side of single-acting doors. Both sides of double-acting doors.

b. Mop Plates: Bottom flush with bottom of door.

3.3 FIELD QUALITY CONTROL

After installation, protect hardware from paint, stains, blemishes, and other damage until acceptance of work. Submit notice of testing 15 days before scheduled, so that testing can be witnessed by the Contracting Officer. Adjust hinges, locks, latches, bolts, holders, closers, and other items to operate properly. Demonstrate that permanent keys operate respective locks, and give keys to the Contracting Officer. Correct, repair, and finish, as directed, errors in cutting and fitting and damage to adjoining work.

3.4 HARDWARE SETS

HW-1

1 1/2pr.	Butts
1 ea.	Exit Device
1 ea.	Closer
1 ea.	Kick plate
1 ea.	Wall stop
1 set	Weather stripping
1 ea.	Threshold

HW-2

3 pr.	Butts	
2 ea.	Exit Device	
2 ea.	Closer	
2 ea.	Kick Plates	
2 ea.	Wall Stops	Door 101B only
1 ea.	Walls Stop	Door 104 B only
1 set	Weatherstripping	
1 ea.	Threshold	

HW-3

1 1/2 pr.	Butts
1 ea.	Lockset
1 ea.	Kick plate

HW-4

Overhead doors shall be supplied with all required hardware by the overhead door supplier Included shall be:

3" door tracks and rollers
locks
chain hoist
weatherstripping

-- End of Section --

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DIVISION 08 - DOORS AND WINDOWS

SECTION 08810

GLASS AND GLAZING

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2.4.3 Glazing Gaskets
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2.4.3.2 Wedge Glazing Gaskets
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2.4.5 Setting and Edge Blocking

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3.3 CLEANING
3.4 PROTECTION

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SECTION 08810

GLASS AND GLAZING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z97.1	(1984; R 1994) Safety Performance Specifications and Methods of Test for Safety Glazing Materials Used in Buildings

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 509	(2000) Elastomeric Cellular Preformed Gasket and Sealing Material
ASTM C 669	(1995) Glazing Compounds for Back Bedding and Face Glazing of Metal Sash
ASTM C 864	(1999) Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers
ASTM C 920	(2002) Elastomeric Joint Sealants
ASTM C 1036	(1991; R 1997) Flat Glass
ASTM C 1172	(1996el) Laminated Architectural Flat Glass
ASTM D 395	(1998) Rubber Property - Compression Set
ASTM E 773	(1997) Accelerated Weathering of Sealed Insulating Glass Units
ASTM E 774	(1997) Classification of the Durability of Sealed Insulating Glass Units
ASTM E 1300	(1998) Determining the Minimum Thickness and Type of Glass Required to Resist a Specified Load

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

16 CFR 1201	Safety Standard for Architectural Glazing Materials

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

CID A-A-378	(Basic) Putty Linseed Oil Type, (for

Wood-Sash-Glazing)

GLASS ASSOCIATION OF NORTH AMERICA (GANA)

GANA Glazing Manual	(1997) Glazing Manual

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 80	(1999) Fire Doors and Fire Windows
NFPA 252	(1999) Fire Tests of Door Assemblies
NFPA 257	(1996) Fire Tests for Window and Glass Block Assemblies

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with SECTION 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Installation; G-AO.

Drawings showing complete details of the proposed setting methods, mullion details, edge blocking, size of openings, frame details, materials, and types and thickness of glass.

SD-03 Product Data

Insulating Glass; G-AO.

Glazing Accessories; G-AO.

Manufacturer's descriptive product data, handling and storage recommendations, installation instructions, and cleaning instructions.

SD-04 Samples

Insulating Glass; G-AO

Two 8 x 10 inch samples of each of the following: tinted glass, and insulating glass units.

SD-07 Certificates

Insulating Glass;

Certificates stating that the glass meets the specified requirements. Labels or manufacturers marking affixed to the glass will be accepted in lieu of certificates.

1.3 SYSTEM DESCRIPTION

Glazing systems shall be fabricated and installed watertight and airtight

to withstand thermal movement and wind loading without glass breakage, gasket failure, deterioration of glazing accessories, and defects in the work. Glazed panels shall comply with the safety standards, as indicated in accordance with ANSI Z97.1. Glazed panels shall comply with indicated wind/snow loading in accordance with ASTM E 1300.

1.4 DELIVERY, STORAGE AND HANDLING

Glazing compounds shall be delivered to the site in the manufacturer's unopened containers. Glass shall be stored indoors in a safe, well ventilated dry location in accordance with manufacturer's instructions, and shall not be unpacked until needed for installation. Glass shall not be stored on site over 1 month.

1.5 PROJECT/SITE CONDITIONS

Glazing work shall not be started until outdoor temperature is above 40 degrees F and rising, unless procedures recommended by glass manufacturer and approved by Contracting Officer are made to warm the glass and rabbet surfaces. Ventilation shall be provided to prevent condensation of moisture on glazing work during installation. Glazing work shall not be performed during damp or raining weather.

1.6 WARRANTY

1.6.1 Insulating Glass

Manufacturer shall warrant the insulating glass to be free of fogging or film formation on the internal glass surfaces caused by failure of the hermetic seal for a period of 10 years from Date of Substantial Completion. Warranty shall be signed by manufacturer.

PART 2 PRODUCTS

2.1 ROLLED GLASS

2.1.1 Wired Glass

Wired glass shall be Type II flat type, Class 1 - translucent 1 - wired and polished both sides, conforming to ASTM C 1036. Wire mesh shall be polished stainless steel Mesh 1 - diamond. Wired glass for fire-rated windows shall bear an identifying UL label or the label of a nationally recognized testing agency, and shall be rated for 20 minutes when tested in accordance with NFPA 257. Wired glass for fire-rated doors shall be tested as part of a door assembly in accordance with NFPA 252.

2.2 INSULATING GLASS

Insulating glass shall be Class A preassembled units of dual-seal construction consisting of lites of glass separated by an aluminum, steel, or stainless steel, spacer and dehydrated space conforming to ASTM E 773 and ASTM E 774. Spacer shall be roll-formed, with bent or tightly welded or keyed and sealed joints to completely seal the spacer periphery and eliminate moisture and hydrocarbon vapor transmission into airspace through the corners. Primary seal shall be compressed polyisobutylene and the secondary seal shall be a specially formulated silicone. Glass types shall be as follows:

2.2.1 Clear Insulating Glass

Glass for two-pane insulating units shall be Type I annealed glass, Class 1 - clear, Quality q3 - glazing select, conforming to ASTM C 1036. Glass performance shall be R-Value/Winter Nighttime 2.1 to 2.8.

2.2.2 Low-E Insulating Glass

Interior glass panes for Low-E insulating units shall be Type I annealed flat glass, Class 1-clear with anti-reflective low-emissivity coating on No. 2 surface (inside surface of exterior pane), Quality q3 - glazing select, conforming to ASTM C 1036.

2.3 LAMINATED GLAZINGS

2.3.1 Laminated Glass

Laminated glass shall consist of one layers of Type I transparent float glass and one layer of Low-E insulating glass, , Class 1-clear Quality q3 - glazing select, conforming to ASTM C 1036. Glass shall be bonded together with 0.030 inchthick PVB interlayer under pressure, or alternatives such as resin laminates, conforming to requirements of 16 CFR 1201 and ASTM C 1172.

2.4 GLAZING ACCESSORIES

2.4.1 Preformed Tape

Preformed tape shall be elastomeric rubber extruded into a ribbon of a width and thickness suitable for specific application. Tape shall be of type which will remain resilient, have excellent adhesion, and be chemically compatible to glass, metal, or wood.

2.4.2 Sealant

Sealant shall be elastomeric conforming to ASTM C 920, Type S or M, Grade NS, Class 12.5, Use G, of type chemically compatible with setting blocks, preformed sealing tape and sealants used in manufacturing insulating glass. Color of sealant shall be as selected.

2.4.3 Glazing Gaskets

Glazing gaskets shall be extruded with continuous integral locking projection designed to engage into metal glass holding members to provide a watertight seal during dynamic loading, building movements and thermal movements. Glazing gaskets for a single glazed opening shall be continuous one-piece units with factory-fabricated injection-molded corners free of flashing and burrs. Glazing gaskets shall be in lengths or units recommended by manufacturer to ensure against pull-back at corners. Glazing gasket profiles shall be as indicated on drawings.

2.4.3.1 Fixed Glazing Gaskets

Fixed glazing gaskets shall be closed-cell (sponge) smooth extruded compression gaskets of cured elastomeric virgin neoprene compounds conforming to ASTM C 509, Type 2, Option 1.

2.4.3.2 Wedge Glazing Gaskets

Wedge glazing gaskets shall be high-quality extrusions of cured elastomeric virgin neoprene compounds, ozone resistant, conforming to ASTM C 864, Option 1, Shore A durometer between 65 and 75.

2.4.3.3 Aluminum Framing Glazing Gaskets

Glazing gaskets for aluminum framing shall be permanent, elastic, non-shrinking, non-migrating, watertight and weathertight.

2.4.4 Putty and Glazing Compound

Glazing compound shall conform to ASTM C 669 for face-glazing metal sash. Putty shall be linseed oil type conforming to CID A-A-378 for face-glazing primed wood sash. Putty and glazing compounds shall not be used with insulating glass or laminated glass.

2.4.5 Setting and Edge Blocking

Neoprene setting blocks shall be dense extruded type conforming to ASTM D 395, Method B, Shore A durometer between 70 and 90. Edge blocking shall be Shore A durometer of 50 (+ or - 5). Silicone setting blocks shall be required when blocks are in contact with silicone sealant. Profiles, lengths and locations shall be as required and recommended in writing by glass manufacturer.

PART 3 EXECUTION

3.1 PREPARATION

Openings and framing systems scheduled to receive glass shall be examined for compliance with approved shop drawings, GANA Glazing Manual and glass manufacturer's recommendations including size, squareness, offsets at corners, presence and function of weep system, face and edge clearance requirements and effective sealing between joints of glass-framing members. Detrimental materials shall be removed from glazing rabbet and glass surfaces and wiped dry with solvent. Glazing surfaces shall be dry and free of frost.

3.2 INSTALLATION

Glass and glazing work shall be performed in accordance with approved shop drawings, GANA Glazing Manual, glass manufacturer's instructions and warranty requirements. Glass shall be installed with factory labels intact and removed only when instructed. Wired glass and shall be installed in accordance with NFPA 80. Edges and corners shall not be ground, nipped or cut after leaving factory. Springing, forcing or twisting of units during installation will not be permitted.

3.3 CLEANING

Upon completion of project, outside surfaces of glass shall be washed clean and the inside surfaces of glass shall be washed and polished in accordance with glass manufacturer's recommendations.

3.4 PROTECTION

Glass work shall be protected immediately after installation. Glazed

openings shall be identified with suitable warning tapes, cloth or paper flags, attached with non-staining adhesives. Reflective glass shall be protected with a protective material to eliminate any contamination of the reflective coating. Protective material shall be placed far enough away from the coated glass to allow air to circulate to reduce heat buildup and moisture accumulation on the glass. Glass units which are broken, chipped, cracked, abraded, or otherwise damaged during construction activities shall be removed and replaced with new units.

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SECTION 09250

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SECTION 09250

GYPSUM WALLBOARD

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 580/A 580M	(1998) Stainless Steel Wire
ASTM A 853	(1993; R 1998) Steel Wire, Carbon, for General Use
ASTM C 36/C 36M	(1999) Gypsum Wallboard
ASTM C 475	(1994) Joint Compound and Joint Tape for Finishing Gypsum Board
ASTM C 630/C 630M	(2000) Water-Resistant Gypsum Backing Board
ASTM C 645	(2000) Nonstructural Steel Framing Members
ASTM C 754	(1999a) Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products
ASTM C 840	(1999) Application and Finishing of Gypsum Board
ASTM C 1002	(2000) Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases
ASTM C 1047	(1999) Accessories for Gypsum Wallboard and Gypsum Veneer Base

GYPSUM ASSOCIATION (GA)

GA 214	(1996) Recommended Levels of Gypsum Board Finish
GA 216	(1996) Application and Finishing of Gypsum Board

1.2 SYSTEM DESCRIPTION

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with SECTION 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Steel Framing; G-AO.

Control Joints; G-AO.

Fire-Resistant Assemblies; G-AO.

Drawings and installation details for ceiling framing, furring, special wall framing, and framed openings in walls and ceilings.

SD-07 Certificates

Gypsum Board.

Steel Framing.

Fire-Rated Gypsum Board.

Certificates stating that the steel framing and gypsum wallboard meet the specified requirements.

1.4 QUALIFICATIONS

Manufacturer shall specialize in manufacturing the types of material specified and shall have a minimum of 5 years of documented successful experience. Installer shall specialize in the type of gypsum board work required and shall have a minimum of 3 years of documented successful experience.

1.5 DELIVERY, STORAGE AND HANDLING

Materials shall be delivered in original containers bearing the name of manufacturer, contents, and brand name. Materials shall be stored off the ground in a weathertight structure for protection. Gypsum boards shall be stacked flat, off floor and supported to prevent sagging and warpage. Adhesives and joint materials shall be stored in accordance with manufacturer's printed instructions. Damaged or deteriorated materials shall be removed from jobsite.

1.6 ENVIRONMENTAL CONDITIONS

Environmental conditions for application and finishing of gypsum board shall be in accordance with ASTM C 840. During the application of gypsum board without adhesive, a room temperature of not less than 40 degrees F shall be maintained. During the application of gypsum board with adhesive, a room temperature of not less than 50 degrees F shall be maintained for 48 hours prior to application and continuously afterwards until completely dry. Building spaces shall be ventilated to remove water not required for

drying joint treatment materials. Drafts shall be avoided during dry hot weather to prevent materials from drying too rapidly.

PART 2 MATERIALS

2.1 NON-LOADBEARING STUD WALLS

2.1.1 Studs

Studs for non-loadbearing walls shall conform to ASTM C 645. Studs shall be C-shaped, roll formed steel with minimum uncoated design thickness of 0.0284 in made from G40 hot-dip galvanized coated sheet.

2.1.2 Runner Tracks

Floor and ceiling runner tracks shall conform to ASTM C 645. Tracks shall be prefabricated, U-shaped with minimum 1 inch flanges, unpunched web, thickness to match studs, made from G40 hot-dip galvanized coated sheet.

2.2 GYPSUM BOARD

Gypsum board shall be asbestos-free. Gypsum board shall have square-cut ends, tapered or beveled edges and shall be maximum possible length. Gypsum board thickness shall be as shown.

2.2.1 Standard Gypsum Board

Regular gypsum board shall conform to ASTM C 36/C 36M, and shall be 5/8 inch thick 48 inches wide.

2.3 TRIM, MOLDINGS, AND ACCESSORIES

2.3.1 Taping and Embedding Compound

Taping and embedding compound shall conform to ASTM C 475. Compound shall be specifically formulated and manufactured for use in embedding tape at gypsum wallboard joints and fastener heads, and shall be compatible with tape and substrate.

2.3.2 Finishing or Topping Compound

Finishing or topping compound shall conform to ASTM C 475. Compound shall be specifically formulated and manufactured for use as a finishing compound for gypsum board.

2.3.3 All-Purpose Compound

All-purpose compound shall be specifically formulated and manufactured to use as a taping and finishing compound, and shall be compatible with tape and substrate.

2.3.4 Joint Tape

Joint tape shall conform to ASTM C 475 and shall be as recommended by gypsum board manufacturer.

2.3.5 Trim, Control Joints, Beads, Stops and Nosings

Items used to protect edges, corners, and to provide architectural features

shall be in accordance with ASTM C 1047.

2.4 FASTENINGS AND ADHESIVES

2.4.1 Screws

Screws shall conform to ASTM C 1002. Screws shall be self-drilling and self-tapping steel, Type G for gypsum board to gypsum board Type S for wood or light-gauge steel framing.

2.4.2 Wire and Clip Type Fastenings

Tie wire, clips, rings, and other fastenings shall be corrosion-resisting steel conforming to ASTM A 580/A 580M, composition 302, 304, or 316, Condition A, except that walls, partitions, and other vertical surfaces not incorporated in ceiling construction may be erected with soft, annealed steel conforming to ASTM A 853.

2.4.2.1 Tie Wire

Tie wire for constructing partitions and vertical furring, for securing metal lath to supports, and for lacing shall be not less than No. 18 SWG. Tie wire for other applications shall be not less than No. 16 SWG.

PART 3 EXECUTION

3.1 INTERIOR WALL FRAMING

Steel framing and furring members shall be installed in accordance with ASTM C 754. Members shall be in alignment with spacings not to exceed the maximum spacings indicated on drawings. Runners shall be aligned accurately at the floor and ceiling and securely anchored.

3.1.1 Wall Openings

The framing system shall provide for the installation and anchorage of the required subframes or finish frames for wall openings at doors, pass-through openings, and access panels. Partitions abutting continuous suspended ceilings shall be strengthened for rigidity at rough openings of more than 30 inches wide. Studs at openings shall be 0.0329 in minimum bare metal thickness and spot grouted at jamb anchor inserts. Double studs shall be fastened together with screws and secured to floor and overhead runners. Two studs shall be used for framing solid-core doors, doors over 36 inches wide and extra-heavy doors such as X-ray room doors.

3.1.2 Wall Control Joints

Control joints for expansion and contraction in the walls shall be constructed with double studs installed 1/2 inch apart in interior walls or wall furrings where indicated on drawings. Control joint spacing shall not exceed 30 feet. Ceiling-height door frames may be used as vertical control joints. Door frames of less than ceiling height may be used as control joints only if standard control joints extend to ceiling from both corners of top of door frame.

3.1.3 Blocking

Blocking shall be provided as necessary for mounted equipment. Blocking shall be metal or wood and shall be cut to fit between framing members.

Blocking shall be rigidly anchored to the framing members. Under no circumstances will accessories or other wall mounted equipment be anchored directly to gypsum wallboard.

3.2 APPLICATION OF GYPSUM BOARD

Gypsum board shall be installed in accordance with ASTM C 840, GA 214 and GA 216 and as specified. Edges and ends of gypsum boards shall be cut to obtain neat fitting joints. End joints of adjoining boards shall be staggered, and shall be staggered on opposite sides of wall. Boards shall be applied with moderate contact without forcing in place. Holes for pipes, fixtures or other small openings shall be cut with a tool which will provide a neat fit. Screws shall be driven so that the heads are slightly below the plane of paper face. Fracturing the paper face or damaging the core shall be avoided. Trim shall be installed at external and internal angles formed by the intersecting gypsum board surfaces with other surfaces. Corner beads shall be installed to vertical and horizontal corners in accordance with manufacturer's published instructions. Boards of maximum practical length shall be used so that an absolute minimum number of end joints occur. Gypsum board partitions in rooms with ceiling heights less than 10 feet shall have full height boards installed vertically with no end joints in the gypsum installation.

3.2.1 Two-Ply Gypsum Board

Second layer of gypsum board shall be applied perpendicular to first layer with joints staggered and secured with mechanical fasteners. The use of adhesive shall be in accordance with ASTM C 840.

3.3 TRIM, MOLDINGS, AND ACCESSORIES INSTALLATION

Trim, moldings and accessories shall be installed in accordance with GA 216.

3.4 GYPSUM BOARD FINISH

Gypsum board shall be finished in accordance with ASTM C 840, GA 214 and GA 216. Plenum areas above ceilings shall be finished to Level 1 in accordance with GA 214. Water resistant gypsum backing board, ASTM C 630/C 630M, to receive ceramic tile shall be finished to Level 2 in accordance with GA 214. Walls and ceilings to receive a heavy-grade wall covering or heave textured finish before painting shall be finished to Level 3 in accordance with GA 214. Walls and ceilings without critical lighting to receive flat paints, light textures, or wall coverings shall be finished to Level 4 in accordance with GA 214. Unless otherwise specified, all gypsum board walls, partitions and ceilings shall be finished to Level 5 in accordance with GA 214.

3.5 PATCHING

Surface defects and damage shall be corrected as required to leave gypsum board smooth, uniform in appearance, and ready to receive finish as specified.

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SECTION 09510

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SECTION 09510

ACOUSTICAL CEILINGS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 635	(2000) Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings
ASTM C 636	(1996) Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels
ASTM E 580	(2000) Application of Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels in Areas Requiring Moderate Seismic Restraint
ASTM E 1264	(1998) Standard Classification for Acoustical Ceiling Products
ASTM E 1414	(2000) Standard Test for Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum

U.S. ARMY CORPS OF ENGINEERS (USACE)

TI 809-04	(1998) Seismic Design for Buildings

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with SECTION 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Approved Detail Drawings; G-AE.

Drawings showing suspension system, method of anchoring and fastening, details, and reflected ceiling plan.

SD-03 Product Data

Acoustical Ceiling Systems; G-AE.

Manufacturer's descriptive data, catalog cuts, and installation instructions. Submittals which do not provide adequate data for the product evaluation will be rejected.

SD-04 Samples

Acoustical Units; G-AE.

Two samples of each type of acoustical unit and each type of suspension grid tee section showing texture, finish, and color.

SD-06 Test Reports

Ceiling Attenuation Class and Test.

Reports by an independent testing laboratory attesting that acoustical ceiling systems meet specified sound transmission requirements.

SD-07 Certificates

Acoustical Units.

Certificate attesting that the mineral based acoustical units furnished for the project contains recycled material and showing an estimated percent of such material.

1.3 GENERAL REQUIREMENTS

Acoustical treatment shall consist of sound controlling units mechanically mounted on a ceiling suspension system. The unit size, texture, finish, and color shall be as specified. The location and extent of acoustical treatment shall be as shown on the approved detail drawings. Reclamation of mineral fiber acoustical ceiling panels to be removed from the job site shall be in accordance with paragraph RECLAMATION PROCEDURES.

1.4 DELIVERY AND STORAGE

Materials shall be delivered to the site in the manufacturer's original unopened containers with brand name and type clearly marked. Materials shall be carefully handled and stored in dry, watertight enclosures. Immediately before installation, acoustical units shall be stored for not less than 24 hours at the same temperature and relative humidity as the space where they will be installed in order to assure proper temperature and moisture acclimation.

1.5 ENVIRONMENTAL REQUIREMENTS

A uniform temperature of not less than 60 degrees F nor more than 85 degrees F and a relative humidity of not more than 70 percent shall be maintained before, during, and after installation of acoustical units.

1.6 SCHEDULING

Interior finish work such as plastering, concrete and terrazzo work shall

be complete and dry before installation. Mechanical, electrical, and other work above the ceiling line shall be completed and heating, ventilating, and air conditioning systems shall be installed and operating in order to maintain temperature and humidity requirements.

1.7 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a one year period shall be provided. Standard performance guarantee or warranty shall contain an agreement to repair or replace acoustical panels that fail within the warranty period. Failures include, but are not limited to, sagging and warping of panels; rusting and manufacturers defects of grid system.

1.8 EXTRA MATERIALS

Spare tiles of each color shall be furnished at the rate of 20 tiles . Tiles shall be from the same lot as those installed.

PART 2 PRODUCTS

2.1 ACOUSTICAL UNITS

Acoustical units shall conform to EPA requirements in accordance with SECTION 01670 RECYCLED / RECOVERED MATERIALS . Acoustical units shall conform to ASTM E 1264, Class A, and the following requirements:

2.1.1 Units for Exposed-Grid System

Type: III (mineral fiber with painted finish). Type III acoustical units shall have a minimum recycled material content of 18 percent.

Minimum NRC: 0.55 when tested on mounting No. E-400

Pattern: E.

Nominal size: 24 BY 24 inches.

Edge detail: Tegular trim.

Finish: Factory-applied standard finish.

Minimum CAC: 40.

2.2 SUSPENSION SYSTEM

Suspension system shall be standard , and shall conform to ASTM C 635 for intermediate-duty systems. Surfaces exposed to view shall be aluminum or steel with a factory-applied white baked-enamel finish. Wall molding shall have a flange of not less than 15/16 inch. Inside and outside corner caps Mitered corners shall be provided. Suspended ceiling framing system shall have the capability to support the finished ceiling, light fixtures, air diffusers, and accessories, as shown. The suspension system shall have a maximum deflection of 1/360 of span length. Suspension shall comply with force protection requirements by incorporating seismic details and guidance in TI 809-04 and ASTM E 580.

2.3 HANGERS

Hangers shall be galvanized steel wire. Hangers and attachment shall support a minimum 300 pound ultimate vertical load without failure of supporting material or attachment.

2.4 FINISHES

Acoustical units and suspension system members shall have manufacturer's standard textures, patterns and finishes as specified. Ceiling suspension system components shall be treated to inhibit corrosion.

2.5 CEILING ATTENUATION CLASS AND TEST

Ceiling attenuation class (CAC) range of acoustical units, when required, shall be determined in accordance with ASTM E 1414. Test ceiling shall be continuous at the partition and shall be assembled in the suspension system in the same manner that the ceiling will be installed on the project. System shall be tested with all acoustical units installed.

PART 3 EXECUTION

3.1 INSTALLATION

Acoustical work shall be provided complete with necessary fastenings, clips, and other accessories required for a complete installation. Mechanical fastenings shall not be exposed in the finished work. Hangers shall be laid out for each individual room or space. Hangers shall be placed to support framing around beams, ducts, columns, grilles, and other penetrations through ceilings. Main runners and carrying channels shall be kept clear of abutting walls and partitions. At least two main runners shall be provided for each ceiling span. Wherever required to bypass an object with the hanger wires, a subsuspension system shall be installed, so that all hanger wires will be plumb.

3.1.1 Suspension System

Suspension system shall be installed in accordance with ASTM C 636 and as specified herein. There shall be no hanger wires or other loads suspended from underside of steel decking.

3.1.1.1 Plumb Hangers

Hangers shall be plumb and shall not press against insulation covering ducts and pipes.

3.1.1.2 Splayed Hangers

Where hangers must be splayed (sloped or slanted) around obstructions, the resulting horizontal force shall be offset by bracing, countersplaying, or other acceptable means.

3.1.2 Wall Molding

Wall molding shall be provided where ceilings abut vertical surfaces. Wall molding shall be secured not more than 3 inches from ends of each length and not more than 16 inches on centers between end fastenings. Wall molding springs shall be provided at each acoustical unit in semi-exposed or concealed systems.

3.1.3 Acoustical Units

Acoustical units shall be installed in accordance with the approved installation instructions of the manufacturer. Edges of acoustical units shall be in close contact with metal supports, with each other, and in true alignment. Acoustical units shall be arranged so that units less than one-half width are minimized. Units in exposed-grid system shall be held in place with manufacturer's standard hold-down clips, if units weigh less than 1 psf or if required for fire resistance rating.

3.2 CLEANING

Following installation, dirty or discolored surfaces of acoustical units shall be cleaned and left free from defects. Units that are damaged or improperly installed shall be removed and new units provided as directed.

3.3 RECLAMATION PROCEDURES

Ceiling tile, designated for recycling by the Contracting Officer, shall be neatly stacked on 4 by 4 footpallets not higher than 4 foot. Panels shall be completely dry. Pallets shall then be shrink wrapped and symmetrically stacked on top of each other without falling over. Disposal shall be in accordance with SECTION 01572 CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT.

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SECTION 09650

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SECTION 09650

RESILIENT FLOORING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM E 648	(2000) Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source
ASTM E 662	(2001) Specific Optical Density of Smoke Generated by Solid Materials

1.2 FIRE RESISTANCE REQUIREMENTS

Flooring in corridors and exits shall have a minimum average critical radiant flux of 0.45 watts per square centimeter when tested in accordance with ASTM E 648. The smoke density rating shall be less than 450 when tested in accordance with ASTM E 662.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with SECTION 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Adhesive for Wall Base; G-AO.

Manufacturer's descriptive data and installation instructions including cleaning and maintenance instructions.

SD-04 Samples

Tile Flooring; G-AE.

Wall Base; G-AE.

Three samples of each indicated color and type of flooring and base. Sample size shall be minimum 2-1/2 x 4 inches.

SD-06 Test Reports

Moisture Test.

Copies of test reports showing that representative product samples of the flooring proposed for use have been tested by an independent testing laboratory within the past three years or when formulation change occurred and conforms to the requirements specified.

SD-08 Manufacturer's Instructions

Tile Flooring.

Copies of flooring manufacturer's recommended installation procedures.

SD-10 Operation and Maintenance Data

Data Package 1.

Data Package in accordance with SECTION 01781 OPERATION AND MAINTENANCE DATA.

1.4 DELIVERY AND STORAGE

Materials shall be delivered to the building site in original unopened containers bearing the manufacturer's name, brands, stock names, production run, project identification, and handling instructions. Materials shall be stored in a clean dry area with temperature maintained above 70 degrees F for 2 days prior to installation, and shall be stacked according to manufacturer's recommendations. Materials shall be protected from the direct flow of heat from hot-air registers, radiators and other heating fixtures and appliances. Do not open containers until materials are to be used, except for inspection to verify compliance with requirements.

1.5 ENVIRONMENTAL REQUIREMENTS

a. Areas to receive resilient flooring shall be maintained at a temperature above 70 degrees F and below 100 degrees F for 2 days before application, during application and 2 days after application . A minimum temperature of 55 degrees F shall be maintained thereafter.

b. Provide adequate ventilation to remove moisture from area and to comply with regulations limiting concentrations of hazardous vapors.

1.6 SCHEDULING

Resilient flooring application shall be scheduled after the completion of other work which would damage the finished surface of the flooring.

1.7 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a one year period shall be provided.

1.8 EXTRA MATERIALS

5 . Extra base material composed of 20 linear feet of each color shall be furnished. All extra materials shall be packaged in original containers, properly marked.

PART 2 PRODUCTS

2.1 ADHESIVE FOR WALL BASE

Adhesive for wall base shall be emulsified acrylic latex; non-flammable.

2.2 WALL BASE

Base shall be manufacturers standard rubber or vinyl, coved style. Base shall be 4 inches high and a minimum 1/8 inch thick, in color shown on drawings, and in matte finish. Job Formed corners shall be furnished. Use flexible base to conform to irregularities in walls, partitions, and floors. Provide premolded corners in matching size, shape, and color for all right-angle inside and outside corners.

2.3 CAULKING AND SEALANTS

Caulking and sealants shall be in accordance with SECTION 07900 JOINT SEALING.

PART 3 EXECUTION

3.1 EXAMINATION/VERIFICATION OF CONDITIONS

The Contractor shall examine and verify that site conditions are in agreement with the design package and shall report all conditions that will prevent a proper installation. The Contractor shall not take any corrective action without written permission from the Government.

3.2 CONCRETE FLOOR

Grind ridges and other uneven surfaces smooth. Cut out and fill cracks 1/16 inch or wider with crack filler. Provide mastic underlayment to fill remaining holes, cracks, and depressions and for smoothing, leveling, or creating a feather edge in accordance with instructions of mastic manufacturer. After cleaning and removal of loose particles, prime chalky or dusty surfaces with primer recommended by flooring manufacturer.

3.3 INSTALLATION OF WALL BASE

Wall base shall be installed with adhesive in accordance with the manufacturer's written instructions. Base joints shall be tight and base shall be even with adjacent resilient flooring. Voids along the top edge of base at masonry walls shall be filled with caulk. Roll entire vertical surface of base with hand roller, and press toe of base with a straight piece of wood to ensure proper alignment. Avoid excess adhesive in corners.

-- End of Section --

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DIVISION 09 - FINISHES

SECTION 09900

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SECTION 09900

PAINTS AND COATINGS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS (ACGIH)

ACGIH Limit Values	(2004) Chemical Substances TLVs and BEIs
ACGIH TLV-DOC	(2001) Documentation of Threshold Limit Values and Biological Exposure Indices

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 235	(2002) Mineral Spirits (Petroleum Spirits) (Hydrocarbon Dry Cleaning Solvent)
ASTM D 2092	(1995) Preparation of Zinc-Coated (Galvanized) Steel Surfaces for Painting
ASTM D 4263	(1983; R 1999) Indicating Moisture in Concrete by the Plastic Sheet Method
ASTM D 4444	(1998) Standard Test Methods for Use and Calibration of Hand-Held Moisture Meters
ASTM F 1869	(1998) Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride

FEDERAL STANDARDS (FED-STD)

FED-STD-313	(Rev. C) Material Safety Data, Transportation Data and Disposal Data for Hazardous Materials Furnished to Government Activities

MASTER PAINTERS INSTITUTE (MPI)

MPI 1	(2001) Aluminum Paint
MPI 4	(2001) Interior/Exterior Latex Block Filler
MPI 11	(2001) Exterior Latex, Semi-Gloss
MPI 23	(2001) Surface Tolerant Metal Primer
MPI 26	(2001) Cementitious Galvanized Metal Primer

MPI 50	(2001) Interior Latex Primer Sealer
MPI 54	(2001) Interior Latex, Semi-Gloss
MPI 79	(2001) Marine Alkyd Metal Primer
MPI 94	(2001) Exterior Alkyd, Semi-Gloss
MPI 95	(2001) Fast Drying Metal Primer
MPI 99	(2001) Interior/Exterior Clear Concrete Floor Sealer (water based)
MPI 107	(2001) Rust Inhibitive Primer (Water-Based)
MPI 110	(2001) Interior/Exterior High Performance Acrylic
MPI 141	(2001) High Performance Semigloss Latex, White and Tints - Gloss Level 5

SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS SP01-01	(2001) Environmentally Preferable Product Specification for Architectural and Anti-Corrosive Paints

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC QP 1	(1998) Evaluating Qualifications of Painting Contractors (Field Application to Complex Industrial Structures)
SSPC PA 1	(2000) Shop, Field, and Maintenance Painting
SSPC Guide 3	(1995) Safety in Paint Application
SSPC VIS 3	(1993) Visual Standard for Power- and Hand-Tool Cleaned Steel (Standard Reference Photographs)
SSPC SP 1	(1982) Solvent Cleaning
SSPC SP 2	(1995) Hand Tool Cleaning
SSPC SP 3	(1982; Rev. Sep 2000) Power Tool Cleaning
SSPC SP 6	(1994) Commercial Blast Cleaning
SSPC SP 7	(1994) Brush-Off Blast Cleaning
SSPC SP 12	(1995) Surface Preparation and Cleaning of Steel and Other Hard Materials by High-and Ultra high-Pressure Water Jetting Prior to Recoating

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-STD-101	(Rev. B) Color Code for Pipelines and for Compressed Gas Cylinders

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2003) U.S. Army Corps of Engineers Safety and Health Requirements Manual

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.1000	Air Contaminants

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with SECTION 01330 SUBMITTAL PROCEDURES:

The current MPI, "Approved Product List" which lists paint by brand, label, product name and product code as of the date of contract award, will be used to determine compliance with the submittal requirements of this specification. The Contractor may choose to use a subsequent MPI "Approved Product List", however, only one list may be used for the entire contract and each coating system is to be from a single manufacturer. All coats on a particular substrate must be from a single manufacturer. No variation from the MPI Approved Products List is acceptable.

Samples of specified materials may be taken and tested for compliance with specification requirements.

In keeping with the intent of Executive Order 13101, "Greening the Government through Waste Prevention, Recycling, and Federal Acquisition", products certified by SCS as meeting SCS SP01-01 shall be given preferential consideration over registered products. Products that are registered shall be given preferential consideration over products not carrying any EPP designation.

SD-02 Shop Drawings

Piping identification; G-AO

Submit color stencil codes

SD-03 Product Data

Coating; G-AO

Manufacturer's Technical Data Sheets

SD-04 Samples

Color; G-AO

Submit manufacturer's samples of paint colors. Cross reference color

samples to color scheme as indicated.

SD-07 Certificates

Applicator's qualifications

SD-08 Manufacturer's Instructions

Application instructions

Mixing

Detailed mixing instructions, minimum and maximum application temperature and humidity, potlife, and curing and drying times between coats.

Manufacturer's Material Safety Data Sheets

Submit manufacturer's Material Safety Data Sheets for coatings, solvents, and other potentially hazardous materials, as defined in FED-STD-313.

SD-10 Operation and Maintenance Data

Coatings:; G-AO

Preprinted cleaning and maintenance instructions for all coating systems shall be provided.

1.3 APPLICATOR'S QUALIFICATIONS

1.3.1 SSPC QP 1 Certification

All contractors and subcontractors that perform surface preparation or coating application shall be certified by the Society for Protective Coatings (formerly Steel Structures Painting Council) (SSPC) to the requirements of SSPC QP 1 prior to contract award, and shall remain certified while accomplishing any surface preparation or coating application. The painting contractors and painting subcontractors must remain so certified for the duration of the project. If a contractor's or subcontractor's certification expires, the firm will not be allowed to perform any work until the certification is reissued. Requests for extension of time for any delay to the completion of the project due to an inactive certification will not be considered and liquidated damages will apply. Notify the Contracting Officer of any change in contractor certification status.

1.4 REGULATORY REQUIREMENTS

1.4.1 Environmental Protection

In addition to requirements specified elsewhere for environmental protection, provide coating materials that conform to the restrictions of the local Air Pollution Control District and regional jurisdiction. Notify Contracting Officer of any paint specified herein which fails to conform.

1.4.2 Lead Content

Do not use coatings having a lead content over 0.06 percent by weight of nonvolatile content.

1.4.3 Chromate Content

Do not use coatings containing zinc-chromate or strontium-chromate.

1.4.4 Asbestos Content

Materials shall not contain asbestos.

1.4.5 Mercury Content

Materials shall not contain mercury or mercury compounds.

1.4.6 Silica

Abrasive blast media shall not contain free crystilline silica.

1.4.7 Human Carcinogens

Materials shall not contain ACGIH Limit Values and ACGIH TLV-DOC confirmed human carcinogens (A1) or suspected human carcinogens (A2).

1.5 PACKAGING, LABELING, AND STORAGE

Paints shall be in sealed containers that legibly show the contract specification number, designation name, formula or specification number, batch number, color, quantity, date of manufacture, manufacturer's formulation number, manufacturer's directions including any warnings and special precautions, and name and address of manufacturer. Pigmented paints shall be furnished in containers not larger than 5 gallons. Paints and thinners shall be stored in accordance with the manufacturer's written directions, and as a minimum, stored off the ground, under cover, with sufficient ventilation to prevent the buildup of flammable vapors, and at temperatures between 40 to 95 degrees F.

1.6 SAFETY AND HEALTH

Apply coating materials using safety methods and equipment in accordance with the following:

Work shall comply with applicable Federal, State, and local laws and regulations, and with the ACCIDENT PREVENTION PLAN, including the Activity Hazard Analysis as specified in SECTION 01400 SPECIAL SAFETY REQUIREMENTS and in Appendix A of EM 385-1-1. The Activity Hazard Analysis shall include analyses of the potential impact of painting operations on painting personnel and on others involved in and adjacent to the work zone.

1.6.1 Safety Methods Used During Coating Application

Comply with the requirements of SSPC Guide 3.

1.6.2 Toxic Materials

To protect personnel from overexposure to toxic materials, conform to the most stringent guidance of:

a. The applicable manufacturer's Material Safety Data Sheets (MSDS) or local regulation.

b. 29 CFR 1910.1000.

c. ACGIH Limit Values, threshold limit values.

1.7 ENVIRONMENTAL CONDITIONS

1.7.1 Coatings

Do not apply coating when air or substrate conditions are:

a. Less than 5 degrees F above dew point;

b. Below 50 degrees F or over 95 degrees F, unless specifically pre-approved by the Contracting Officer and the product manufacturer. Under no circumstances shall application conditions exceed manufacturer recommendations.

1.8 COLOR SELECTION

Colors of finish coats shall be as indicated or specified. Where not indicated or specified, colors shall be selected by the Contracting Officer. Manufacturers' names and color identification are used for the purpose of color identification only. Named products are acceptable for use only if they conform to specified requirements. Products of other manufacturers are acceptable if the colors approximate colors indicated and the product conforms to specified requirements.

Tint each coat progressively darker to enable confirmation of the number of coats.

Color, texture, and pattern of wall coating systems shall be in accordance with the drawings.

1.9 LOCATION AND SURFACE TYPE TO BE PAINTED

1.9.1 Painting Included

Where a space or surface is indicated to be painted, include the following unless indicated otherwise.

a. Surfaces behind portable objects and surface mounted articles readily detachable by removal of fasteners, such as screws and bolts.

b. New factory finished surfaces that require identification or color coding and factory finished surfaces that are damaged during performance of the work.

1.9.1.1 Exterior Painting

Includes new surfaces of the building and appurtenances as indicated. Also included are existing coated surfaces made bare by cleaning operations.

1.9.1.2 Interior Painting

Includes new surfaces of the building and appurtenances as indicated and existing coated surfaces made bare by cleaning operations. Where a space or surface is indicated to be painted, include the following items, unless indicated otherwise.

a. Exposed columns, girders, beams, joists, and metal deck; and

b. Other contiguous surfaces.

1.9.2 Painting Excluded

Do not paint the following unless indicated otherwise.

a. Surfaces concealed and made inaccessible by panelboards, fixed ductwork, machinery, and equipment fixed in place.

b. Surfaces in concealed spaces. Concealed spaces are defined as enclosed spaces above suspended ceilings, furred spaces, attic spaces, crawl spaces, elevator shafts and chases.

c. Steel to be embedded in concrete.

d. Copper, stainless steel, aluminum, brass, and lead except existing coated surfaces.

e. Hardware, fittings, and other factory finished items.

1.9.3 Mechanical and Electrical Painting

Includes field coating of interior and exterior new surfaces.

a. Where a space or surface is indicated to be painted, include the following items unless indicated otherwise.

(1) Exposed piping, conduit, and ductwork;

(2) Supports, hangers, air grilles, and registers;

(3) Miscellaneous metalwork and insulation coverings.

b. Do not paint the following, unless indicated otherwise:

(1) New zinc-coated, aluminum, and copper surfaces under insulation

(2) New aluminum jacket on piping

(3) New interior ferrous piping under insulation.

PART 2 PRODUCTS

2.1 MATERIALS

Conform to the coating specifications and standards referenced in PART 3. Submit manufacturer's technical data sheets for specified coatings and solvents.

PART 3 EXECUTION

3.1 PROTECTION OF AREAS AND SPACES NOT TO BE PAINTED

Prior to surface preparation and coating applications, remove, mask, or otherwise protect, hardware, hardware accessories, machined surfaces,

radiator covers, plates, lighting fixtures, public and private property, and other such items not to be coated that are in contact with surfaces to be coated. Following completion of painting, workmen skilled in the trades involved shall reinstall removed items. Restore surfaces contaminated by coating materials, to original condition and repair damaged items.

3.2 SURFACE PREPARATION

Remove dirt, splinters, loose particles, grease, oil, and other foreign matter and substances deleterious to coating performance as specified for each substrate before application of paint or surface treatments. Oil and grease shall be removed prior to mechanical cleaning. Cleaning shall be programmed so that dust and other contaminants will not fall on wet, newly painted surfaces. Exposed ferrous metals such as nail heads on or in contact with surfaces to be painted with water-thinned paints, shall be spot-primmed with a suitable corrosion-inhibitive primer capable of preventing flash rusting and compatible with the coating specified for the adjacent areas.

3.3 PREPARATION OF METAL SURFACES

3.3.1 New Ferrous Surfaces

a. Ferrous Surfaces including Shop-coated Surfaces and Small Areas That Contain Rust, Mill Scale and Other Foreign Substances: Solvent clean or detergent wash in accordance with SSPC SP 1 to remove oil and grease. Where shop coat is missing or damaged, clean according to SSPC SP 3. Brush-off blast remaining surface in accordance with SSPC SP 7. Use inhibitor as recommended by coating manufacturer to prevent premature rusting. Shop-coated ferrous surfaces shall be protected from corrosion by treating and touching up corroded areas immediately upon detection.

b. Surfaces With More Than 20 Percent Rust, Mill Scale, and Other Foreign Substances: Clean entire surface in accordance with SSPC SP 6/SSPC SP 12 WJ-3.

3.3.2 Final Ferrous Surface Condition:

For tool cleaned surfaces, the requirements are stated in SSPC SP 2 and SSPC SP 3. As a visual reference, cleaned surfaces shall be similar to photographs in SSPC VIS 3.

3.3.3 Galvanized Surfaces

a. New Galvanized Surfaces With Only Dirt and Zinc Oxidation Products: Clean with solvent, steam, or non-alkaline detergent solution in accordance with SSPC SP 1. If the galvanized metal has been passivated or stabilized, the coating shall be completely removed by brush-off abrasive blast. New galvanized steel to be coated shall not be "passivated" or "stabilized" If the absence of hexavalent stain inhibitors is not documented, test as described in ASTM D 2092, Appendix X2, and remove by one of the methods described therein.

b. Galvanized with Slight Coating Deterioration or with Little or No Rusting: Water jetting to SSPC SP 12 WJ3 to remove loose coating from surfaces with less than 20 percent coating deterioration and no blistering, peeling, or cracking. Use inhibitor as recommended

by the coating manufacturer to prevent rusting.

c. Galvanized With Severe Deteriorated Coating or Severe Rusting: Spot abrasive blast rusted areas as described for steel in SSPC SP 6, and waterjet to SSPC SP 12, WJ3 to remove existing coating.

3.3.4 Non-Ferrous Metallic Surfaces

Aluminum and aluminum-alloy, lead, copper, and other nonferrous metal surfaces.

a. Surface Cleaning: Solvent clean in accordance with SSPC SP 1 and wash with mild non-alkaline detergent to remove dirt and water soluble contaminants.

3.3.5 Terne-Coated Metal Surfaces

Solvent clean surfaces with mineral spirits, ASTM D 235. Wipe dry with clean, dry cloths.

3.4 PREPARATION OF CONCRETE AND CEMENTITIOUS SURFACE

3.4.1 Concrete and Masonry

a. Curing: Concrete and masonry surfaces shall be allowed to cure at least 30 days before painting, except concrete slab on grade, which shall be allowed to cure 90 days before painting.

b. Surface Cleaning: Remove the following deleterious substances.

(1) Dirt, Chalking, Grease, and Oil: Wash new surfaces with a solution composed of 1/2 cup trisodium phosphate, 1/4 cuphousehold detergent, and 4 quarts of warm water. Then rinse thoroughly with fresh water. Wash existing coated surfaces with a suitable detergent and rinse thoroughly. For large areas, water blasting may be used.

(2) Fungus and Mold: Wash new surfaces with a solution composed of 1/2 cup trisodium phosphate, 1/4 cup household detergent, 1 quart 5 percent sodium hypochlorite solution and 3 quarts of warm water. Rinse thoroughly with fresh water.

(3) Paint and Loose Particles: Remove by wire brushing.

(4) Efflorescence: Remove by scraping or wire brushing followed by washing with a 5 to 10 percent by weight aqueous solution of hydrochloric (muriatic) acid. Do not allow acid to remain on the surface for more than five minutes before rinsing with fresh water. Do not acid clean more than 4 square feet of surface, per workman, at one time.

c. Cosmetic Repair of Minor Defects: Repair or fill mortar joints and minor defects, including but not limited to spalls, in accordance with manufacturer's recommendations and prior to coating application.

d. Allowable Moisture Content: Latex coatings may be applied to damp surfaces, but not to surfaces with droplets of water. Do not apply epoxies to damp vertical surfaces as determined by ASTM D

4263 or horizontal surfaces that exceed 3 lbs of moisture per 1000 square feet in 24 hours as determined by ASTM F 1869. In all cases follow manufacturers recommendations. Allow surfaces to cure a minimum of 30 days before painting.

3.4.2 Gypsum Board

a. Surface Cleaning: Plaster and stucco shall be clean and free from loose matter; gypsum board shall be dry. Remove loose dirt and dust by brushing with a soft brush, rubbing with a dry cloth, or vacuum-cleaning prior to application of the first coat material. A damp cloth or sponge may be used if paint will be water-based.

b. Repair of Minor Defects: Prior to painting, repair joints, cracks, holes, surface irregularities, and other minor defects with patching plaster or spackling compound and sand smooth.

c. Allowable Moisture Content: Latex coatings may be applied to damp surfaces, but not surfaces with droplets of water. Do not apply epoxies to damp surfaces as determined by ASTM D 4263. New plaster to be coated shall have a maximum moisture content of 8 percent, when measured in accordance with ASTM D 4444, Method A, unless otherwise authorized. In addition to moisture content requirements, allow new plaster to age a minimum of 30 days before preparation for painting.

3.5 APPLICATION

3.5.1 Coating Application

Painting practices shall comply with applicable federal, state and local laws enacted to insure compliance with Federal Clean Air Standards. Apply coating materials in accordance with SSPC PA 1. SSPC PA 1 methods are applicable to all substrates, except as modified herein.

At the time of application, paint shall show no signs of deterioration. Uniform suspension of pigments shall be maintained during application.

Unless otherwise specified or recommended by the paint manufacturer, paint may be applied by brush, roller, or spray. Rollers for applying paints and enamels shall be of a type designed for the coating to be applied and the surface to be coated.

Paints, except water-thinned types, shall be applied only to surfaces that are completely free of moisture as determined by sight or touch.

Thoroughly work coating materials into joints, crevices, and open spaces. Special attention shall be given to insure that all edges, corners, crevices, welds, and rivets receive a film thickness equal to that of adjacent painted surfaces.

Each coat of paint shall be applied so dry film shall be of uniform thickness and free from runs, drops, ridges, waves, pinholes or other voids, laps, brush marks, and variations in color, texture, and finish. Hiding shall be complete.

Touch up damaged coatings before applying subsequent coats. Interior areas shall be broom clean and dust free before and during the application of coating material.

a. Drying Time: Allow time between coats, as recommended by the coating manufacturer, to permit thorough drying, but not to present topcoat adhesion problems. Provide each coat in specified condition to receive next coat.

b. Primers, and Intermediate Coats: Do not allow primers or intermediate coats to dry more than 30 days, or longer than recommended by manufacturer, before applying subsequent coats. Follow manufacturer's recommendations for surface preparation if primers or intermediate coats are allowed to dry longer than recommended by manufacturers of subsequent coatings. Each coat shall cover surface of preceding coat or surface completely, and there shall be a visually perceptible difference in shades of successive coats.

c. Finished Surfaces: Provide finished surfaces free from runs, drops, ridges, waves, laps, brush marks, and variations in colors.

d. Thermosetting Paints: Topcoats over thermosetting paints (epoxies and urethanes) should be applied within the overcoating window recommended by the manufacturer.

3.5.2 Mixing and Thinning of Paints

Reduce paints to proper consistency by adding fresh paint, except when thinning is mandatory to suit surface, temperature, weather conditions, application methods, or for the type of paint being used. Obtain written permission from the Contracting Officer to use thinners. The written permission shall include quantities and types of thinners to use.

When thinning is allowed, paints shall be thinned immediately prior to application with not more than 1 pint of suitable thinner per gallon. The use of thinner shall not relieve the Contractor from obtaining complete hiding, full film thickness, or required gloss. Thinning shall not cause the paint to exceed limits on volatile organic compounds. Paints of different manufacturers shall not be mixed.

3.5.3 Two-Component Systems

Two-component systems shall be mixed in accordance with manufacturer's instructions. Any thinning of the first coat to ensure proper penetration and sealing shall be as recommended by the manufacturer for each type of substrate.

3.5.4 Coating Systems

a. Systems by Substrates: Apply coatings that conform to the respective specifications listed in the following Tables:

Table

Division 5. Exterior Metal, Ferrous and Non-Ferrous Paint Table
Division 3. Interior Concrete Paint Table
Division 4. Interior Concrete Masonry Units Paint Table
Division 5. Interior Metal, Ferrous and Non-Ferrous Paint Table
Division 9: Interior Plaster, Gypsum Board, Textured Surfaces Paint Table

b. Minimum Dry Film Thickness (DFT): Apply paints, primers, varnishes, enamels, undercoats, and other coatings to a minimum dry film thickness of 1.5 mil each coat unless specified otherwise in the Tables. Coating thickness where specified, refers to the minimum dry film thickness.

c. Coatings for Surfaces Not Specified Otherwise: Coat surfaces which have not been specified, the same as surfaces having similar conditions of exposure.

d. Existing Surfaces Damaged During Performance of the Work, Including New Patches In Existing Surfaces: Coat surfaces with the following:

(1) One coat of primer.

(2) One coat of undercoat or intermediate coat.

(3) One topcoat to match adjacent surfaces.

e. Existing Coated Surfaces To Be Painted: Apply coatings conforming to the respective specifications listed in the Tables herein, except that pretreatments, sealers and fillers need not be provided on surfaces where existing coatings are soundly adhered and in good condition. Do not omit undercoats or primers.

3.6 COATING SYSTEMS FOR METAL

Apply coatings of Tables in Division 5 for Exterior and Interior.

a. Apply specified ferrous metal primer on the same day that surface is cleaned, to surfaces that meet all specified surface preparation requirements at time of application.

b. Inaccessible Surfaces: Prior to erection, use one coat of specified primer on metal surfaces that will be inaccessible after erection.

c. Shop-primed Surfaces: Touch up exposed substrates and damaged coatings to protect from rusting prior to applying field primer.

d. Surface Previously Coated with Epoxy or Urethane: Apply MPI 101, 1.5 mils DFT immediately prior to application of epoxy or urethane coatings.

e. Pipes and Tubing: The semitransparent film applied to some pipes and tubing at the mill is not to be considered a shop coat, but shall be overcoated with the specified ferrous-metal primer prior to application of finish coats.

f. Exposed Nails, Screws, Fasteners, and Miscellaneous Ferrous Surfaces. On surfaces to be coated with water thinned coatings, spot prime exposed nails and other ferrous metal with latex primer MPI 107.

3.7 COATING SYSTEMS FOR CONCRETE AND CEMENTITIOUS SUBSTRATES

Apply coatings of Tables in Division 3, 4 and 9 for Exterior and Interior.

3.8 PIPING IDENTIFICATION

Piping Identification, Including Surfaces In Concealed Spaces: Provide in accordance with MIL-STD-101. Place stenciling in clearly visible locations. On piping not covered by MIL-STD-101, stencil approved names or code letters, in letters a minimum of 1/2 inch high for piping and a minimum of 2 inches high elsewhere. Stencil arrow-shaped markings on piping to indicate direction of flow using black stencil paint.

3.9 INSPECTION AND ACCEPTANCE

In addition to meeting previously specified requirements, demonstrate mobility of moving components, including swinging and sliding doors, cabinets, and windows with operable sash, for inspection by the Contracting Officer. Perform this demonstration after appropriate curing and drying times of coatings have elapsed and prior to invoicing for final payment.

3.10 PAINT TABLES

All DFT's are minimum values.

3.10.1 EXTERIOR PAINT TABLES

DIVISION 5: EXTERIOR METAL, FERROUS AND NON-FERROUS PAINT TABLE

STEEL / FERROUS SURFACES

A. New Steel that has been hand or power tool cleaned to SSPC SP 2 or SSPC SP 3

1. Alkyd
New; MPI EXT 5.1Q-G5 (Semigloss) Existing; MPI REX 5.1D-G5

Primer:	Intermediate:	Topcoat:
MPI 23	MPI 94	MPI 94

System DFT: 5.25 mils

EXTERIOR GALVANIZED SURFACES

F. New Galvanized surfaces:

1.
MPI EXT 5.3A-G5 (Semigloss)

Primer:	Intermediate:	Topcoat:
MPI 26	MPI 11	MPI 11

System DFT: 4.5 mils

EXTERIOR SURFACES, OTHER METALS (NON-FERROUS)

I. Aluminum, aluminum alloy and other miscellaneous non-ferrous metal items not otherwise specified except hot metal surfaces, roof surfaces, and new prefinished equipment. Match surrounding finish:

2. Waterborne Light Industrial Coating
MPI EXT 5.4G-G3(Eggshell)

Primer:	Intermediate:	Topcoat:
MPI 95	MPI 110-G3	MPI 110-G3

System DFT: 5 mils

J. Surfaces adjacent to painted surfaces; Mechanical, Electrical, and

EXTERIOR SURFACES, OTHER METALS (NON-FERROUS)
miscellaneous metal items not
otherwise specified except floors, hot metal surfaces, and new prefinished equipment. Match surrounding finish:

1.
MPI EXT 5.1C-G5(Semigloss)

Primer:	Intermediate:	Topcoat:
MPI 79	MPI 110-G5	MPI 110-G5

System DFT: 5 mils

3.10.2 INTERIOR PAINT TABLES

DIVISION 3: INTERIOR CONCRETE PAINT TABLE

E. New concrete
floors in following areas Pump Room and Mechanical Room:

1. Floor Sealer
New; MPI INT 3.2F

Primer:	Intermediate:	Topcoat:
	MPI 99	

DIVISION 4: INTERIOR CONCRETE MASONRY UNITS PAINT TABLE

A. New Concrete masonry:

1. MPI INT 4.2D-G5 (Semigloss)

Filler	Primer:	Intermediate:	Topcoat:
MPI 4	N/A	MPI 141	MPI 141

System DFT: 11 mils

Fill all holes in masonry surface

DIVISION 5: INTERIOR METAL, FERROUS AND NON-FERROUS PAINT TABLE

INTERIOR STEEL / FERROUS SURFACES

A. Metal, Mechanical, Electrical,Surfaces adjacent to
painted surfaces (Match surrounding finish),and
miscellaneous metal items not otherwise specified except floors, hot metal surfaces, and new prefinished equipment:

1. MPI INT 5.1R-G5 (Semigloss)

Primer:	Intermediate:	Topcoat:
MPI 79	MPI 141	MPI 141

System DFT: 5 mils

D. Ferrous metal in concealed spaces or in exposed areas having
unpainted adjacent surfaces.

1. Aluminum Paint
MPI INT 5.1M

Primer:	Intermediate:	Topcoat:
MPI 79	MPI 1	MPI 1

System DFT: 4.25 mils

E. Miscellaneous non-ferrous metal items not otherwise specified except

INTERIOR STEEL / FERROUS SURFACES
floors, hot metal surfaces, and new prefinished equipment. Match surrounding finish:

1. MPI INT 5.4F-G5 (Semigloss)

Primer:	Intermediate:	Topcoat:
MPI 95	MPI 141	MPI 141

System DFT: 5 mils

DIVISION 9: INTERIOR GYPSUM BOARDSURFACES PAINT TABLE

A. New Wallboard not otherwise specified:

1. Latex

New; MPI INT 9.2A-G5 (Semigloss) / Existing; RIN 9.2A-G5 (Semigloss)

Primer:	Intermediate:	Topcoat:
MPI 50	MPI 54	MPI 54

System DFT: 4 mils

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SECTION 09971

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SECTION 09971

EXTERIOR COATING OF STEEL STRUCTURES

PART 1 GENERAL

Two identical tanks requires blasting to near-white metal in accordance with SSPC SP 10 and coating. The size of the tanks is as follows:

	Size	Diameter	Height
Tank #	10,000 BBL	Inside 43'6"	43'3"
Tank #	10,000 BBL	Inside 43'6"	43'3"

Coat the exterior steel surfaces of all tanks including the steel shell, roof, manholes, roof manways, railing, exterior stairs, platforms, nozzles and all exterior steel surfaces connecting to the tank. Contractor shall protect all aluminum, galvanized or stainless steel surfaces and API name plates from coating and overspray. Items with wearing surfaces, such as hinges, snap hooks, and link locks shall not be coated and shall beprotected from overspray. The Aluminum floating pan shall be installed after coating. Contactor shall spot paint any damages caused by installing floating pan. Contractor shall maintain containment to control environmental conditions during coating such as temperature and humidity. Contractor shall control particulates during blasting and VOC during painting by filtering the discharge of air. No coating of steel tanks is allowed off-site with the exception of the interiors of piping inside the tank shall be factory applied.

1.1 REFERENCES

The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the references thereto:

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 1200	(1999) Standard Test Method for Viscosity by Ford Viscosity Cup
ASTM D 3276	(1996) Standard Guide for Painting Inspectors (Metal Substrates)
ASTM D 3925	(1991) Sampling Liquid Paints and Related Pigmented Coatings
ASTM D 4285	(1999) Indicating Oil or Water in Compressed Air
ASTM D 4417	(1993; R 1999) Field Measurement of Surface Profile of Blast Cleaned Steel

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.134	Respiratory Protection

29 CFR 1910.1000	Air Contaminants
29 CFR 1910-SUBPART Z	Toxic and Hazardous Substances
29 CFR 1926.59	Hazard Communication
40 CFR 261	Identification and Listing of Hazardous Waste
40 CFR 262	Standards Applicable to Generators of Hazardous Waste

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FED-STD-595	(Rev. B) Colors Used in Government Procurement

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-A-22262	(Rev. B) Abrasive Blasting Media Ship Hull Blast Cleaning
MIL-DTL-24441	(Rev. C; Supp. 1) Paint, Epoxy-Polyamide
MIL-DTL-24441/19	(Rev. B) Paint, Epoxy-Polyamide, Zinc Primer, Formula 159, Type III
MIL-DTL-24441/31	(Rev. A) Paint, Epoxy-Polyamide, White, Formula 152, Type IV
MIL-PRF-85285	(Rev. C) Coating: Polyurethane, High-Solids
MIL-STD-161	(Rev. F; Notice 2) Identification Methods for Bulk Petroleum Products Systems Including Hydrocarbon Missile Fuels

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC AB 2	(1999) Cleanliness of Recycled Ferrous Metallic Abrasives
SSPC AB 3	(1997) Newly Manufactured or Re-Manufactured Steel Abrasives
SSPC Guide to VIS 1	(1989) Guide to Visual Standard for Abrasive Blast Cleaned Steel
SSPC VIS 1	(1989) Visual Standard for Abrasive Blast Cleaned Steel (Standard Reference Photographs)
SSPC SP COM	(2000) Surface Preparation Commentary
SSPC SP 1	(1982) Solvent Cleaning
SSPC SP 7	(1994) Brush-Off Blast Cleaning
SSPC SP 10	(2000) White Metal Blast Cleaning

SSPC PA 1	(2000) Shop, Field, and Maintenance Painting
SSPC PA 2	(1997) Measurement of Dry Paint Thickness with Magnetic Gages
SSPC Guide 6	(1997) Containing Debris Generated During Paint Removal Operations
SSPC Guide 12	(1998) Illumination of Industrial Painting Projects
SSPC QP 1	(1998) Evaluating Qualifications of Painting Contractors (Field Application to Complex Industrial Structures)
SSPC QP 2	(1995) Standard Procedure for Evaluating the Qualifications of Painting Contractors to Remove Hazardous Paint
SSPC QP 5	(1999) Evaluating Qualifications of Coating and Lining Inspection Companies

1.2 DEFINITIONS

Definitions are provided throughout this Section, generally in the Article where used, and denoted by capital letters.

1.3 SUBMITTALS

Submit the following in accordance with Section 01330, "Submittal Procedures."

SD-04 Samples

Color; G-AO

Submit manufacturer's sample of Polyurethane Topcoat color.

Specification and Proprietary Paints; G-AO

The Contractor shall submit coating components and thinners samples. Contractor shall ship samples to the Government Lab of all Military paints. For products that are specified to be applied in accordance with the manufacturer's recommendations the Contractor shall submit the paint producers product data sheet or other written instructions for those products to include mix ratios. Contractor shall coordinate with resident office on the shipping of samples to Government Lab.

SD-05, Design Data

Containment System; G-AE

SD-06 Test Reports

Coatings Qualification Test Reports; G-AO

Coating Sample Test Reports; G-AO

Abrasive Sample Test Reports; G-AO

Daily Inspection Reports; G-AO

Recycled Metallic Abrasive Field Test Reports (Daily and Weekly); G-AO

SD-07 Certificates

Work Plan; G-AE

Qualifications of Certified Industrial Hygienist (CIH); G-AE

Qualifications of Testing Laboratory for Coatings; G-AE

Qualifications of Testing Laboratory for Abrasive; G-AE

Qualifications of Coating Contractors; G-AE

Qualified Painting Contractor; G-AE

The Contractor shall submit a copy of their current SSPC QP 1 certification.

Qualified Hazardous Paint Removal Contractor; G-AO

The Contractor shall submit a copy of their current SSPC QP 2 certification.

Coating Inspection Company Certification; G-AE

Coating Inspector Qualification; G-AO

NACE Certified Inspectors/painters; G-AO

The Contractor shall submit a copy of their current SSPC QP 5 certification.

Qualifications of Coating Manufacturer's Representative; G-AE

Coating Materials; G-AE

Coating System Component Compatibility; G-AE

Non-metallic Abrasive; G-AO

Metallic Abrasive; G-AO

SD-08 Manufacturer's Instructions

Coating System Instructions; G-AE

SD-11 Closeout Submittals

Disposal of Used Abrasive; G-AO

Inspection Logbook; G-AO

1.4 QUALITY ASSURANCE

1.4.1 Design Data

1.4.1.1 Containment System

Submit complete design drawings and calculations for the scaffolding and containment system, including an analysis of the loads which will be added to the structure by the containment system and waste materials. A registered engineer shall approve calculations and scaffold system design.

1.4.2 Test Reports

1.4.2.1 Coatings Qualification Test Reports

Submit test results from independent laboratory of representative samples of each coating material. U.S. Department of Defense laboratories are considered to be independent laboratories for purposes of compliance. Samples must have been tested within the last three years. Submit results for epoxy materials as required in article entitled "QUALIFICATION INSPECTION" of MIL-DTL-24441, and as revised by article entitled "Coating System" herein. Submit results for polyurethane materials as required in article entitled "QUALIFICATION INSPECTION" of MIL-PRF-85285, and as revised by article entitled "Coating System" herein. See appropriate Military Specification for specific test requirements.

1.4.2.2 Recycled Metallic Abrasive Field Test Reports (Daily and Weekly)

Submit test results from independent laboratory of daily and weekly Quality Control testing required by SSPC AB 2.

1.4.3 Certificates

1.4.3.1 Work Plan

Submit a written plan describing in detail all phases of coating operations. Address work sequencing, surface preparation, coating application, recoat and cure time projections, as well as how each step will be controlled, tested, and evaluated. Also provide the time to surface prep, time to prime, time to coat intermediate coat and time to coat the final coating for the anticipated coating temperature. Describe process of determining the existing surface profile under paint, and procedures for ensuring that the profile is not increased beyond the maximum profile specified herein. Describe equipment and methods used to measure and monitor weather conditions, including but not limited to temperature, relative humidity, and dew point. Provide detailed procedures, including manufacturer's instructions, for repairing defects in the coating film such as runs, drips, sags, holidays, overspray, etc. Address safety measures, work scheduling around weather, and record keeping. See Section 01400 SPECIAL SAFETY REQUIREMENTS for Accident Prevention Plan and Activity Hazard Analysis requirements. The Certified Industrial Hygienist shall review and approve all portions of these plans pertaining to painting activities. Provide a signature page with health and safety documents, indicating the Certified Industrial Hygienist's approval of the work procedures and equipment for painting tasks. See Section 01355 ENVIRONMENTAL PROTECTION for any Air Monitoring Requirements.

1.4.3.2 Qualifications of Certified Industrial Hygienist (CIH)

Submit name, address, telephone number, FAX number, and e-mail address of the independent third party CIH. Submit documentation that hygienist is certified by the American Board of Industrial Hygiene in comprehensive practice, including certification number and date of certification/recertification. Provide evidence of experience with hazards involved in industrial coating application work.

1.4.3.3 Qualifications of Testing Laboratory for Coatings

Submit name, address, telephone number, FAX number, and e-mail address of the independent third party laboratory selected to perform testing of coating samples for compliance with specification requirements. Submit documentation that laboratory is regularly engaged in testing of paint samples for conformance with specifications, and that persons performing analyses are qualified.

1.4.3.4 Qualifications of Testing Laboratory for Abrasive

Submit name, address, telephone number, FAX number, and e-mail address of the independent third party laboratory selected to perform testing of abrasive for compliance with specification requirements. Submit documentation that laboratory has experience in testing samples of abrasive for conformance with specifications, and that persons performing analyses are qualified.

1.4.3.5 Qualifications of Coating Contractors

All contractors and subcontractors that perform surface preparation or coating application shall be certified by the Society for Protective Coatings (formerly Steel Structures Painting Council) (SSPC) to the requirements of SSPC QP 1 and SSPC QP 2, and shall remain certified while accomplishing any surface preparation or coating application. The QP 2 Contractor shall be certified to Category A.
The painting contractors and painting subcontractors must remain so certified for the duration of the project. If a contractor's or subcontractor's certification expires, the firm will not be allowed to perform any work until the certification is reissued. Requests for extension of time for any delay to the completion of the project due to an inactive certification will not be considered and liquidated damages will apply. Notify the Contracting Officer of any change in contractor certification status.

1.4.3.6 Qualifications of Coating Manufacturer's Representative

Evidence of experience and training of the Coating Manufacturer’s Representative(s), including name, phone number and address, a statement from the coating manufacturer certifying that the representative has successfully completed all of the manufacturer’s training for material storage, mixing, application, and testing, has been directly involved in evaluation and application of industrial coatings for not less than 10 steel structures within the last 5 years, and is not an employee of the Contractor. The manufacturer's representative shall advise on surface preparation, inspections, surface repair materials and methods, material handling, batching and mixing, application, curing, and testing.

1.4.3.7 Coating Inspection Company Certification

Submit documentation that the coating inspection company that will be performing all coating inspection functions is certified by the Society for Protective Coatings (SSPC) to the requirements of SSPC QP 5 or National Association of Corrosion Engineers (NACE), and shall remain certified while accomplishing any coating inspection functions. The coating inspection company must remain so certified for the duration of the project. If a coating inspection company's certification expires, the firm will not be allowed to perform any inspection functions, and all surface preparation and coating application work must stop, until the certification is reissued. Requests for extension of time for any delay to the completion of the project due to an inactive certification will not be considered and liquidated damages will apply. Notify the Contracting Officer of any change in coating inspection company certification status.

1.4.3.8 Coating Inspector Qualification

Submit documentation that each coating inspector is employed, and qualified to SSPC QP 5, Level III, by the selected coating inspection company. Each inspector shall remain employed by the coating inspection company while performing any coating inspection functions.

"QC Specialists Duties and Qualifications" as follows:

Qualification/Experience in Area of Responsibility	Area of Responsibility	Frequency
Coating Inspector (no other duties)	Surface preparation, coating application, and testing.	Full time during coating system application testing, surface preparation, coating application and initial curing, testing, and repair work.

1.4.3.9 Coating Materials

Provide manufacturer's certification of conformance to contract requirements.

1.4.3.10 Coating System Component Compatibility

Provide certification from each manufacturer of components of the coating system, epoxy primer, epoxy intermediate, and polyurethane topcoat, that the supplied coating material is suitable for use in the specified coating system. Each manufacturer shall identify the specific products, including manufacturer's name, which their product may be used with. The certification shall provide the name of the manufacturer that will provide technical support for the entire system. The Coating manufacture shall certify that the non-slip surface grit is compatible with the urethane top coat material.

1.4.3.11 Non-metallic Abrasive

Provide manufacturer's certification of conformance.

1.4.3.12 Metallic Abrasive

Provide manufacturer's certification of conformance to contract requirements and provide copies of test results.

1.4.4 Product Data

1.4.4.1 Coating System Instructions

Submit manufacturer's printed instructions including detailed mixing and application procedures, number and types of coats required, minimum and maximum application temperatures, and curing procedures. Include materials safety data sheets (MSDS) for materials to be used at the job site in accordance with 29 CFR 1926.59.

1.5 DELIVERY AND STORAGE

Ship, store, and handle materials in accordance with SSPC PA 1, and as modified in this Section. Maintain temperature in storage spaces between 40 and 75 degrees F, and air temperature more than 5 degrees F above the dew-point at all times. Inspect materials for damage prior to use and return non-compliant materials to manufacturer. Remove materials with expired shelf life from government property immediately and notify the Contracting Officer. Expired materials may be returned to manufacturer, tested, and if compliant, issued a shelf life extension.

1.6 COATING HAZARDS

Ensure that employees are trained in all aspects of the safety plan. Specified coatings may have potential health hazards if ingested or improperly handled. The coating manufacturer's written safety precautions shall be followed throughout mixing, application, and curing of the coatings. During all cleaning, cleanup, surface preparation, and paint application phases, ensure that employees are protected from toxic and hazardous chemical agents which exceed concentrations in 29 CFR 1910.1000. Comply with respiratory protection requirements in 29 CFR 1910.134. The CIH shall approve work procedures and personal protective equipment.

1.7 JOB SITE REFERENCES

Make available to the Contracting Officer at least one copy each of ASTM D 3276, ASTM D 3925, ASTM D 4285, ASTM D 4417, SSPC SP COM, SSPC SP 1, SSPC SP 7, SSPC SP 10, SSPC PA 1, SSPC PA 2, SSPC Guide 6, SSPC Guide 12, SSPC Guide to VIS 1, SSPC VIS 1, and an SSPC Certified Contractor Evaluation Form at the job site.

1.8 PRE-APPLICATION MEETING

After approval of submittals but prior to the initiation of coating work, Contractor representatives, including at a minimum, project superintendent and QC manager, paint foreman, Contracting Officer representatives, coating inspector, and coating systems manufacturer's representative shall have a pre-application coating preparatory meeting. This meeting shall be in addition to the pre-construction conference. Specific items addressed shall include: work plan, safety plan, inspection standards, inspector qualifications and tools, test procedures, environmental control system, safety plan, and test logs. Notify Contracting Officer at least ten days prior to meeting.

1.9 SAMPLING AND TESTING

Samples shall be submitted to US Army CERL, ATTN: Paint Laboratory, 2902 Farber Drive, Champaign, IL 61821. The Contractor shall allow at least 30 days for sampling and testing. Sampling may be at the jobsite or source of supply. The Contractor shall notify the Contracting Officer when the paint and thinner are available for sampling. Sampling of each batch shall be witnessed by the Contracting Officer unless otherwise specified or directed. A 1-quart 1 liter sample of paint and thinner shall be submitted for each batch proposed for use. The sample shall be labeled to indicate formula or specification number and nomenclature, batch number, batch quantity, color, date made, and applicable project contract number. Shipping will be performed by the Contractor to the above laboratory. Shipping costs shall be paid by the contractor. Paint samples shall be shipped to all Federal, State and Local regulations. Costs for retesting rejected material will be deducted from payments to the Contractor at the rate of $500 dollars for each paint sample retested and 500 dollars for each thinner retested.

PART 2 PRODUCTS

2.1 COATING SYSTEM

The Military specification epoxy and polyurethane products specified in this Section do not require approval for listing on the QPL prior to contract award, as indicated in paragraph 3.2 of MIL-DTL-24441 and paragraph 3.1 of MIL-PRF-85285. Testing of products by an independent laboratory to the requirements of MIL-DTL-24441 and MIL-PRF-85285 after contract award is required. See specific submittal requirements in Article entitled "Quality Assurance."

2.1.1 Zinc-Rich Epoxy Primer Coat

Epoxy polyamide, MIL-DTL-24441/19 (Formula 159, Type III).

2.1.2 Epoxy Intermediate Coat

Epoxy polyamide, MIL-DTL-24441/31 (Formula 152, Type IV, White (Tinted)). Tint to approximately FED-STD-595 color number 27778 parchment using pigment dispersions prepared for epoxy paint tinting. Manufacturer shall tint material and appropriately label. All other requirements of this Military Specification apply.

2.1.3 Polyurethane Topcoat

Polyurethane coating topcoat of MIL-PRF-85285, Type II, color shall match "Shell White". Color shall be submitted to the Contracting Officer for Approval.

Modify paragraph 3.6.4 of MIL-PRF-85285, Viscosity and Pot Life, as follows:

The viscosity of the admixed coating, when tested in accordance with ASTM D 1200 through a No. 4 Ford cup, shall be as follows:

Time from mix (minimum)	Maximum time through a No. 4 Ford cup
Initially	30 seconds
2 hours	60 seconds
4 hours	No gel

Modify paragraph 3.7.1 of MIL-PRF-85285, Drying Time, as follows:

When applied by spray techniques and when tested in accordance with ASTM D 1640, the coating shall be set-to-touch within four hours and dry-hard within eight hours (see 4.6 and table I).

2.2 COLOR IDENTIFICATION OF FUEL HANDLING AND STORAGE FACILITIES

Piping, conduit, and tank identification shall be in accordance with MIL-STD-161. Mark direction of fluids in accordance with MIL-STD-161.

2.3 COATING SAMPLE COLLECTION AND SHIPPING KIT

Provide a kit that contains one quart can for the base of each coating material, an appropriately sized can for each activator, dipping cups for each component to be sampled, a shipping box sized for the samples to to be shipped, and packing material. Mark cans for the appropriate component. Provide shipping documents, including either pre-paid shipping or a shipper number that can be used by the Contracting Officer to arrange pickup, addressed to the approved coating testing laboratory.

2.4 ABRASIVE SAMPLE COLLECTION AND SHIPPING KIT

Provide a kit that contains one suitable plastic bag or container for each sample to be collected. Mark containers for the appropriate component. Provide shipping documents, including either pre-paid shipping or a shipper number that can be used by the Contracting Officer to arrange pickup, addressed to the approved coating testing laboratory.

2.5 SOLUBLE SALTS TEST KITS

2.5.1 Test Kit for Measuring Chlorides on Steel Surfaces

Provide test kits called CHLOR*TEST, as manufactured by CHLOR*RID International Inc. of Chandler, Arizona (www.chlor-rid.com) or equal. An "equal" test kit shall meet the following requirements:

a. Kit contains all materials,supplies, tools and instructions for field testing and on-site quantitative evaluation;

b. Kit extract solution is acidic, factory pre-measured, pre-packaged, and of uniform concentration;

c. Kit components and solutions are mercury free and environmentally friendly;

d. Kit contains a factory sealed titration device;

e. Kit contains new materials and solutions for each test;

f. Test container (vessel, sleeve, cell. etc.) creates a sealed, encapsulated environment during chloride ion extraction;

g. Test container is suitable for testing the following steel surfaces: horizontal (up/down configuration), vertical, flat, curved, smooth, pitted, and rough;

h. Kit uses test container, with resulting chloride ion extract

solution, as the titration container;

i. Chloride ion concentration is directly measured in micrograms per square centimeter without using either conversion charts or tables.

2.6 ABRASIVE

The referenced abrasive specifications have maximum limits for soluble salts contamination, however, this maximum level of contamination does not guarantee that contamination will not be transferred to the steel surface during abrasive blasting. Other factors such as on-site handling and recycling can allow contamination of abrasive. Contractors are cautioned to verify that the chosen abrasive, along with work and storage processes, allow the final surface cleanliness requirements to be achieved. Successful testing of chlorides in abrasive does not negate the final acceptance testing of steel surfaces.

Interpret MIL-A-22262 to include the meaning that abrasive material contains a maximum one percent by weight of any toxic substance listed in either Table Z-1, Z-2, or Z-3 or 29 CFR 1910-SUBPART Z, with the exception of inert or nuisance dust materials, arsenic, beryllium, cadmium, cobalt, lead, mercury, rhodium, silver, tellurium, thallium, and uranium.

2.6.1 Non-metallic Abrasive

Conform to MIL-A-22262, Type I (Inorganic materials) except that the gross gamma radioactivity shall not exceed 5 picocuries per gram Use sampling procedures and testing frequencies as prescribed in MIL-A-22262. Use abrasive that is specifically selected and graded to provide a sharp, angular profile to the specified depth. Do not use ungraded abrasive. Make adjustments to processes or abrasive gradation to achieve specified surface profile. Recycled non-metallic abrasive shall meet all requirements of the specification each time that it is placed in the blast pot.

2.6.2 Metallic Abrasive

2.6.2.1 New and Remanufactured Steel Grit

Conform to the chemical and physical properties of SSPC AB 3 except that the gross gamma radioactivity shall not exceed 5 picocuries per gram.

2.6.2.2 Recycled Steel Grit

Conform to the chemical and physical properties of SSPC AB 2

PART 3 EXECUTION

3.1 REMOVAL OF COATINGS CONTAINING HAZARDOUS MATERIALS

Coatings containing hazardous materials and identified for disturbance during surface preparation, including removal, shall be handled in accordance with Section 01400 Special Safety Requirements."
The contractor shall submit a Waste Classification, Handling, and Disposal Plan in accordance with the requirements of 40 CFR 261 and 40 CFR 262.

3.2 COATING AND ABRASIVE SAMPLE COLLECTION AND TESTING

3.2.1 Coating Sample Collection

Notify Contracting Officer three days in advance of sampling. The Contracting Officer and either the QC Manager or NACE Coating Inspector shall witness all sampling. Provide a sample collection kit as required in Article entitled "Coating Sample Collection and Shipping Kit." Obtain a one quart sample of each batch of each base material, and proportional samples of each activator based on mix ratio, by random selection from sealed containers in accordance with ASTM D 3925. Prior to sampling, mix contents of each sealed container to ensure uniformity. A batch is defined as that quantity of material processed by the manufacturer at one time and identified by number on the label. Identify samples by designated name, specification number, batch number, project contract number, sample date, intended use, and quantity involved. The Contracting Officer will take possession of the packaged samples, contact the shipping company to arrange for pickup, and relinquish the samples only to the shipping representative for shipment to the approved laboratory for testing as required by the paragraph entitled "Coating Sample Testing."

3.2.2 Abrasive Sample Collection

Notify Contracting Officer three days in advance of sampling. The Contracting Officer and either the QC Manager or NACE Coating Inspector shall witness all sampling. Provide suitably sized containers for each sample to be taken. Provide a sample collection kit as required in Article entitled "Abrasive Sample Collection and Shipping Kit." For purposes of quality conformance inspection, a lot shall consist of all abrasive materials of the same type from a single, uniform batch produced and offered for delivery at one time. Obtain samples of each abrasive lot using the sampling techniques and schedule of MIL-A-22262. The addition of any substance to a batch shall constitute a new lot. Identify samples by designated name, specification number, lot number, project contract number, sample date, intended use, and quantity involved. The Contracting Officer will take possession of the packaged samples, contact the shipping company to arrange for pickup, and relinquish the samples only to the shipping representative for shipment to the approved laboratory for testing as required by the Article entitled "Abrasive Sample Testing."

3.2.3 Coating Sample Test Reports

Test samples of all primer, intermediate, and topcoat materials for compliance with requirements of Table I. Reject entire batch represented by samples that fail one or more tests, reselect, and retest samples.

3.2.4 Abrasive Sample Test Reports

Test samples of abrasive materials for compliance with the appropriate abrasive specification. Reject entire lot represented by samples that fail one or more tests, reselect, and retest samples.

3.3 SURFACES TO BE COATED

Coat the exterior surfaces of all tanks including the shell, roof, manholes, roof manways, railing, exterior stairs, platforms, nozzles and all exterior steel surfaces connecting to the tank. Contractor shall protect all aluminum, galvanized or stainless steel surfaces and API name plates from coating and overspray. The Aluminum floating pan shall be

installed after coating. Contactor shall spot paint any damages caused by installing floating pan.

3.4 LIGHTING

Provide lighting for all work areas as prescribed in SSPC Guide 12.

3.5 Containment

The contractor shall design and provide a containment system for the capture, containment, collection, storage and disposal of the waste materials generated by the work under this specification Section, to meet the requirements of SSPC Guide 6, Class 2a. It is the contractors responsibility to insure the feasibility and workability of the containment system. The contractor shall perform his operations and work schedule in a manner as to minimize leakage of the containment system. The containment system shall be properly maintained and shall not deviate from the approved drawings, without the Contracting Officers approval. If at any time during the execution of the work, the containment system fails to function satisfactory in the opinion of the Contracting Officer, the contractor shall suspend all operations, except those required to minimize adverse impact on the environment or government property. Operations shall not resume until modifications have been made to correct the cause of the failure. Modifications shall be approved by the Contracting Officer.

3.6 SURFACE PREPARATION

3.6.1 Abrasive Blasting Equipment

Use abrasive blasting equipment of conventional air, force-feed, or pressure type. Maintain a minimum pressure of 95 psig at nozzle. Confirm that air supply for abrasive blasting is free of oil and moisture when tested in accordance with ASTM D 4285. Test air quality at each startup, but in no case less often than every five operating hours.

3.6.2 Surface Standard

Inspect surfaces to be coated, and select plate with similar properties and surface characteristics for use as a surface standard. Blast clean one or more 1 foot square steel panels as specified in Article entitled "Surface Preparation." Record blast nozzle type and size, air pressure at nozzle and compressor, distance of nozzle from panel, and angle of blast to establish procedures for blast cleaning. Measure surface profile in accordance with ASTM D 4417. When the surface standard complies with all specified requirements, seal with a clearcoat protectant. Use the surface standard for comparison to abrasive blasted surfaces throughout the course of work.

3.6.3 Pre-Preparation Testing for Surface Contamination

Perform testing, abrasive blasting, and testing in the prescribed order.

3.6.3.1 Pre-Preparation Testing for Oil and Grease Contamination

Inspect all surfaces for oil and/or grease contamination using two or more of the following inspection techniques: 1) Visual inspection, 2) WATER BREAK TEST, 3) CLOTH RUB TEST. Reject oil and/or grease contaminated surfaces, clean using a water based pH neutral degreaser in accordance with SSPC SP 1, and recheck for contamination until surfaces are free of oil and

grease.

WATER BREAK TEST - Spray atomized mist of distilled water onto surface, and observe for water beading. If water "wets" surface rather than beading up, surface can be considered free of oil or grease contamination. Beading of water (water forms droplets) is evidence of oil or grease contamination.

CLOTH RUB TEST - Rub a clean, white, lint free, cotton cloth onto surface and observe for discoloration. To confirm oil or grease contamination in lightly stained areas, a non-staining solvent may be used to aid in oil or grease extraction. Any visible discoloration is evidence of oil or grease contamination.

3.6.3.2 Pre-Preparation Testing for Soluble Salts Contamination

Test surfaces for soluble salts, and wash as required, prior to abrasive blasting. Soluble salt testing is also required in Article entitled "Pre-Application Testing for Soluble Salts Contamination" as a final acceptance test of prepared surfaces after abrasive blasting, and successful completion of this phase does not negate that requirement. This phase is recommended since pre-preparation testing and washing are generally more advantageous than attempting to remove soluble salt contamination after abrasive blasting. Effective removal of soluble salts will require removal of any barrier to the steel surface, including rust. This procedure may necessitate combinations of wet abrasive blasting, high pressure water rinsing, and cleaning using a solution of water washing and soluble salts remover. The soluble salts remover shall be acidic, biodegradable, nontoxic, noncorrosive, and after application, will not interfere with primer adhesion. Delays between testing and preparation, or testing and coating application, may allow for the formation of new contamination. Use potable water, or potable water modified with soluble salt remover, for all washing or wet abrasive blasting. Test methods and equipment used in this phase are selected at the Contractor's discretion.

3.6.4 Abrasive Blasting

Abrasive blast steel surfaces to near-white metal in accordance with SSPC SP 10. Prepared surfaces shall conform to SSPC VIS 1 and SSPC Guide to VIS 1 and shall match the prepared test-panels. Provide a 2 to 3 mil surface profile. Reject profile greater than 3 mils, discontinue abrasive blasting, and modify processes and materials to provide the specified profile. Measure surface profile in accordance with ASTM D 4417. Measure profile at rate of three tests for the first 1000 square feet plus one test for each additional 1000 square feet or part thereof. Provide two additional measurements for each non-compliant measurement. When surfaces are reblasted for any reason, retest profile as specified. If Method C of ASTM D 4417 is used to measure profile, attach test tapes to Daily Inspection Reports. Following abrasive blasting, remove dust and debris by brushing, blowing with oil-free and moisture-free compressed air, or vacuum cleaning. Time interval between abrasive blasting and application of primer shall not exceed eight hours.

3.6.5 Disposal of Used Abrasive

Dispose of used abrasive off Government property in accordance with Federal, State, and Local mandated regulations.

3.6.6 Pre-Application Testing For Surface Contamination

3.6.6.1 Pre-Application Testing for Oil and Grease Contamination

Ensure tank surfaces are free of contamination as described in Article entitled "Pre-Preparation Testing for Oil and Grease Contamination," except that only questionable areas need be checked for beading of water misted onto surface.

3.6.6.2 Pre-Application Testing for Soluble Salts Contamination

Test surfaces for chloride contamination using the Test Kit described in article entitled "Test Kit for Measuring Chlorides on Steel Surfaces." Test all surfaces at rate of three tests for the first 1000 square feet plus one test for each additional 2000 square feet or part thereof. Concentrate testing of bare steel at areas of coating failure to bare steel and areas of corrosion pitting. Perform 30% of tests on bare steel at welds, divided equally between horizontal and vertical welds. One or more readings greater than 5 micrograms per square centimeter of chlorides is evidence of chloride contamination. Reject contaminated surfaces, wash as discussed in article entitled "Pre-Preparation Testing for Soluble Salts Contamination," allow to dry, and re-test until all required tests show allowable results. Reblast tested and cleaned areas as required. Label all test tubes and retain for test verification.

3.6.6.3 Pre-Application Testing for Surface Cleanliness

Apply coatings to dust free surfaces. To test surfaces, apply strip of clear adhesive tape to surface and rub onto surface with finger. When removed, the tape should show little or no dust, blast abrasive, or other contaminant. Reject contaminated surfaces and retest. Test surfaces at rate of three tests for the first 1000 square feet plus one test for each additional 1000 square feet or part thereof. Provide two additional tests for each failed test or questionable test. Attach test tapes to Daily Inspection Reports.

3.7 MIXING AND APPLICATION OF COATING SYSTEM

3.7.1 Preparation of Coating Materials for Application

Each of the primer, intermediate, and topcoat materials is a two-component material supplied in separate containers.

3.7.1.1 Mixing Primer and Intermediate Coat Materials

Mix in accordance with manufacturer's instructions, which may differ for each product. Do not mix partial kits, or alter mix ratios. Mix materials in same temperature and humidity conditions specified in article entitled "Delivery and Storage." Allow mixed material to stand for the required induction time based on its temperature.

3.7.1.2 Mixing Topcoat Material

Do not mix partial kits, or alter mix ratios. Mix polyurethane coating materials in same temperature conditions specified in article entitled "Delivery and Storage." The polyurethane coating material is moisture sensitive and any introduction of moisture or water into the material during mixing or application will shorten usable pot life. Use a mixer that does not create a vortex. Do not add solvent without specific written

recommendation from the manufacturer. No induction time is required, only thorough agitation of the mixed material.

3.7.1.3 Pot Life

Apply mixed products within stated pot life for each product. Stop applying when material becomes difficult to apply in a smooth, uniform wet film. Add all required solvent at time of mixing. Do not add solvent to extend pot life. Pot life is based on standard conditions at 70 degrees F and 50 percent relative humidity. For every 18 degrees F rise in temperature, pot life is reduced by approximately half, and for every 18 degrees F drop it is approximately doubled. Usable pot life depends on the temperature of the material at the time of mixing and the sustained temperature at the time of application. Other factors such as the shape of the container and volume of mixed material may also affect pot life. Precooling or exterior icing of components for at least 24 hours to a minimum of 50 degrees F in hot climates will extend pot life. High humidity at time of mixing and application shortens pot life of the Polyurethane topcoat material. Following are approximate pot life times:

Epoxy primer and intermediate materials	4 hours
Polyurethane topcoat materials	2 hours.

3.7.1.4 Application Conditions and Recoat Windows

The application condition requirements for the coating system are very time and temperature sensitive, and are intended to avoid the delamination problems frequently found on industrial structures. Plan coating application to ensure that specified temperature, humidity, and condensation conditions are met. If conditions do not allow for orderly application of primer, stripe coat, intermediate coat and topcoat, use appropriate means of controlling air and surface temperatures, as required. Partial or total enclosures may be required, as well as other measures, to control conditions to allow for orderly application of all required coats.

Apply coating only when ambient air and steel temperatures are between 60 and 100 degrees F, and steel surface temperature is more than 5 degrees F above the dew-point of the ambient air during application and the first four hours for epoxy and the first eight hours for polyurethane. Do not apply coatings above 100 degrees F or below 60 degrees F.

Use Table entitled "RECOAT WINDOWS" to determine appropriate recoat windows for each coat after the initial coat. Apply each coating during appropriate RECOAT WINDOW.

If coating is not applied during RECOAT WINDOW, apply during EXTENDED RECOAT WINDOW. Application of any epoxy coat within the EXTENDED RECOAT WINDOW requires application of a TACK COAT prior to applying any full coat. Perform cure test immediately prior to application of TACK COAT to determine condition of applied coating. If CURE TEST indicates that surface is fully cured, provide GLOSS REMOVAL prior to application of TACK COAT.

If coating is not applied during EXTENDED RECOAT WINDOW, or if surface temperature exceeds 120 degrees F between applications, wash surface with water and detergent, rinse clean with fresh water and allow surface to dry thoroughly, provide GLOSS REMOVAL, apply TACK COAT, where applicable, within 24 hours, and apply next full coat within TACK COAT RECOAT WINDOW.

RECOAT WINDOWS

EPOXY OVER EPOXY

Temperature degrees F	60-70	71-80	81-90	91-100	101-110	111-120
RECOAT WINDOW (Hrs.)	24-72	18-60	16-48	12-36	8-18	4-6
EXTENDED RECOAT WINDOW (Hrs.)	72-168	60-140	48-120	36-96	18-36	6-12
TACK COAT RECOAT WINDOW (Hrs.)	6-72	4-60	4-48	3-36	2-18	1-6

POLYURETHANE OVER EPOXY

Temperature degrees F	60-70	71-80	81-90	91-100	101-110	111-120
RECOAT WINDOW (Hrs.)	24-96	24-72	16-48	12-36	10-24	8-16
EXTENDED RECOAT WINDOW (Hrs.)	96-168	72-144	48-120	36-96	24-48	16-24
TACK COAT RECOAT WINDOW (Hrs.)	24-96	24-72	16-48	12-36	10-24	8-16

POLYURETHANE OVER POLYURETHANE

Temperature degrees F	60-70	71-80	81-90	91-100	101-110	111-120
RECOAT WINDOW (Hrs.)	8-48	6-48	4-36	3-24	2-12	1-2
EXTENDED RECOAT WINDOW (Hrs.)	NONE ----------					
TACK COAT RECOAT WINDOW (Hrs.)	NO TACK COAT USED ----------					

The temperature ranges shown in the table above are for determining recoat windows. Choose recoat window based on the highest surface temperature that was sustained for one or more hours between coats. This applies to the entire time between coats. Measure and record air and surface temperatures on hourly basis to determine appropriate recoat windows. If surface temperature goes above 100 degrees F, measure and record temperatures every half hour.

CURE TEST - Where indicated, test surface for cure using high-flash aromatic Naphtha only (cas #64742-95-6). Do not use aliphatic VMP Naphtha. Wipe surface with rag saturated with Naphtha, and check for surface tackiness, loss of gloss, or other indications that solvent has softened surface. If softening is found on 95% of test sites, this is indication that coating has not fully cured, and GLOSS REMOVAL is not required if TACK COAT is applied within three hours and full coat is applied within the TACK COAT RECOAT WINDOW. Test surfaces at rate of three tests for the first 1000 square feet plus one test for each additional 1000 square feet or part thereof.

TACK COAT - Where indicated, apply coat of intermediate coat epoxy, at 1 to 2 mils WFT, then apply next specified full coat within TACK COAT RECOAT WINDOW. Thin TACK COAT material approximately 25% by volume, using appropriate epoxy thinner.

GLOSS REMOVAL - Where indicated, remove all gloss by hand sanding with 150-200 grit wet/dry sandpaper in a linear fashion, pressure wash or wipe down with a clean rag soaked with denatured alcohol to remove dust. Do not

use rotary sanders or grinders.

3.7.2 Application of Coating System

Apply coatings in accordance with SSPC PA 1 and as specified herein. Apply coatings to surfaces that meet all stated surface preparation requirements.

After application of primer coat and prior to application of each subsequent coat, perform testing prescribed in article entitled "Pre-Application Testing For Surface Contamination," as necessary, to ensure minimal intercoat contamination. This testing may be reduced to one half of the prescribed rate for bare steel if the testing indicates no contamination when sampling is evenly distributed over surfaces being tested. If contamination is found between coats, revert to the specified testing rate. Generally, oil and grease contamination and soluble salts contamination are not encountered if subsequent coats are applied within specified recoat windows and unusual atmospheric events do not occur. Such atmospheric events as a coastal storm blowing onshore can bring unusual chloride contamination. Concern for intercoat contamination should be continually prevalent, and spot testing should be accomplished to verify satisfactory conditions. Where visual examination or spot testing indicates contamination, perform sufficient testing to verify non-contamination, or to define extent of contamination for appropriate treatment.

Apply each coat in a consistent wet film, at 90 degrees to previous coat. Ensure that primer and intermediate coat "cold joints" are no less than six inches from welds. Apply stripe coat by brush. Apply all other coats by spray application. Use appropriate controls to prevent airborne coating fog from drifting beyondcontainment perimeter . Cover or protect all surfaces that will not be coated. The cleanliness, temperature, recoat windows, and airborne paint containment requirements may necessitate the use of enclosures, portable shelters, or other appropriate controls.

Apply coatings at the following specified thickness:

Coat	Desired Thickness Range Mils DFT	Minimum Mils DFT	Maximum Mils DFT
Primer	2 - 5	2	6
Intermediate	3 - 5	3	8
Top	2 - 3	2	4
Total system	-----	9	12

3.7.2.1 Application of Primer

Apply primer coat, maintaining paint supply container height within 3 feet of the paint nozzle for applying zinc primer. Maintain constant agitation of paint pot to ensure that zinc does not settle in container.

3.7.2.2 Application of Stripe Coat

Apply a stripe coat of intermediate coat epoxy material within RECOAT WINDOW of primer, allowing sufficient dry time to allow application of intermediate coat within RECOAT WINDOW of primer. Apply by brush, working material into corners, crevices, angles, and welds, and onto outside corners and angles.

3.7.2.3 Application of Intermediate Coat

Apply intermediate coat within RECOAT WINDOW of primer coat.

3.7.2.4 Application of Topcoat

Make all required repairs to primer and intermediate coats as specified in paragraph entitled "Procedure for Holiday and Spot Repairs of Newly Applied Coating" prior to applying topcoat. Apply topcoat within RECOAT WINDOW of intermediate coat. The polyurethane topcoat may require multiple passes to achieve desired aesthetics and required thickness. Consult manufacturer for thinning and application procedures for anticipated temperature, humidity, and wind conditions. Touch-up blemishes and defects within recoat window of polyurethane topcoat. Retain sample of polyurethane topcoat, from the same batch used to coat structure, to make touch-ups that might be required later.

3.7.2.5 Non-Slip Coating from manway to stairs

After the final topcoat is applied and dry. Contractor shall apply 1 additional polyurethane top coat between 2 to 4 mils thick with new steel grit broadcasted into the wet polyurethane topcoat. The non-slip surface shall be applied a width of 5 feet wide from the manway hatch to the exterior tank stairs and on other areas identified. Contractor shall lightly brush or vacuum surface after drying to remove any loose steel grit.

3.7.2.6 Procedure for Holiday and Spot Repairs of Newly Applied Coating

Repair coating film defects at the earliest practicable time, preferably before application of the succeeding coat. Observe all requirements for soluble salts contamination, cleanliness between coats, and application conditions. Prepare defective area in accordance with SSPC SP 10, and feather coating as required to leave 4 inches of each succeeding coat feathered and abraded. Protect adjacent areas from damage and overspray. Remove dust and solvent wipe the prepared area plus an additional 4 inches beyond the prepared area with clean denatured alcohol. Apply each coat within RECOAT WINDOW of preceeding coat. Within four hours of preparation, apply zinc-rich primer to prepared steel and feather onto prepared primer. Apply intermediate coat to primed area and feather to prepared intermediate area. Apply topcoat to intermediate coat and feather to prepared topcoat. Apply each repair coat to approximate thickness of surrounding coating system.

3.7.2.7 Structure Occupancy After Coating Application

Use clean canvas or other approved shoe covers when walking on coated surfaces, regardless of curing time allowed. For heavily trafficked areas, provide cushioned mats for additional protection.

3.8 FIELD TESTS AND INSPECTION

For marking of tank surfaces, use chalk for marking bare steel, and water based markers for marking coated surfaces, and remove marks prior to coating. Do not use any wax or grease based markers, or any other markers that leave a residue or stain.

3.8.1 Coating Inspector

The coating inspector shall work for the CQC Manager in accordance with Section 01451 CONTRACTOR QUALITY CONTROL. The Coating Inspector shall be present during all pre-preparation testing, surface preparation, coating application, initial cure of the coating system, and during all coating repair work. The Coating Inspector shall provide complete documentation of conditions and occurrences on the job site, and be aware of conditions and occurrences that are potentially detrimental to the coating system. The requirements for inspection listed in this Section are in addition to the QC inspection and reporting requirements outlined in Section 01451 CONTRACTOR QUALITY CONTROL. The Coating Inspector shall prepare a project reference sheet outlining all requirements, tests, test methods, and evaluation criteria, and hold regular meetings with contractor personnel, including nozzlemen and applicators, to review requirements and evaluation criteria for upcoming work in advance of the work.

3.8.2 Field Inspection

3.8.2.1 Inspection Requirements

Accomplish field inspection in accordance with ASTM D 3276 and as required herein. Perform all appropriate tests and inspections, except that viscosity and weight per gallon measurements are not required. Provide all tools and instruments required to perform the required testing, as well as any tools or instruments that the inspector considers necessary to perform the required inspections and tests. Document each inspection and test, including required hold points and other required inspections and tests, as well as those inspections and tests deemed prudent from on-site evaluation, as follows:

a. Location or area;
b. Purpose (required or special);
c. Method;
d. Criteria for evaluation;
e. Results;
f. Determination of compliance;
g. List of required rework;
h. Observations.

Collect and record Environmental Conditions as described in ASTM D 3276 on a 24 hour basis, as follows:

a. During surface preparation, every two hours or when changes occur;
b. During coating application and the first four days of initial cure, every hour, or when changes occur;
c. Overnight hours may be excluded if conditions are measured and recorded through 1800 hours and then prior to dawn the next day;
d. Note location, time, and temperature of the highest and lowest surface temperatures each day.
e. Use a non-contact thermometer to locate temperature extremes, then verify with contact thermometers.

Document all equipment used in inspections and testing, including manufacturer, model number, serial number, last calibration date and future calibration date, and results of on-site calibration performed.

3.8.2.2 Daily Inspection Reports

Submit one copy of daily inspection report completed each day when performing work under this Section, to the Contracting Officer. Use ASTM D 3276 Appendix X1 Inspection Checklist to monitor daily activity and prepare Daily Inspection Report. Use of forms containing entry blocks for all required data is encouraged. The data may be in any format, but must be legible and presented so that it can be easily interpreted. Note all non-compliance issues, and all issues that were reported for rework in accordance with QC procedures of Section 01451 CONTRACTOR QUALITY CONTROL. Submit report within 24 hours of date recorded on the report.

3.8.2.3 Inspection Logbook

A continuous record of all activity related to this Section shall be maintained in an Inspection Logbook on a daily basis. The logbook shall be hard or spiral bound with consecutively numbered pages, and shall be used to record all information provided in the Daily Inspection Reports, as well as other pertinent observations and information. The Coating Inspector's Logbook that is sold by NACE is satisfactory. Submit the original Inspection Logbook to the Contracting Officer upon completion of the project and prior to final payment.

3.8.2.4 Inspection Equipment

All equipment shall be in good condition, operational within its design range, and calibrated as required by the specified standard for use of each device.

3.8.3 Hold Points for Quality Control Inspections

Provide appropriate QC inspections at the following hold-points:

Step	Action
Prior to preparation of structure(s) for cleaning and repair	Safety inspection
After cleaning of structure(s) and prior to abrasive blasting	1. Safety inspection, removal of dirt, trash, debris, and any hindrance to abrasive blasting. 2. Surface inspection for oil, grease, soluble salts, or other contaminants
Initiation of abrasive blasting, and at each work stoppage	1. Confirm environmental conditions are suitable for abrasive blasting and coating, and are expected to remain suitable to the point where the coating will be unaffected. 2. Surface inspection to insure all aspects of surface preparation are properly addressed, as specified in article entitled "Surface Preparation." 3. Test compressor air for oil and water contamination

After abrasive blasting	Surface inspection to insure all aspects of surface preparation are properly addressed, as specified in article entitled "Surface Preparation."
Immediately prior to coating application - provide for each coating application evolution	1. Confirm environmental conditions are suitable for coating application and are expected to remain suitable to the point where the coating will be unaffected. 2. Surface inspection to insure all aspects of surface preparation are properly addressed, as specified in article entitled "Surface Preparation." 3. Confirm that testing equipment for monitoring for hazardous conditions during coating application are working properly and are prepared for use as outlined in contractor's Safety Plan.
During and after coating application.	Coating application inspection per paragraphs entitled "Application of Coating System" and "Field Tests and Inspection".
After final cleanup	Clean-up inspection specified in the paragraph entitled "Final Cleanup."

3.9 FINAL CLEANUP

Following completion of the work, remove debris, equipment, and materials from the site. Remove temporary connections to Government or Contractor furnished water and electrical services. Restore existing facilities in and around the work areas to their original condition.

TABLE 1
COATING QUALITY CONFORMANCE INSPECTION REQUIREMENTS

Table Ia - Zinc-rich Epoxy Primer Coat MIL-DTL-24441/19 Formula 159

Test	Component A		Component B		Mixed	
	Min.	Max.	Min.	Max.	Min.	Max.
Pigment content, percent (zinc dust)	---	---	81.5	85.5	---	---
Volatiles, percent	42.8	44.3	8.0	8.4	---	---
Non-volatile vehicle percent	53.7	57.7	8.3	8.7	---	---
Weight,						
Kilograms/liter	0.87	1.01	3.30	3.40	---	---
Pounds/gallon	7.3	8.4	27.5	28.4	---	---
Flashpoint						
Degrees C	35.6	---	37.8	---	---	---
Degrees F	96	---	100	---	---	---
Consistency, grams	---	---	250	500	---	---
Set to touch time, hours at 23 degrees C, 73 degrees F	---	---	---	---	---	2
Dry-hard time, hours at 23 degrees C, 73 degrees F	---	---	---	---	---	8
Pot life, hours at 23 degrees C, 73 degrees F	---	---	---	---	4	---
Sag resistance						
Micrometers	---	---	---	---	300	---
Mils	---	---	---	---	12	---
VOC						
Grams/liter	---	---	---	---	---	304
Pounds/gallon	---	---	---	---	---	2.5

NOTES:
Test methods as specified in MIL-DTL-24441.

TABLE 1
COATING QUALITY CONFORMANCE INSPECTION REQUIREMENTS

Table Ib. - Epoxy Intermediate Coat MIL-DTL-24441/31 Formula 152 Type IV (White (Tinted))

Test	Component A		Component B		Mixed	
	Min.	Max.	Min.	Max.	Min.	Max.
Pigment content, percent	44.0	49.0	33.0	38.0	---	---
Volatiles, percent	29.0	35.0	16.0	21.0	---	---
Non-volatile vehicle, percent	17.5	23.5	44.0	49.0	---	---
Coarse particles, percent	---	0.3	---	0.3	---	---
Consistency, grams	180	320	300	470	---	---
Weight						
Kilograms/liter	1.39	1.45	1.29	1.35	---	---
Pounds per gallon	11.6	12.1	10.8	11.3	---	---
Set to touch, hours at 23 degrees C, 73 degrees F	---	---	---	---	---	3
Dry-hard time, hours at 23 degrees C, 73 degrees F	---	---	---	---	---	8
Fineness of grind, Hegman	4	---	4	---	---	---
Flashpoint						
Degrees C	35.5	---	37.8	---	---	---
Degrees F	96	---	100	---	---	---
Titanium dioxide, percent of pigment	91	---	---	---	---	---
Pot life, hours at 23 degrees C, 73 degrees F	---	---	---	---	4	---
Sag resistance						
Micrometers	---	---	---	---	300	---
Mils	---	---	---	---	12	---
Color of dry film to approximate color of FED-STD 595 color 27778	---	---	---	---	Conform	
Contrast ratio, at 75 micrometers, 3 mils DFT	---	---	---	---	0.98	---
VOC						
Grams/liter	---	---	---	---	---	340
Pounds/gallon	---	---	---	---	---	2.8

GENERAL NOTES:
Test methods as specified in MIL-DTL-24441.
Where "Conform" is indicated, refer to specific requirements of MIL-DTL-24441/31.

TABLE 1
COATING QUALITY CONFORMANCE INSPECTION REQUIREMENTS

Table Ic - Polyurethane Topcoat MIL-PRF-85285 Type II
(White and Colors)

Test	Component A		Component B		Mixed	
	Min.	Max.	Min.	Max.	Min.	Max.
Moisture content, percent	---	1	---	---	---	---
Coarse particles, percent	---	---	---	---	---	.5
Viscosity	---	---	---	---	See Note 1	
Fineness of grind, Hegman	---	---	---	---	7	---
Drying to touch (See Note 2)	---	---	---	---	---	4
Dry hard (See Note 2)	---	---	---	---	---	8
VOC, grams per liter	---	---	---	---	---	340
Color	---	---	---	---	delta E+-1.0	
Gloss 60 degree specular gloss						
Gloss	---	---	---	---	---	90
Semi-gloss	---	---	---	---	15	45
Opacity	---	---	---	---	0.95	---
Flexibility	---	---	---	---	Conform	
Fluid resistance	---	---	---	---	Conform	
Heat resistance (cure)	---	---	---	---	Conform	
Solvent resistance (cure)	---	---	---	---	Conform	
Condition in container	---	---	---	---	Conform	
Odor	---	---	---	---	Conform	
Lead percent	---	---	---	---	---	0.06
Cadmium percent	---	---	---	---	---	0.06
Chromium percent	---	---	---	---	---	0.00

NOTES:
(1) Modify paragraph 3.6.4 Viscosity and Pot Life, of MIL-PRF-85285 as follows:

The viscosity of the admixed coating, when tested in accordance with ASTM D 1200 through a No. 4 Ford cup, shall be as follows:

Time from mix (minimum)	Maximum time through a No. 4 Ford cup
Initially	30 seconds
2 hours	60 seconds
4 hours	No gel

(2) Modify paragraph 3.7.1 Drying Time, of MIL-PRF-85285

When applied by spray techniques and when tested in accordance with ASTM D 1640, the coating shall be set-to-touch within four hours and dry-hard within eight hours (see 4.6 and table I).

GENERAL NOTES:
- Test methods as specified in MIL-PRF-85285.
- Where "Conform" is indicated, refer to specific requirements of MIL-PRF-85285.

-- End of Section --

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DIVISION 09 - FINISHES

SECTION 09973

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SECTION 09973

INTERIOR COATING OF WELDED STEEL PETROLEUM FUEL TANKS

PART 1 GENERAL

Two identical tanks requires blasting to SSPC SP 5 and coating. The size of the tanks is as follows:

	Size	Diameter	Height
Tank #	10,000 BBL	Inside 43'6"	43'3"
Tank #	10,000 BBL	Inside 43'6"	43'3"

For all tanks, the Aluminum floating pan shall be installed after coating. Contractor shall protect all aluminum (Aluminum Ladders, Aluminum Stilling Well), and stainless steel surfaces from coating and overspray. Contactor shall spot paint any damages caused by installing floating pan.

Coat interior surfaces including the floor, shell and roof of the tank, including the manholes, pipe supports, and the exterior portions of piping in the interior of the tank. The contractor shall not coat any aluminum, stainless steel or galvanized surfaces and shall protect from overspray. No coating of steel tanks is allowed off-site with the exception of the interiors of misc. piping inside the tank shall be factory applied. Contractor shall maintain containment to control environmental conditions during coating such as temperature and humidity. Contractor shall control particulates during blasting and VOC during painting by filtering and evaluate the use of scrubbers before the air is discharge to meet any state or local air quality requirements. No coating of steel tanks is allowed off-site with the exception of the interiors of piping used inside the tank shall be factory applied. Contractor shall reference Specification 01400 for any Safety Monitoring and Permit requirements.

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN PETROLEUM INSTITUTE (API)

API Std 653	(2001) Tank Inspection, Repair, Alteration, and Reconstruction

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 3276	(1996) Standard Guide for Painting Inspectors (Metal Substrates)
ASTM D 3925	(1991) Sampling Liquid Paints and Related Pigmented Coatings
ASTM D 4285	(1999) Indicating Oil or Water in Compressed Air

ASTM D 4417	(1993; R 1999) Field Measurement of Surface Profile of Blast Cleaned Steel

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.134	Respiratory Protection
29 CFR 1910.1000	Air Contaminants
29 CFR 1910-SUBPART Z	Toxic and Hazardous Substances
29 CFR 1926.59	Hazard Communication
40 CFR 261	Identification and Listing of Hazardous Waste
40 CFR 262	Standards Applicable to Generators of Hazardous Waste

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FED-STD-595	(Rev. B) Colors Used in Government Procurement

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-A-22262	(Rev. B) Abrasive Blasting Media Ship Hull Blast Cleaning
MIL-DTL-24441	(Rev. C; Supp. 1) Paint, Epoxy-Polyamide
MIL-DTL-24441/29	(Rev. A) Paint, Epoxy-Polyamide, Green Primer, Formula 150, Type IV
MIL-DTL-24441/31	(Rev. A) Paint, Epoxy-Polyamide, White, Formula 152, Type IV

NACE INTERNATIONAL (NACE)

NACE RP0178	(1995) Fabrication Details, Surface Finish Requirements, and Proper Design Considerations for Tanks and Vessels to be Lined for Immersion Service
NACE RP0188	(1999) Discontinuity (Holiday) Testing of Protective Coatings

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC AB 2	(1999) Cleanliness of Recycled Ferrous Metallic Abrasives
SSPC AB 3	(1997) Newly Manufactured or Re-Manufactured Steel Abrasives
SSPC Guide to VIS 1	(1989) Guide to Visual Standard for Abrasive Blast Cleaned Steel

SSPC VIS 1	(1989) Visual Standard for Abrasive Blast Cleaned Steel (Standard Reference Photographs)
SSPC SP COM	(2000) Surface Preparation Commentary
SSPC SP 1	(1982) Solvent Cleaning
SSPC SP 5	(2000) White Metal Blast Cleaning
SSPC SP 7	(1994) Brush-Off Blast Cleaning
SSPC PA 1	(2000) Shop, Field, and Maintenance Painting
SSPC PA 2	(1997) Measurement of Dry Paint Thickness with Magnetic Gages
SSPC Guide 12	(1998) Illumination of Industrial Painting Projects
SSPC QP 1	(1998) Evaluating Qualifications of Painting Contractors (Field Application to Complex Industrial Structures)
SSPC QP 2	(1995) Standard Procedure for Evaluating the Qualifications of Painting Contractors to Remove Hazardous Paint
SSPC QP 5	(1999) Evaluating Qualifications of Coating and Lining Inspection Companies

1.2 DEFINITIONS

Definitions are provided throughout this Section, generally in the Article where used, and denoted by capital letters. The following definitions are used throughout this Section:

a. CEILING - interior tank surfaces that extend from the horizontal plane at the designated maximum fuel line upward, including the upper portion of the tank shell (walls), columns, structural steel, the underside of the roof plates and other steel components in this area.

b. SHELL - interior tank surfaces that extend along the vertical tank walls between the horizontal planes approximately 40 inches above the shell to bottom joint upward to the horizontal plane at the designated fuel line, including columns, wall plates, and other steel components in this area.

c. FLOOR - interior tank surfaces below the horizontal plane approximately 40 inches above the shell to bottom joint, including columns, wall plates, piping, pipe supports, bottom plates, and other steel components in this area.

1.3 SUBMITTALS

Submit the following in accordance with Section 01330, "Submittal Procedures."

SD-04 Samples

Specification and Proprietary Paints; G-AO;

a. The Contractor shall submit coating components and thinners samples. Contractor shall ship samples to the Government Lab of all Military paints. For products that are specified to be applied in accordance with the manufacturer's recommendations the Contractor shall submit the paint producers product data sheet or other written instructions for those products to include mix ratios.

SD-05, Design Data

Environmental Control System; G-AE

SD-06 Test Reports

Coating Sample Test Reports; G-AO

Abrasive Sample Test Reports; G-AO

Daily Inspection Reports; G-AO

Recycled Metallic Abrasive Field Test Reports (Daily and Weekly); G-AO

SD-07 Certificates

Work Plan; G-AE

Qualifications of Certified Industrial Hygienist (CIH); G-AE

Qualifications of Testing Laboratory for Coatings; G-AE

Qualifications of Testing Laboratory for Abrasive; G-AE

Qualifications of Coating Contractors; G-AE

Qualified Painting Contractor; G-AE

The Contractor shall submit a copy of their current SSPC QP 1 certification.

Qualified Hazardous Paint Removal Contractor; G-AE

The Contractor shall submit a copy of their current SSPC QP 2 certification.

Coating Inspection Company Certification; G-AE

Coating Inspector Qualification; G-AE

The Contractor shall submit a copy of their current SSPC QP 5 certification.

NACE Certified Inspectors/painters

Qualifications of Coating Manufacturer's Representative; G-AE

Epoxy Coating Materials; G-AE

Non-metallic Abrasive; G-AO

Metallic Abrasive; G-AO

SD-08 Manufacturer's Instructions

Coating System Instructions; G-AE

SD-11 Closeout Submittals

Disposal of Used Abrasive; G-AO

Inspection Logbook; G-AO

1.4 QUALITY ASSURANCE

1.4.1 Design Data

1.4.1.1 Environmental Control System

Submit design details of the proposed environmental control system to include ventilation, humidity control, and temperature regulation. Provide calculations for humidity control during separate surface preparation and coating application procedures, ventilation requirements during coating application, and maximum allowable coating application rates to coincide with ventilation. Include basis of design data on local conditions. Provide equipment layout sketches and procedures showing function of each piece of equipment and fail-safe measures. A Certified Industrial Hygienist shall approve calculations, work procedures and personal protective equipment.

1.4.2 Test Reports

1.4.2.1 Recycled Metallic Abrasive Field Test Reports (Daily and Weekly)

Submit test results from independent laboratory of daily and weekly Quality Control testing required by SSPC AB 2.

1.4.3 Certificates

1.4.3.1 Work Plan

Submit a written plan describing in detail all phases of the coating operations. Address work sequencing, surface preparation, coating application, recoat and cure time projections, as well as how each step will be controlled, tested, and evaluated. Describe process of determining the existing surface profile under paint, and procedures for ensuring that the profile is not increased beyond the maximum profile specified herein. Describe equipment and methods used to measure tank temperatures and humidity. Provide detailed procedures, including manufacturer's instructions, for repairing defects in the coating film such as runs, drips, sags, holidays, overspray, etc. Also provide the time to surface prep, time to prime, time to coat intermediate coat and time to coat the final coating for the anticipated coating temperature. Address safety measures, work scheduling based on expected weather condition extremes, and

record keeping. Describe method of removing floating pan and preparing for re-installation. Describe method of floating pan installation after tank lining has been applied and cured, how the coated floor and shell surfaces will be protected during pan installation, and how damaged coating will be repaired after pan installation. Describe how the floating pan will be protected, and procedures for evaluating and repairing damage to pan. The floating pan shall not be used as staging or as a work platform. See Section 01400 SPECIAL SAFETY REQUIREMENTS for Accident Prevention Plan and Activity Hazard Analysis requirements. The Certified Industrial Hygienist shall review and approve all portions of these plans pertaining to painting activities. Provide a signature page with health and safety documents, indicating the Certified Industrial Hygienist's approval of the work procedures and equipment for painting tasks. See Section 01355 ENVIRONMENTAL PROTECTION and Section 13281 LEAD HAZARD CONTROL ACTIVITIES for any Air Monitoring Requirements.

1.4.3.2 Qualifications of Certified Industrial Hygienist (CIH)

Submit name, address, telephone number, FAX number, and e-mail address of the independent third party CIH. Submit documentation that hygienist is certified by the American Board of Industrial Hygiene in comprehensive practice, including certification number and date of certification/recertification. Provide evidence of experience with hazards involved in industrial coating application work.

1.4.3.3 Qualifications of Testing Laboratory for Coatings

Submit name, address, telephone number, FAX number, and e-mail address of the independent third party laboratory selected to perform testing of coating samples for compliance with specification requirements. Submit documentation that laboratory is regularly engaged in testing of paint samples for conformance with specifications, and that employees performing testing are qualified.

1.4.3.4 Qualifications of Testing Laboratory for Abrasive

Submit name, address, telephone number, FAX number, and e-mail address of the independent third party laboratory selected to perform testing of abrasive for compliance with specification requirements. Submit documentation that laboratory has experience in testing samples of abrasive for conformance with specifications, and that employees performing testing are qualified.

1.4.3.5 Qualifications of Coating Contractors

All contractors and subcontractors that perform surface preparation or coating application shall be certified by the Society for Protective Coatings (formerly Steel Structures Painting Council) (SSPC) to the requirements of SSPC QP 1, and shall remain certified while accomplishing any surface preparation or coating application. The painting contractors and painting subcontractors must remain so certified for the duration of the project. If a contractor's or subcontractor's certification expires, the firm will not be allowed to perform any work until the certification is reissued. Requests for extension of time for any delay to the completion of the project due to an inactive certification will not be considered and liquidated damages will apply. Notify the Contracting Officer of any change in contractor certification status.

1.4.3.6 Qualifications of Coating Manufacturer's Representative

Evidence of experience and training of the Coating Manufacturer’s Representative(s) shall include literature documenting name, phone number and address, a statement from the coating manufacturer certifying that the representative has successfully completed all of the manufacturer’s training for material storage, mixing, application, and testing, and has been directly involved in evaluation and application of industrial coatings on a minimum of 10 steel structures within the last 5 years, and is not an employee of the Contractor. The manufacturer's representative shall advise on surface preparation, inspections, surface repair materials and methods, material handling, batching and mixing, application, curing, and testing.

1.4.3.7 Coating Inspection Company Certification

Submit documentation that the coating inspection company that will be performing all coating inspection functions is certified by the Society for Protective Coatings (SSPC) to the requirements of SSPC QP 5, and shall remain certified while accomplishing any coating inspection functions. The coating inspection company must remain so certified for the duration of the project. If a coating inspection company's certification expires, the firm will not be allowed to perform any inspection functions, and all surface preparation and coating application work must stop, until the certification is reissued. Requests for extension of time for any delay to the completion of the project due to an inactive certification will not be considered and liquidated damages will apply. Notify the Contracting Officer of any change in coating inspection company certification status.

1.4.3.8 Coating Inspector Qualification

Submit documentation that each coating inspector is employed, and qualified to SSPC QP 5, Level III, by the selected coating inspection company. Each inspector shall remain employed by the coating inspection company while performing any coating inspection functions.

"QC Specialists Duties and Qualifications" as follows:

Qualification/Experience in Area of Responsibility	Area of Responsibility	Frequency
Coating Inspector (no other duties)	Surface preparation, coating application, and testing.	Full time during coating system application testing, surface preparation, coating application and initial curing, testing, and repair work.

1.4.3.9 Nace Certified Painters

Submit documentation Nace Certified Inspector/painter is employed, and qualified. Nace Inspector shall be on the jobsite for all surface preparation, coating and testing of coating system.

1.4.3.10 Epoxy Coating Materials

Provide certification from each manufacturer of components of the coating system, epoxy primer, epoxy intermediate, and polyurethane topcoat, that the supplied coating material is suitable for use in the specified coating system. Each manufacturer shall identify the specific products, including manufacturer's name, which their product may be used with. The certification shall provide the name of the manufacturer that will provide technical support for the entire system.

1.4.3.11 Non-metallic Abrasive

1.4.3.12 Metallic Abrasive

Provide manufacturer's certification of conformance to contract requirements and provide copies of test results. Provide manufacturer's certification of conformance

1.4.4 Product Data

1.4.4.1 Coating System Instructions

Submit manufacturer's printed instructions including detailed mixing and application procedures, number and types of coats required, minimum and maximum application temperatures, and curing procedures. Include Materials Safety Data Sheets (MSDS) for materials to be used at the job site in accordance with 29 CFR 1926.59.

1.5 DELIVERY AND STORAGE

Ship, store, and handle materials in accordance with SSPC PA 1, and as modified in this Section. Maintain temperature in storage spaces between 40 and 75 degrees F, and air temperature more than 5 degrees F above the dew-point at all times. Inspect materials for damage prior to use and return non-compliant materials to manufacturer. Remove materials with expired shelf life from government property immediately and notify the Contracting Officer. Expired materials may be returned to manufacturer, tested, and if compliant, issued a shelf life extension.

1.6 COATING HAZARDS

Ensure that employees are trained in all aspects of the safety plan. Specified coatings may have potential health hazards if ingested or improperly handled. The coating manufacturer's written safety precautions shall be followed throughout mixing, application, and curing of the coatings. During tank cleaning, cleanup, surface preparation, and paint application phases, ensure that employees are protected from toxic and hazardous chemical agents which exceed concentrations in 29 CFR 1910.1000. Comply with respiratory protection requirements in 29 CFR 1910.134. The CIH shall approve work procedures and personal protective equipment.

1.7 WORK SEQUENCE

Coat tank interior following tank tightness testing. Coat tank interior before installation of floating pan.

1.8 JOB SITE REFERENCES

Make available to the Contracting Officer at least one copy each of API Std

653, ASTM D 3276, ASTM D 3925, ASTM D 4285, ASTM D 4417, NACE RP0178 and companion visual comparator, NACE RP0188, SSPC SP COM, SSPC SP 1, SSPC SP 7, SSPC SP 5, SSPC PA 1, SSPC PA 2, SSPC Guide 12, SSPC Guide to VIS 1, SSPC VIS 1, and an SSPC Certified Contractor Evaluation Form at the job site.

1.9 PRE-APPLICATION MEETING

After approval of submittals but prior to the initiation of coating work, Contractor representatives, including at a minimum, project superintendent and QC manager, paint foreman, Contracting Officer representatives, coating inspector, and coating systems manufacturer's representative shall have a pre-application coating preparatory meeting. This meeting shall be in addition to the pre-construction conference. Specific items addressed shall include: work plan, safety plan, inspection standards, inspector qualifications and tools, test procedures, environmental control system, safety plan, and test logs. Notify Contracting Officer at least ten days prior to meeting. Coating Nace inspector/painter shall prepare test plate with a welded seam a minimum of 3 feet by 3 feet to the required surface preparation. The test place shall have each layer of the coating system exposed/feathered. After the test plate is coated the Manufacturer Representative, Inspection Company Representative, Corp Representative and Contractors Quality Assurance/NACE inspector shall agree that the amount of effort on the surface preparation and coating is sufficient to meet contract requirements.

1.10 SAMPLING AND TESTING

NOTE: US Army Construction Engineering Research Laboratory provides paint testing services on a reimbursable basis. Samples shall be submitted to US Army CERL, ATTN: Paint Laboratory, 2902 Farber Drive, Champaign, IL 61821. The Contractor shall allow at least 30 days for sampling and testing. Sampling may be at the jobsite or source of supply. The Contractor shall notify the Contracting Officer when the paint and thinner are available for sampling. Sampling of each batch shall be witnessed by the Contracting Officer unless otherwise specified or directed. A 1-quart 1 liter sample of paint and thinner shall be submitted for each batch proposed for use. The sample shall be labeled to indicate formula or specification number and nomenclature, batch number, batch quantity, color, date made, and applicable project contract number. Testing will be performed by the Government. Contractor shall ship paint samples according to all Federal, State and Local regulations. Costs for retesting rejected material will be deducted from payments to the Contractor at the rate of $500 dollars for each paint sample retested and 500 dollars for each thinner retested.

PART 2 PRODUCTS

2.1 COATING SYSTEM

Alternate systems or products will not be considered. All primer, intermediate, and topcoat materials shall be manufactured by one manufacturer. The entire coating system is intended to be applied in the field.

2.1.1 Epoxy Primer, Intermediate, and Topcoats

The Military specification epoxy and polyurethane products specified in this Section do not require approval for listing on the QPL prior to

contract award, as indicated in paragraph 3.2 of MIL-DTL-24441. Testing of products by an independent laboratory to the requirements of MIL-DTL-24441 after contract award is required. See specific submittal requirements in Article entitled "Quality Assurance."

2.1.1.1 Epoxy Primer Coat

Epoxy polyamide, MIL-DTL-24441/29 (Formula 150, Type IV, Green).

2.1.1.2 Epoxy Intermediate Coat

Epoxy polyamide, MIL-DTL-24441/31 (Formula 152, Type IV, White (Tinted)). Tint to approximately FED-STD-595 color number 27778 parchment using pigment dispersions prepared for epoxy paint tinting. Manufacturer shall tint material and appropriately label. All other requirements of this Military Specification apply.

2.1.1.3 Epoxy Topcoat

Epoxy polyamide, MIL-DTL-24441/31 (Formula 152, Type IV, White).

2.2 COATING SAMPLE COLLECTION AND SHIPPING KIT

Provide a kit that contains one quart can for the base of each coating material, an appropriately sized can for each activator, dipping cups for each component to be sampled, a shipping box sized for the samples to to be shipped, and packing material. Mark cans for the appropriate component. Provide shipping documents, including either pre-paid shipping or a shipper number that can be used by the Contracting Officer to arrange pickup, addressed to the approved coating testing laboratory.

2.3 ABRASIVE SAMPLE COLLECTION AND SHIPPING KIT

Provide a kit that contains one suitable plastic bag or container for each sample to be collected. Mark containers for the appropriate component. Provide shipping documents, including either pre-paid shipping or a shipper number that can be used by the Contracting Officer to arrange pickup, addressed to the approved coating testing laboratory.

2.4 SOLUBLE SALTS TEST KITS

2.4.1 Test Kit for Measuring Chlorides on Steel Surfaces

Provide test kits called CHLOR*TEST, as manufactured by CHLOR*RID International Inc. of Chandler, Arizona (www.chlor-rid.com) or equal. An "equal" test kit shall meet the following requirements:

a. Kit contains all materials,supplies, tools and instructions for field testing and on-site quantitative evaluation;

b. Kit extract solution is acidic, factory pre-measured, pre-packaged, and of uniform concentration;

c. Kit components and solutions are mercury free and environmentally friendly;

d. Kit contains a factory sealed titration device;

e. Kit contains new materials and solutions for each test;

f. Test container (vessel, sleeve, cell. etc.) creates a sealed, encapsulated environment during chloride ion extraction;

g. Test container is suitable for testing the following steel surfaces: horizontal (up/down configuration), vertical, flat, curved, smooth, pitted, and rough;

h. Kit uses test container, with resulting chloride ion extract solution, as the titration container;

i. Chloride ion concentration is directly measured in micrograms per square centimeter without using either conversion charts or tables.

2.5 ABRASIVE

The referenced abrasive specifications have maximum limits for soluble salts contamination, however, this maximum level of contamination does not guarantee that contamination will not be transferred to the steel surface during abrasive blasting. Other factors such as on-site handling and recycling can allow contamination of abrasive. Contractors are cautioned to verify that the chosen abrasive, along with work and storage processes, allow the final surface cleanliness requirements to be achieved. Successful testing of chlorides in abrasive does not negate the final acceptance testing of steel surfaces.

Interpret MIL-A-22262 to include the meaning that abrasive material contains a maximum one percent by weight of any toxic substance listed in either Table Z-1, Z-2, or Z-3 or 29 CFR 1910-SUBPART Z, with the exception of inert or nuisance dust materials, arsenic, beryllium, cadmium, cobalt, lead, mercury, rhodium, silver, tellurium, thallium, and uranium.

2.5.1 Non-metallic Abrasive

Conform to MIL-A-22262, Type I (Inorganic materials) except that the gross gamma radioactivity shall not exceed 5 picocuries per gram. Use sampling procedures and testing frequencies as prescribed in MIL-A-22262. Use abrasive that is specifically selected and graded to provide a sharp, angular profile to the specified depth. Do not use ungraded abrasive. Make adjustments to processes or abrasive gradation to achieve specified surface profile. Recycled non-metallic abrasive shall meet all requirements of the specification each time that it is placed in the blast pot.

2.5.2 Metallic Abrasive

2.5.2.1 New and Remanufactured Steel Grit

Conform to the chemical and physical properties of SSPC AB 3 except that the gross gamma radioactivity shall not exceed 5 picocuries per gram.

2.5.2.2 Recycled Steel Grit

Conform to the chemical and physical properties of SSPC AB 2

PART 3 EXECUTION

3.1 REMOVAL OF COATINGS CONTAINING HAZARDOUS MATERIALS

Coatings containing hazardous materials and identified for disturbance during surface preparation, including removal, shall be handled in accordance with Section 13281, "LEAD HAZARD CONTROL ACTIVITIES Paint and Section 01400 Special Safety Requirements." The contractor shall submit a Waste Classification, Handling, and Disposal Plan in accordance with the requirements of 40 CFR 261 and 40 CFR 262.

3.2 COATING AND ABRASIVE SAMPLE COLLECTION AND TESTING

3.2.1 Coating Sample Collection

Notify Contracting Officer three days in advance of sampling. The Contracting Officer and either the QC Manager or NACE Coating Inspector shall witness all sampling. Provide a sample collection kit as required in Article entitled "Coating Sample Collection and Shipping Kit." Obtain a one quart sample of each batch of each base material, and proportional samples of each activator based on mix ratio, by random selection from sealed containers in accordance with ASTM D 3925. Prior to sampling, mix contents of each sealed container to ensure uniformity. A batch is defined as that quantity of material processed by the manufacturer at one time and identified by number on the label. Identify samples by designated name, specification number, batch number, project contract number, sample date, intended use, and quantity involved. The Contracting Officer will take possession of the packaged samples, contact the shipping company to arrange for pickup, and relinquish the samples only to the shipping representative for shipment to the approved laboratory for testing as required by the paragraph entitled "Coating Sample Testing."

3.2.2 Abrasive Sample Collection

Notify Contracting Officer three days in advance of sampling. The Contracting Officer and either the QC Manager or NACE Coating Inspector shall witness all sampling. Provide suitably sized containers for each sample to be taken. Provide a sample collection kit as required in Article entitled "Abrasive Sample Collection and Shipping Kit." For purposes of quality conformance inspection, a lot shall consist of all abrasive materials of the same type from a single, uniform batch produced and offered for delivery at one time. Obtain samples of each abrasive lot using the sampling techniques and schedule of MIL-A-22262. The addition of any substance to a batch shall constitute a new lot. Identify samples by designated name, specification number, lot number, project contract number, sample date, intended use, and quantity involved. The Contracting Officer will take possession of the packaged samples, contact the shipping company to arrange for pickup, and relinquish the samples only to the shipping representative for shipment to the approved laboratory for testing as required by the Article entitled "Abrasive Sample Testing."

3.2.3 Coating Sample Test Reports

Test samples of all primer, intermediate, and topcoat materials for compliance with requirements of Table I. Reject entire batch represented by samples that fail one or more tests, reselect, and retest samples.

3.2.4 Abrasive Sample Test Reports

Test samples of abrasive materials for compliance with the appropriate abrasive specification. Reject entire lot represented by samples that fail one or more tests, reselect, and retest samples.

3.3 LIGHTING

Provide lighting for all work areas as prescribed in SSPC Guide 12.

3.4 ENVIRONMENTAL CONDITIONS

3.4.1 Control System Requirements

Provide and utilize dehumidification and ventilation equipment to control humidity, temperature, and vapor levels in tank from beginning of abrasive blasting through coating application and for four days after the last coating is applied. System shall maintain vapor concentrations at or below 10 percent of Lower Explosive Limit (LEL). System may incorporate any combination of solid desiccant and direct expansion refrigeration equipment. No liquid, granular, calcium chloride, or lithium chloride drying systems will be accepted. Use only electric, indirect fired combustion, indirect friction, or steam coil auxiliary heaters. System shall be compatible with removal of dust and solvent vapors, and shall have fail-safe measures to ensure reliability during operations.

3.4.1.1 Humidity Control for Surface Preparation and Primer Application

Provide and utilize dehumidification equipment to maintain relative humidity at appropriate level to prevent prepared steel surfaces from corroding at all times during abrasive blasting through primer application. Failure of humidity control system, or failure to maintain proper conditions, during surface preparation stage may allow surface rusting, which will be rejected and require rework. All surfaces to be coated must meet all requirements of SSPC SP 5 at time of primer application. Failure of humidity control system during primer application stage will be cause for removal and replacement of all materials applied and cured while conditions were not as prescribed above.

3.4.1.2 Humidity Control for Application of Intermediate and Topcoats and Initial Curing

Provide and utilize dehumidification equipment to maintain relative humidity near the coldest steel surface in tank below 55 percent at all times during coating application, and during the first four days of initial curing after application of topcoat. This measurement is not the same as measuring the relative humidity of ambient air in the tank, and will require either electronic equipment to monitor relative humidity at the steel surface, or complex calculations to convert relative humidity of air in tank to relative humidity at steel surface. An approved alternative method of monitoring dehumidification that requires less sophisticated equipment or calculations is to maintain a minimum dew point depression of 18 degrees F below coldest steel surface temperature. This is in lieu of specific relative humidity and dew point requirements in this Section. Failure to maintain specified humidity control during this phase will be cause for extension of humidity controlled cure time to ensure four consecutive days at specified relative humidity at steel surfaces. Formation of condensation in coating application stage prior to the indicated dry-hard time will be cause for removal and replacement of all

materials contacted by condensation.

3.5 EQUIPMENT USED IN TANK

Equipment used in the tank after surface preparation begins shall not leave any oily residue from exhaust or other sources. Internal combustion driven equipment, other than that powered by natural or bottled gas, shall not be used.

3.6 SURFACES TO BE COATED

Prepare and coat interior tank surfaces, including FLOOR, SHELL, and CEILING. Remove interior piping to ensure complete coverage of floor and underside of pipe supports. Do not coat aluminum floating pan. Do not coat any aluminum, stainless or galvanized surfaces. Areas between the underside of the tank roof and the top surface of the rafters shall be coated. Contractor will be allowed to insert small wooden blocks between the roof and the rafters, sandblast the area, and then apply the coating. After the coating has dried, remove the blocks to allow the blocked areas to be sandblasted, coated, and dried. The area between the underside of the tank and the rafters ranges between unaccessable to accessible, thickness of coating system and surface preparation will very in this region. Coordinate any variances with the Contracting Officer for the unaccessable area identified.

3.7 SURFACE PREPARATION

3.7.1 Abrasive Blasting Equipment

Use abrasive blasting equipment of conventional air, force-feed, or pressure type. Maintain a minimum pressure of 95 psig at nozzle. Confirm that air supply for abrasive blasting is free of oil and moisture when tested in accordance with ASTM D 4285. Test air quality at each startup, but in no case less often than every five operating hours.

3.7.2 Surface Standard

Inspect surfaces to be coated, and select plate with similar properties and surface characteristics for use as a surface standard. Blast clean one or more 1 foot square steel panels as specified in Article entitled "Surface Preparation." Record blast nozzle type and size, air pressure at nozzle and compressor, distance of nozzle from panel, and angle of blast to establish procedures for blast cleaning. Measure surface profile in accordance with ASTM D 4417. When the surface standard complies with all specified requirements, seal with a clearcoat protectant. Use the surface standard for comparison to abrasive blasted surfaces throughout the course of work.

3.7.3 Pre-Preparation Testing for Surface Contamination

Perform testing, abrasive blasting, and testing in the prescribed order.

3.7.3.1 Pre-Preparation Testing for Oil and Grease Contamination

Inspect all surfaces for oil and/or grease contamination using two or more of the following inspection techniques: 1) Visual inspection, 2) WATER BREAK TEST, 3) BLACK LIGHT TEST, and 4) CLOTH RUB TEST. Reject oil and/or grease contaminated surfaces, clean using a water based pH neutral degreaser in accordance with SSPC SP 1, and recheck for contamination until

surfaces are free of oil and grease.

WATER BREAK TEST - Spray atomized mist of distilled water onto surface, and observe for water beading. If water "wets" surface rather than beading up, surface can be considered free of oil or grease contamination. Beading of water (water forms droplets) is evidence of oil or grease contamination.

BLACK LIGHT TEST - Inspect surfaces for oil and grease contamination using the light specified in the Article entitled "Black Light." Use light no more than 15 inches from surface unless testing indicates that the specific oil or grease found in tank fluoresce at a greater distance. Use light in tank that is completely sealed from light infiltration, under a hood, or at night. Any fluorescing on steel surfaces is indication of petroleum oil/grease contamination. Use either WATER BREAK TEST or CLOTH RUB TEST to confirm both contaminated and non-contaminated areas detected by BLACK LIGHT TEST. The BLACK LIGHT TEST may not be used during inspection of prepared surfaces for oil and grease contamination unless proven to fluoresce the oil and/or grease found in the specific tank and documented during testing prior to abrasive blasting. Generally, only petroleum oil/grease will fluoresce, however, some may not fluoresce sufficiently to be recognized and other methods, such as the WATER BREAK TEST or CLOTH RUB TEST, must be used to confirm findings of the BLACK LIGHT TEST.

CLOTH RUB TEST - Rub a clean, white, lint free, cotton cloth onto surface and observe for discoloration. To confirm oil or grease contamination in lightly stained areas, a non-staining solvent may be used to aid in oil or grease extraction. Any visible discoloration is evidence of oil or grease contamination.

3.7.3.2 Pre-Preparation Testing for Soluble Salts Contamination

Test surfaces for soluble salts, and wash as required, prior to abrasive blasting. Soluble salt testing is also required in Article entitled "Pre-Application Testing for Soluble Salts Contamination" as a final acceptance test of prepared surfaces after abrasive blasting, and successful completion of this phase does not negate that requirement. This phase is recommended since pre-preparation testing and washing are generally more advantageous than attempting to remove soluble salt contamination after abrasive blasting. Effective removal of soluble salts will require removal of any barrier to the steel surface, including rust. This procedure may necessitate combinations of wet abrasive blasting, high pressure water rinsing, and cleaning using a solution of water washing and soluble salts remover. The soluble salts remover shall be acidic, biodegradable, nontoxic, noncorrosive, and after application, will not interfere with primer adhesion. Delays between testing and preparation, or testing and coating application, may allow for the formation of new contamination. Use potable water, or potable water modified with soluble salt remover, for all washing or wet abrasive blasting. Test methods and equipment used in this phase are selected at the Contractor's discretion.

3.7.4 Abrasive Blasting

Abrasive blast steel surfaces to white metal in accordance with SSPC SP 5. Prepared surfaces shall conform to SSPC VIS 1 and SSPC Guide to VIS 1 and shall match the prepared test-panels. Provide a 2 to 3 mil surface profile. Reject profile greater than 3 mils, discontinue abrasive blasting, and modify processes and materials to provide the specified profile. Measure surface profile in accordance with ASTM D 4417. Measure profile at rate of three tests for the first 1000 square feet plus one test

for each additional 1000 square feet or part thereof. Provide two additional measurements for each non-compliant measurement. When surfaces are reblasted for any reason, retest profile as specified. If Method C of ASTM D 4417 is used to measure profile, attach test tapes to Daily Inspection Reports. Following abrasive blasting, remove dust and debris by vacuum cleaning.

3.7.5 Disposal of Used Abrasive

Dispose of used abrasive off Government property in accordance with Federal, State and Local mandated regulations.

3.7.6 Pre-Application Testing For Surface Contamination

3.7.6.1 Pre-Application Testing for Oil and Grease Contamination

Ensure tank surfaces are free of contamination as described in Article entitled "Pre-Preparation Testing for Oil and Grease Contamination."

3.7.6.2 Pre-Application Testing for Soluble Salts Contamination

Test surfaces for chloride contamination using the Test Kit described in article entitled "Test Kit for Measuring Chlorides on Steel Surfaces." Test all surfaces at rate of three tests for the first 1000 square feet plus one test for each additional 2000 square feet or part thereof. Concentrate testing of bare steel at areas of coating failure to bare steel and areas of corrosion pitting. Perform 30% of tests on bare steel at welds, divided equally between horizontal and vertical welds. One or more readings greater than 3 micrograms per square centimeter of chlorides is evidence of chloride contamination. Reject contaminated surfaces, wash as discussed in article entitled "Pre-Preparation Testing for Soluble Salts Contamination," allow to dry, and re-test until all required tests show allowable results. Reblast tested areas using vacuum equipped blast equipment. Label all test tubes and retain for test verification.

3.7.6.3 Pre-Application Testing for Surface Cleanliness

Apply coatings to dust free surfaces. To test surfaces, apply strip of clear adhesive tape to surface and rub onto surface with finger. When removed, the tape should show little or no dust, blast abrasive, or other contaminant. Reject contaminated surfaces, clean by vacuum cleaning, and retest. Test surfaces at rate of three tests for the first 1000 square feet plus one test for each additional 1000 square feet or part thereof. Provide two additional tests for each failed test or questionable test. Attach test tapes to Daily Inspection Reports.

3.8 MIXING AND APPLICATION OF COATING SYSTEM

3.8.1 Preparation of Coating Materials for Application

Each of the different products, primer, intermediate, and topcoat, is a two-component material supplied in separate containers.

3.8.1.1 Mixing

Mix in accordance with manufacturer's instructions, which may differ for each product. Do not mix partial kits, or alter mix ratios. Mix materials in same temperature and humidity conditions specified in article entitled "Delivery and Storage." Allow mixed material to stand for the required

induction time based on its temperature.

3.8.1.2 Pot Life

Apply mixed products within stated pot life for each product. Stop applying when material becomes difficult to apply in a smooth, uniform wet film. Do not add solvent to extend pot life. Add all required solvent at time of mixing. Pot life is based on standard conditions at 70 degrees F and 50 percent relative humidity. For every 18 degrees F rise in temperature, pot life is reduced by approximately half, and for every 18 degrees F drop, it is approximately doubled. Usable pot life depends on the temperature of the material at the time of mixing and the sustained temperature at the time of application. Other factors such as the shape of the container and volume of mixed material may also affect pot life. In hot climates, precooling or exterior icing of components for at least 24 hours to a minimum of 50 degrees F will extend pot life. Following are approximate pot life times:

Epoxy Primer and Intermediate Coat Materials 4 hours

3.8.1.3 Application Conditions and Recoat Windows

The application condition requirements for the coating system are very time and temperature sensitive, and are intended to avoid the delamination problems frequently found on industrial structures. Plan coating application to ensure that specified temperature, humidity, and condensation conditions are met. If conditions do not allow for orderly application of primer, stripe coat, intermediate coat and topcoat, use appropriate means of controlling air and surface temperatures, as required. Partial or total enclosures may be required, as well as other measures, to control conditions to allow for orderly application of all required coats.

Apply coating only when steel and internal air temperatures are between 60 and 100 degrees F. Do not apply coatings above 100 degrees F or below 60 degrees F.

Use Table entitled "RECOAT WINDOWS" to determine appropriate recoat windows for each coat after the initial coat. Apply each coating during appropriate RECOAT WINDOW.

If coating is not applied during RECOAT WINDOW, apply during EXTENDED RECOAT WINDOW. Application of any epoxy coat within the EXTENDED RECOAT WINDOW requires application of a TACK COAT prior to applying any full coat. Perform CURE TEST immediately prior to application of TACK COAT to determine condition of applied coating. If CURE TEST indicates that surface is fully cured, provide GLOSS REMOVAL prior to application of TACK COAT.

If coating is not applied during EXTENDED RECOAT WINDOW, or if surface temperature exceeds 120 degrees F between applications, provide GLOSS REMOVAL, apply TACK COAT, where applicable, within 24 hours, and apply next full coat within TACK COAT RECOAT WINDOW.

RECOAT WINDOWS

Temperature degrees F	60-70	71-80	81-90	91-100	101-110	111-120
RECOAT WINDOW (Hrs.)	24-72	18-60	16-48	12-36	8-18	4-6
EXTENDED RECOAT	72-168	60-140	48-120	36-96	18-36	6-12

RECOAT WINDOWS WINDOW (Hrs.)						
TACK COAT RECOAT WINDOW (Hrs.)	6-72	4-60	4-48	3-36	2-18	1-6

The temperature ranges shown in the table above are for determining recoat windows. Choose recoat window based on the highest surface temperature that was sustained for one or more hours between coats. This applies to the entire time between coats. Measure and record air and surface temperatures on hourly basis to determine appropriate recoat windows. If surface temperature goes above 100 degrees F, measure and record temperatures every half hour.

CURE TEST - Where indicated, test surface for cure using high-flash aromatic Naphtha only (cas #64742-95-6). Do not use aliphatic VMP Naphtha. Wipe surface with rag saturated with Naphtha, and check for surface tackiness, loss of gloss, or other indications that solvent has softened surface. If softening is found on 95% of test sites, this is indication that coating has not fully cured, and GLOSS REMOVAL is not required if TACK COAT is applied within three hours and full coat is applied within the TACK COAT RECOAT WINDOW. Test surfaces at rate of three tests for the first 1000 square feet plus one test for each additional 1000 square feet or part thereof.

TACK COAT - Where indicated, apply coat of intermediate coat epoxy, at 1 to 2 mils WFT, then apply next specified full coat within TACK COAT RECOAT WINDOW. Thin TACK COAT material approximately 25% by volume, using appropriate epoxy thinner.

GLOSS REMOVAL - Where indicated, remove all gloss by hand sanding, in a linear fashion, with 150-200 grit wet/dry sandpaper, followed by a solvent wiping with a clean rag soaked with denatured alcohol to remove dust. Do not use rotary sanders or grinders.

3.8.2 Application of Coating System

Apply coatings in accordance with SSPC PA 1 and as specified herein.

After application of primer coat and prior to application of each subsequent coat, perform testing prescribed in article entitled "Pre-Application Testing For Surface Contamination," as necessary, to ensure minimal intercoat contamination. This testing may be reduced to one half of the prescribed rate for bare steel if the testing indicates no contamination when sampling is evenly distributed over surfaces being tested. If contamination is found between coats, revert to the specified testing rate. Generally, oil and grease contamination and soluble salts contamination are not encountered if subsequent coats are applied within specified recoat windows and the quality of air entering tank is controlled. Concern for intercoat contamination should be continually prevalent, and spot testing should be accomplished to verify satisfactory conditions. Where visual examination or spot testing indicates contamination, perform sufficient testing to verify non-contamination, or to define extent of contamination for appropriate treatment.

Apply each coat in a consistent wet film, at 90 degrees to previous coat. Ensure that primer and intermediate coat "cold joints" are no less than six inches from welds. Apply stripe coat by brush. Apply all other coats by spray application. . The cleanliness, temperature, recoat windows, and airborne paint containment requirements may necessitate the use of portable

shelters or other appropriate controls.

Apply coatings at the following specified thickness:

Coat	Desired Thickness Range Mils DFT	Minimum Mils DFT	Maximum Mils DFT
Primer	3 - 5	3	8
Intermediate	3 - 5	3	8
Top	3 - 5	3	8
Total system	-----	9	20

Measure coating thickness in accordance with SSPC PA 2 to confirm that coating application is within the specified range and within the tolerances of that standard. For non-compliant areas, increase number of test areas to identify all non-compliant application as required by SSPC PA 2. Add coating as required to correct underuns, and remove coating with excess thickness to bare steel and reapply as specified in Article entitled "Procedure for Holiday and Spot Repairs of Newly Applied Coating."

3.8.2.1 Application of Stripe Coat

Apply stripe coat of epoxy primer material prior to application of general primer coat on CEILING and SHELL. Apply stripe coat of epoxy intermediate coat material after application of general primer coat on FLOOR. Apply stripe coat by brush, working the material into corners, crevices, pitted areas, and welds, and onto outside corners and angles. Where roof-to-rafter joints exceed 0.5 inch gap use appropriate application tools to provide "best effort" coating of all exposed steel surfaces in the gap. Mini-rollers or other tools may be required.

3.8.2.2 Application of Primer

Apply primer coat within RECOAT WINDOW of stripe coat.

3.8.2.3 Application of Intermediate Coat

Apply intermediate coat within RECOAT WINDOW of primer coat.

3.8.2.4 Application of Topcoat

Apply topcoat within RECOAT WINDOW of intermediate coat.

3.8.3 Holiday Testing

No sooner than 48 hours after application of the topcoat, perform holiday testing in accordance with the low voltage wet sponge method of NACE RP0188. Repair holidays per paragraph entitled "Procedure for Holiday and Spot Repairs of Newly Applied Coating." .

3.8.4 Procedure for Holiday and Spot Repairs of Newly Applied Coating

Repair coating film defects at the earliest practicable time, preferably before application of the succeeding coat. Observe all requirements for soluble salts contamination, cleanliness between coats, and application conditions. Prepare defective area in accordance with SSPC SP 5, and feather coating as required to leave 4 inches of each succeeding coat feathered and abraded. Do not abrade the polyurethane topcoat. Protect adjacent areas from damage and overspray. Remove dust and solvent wipe the

prepared area plus an additional 4 inches beyond the prepared area with clean denatured alcohol. Apply each coat within RECOAT WINDOW of preceeding coat. Within four hours of preparation, apply primer to prepared steel and feather onto prepared primer. Apply intermediate coat to primed area and feather to prepared intermediate area. Apply topcoat to intermediate coat and feather to prepared topcoat. Apply each repair coat to approximate thickness of surrounding coating system. If one percent or more of the total surface area, or more than one spot per 2000 square feet, of the FLOOR area requires repair to any coat or coats, including feathered areas, the entire FLOOR coating system shall be removed and reapplied. If 5 percent or more of the total surface area, or more than one spot per 1000 square feet, of the CEILING area requires repair to any coat or coats, including feathered areas, the entire CEILING coating system shall be removed and reapplied. Repairs on the SHELL are not limited.

3.8.5 Tank Occupancy After Coating Application

Use clean canvas, or other approved, shoe covers when walking on coated surfaces, regardless of curing time allowed. For heavily trafficked areas, provide cushioned mats for additional protection.

3.8.6 Extended Cure of Coating System Prior to Immersion Service

Allow a cure time of at least 14 days after the final coating material has been applied before introducing water or fuel into tank. Allow a cure time of 12 days after the final coating material has been applied before beginning installation of the floating pan.

3.9 FIELD TESTS AND INSPECTION

For marking of tank surfaces, use chalk for marking bare steel, and water based markers for marking coated surfaces, and remove marks prior to coating. Do not use any wax or grease based markers, or any other markers that leave a residue or stain.

3.9.1 Coating Inspector

The coating inspector shall shall work for the CQC System Manager in accordance with Section 01451, "Contractor Quality Control." The Coating Inspector shall be present during all pre-preparation testing, surface preparation, coating application, initial cure of the coating system, and during all coating repair work. The Coating Inspector shall provide complete documentation of conditions and occurrences on the job site, and be aware of conditions and occurrences that are potentially detrimental to the coating system. The requirements for inspection listed in this Section are in addition to the CQC inspection and reporting requirements outlined in Section 01451, "Contractor Quality Control." The Coating Inspector shall prepare a project reference sheet outlining all requirements, tests, test methods, and evaluation criteria, and hold regular meetings with contractor personnel, including nozzlemen and applicators, to review requirements and evaluation criteria for upcoming work in advance of the work.

3.9.2 Field Inspection

3.9.2.1 Inspection Requirements

Accomplish field inspection in accordance with ASTM D 3276 and as required herein. Perform all appropriate tests and inspections, except that

viscosity and weight per gallon measurements are not required. Provide all tools and instruments required to perform the required testing, as well as any tools or instruments that the inspector considers necessary to perform the required inspections and tests. Document each inspection and test, including required hold points and other required inspections and tests, as well as those inspections and tests deemed prudent from on-site evaluation, as follows:

a. Location or area;
b. Purpose (required or special);
c. Method;
d. Criteria for evaluation;
e. Results;
f. Determination of compliance;
g. List of required rework;
h. Observations.

Collect and record Environmental Conditions as described in ASTM D 3276 on a 24 hour basis, as follows:

a. During surface preparation, every two hours or when changes occur;
b. During coating application and the first four days of initial cure, every hour, or when changes occur;
c. Overnight hours may be excluded if conditions are measured and recorded through 1800 hours and then prior to dawn the next day;
d. Note location, time, and temperature of the highest and lowest surface temperatures each day.
e. Use a non-contact thermometer to locate temperature extremes, then verify with contact thermometers.

Document all equipment used in inspections and testing, including manufacturer, model number, serial number, last calibration date and future calibration date, and results of on-site calibration performed.

3.9.2.2 Daily Inspection Reports

Submit one copy of daily inspection report completed each day when performing work under this Section, to the Contracting Officer. Use ASTM D 3276 Appendix X1 Inspection Checklist to monitor daily activity and prepare Daily Inspection Report. Use of forms containing entry blocks for all required data is encouraged. The data may be in any format, but must be legible and presented so that it can be easily interpreted. Note all non-compliance issues, and all issues that were reported for rework in accordance with QC procedures of Section 01451, "Contractor Quality Control." Submit report within 24 hours of date recorded on the report.

3.9.2.3 Inspection Logbook

A continuous record of all activity related to this Section shall be maintained in an Inspection Logbook on a daily basis. The logbook shall be hard or spiral bound with consecutively numbered pages, and shall be used to record all information provided in the Daily Inspection Reports, as well as other pertinent observations and information. The Coating Inspector's Logbook that is sold by NACE is satisfactory. Submit the original Inspection Logbook to the Contracting Officer upon completion of the project and prior to final payment.

3.9.3 Inspection Equipment

All equipment shall be in good condition, operational within its design range, and calibrated as required by the specified standard for use of each device.

3.9.3.1 Black Light

Use a black light having a 365 nanometer intensity of 4,000 microwatts per square centimeter minimum at 15 inches. The Spectroline BIB-150P from Spectronics Corporation satisfies this requirement.

3.9.4 Hold Points for Quality Control Inspections

Provide appropriate QC inspections at the following hold-points:

Step	Action
Prior to preparation of tank(s) for cleaning and repair	Safety inspection
After cleaning of tank(s) and prior to abrasive blasting	1. Safety inspection, removal of dirt, trash, debris, and any hindrance to abrasive blasting.
	2. Surface inspection for oil, grease, soluble salts, and other contaminants
Initiation of abrasive blasting, and at each work stoppage	1. Confirm environmental conditions are suitable for abrasive blasting and for holding the blast.
	23 Surface inspection to insure all aspects of surface preparation are properly addressed, as specified in article entitled "Surface Preparation."
	3. Test compressor air for oil and water contamination
After abrasive blasting	Surface inspection to insure all aspects of surface preparation are properly addressed, as specified in article entitled "Surface Preparation."
Immediately prior to coating application - provide for each coating application evolution	1. Confirm environmental conditions are suitable for abrasive blasting and for holding the blast as specified in article entitled "Environmental Conditions"
	2. Surface inspection to insure all aspects of surface preparation are properly addressed, as specified in article entitled "Surface Preparation."
	3. Confirm that testing equipment for

	monitoring of hazardous conditions during coating application are working properly and are prepared for use as outlined in contractor's Confined Space Entry Plan.
During and after coating application.	Coating application inspection as specified in paragraphs entitled "Application of Coating System" and "Field Tests and Inspection".
After final cleanup	Clean-up inspection specified in the article entitled "Final Cleanup."

3.10 FINAL CLEANUP

Following completion of the work, remove debris, equipment, and materials from the site. Remove temporary connections to Government or Contractor furnished water and electrical services. Restore existing facilities in and around the work areas to their original condition.

TABLE I
COATING QUALITY CONFORMANCE INSPECTION REQUIREMENTS

Table Ia. - Epoxy Primer Coat MIL-DTL-24441/29 Formula 150 Type IV (Green)

Test	Component A		Component B		Mixed	
	Min.	Max.	Min.	Max.	Min.	Max.
Pigment content, percent	45.0	50.0	35.0	40.0	---	---
Volatiles, percent	29.0	35.0	15.0	20.0	---	---
Non-volatile vehicle, percent	17.5	23.5	43.0	48.0	---	---
Coarse particles, percent	---	0.3	---	0.3	---	---
Consistency, grams	300	410	470	600	---	---
Weight						
Kilograms/liter	1.33	1.39	1.33	1.39	---	---
Pounds/gallon	11.1	11.6	11.1	11.6	---	---
Set to touch, hours at 23degrees C, 73 degrees F	---	---	---	---	---	3
Dry-hard time, hours at 23 degrees C, 73 degrees F	---	---	---	---	---	6
Fineness of grind, Hegman	3	---	2	---	---	---
Flashpoint						
Degrees C	35.5	---	37.8	---	---	---
Degrees F	96	---	100	---	---	---
Titanium Dioxide, percent of pigment	18	---	---	---	---	---
Pot life, hours at 23degrees C, 73 degrees F	---	---	---	---	4	---
Sag resistance,						
Micrometers	---	---	---	---	300	---
Mils	---	---	---	---	12	---
Color of dry film to approximate color of standard color chip	---	---	---	---	Conform	
Contrast ratio at 75 micrometers, 3 mils DFT	---	---	---	---	0.98	---
VOC						
Grams/liter	---	---	---	---	---	340
Pounds/gallon	---	---	---	---	---	2.8

GENERAL NOTES:
Test methods as specified in MIL-DTL-24441.
Where "Conform" is indicated, refer to specific requirements of MIL-DTL-24441/29.

TABLE I
COATING QUALITY CONFORMANCE INSPECTION REQUIREMENTS

Table Ib. - Epoxy Intermediate Coat MIL-DTL-24441/31 Formula 152 Type IV (White (Tinted))

Test	Component A		Component B		Mixed	
	Min.	Max.	Min.	Max.	Min.	Max.
Pigment content, percent	44.0	49.0	33.0	38.0	---	---
Volatiles, percent	29.0	35.0	16.0	21.0	---	---
Non-volatile vehicle, percent	17.5	23.5	44.0	49.0	---	---
Coarse particles, percent	---	0.3	---	0.3	---	---
Consistency, grams	180	320	300	470	---	---
Weight						
Kilograms/liter	1.39	1.45	1.29	1.35	---	---
Pounds per gallon	11.6	12.1	10.8	11.3	---	---
Set to touch, hours at 23 degrees C, 73 degrees F	---	---	---	---	---	3
Dry-hard time, hours at 23 degrees C, 73 degrees F	---	---	---	---	---	8
Fineness of grind, Hegman	4	---	4	---	---	---
Flashpoint						
Degrees C	35.5	---	37.8	---	---	---
Degrees F	96	---	100	---	---	---
Titanium dioxide, percent of pigment	91	---	---	---	---	---
Pot life, hours at 23 degrees C, 73 degrees F	---	---	---	---	4	---
Sag resistance						
Micrometers	---	---	---	---	300	---
Mils	---	---	---	---	12	---
Color of dry film to approximate color of FED-STD 595 color 27778	---	---	---	---	Conform	
Contrast ratio, at 75 micrometers, 3 mils DFT	---	---	---	---	0.98	---
VOC						
Grams/liter	---	---	---	---	---	340
Pounds/gallon	---	---	---	---	---	2.8

GENERAL NOTES:
Test methods as specified in MIL-DTL-24441.
Where "Conform" is indicated, refer to specific requirements of MIL-DTL-24441/31.

TABLE I
COATING QUALITY CONFORMANCE INSPECTION REQUIREMENTS

Table Ic. - Epoxy Intermediate Coat MIL-DTL-24441/31 Formula 152 Type IV (White)

Test	Component A		Component B		Mixed	
	Min.	Max.	Min.	Max.	Min.	Max.
Pigment content, percent	44.0	49.0	33.0	38.0	---	---
Volatiles, percent	29.0	35.0	16.0	21.0	---	---
Non-volatile vehicle, percent	17.5	23.5	44.0	49.0	---	---
Coarse particles, percent	---	0.3	---	0.3	---	---
Consistency, grams	180	320	300	470	---	---
Weight						
Kilograms/liter	1.39	1.45	1.29	1.35	---	---
Pounds per gallon	11.6	12.1	10.8	11.3	---	---
Set to touch, hours at 23 degrees C, 73 degrees F	---	---	---	---	---	3
Dry-hard time, hours at 23 degrees C, 73 degrees F	---	---	---	---	---	8
Fineness of grind, Hegman	4	---	4	---	---	---
Flashpoint						
Degrees C	35.5	---	37.8	---	---	---
Degrees F	96	---	100	---	---	---
Titanium dioxide, percent of pigment	91	---	---	---	---	---
Pot life, hours at 23 degrees C, 73 degrees F	---	---	---	---	4	---
Sag resistance						
Micrometers	---	---	---	---	300	---
Mils	---	---	---	---	12	---
Color of dry film to approximate color of FED-STD 595 color 27778	---	---	---	---	Conform	
Contrast ratio, at 75 micrometers, 3 mils DFT	---	---	---	---	0.98	---
VOC						
Grams/liter	---	---	---	---	---	340
Pounds/gallon	---	---	---	---	---	2.8

GENERAL NOTES:
Test methods as specified in MIL-DTL-24441.
Where "Conform" is indicated, refer to specific requirements of MIL-DTL-24441/31.

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SECTION 10800

TOILET ACCESSORIES

PART 1 GENERAL

1.1 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Finishes; G-AO
Accessory Items; G-AO

Manufacturer's descriptive data and catalog cuts indicating materials of construction, fasteners proposed for use for each type of wall construction, mounting instructions, operation instructions, and cleaning instructions.

SD-04 Samples

Finishes.
Accessory Items.

One sample of each accessory proposed for use. Approved samples may be incorporated into the finished work, provided they are identified and their locations noted.

SD-07 Certificates

Accessory Items.

Submit for each type of accessory specified, attesting that the items meet the specified requirements.

1.2 DELIVERY, STORAGE, AND HANDLING

Toilet accessories shall be wrapped for shipment and storage, delivered to the jobsite in manufacturer's original packaging, and stored in a clean, dry area protected from construction damage and vandalism.

1.3 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period shall be provided.

PART 2 PRODUCTS

2.1 MANUFACTURED UNITS

Toilet accessories shall be provided where indicated in accordance with paragraph SCHEDULE. Each accessory item shall be complete with the necessary mounting plates and shall be of sturdy construction with corrosion resistant surface.

2.1.1 Anchors and Fasteners

Anchors and fasteners shall be capable of developing a restraining force commensurate with the strength of the accessory to be mounted and shall be suited for use with the supporting construction. Exposed fasteners shall have oval heads and shall be finished to match the accessory.

2.1.2 Finishes

Except where noted otherwise, finishes on metal shall be provided as follows:

Metal	Finish
Stainless steel	No. 4 satin finish
Carbon steel, copper alloy, and brass	Chromium plated, bright

2.2 ACCESSORY ITEMS

Accessory items shall conform to the requirements specified below.

2.2.1 Paper Towel Dispenser (PTD)

Paper towel dispenser shall be constructed of not less than 0.269 inch Type 304 stainless steel, and shall be recessed mounted. Dispenser shall have a towel compartment and a mirror door and liquid soap dispenser. Locking mechanism shall be tumbler key lock.

2.2.2 Toilet Tissue Dispenser (TTD)

Toilet tissue holder shall be Type II - surface mounted with two rolls of standard tissue mounted horizontally. Cabinet shall be stainless steel, satin finish.

PART 3 EXECUTION

3.1 INSTALLATION

Surfaces of fastening devices exposed after installation shall have the same finish as the attached accessory. Exposed screw heads shall be oval. Install accessories at the location and height indicated. Protect exposed surfaces of accessories with strippable plastic or by other means until the installation is accepted. After acceptance of accessories, remove and dispose of strippable plastic protection. Coordinate accessory manufacturer's mounting details with other trades as their work progresses.

After installation, thoroughly clean exposed surfaces and restore damaged work to its original condition or replace with new work.

3.1.1 Recessed Accessories

Fasten accessories with wood screws to studs, blocking or rough frame in wood construction. Set anchors in mortar in masonry construction. Fasten to metal studs or framing with sheet metal screws in metal construction.

3.1.2 Surface Mounted Accessories

Mount on concealed backplates, unless specified otherwise. Accessories without backplates shall have concealed fasteners. Unless indicated or specified otherwise, install accessories with sheet metal screws or wood screws in lead-lined braided jute, teflon or neoprene sleeves, or lead expansion shields, or with toggle bolts or other approved fasteners as required by the construction. Install backplates in the same manner, or provide with lugs or anchors set in mortar, as required by the construction. Fasten accessories mounted on gypsum board and plaster walls without solid backing into the metal or wood studs or to solid wood blocking secured between wood studs, or to metal backplates secured to metal studs.

3.2 CLEANING

Material shall be cleaned in accordance with manufacturer's recommendations. Alkaline or abrasive agents shall not be used. Precautions shall be taken to avoid scratching or marring of surfaces.

3.3 SCHEDULE

Accessories Required

Room or Space	MG/PTD	TTD
103	1	1

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SECTION 12320

CABINETS AND COUNTERTOPS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

BHMA A156.9	(1994) Cabinet Hardware

KITCHEN CABINET MANUFACTURERS ASSOCIATION (KCMA)

KCMA A161.1	(1995) Performance & Construction Standards for Kitchen and Vanity Cabinets

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA LD 3	(1995) High-Pressure Decorative Laminates

1.2 DESIGN

Cabinets shall be wood, factory-fabricated and finished in the manufacturer's standard sizes and finishes of the type, design, and configuration indicated. Cabinets shall be constructed as specified and shall meet the requirements of KCMA A161.1. Fastenings shall be accomplished to permit removal and replacement of individual units. Counters shall be provided with watertight sink rim when indicated. Shelves shall be adjustable as indicated.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Installation; G-AO

Drawings showing type of cabinet and related item, and clearly indicating the complete plan, location, and elevations of the cabinets and accessories and pertinent details of construction, fabrication, and attachments.

SD-03 Product Data

Cabinets; G-AO
Countertops and Backsplash; G-AO

Manufacturer's printed data, catalog cuts, installation and cleaning instructions.

1.4 DELIVERY AND STORAGE

Cabinet shall be delivered to the jobsite wrapped in a protective covering. Cabinet shall be stored in accordance with manufacturer's recommendations in an adequately ventilated, dry location that is free of dust, water, or other contaminants and in a manner to permit access for inspection and handling. Cabinets shall be handled carefully to prevent damage to the surfaces. Damaged items that cannot be restored to like-new condition shall be replaced.

PART 2 PRODUCTS

2.1 CABINETS

Door design shall be solid flush face from vendors standard styles. Shelf shall be fully adjustable. Adjustable shelf shall be capable of adjusting on approximately 3 inch increments. Shelf shall be supported by self-locking clips or wood dowels. Dowels shall be approximately 5/16 inch in diameter by 1-9/16 inches long. Dowels shall be inserted into borings for the shelf adjustments. Shelves shall be minimum 1/2 inch thick plywood or minimum 1/2 inch thick 45 pound density particle board.

2.1.1 Frame Type Cabinets

The cabinet shall be constructed with frame fronts and solid ends, or frame construction throughout. Frame members shall be 3/4 inch thick by 1-1/2 inch wide; kiln-dried hardwood, glued together, and shall be either mortised and tenoned, dovetailed or doweled, nailed, stapled or screwed. Top and bottom corners shall be braced with either hardwood blocks that are glued together with water resistant glue and nailed in place, or metal or plastic corner braces. Backs of wall cabinets shall be 1/8 inch thick plywood, tempered hardboard or 3/8 inch thick,45 pound density particle board. Backs of base and tall cabinets shall be 3/8 inch thick hardwood or 3/8 inch thick, 45 pound density particle board. Bottoms of cabinets shall be minimum 3/8 inch thick plywood 45 pound density particle board or sound grade plywood and shall be braced with wood members glued in place. Cabinet ends shall be 5/8 inch thick hardwood plywood.

2.2 COUNTERTOPS AND BACKSPLASH

2.2.1 High-Pressure Laminated Plastic Clad Countertops

Clad countertop and backsplash shall be constructed of 3/4 inch thick plywood or 3/4 inch thick, 45 pound density particle board core and shall be post formed cove type or fully formed type. Cove type shall be a single unit with self-edging and plastic laminate coved at the juncture of the countertop and backsplash. Edging and trim shall consist of plastic laminate cut and fitted to all exposed edges. End splashes constructed of 3/4 inch plywood or 3/4 inch thick, 45 pound density particle board core shall be supplied. Continuous sheets of longest lengths practicable shall

be provided. Joints in surface sheeting shall be tight and flush and held to a practicable minimum. When the countertop and backsplash are two separate units, GP50 plastic laminate shall be used. When the countertop and backsplash are one unit, PF42 plastic laminate shall be used. Plastic laminate shall conform to the requirements of NEMA LD 3 and plastic laminate adhesive shall be contact type applied to both surfaces. For fully formed and cove type countertops, the post-forming plastic laminate shall not be bent to a radius smaller than the limit recommended by the plastic manufacturer.

2.3 Sink/Lavatory Rims

Sink/lavatory rims shall be of the type as shown, and a standard product of a manufacturer regularly producing this type of equipment.

2.4 FINISH

2.4.1 Cabinet Finish

Cabinets shall be provided with a factory-applied durable finish in accordance with KCMA A161.1 requirements and of a type standard with the manufacturer.

2.4.2 Melamine Laminated Interior Cabinet Finish

Plywood, particle board or tempered hardboard cabinet backs shall be finished with a melamine laminate on the exposed side. Particle board shelves shall be covered on both sides with a laminated melamine finish. Melamine laminate shall conform to the requirements of NEMA LD 3 and laminate adhesive shall be contact type applied to both surfaces.

2.4.3 Backer Sheets

Backer Sheets of high pressure plastic laminate, shall conform to NEMA LD 3, Grade BK20 and shall be applied to the underside of all core material.

2.5 HARDWARE

Hardware shall conform to BHMA A156.9, shall be suitable for cabinet use, and shall include all miscellaneous hardware for a complete installation. Door hinges shall be self-closing type. Hardware and fastenings for doors and drawers with particle board cores shall be of the through-bolt type.

2.6 COLOR, TEXTURE, AND PATTERN

Design, color, and finish shall be selected from manufacturer's standard.

PART 3 EXECUTION

3.1 INSTALLATION

Cabinets shall be installed level, plumb, and true to line, and shall be attached to the walls or floors with suitable devices to securely anchor each unit. Countertops, accessories, and hardware shall be installed as indicated on the drawings. Installation shall be in accordance with the manufacturer's approved printed instructions. The inner edge of sink cut-outs in laminated plastic tops shall be painted with a coat of semigloss enamel paint and sink flanges shall be set in a bed of sealant. Closer and filler strips and finish moldings shall be provided as required.

Prior to final acceptance, doors shall be aligned, and hardware shall be adjusted.

3.2 CLEANING

Cabinet and countertop surfaces shall be cleaned in accordance with manufacturer's instructions.

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DIVISION 13 - SPECIAL CONSTRUCTION

SECTION 13080

SEISMIC PROTECTION FOR MISCELLANEOUS EQUIPMENT

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SECTION 13080

SEISMIC PROTECTION FOR MISCELLANEOUS EQUIPMENT

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 36/A 36M	(2001) Carbon Structural Steel
ASTM A 53/A 53M	(2002) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 153/A 153M	(2001a) Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A 307	(2002) Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
ASTM A 325	(2002) Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
ASTM A 500	(1999) Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A 563	(2000) Carbon and Alloy Steel Nuts
ASTM A 603	(1998) Zinc-Coated Steel Structural Wire Rope
ASTM A 653/A 653M	(2001a) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM E 488	(1996) Strength of Anchors in Concrete and Masonry Elements

ASME INTERNATIONAL (ASME)

ASME B18.2.1	(1996) Square and Hex Bolts and Screws (Inch Series)
ASME B18.2.2	(1987; R 1999) Square and Hex Nuts (Inch Series)

U.S. ARMY CORPS OF ENGINEERS (USACE)

TI 809-04 (1998) Seismic Design for Buildings

1.2 SYSTEM DESCRIPTION

1.2.1 General Requirements

The requirements for seismic protection measures described in this section shall be applied to the mechanical equipment and systems outlined in Section 15070 SEISMIC PROTECTION FOR MECHANICAL EQUIPMENT, the electrical equipment and systems outlined in Section 16070 SEISMIC PROTECTION FOR ELECTRICAL EQUIPMENT, and the miscellaneous equipment and systems listed below. Seismic protection requirements shall be in accordance with TI 809-04 and additional data furnished by the Contracting Officer, and shall be provided in addition to any other requirements called for in other sections of these specifications.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Bracing; G-AE

Detail drawings along with catalog cuts, templates, and erection and installation details, as appropriate, for the items listed. Submittals shall be complete in detail; shall indicate thickness, type, grade, class of metal, and dimensions; and shall show construction details, reinforcement, anchorage, and installation with relation to the building construction.

PART 2 PRODUCTS

2.1 BOLTS AND NUTS

Squarehead and hexhead bolts, and heavy hexagon nuts, ASME B18.2.1, ASME B18.2.2, or ASTM A 307 for bolts and ASTM A 563 for nuts or ASTM A 325 for bolts and nuts. Bolts and nuts used underground and/or exposed to weather shall be galvanized in accordance with ASTM A 153/A 153M.

2.2 SWAY BRACING

Material used for members listed in this section and on the drawings, shall be structural steel conforming with the following:

a. Plates, rods, and rolled shapes, ASTM A 36/A 36M.

b. Wire rope, ASTM A 603.

c. Tubes, ASTM A 500, Grade B.

d. Pipes, ASTM A 53/A 53M, Type E or S, Grade B.

e. Light gauge angles, less than 1/4 inch thickness, ASTM A 653/A 653M.

PART 3 EXECUTION

3.1 BRACING

Bracing shall conform to the arrangements shown. Trapeze-type hanger shall be secured with not less than two 1/2 inch bolts.

3.2 BUILDING DRIFT

Sway braces for a piping run shall not be attached to two dissimilar structural elements of a building that may respond differentially during an earthquake unless a flexible joint is provided.

3.3 ANCHOR BOLTS

3.3.1 Cast-In-Place

Floor or pad mounted equipment shall use cast-in-place anchor bolts, except as specified below. One nut shall be provided on each bolt. Anchor bolts shall conform to ASTM A 307. Anchor bolts shall have an embedded straight length equal to at least 12 times nominal diameter of the bolt. Anchor bolts that exceed the normal depth of equipment foundation piers or pads shall either extend into concrete floor or the foundation shall be increased in depth to accommodate bolt lengths.

3.3.2 Expansion or Chemically Bonded Anchors

Expansion or chemically bonded anchors shall not be used unless test data in accordance with ASTM E 488 has been provided to verify the adequacy of the specific anchor and application. Expansion or chemically bonded anchors shall not be used to resist pull-out in overhead and wall installations if the adhesive is manufactured with temperature sensitive epoxies and the location is accessible to a building fire. Expansion and chemically bonded anchors shall be installed in accordance with the manufacturer's recommendations. The allowable forces shall be adjusted for the spacing between anchor bolts and the distance between the anchor bolt and the nearest edge, as specified by the manufacturer.

3.4 SWAY BRACES FOR PIPING

Transverse sway bracing for steel and copper pipe shall be provided at intervals not to exceed those shown on the drawings. Transverse sway bracing for pipes of materials other than steel and copper shall be provided at intervals not to exceed the hanger spacing as specified in Section 15400 PLUMBING, GENERAL PURPOSE. Bracing shall consist of at least one vertical angle 2 x 2 x 16 gauge and one diagonal angle of the same size.

3.4.1 Longitudinal Sway Bracing

Longitudinal sway bracing shall be provided in accordance with Section 15070 SEISMIC CONTROL FOR MECHANICAL EQUIPMENT.

3.4.2 Anchor Rods, Angles, and Bars

Anchor rods, angles, and bars shall be bolted to either pipe clamps or pipe flanges at one end and cast-in-place concrete or masonry insert or clip

angles bolted to the steel structure on the other end. Rods shall be solid metal or pipe as specified below. Anchor rods, angles, and bars shall not exceed lengths given in the tabulation below.

3.4.3 Maximum Length for Anchor Braces

Type	Size (Inches)	Maximum Length* (Feet/Inches)
Angles	1-1/2 x 1-1/2 x 1/4	4-10
	2 x 2 x 1/4	6-6
	2-1/2 x 1-1/2 x 1/4	8-0
	3 x 2-1/2 x 1/4	8-10
	3 x 3 x 1/4	9-10
Rods	3/4	3-1
	7/8	3-8
Flat Bars	1-1/2 x 1/4	1-2
	2 x 1/4	1-2
	2 x 3/8	1-9
Pipes (40S)	1	7-0
	1-1/4	9-0
	1-1/2	10-4
	2	13-1

3.4.4 Bolts

Bolts used for attachment of anchors to pipe and structure shall be not less than 1/2 inch diameter.

3.5 EQUIPMENT SWAY BRACING

3.5.1 Suspended Equipment and Light Fixtures

Equipment sway bracing shall be provided for items supported from overhead floor or roof structural systems, including light fixtures. Braces shall consist of angles, rods, wire rope, bars, or pipes arranged as shown and secured at both ends with not less than 1/2 inch bolts. Details of equipment bracing shall be submitted for acceptance. In lieu of bracing with vertical supports, these items may be supported with hangers inclined at 45 degrees directed up and radially away from equipment and oriented symmetrically in 90-degree intervals on the horizontal plane, bisecting the angles of each corner of the equipment, provided that supporting members are properly sized to support operating weight of equipment when hangers are inclined at a 45-degree angle.

3.5.2 Floor or Pad Mounted Equipment

3.5.2.1 Shear Resistance

Floor mounted equipment shall be bolted to the floor. Requirements for the number and installation of bolts to resist shear forces shall be in accordance with paragraph ANCHOR BOLTS.

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DIVISION 13 - SPECIAL CONSTRUCTION

SECTION 13100

LIGHTNING PROTECTION SYSTEM

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SECTION 13100

LIGHTNING PROTECTION SYSTEM

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C135.30	(1988) Zinc-Coated Ferrous Ground Rods for Overhead or Underground Line Construction

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2002) National Electrical Code
NFPA 780	(2000) Installation of Lightning Protection Systems

UNDERWRITERS LABORATORIES (UL)

UL 96	(1994; Rev thru Dec 1996) Lightning Protection Components
UL 96A	(1994) Installation Requirements for Lightning Protection Systems
UL 467	(1993; Rev thru Feb 2001) Grounding and Bonding Equipment
UL Elec Const Dir	(2001) Electrical Construction Equipment Directory

1.2 GENERAL REQUIREMENTS

1.2.1 Verification of Dimensions

The Contractor shall become familiar with all details of the work, verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing the work. No departures shall be made without the prior approval of the Contracting Officer.

1.2.2 System Requirements

The system furnished under this specification shall consist of the standard products of a manufacturer regularly engaged in the production of lightning protection systems and shall be the manufacturer's latest UL approved design. The lightning protection system shall conform to NFPA 70 and NFPA 780, UL 96 and UL 96A, except where requirements in excess thereof are specified herein.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Installation Drawings; G-AE

Detail drawings consisting of a complete list of material, including manufacturer's descriptive and technical literature, catalog cuts, drawings, and installation instructions. Detail drawings shall demonstrate that the system has been coordinated and will function as a unit. Drawings shall show proposed layout and mounting and relationship to other parts of the work.

SD-07 Certificates

Materials; G-AO

Where material or equipment is specified to comply with requirements of UL, proof of such compliance. The label of or listing in UL Elec Const Dir will be acceptable evidence. In lieu of the label or listing, a written certificate from an approved nationally recognized testing organization equipped to perform such services, stating that the items have been tested and conform to the requirements and testing methods of Underwriters Laboratories may be submitted. A letter of findings shall be submitted certifying UL inspection of lightning protection systems provided on the following facilities: Pump House.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 General Requirements

No combination of materials shall be used that form an electrolytic couple of such nature that corrosion is accelerated in the presence of moisture unless moisture is permanently excluded from the junction of such metals. Where unusual conditions exist which would cause corrosion of conductors, conductors with protective coatings or oversize conductors shall be used. Where a mechanical hazard is involved, the conductor size shall be increased to compensate for the hazard or the conductors shall be protected by covering them with molding or tubing made of wood or nonmagnetic material. When metallic conduit or tubing is used, the conductor shall be electrically connected at the upper and lower ends.

2.1.2 Main and Secondary Conductors

Conductors shall be in accordance with NFPA 780 and UL 96 for Class I, Class II, or Class II modified materials as applicable.

2.1.2.1 Copper

Counterpoise shall be copper conductors not smaller than No. 1/0 AWG.

2.1.2.2 Aluminum

Aluminum shall not contact the earth nor shall it be used in any other manner that will contribute to rapid deterioration of the metal. Appropriate precautions shall be observed at connections with dissimilar metals. Aluminum conductors for bonding and interconnecting metallic bodies to the main cable shall be at least equivalent to strength and cross-sectional area of a No. 4 AWG aluminum wire. When perforated strips are provided, strips that are much wider than solid strips shall be. A strip width that is at least twice that of the diameter of the perforations shall be used. Aluminum strip for connecting exposed water pipes shall be not less than No. 12 AWG in thickness and at least 1-1/2 inches wide.

2.1.3 Air Terminals

Terminals shall be in accordance with UL 96 and NFPA 780. The tip of air terminals on buildings used for handling explosive ingredients shall be a minimum of 2 feet above the ridge parapet, ventilator or perimeter. On open or hooded vents emitting explosive dusts or vapors under natural or forced draft, air terminals shall be a minimum of 5 feet above the opening. Air terminals more than 24 inches in length shall be supported by a suitable brace, with guides not less than one-half the height of the terminal.

2.1.4 Ground Rods

Rods made of copper-clad steel shall conform to UL 467 and galvanized ferrous rods shall conform to ANSI C135.30. Ground rods shall be not less than 3/4 inch in diameter and 10 feet in length. Ground rods of copper-clad steel, stainless steel, galvanized ferrous, and solid copper shall not be mixed on the job.

2.1.5 Connectors

Clamp-type connectors for splicing conductors shall conform to UL 96, class as applicable, and, Class 2, style and size as required for the installation. Clamp-type connectors shall only be used for the connection of the roof conductor to the air terminal and to the guttering. All other connections, bonds, and splices shall be done by exothermic welds or by high compression fittings. The exothermic welds and high compression fittings shall be listed for the purpose. The high compression fittings shall be the type which require a hydraulically operated mechanism to apply a minimum of 10,000 psi.

2.1.6 Lightning Protection Components

Lightning protection components, such as bonding plates, air terminal supports, chimney bands, clips, and fasteners shall conform to UL 96, classes as applicable.

PART 3 EXECUTION

3.1 INTEGRAL SYSTEM

3.1.1 General Requirements

The lightning protection system shall consist of air terminals, roof conductors, down conductors, ground connections, and grounds, electrically interconnected to form the shortest distance to ground. All conductors on the structures shall be exposed except where conductors are in protective sleeves exposed on the outside walls. Secondary conductors shall interconnect with grounded metallic parts within the building. Interconnections made within side-flash distances shall be at or above the level of the grounded metallic parts.

3.1.1.1 Air Terminals

Air terminal design and support shall be in accordance with NFPA 780. Terminals shall be rigidly connected to, and made electrically continuous with, roof conductors by means of pressure connectors or crimped joints of T-shaped malleable metal and connected to the air terminal by a dowel or threaded fitting. Air terminals at the ends of the structure shall be set not more than 2 feet from the ends of the ridge or edges and corners of roofs. Spacing of air terminals 2 feet in height on ridges, parapets, and around the perimeter of buildings with flat roofs shall not exceed 25 feet. In specific instances where it is necessary to exceed this spacing, the specified height of air terminals shall be increased not less than 2 inches for each foot of increase over 25 feet. On large, flat or gently sloping roofs, as defined in NFPA 780, air terminals shall be placed at points of the intersection of imaginary lines dividing the surface into rectangles having sides not exceeding 50 feet in length. Air terminals shall be secured against overturning either by attachment to the object to be protected or by means of a substantial tripod or other braces permanently and rigidly attached to the building or structure. Metal projections and metal parts of buildings and other metal objects that do not contain hazardous materials and that may be struck but not appreciably damaged by lightning, need not be provided with air terminals. However, these metal objects shall be bonded to the lightning conductor through a metal conductor of the same unit weight per length as the main conductor. Where metal ventilators are installed, air terminals shall be mounted thereon, where practicable. Any air terminal erected by necessity adjacent to a metal ventilator shall be bonded to the ventilator near the top and bottom. Where metal ventilators are installed with air terminals mounted thereon, the air terminal shall not be more than 24 inches away from the farther edge or corner. If the air terminal is farther than this distance, an additional air terminal shall be added in order to meet this requirement. Where metal ventilators are installed with air terminals mounted adjacent, the air terminal shall not be more than 24 inches away from the farther edge or corner. If the air terminal is farther than this distance, an additional air terminal shall be added in order to meet this requirement.

3.1.1.2 Roof Conductors

Roof conductors shall be connected directly to the roof or ridge roll. Sharp bends or turns in conductors shall be avoided. Necessary turns shall have a radius of not less than 8 inches. Conductors shall preserve a downward or horizontal course and shall be rigidly fastened every 3 feet along the roof and down the building to ground. Metal ventilators shall be rigidly connected to the roof conductor at three places. All connections

shall be electrically continuous. Roof conductors shall be coursed along the contours of flat roofs, ridges, parapets, and edges; and where necessary, over flat surfaces, in such a way as to join each air terminal to all the rest. Roof conductors surrounding tank tops, decks, flat surfaces, and flat roofs shall be connected to form a closed loop.

3.1.1.3 Down Conductors

Down conductors shall be electrically continuous from air terminals and roof conductors to grounding electrodes. Down conductors shall be coursed over extreme outer portions of the building, such as corners, with consideration given to the location of ground connections and air terminals. Each building or structure shall have not less than two down conductors located as widely separated as practicable, at diagonally opposite corners. Additional down conductors shall be installed when necessary to avoid "dead ends" or branch conductors ending at air terminals, except where the air terminal is on a roof below the main protected level and the "dead end" or branch conductor is less than 16 feet in length and maintains a horizontal or downward coursing. Down conductors shall be equally and symmetrically spaced about the perimeter of the structure. Down conductors shall be protected by placing in pvc conduit for a minimum distance of above finished grade level. .

3.1.1.4 Interconnection of Metallic Parts

Metal doors, windows, and gutters shall be connected directly to the grounds or down conductors using not smaller than No. 6 copper conductor, or equivalent. Conductors placed where there is probability of unusual wear, mechanical injury, or corrosion shall be of greater electrical capacity than would normally be used, or shall be protected. The ground connection to metal doors and windows shall be by means of mechanical ties under pressure, or equivalent.

3.1.1.5 Ground Connections

Ground connections comprising continuations of down conductors from the structure to the grounding electrode shall securely connect the down conductor and ground in a manner to ensure electrical continuity between the two. All connections shall be of the clamp type. There shall be a ground connection for each down conductor. Metal water pipes and other large underground metallic objects shall be bonded together with all grounding mediums. Ground connections shall be protected from mechanical injury. In making ground connections, advantage shall be taken of all permanently moist places where practicable, although such places shall be avoided if the area is wet with waste water that contains chemical substances, especially those corrosive to metal.

3.1.1.6 Grounding Electrodes

A grounding electrode shall be provided for each down conductor located as shown. A driven ground shall extend into the earth for a distance of not less than 10 feet. Ground rods shall be set not less than 3 feet, nor more than 8 feet, from the structures foundation. The complete installation shall have a total resistance to ground of not more than 25 ohms if a counterpoise is not used. Ground rods shall be tested individually prior to connection to the system and the system as a whole shall be tested not less than 48 hours after rainfall. When the resistance of the complete installation exceeds the specified value or two ground rods individually exceed 25 ohms, the Contracting Officer shall be notified immediately. A

counterpoise, where required, shall be of No. 1/0 copper cable or equivalent material having suitable resistance to corrosion and shall be laid around the perimeter of the structure in a trench not less than 2 feet deep at a distance not less than 3 feet nor more than 8 feet from the nearest point of the structure. All connections between ground connectors and grounds or counterpoise, and between counterpoise and grounds shall be electrically continuous..

3.1.2 Metal Roofs

Wall-Bearing Masonry or Tile Structure with Metallic Roof and Nonmetallic Exterior Walls, or Reinforced Concrete Building with Metallic Roof: Metal roofs which are in the form of sections insulated from each other shall be made electrically continuous by bonding. Air terminals shall be connected to, and made electrically continuous with, the metal roof as well as the roof conductors and down conductors. Ridge cables and roof conductors shall be bonded to the roof at the upper and lower edges of the roof and at intervals not to exceed 100 feet. The down conductors shall be bonded to roof conductors and to the lower edge of the metal roof. Where the metal of the roof is in small sections, the air terminals and down conductors shall have connections made to at least four of the sections. All connections shall have electrical continuity and have a surface contact of at least 3 square inches.

3.2 INTERCONNECTION OF METAL BODIES

Metal bodies of conductance shall be protected if not within the zone of protection of an air terminal. Metal bodies of conductance having an area of 400 square inches or greater or a volume of 1000 cubic inches or greater shall be bonded to the lightning protection system using main size conductors and a bonding plate having a surface contact area of not less than 3 square inches.Provisions shall be made to guard against the corrosive effect of bonding dissimilar metals. Metal bodies of inductance shall be bonded at their closest point to the lightning protection system using secondary bonding conductors and fittings. A metal body that exceeds 5 feet in any dimension, that is situated wholly within a building, and that does not at any point come within 6 feet of a lightning conductor or metal connected thereto shall be independently grounded.

3.3 FENCES

Except as indicated below, metal fences that are electrically continuous with metal posts extending at least 2 feet into the ground require no additional grounding. Other fences shall be grounded on each side of every gate. Fences shall be grounded by means of ground rods every 1000 to 1500 feet of length when fences are located in isolated places, and every 500 to 750 feet when in proximity (100 feet or less) to public roads, highways, and buildings. The connection to ground shall be made from the post where it is of metal and is electrically continuous with the fencing. All metal fences shall be grounded at or near points crossed by overhead lines in excess of 600 volts and at distances not exceeding 150 feet on each side of line crossings.

3.4 INSPECTION

The lightning protection system will be inspected by the Contracting Officer to determine conformance with the requirements of this specification. No part of the system shall be concealed until so authorized by the Contracting Officer.

-- End of Section --

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SECTION 13110

CATHODIC PROTECTION SYSTEM (SACRIFICIAL ANODE)

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM B 418	(1995a) Cast and Wrought Galvanic Zinc Anodes
ASTM B 843	(1993; R 1998) Magnesium Alloy Anodes for Cathodic Protection
ASTM D 1248	(2000a) Polyethylene Plastics Extrusion Materials for Wire and Cable

NACE INTERNATIONAL (NACE)

NACE RP0169	(1996) Control of External Corrosion on Underground or Submerged Metallic Piping Systems
NACE RP0177	(1995) Mitigation of Alternating Current and Lightning Effects on Metallic Structures and Corrosion Control Systems
NACE RP0188	(1999) Discontinuity (Holiday) Testing of Protective Coatings
NACE RP0190	(1995) External Protective Coatings for Joints, Fittings, and Valves on Metallic Underground or Submerged Pipelines and Piping Systems
NACE RP0285	(1995) Corrosion Control of Underground Storage Tank Systems by Cathodic Protection

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA TC 2	(1998) Electrical Polyvinyl Chloride (PVC) Tubing (EPT) and Conduit (EPC-40 and EPC-80)
NEMA WC 5	(1992; Rev 2, 1996) Thermoplastic-Insulated Wire and Cable for

the Transmission and Distribution of Electrical Energy

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2002) National Electrical Code

UNDERWRITERS LABORATORIES (UL)

UL 6 (2000) Rigid Metal Conduit

UL 510 (1994; Rev thru Apr 1998) Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape

UL 514A (1996; Rev Dec 1999) Metallic Outlet Boxes

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Drawings; G-AO

Six copies of detail drawings consisting of a complete list of equipment and material including manufacturer's descriptive and technical literature, catalog cuts, results of system design calculations including soil-resistivity, installation instructions and certified test data stating the maximum recommended anode current output density and the rate of gaseous production if any at that current density. Detail drawings shall contain complete wiring and schematic diagrams and any other details required to demonstrate that the system has been coordinated and will function properly as a unit.

Contractor's Modifications; G-AO

Six copies of detail drawings showing proposed changes in location, scope of performance indicating any variations from, additions to, or clarifications of contract drawings. The drawings shall show proposed changes in anode arrangement, anode size and number, anode materials and layout details, conduit size, wire size, mounting details, wiring diagram, method for electrically-isolating each pipe, and any other pertinent information to proper installation and performance of the system.

SD-03 Product Data

Equipment; G-A0

Within 30 days after receipt of notice to proceed, an itemized list of equipment and materials including item number, quantity, and manufacturer of each item. The list shall be accompanied by a description of procedures for each type of testing and

adjustments, including testing of coating for thickness and holidays. Installation of materials and equipment shall not commence until this submittal is approved.

Spare Parts;

Spare parts data for each different item of material and equipment specified, after approval of detail drawings and not later than six (6) months prior to the date of beneficial occupancy. The data shall include a complete list of parts, special tools, and supplies, with current unit prices and source of supply. One (1) spare anode of each type shall be furnished.

SD-06 Test Reports

Tests and Measurements; G-AO

Test reports in booklet form tabulating all field tests and measurements performed, upon completion and testing of the installed system and including close interval potential survey, casing and interference tests, final system test verifying protection, insulated joint and bond tests, and holiday coating test. A certified test report showing that the connecting method has passed a 120-day laboratory test without failure at the place of connection, wherein the anode is subjected to maximum recommended current output while immersed in a three percent sodium chloride solution.

Contractor's Modifications; G-AO

Final report regarding Contractor's modifications. The report shall include pipe-to-soil measurements throughout the affected area, indicating that the modifications improved the overall conditions, and current measurements for anodes. The following special materials and information are required: taping materials and conductors; zinc grounding cell, installation and testing procedures, and equipment; coating material; system design calculations for anode number, life, and parameters to achieve protective potential; backfill shield material and installation details showing waterproofing; bonding and waterproofing details; insulated resistance wire; exothermic weld equipment and material.

SD-07 Certificates

Cathodic Protection System; G-AO

Proof that the materials and equipment furnished under this section conform to the specified requirements contained in the referenced standards or publications. The label or listing by the specified agency will be acceptable evidence of such compliance.

Services of "Corrosion Expert"; G-AO

Evidence of qualifications of the "corrosion expert."

a. The "corrosion expert's" name and qualifications shall be certified in writing to the Contracting Officer prior to the start of construction.

b. Certification shall be submitted giving the name of the firm, the number of years of experience, and a list of not less than five (5) of the firm's installations three (3) or more years old that have been tested and found satisfactory.

SD-10 Operation and Maintenance Data

Cathodic Protection System;

Before final acceptance of the cathodic protection system, six copies of operating manuals outlining the step-by-step procedures required for system startup, operation, adjustment of current flow, and shutdown. The manuals shall include the manufacturer's name, model number, service manual, parts list, and brief description of all equipment and their basic operating features. Six copies of maintenance manual, listing routine maintenance procedures, recommendation for maintenance testing, possible breakdowns and repairs, and troubleshooting guides. The manuals shall include single-line diagrams for the system as installed; instructions in making pipe-to-reference cell and tank-to-reference cell potential measurements and frequency of monitoring; instructions for dielectric connections, interference and sacrificial anode bonds; instructions shall include precautions to ensure safe conditions during repair of pipe or other metallic systems. The instructions shall be neatly bound between permanent covers and titled "Operating and Maintenance Instructions." These instructions shall be submitted for the Contracting Officer's approval. The instructions shall include the following:

a. As-built drawings, to scale of the entire system, showing the locations of the piping, location of all anodes and test stations, locations of all insulating joints, and structure-to-reference cell potentials as measured during the tests required by Paragraph: TESTS AND MEASUREMENTS, of this section.

b. Recommendations for maintenance testing, including instructions in making pipe-to-reference cell potential measurements and frequency of testing.

c. All maintenance and operating instructions and nameplate data shall be in English.

d. Instructions shall include precautions to insure safe conditions during repair of pipe system.

Training Course;

The proposed Training Course Curriculum (including topics and dates of discussion) indicating that all of the items contained in the operating and maintenance instructions, as well as demonstrations of routine maintenance operations, including testing procedures included in the maintenance instructions, are to be covered.

1.3 GENERAL REQUIREMENTS

The Contractor shall furnish and install a complete, operating, sacrificial

anode cathodic protection system in complete compliance with NFPA 70, with all applicable Federal, State, and local regulations and with minimum requirements of this contract. The services required include planning, installation, adjusting and testing of a cathodic protection system, using sacrificial anodes for cathodic protection of the Hydrant fuel lines, their connectors and lines under the slab or floor foundation. The cathodic protection system shall include anodes, cables, connectors, corrosion protection test stations, and any other equipment required for a complete operating system providing the NACE criteria of protection as specified. Insulators are required whenever needed to insulate the pipes from any other structure. Any pipe crossing the hydrant fuel pipe shall have a test station. The cathodic protection shall be provided on Hydrant fuel pipes. In addition, cathodic protection systems shall be provided on the above ground storage tanks (AST) and the underground storage tanks (UST).

1.3.1 Services of "Corrosion Expert"

The Contractor shall obtain the services of a "corrosion expert" to supervise, inspect, and test the installation and performance of the cathodic protection system. "Corrosion expert" refers to a person, who by thorough knowledge of the physical sciences and the principles of engineering and mathematics, acquired by professional education and related practical experience, is qualified to engage in the practice of corrosion control of buried or submerged metallic surfaces. Such a person must be accredited or certified by the National Association of Corrosion Engineers (NACE) as a NACE Accredited Corrosion Specialist or a NACE certified Cathodic Protection (CP) Specialist or be a registered professional engineer who has certification or licensing that includes education and experience in corrosion control of buried or submerged metallic piping and tank systems, if such certification or licensing includes 5 years experience in corrosion control on underground metallic surfaces of the type under this contract. The "corrosion expert" shall make at least 3 visits to the project site. The first of these visits shall include obtaining soil resistivity data, acknowledging the type of pipeline coatings to be used and reporting to the Contractor the type of cathodic protection required. Once the submittals are approved and the materials delivered, the "corrosion expert" shall revisit the site the ensure the Contractor understands installation practices and laying out the components. The third visit shall involve testing the installed cathodic protection systems and training applicable personnel on proper maintenance techniques. The "corrosion expert" shall supervise installation and testing of all cathodic protection.

1.3.2 Contractor's Modifications

The specified system is based on a complete system with magnesium sacrificial anodes. The Contractor may modify the cathodic protection system after review of the project, site verification, and analysis, if the proposed modifications include the anodes specified and will provide better overall system performance. The modifications shall be fully described, shall be approved by the Contracting Officer's representative, and shall meet the following criteria. The proposed system shall achieve a minimum pipe-to-soil "instant off" potential of minus 850 millivolts with reference to a saturated copper-copper sulfate reference cell on the underground components of the piping or other metallic surface. The Contractor shall take resistivity measurements of the soil in the vicinity of the pipes and ground bed sites. Based upon the measurements taken, the current and voltage shall be required to produce a minimum of minus 850 millivolts "instant off" potential between the structure being tested and the

reference cell. This potential shall be obtained over 95 percent of the metallic area. The anode system shall be designed for a life of twenty-five (25) years of continuous operation.

1.3.3 Anode and Bond Wires

For each cathodic system, the metallic components and structures to be protected shall be made electrically continuous. This shall be accomplished by installing bond wires between the various structures. Bonding of existing buried structures may also be required to preclude detrimental stray current effects and safety hazards. Provisions shall be included to return stray current to its source without damaging structures intercepting the stray current. The electrical isolation of underground facilities in accordance with acceptable industry practice shall be included under this section. All tests shall be witnessed by the Contracting Officer.

1.3.4 Surge Protection

Lightning arrestors are not required for insulated flanges on metallic components used on nonmetallic piping systems. Lightning arrestors are to be provided on the hydrant fuel lines per 15060 where the type is specified..

1.3.5 Summary of Services Required

The scope of services shall include, but shall not be limited to, the following:

a. Close-interval potential surveys.

b. Cathodic Protection Systems.

c. System testing.

d. Not Used.

e. Interference testing.

f. Training.

g. Operating and maintenance manual.

h. Insulator testing and bonding testing.

i. Coating and holiday testing shall be submitted within 45 days of notice to proceed.

1.3.6 Nonmetallic Pipe System

In the event pipe other than metallic pipe is approved and used in lieu of metallic pipe, all metallic components of this pipe system shall be protected with cathodic protection. Detailed drawings of cathodic protection for each component shall be submitted to the Contracting Officer for approval within 45 days after date of receipt of notice to proceed, and before commencement of any work.

1.3.6.1 Coatings

Coatings for metallic components shall be as required for metallic fittings. Protective covering (coating and taping) shall be completed and tested on each metallic component (such as valves, hydrants and fillings). This covering shall be as required for underground metallic pipe. Each test shall be witnessed by the Contracting Officer. Coatings shall be selected, applied, and inspected in accordance with NACE RP0190 and as specified in these specifications. The use of nonmetallic pipe does not change other requirements of the specifications. Any deviations due to the use of nonmetallic pipe shall be submitted for approval.

1.3.6.2 Tracer Wire

When a nonmetallic pipe line is used to extend or add to an existing metallic line, an insulated No. 8 AWG copper wire shall be thermit-welded to the existing metallic line and run the length of the new nonmetallic line. This wire shall be used as a locator tracer wire and to maintain continuity to any future extensions of the pipe line.

1.3.7 Drawings

Detailed drawings shall be provided showing location of anodes, insulated fittings, test stations, permanent reference cells, and bonding. Locations shall be referenced to two (2) permanent facilities or mark points.

1.3.8 Electrical Potential Measurements

All potential tests shall be made at a minimum of 10 foot intervals witnessed by the Contracting Officer. Submittals shall identify test locations on separate drawing, showing all metal to be protected and all cathodic protection equipment. Test points equipment and protected metal shall be easily distinguished and identified.

1.3.9 Achievement of Criteria for Protection

All conductors, unless otherwise shown, shall be routed to or through the test stations. Each system provided shall achieve a minimum pipe-to-soil "instant off" potential of minus 850 millivolt potentials with reference to a saturated copper-copper-sulfate reference cell on all underground components of the piping. Based upon the measurements taken, the current and voltage of the anodes should be adjusted as required to produce a minimum of minus 850 millivolts "instant off" potential between the structure being tested and the reference cell. This potential should be obtained over 95 percent of the metallic area. This must be achieved without the "instant off" potential exceeding 1150 millivolts. Testing will be witnessed by the Contracting Officer. Additional anodes shall be provided by the Contractor if required to achieve the minus 850 millivolts "instant off". Although acceptance criteria of the cathodic protection systems are defined in NACE RP0169, for this project the "instant off" potential of minus 850 millivolts is the only acceptable criteria.

PART 2 PRODUCTS

2.1 MAGNESIUM ANODES

A minimum of 4 seventeen pound anodes shall be installed on any underground storage tank. The product recovery tank shall have a minimum of 6 seventeen pound anodes. See Paragraph METALLIC COMPONENTS AND TYPICALS for

additional anodes under slab. See drawings for number and type of anodes on hydrant fuel pipeline.

2.1.1 Anode Composition

Anodes shall be of high-potential magnesium alloy, made of primary magnesium obtained from sea water or brine, and not made from scrap metal. Magnesium anodes shall conform to ASTM B 843 and to the following analysis (in percents) otherwise indicated:

Aluminum, max.	0.010
Manganese, max.	0.50 to 1.30
Zinc	0.05
Silicon, max.	0.05
Copper, max.	0.02
Nickel, max.	0.001
Iron, Max.	0.03
Other impurities, max.	0.05 each or 0.3 max. total
Magnesium	Remainder

The Contractor shall furnish spectrographic analysis on samples from each heat or batch of anodes used on this project.

2.1.2 Dimensions and Weights

Dimensions and weights of anodes shall be approximately as follows:

TYPICAL MAGNESIUM ANODE SIZE

(Cross sections may be round, square, or D shaped)

NOMINAL WT. LBS.	APPROX. SIZE (IN)	NOMINAL GROSS WT lb PACKAGED IN BACKFILL	NOMINAL PACKAGE DIMENSIONS (IN)
3	3 X 3 X 5	8	5-1/4 X 5-1/4 X 8
5	3 X 3 X 8	13	5-1/4 X 5-1/4 X 11-1/4
9	3 X 3 X 14	27	5-1/4 X 20
12	4 X 4 X 12	32	7-1/2 X 18
17	4 X 4 X 17	45	7-1/2 X 24
32	5 X 5 X 20-1/2	68	8-1/2 X 28
50	7 X 7 X 16	100	10 X 24

2.1.3 Packaged Anodes

Anodes shall be provided in packaged form with the anode surrounded by specially-prepared quick-wetting backfill and contained in a water permeable cloth or paper sack. Anodes shall be centered by means of spacers in the backfill material. The backfill material shall have the following composition, unless otherwise indicated:

Material	Approximate Percent by Weight
Gypsum	75
Bentonite	20
Sodium Sulphate	5
Total	100

2.1.4 Ribbon Anodes

Extruded magnesium ribbon anodes shall be used on the pipelines and the above ground storage tank. The ribbon anodes shall be 3/8" x 3/8" minimum in size. The ribbon anodes shall have a solid steel core that runs lengthwise through the center of the anode.

2.1.5 Zinc Anodes

Zinc anodes shall conform to ASTM B 418, Type II.

2.1.6 Connecting Wire

2.1.6.1 Wire Requirements

Wire shall be No. 12 AWG solid copper wire minimum, not less than 10 feet long, unspliced, complying with NFPA 70, Type TW or RHH insulation. Connecting wires for magnesium anodes shall be factory installed with the place or emergence from the anode in a cavity sealed flush with a dielectric sealing compound.

2.1.6.2 Anode Header Cable

Cable for anode header and distribution shall be stranded copper wire with type CP high molecular weight polyethylene, 7/64 inch thick insulation, 600-volt rating, in accordance with NEMA WC 5. The minimum size shall be 12 AWG, if not indicated on the drawings.

2.2 MISCELLANEOUS MATERIALS

2.2.1 Electrical Wire

Wire shall be No. 12 AWG stranded copper wire with NFPA 70, Type TW, RHW-USE or Polyethylene insulation. Polyethylene insulation shall comply with the requirements of ASTM D 1248 and shall be of the following types, classes, and grades:

High-molecular weight polyethylene shall be Type I, Class C, Grade E5.

High-density polyethylene shall be Type III, Class C, Grade E3.

2.2.1.1 Wire Splicing

Connecting wire splicing shall be made with copper compression connectors or exothermic welds, following instructions of the manufacturer. Single split-bolt connections shall not be used. Sheaths for encapsulating electrical wire splices to be buried underground shall fit the insulated wires entering the spliced joints and epoxy potting compound shall be as specified below. The splicing method shall be suitable for the environment. Epoxy potting shall be suitable down to . If this is not available other methods such as heat shrink would be considered acceptable.

2.2.1.2 Test Wires

Test wires shall be AWG No. 12 stranded copper wire with NFPA 70, Type TW or RHW or polyethylene insulation.

2.2.2 Conduit

Rigid galvanized steel conduit and accessories shall conform to UL 6. Non metallic conduit shall conform to NEMA TC 2.

2.2.3 Test Boxes and Junctions Boxes

Boxes shall be outdoor type conforming to UL 514A.

2.2.4 Joint, Patch, Seal, and Repair Coating

Sealing and dielectric compound shall be a black, rubber based compound that is soft, permanently pliable, tacky, moldable, and unbacked. Compound shall be applied as recommended by the manufacturer, but not less than 1/2-inch thick. Coating compound shall be cold-applied coal-tar base mastic . Pressure-sensitive vinyl plastic electrical tape shall conform to UL 510.

2.2.5 Backfill Shields

Shields shall consist of approved pipeline wrapping or fiberglass-reinforced, coal-tar impregnated tape, or plastic weld caps, specifically made for the purpose and installed in accordance with the manufacturer's recommendations. When joint bonds are required, due to the use of mechanical joints, the entire joint shall be protected by the use of a kraft paper joint cover. The joint cover shall be filled with poured-in, hot coat-tar enamel.

2.2.6 Epoxy Potting Compound

Compound for encapsulating electrical wire splices to be buried underground shall be a two package system made for the purpose.

2.2.7 Test Stations

Stations shall be of the aboveground or flush-curb-box type as indicated on the drawings and shall be the standard product of a recognized manufacturer. Test stations shall be complete with an insulated terminal block having the required number of terminals. The test station shall be provided with a lockable over and shall have an embossed legend, "C.P. Test." A minimum of one (1) test station shall be provided each component of the nonmetallic pipe and shall be provided every 200 feet on metallic lines (not the hydrant fuel lines) and shall be located on the hydrant fuel lines as shown and specified. A minimum of four (4) terminals shall be provided in each test station. A minimum of two (2) leads are required to the metallic pipe from each test station. Other conductors shall be provided for each anode, other foreign pipe, and reference cells as required. Test stations may be constructed of nonmetallic materials for the above ground test stations only. However, if nonmetallic materials are utilized, as a minimum, the materials shall be resistant to damage from ultraviolet radiation, contain good color retention qualities, contain high strength qualities, and be resistant to accidental or vandalistic impacts that might be normally encountered in the environment for which they are to be installed. The test stations shall be listed for the particular application for which they are to be utilized.

2.2.8 Joint and Continuity Bonds

Bonds shall be provided across all joints in the metallic water, waste

drain and force main lines, across any electrically discontinuous connections and all other pipes and structures with other than welded or threaded joints that are included in this cathodic protection system. Unless otherwise specified in the specifications or shown on the drawings, bonds between structures and across joints in pipe with other than welded or threaded joints shall be No. 8 AWG stranded copper cable with polyethylene insulation. Bonds between structures shall contain sufficient slack for any anticipated movement between structures. Bonds across pipe joints shall contain a minimum of 4 inches of slack to allow for pipe movement and soil stress. Bonds shall be attached by exothermic welding. Exothermic weld areas shall be insulated with coating compound and approved, and witnessed by the Contracting Officer. Continuity bonds shall be installed as necessary to reduce stray current interference. Additional joint bondings shall be accomplished by the Contractor where the necessity is discovered during construction or testing or where the Contracting Officer's representative directs that such bonding be done. Joint bonding shall include all associated excavation and backfilling. There shall be a minimum of two (2) continuity bonds between each structure and other than welded or threaded joints. The Contractor shall test for electrical continuity across all joints with other than welded or threaded joints and across all metallic portions or components. The Contractor shall provide bonding as required and as specified above until electrical continuity is achieved. Bonding test data shall be submitted for approval.

2.2.9 Resistance Bonds

Resistance bonds should be adjusted as outlined in this specification. Alternate methods may be used if they are approved by the Contracting Officer.

2.2.10 Stray Current Measurements

Stray current measurements should be performed at each test station. Stray currents resulting from lightning or overhead alternating current (AC) power transmission systems shall be mitigated in accordance with NACE RP0177.

2.2.11 Electrical Isolation of Structures

As a minimum, isolating flanges or unions shall be provided at the following locations:

a. Connection of new metallic piping or components to existing piping.

b. Pressure piping under floor slab to a building.

Isolation shall be provided at metallic connection of all lines to existing system and where connecting to a building. Additionally, isolation shall be provided between water and/or gas line; and foreign pipes that cross the new lines within 10 feet. Isolation fittings, including isolating flanges and couplings, shall be installed aboveground or in a concrete pit.

2.2.11.1 Electrically Isolating Pipe Joints

Electrically isolating pipe joints shall be of a type that is in regular factory production.

2.2.11.2 Electrically Conductive Couplings

Electrically conductive couplings shall be of a type that has a published maximum electrical resistance rating given in the manufacturer's literature. Cradles and seals shall be of a type that is in regular factory production made for the purpose of electrically insulating the carrier pipe from the casing and preventing the incursion of water into the annular space.

2.2.11.3 Insulating Joint Testing

A Model 601 Insulation Checker, as manufactured by "Gas Electronics", , or an approved equal, shall be used for insulating joint (flange) electrical testing.

2.2.12 Underground Structure Coating

This coating specification shall take precedence over any other project specification and drawing notes, whether stated or implied, and shall also apply to the pipeline or tank supplier. No variance in coating quality shall be allowed by the Contractor or Base Construction Representative without the written consent of the designer. All underground metallic pipelines and tanks to be cathodically protected shall be afforded a good quality factory-applied coating. This includes all carbon steel, cast-iron and ductile-iron pipelines or vessels. Coatings shall be selected, applied, and inspected in accordance with NACE RP0190 and as specified. The hydrant fuel piping coating shall be as covered in Section 15060. If non-metallic pipelines are installed, all metallic fittings on pipe sections shall be coated in accordance with this specification section.

a. The nominal thickness of the metallic pipe joint or other component coating shall be 24 mils, plus or minus 5 percent.

b. Pipe and joint coating for factory applied or field repair material shall be applied as recommended by the manufacturer and shall be one of the following:

(1) Continuously extruded polyethylene and adhesive coating system.
(2) Polyvinyl chloride pressure-sensitive adhesive tape (field patching only).
(3) High density polyethylene/bituminous rubber compound tape (field patching only).
(4) Butyl rubber tape.
(5) Coal tar epoxy.

2.2.12.1 Field Joints

All field joints shall be coated with materials compatible with the pipeline coating compound. The joint coating material shall be applied to an equal thickness as the pipeline coating. Unbonded coatings shall not be used on these buried metallic components. This includes the elimination of all unbonded polymer wraps or tubes. Once the pipeline or vessel is set in the trench, an inspection of the coating shall be conducted. This inspection shall include electrical holiday detection. Any damaged areas of the coating shall be properly repaired. The Contracting Officer shall be asked to witness inspection of the coating and testing using a holiday detector.

2.2.12.2 Inspection of Pipe Coatings

Any damage to the protective covering during transit and handling shall be repaired before installation. After field coating and wrapping has been applied, the entire pipe shall be inspected by an electric holiday detector with impressed current in accordance with NACE RP0188 using a full-ring, spring-type coil electrode. The holiday detector shall be equipped with a bell, buzzer, or other type of audible signal which sounds when a holiday is detected. All holidays in the protective covering shall be repaired immediately upon detection. Occasional checks of holiday detector potential will be made by the Contracting Officer's representative to determine suitability of the detector. All labor, materials, and equipment necessary for conducting the inspection shall be furnished by the Contractor.

a. Protective covering for aboveground piping system: Finish painting shall conform to the applicable paragraph of SECTION: 09900, PAINTS AND COATINGS, and as follows:

b. Ferrous surfaces: Shop-primed surfaces shall be touched-up with ferrous metal primer. Surfaces that have not been shop-primed shall be solvent-cleaned. Surfaces that contain loose rust, loose mil scale, and other foreign substances shall be mechanically-cleaned by power wire-brushing and primed with ferrous metal primer. Primed surface shall be finished with two (2) coats of exterior oil paint and vinyl paint. Coating for each entire piping service shall be an approved pipe line wrapping having a minimum coating resistance of 50,000 Ohms per square foot.

2.2.13 Resistance Wire

Wire shall be No. 16 or No. 22 nickel-chromium wire with TW insulation.

2.2.14 Electrical Connections

Electrical connections shall be done as follows:

a. Exothermic welds shall be "Cadweld"," Bundy", "Thermoweld" or an approved equal. Use of this material shall be in strict accordance with the manufacturer's recommendations.

b. Electrical-shielded arc welds shall be approved for use on steel pipe by shop drawing submittal action.

2.2.15 Electrical Tape

Pressure-sensitive vinyl plastic electrical tape shall conform to UL 510.

2.2.16 Permanent Reference Electrodes

Permanent reference electrodes shall be Cu-CuS04 electrodes suitable for direct burial. Electrodes shall be guaranteed by the supplier for 15 years' service in the environment in which they shall be placed. Electrodes shall be installed directly beneath pipe, or metallic component.

2.2.17 Casing

Where a pipeline is installed in a casing under a roadway or railway, the pipeline shall be electrically insulated from the casing, and the annular space sealed and filled with an approved corrosion inhibiting product

against incursion of water.

PART 3 EXECUTION

3.1 CRITERIA OF PROTECTION

Acceptance criteria for determining the adequacy of protection on a buried underground pipe, tank, metallic component shall be in accordance with NACE RP0169 and NACE RP0285 and as specified below.

3.1.1 Iron and Steel

The following method (a) shall be used for testing cathodic protection voltages. If more than one method is required, method (b) shall be used.

a. A negative voltage of at least minus 850 millivolts as measured between the underground component and a saturated copper-copper sulphate reference electrode connecting the earth (electrolyte) directly over the underground component. Determination of this voltage shall be made with the cathodic protection system in operation. Voltage drops shall be considered for valid interpretation of this voltage measurement. A minimum of minus 850 millivolts "instant off" potential between the underground component being tested and the reference cell shall be achieved over 95 percent of the area of the structure. Adequate number of measurements shall be obtained over the entire structure, pipe, tank, or other metallic component to verify and record achievement of minus 850 millivolts "instant off." This potential shall be obtained over 95 percent of the total metallic area without the "instant off" potential exceeding 1200 millivolts.

b. A minimum polarization voltage shift of 100 millivolts as measured between the underground component and a saturated copper-copper sulphate reference electrode contacting the earth directly over the underground component. This polarization voltage shift shall be determined by interrupting the protective current and measuring the polarization decay. When the protective current is interrupted, an immediate voltage shift will occur. The voltage reading, after the immediate shift, shall be used as the base reading from which to measure polarization decay. Measurements achieving 100 millivolts decay shall be made over 95 percent of the metallic surface being protected.

c. For any metallic component, a minimum of four (4) measurements shall be made using subparagraph (a), above, and achieving the "instant off" potential of minus 850 millivolts. Two (2) measurements shall be made over the anodes and two (2) measurements shall be made at different locations near the component and farthest away from the anode.

3.2 ANODE STORAGE AND INSTALLATION

3.2.1 Anode Storage

Storage area for magnesium anodes will be designated by the Contracting Officer. If anodes are not stored in a building, tarps or similar protection should be used to protect anodes from inclement weather. Packaged anodes, damaged as a result of improper handling or being exposed to rain, shall be resacked by the Contractor and the required backfill added.

3.2.2 Anode Installation

Unless otherwise authorized, installation shall not proceed without the presence of the Contracting Officer. Anodes of the size specified shall be installed to the depth indicated and at the locations shown. Locations may be changed to clear obstructions with the approval of the Contracting Officer. Anodes shall be installed in sufficient number and of the required type, size, and spacing to obtain a uniform current distribution over the surface of the structure. The anode system shall e designed for a life of 25 years of continuous operation. Anodes shall be installed as indicated in a dry condition after any plastic or waterproof protective covering has been completely removed from the water permeable, permanent container housing the anode metal. The anode connecting wire shall not be used for lowering the anode into the hole. The annular space around the anode shall be backfilled with fine earth in 6 inch layers and each layer shall be hand tamped. Care must be exercised not to strike the anode or connecting wire with the tamper. Approximately 5 gallonsof water shall be applied to each filled hole after anode backfilling and tamping has been completed to a point about 6inches above the anode. After the water has been absorbed by the earth, backfilling shall be completed to the ground surface level.

3.2.2.1 Single Anodes

Single anodes, spaced as shown, shall be connected through a test station to the pipeline, allowing adequate slack in the connecting wire to compensate for movement during backfill operation.

3.2.2.2 Groups of Anodes

Groups of anodes, in quantity and location shown, shall be connected to an anode header cable. The anode header cable shall make contact with the structure to be protected only through a test station. Anode lead connection to the anode header cable shall be made by an approved crimp connector or exothermic weld and splice mold kit with appropriate potting compound.

3.2.2.3 Welding Methods

Connections to ferrous pipe and metal tanks shall be made by exothermic weld methods manufactured for the type of pipe and tank supplied. Electric arc welded connections and other types of welded connections to ferrous pipe and structures shall be approved before use.

3.2.3 Anode Placement - General

Packaged anodes shall be installed completely dry, and shall be lowered into holes by rope sling or by grasping the cloth gather. The anode lead wire shall not be used in lowering the anodes. The hole shall be backfilled with fine soil in 6inch layers and each layer shall be hand-tamped around the anode. Care must be exercised not to strike the anode or lead wire with the tamper. If immediate testing is to be performed, water shall be added only after backfilling and tamping has been completed to a point 6 inches above the anode. Approximately 2 gallons of water may be poured into the hole. After the water has been absorbed by the soil, backfilling and tamping may be completed to the top of the hole. Anodes shall be installed as specified or shown. In the event a rock strata is encountered prior to achieving specified augered-hole depth, anodes may be installed horizontally to a depth at least as deep as the bottom of the pipe, with

the approval of the Contracting Officer.

3.2.4 Underground Pipeline

Anodes shall be installed at a minimum of 8 feet and a maximum of 10 feet from the line to be protected.

3.2.5 Installation Details

Details shall conform to the requirements of this specification. Details shown on the drawings are indicative of the general type of material required, and are not intended to restrict selection to material of any particular manufacturer.

3.2.6 Lead Wire Connections

3.2.6.1 Underground Pipeline (Metallic)

To facilitate periodic electrical measurements during the life of the sacrificial anode system and to reduce the output current of the anodes, if required, all anode lead wires shall be connected to a test station and buried a minimum of 24 inches in depth. The cable shall be No. 12 AWG, stranded copper, polyethylene or RHW-USE insulated cable. The cable shall make contact with the structure only through a test station. Resistance wire shall be installed between the cable and the pipe cable, in the test station, to reduce the current output, if required. Anode connections, except in the test station, shall be made with exothermic welding process, and shall be insulated by means of at least three (3) layers of electrical tape; and all lead wire connections shall be installed in a moistureproof splice mold kit and filled with epoxy resin. Lead wire-to-structure connections shall be accomplished by an exothermic welding process. All welds shall be in accordance with the manufacturer's recommendations. A backfill shield filled with a pipeline mastic sealant or material compatible with the coating shall be placed over the weld connection and shall be of such diameter as to cover the exposed metal adequately.

3.2.6.2 Resistance Wire Splices

Resistance wire connections shall be accomplished with silver solder and the solder joints wrapped with a minimum of three (3) layers of pressure-sensitive tape. Lead wire connections shall be installed in a moistureproof splice mold kit and filled with epoxy resin.

3.2.7 Location of Test Stations

Test stations shall be of the type and location shown and shall be curb box mounted. Buried insulating joints shall be provided with test wire connections brought to a test station. Unless otherwise shown, other test stations shall be located as follows:

a. At 1,000-foot intervals or less.

b. Where the pipe or conduit crosses any other metal pipe.

c. At both ends of casings under roadways and railways.

d. Where both sides of an insulating joint are not accessible above ground for testing purposes.

3.2.8 Underground Pipe Joint Bonds

Underground pipe having other than welded or threaded coupling joints shall be made electrically continuous by means of a bonding connection installed across the joint.

3.3 ELECTRICAL ISOLATION OF STRUCTURES

3.3.1 Isolation Joints and Fittings

Isolating fittings, including main line isolating flanges and couplings, shall be installed aboveground, or within manholes, wherever possible. Where isolating joints must be covered with soil, they shall be fitted with a paper joint cover specifically manufactured for covering the particular joint, and the space within the cover filled with hot coal-tar enamel. Isolating fittings in lines entering buildings shall be located at least 12 inches above grade of floor level, when possible. Isolating joints shall be provided with grounding cells to protect against over-voltage surges or approved surge protection devices. The cells shall provide a low resistance across isolating joint without excessive loss of cathodic current.

3.3.2 Gas Distribution Piping

Electrical isolation shall be provided at each building riser pipe to the pressure regulator, at all points where a short to another structure or to a foreign structure may occur, and at other locations as indicated on the drawings.

3.4 TRENCHING AND BACKFILLING

Trenching and backfilling shall be in accordance with Section 02314 EARTHWORK FOR UTILITIES.

3.5 TESTS AND MEASUREMENTS

3.5.1 Baseline Potentials

Each test and measurement will be witnessed by the Contracting Officer. The Contractor shall notify the Contracting Officer a minimum of five (5) working days prior to each test. After backfill of the pipe or tank , the static potential-to-soil of the pipe or tank shall be measured. The locations of these measurements shall be identical to the locations specified for pipe- or tank-to-reference electrode potential measurements. The initial measurements shall be recorded.

3.5.2 Isolation Testing

Before the anode system is connected to the pipe or tank, an isolation test shall be made at each isolating joint or fitting. This test shall demonstrate that no metallic contact, or short circuit exists between the two isolated sections of the pipe or tank. Any isolating fittings installed and found to be defective shall be reported to the Contracting Officer.

3.5.2.1 Insulation Checker

A Model 601 insulation checker, as manufactured by "Gas Electronics", or an approved equal, using the continuity check circuit, shall be used for

isolating joint (flange) electrical testing. Testing shall conform to the manufacturer's operating instructions. Test shall be witnessed by the Contracting Officer. An isolating joint that is good will read full scale on the meter. If an isolating joint is shorted, the meter pointer will be deflected or near zero on the meter scale. Location of the fault shall be determined from the instructions, and the joint shall be repaired. If an isolating joint is located inside a vault, the pipe shall be sleeved with insulator when entering and leaving the vault.

3.5.2.2 Cathodic Protection Meter

A Model B3A2 cathodic protection meter, as manufactured by "M.C. Miller", or an approved equal, using the continuity check circuit, shall be used for isolating joint (flange) electrical testing. This test shall be performed in addition to the Model 601 insulation checker. Continuity is checked across the isolation joint after the test lead wire is shorted together and the meter adjusted to scale. A full-scale deflection indicates the system is shorted at some location. The Model 601 verifies that the particular insulation under test is good and the Model B3A2 verifies that the system is isolated. If the system is shorted, further testing shall be performed to isolate the location of the short.

3.5.3 Anode Output

As the anodes or groups of anodes are connected to the pipe or tank, current output shall be measured with an approved clamp-on milliammeter, calibrated shunt with a suitable millivoltmeter or multimeter, or a low resistance ammeter. (Of the three methods, the low-resistance ammeter is the least desirable and most inaccurate. The clamp-on milliammeter is the most accurate.) The valves obtained and the date, time, and location shall be recorded.

3.5.4 Reference Electrode Potential Measurements

Upon completion of the installation and with the entire cathodic protection system in operation, electrode potential measurements shall be made using a copper-copper sulphate reference electrode and a potentiometer-voltmeter, or a direct-current voltmeter having an internal resistance (sensitivity) of not less than 10 megohms per volt and a full scale of 10 volts. The locations of these measurements shall be identical to the locations used for baseline potentials. The values obtained and the date, time, and locations of measurements shall be recorded. No less than eight (8) measurements shall be made over any length of line or component. Additional measurements shall be made at each distribution service riser, with the reference electrode placed directly over the service line.

3.5.5 Location of Measurements

3.5.5.1 Piping or Conduit

For coated piping or conduit, measurements shall be taken from the reference electrode located in contact with the earth, directly over the pipe. Connection to the pipe shall be made at service risers, valves, test leads, or by other means suitable for test purposes. Pipe-to-soil potential measurements shall be made at intervals not exceeding 10 feet. The Contractor may use a continuous pipe-to-soil potential profile in lieu of 5 foot interval pipe-to-soil potential measurements. Additional measurements shall be made at each distribution service riser, with the reference electrode placed directly over the service line adjacent to the

riser. Potentials shall be plotted versus distance to an approved scale. Locations where potentials do not meet or exceed the criteria shall be identified and reported to the Contracting Officer's representative.

3.5.5.2 Tanks

For underground tanks, measurements shall be taken from the reference electrode located:

a. Directly over the center of the tank.

b. At a point directly over the tank and midway between each pair of anodes.

At least six measurements shall be made.

3.5.5.3 Interference Testing

Before final acceptance of the installation, interference tests shall be made with respect to any foreign pipes in cooperation with the owner of the foreign pipes. A full report of the tests giving all details shall be made. Stray current measurements shall be performed at all isolating locations and at locations where the new pipeline crosses foreign metallic pipes. The method of measurements and locations of measurements shall be submitted for approval. As a minimum, stray current measurements shall be performed at the following locations:

a. Connection point of new pipeline to existing pipeline.

b. Crossing points of new pipeline with existing lines.

Results of stray current measurements shall also be submitted for approval.

3.5.5.4 Holiday Test

Any damage to the protective covering during transit and handling shall be repaired before installation. After field-coating and wrapping has been applied, the entire pipe shall be inspected by an electric holiday detector with impressed current in accordance with NACE RP0188 using a full-ring, spring-type coil electrode. The holiday detector shall be equipped with a bell, buzzer, or other type of audible signal which sounds when a holiday is detected. Holidays in the protective covering shall be repaired upon detection. Occasional checks of holiday detector potential will be made by the Contracting Officer to determine suitability of the detector. Labor, materials, and equipment necessary for conducting the inspection shall be furnished by the Contractor. The coating system shall be inspected for holes, voids, cracks, and other damage during installation.

3.5.5.5 Recording Measurements

All pipe- or tank-to-soil potential measurements, including initial potentials where required, shall be recorded. The Contractor shall locate, correct and report to the Contracting Officer any short circuits to foreign pipes encountered during checkout of the installed cathodic protection system. Pipe- and Tank-to-soil potential measurements shall be taken on as many pipes as necessary to determine the extent of protection or to locate short-circuits.

3.6 TRAINING COURSE

The Contractor shall conduct a training course for the operating staff as designated by the Contracting Officer. The training period shall consist of a total of 4 hours of normal working time and shall start after the system is functionally completed but prior to final acceptance tests. The field instructions shall cover all of the items contained in the operating and maintenance instructions, as well as demonstrations of routine maintenance operations, including testing procedures included in the maintenance instructions. At least 14 days prior to date of proposed conduction of the training course, the training course curriculum shall be submitted for approval, along with the proposed training date. Training shall consist of demonstration of test equipment, providing forms for test data and the tolerances which indicate that the system works.

3.7 CLEANUP

The Contractor shall be responsible for cleanup of the construction site. All paper bags, wire clippings, etc., shall be disposed of as directed. Paper bags, wire clippings and other waste shall not be put in bell holes or anodes excavation.

3.8 MISCELLANEOUS INSTALLATION AND TESTING

3.8.1 Coatings

All aboveground pipeline shall be coated as indicated or as approved. The coating shall have a minimum thickness of 7 mil. The pipeline coating shall be in accordance with all applicable Federal, State, and local regulations.

3.8.2 Excavation

In the event rock is encountered in providing the required depth for anodes, the Contractor shall determine an alternate approved location and, if the depth is still not provided, an alternate plan shall be submitted to the Contracting Officer. Alternate techniques and depths must be approved prior to implementation.

3.9 SPARE PARTS

After approval of shop drawings, and not later than three (3) months prior to the date of beneficial occupancy, the Contractor shall furnish spare parts data for each different item of material and equipment specified. The data shall include a complete list of parts, special tools, and supplies, with current unit prices and source of supply. In addition, the Contractor shall supply information for material and equipment replacement for all other components of the complete system, including anodes, cables, splice kits and connectors, corrosion test stations, and any other components not listed above. The Contractor shall furnish a reference cell on a reel with 350 feet of conductor, along with other accessories, and a digital voltmeter that can be used in the maintenance of this cathodic protection system. Use of this equipment shall be demonstrated in actual tests during the training course, which shall include a description of the the equipment and measurement of the pipe-to-soil potential, rainfall, and gas company voltages. The equipment shall be turned over to the Contracting Office to give to the base.

3.10 SEEDING

Seeding shall be done by the Contractor, as directed, in all unsurfaced locations disturbed by this construction. In areas where grass cover exists, it is possible that sod can be carefully removed, watered, and stored during construction operations, and replaced after the operations are completed since it is estimated that no section of pipeline should remain uncovered for more than two (2) days. The use of sod in lieu of seeding shall require approval by the Contracting Officer.

3.11 SYSTEM TESTING

The Contractor shall submit a report including potential measurements taken at adequately-close intervals to establish that minus 850 millivolts potential, "instant-off" potential, is provided, and that the cathodic protection is not providing interference to other foreign pipes causing damage to paint or pipes. The report shall provide a narrative describing how the criteria of protection is achieved without damaging other pipe or structures in the area.

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SECTION 13120

STANDARD METAL BUILDING SYSTEMS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ALUMINUM ASSOCIATION (AA)

AA Design Manual	(2000) Aluminum Design Manual: Specification & Guidelines for Aluminum Structures
AA Standards & Data	(1997) Aluminum Standards and Data

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC ASD Spec S335	(1989) Specification for Structural Steel Buildings - Allowable Stress Design, Plastic Design
AISC FCD	(1995a) Quality Certification Program
AISC S303	(2000) Code of Standard Practice for Steel Buildings and Bridges
AISC S329	(1985) Allowable Stress Design Specification for Structural Joints Using ASTM A325 or A490 Bolts
AISC Pub No. S342L	(1993) Load and Resistance Factor Design Specification for Structural Steel Buildings

AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI Cold-Formed Mnl	(1996) Cold-Formed Steel Design Manual

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 252	(1998; R 2002) Welded and Seamless Steel Pipe Piles
ASTM A 325	(2002) Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
ASTM A 36/A 36M	(2001) Carbon Structural Steel
ASTM A 463/A 463M	(2000) Steel Sheet, Aluminum-Coated, by

	the Hot-Dip Process
ASTM A 490	(2002) Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength
ASTM A 490M	(2000) High-Strength Steel Bolts, Classes 10.9 and 10.9.3, for Structural Steel Joints (Metric)
ASTM A 500	(1999) Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A 501	(1999) Hot-Formed Welded and Seamless Carbon Steel Structural Tubing
ASTM A 529/A 529M	(2001) High-Strength Carbon-Manganese Steel of Structural Quality
ASTM A 53/A 53M	(2002) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 570/A 570M	(1998) Steel, Sheet and Strip, Carbon, Hot-Rolled, Structural Quality
ASTM A 572/A 572M	(2001) High-Strength Low-Alloy Columbium-Vanadium Structural Steel
ASTM A 588/A 588M	(2001) High-Strength Low-Alloy Structural Steel with 50 ksi (345 MPa) Minimum Yield Point to 4 in. (100 mm) Thick
ASTM A 606	(1998) Steel, Sheet and Strip, High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, with Improved Atmospheric Corrosion Resistance
ASTM A 607	(1998) Steel, Sheet and Strip, High-Strength, Low-Alloy, Columbium or Vanadium, or Both, Hot-Rolled and Cold-Rolled
ASTM A 618	(1999) Hot-Formed Welded and Seamless High-Strength Low-Alloy Structural Tubing
ASTM A 653/A 653M	(2001a) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A 792/A 792M	(2002) Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process
ASTM B 209	(2002a) Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B 221	(2000) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

ASTM B 241/B 241M	(2000) Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube
ASTM B 308/B 308M	(2000) Aluminum-Alloy 6061-T6 Standard Structural Profiles
ASTM B 429	(2000) Aluminum-Alloy Extruded Structural Pipe and Tube
ASTM D 1308	(1987; R 1998) Effect of Household Chemicals on Clear and Pigmented Organic Finishes
ASTM D 1654	(1992; R 2000) Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
ASTM D 2244	(1995) Calculation of Color Differences from Instrumentally Measured Color Coordinates
ASTM D 2247	(1999) Testing Water Resistance of Coatings in 100% Relative Humidity
ASTM D 2794	(1993; R 1999el) Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
ASTM D 3359	(1997) Measuring Adhesion by Tape Test
ASTM D 4141	(1995) Standard Practice for Conducting Accelerated Outdoor Exposure Tests of Coatings
ASTM D 4214	(1998) Evaluating the Degree of Chalking of Exterior Paint Films
ASTM D 522	(1993a) Mandrel Bend Test of Attached Organic Coatings
ASTM D 523	(1989; R 1999) Specular Gloss
ASTM D 5894	(1996) Standard Practice for Cyclic Salt Fog/UV Exposure of Painted Metal, (Alternating Exposures in a Fog/Dry Cabinet and a UV/Condensation Cabinet)
ASTM D 610	(1995) Evaluating Degree of Rusting on Painted Steel Surfaces
ASTM D 714	(1987; R 1994el) Evaluating Degree of Blistering of Paints
ASTM D 968	(1993) Abrasion Resistance of Organic Coatings by Falling Abrasive
ASTM E 84	(2001) Surface Burning Characteristics of Building Materials

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7	(1998) Minimum Design Loads for Buildings and Other Structures

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1	(2000) Structural Welding Code - Steel

U.S. FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA)

FEMA 302	(Feb 1998) NEHRP Recommended Provisions for Seismic Regulations for New Buildings and Other Structures

MATERIAL HANDLING INDUSTRY OF AMERICA (MHI)

MHI CMAA 70	(1994) Electric Overhead Traveling Cranes

METAL BUILDING MANUFACTURERS ASSOCIATION (MBMA)

MBMA Low Rise Manual	(1996) Low Rise Building Systems Manual

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Drawings; G-AE

Detail drawings consisting of catalog cuts, design and erection drawings, and an isometric view of the roof showing the design wind uplift pressure and dimensions of edge and corner zones. Shop painting and finishing specifications. Anchor bolt placement plan and column reactions.

SD-03 Product Data

Design Analysis; G-AE

Design analysis (building and foundations including anchor bolt plans) as one package with the drawings. Include foundation analysis only if foundation redesign is required.

Instruction Manuals; G-AE

Manufacturer's literature for individual building component systems.

Erection; G-AE

Manufacturer's erection instruction and erection drawings describing the preparation requirements, assembly sequence,

temporary bracing, shoring, and related information necessary for erection of the metal building including its structural framework and components.

Qualifications;

Qualifications of the manufacturer, the manufacturer's Representative when one is used, and qualifications and experience of the building erector. A brief list of locations where buildings of similar design have been used shall be included with the detail drawings and shall also include information regarding date of completion, name and address of owner, and how the structure is used.

SD-04 Samples

Accessories; G-AO

One sample of each type of flashing, trim, closure, cap and similar items. Size shall be sufficient to show construction and configuration.

Siding; G-AO

One piece of each type and finish (exterior and interior) to be used, 9 inches long, full width. The sample for factory color finished covering shall be accompanied by certified laboratory test reports showing that the sheets to be furnished are produced under a continuing quality control program and that a representative sample consisting of not less than 5 pieces has been tested and has met the quality standards specified for factory color finish.

Insulation; G-AO

One piece of each type to be used, and descriptive data covering installation.

SD-07 Certificates

Metal Building Systems;

a. A Certificate from the metal building manufacturer stating that the metal building was designed from a complete set of the contract drawings and specifications and that the building furnished complies with the specified requirements.

b. Mill certification for structural bolts, framing steel, siding.

c. Warranty certificate. At the completion of the project the Contractor shall furnish signed copies of the 5-year Warranty for Metal Building System, a sample copy of which is attached to this section, the 20-year Manufacturer's Material Warranties, and the Manufacturer's 20-year System Weathertightness Warranty when one is required.

1.3 GENERAL REQUIREMENTS

The metal building system covered under this specification shall be provided by a single manufacturer and shall include all components and assemblies that form a building. Roofing is specified in SECTION, STRUCTURAL STANDING SEAM METAL ROOFING (SSSMR) SYSTEM.

1.3.1 Building Configuration

Building shall have structural steel rigid frames, and secondary framing including purlins and girts, engineered and fabricated by the building systems supplier. Building shall have wall and roof systems as indicated on the contract drawings. Roof slope shall be as shown on the drawings. Exterior doors and louvers shall be included in the metal building system. Building dimensions shall be not less than those indicated. The minimum inside clear dimensions shall be as shown on the drawings.

1.3.2 Qualifications

1.3.2.1 Manufacturer

Metal building shall be the product of a recognized steel building systems manufacturer who has been in the practice of manufacturing steel building systems for a period of not less than 5 years. The manufacturer shall be chiefly engaged in the practice of designing and fabricating steel building systems. The manufacturer shall be certified under the Metal Building Systems (MB) Certification Program, AISC FCD. Structural framing and covering shall be designed by a licensed Professional Engineer experienced in design of this work.

1.3.2.2 Installer

Erector shall have specialized experience in the erection of steel building systems for a period of at least 3 years. Framing shall be erected in accordance with MBMA Low Rise Manual, common industry practices and erection instructions describing the basic sequence of assembly, temporary bracing, shoring, and related information necessary for erection of the metal building including its structural framework and components. The erector shall furnish temporary guys and bracing where needed for squaring, plumbing, and securing the structural framing against loads acting on the exposed framing, such as wind loads and seismic forces, as well as loads due to erection equipment and erection operation. Bracing furnished by the manufacturer for the metal building system shall not be assumed to be adequate during erection. Structural members shall not be field cut or altered without approval of the metal building manufacturer. Welds, abrasions, and surfaces not shop primed shall be primed after erection.

1.3.2.3 Manufacturer's Representative

A representative designated by the building manufacturer, who is familiar with the design of the building supplied and experienced in the erection of metal buildings similar in size to the one required under this contract, shall be present at the job site during construction, from the start of the structural framing erection until completion of the installation of the exterior covering, to assure that the building is erected properly.

1.4 DESIGN REQUIREMENTS

Criteria and definitions shall be in accordance with MBMA Low Rise Manual,

except criteria for seismic loads which shall be in accordance with FEMA 302 and all other loads and load combinations in accordance with ASCE 7.

1.4.1 Dead Loads

The dead load shall consist of the weight of all permanent construction such as roof, framing, covering members and all other materials of the building system.

1.4.2 Collateral Loads

Collateral load of 5 pounds per square foot shall be applied to the entire structure to account for the weight of additional permanent materials other than the building system, such as sprinklers, mechanical systems, electrical systems, hung partitions, and ceilings. This allowance does not include the weight of hung equipment weighing 50 pounds or more. Equipment loads of 50 pounds or more shall be shown on the shop (detail) drawings and the structure (frame, purlins, girts) shall be strengthened as required. See the mechanical and electrical sheets for suspended equipment in the pumphouse and generator buildings. The Contractor is responsible for providing the building manufacturer the magnitude and approximate location of all concentrated loads greater than 50 pounds before design of the building commences.

1.4.3 Roof Live Loads

1.4.4 Roof Snow Loads

The design roof snow loads shall be determined and applied in accordance with ASCE 7 using a ground snow load of 70 psf, a thermal factor of 1.1, and an importance factor of 1.2.
Drifting, sliding, and unbalanced snow loads shall be considered.

1.4.5 Wind Loads

Wind pressures shall be computed and applied in accordance with ASCE 7 using a basic wind speed of 90 mph (3 second gust), and importance factor of 1.15, and exposure C.

1.4.6 Seismic Loads

Seismic loads shall be computed in accordance with FEMA 302 using a short period spectral acceleration (Ss) of 1.106, a one second spectral acceleration (S1) of 0.305 and Seismic Design Category D.

1.4.7 Impact Loads

Impact loads due to cranes shall be applied as indicated in MBMA Low Rise Manual.

1.4.8 Foundations

Foundations have been designed for an allowable soil bearing pressure of 4000 psf for isolated and strip footings ,a bottom of footing depth of 4'-0" below finish floor elevation, a factor of safety of 1.5 for overturning, sliding and uplift, and a concrete compressive strength as specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE. The foundation was designed using estimated reactions for rigid framesmeeting the project requirements, controlling reactions are indicated on the

drawings. The anchor bolts and any necessary shear transfer elements shall be designed and provided by the Contractor for the reactions of the supplied building. If the reactions of the building supplied by the Contractor exceed the indicated design reactions, the Contractor shall design and provide a foundation adequate to resist the reactions at no additional expense to the Government. Any Contractor-designed foundation shall maintain the basic features of the original design, which includes a maximum footing width of 3'-6", and shall be designed by a Registered Professional Engineer. All design calculations shall be submitted for approval.

1.4.9 Framing and Structural Members

Structural steel members and their connections shall be designed in accordance with AISC ASD Spec S335 or AISC Pub No. S342L. Structural cold-formed steel framing members and their connections shall be designed in accordance with AISI COLD-FORMRD Mnl. Aluminum structural members and their connections shall be designed in accordance with AA Design Manual. Maximum deflection under applied live load, snow, or wind load shall not exceed 1/180th of the span length. Members with openings in their webs shall be designed with consideration of the additional stresses which will result due to the openings. Deflections of the steel framing above and along the side of commercially framed door openings shall be limited to a maximum allowable deflection of 1/360 of the opening width to ensure proper operation of the doors. The contractor shall include the loads that the door transfers to the building frame in the design. Framed openings shall be designed to structurally replace the covering and framing displaced. The subpurlin and/or purlin spacing shall not exceed 30 inches on centers at the corner, edge and ridge zones, and 5 foot maximum on centers for the remainder of the roof. The maximum deflection of steel framing that provides lateral support for masonry veneer panels shall be 1/240 of the height of framing span.

1.4.10 Insulated Siding

Except as otherwise specified, steel siding shall be designed in accordance with AISI Cold-Formed Mnl. Aluminum siding shall be designed in accordance with AA Standards & Data. Section modulus and moment of inertia of aluminum sheet shall be determined for actual cross section dimensions by the conventional methods for actual design stresses and by effective width concept for deflection in accordance with AA Design Manual. Maximum deflection for wall panels under applied live load, snow or wind loads shall not exceed 1/180th of the span length.

1.4.11 Provisions for Louvers

Louvers shall be fixed-blade type designed for a minimum net open area of as indicated on the drawings. Louvers shall be rainproof, and to resist vibration.

1.4.12 Drift Provisions

Lateral deflections, or drift, at the roof level of a structure in relation to the floor or slab on grade, caused by deflection of horizontal force resisting elements, shall conform to MBMA Low Rise Manual.

1.4.13 Cranes

The Pumphouse shall be designed for a 1 ton capacity bridge crane, service

classification A (infrequent service). Crane location shall be as indicated on the contract drawings. The crane loads shall be obtained from the crane manufacturer and shall be applied per MBMA Low Rise Manual for the design of the crane runways and supports. The cranes, girders, rails, end trucks, stops, and bumpers shall be provided by the crane manufacturer as specified in Section 14602 CRANES, SINGLE-GIRDER BRIDGE The connections which carry the crane vertical and lateral forces into the building frames shall be designed by the contractor or the metal building supplier and constructed to allow for the difference in required erection tolerances between the building frame and the crane support members.

1.4.14 Grounding and Lightning Protection

Grounding and lightning protection shall be provided as specified in Section 13100 LIGHTNING PROTECTION SYSTEM.

1.5 DESIGN ANALYSIS

The design analysis shall be the design of a licensed Professional Engineer experienced in design of this work and shall include complete calculations for the building, its components, including roofing and siding; and the foundations. Foundations shown on the drawings are based on loads derived from a representative set of similar building types. If the loads are exceeded, the Contractor shall obtain the services of a licensed Professional Engineer and provide a revised design with the design analysis. Formulas and references shall be identified. Assumptions and conclusions shall be explained, and cross-referencing shall be clear. Wind forces on various parts of the structure, both positive and negative pressure, shall be calculated with the controlling pressure summarized. Lateral forces due to seismic loading shall be calculated and tabulated for the various parts and portions of the building. Computer programmed designs shall be accompanied by stress values and a letter of certification, signed by a licensed Professional Engineer, stating the design criteria and procedures used and attesting to the adequacy and accuracy of the design. A narrative of the computer program delineating the basic methodology shall be included. Computer program output shall be annotated and supplemented with sketches to verify the input and output. Critical load conditions used in the final sizing of the members shall be emphasized. The design analysis shall include the name and office phone number of the designer, who shall function as a point of contact to answer questions during the detail drawing review.

1.6 DELIVERY AND STORAGE

Materials shall be delivered to the site in a dry and undamaged condition and stored out of contact with the ground. Materials other than framing and structural members shall be covered with weathertight coverings and kept dry. Storage accommodations for roofing and siding shall provide good air circulation and protection from surface staining.

1.7 WARRANTIES

The Metal Building System, composed of framing and structural members, roofing and siding, gutters and downspouts, accessories, fasteners, trim, and miscellaneous building closure items such as doors and windows (when furnished by the manufacturer) shall be warranted as described below against material and workmanship deficiencies, system deterioration caused by exposure to the elements and service design loads, leaks and wind uplift damage. Any emergency temporary repairs conducted by the owner shall not

negate the warranties.

1.7.1 Prime Contractor's Weathertightness Warranty

The Metal Building System shall be warranted by the Contractor on a no penal sum basis for a period of five years against materials and workmanship deficiencies; system deterioration caused by exposure to the elements and/or inadequate resistance to specified service design loads, water leaks, and wind uplift damage. The Metal Building System covered under this warranty shall include but is not limited to the following: framing and structural members, siding panels and seams, accessories, fasteners, trim, flashings and miscellaneous building closure items such as doors and windows (when furnished by the manufacturer), connectors, components, and fasteners, and other system components and assemblies installed to provide a weathertight system; and items specified in other sections of these specifications that become part of the metal building system. All material and workmanship deficiencies, system deterioration caused by exposure to the elements and/or inadequate resistance to specified service design loads, water leaks and wind uplift damage shall be repaired as approved by the Contracting Officer. See the attached Contractor's written warranty for issue resolution of warrantable defects. This warranty shall warrant and cover the entire cost of repair or replacement, including all material, labor, and related markups. The Contractor shall supplement this warranty with written warranties from the installer and/or system manufacturer, which shall be submitted along with Contractor's warranty. However, the Contractor is ultimately responsible for this warranty. The Contractor's written warranty shall be as outlined in attached WARRANTY FOR METAL BUILDING SYSTEMS, and start upon final acceptance of the facility. The Contractor shall provide a separate bond in an amount equal to the installed total metal building system cost in favor of the owner (Government) covering the Contractor's warranty responsibilities effective throughout the five year Contractor's warranty period for the entire metal building system as outlined above.

1.7.2 Manufacturer's Material and/or System Weathertightness Warranties

The Contractor shall furnish, in writing, the following manufacturer's material warranties to the Contracting Officer which cover all Metal Building System components:

a. A manufacturer's 20 year material warranty warranting that the specified aluminum, zinc-coated steel, aluminum-zinc alloy coated steel or aluminum-coated steel will not rupture, structurally fail, fracture, deteriorate, or become perforated under normal design atmospheric conditions and service design loads. Liability under this warranty shall be limited exclusively to the cost of either repairing or replacing nonconforming, ruptured, perforated, or structurally failed securement system including fasteners and coil material.

b. A manufacturer's 20 year exterior material finish warranty on the factory colored finish warranting that the finish, under normal atmospheric conditions at the site, will not crack, peel, or delaminate; chalk in excess of a numerical rating of eight, as determined by ASTM D 4214test procedures; or change colors in excess of five CIE or Hunter Lab color difference (delta E) units in accordance with ASTM D 2244. Liability under this warranty is exclusively limited to replacing the defective coated material.

1.8 COORDINATION MEETING

A coordination meeting shall be held within 45 days after contract award for mutual understanding of the metal building system contract requirements. This meeting shall take place at the building site and shall include representatives from the Contractor, the roofing/metal building system manufacturer, the roofing/metal building supplier, the erector, the designer, and the Contracting Officer. All items required by paragraph SUBMITTALS shall be discussed, including applicable standard manufacturer shop drawings, and the approval process. The Contractor shall coordinate time and arrangements for the meeting

PART 2 PRODUCTS

2.1 BUILDING COMPONENTS

Each piece or part of the assembly shall be clearly and legibly marked to correspond with the drawings.

2.2 FRAMING AND STRUCTURAL MEMBERS

Steel 1/8 inch or more in thickness shall conform to ASTM A 36/A 36M, ASTM A 529/A 529M, ASTM A 572/A 572M, or ASTM A 588/A 588M. Uncoated steel less than 1/8 inch in thickness shall conform to ASTM A 570/A 570M, ASTM A 606, or ASTM A 607. Galvanized steel shall conform to ASTM A 653/A 653M, G 90 coating designation, 0.045 inch minimum thickness. Aluminum-zinc coated steel shall conform to ASTM A 792/A 792M, AZ 55 coating designation,)0.045 inch minimum thickness. Aluminum sheet shall conform to ASTM B 209, 0.032 inch minimum thickness. Aluminum structural shapes and tubes shall conform to ASTM B 221, or ASTM B 308/B 308M. Structural pipe shall conform to ASTM A 53/A 53M, ASTM A 252, ASTM A 500, ASTM A 501, ASTM A 618, ASTM B 221, ASTM B 241/B 241M or ASTM B 429. Holes for structural connections shall be made in the shop.

2.3 INSULATED SIDING

Siding shall be either steel or aluminum and shall have a factory color finish.

2.3.1 Roofing

Roofing is specified in SECTION 07416, STRUCTURAL STANDING SEAM METAL ROOF(SSSMR) SYSTEM.

2.3.2 Siding

Length of sheet shall be sufficient to cover the entire height of any unbroken height of wall surface unless otherwise approved. Width of sheets with interlocking ribs shall provide not less than 12 inches of coverage in place. Provisions shall be made for thermal expansion and contraction consistent with the type of system to be used. Siding shall have interlocking ribs for securing adjacent sheets. Siding shall be fastened to framework using concealed fasteners.

2.3.3 Steel Panels

Siding shall be zinc-coated steel conforming to ASTM A 653/A 653M, G 90 coating designation; aluminum-zinc alloy coated steel conforming to ASTM A 792/A 792M, AZ 55 coating; or aluminum-coated steel conforming to ASTM A

463/A 463M, Type 2, coating designation T2 E5. Panels shall be 0.024 inch thick minimum, except that when the mid field of the roof is subject to design wind uplift pressures of 60 psf or greater or the steel covering is used as a diaphragm, the entire roof system shall have a minimum thickness of 0.030 inch. Prior to shipment, mill finish panels shall be treated to inhibit the formation of oxide corrosion. Panels that have become wet during shipment but have not started to oxidize shall be dried, and retreated in accordance with manufacturer's standard practice.

2.3.4 Aluminum Panels

Siding shall be aluminum alloy conforming to ASTM B 209, temper as required for the forming operation, minimum 0.032 inch thick.

2.3.5 Factory Insulated Panels

Insulated wall panels shall be factory-fabricated units with insulating core between metal face sheets, securely fastened together and uniformly separated with rigid spacers, facing of steel or aluminum of composition and gauge specified for covering, constructed in a manner that will eliminate condensation on interior of panel. Panels shall have a factory color finish. Insulation shall be compatible with adjoining materials; nonrunning and nonsettling; capable of retaining its R-value for the life of the metal facing sheets; and unaffected by extremes of temperature and humidity. The assembly shall have a flame spread rating not higher than 25, and smoke developed rating not higher than 450 when tested in accordance with ASTM E 84. The insulation shall remain odorless, free from mold, and shall not become a source of food and shelter for insects. Panels shall be not less than 8 inches wide and shall be in one piece for unbroken wall heights.

2.3.6 Factory Color Finish

Panels shall have a factory applied polyvinylidene fluoride finish on the exposed side. The exterior finish shall consist of a baked-on topcoat with an appropriate prime coat. Color shall match the color indicated on the drawings. The exterior coating shall be a nominal 2 mil thickness consisting of a topcoat of not less than 0.7 mil dry film thickness and the paint manufacturer's recommended primer of not less than 1.0 mil thickness. The interior color finish shall consist of a backer coat with a dry film thickness of 0.5 mil. The exterior color finish shall meet the test requirements specified below.

2.3.6.1 Salt Spray Test

A sample of the sheets shall withstand a cyclic corrosion test for a minimum of 2016 hours in accordance with ASTM D 5894, including the scribe requirement in the test. Immediately upon removal of the panel from the test, the coating shall receive a rating of not less than 10, no blistering, as determined by ASTM D 714; 10, no rusting, as determined by ASTM D 610 and a rating of 6, over 1/16 to 1/8 inch failure at scribe, as determined by ASTM D 1654.

2.3.6.2 Formability Test

When subjected to testing in accordance with ASTM D 522 Method B, 1/8 inch diameter mandrel, the coating film shall show no evidence of cracking to the naked eye.

2.3.6.3 Accelerated Weathering, Chalking Resistance and Color Change

A sample of the sheets shall be tested in a UV/Condensation Apparatus in accordance with ASTM D 4141 for2hours. Exposure conditions shall be as follows: 8 hours UV/60 degrees C followed by 4 hours CON/45 degrees C.where UV = ultraviolet light (lamps) only and CON equals condensation conditions only. The coatings shall withstand the weathering test without cracking, peeling, blistering, loss of adhesion of the protective coating, or corrosion of the base metal. Protective coating that can be readily removed from the base metal with tape in accordance with ASTM D 3359, Test Method B, shall be considered as an area indicating loss of adhesion. Following the accelerated weathering test, the coating shall have a chalk rating not less than No. 8 in accordance with ASTM D 4214 test procedures, and the color change shall not exceed 5 CIE or Hunter Lab color difference (delta E) units in accordance with ASTM D 2244. For sheets required to have a low gloss finish, the chalk rating shall be not less than No. 6 and the color difference shall be not greater than 7 units.

2.3.6.4 Humidity Test

When subjected to a humidity cabinet test in accordance with ASTM D 2247 for 1000 hours, a scored panel shall show no signs of blistering, cracking, creepage or corrosion.

2.3.6.5 Impact Resistance

Factory-painted sheet shall withstand direct and reverse impact in accordance with ASTM D 2794 0.500 inch diameter hemispherical head indenter, equal to 1.5 times the metal thickness in mils, expressed in inch-pounds, with no loss of adhesion.

2.3.6.6 Abrasion Resistance Test

When subjected to the falling sand test in accordance with ASTM D 968, Method A, the coating system shall withstand a minimum of 80 liters of sand before the appearance of the base metal. The term "appearance of base metal" refers to the metallic coating on steel or the aluminum base metal.

2.3.6.7 Specular Gloss

Finished roof surfaces shall have a specular gloss value of 30 at 60 degrees when measured in accordance with ASTM D 523.

2.3.6.8 Pollution Resistance

Coating shall show no visual effects when covered spot tested in a 10 percent hydrochloric acid solution for 24 hours in accordance with ASTM D 1308.

2.3.7 Accessories

Flashing, trim, metal closure strips and curbs, fascia, caps, diverters, and similar metal accessories shall be the manufacturer's standard products. Exposed metal accessories shall be finished to match the building finish. Molded closure strips shall be bituminous-saturated fiber, closed-cell or solid-cell synthetic rubber or neoprene, or polyvinyl chloride premolded to match configuration of the roofing or siding and shall not absorb or retain water.

2.4 FASTENERS

Fasteners for steel wall panels shall be zinc-coated steel, aluminum, corrosion resisting steel, or nylon capped steel, type and size specified below or as otherwise approved for the applicable requirements. Fasteners for aluminum wall panels shall be aluminum or corrosion resisting steel. Fasteners for attaching wall panels to supports shall provide both tensile and shear strength of not less than 750 lbs per fastener. Fasteners for accessories shall be the manufacturer's standard. Exposed wall fasteners shall be color finished or provided with plastic color caps to match the covering. Nonpenetrating fastener system for wall panels using concealed clips shall be manufacturer's standard for the system provided.

2.4.1 Screws

Screws shall be as recommended by the manufacturer to meet the design strength requirements.

2.4.2 End-Welded Studs

Automatic end-welded studs shall be shouldered type with a shank diameter of not less than 3/16 inch and cap or nut for holding covering against the shoulder.

2.4.3 Explosive Actuated Fasteners

Fasteners for use with explosive actuated tools shall have a shank of not less than 0.145 inch with a shank length of not less than 1/2 inch for fastening panels to steel and not less than 1 inch for fastening panels to concrete.

2.4.4 Blind Rivets

Blind rivets shall be aluminum with 3/16 inch nominal diameter shank or stainless steel with 1/8 inch nominal diameter shank. Rivets shall be threaded stem type if used for other than the fastening of trim. Rivets with hollow stems shall have closed ends.

2.4.5 Bolts

Bolts shall be not less than 1/4 inch diameter, shouldered or plain shank as required, with proper nuts.

2.5 LOUVERS

Louvers shall be fabricated of aluminum, zinc-coated steel, or aluminum-zinc alloy coated steel; shall have manufacturer's standard mill finish; and shall be furnished with bird screens. Minimum uncoated thickness of materials shall be 0.048 inch for steel and 0.064 inch for aluminum. Manually operated louvers shall be designed to be opened and closed from the operating floor.

2.6 DOORS

2.6.1 Hinged Doors

Hinged doors and frames shall receive a galvanic coating and factory primer and shall conform to the requirements of Section 08110 STEEL DOORS AND FRAMES. Exterior doors shall have top edges closed flush and sealed

against water penetration. Hardware shall be as specified in Section 08710 DOOR HARDWARE.

2.7 SEALANT

Sealant shall be an elastomeric type containing no oil or asphalt. Exposed sealant shall be colored to match the applicable building color and shall cure to a rubber like consistency.

2.8 GASKETS AND INSULATING COMPOUNDS

Gaskets and insulating compounds shall be nonabsorptive and suitable for insulating contact points of incompatible materials. Insulating compounds shall be nonrunning after drying.

2.9 SHOP PRIMING

Ferrous surfaces shall be cleaned of oil, grease, loose rust, loose mill scale, and other foreign substances and shop primed. Primer coating shall be in accordance with the manufacturer's standard system.

PART 3 EXECUTION

3.1 ERECTION

Dissimilar materials which are not compatible when contacting each other shall be insulated from each other by means of gaskets or insulating compounds. Improper or mislocated drill holes in panels shall be plugged with an oversize screw fastener and gasketed washer; however, panels with an excess of such holes or with such holes in critical locations shall not be used. Exposed surfaces shall be kept clean and free from sealant, metal cuttings, excess material from thermal cutting, and other foreign materials. Exposed surfaces which have been thermally cut shall be finished smooth within a tolerance of 1/8 inch. Stained, discolored or damaged sheets shall be removed from the site. Welding of steel shall conform to AWS D1.1; welding of aluminum shall conform to AA Design Manual.

3.1.1 Framing Members and Anchor Bolts

Erection shall be in accordance with the approved erection instructions and drawings and with applicable provision of AISC ASD Spec S335. Framing members fabricated or modified on site shall be saw or abrasive cut; bolt holes shall be drilled. Onsite flame cutting of framing members, with the exception of small access holes in structural beam or column webs, will not be permitted. High-strength bolting shall conform to AISC S329 using ASTM A 325 or ASTM A 490, ASTM A 490M bolts. Improper or mislocated bolt holes in structural members or other misfits caused by improper fabrication or erection, shall be repaired in accordance with AISC S303. Concrete work is specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE. Anchor bolts shall be accurately set by template while the concrete is in a plastic state. Uniform bearing under base plates and sill members shall be provided using a nonshrinking grout. Separate leveling plates under column base plates shall not be used. Members shall be accurately spaced to assure proper fitting of panels. As erection progresses, the work shall be securely fastened to resist the dead load and wind and erection stresses. Supports for electric overhead traveling cranes shall be positioned and aligned in accordance with MHI CMAA 70.

3.1.2 Insulated Siding Installation

Insulated siding shall be applied with the longitudinal configurations in the vertical position. Accessories shall be fastened into framing members, except as otherwise approved. Closure strips shall be provided as indicated and where necessary to provide weathertight construction. Fastener and fastener spacing shall be in accordance with manufacture design.

3.1.3 Louvers

Louvers shall be rigidly attached to the supporting construction to assure a weather tight installation.

3.1.4 Doors

Doors, including frames and hardware, shall be securely anchored to the supporting construction, shall be installed plumb and true, and shall be adjusted as necessary to provide proper operation. Joints at doors and windows shall be sealed according to manufacturer's recommendations to provide weathertight construction.

3.2 FIELD PAINTING

Immediately upon detection, abraded or corroded spots on shop-painted surfaces shall be wire brushed and touched up with the same material used for the shop coat. Shop-primed ferrous surfaces exposed on the outside of the building and all shop-primed surfaces of doors and windows shall be painted with two coats of an approved exterior enamel. Factory color finished surfaces shall be touched up as necessary with the manufacturer's recommended touch-up paint.

CONTRACTOR'S FIVE (5) YEAR NO PENAL SUM WARRANTY
FOR
METAL BUILDING SYSTEM

FACILITY
DESCRIPTION:_____

BUILDING
NUMBER:_____

CORPS OF ENGINEERS CONTRACT
NUMBER:_____

CONTRACTOR

CONTRACTOR:_____
ADDRESS:_____

POINT OF
CONTACT:_____

TELEPHONE
NUMBER:_____

OWNER

OWNER:_____

ADDRESS:_____

POINT OF
CONTACT:_____

TELEPHONE
NUMBER:_____

CONSTRUCTION AGENT

CONSTRUCTION
AGENT:_____
ADDRESS:_____

POINT OF CONTACT:_____

TELEPHONE
NUMBER:_____

CONTRACTOR'S FIVE (5) YEAR NO PENAL SUM WARRANTY
FOR
METAL BUILDING SYSTEM
(continued)

THE METAL BUILDING SYSTEM INSTALLED ON THE ABOVE NAMED BUILDING IS WARRANTED BY _____ FOR A PERIOD OF FIVE (5) YEARS AGAINST WORKMANSHIP AND MATERIAL DEFICIENCIES, WIND DAMAGE AND STRUCTURAL FAILURE WITHIN PROJECT SPECIFIED DESIGN LOADS, AND LEAKAGE. THE METAL BUILDING SYSTEM COVERED UNDER THIS WARRANTY SHALL INCLUDE, BUT SHALL NOT BE LIMITED TO, THE FOLLOWING: FRAMING AND STRUCTURAL MEMBERS, ROOFING AND SIDING PANELS AND SEAMS, INTERIOR OR EXTERIOR GUTTERS AND DOWNSPOUTS, ACCESSORIES, TRIM, FLASHINGS AND MISCELLANEOUS BUILDING CLOSURE ITEMS SUCH AS DOORS AND WINDOWS (WHEN FURNISHED BY THE MANUFACTURER), CONNECTORS, COMPONENTS, AND FASTENERS, AND OTHER SYSTEM COMPONENTS AND ASSEMBLIES INSTALLED TO PROVIDE A WEATHERTIGHT SYSTEM; AND ITEMS SPECIFIED IN OTHER SECTIONS OF THESE SPECIFICATIONS THAT BECOME PART OF THE METAL BUILDING SYSTEM. ALL MATERIAL AND WORKMANSHIP DEFICIENCIES, SYSTEM DETERIORATION CAUSED BY EXPOSURE TO THE ELEMENTS AND/OR INADEQUATE RESISTANCE TO SPECIFIED SERVICE DESIGN LOADS, WATER LEAKS AND WIND UPLIFT DAMAGE SHALL BE REPAIRED AS APPROVED BY THE CONTRACTING OFFICER

ALL MATERIAL DEFICIENCIES, WIND DAMAGE, STRUCTURAL FAILURE AND LEAKAGE ASSOCIATED WITH THE METAL BUILDING SYSTEM COVERED UNDER THIS WARRANTY SHALL BE REPAIRED AS APPROVED BY THE CONTRACTING OFFICER. THIS WARRANTY SHALL COVER THE ENTIRE COST OF REPAIR OR REPLACEMENT, INCLUDING ALL MATERIAL, LABOR, AND RELATED MARKUPS. THE ABOVE REFERENCED WARRANTY COMMENCED ON THE DATE OF FINAL ACCEPTANCE ON _____ AND WILL REMAIN IN EFFECT FOR STATED DURATION FROM THIS DATE.

SIGNED, DATED, AND NOTARIZED (BY COMPANY PRESIDENT)

_____

(Company President) (Date)

CONTRACTOR'S FIVE (5) YEAR NO PENAL SUM WARRANTY
FOR
METAL BUILDING SYSTEM
(continued)

THE CONTRACTOR SHALL SUPPLEMENT THIS WARRANTY WITH WRITTEN WARRANTIES FROM THE MANUFACTURER AND/OR INSTALLER OF THE METAL BUILDING SYSTEM, WHICH SHALL BE SUBMITTED ALONG WITH THE CONTRACTOR'S WARRANTY. HOWEVER, THE CONTRACTOR WILL BE ULTIMATELY RESPONSIBLE FOR THIS WARRANTY AS OUTLINED IN THE SPECIFICATIONS AND AS INDICATED IN THIS WARRANTY.

EXCLUSIONS FROM COVERAGE

1. NATURAL DISASTERS, ACTS OF GOD (LIGHTNING, FIRE, EXPLOSIONS, SUSTAINED WIND FORCES IN EXCESS OF THE DESIGN CRITERIA, EARTHQUAKES, AND HAIL).

2. ACTS OF NEGLIGENCE OR ABUSE OR MISUSE BY GOVERNMENT OR OTHER PERSONNEL, INCLUDING ACCIDENTS, VANDALISM, CIVIL DISOBEDIENCE, WAR, OR DAMAGE CAUSED BY FALLING OBJECTS.

3. DAMAGE BY STRUCTURAL FAILURE, SETTLEMENT, MOVEMENT, DISTORTION, WARPAGE, OR DISPLACEMENT OF THE BUILDING STRUCTURE OR ALTERATIONS MADE TO THE BUILDING.

4. CORROSION CAUSED BY EXPOSURE TO CORROSIVE CHEMICALS, ASH OR FUMES GENERATED OR RELEASED INSIDE OR OUTSIDE THE BUILDING FROM CHEMICAL PLANTS, FOUNDRIES, PLATING WORKS, KILNS, FERTILIZER FACTORIES, PAPER PLANTS, AND THE LIKE.

5. FAILURE OF ANY PART OF THE BUILDING SYSTEM DUE TO ACTIONS BY THE OWNER WHICH INHIBIT FREE DRAINAGE FROM THE ROOF, AND GUTTERS AND DOWNSPOUTS; OR CONDITIONS WHICH CREATE PONDING WATER ON THE ROOF OR AGAINST THE BUILDING SIDING.

6. THIS WARRANTY APPLIES TO THE METAL BUILDING SYSTEM. IT DOES NOT INCLUDE ANY CONSEQUENTIAL DAMAGE TO THE BUILDING INTERIOR OR CONTENTS WHICH IS COVERED BY THE WARRANTY OF CONSTRUCTION CLAUSE INCLUDED IN THIS CONTRACT.

7. THIS WARRANTY CANNOT BE TRANSFERRED TO ANOTHER OWNER WITHOUT WRITTEN CONSENT OF THE CONTRACTOR AND THIS WARRANTY AND THE CONTRACT PROVISIONS WILL TAKE PRECEDENCE OVER ANY CONFLICTS WITH STATE STATUTES. REPORTS OF LEAKS AND BUILDING SYSTEM DEFICIENCIES SHALL BE RESPONDED TO WITHIN 48 HOURS OF RECEIPT OF NOTICE BY TELEPHONE OR IN WRITING FROM EITHER THE OWNER, OR CONTRACTING OFFICER. EMERGENCY REPAIRS, TO PREVENT FURTHER ROOF LEAKS, SHALL BE INITIATED IMMEDIATELY; A WRITTEN PLAN SHALL BE SUBMITTED FOR APPROVAL TO REPAIR OR REPLACE THIS SSSMR SYSTEM WITHIN SEVEN CALENDAR DAYS. ACTUAL WORK FOR PERMANENT REPAIRS OR REPLACEMENT SHALL BE STARTED WITHIN 30 DAYS AFTER RECEIPT OF NOTICE, AND COMPLETED WITHIN A REASONABLE TIME FRAME. IF THE CONTRACTOR FAILS TO ADEQUATELY RESPOND TO THE WARRANTY PROVISIONS, AS STATED

CONTRACTOR'S FIVE (5) YEAR NO PENAL SUM WARRANTY
FOR
METAL BUILDING SYSTEM
(Exclusions from Coverage Continued)

IN THE CONTRACT AND AS CONTAINED HEREIN, THE CONTRACTING OFFICER MAY HAVE THE METAL BUILDING SYSTEM REPLACED OR REPAIRED BY OTHERS AND CHARGE THE COST TO THE CONTRACTOR. IN THE EVENT THE CONTRACTOR DISPUTES THE EXISTENCE OF A WARRANTABLE DEFECT, THE CONTRACTOR MAY CHALLENGE THE OWNER'S DEMAND FOR REPAIRS AND/OR REPLACEMENT DIRECTED BY THE OWNER OR CONTRACTING OFFICER EITHER BY REQUESTING A CONTRACTING OFFICER'S DECISION, UNDER THE CONTRACT DISPUTES ACT, OR BY REQUESTING THAT AN ARBITRATOR RESOLVE THE ISSUE. THE REQUEST FOR AN ARBITRATOR MUST BE MADE WITHIN 48 HOURS OF BEING NOTIFIED OF THE DISPUTED DEFECTS. UPON BEING INVOKED THE PARTIES SHALL, WITHIN 10 DAYS JOINTLY REQUEST A LIST OF FIVE (5) ARBITRATORS FROM THE FEDERAL MEDIATION AND CONCILIATION SERVICE. THE PARTIES SHALL CONFER WITHIN 10 DAYS AFTER RECEIPT OF THE LIST TO SEEK AGREEMENT ON AN ARBITRATOR. IF THE PARTIES CANNOT AGREE ON AN ARBITRATOR, THE CONTRACTING OFFICER AND THE PRESIDENT OF THE CONTRACTOR'S COMPANY WILL STRIKE ONE (1) NAME FROM THE LIST ALTERNATIVELY UNTIL ONE NAME REMAINS. THE REMAINING PERSON SHALL BE THE DULY SELECTED ARBITRATOR. THE COSTS OF THE ARBITRATION, INCLUDING THE ARBITRATOR'S FEE AND EXPENSES, COURT REPORTER, COURTROOM OR SITE SELECTED ETC., SHALL BE BORNE EQUALLY BETWEEN THE PARTIES. EITHER PARTY DESIRING A COPY OF THE TRANSCRIPT SHALL PAY FOR THE TRANSCRIPT. A HEARING WILL BE HELD AS SOON AS THE PARTIES CAN MUTUALLY AGREE. A WRITTEN ARBITRATOR'S DECISION WILL BE REQUESTED NOT LATER THAN 30 DAYS FOLLOWING THE HEARING. THE DECISION OF THE ARBITRATOR WILL NOT BE BINDING; HOWEVER, IT WILL BE ADMISSIBLE IN ANY SUBSEQUENT APPEAL UNDER THE CONTRACT DISPUTES ACT. A FRAMED COPY OF THIS WARRANTY SHALL BE POSTED IN THE MECHANICAL ROOM OR OTHER APPROVED LOCATION DURING THE ENTIRE WARRANTY PERIOD.

-- End of Section --

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DIVISION 13 - SPECIAL CONSTRUCTION

SECTION 13280

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SECTION 13280

ASBESTOS ABATEMENT

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

STATE OF ALASKA ADMINISTRATIVE CODE (AAC)

8 AAC 61	(2003) Occupational Safety and Health Standards
18 AAC 60	(2003) Solid Waste Management

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z87.1	(1989; Errata; Z87.1a) Occupational and Educational Eye and Face Protection
ANSI Z88.2	(1992) Respiratory Protection
ANSI Z9.2	(1979; R 1991) Fundamentals Governing the Design and Operation of Local Exhaust Systems

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 732	(1995) Aging Effects of Artificial Weathering on Latex Sealants
ASTM D 1331	(1989; R 1995) Surface and Interfacial Tension of Solutions of Surface-Active Agents
ASTM D 2794	(1993; R 1999el) Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
ASTM D 4397	(1996) Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications
ASTM D 522	(1993a) Mandrel Bend Test of Attached Organic Coatings
ASTM E 119	(2000) Fire Tests of Building Construction and Materials
ASTM E 1368	(2000) Visual Inspection of Asbestos

	Abatement Projects
ASTM E 736	(1992) Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members
ASTM E 84	(2001) Surface Burning Characteristics of Building Materials
ASTM E 96	(2000) Water Vapor Transmission of Materials

COMPRESSED GAS ASSOCIATION (CGA)

CGA G-7	(1990) Compressed Air for Human Respiration
CGA G-7.1	(1997) Commodity Specification for Air

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 701	(1999) Methods of Fire Tests for Flame-Resistant Textiles and Films

NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH (NIOSH)

NIOSH 84-100	(1984; Supple 1985, 1987, 1988 & 1990) NIOSH Manual of Analytical Methods

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2003) U.S. Army Corps of Engineers Safety and Health Requirements Manual

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA 340/1-90/018	(1990) Asbestos/NESHAP Regulated Asbestos Containing Materials Guidance
EPA 340/1-90/019	(1990) Asbestos/NESHAP Adequately Wet Guidance

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910	Occupational Safety and Health Standards
29 CFR 1926	Safety and Health Regulations for Construction
40 CFR 61	National Emission Standards for Hazardous Air Pollutants
40 CFR 763	Asbestos
42 CFR 84	Approval of Respiratory Protective Devices
49 CFR 107	Hazardous Materials Program Procedures
49 CFR 171	General Information, Regulations, and Definitions

49 CFR 172	Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements
49 CFR 173	Shippers - General Requirements for Shipments and Packagings

UNDERWRITERS LABORATORIES (UL)

UL 586	(1996; Rev thru Apr 2000) High-Efficiency, Particulate, Air Filter Units

1.2 DEFINITIONS

a. Adequately Wet: A term defined in 40 CFR 61, Subpart M, and EPA 340/1-90/019 meaning to sufficiently mix or penetrate with liquid to prevent the release of particulate. If visible emissions are observed coming from asbestos-containing material (ACM), then that material has not been adequately wetted. However, the absence of visible emissions is not sufficient evidence of being adequately wetted.

b. Aggressive Method: Removal or disturbance of building material by sanding, abrading, grinding, or other method that breaks, crumbles, or disintegrates intact asbestos-containing material (ACM).

c. Amended Water: Water containing a wetting agent or surfactant with a surface tension of at least 29 dynes per square centimeter when tested in accordance with ASTM D 1331.

d. Asbestos: Asbestos includes chrysotile, amosite, crocidolite, tremolite asbestos, anthophylite asbestos, actinolite asbestos, and any of these minerals that have been chemically treated and/or altered.

e. Asbestos-Containing Material (ACM): Any materials containing more than one percent asbestos.

f. Asbestos Fiber: A particulate form of asbestos, 5 micrometers or longer, with a length-to-width ratio of at least 3 to 1.

g. Authorized Person: Any person authorized by the Contractor and required by work duties to be present in the regulated areas.

h. Building Inspector: Individual who inspects buildings for asbestos and has EPA Model Accreditation Plan (MAP) "Building Inspector" training; accreditation required by 40 CFR 763, Subpart E, Appendix C.

i. Certified Industrial Hygienist (CIH): An Industrial Hygienist certified in the practice of industrial hygiene by the American Board of Industrial Hygiene.

j. Class I Asbestos Work: Activities defined by OSHA involving the removal of thermal system insulation (TSI) and surfacing ACM.

k. Class II Asbestos Work: Activities defined by OSHA involving the removal of ACM which is not thermal system insulation or surfacing material. This includes, but is not limited to, the removal of asbestos - containing wallboard, floor tile and sheeting, roofing and

siding shingles, and construction mastic. Certain "incidental" roofing materials such as mastic, flashing and cements when they are still intact are excluded from Class II asbestos work. Removal of small amounts of these materials which would fit into a glovebag may be classified as a Class III job.

l. Class III Asbestos Work: Activities defined by OSHA that involve repair and maintenance operations, where ACM, including TSI and surfacing ACM, is likely to be disturbed. Operations may include drilling, abrading, cutting a hole, cable pulling, crawling through tunnels or attics and spaces above the ceiling, where asbestos is actively disturbed or asbestos-containing debris is actively disturbed.

m. Class IV Asbestos Work: Maintenance and custodial construction activities during which employees contact but do not disturb ACM and activities to clean-up dust, waste and debris resulting from Class I, II, and III activities. This may include dusting surfaces where ACM waste and debris and accompanying dust exists and cleaning up loose ACM debris from TSI or surfacing ACM following construction.

n. Clean room: An uncontaminated room having facilities for the storage of employees' street clothing and uncontaminated materials and equipment.

o. Competent Person: In addition to the definition in 29 CFR 1926, Section .32(f), a person who is capable of identifying existing asbestos hazards as defined in 29 CFR 1926, Section .1101, selecting the appropriate control strategy, has the authority to take prompt corrective measures to eliminate them and has EPA Model Accreditation Plan (MAP) "Contractor/Supervisor" training; accreditation required by 40 CFR 763, Subpart E, Appendix C.

p. Contractor/Supervisor: Individual who supervises asbestos abatement work and has EPA Model Accreditation Plan "Contractor/Supervisor" training; accreditation required by 40 CFR 763, Subpart E, Appendix C.

q. Critical Barrier: One or more layers of plastic sealed over all openings into a regulated area or any other similarly placed physical barrier sufficient to prevent airborne asbestos in a regulated area from migrating to an adjacent area.

r. Decontamination Area: An enclosed area adjacent and connected to the regulated area and consisting of an equipment room, shower area, and clean room, which is used for the decontamination of workers, materials, and equipment that are contaminated with asbestos.

s. Demolition: The wrecking or taking out of any load-supporting structural member and any related razing, removing, or stripping of asbestos products.

t. Disposal Bag: A 6 mil thick, leak-tight plastic bag, pre-labeled in accordance with 29 CFR 1926, Section .1101, used for transporting asbestos waste from containment to disposal site.

u. Disturbance: Activities that disrupt the matrix of ACM, crumble or pulverize ACM, or generate visible debris from ACM. Disturbance includes cutting away small amounts of ACM, no greater than the amount which can be contained in 1 standard sized glovebag or waste bag, not

larger than 60 inches in length and width in order to access a building component.

v. Equipment Room or Area: An area adjacent to the regulated area used for the decontamination of employees and their equipment.

w. Employee Exposure: That exposure to airborne asbestos that would occur if the employee were not using respiratory protective equipment.

x. Fiber: A fibrous particulate, 5 micrometers or longer, with a length to width ratio of at least 3 to 1.

y. Friable ACM: A term defined in 40 CFR 61, Subpart M and EPA 340/1-90/018 meaning any material which contains more than 1 percent asbestos, as determined using the method specified in 40 CFR 763, Subpart E, Appendix A, Section 1, Polarized Light Microscopy (PLM), that when dry, can be crumbled, pulverized, or reduced to powder by hand pressure. If the asbestos content is less than 10 percent, as determined by a method other than point counting by PLM, the asbestos content is verified by point counting using PLM.

z. Glovebag: Not more than a 60 by 60 inch impervious plastic bag-like enclosure affixed around an asbestos-containing material, with glove-like appendages through which material and tools may be handled.

aa. High-Efficiency Particulate Air (HEPA) Filter: A filter capable of trapping and retaining at least 99.97 percent of all mono-dispersed particles of 0.3 micrometers in diameter.

bb. Homogeneous Area: An area of surfacing material or thermal system insulation that is uniform in color and texture.

cc. Industrial Hygienist: A professional qualified by education, training, and experience to anticipate, recognize, evaluate, and develop controls for occupational health hazards.

dd. Intact: ACM which has not crumbled, been pulverized, or otherwise deteriorated so that the asbestos is no longer likely to be bound with its matrix. Removal of "intact" asphaltic, resinous, cementitious products does not render the ACM non-intact simply by being separated into smaller pieces.

ee. Model Accreditation Plan (MAP): USEPA training accreditation requirements for persons who work with asbestos as specified in 40 CFR 763, Subpart E, Appendix C.

ff. Modification: A changed or altered procedure, material or component of a control system, which replaces a procedure, material or component of a required system.

gg. Negative Exposure Assessment: A demonstration by the Contractor to show that employee exposure during an operation is expected to be consistently below the OSHA Permissible Exposure Limits (PELs).

hh. NESHAP: National Emission Standards for Hazardous Air Pollutants. The USEPA NESHAP regulation for asbestos is at 40 CFR 61, Subpart M.

ii. Nonfriable ACM: A NESHAP term defined in 40 CFR 61, Subpart M and EPA 340/1-90/018 meaning any material containing more than 1 percent

asbestos, as determined using the method specified in 40 CFR 763, Subpart E, Appendix A, Section 1, Polarized Light Microscopy, that, when dry, cannot be crumbled, pulverized or reduced to powder by hand pressure.

jj. Nonfriable ACM (Category I): A NESHAP term defined in 40 CFR 61, Subpart E and EPA 340/1-90/018 meaning asbestos-containing packings, gaskets, resilient floor covering, and asphalt roofing products containing more than 1 percent asbestos as determined using the method specified in 40 CFR 763, Subpart F, Appendix A, Section 1, Polarized Light Microscopy.

kk. Nonfriable ACM (Category II): A NESHAP term defined in 40 CFR 61, Subpart E and EPA 340/1-90/018 meaning any material, excluding Category I nonfriable ACM, containing more than 1 percent asbestos, as determined using the methods specified in 40 CFR 763, Subpart F, Appendix A, Section 1, Polarized Light Microscopy, that when dry, cannot be crumbled, pulverized, or reduced to powder by hand pressure.

ll. Permissible Exposure Limits (PELs):

1. PEL-Time weighted average(TWA): Concentration of asbestos not in excess of 0.1 fibers per cubic centimeter of air (f/cc) as an 8 hour time weighted average (TWA), as determined by the method prescribed in 29 CFR 1926, Section .1101, Appendix A, or the current version of NIOSH 84-100 analytical method 7400.

2. PEL-Excursion Limit: An airborne concentration of asbestos not in excess of 1.0 f/cc of air as averaged over a sampling period of 30 minutes as determined by the method prescribed in 29 CFR 1926, Section .1101, Appendix A, or the current version of NIOSH 84-100 analytical method 7400.

mm. Regulated Area: An OSHA term defined in 29 CFR 1926, Section .1101 meaning an area established by the Contractor to demarcate areas where Class I, II, and III asbestos work is conducted; also any adjoining area where debris and waste from such asbestos work accumulate; and an area within which airborne concentrations of asbestos exceed, or there is a reasonable possibility they may exceed, the permissible exposure limit.

nn. Removal: All operations where ACM is taken out or stripped from structures or substrates, and includes demolition operations.

pp. Spills/Emergency Cleanups: Cleanup of sizable amounts of asbestos waste and debris which has occurred, for example, when water damage occurs in a building, and sizable amounts of ACM are dislodged. A Competent Person evaluates the site and ACM to be handled, and based on the type, condition and extent of the dislodged material, classifies the cleanup as Class I, II, or III. Only if the material was intact and the cleanup involves mere contact of ACM, rather than disturbance, could there be a Class IV classification.

qq. Surfacing ACM: Asbestos-containing material which contains more than 1% asbestos and is sprayed-on, troweled-on, or otherwise applied to surfaces, such as acoustical plaster on ceilings and fireproofing materials on structural members, or other materials on surfaces for acoustical, fireproofing, or other purposes.

rr. Thermal system insulation (TSI) ACM: ACM which contains more than 1% asbestos and is applied to pipes, fittings, boilers, breeching, tanks, ducts, or other interior structural components to prevent heat loss or gain or water condensation.

ss. Transite: A generic name for asbestos cement wallboard and pipe.

tt. Worker: Individual (not designated as the Competent Person or a supervisor) who performs asbestos work and has completed asbestos worker training required by 29 CFR 1926, Section .1101, to include EPA Model Accreditation Plan (MAP) "Worker" training; accreditation required by 40 CFR 763, Subpart E, Appendix C, if required by the OSHA Class of work to be performed or by the state where the work is to be performed.

1.3 DESCRIPTION OF WORK

The work covered by this section includes the removal and disposal of asbestos-containing materials (ACM) tat are distrubed while performing work associated with this project. This section describes the procedures and equipment required to protect workers and occupants of the regulated and adjacent areas from contact with airborne asbestos fibers and ACM dust and debris. The work also includes containment, storage, transportation and disposal of the generated ACM wastes. More specific operational procedures shall be detailed in the required Accident Prevention Plan and its subcomponents, the Asbestos Hazard Abatement Plan and Activity Hazard Analyses required in paragraph SAFETY AND HEALTH PROGRAM AND PLANS.

1.3.1 Abatement Work Tasks

The ACM to be abated includes all asphaltic coating on subsurface and adjacent pipeline components, all gaskets and valve packing, all asphaltic roofing mastics and felts used on the roofing systems and all penetration sealants located in the three (3)existing pumphouses to be demolished and all floor tile mastics and window glazings in the control rooms of the three (3) pumphouses to be demolished. Abatement shall include all materials that are disturbed during the performance of work. Materials that are not disturbed by the work will not require abatement.

1.3.2 Unexpected Discovery of Asbestos

For any previously unidentified building components suspected to contain asbestos and located in areas impacted by the work, the Contractor shall notify the Contracting Officer (CO) who will have the option of ordering up to 10 bulk samples to be obtained at the Contractor's expense and delivered to a laboratory accredited under the National Institute of Standards and Technology (NIST) "National Voluntary Laboratory Accreditation Program (NVLAP)" and analyzed by PLM at no additional cost to the Government. Any additional components identified as ACM that have been approved by the Contracting Officer for removal shall be removed by the Contractor and will be paid for by an equitable adjustment to the contract price under the CONTRACT CLAUSE titled "changes". Sampling activities undertaken to determine the presence of additional ACM shall be conducted by personnel who have successfully completed the EPA Model Accreditation Plan (MAP) "Building Inspector" training course required by 40 CFR 763, Subpart E, Appendix C.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Respiratory Protection Program; G.

Records of the respirator program.

Cleanup and Disposal

Waste shipment records. Weigh bills and delivery tickets shall be furnished for information only.

Asbestos Hazard Abatement Plan; G.

Descriptions, detail project drawings, and site layout to include worksite containment area techniques, decontamination units and load-out units, other temporary waste storage facilities, location of temporary utilities (electrical, water, sewer) and boundaries of each regulated area.

Materials and Equipment

Manufacturer's catalog data for all materials and equipment to be used in the work, including brand name, model, capacity, performance characteristics and any other pertinent information. Test results and certificates from the manufacturer of encapsulants substantiating compliance with performance requirements of this specification. Material Safety Data Sheets for all chemicals to be used onsite in the same format as implemented in the Contractor's HAZARD COMMUNICATION PROGRAM. Data shall include, but shall not be limited to, the following items, if they will be used:

a. High Efficiency Filtered Air (HEPA) local exhaust equipment

b. Vacuum cleaning equipment

c. Pressure differential monitor for HEPA local exhaust equipment

d. Air monitoring equipment

e. Respirators

f. Personal protective clothing and equipment

g. Glovebag

h. Duct Tape

i. Disposal Containers

j. Sheet Plastic

k. Wetting Agent

1. Amended Water

2. Removal encapsulant

l. Strippable Coating

m. Prefabricated Decontamination Unit

n. Other items

o. Material Safety Data Sheets (for all chemicals proposed)

Qualifications; G

A written report providing evidence of qualifications for personnel, facilities and equipment assigned to the work.

Training Program; G

A copy of the written project site-specific training material as indicated in 29 CFR 1926, Section .1101 that will be used to train onsite employees. The training document shall be signed by the Contractor's Designated IH and Competent Person.

Medical Requirements; G

Physician's written opinion.

SD-06 Test Reports

Exposure Assessment and Air Monitoring; G.

Initial exposure assessments, negative exposure assessments, air-monitoring results and documentation.

Local Exhaust Ventilation;

Pressure differential recordings.

Licenses, Permits and Notifications; G.

Licenses, permits, and notifications.

SD-07 Certificates

Vacuum, Filtration and Ventilation Equipment.

Manufacturer's certifications showing compliance with ANSI Z9.2 for:

a. Vacuums.

b. Water filtration equipment.

c. Ventilation equipment.

d. Other equipment required to contain airborne asbestos fibers.

1.5 QUALIFICATIONS

1.5.1 Written Qualifications and Organization Report

The Contractor shall furnish a written qualifications and organization report providing evidence of qualifications of the Contractor, Contractor's Project Supervisor, Designated Competent Person, supervisors and workers; Designated IH (person assigned to project and firm name); independent testing laboratory (including name of firm, principal, and analysts who will perform analyses); all subcontractors to be used including disposal transportation and disposal facility firms, subcontractor supervisors, subcontractor workers; and any others assigned to perform asbestos abatement and support activities. The report shall include an organization chart showing the Contractor's staff organization for this project by name and title, chain of command and reporting relationship with all subcontractors. The report shall be signed by the Contractor, the Contractor's onsite project manager, Designated Competent Person, Designated IH, designated testing laboratory and the principals of all subcontractors to be used. The Contractor shall include the following statement in the report: "By signing this report I certify that the personnel I am responsible for during the course of this project fully understand the contents of 29 CFR 1926, Section .1101, 40 CFR 61, Subpart M, and the federal, state and local requirements for those asbestos abatement activities that they will be involved in."

1.5.2 Specific Requirements

The Contractor shall designate in writing, personnel meeting the following qualifications:

a. Designated Competent Person: The name, address, telephone number, and resume of the Contractor's Designated Competent Person shall be provided. Evidence that the full-time Designated Competent Person is qualified in accordance with 29 CFR 1926, Sections .32 and .1101, has EPA Model Accreditation Plan (MAP) "Contractor/Supervisor" training accreditation required by 40 CFR 763, Subpart E, Appendix C, and is experienced in the administration and supervision of asbestos abatement projects. The Designated Competent Person shall be responsible for compliance with applicable federal, state and local requirements, the Contractor's Accident Prevention Plan and Asbestos Hazard Abatement Plan. The Designated Competent Person shall provide, and the Contractor shall submit, the "Contractor/Supervisor" course completion certificate and the most recent certificate for required refresher training with the employee "Certificate of Worker Acknowledgment" required by this paragraph. The Contractor shall submit evidence that this person has a minimum of 2 years of on-the-job asbestos abatement experience relevant to OSHA competent person requirements. The Designated Competent Person shall be onsite at all times during the performanc of asbestos-related work for this project.

b. Project and Other Supervisors: The Contractor shall provide the name, address, telephone number, and resume of the Project Supervisor and other supervisors who have responsibility to implement the Accident Prevention Plan, including the Asbestos Hazard Abatement Plan and Activity Hazard Analyses, the authority to direct work performed under this contract and verify compliance, and have EPA Model Accreditation Plan (MAP) "Contractor/Supervisor" training accreditation required by 40 CFR 763, Subpart E, Appendix C. The Project Supervisor and other supervisors shall provide, and the Contractor shall submit, the

"Contractor/Supervisor" course completion certificate and the most recent certificate for required refresher training with the employee "Certificate of Worker Acknowledgment" required by this paragraph. The Contractor shall submit evidence that the Project Supervisor has a minimum of 2 years of on-the-job asbestos abatement experience relevant to project supervisor responsibilities and the other supervisors have a minimum of 1 year on-the-job asbestos abatement experience commensurate with the responsibilities they will have on this project.

c. Designated Industrial Hygienist: The Contractor shall provide the name, address, telephone number, resume and other information specified below for the Industrial Hygienist (IH) selected to prepare the Contractor's Asbestos Hazard Abatement Plan, prepare and perform training, direct air monitoring and assist the Contractor's Competent Person in implementing and ensuring that safety and health requirements are complied with during the performance of all required work. The Designated IH shall be a person who is board eligible (meets all education and experience requirements) as determined and documented by the American Board of Industrial Hygiene (ABIH), has EPA Model Accreditation Plan (MAP) "Contractor/Supervisor" training accreditation required by 40 CFR 763, Subpart E, Appendix C, and has a minimum of 2 years of comprehensive experience in planning and overseeing asbestos abatement activities. The Designated IH shall provide, and the Contractor shall submit, the "Contractor/Supervisor" course completion certificate and the most recent certificate for required refresher training with the employee "Certificate of Worker Acknowledgment" required by this paragraph. The Designated IH shall be completely independent from the Contractor according to federal, state, or local regulations; that is, shall not be a Contractor's employee or be an employee or principal of a firm in a business relationship with the Contractor negating such independent status. A copy of the Designated IH's current valid ABIH certification or confirmation of eligibility in writing from the ABIH shall be included. The Designated IH shall visit the site at least once per week for the duration of asbestos activities and shall be available for emergencies. In addition, the Designated IH shall prepare, and the Contractor shall submit, the name, address, telephone numbers and resumes of additional IH's and industrial hygiene technicians (IHT) who will be assisting the Designated IH in performing onsite tasks. IHs and IHTs supporting the Designated IH shall have a minimum of 2 years of practical onsite asbestos abatement experience. The formal reporting relationship between the Designated IH and the support IHs and IHTs, the Designated Competent Person, and the Contractor shall be indicated.

d. Asbestos Abatement Workers: Asbestos abatement workers shall meet the requirements contained in 29 CFR 1926, Section .1101, 40 CFR 61, Subpart M, and other applicable federal, state and local requirements. Worker training documentation shall be provided as required on the "Certificate of Workers Acknowledgment" in this paragraph.

e. Worker Training and Certification of Worker Acknowledgment: Training documentation will be required for each employee who will perform asbestos abatement operations. Such documentation shall be submitted on a Contractor generated form titled "Certificate of Workers Acknowledgment", to be completed for each employee in the same format and containing the same information as the example certificate at the end of this section. Training course completion certificates (initial and most recent update refresher) required by the information checked on the form shall be attached.

f. Physician: The Contractor shall provide the name, medical qualifications, address, telephone number and resume of the physician who will or has performed the medical examinations and evaluations of the persons who will conduct the asbestos abatement work tasks. The physician shall be currently licensed by the state where the workers will be or have been examined, have expertise in pneumoconiosis and shall be responsible for the determination of medical surveillance protocols and for review of examination/test results performed in compliance with 29 CFR 1926, Section .1101 and paragraph MEDICAL REQUIREMENTS. The physician shall be familiar with the hazards and the scope of activities associated with this project.

g. First Aid and CPR Trained Persons: The names of at least 2 persons who are currently trained in first aid and CPR by the American Red Cross or other approved agency shall be designated and shall be onsite at all times during site operations. They shall be trained in universal precautions and the use of PPE as described in the Bloodborne Pathogens Standard of 29 CFR 1910, Section .1030 and shall be included in the Contractor's Bloodborne Pathogen Program. These persons may perform other duties but shall be immediately available to render first aid when needed. A copy of each designated person's current valid First Aid and CPR certificate shall be provided.

h. Independent Testing Laboratory: The Contractor shall provide the name, address and telephone number of the independent testing laboratory selected to perform the sample analyses and report the results. The testing laboratory shall be completely independent from the Contractor as recognized by federal, state or local regulations. Written verification of the following criteria, signed by the testing laboratory principal and the Contractor, shall be submitted:

1. Phase contrast microscopy (PCM): The laboratory is fully equipped and proficient in conducting PCM of airborne samples using the methods specified by 29 CFR 1926, Section .1101, OSHA method ID-160, the most current version of NIOSH 84-100 Method 7400, and NIOSH 84-100 Method 7402, transmission electron microscopy (TEM); the laboratory is currently judged proficient (classified as acceptable) in counting airborne asbestos samples by PCM by successful participation in each of the last 4 rounds in the American Industrial Hygiene Association (AIHA) Proficiency Analytical Testing (PAT) Program; the names of the selected microscopists who will analyze airborne samples by PCM with verified documentation of their proficiency to conduct PCM analyses by being judged proficient in counting samples as current participating analysts in the AIHA PAT Program, and having successfully completed the Asbestos Sampling and Analysis course (NIOSH 582 or equivalent) with a copy of course completion certificate provided; when the PCM analysis is to be conducted onsite, documentation shall be provided certifying that the onsite analyst meets the same requirements.

2. Polarized light microscopy (PLM): The laboratory is fully equipped and proficient in conducting PLM analyses of suspect ACM bulk samples in accordance with 40 CFR 763, Subpart E, Appendix E; the laboratory is currently accredited by NIST under the NVLAP for bulk asbestos analysis and will use analysts (names shall be provided) with demonstrated proficiency to conduct PLM to include its application to the identification and quantification of

asbestos content.

3. PCM/TEM: The laboratory is fully equipped and each analyst (name shall be provided) possesses demonstrated proficiency in conducting PCM and TEM analysis of airborne samples using NIOSH 84-100Method 7400 PCM and NIOSH 84-100 Method 7402 (TEM confirmation of asbestos content of PCM results) from the same filter.

i. Disposal Facility, Transporter: The Contractor shall provide written evidence that the landfill to be used is approved for asbestos disposal by the USEPA and the Alaska Department of Environmental Conservation. Copies of signed agreements between the Contractor (including subcontractors and transporters) and the asbestos waste disposal facility to accept and dispose of all asbestos containing waste generated during the performance of this contract shall be provided. Qualifications shall be provided for each subcontractor or transporter to be used, indicating previous experience in transport and disposal of asbestos waste to include all required state and local waste hauler requirements for asbestos. The Contractor and transporters shall meet the DOT requirements of 49 CFR 171, 49 CFR 172, and 49 CFR 173 as well as registration requirements of 49 CFR 107 and other applicable state or local requirements. The disposal facility shall meet the requirements of 40 CFR 61, Sections .154 or .155, as required in 40 CFR 61, Section .150(b), and other applicable state or local requirements.

1.6 REGULATORY REQUIREMENTS

In addition to detailed requirements of this specification, work performed under this contract shall comply with EM 385-1-1, applicable federal, state, and local laws, ordinances, criteria, rules and regulations regarding handling, storing, transporting, and disposing of asbestos waste materials. This includes, but is not limited to, OSHA standards, 29 CFR 1926, especially Section .1101, 40 CFR 61, Subpart M, 8 AAC 61, 18 AAC 60 and 40 CFR 763. Matters of interpretation of standards shall be submitted to the appropriate administrative agency for resolution before starting work. Where the requirements of this specification, applicable laws, criteria, ordinances, regulations, and referenced documents vary, the most stringent requirements shall apply.

1.7 SAFETY AND HEALTH PROGRAM AND PLANS

The Contractor shall develop and submit a written comprehensive site-specific Accident Prevention Plan at least 35 days prior to the preconstruction conference. The Accident Prevention Plan shall address requirements of EM 385-1-1, Appendix A, covering onsite work to be performed by the Contractor and subcontractors. The Accident Prevention Plan shall incorporate an Asbestos Hazard Abatement Plan, and Activity Hazard Analyses as separate appendices into 1 site specific Accident Prevention Plan document. Any portions of the Contractor's overall Safety and Health Program that are referenced in the Accident Prevention Plan, e.g., respirator program, hazard communication program, confined space entry program, etc., shall be included as appendices to the Accident Prevention Plan. The plan shall be prepared, signed and dated by the Contractor's Designated IH, Competent Person, and Project Supervisor.

1.7.1 Asbestos Hazard Abatement Plan Appendix

The Asbestos Hazard Abatement Plan appendix to the Accident Prevention Plan shall include, but not be limited to, the following:

a. The personal protective equipment to be used;

b. The location and description of regulated areas including clean and dirty areas, and decontamination unit (clean room, shower room, equipment room, storage areas such as load-out unit);

c. Initial exposure assessment in accordance with 29 CFR 1926, Section .1101;

d. Level of supervision;

e. Method of notification of other employers at the worksite;

f. Abatement method to include containment and control procedures;

g. Interface of trades involved in the construction;

h. Sequencing of asbestos related work;

i. Storage and disposal procedures and plan;

j. Type of wetting agent and asbestos encapsulant to be used;

k. Location of local exhaust equipment;

l. Air monitoring methods (personal, environmental and clearance);

m. Bulk sampling and analytical methods (if required);

n. A detailed description of the method to be employed in order to control the spread of ACM wastes and airborne fiber concentrations;

o. Fire and medical emergency response procedures;

p. The security procedures to be used for all regulated areas.

1.7.2 Activity Hazard Analyses Appendix

Activity Hazard Analyses, for each major phase of work, shall be submitted and updated during the project. The Activity Hazard Analyses format shall be in accordance with EM 385-1-1 (Figure 1-1). The analysis shall define the activities to be performed for a major phase of work, identify the sequence of work, the specific hazards anticipated, and the control measures to be implemented to eliminate or reduce each hazard to an acceptable level. Work shall not proceed on that phase until the Activity Hazard Analyses has been accepted and a preparatory meeting has been conducted by the Contractor to discuss its contents with everyone engaged in the activities, including the onsite Government representatives. The Activity Hazard Analyses shall be continuously reviewed and, when appropriate, modified to address changing site conditions or operations.

1.8 PRECONSTRUCTION CONFERENCE AND ONSITE SAFETY

The Contractor and the Contractor's Designated Competent Person, Project Supervisor, and Designated IH shall meet with the Contracting Officer prior

to beginning work at a safety preconstruction conference to discuss the details of the Contractor's submitted Accident Prevention Plan to include the Asbestos Hazard Abatement Plan and Activity Hazard Analyses appendices. Deficiencies in the Accident Prevention Plan will be discussed and the Accident Prevention Plan shall be revised to correct the deficiencies and resubmitted for acceptance. Any changes required in the specification as a result of the Accident Prevention Plan shall be identified specifically in the plan to allow for free discussion and acceptance by the Contracting Officer, prior to the start of work. Onsite work shall not begin until the Accident Prevention Plan has been accepted. A copy of the written Accident Prevention Plan shall be maintained onsite. Changes and modifications to the accepted Accident Prevention Plan shall be made with the knowledge and concurrence of the Designated IH, the Project Supervisor, Designated Competent Person, and the Contracting Officer. Should any unforeseen hazard become evident during the performance of the work, the Designated IH shall bring such hazard to the attention of the Project Supervisor, Designated Competent Person, and the Contracting Officer, both verbally and in writing, for resolution as soon as possible. In the interim, all necessary action shall be taken by the Contractor to restore and maintain safe working conditions in order to safeguard onsite personnel, visitors, the public, and the environment. Once accepted by the Contracting Officer, the Accident Prevention Plan, including the Asbestos Hazard Abatement Plan and Activity Hazard Analyses will be enforced as if an addition to the contract. Disregarding the provisions of this contract or the accepted Accident Prevention Plan will be cause for stopping of work, at the discretion of the Contracting Officer, until the matter has been rectified.

1.9 SECURITY

A log book shall be kept documenting entry into and out of the regulated area. Entry into regulated areas shall only be by personnel authorized by the Contractor and the Contracting Officer. Personnel authorized to enter regulated areas shall be trained, be medically evaluated, and wear the required personal protective equipment for the specific regulated area to be entered.

1.10 MEDICAL REQUIREMENTS

Medical requirements shall conform to 29 CFR 1926, Section .1101.

1.10.1 Medical Examinations

Before being exposed to airborne asbestos fibers, workers shall be provided with a medical examination as required by 29 CFR 1926, Section .1101 and other pertinent state or local requirements. This requirement shall have been satisfied within the last 12 months. The same medical examination shall be given on an annual basis to employees engaged in an occupation involving asbestos and within 30 calendar days before or after the termination of employment in such occupation. X-ray films of asbestos workers shall be identified to the consulting radiologist and medical record jackets shall be marked with the word "asbestos."

1.10.1.1 Information Provided to the Physician

The Contractor shall provide the following information in writing to the examining physician:

a. A copy of 29 CFR 1926, Section .1101 and Appendices D, E, G, and I;

b. A description of the affected employee's duties as they relate to the employee's exposure;

c. The employee's representative exposure level or anticipated exposure level;

d. A description of any personal protective and respiratory equipment used or to be used;

e. Information from previous medical examinations of the affected employee that is not otherwise available to the examining physician.

1.10.1.2 Written Medical Opinion

For each worker, a written medical opinion prepared and signed by a licensed physician indicating the following:

a. Summary of the results of the examination.

b. The potential for an existing physiological condition that would place the employee at an increased risk of health impairment from exposure to asbestos.

c. The ability of the individual to wear personal protective equipment, including respirators, while performing strenuous work tasks under cold and/or heat stress conditions.

d. A statement that the employee has been informed of the results of the examination, provided with a copy of the results, informed of the increased risk of lung cancer attributable to the combined effect of smoking and asbestos exposure, and informed of any medical condition that may result from asbestos exposure.

1.10.2 Medical and Exposure Records

Complete and accurate records shall be maintained of each employee's medical examinations, medical records, and exposure data, as required by 29 CFR 1910, Section .1910.20 and 29 CFR 1926, Section .1101 for a period of 50 years after termination of employment. Records of the required medical examinations and exposure data shall be made available, for inspection and copying, to the Assistant Secretary of Labor for Occupational Safety and Health (OSHA) or authorized representatives of the employee and an employee's physician upon request of the employee or former employee.

1.11 TRAINING PROGRAM

1.11.1 General Training Requirements

The Contractor shall establish a training program as specified by EPA Model Accreditation Plan (MAP), training requirements at 40 CFR 763, Subpart E, Appendix C, OSHA requirements of 29 CFR 1926, Section .1101(k)(9), and this specification. Contractor employees shall complete the required training for the type of work they are to perform and such training shall be documented and provided to the Contracting Officer as specified in paragraph QUALIFICATIONS.

1.11.2 Project Specific Training

Prior to commencement of work, each worker shall be instructed in the

following project specific training:

a. The hazards and health effects of the specific types of ACM to be abated;

b. The content and requirements of the Contractor's Accident Prevention Plan to include the Asbestos Hazard Abatement Plan and Activity Hazard Analyses and site-specific safety and health precautions;

c. Hazard Communication Program;

d. Hands-on training for each asbestos abatement technique to be employed;

e. Heat and/or cold stress monitoring specific to this project;

f. Air monitoring program and procedures;

g. Medical surveillance to include medical and exposure record-keeping procedures;

h. The association of cigarette smoke and asbestos-related disease;

i. Security procedures;

j. Specific work practice controls and engineering controls required for each Class of work in accordance with 29 CFR 1926, Section .1101.

1.12 RESPIRATORY PROTECTION PROGRAM

The Contractor shall establish in writing, and implement a respiratory protection program in accordance with 29 CFR 1926, Section .1101, 29 CFR 1910, Section .134, ANSI Z88.2, CGA G-7, and CGA G-7.1. The Contractor shall establish minimum respiratory protection requirements based on measured or anticipated levels of airborne asbestos fiber concentrations encountered during the performance of the asbestos abatement work. The Contractor's respiratory protection program shall include, but not be limited to, the following elements:

a. The company policy, used for the assignment of individual responsibility, accountability, and implementation of the respiratory protection program.

b. The standard operating procedures covering the selection and use of respirators. Respiratory selection shall be determined by the hazard to which the worker is exposed.

c. Medical evaluation of each user to verify that the worker may be assigned to an activity where respiratory protection is required.

d. Training in the proper use and limitations of respirators.

e. Respirator fit-testing, i.e., quantitative, qualitative and individual functional fit checks.

f. Regular cleaning and disinfection of respirators.

g. Routine inspection of respirators during cleaning and after each

use when designated for emergency use.

h. Storage of respirators in convenient, clean, and sanitary locations.

i. Surveillance of regulated area conditions and degree of employee exposure (e.g., through air monitoring).

j. Regular evaluation of the continued effectiveness of the respiratory protection program.

k. Recognition and procedures for the resolution of special problems as they affect respirator use (e.g., no facial hair that comes between the respirator face piece and face or interferes with valve function; prescription eye wear usage; contact lenses usage; etc.).

l. Proper training in putting on and removing respirators.

1.12.1 Respiratory Fit Testing

A qualitative or quantitative fit test conforming to 29 CFR 1926, Section 1101, Appendix C shall be conducted for each Contractor worker required to wear a respirator. A respirator fit test shall be performed for each worker wearing a negative-pressure respirator prior to initially wearing a respirator on this project and every 6 months thereafter. The qualitative fit tests may be used only for testing the fit of half-mask respirators where they are permitted to be worn, or of full-facepiece air purifying respirators where they are worn at levels at which half-facepiece air purifying respirators are permitted. If physical changes develop that will affect the fit, a new fit test for the worker shall be performed. Functional fit checks shall be performed by employees each time a respirator is put on and in accordance with the manufacturer's recommendation.

1.12.2 Respirator Selection and Use Requirements

The Contractor shall provide respirators, and ensure that they are used as required by 29 CFR 1926, Section .1101 and in accordance with the manufacturer's recommendations. Respirators shall be jointly approved by the Mine Safety and Health Administration and the National Institute for Occupational Safety and Health (MSHA/NIOSH), or by NIOSH, under the provisions of 42 CFR 84, for use in environments containing airborne asbestos fibers. The initial respirator selection and the decisions regarding the upgrading or downgrading of respirator type shall be made by the Contractor's Designated IH based on the measured or anticipated airborne asbestos fiber concentrations to be encountered. Recommendations made by the Contractor's Designated IH to downgrade respirator type shall be submitted in writing to the Contracting Officer. The Contractor's Designated Competent Person in consultation with the Designated IH, shall have the authority to take immediate action to upgrade or downgrade respiratory type when there is an immediate danger to the health and safety of the wearer. Respirators shall be used in the following circumstances:

a. During all Class I asbestos jobs.

b. During all Class II work where the ACM is not removed in a substantially intact state.

c. During all Class II and III work which is not performed using wet methods. Respirators need not be worn during removal of ACM from sloped roofs when a negative exposure assessment has been made and ACM is removed in an intact state.

d. During all Class II and III asbestos jobs where the Contractor does not produce a negative exposure assessment.

e. During all Class III jobs where TSI or surfacing ACM is being disturbed.

f. During all Class IV work performed within regulated areas where employees performing other work are required to wear respirators.

g. During all work where employees are exposed above the PEL-TWA or PEL-Excursion Limit.

h. In emergencies

1.12.3 Class I Work

The Contractor shall provide: (1) a tight-fitting, powered air purifying respirator equipped with high efficiency filters, or (2) a full-facepiece supplied air respirator operated in the pressure demand mode, equipped with HEPA egress cartridges, or (3) an auxiliary positive pressure self-contained breathing apparatus, for all employees within the regulated area where Class I work is being performed; provided that a negative exposure assessment has not been produced, and that the exposure level will not exceed 1 f/cc as an 8-hour time weighted average. A full-facepiece supplied air respirator, operated in the pressure demand mode, equipped with an auxiliary positive pressure self-contained breathing apparatus shall be provided under such conditions, if the exposure assessment indicates exposure levels above 1 f/cc as an 8-hour time weighted average.

1.12.4 Class II and III Work

The Contractor shall provide an air purifying respirator, other than a disposable respirator, equipped with high-efficiency filters whenever the employee performs Class II and III asbestos jobs where the Contractor does not produce a negative exposure assessment ; and Class III jobs where TSI or surfacing ACM is being disturbed.

1.12.5 Sanitation

Employees who wear respirators shall be permitted to leave work areas to wash their faces and respirator facepieces whenever necessary to prevent skin irritation associated with respirator use.

1.13 HAZARD COMMUNICATION PROGRAM

A hazard communication program shall be established and implemented in accordance with 29 CFR 1926, Section .59. Material safety data sheets (MSDSs) shall be provided for all hazardous materials brought onto the worksite. One copy shall be provided to the Contracting Officer and 1 copy shall be included in the Contractor's Hazard Communication Program.

1.14 LICENSES, PERMITS AND NOTIFICATIONS

1.14.1 General Legal Requirements

Necessary licenses, permits and notifications shall be obtained in conjunction with the project's asbestos abatement, transportation and disposal actions and timely notification furnished of such actions as required by federal, state, regional, and local authorities. The Contractor shall notify the Regional Office of the USEPA and the Alaska Department of Labor in writing, at least 10 days prior to the commencement of work, in accordance with 40 CFR 61, Subpart M, and state and local requirements to include the mandatory "Notification of Demolition and Renovation Record" form and other required notification documents. Notification shall be by Certified Mail, Return Receipt Requested. The Contractor shall furnish copies of the receipts to the Contracting Officer, in writing, prior to the commencement of work. A copy of the rental company's written acknowledgment and agreement shall be provided as required by paragraph RENTAL EQUIPMENT. For licenses, permits, and notifications that the Contractor is responsible for obtaining, the Contractor shall pay any associated fees or other costs incurred.

1.15 PERSONAL PROTECTIVE EQUIPMENT

Three complete sets of personal protective equipment shall be made available to the Contracting Officer and authorized visitors for entry to the regulated area. Contracting Officer and authorized visitors shall be provided with training equivalent to that provided to Contractor employees in the selection, fitting, and use of the required personal protective equipment and the site safety and health requirements. Contractor workers shall be provided with personal protective clothing and equipment and the Contractor shall ensure that it is worn properly. The Contractor's Designated IH and Designated Competent Person shall select and approve all the required personal protective clothing and equipment to be used.

1.15.1 Respirators

Respirators shall be in accordance with paragraph RESPIRATORY PROTECTION PROGRAM.

1.15.2 Whole Body Protection

Personnel exposed to airborne concentrations of asbestos that exceed the PELs, or for all OSHA Classes of work for which a required negative exposure assessment is not produced, shall be provided with whole body protection and such protection shall be worn properly. The Contractor's Designated IH and Competent Person shall select and approve the whole body protection to be used. The Competent Person shall examine work suits worn by employees at least once per work shift for rips or tears that may occur during performance of work. When rips or tears are detected while an employee is working, rips and tears shall be immediately mended, or the work suit shall be immediately replaced. Disposable whole body protection shall be disposed of as asbestos contaminated waste upon exiting from the regulated area. Reusable whole body protection worn shall be either disposed of as asbestos contaminated waste upon exiting from the regulated area or be properly laundered in accordance with 29 CFR 1926, Section .1101. Whole body protection used for asbestos abatement shall not be removed from the worksite by a worker to be cleaned. Recommendations made by the Contractor's Designated IH to downgrade whole body protection shall be submitted in writing to the Contracting Officer. The Contractor's

Designated Competent Person, in consultation with the Designated IH, has the authority to take immediate action to upgrade or downgrade whole body protection when there is an immediate danger to the health and safety of the wearer.

1.15.2.1 Coveralls

Disposable-breathable or Reusable coveralls with a zipper front shall be provided. Sleeves shall be secured at the wrists, and foot coverings secured at the ankles

1.15.2.2 Underwear

Disposable underwear shall be provided. If reusable underwear are used, they shall be disposed of as asbestos contaminated waste or laundered in accordance with 29 CFR 1926, Section .1101. Asbestos abatement workers shall not remove contaminated reusable underwear worn during abatement of ACM from the site to be laundered.

1.15.2.3 Work Clothing

An additional coverall shall be provided when the abatement and control method employed does not provide for the exit from the regulated area directly into an attached decontamination unit. Cloth work clothes for wear under the protective coverall, and foot coverings, shall be provided when work is being conducted in low temperature conditions. Cloth work clothes shall be either disposed of as asbestos contaminated waste or properly laundered in accordance with 29 CFR 1926, Section .1101.

1.15.2.4 Gloves

Gloves shall be provided to protect the hands. Where there is the potential for hand injuries (i.e., scrapes, punctures, cuts, etc.) a suitable glove shall be provided and used.

1.15.2.5 Foot Coverings

Cloth socks shall be provided and worn next to the skin. Footwear, as required by OSHA and EM 385-1-1, that is appropriate for safety and health hazards in the area shall be worn. Rubber boots shall be used in moist or wet areas. Reusable footwear removed from the regulated area shall be thoroughly decontaminated or disposed of as ACM waste. Disposable protective foot covering shall be disposed of as ACM waste. If rubber boots are not used, disposable foot covering shall be provided.

1.15.2.6 Head Covering

Hood type head covering shall be provided. In addition, protective head gear (hard hats) shall be provided as required. Hard hats shall only be removed from the regulated area after being thoroughly decontaminated.

1.15.2.7 Protective Eye Wear

Eye protection provided shall be in accordance with ANSI Z87.1.

1.16 HYGIENE FACILITIES AND PRACTICES

The Contractor shall establish a decontamination area for the decontamination of employees, material and equipment. The Contractor shall

ensure that employees enter and exit the regulated area through the decontamination area.

1.16.1 Shower Facilities

Shower facilities, when provided, shall comply with 29 CFR 1910, Section .141(d)(3).

1.16.2 3-Stage Decontamination Area

A temporary decontamination unit that is adjacent and attached in a leak-tight manner to the regulated area shall be provided. Utilization of prefabricated units shall have prior approval of the Contracting Officer. The decontamination unit shall have an equipment room and a clean room separated by a shower that complies with 29 CFR 1910, Section .141. Equipment and surfaces of containers filled with ACM shall be cleaned prior to removing them from the equipment room or area. Surfaces of the equipment room shall be wet wiped 2 times after each shift. Materials used for wet wiping shall be disposed of as asbestos contaminated waste. Two separate lockers shall be provided for each asbestos worker, one in the equipment room and one in the clean room. Used shower water shall be collected and filtered to remove asbestos contamination. Filters and residue shall be disposed of as asbestos contaminated material Filtered water shall be discharged to the sanitary system. Wastewater filters shall be installed in series with the first stage pore size of 20 microns and the second stage pore size of 5 microns. The floor of the decontamination unit's clean room shall be kept dry and clean at all times. Water from the shower shall not be allowed to wet the floor in the clean room. Surfaces of the clean room and shower shall be wet-wiped 2 times after each shift change with a disinfectant solution. Proper housekeeping and hygiene requirements shall be maintained. Soap and towels shall be provided for showering, washing and drying. Any cloth towels provided shall be disposed of as ACM waste or shall be laundered in accordance with 29 CFR 1926, Section .1101.

1.16.3 Load-Out Unit

A temporary load-out unit that is adjacent and connected to the regulated area shall be provided. Utilization of prefabricated units shall have prior approval of the Contracting Officer. The load-out unit shall be attached in a leak-tight manner to each regulated area. Surfaces of the load-out unit shall be adequately wet-wiped 2 times after each shift change. Materials used for wet wiping shall be disposed of as asbestos contaminated waste.

1.16.4 Single Stage Decontamination Area

A decontamination area (equipment room/area) shall be provided for Class I work involving less than 25 feet or 10 square feet of TSI or surfacing ACM, and for Class II and Class III asbestos work operations where exposures exceed the PELs or where there is no negative exposure assessment produced before the operation. The equipment room or area shall be adjacent to the regulated area for the decontamination of employees, material, and their equipment which is contaminated with asbestos. The equipment room or area shall consist of an area covered by an impermeable drop cloth on the floor or horizontal working surface. The area must be of sufficient size to accommodate cleaning of equipment and removing personal protective equipment without spreading contamination beyond the area. Surfaces of the equipment room shall be wet wiped 2 times after each shift. Materials used for wet wiping shall be disposed of as asbestos

contaminated waste.

1.16.5 Decontamination Requirements for Class IV Work

The Contractor shall ensure that employees performing Class IV work within a regulated area comply with the hygiene practice required of employees performing work which has a higher classification within that regulated area, or the Contractor shall provide alternate decontamination area facilities for employees cleaning up debris and material which is TSI or surfacing ACM.

1.16.6 Decontamination Area Entry Procedures

The Contractor shall ensure that employees entering the decontamination area through the clean room or clean area:

a. Remove street clothing in the clean room or clean area and deposit it in lockers.

b. Put on protective clothing and respiratory protection before leaving the clean room or clean area.

c. Pass through the equipment room to enter the regulated area.

1.16.7 Decontamination Area Exit Procedures

The Contractor shall ensure that the following procedures are followed:

a. Before leaving the regulated area, respirators shall be worn while employees remove all gross contamination and debris from their work clothing using a HEPA vacuum.

b. Employees shall remove their protective clothing in the equipment room and deposit the clothing in labeled impermeable bags or containers for disposal and/or laundering.

c. Employees shall not remove their respirators in the equipment room.

d. Employees shall shower prior to entering the clean room. If a shower has not been located between the equipment room and the clean room or the work is performed outdoors, the Contractor shall ensure that employees engaged in Class I asbestos jobs: a) Remove asbestos contamination from their work suits in the equipment room or decontamination area using a HEPA vacuum before proceeding to a shower that is not adjacent to the work area; or b) Remove their contaminated work suits in the equipment room, without cleaning worksuits, and proceed to a shower that is not adjacent to the work area.

e. After showering, employees shall enter the clean room before changing into street clothes.

1.16.8 Lunch Areas

The Contractor shall provide lunch areas in which the airborne concentrations of asbestos are below 0.01 f/cc.

1.16.9 Smoking

Smoking, if allowed by the Contractor, shall only be permitted in designated areas approved by the Contracting Officer.

1.17 REGULATED AREAS

All Class I, II, and III asbestos work shall be conducted within regulated areas. The regulated area shall be demarcated to minimize the number of persons within the area and to protect persons outside the area from exposure to airborne asbestos. Where critical barriers or negative pressure enclosures are used, they shall demarcate the regulated area. Access to regulated areas shall be limited to authorized persons. The Contractor shall control access to regulated areas, ensure that only authorized personnel enter, and verify that Contractor required medical surveillance, training and respiratory protection program requirements are met prior to allowing entrance.

1.18 WARNING SIGNS AND TAPE

Warning signs and tape printed in English shall be provided at the regulated boundaries and entrances to regulated areas. The Contractor shall ensure that all personnel working in areas contiguous to regulated areas comprehend the warning signs. Signs shall be located to allow personnel to read the signs and take the necessary protective steps required before entering the area. Warning signs shall be in vertical format conforming to 29 CFR 1910 and 29 CFR 1926, Section .1101, a minimum of 20 by 14 inches, and displaying the following legend in the lower panel:

DANGER
ASBESTOS
CANCER AND LUNG DISEASE HAZARD
AUTHORIZED PERSONNEL ONLY
(
RESPIRATORS AND PROTECTIVE CLOTHING ARE REQUIRED IN THIS AREA)

Spacing between lines shall be at least equal to the height of the upper of any two lines.

1.19 WARNING LABELS

Warning labels shall be affixed to all asbestos disposal containers used to contain asbestos materials, scrap, waste debris, and other products contaminated with asbestos. Containers with preprinted warning labels conforming to requirements are acceptable. Warning labels shall conform to 29 CFR 1926, Section .1101 and shall be of sufficient size to be clearly legible displaying the following legend:

DANGER
CONTAINS ASBESTOS FIBERS
AVOID CREATING DUST
CANCER AND LUNG DISEASE HAZARD

1.20 LOCAL EXHAUST VENTILATION

Local exhaust ventilation units shall conform to ANSI Z9.2 and 29 CFR 1926, Section .1101. Filters on local exhaust system equipment shall conform to ANSI Z9.2 and UL 586. Filter shall be UL labeled.

1.21 TOOLS

Vacuums shall be leak proof to the filter, equipped with HEPA filters, of sufficient capacity and necessary capture velocity at the nozzle or nozzle attachment to efficiently collect, transport and retain the ACM waste material. Power tools shall not be used to remove ACM unless the tool is equipped with effective, integral HEPA filtered exhaust ventilation capture and collection system, or has otherwise been approved for use by the Contracting Officer. Residual asbestos shall be removed from reusable tools prior to storage and reuse. Reusable tools shall be thoroughly decontaminated prior to being removed from regulated areas.

1.22 RENTAL EQUIPMENT

If rental equipment is to be used, written notification shall be provided to the rental agency, concerning the intended use of the equipment, the possibility of asbestos contamination of the equipment and the steps that will be taken to decontaminate such equipment. A written acceptance of the terms of the Contractor's notification shall be obtained from the rental agency.

1.23 AIR MONITORING EQUIPMENT

The Contractor's Designated IH shall approve air monitoring equipment to be used to collect samples. The equipment shall include, but shall not be limited to:

a. High-volume sampling pumps that can be calibrated and operated at a constant airflow up to 16 liters per minute when equipped with a sampling train of tubing and filter cassette.

b. Low-volume, battery powered, body-attachable, portable personal pumps that can be calibrated to a constant airflow up to approximately 3.5 liters per minute when equipped with a sampling train of tubing and filter cassette, and a self-contained rechargeable power pack capable of sustaining the calibrated flow rate for a minimum of 10 hours. The pumps shall also be equipped with an automatic flow control unit which shall maintain a constant flow, even as filter resistance increases due to accumulation of fiber and debris on the filter surface.

c. Single use standard 25 mm diameter cassette, open face, 0.8 micron pore size, mixed cellulose ester membrane filters and cassettes with 50 mm electrically conductive extension cowl, and shrink bands, to be used with low flow pumps in accordance with 29 CFR 1926, Section .1101 for personal air sampling.

d. Single use standard 25 mm diameter cassette, open face, 0.45 micron pore size, mixed cellulose ester membrane filters and cassettes with 50 mm electrically conductive cowl, and shrink bands, to be used with high flow pumps when conducting environmental area sampling using NIOSH 84-100 Methods 7400 and 7402, (and the transmission electric microscopy method specified at 40 CFR 763 if required).

e. Appropriate plastic tubing to connect the air sampling pump to the selected filter cassette.

f. A flow calibrator capable of calibration to within plus or minus 2

percent of reading over a temperature range of minus 4 to plus 140 degrees F and traceable to a NIST primary standard.

1.24 EXPENDABLE SUPPLIES

1.24.1 Glovebag

If used, glovebags shall be provided as described in 29 CFR 1926, Section .1101. The glovebag assembly shall be 6 mil thick plastic, prefabricated and seamless at the bottom with preprinted OSHA warning label.

1.24.2 Duct Tape

Industrial grade duct tape of appropriate widths suitable for bonding sheet plastic and disposal container shall be provided.

1.24.3 Disposal Containers

Leak-tight (defined as solids, liquids, or dust that cannot escape or spill out) disposal containers shall be provided for ACM wastes as required by 29 CFR 1926 Section .1101.

1.24.4 Disposal Bags

Leak-tight bags, 6 mil thick, shall be provided for placement of asbestos generated waste.

1.24.5 Fiberboard Drums

Fiberboard drums shall be lined or coated and sealed to be leak-tight.

1.24.6 Cardboard Boxes

Heavy-duty corrugated cardboard boxes, coated with plastic or wax to retard deterioration from moisture. Boxes shall fit into selected ACM disposal bags. Filled boxes shall be sealed leak-tight with duct tape.

1.24.7 Sheet Plastic

Sheet plastic shall be polyethylene of 6 mil minimum thickness and shall be provided in the largest sheet size necessary to minimize seams Film shall conform to ASTM D 4397, except as specified below:

1.24.7.1 Flame Resistant

Where a potential for fire exists, flame-resistant sheets shall be provided. Film shall conform to the requirements of NFPA 701.

1.24.7.2 Reinforced

Reinforced sheets shall be provided where high skin strength is required, such as where it constitutes the only barrier between the regulated area and the outdoor environment. The sheet stock shall consist of translucent, nylon-reinforced or woven-polyethylene thread laminated between 2 layers of polyethylene film. Film shall meet flame resistant standards of NFPA 701.

1.24.8 Amended Water

Amended water shall meet the requirements of ASTM D 1331.

1.24.9 Mastic Removing Solvent

Mastic removing solvent shall be nonflammable and shall not contain methylene chloride, glycol ether, or halogenated hydrocarbons. Solvents used onsite shall have a flash point greater than 140 degrees F.

1.24.10 Leak-tight Wrapping

Two layers of 6 mil minimum thick polyethylene sheet stock shall be used for the containment of removed asbestos-containing components or materials such as reactor vessels, large tanks, boilers, insulated pipe segments and other materials too large to be placed in disposal bags. Upon placement of the ACM component or material, each layer shall be individually leak-tight sealed with duct tape.

1.24.11 Viewing Inspection Window

Where feasible, a minimum of 1 clear, 1/8 inch thick, acrylic sheet, 18 by 24 inches, shall be installed as a viewing inspection window. The windows shall be sealed leak-tight with industrial grade duct tape.

1.24.12 Wetting Agents

Removal encapsulant (a penetrating encapsulant) shall be provided when conducting removal abatement activities that require a longer removal time or are subject to rapid evaporation of amended water. The removal encapsulant shall be capable of wetting the ACM and retarding fiber release during disturbance of the ACM greater than or equal to that provided by amended water.

1.24.13 Strippable Coating

If used, strippable coating in aerosol cans shall be used to adhere to surfaces and to be removed cleanly by stripping, at the completion of work. This work shall only be done in well ventilated areas.

1.25 MISCELLANEOUS ITEMS

A sufficient quantity of other items, such as, but not limited to: scrapers, brushes, brooms, staple guns, tarpaulins, shovels, rubber squeegees, dust pans, other tools, scaffolding, staging, enclosed chutes, wooden ladders, lumber necessary for the construction of containments, UL approved temporary electrical equipment, material and cords, ground fault circuit interrupters, water hoses of sufficient length, fire extinguishers, first aid kits, portable toilets, logbooks, log forms, markers with indelible ink, spray paint in bright color to mark areas, project boundary fencing, etc., shall be provided.

PART 2 PRODUCTS

2.1 ENCAPSULANTS

Encapsulants shall conform to USEPA requirements, shall contain no toxic or hazardous substances and no solvent and shall meet the following requirements:

ALL ENCAPSULANTS

Requirement	Test Standard
Flame Spread - 25, Smoke Emission - 50	ASTM E 84
Combustion Toxicity Zero Mortality	Univ. of Pittsburgh Protocol
Life Expectancy, 20 yrs Accelerated Aging Test	ASTM C 732
Permeability, Minimum 0.4 perms	ASTM E 96

Additional Requirements for Penetrating Encapsulant

Requirement	Test Standard
Cohesion/Adhesion Test, 50 pounds of force/foot	ASTM E 736
Fire Resistance, Negligible affect on fire resistance rating over 3 hour test(Classified by UL for use over fibrous and cementitious sprayed fireproofing)	ASTM E 119
Impact Resistance, Minimum 43 in-lb (Gardner Impact Test)	ASTM D 2794
Flexibility, no rupture or cracking (Mandrel Bend Test)	ASTM D 522

Additional Requirements for Lockdown Encapsulant

Requirement	Test Standard
Fire Resistance, Negligible affect on fire resistance rating over 3 hour test(Tested with fireproofing over encapsulant applied directly to steel member)	ASTM E 119
Bond Strength, 100 pounds of force/foot (Tests compatibility with cementitious and fibrous fireproofing)	ASTM E 736

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

Asbestos abatement work tasks are summarized in paragraph DESCRIPTION OF WORK and are identified on the project plans. All associated work shall be incorporated into the Contractor's Accident Prevention Plan, Asbestos Hazard Abatement Plan, and the Activity Hazard Analyses. The Contractor shall use the engineering controls and work practices required in 29 CFR 1926, Section .1101(g) in all operations regardless of the levels of exposure. Personnel shall wear and utilize protective clothing and equipment as specified. The Contractor shall not permit eating, smoking, drinking, chewing or applying cosmetics in the regulated area. All hot work (burning, cutting, welding, etc.) shall be conducted under controlled

conditions in conformance with 29 CFR 1926, Section .352, Fire Prevention. Personnel of other trades, not engaged in asbestos abatement activities, shall not be exposed at any time to airborne concentrations of asbestos unless all the administrative and personal protective provisions of the Contractor's Accident Prevention Plan are complied with. Power to the regulated area shall be locked-out and tagged in accordance with 29 CFR 1910, and temporary electrical service with ground fault circuit interrupters shall be provided as needed. Temporary electrical service shall be disconnected when necessary for wet removal. The Contractor shall stop abatement work in the regulated area immediately when the airborne total fiber concentration: (1) equals or exceeds 0.01 f/cc, or the pre-abatement concentration, whichever is greater, outside the regulated area; or (2) equals or exceeds 1.0 f/cc inside the regulated area. The Contractor shall correct the condition to the satisfaction of the Contracting Officer, including visual inspection and air sampling. Work shall resume only upon notification by the Contracting Officer. Corrective actions shall be documented.

3.2 PROTECTION OF ADJACENT WORK OR AREAS TO REMAIN

Asbestos abatement shall be performed without damage to or contamination of adjacent work or area. Where such work or area is damaged or contaminated, as verified by the Contracting Officer using visual inspection or sample analysis, it shall be restored to its original condition or decontaminated by the Contractor at no expense to the Government, as deemed appropriate by the Contracting Officer. This includes inadvertent spill of dirt, dust or debris in which it is reasonable to conclude that asbestos may exist. When these spills occur, work shall stop in all effected areas immediately and the spill shall be cleaned. When satisfactory visual inspection and air sampling analysis results are obtained and have been evaluated by the Contractor's Designated IH and the Contracting Officer, work shall proceed.

3.3 BUILDING VENTILATION SYSTEM AND CRITICAL BARRIERS

Permanent, air-tight critical barriers shall be installed to separate the regulated areas from areas where work will not be performed.

3.4 METHODS OF COMPLIANCE

3.4.1 Mandated Practices

The Contractor shall employ proper handling procedures in accordance with 29 CFR 1926 and 40 CFR 61, Subpart M, and the specified requirements. The specific abatement techniques and items identified shall be detailed in the Contractor's Asbestos Hazard Abatement Plan including, but not limited to, details of construction materials, equipment, and handling procedures. The Contractor shall use the following engineering controls and work practices in all operations, regardless of the levels of exposure:

a. Vacuum cleaners equipped with HEPA filters to collect debris and dust containing ACM.

b. Wet methods or wetting agents to control employee exposures during asbestos handling, mixing, removal, cutting, application, and cleanup; except where it can be demonstrated that the use of wet methods is unfeasible due to, for example, the creation of electrical hazards, equipment malfunction, and in roofing.

c. Prompt clean-up and disposal in leak-tight containers of wastes and debris contaminated with asbestos.

d. Inspection and repair of polyethylene in work and high traffic areas.

e. Cleaning of equipment and surfaces of containers filled with ACM prior to removing them from the equipment room or area.

3.4.2 Control Methods

The Contractor shall use the following control methods to comply with the PELs:

a. Local exhaust ventilation equipped with HEPA filter dust collection systems;

b. Enclosure or isolation of processes producing asbestos dust;

c. Ventilation of the regulated area to move contaminated air away from the breathing zone of employees and toward a filtration or collection device equipped with a HEPA filter;

d. Use of other work practices and engineering controls;

e. Where the feasible engineering and work practice controls described above are not sufficient to reduce employee exposure to or below the PELs, the Contractor shall use them to reduce employee exposure to the lowest levels attainable by these controls and shall supplement them by the use of respiratory protection that complies with paragraph, RESPIRATORY PROTECTION PROGRAM.

3.4.3 Unacceptable Practices

The following work practices and engineering controls shall not be used for work related to asbestos or for work which disturbs ACM, regardless of measured levels of asbestos exposure or the results of initial exposure assessments:

a. High-speed abrasive disc saws that are not equipped with point of cut ventilator or enclosures with HEPA filtered exhaust air.

b. Compressed air used to remove asbestos, or materials containing asbestos, unless the compressed air is used in conjunction with an enclosed ventilation system designed to capture the dust cloud created by the compressed air.

c. Dry sweeping, shoveling, or other dry clean-up of dust and debris containing ACM.

d. Employee rotation as a means of reducing employee exposure to asbestos.

3.4.4 Cleaning After Asbestos Removal

After completion of all asbestos removal work, surfaces from which ACM has been removed shall be wet wiped or sponged clean, or cleaned by some

equivalent method to remove all visible residue. Run-off water shall be collected and filtered through a dual filtration system. A first filter shall be provided to remove fibers 20 micrometers and larger, and a final filter provided that removes fibers 5 micrometers and larger. After the gross amounts of asbestos have been removed from every surface, remaining visible accumulations of asbestos on floors shall be collected using plastic shovels, rubber squeegees, rubber dustpans, and HEPA vacuum cleaners as appropriate to maintain the integrity of the regulated area. When TSI and surfacing material has been removed, workmen shall use HEPA vacuum cleaners to vacuum every surface. Surfaces or locations which could harbor accumulations or residual asbestos dust shall be checked after vacuuming to verify that no asbestos-containing material remains; and shall be re-vacuumed as necessary to remove the ACM.

3.4.5 Sealing Contaminated Items Designated for Disposal

Contaminated mechanical, and electrical appurtenances such as pipes and fittings, radiators, light fixtures, conduit panels, and other contaminated items designated for removal shall be coated with an asbestos lockdown encapsulant at the demolition site before being removed from the asbestos control area. These items shall be vacuumed prior to application of the lockdown encapsulant. The asbestos lockdown encapsulant shall be tinted a contrasting color and shall be spray applied by airless method. Thoroughness of sealing operation shall be visually gauged by the extent of colored coating on exposed surfaces.

3.5 FINAL CLEANING AND VISUAL INSPECTION

Upon completion of abatement, the regulated area shall be cleaned by collecting, packing, and storing all gross contamination A final cleaning shall be performed using HEPA vacuum and wet cleaning of all exposed surfaces and objects in the regulated area.Upon completion of the cleaning, the Contractor shall conduct a visual pre-inspection of the cleaned area in preparation for a final inspection. Upon completion of the final cleaning, the Contractor and the Contracting Officer shall conduct a final visual inspection of the cleaned regulated area in accordance with ASTM E 1368 and document the results . If the Contracting Officer rejects the clean regulated area as not meeting final cleaning requirements, the Contractor shall reclean as necessary and have a follow-on inspection conducted with the Contracting Officer. Recleaning and follow-up reinspection shall be at the Contractor's expense.

3.6 LOCKDOWN

Prior to removal of plastic barriers and after clean-up of gross contamination and final visual inspection, a post removal (lockdown) encapsulant shall be spray applied to ceiling, walls, floors, and other surfaces in the regulated area.

3.7 EXPOSURE ASSESSMENT AND AIR MONITORING

3.7.1 General Requirements For Exposure Monitoring

Exposure assessment, air monitoring and analysis of airborne concentration of asbestos fibers shall be performed in accordance with 29 CFR 1926, Section .1101, the Contractor's air monitoring plan, and as specified. Personal exposure air monitoring (collected at the breathing zone) that is representative of the exposure of each employee who is assigned to work within a regulated area shall be performed by the Contractor's Designated

IH. Breathing zone samples shall be taken for at least 25 percent of the workers in each shift, or a minimum of 2, whichever is greater. Air monitoring results at the 95 percent confidence level shall be calculated as shown in Table 1 at the end of this section. The Contractor shall provide an onsite independent testing laboratory with qualified analysts and appropriate equipment to conduct sample analyses of air samples using the methods prescribed in 29 CFR 1926, Section .1101, to include NIOSH 84-100 Method 7400. Preabatement and abatement environmental air monitoring shall be performed by the Contractor's Designated IH. Environmental air monitoring shall be performed using NIOSH 84-100 Method 7400 (PCM) with optional confirmation of results by NIOSH 84-100 Method 7402 (TEM). Evironmental air monitoring shall be conducted at a sufficient velocity and duration to establish the limit of detection of the method used at 0.005 f/cc. Confirmation of asbestos fiber concentrations (asbestos f/cc) from environmental samples collected and analyzed by NIOSH 84-100 Method 7400 (total f/cc) may be conducted using TEM in accordance with NIOSH 84-100 Method 7402. When such confirmation is conducted, it shall be from the same sample filter used for the NIOSH 84-100 Method 7400 PCM analysis. For all Contractor required environmental air monitoring, confirmation of asbestos fiber concentrations, using NIOSH 84-100 Method 7402, shall be at the Contractor's expense. Monitoring may be duplicated by the Government at the discretion of the Contracting Officer. Results of breathing zone samples shall be posted at the job site and made available to the Contracting Officer. The Contractor shall maintain a fiber concentration inside a regulated area less than or equal to 0.1 f/cc expressed as an 8 hour, time-weighted average (TWA) during the conduct of the asbestos abatement. If fiber concentration rises above 0.1 f/cc, work procedures shall be investigated with the Contracting Officer to determine the cause. At the discretion of the Contracting Officer, fiber concentration may exceed 0.1 f/cc but shall not exceed 1.0 f/cc expressed as an 8-hour TWA. The Contractor's workers shall not be exposed to an airborne fiber concentration in excess of 1.0 f/cc, as averaged over a sampling period of 30 minutes. Should either an environmental concentration of 1.0 f/cc expressed as an 8-hour TWA or a personal excursion concentration of 1.0 f/cc expressed as a 30-minute sample occur inside a regulated work area, the Contractor shall stop work immediately, notify the Contracting Officer, and implement additional engineering controls and work practice controls to reduce airborne fiber levels below prescribed limits in the work area. Work shall not restart until authorized by the Contracting Officer.

3.7.2 Initial Exposure Assessment

The Contractor's Designated IH shall conduct an exposure assessment immediately before or at the initiation of an asbestos abatement operation to ascertain expected exposures during that operation. The assessment shall be completed in time to comply with the requirements which are triggered by exposure data or the lack of a negative exposure assessment, and to provide information necessary to assure that all control systems planned are appropriate for that operation. The assessment shall take into consideration both the monitoring results and all observations, information or calculations which indicate employee exposure to asbestos, including any previous monitoring conducted in the workplace, or of the operations of the Contractor which indicate the levels of airborne asbestos likely to be encountered on the job. For Class I asbestos work, until the employer conducts exposure monitoring and documents that employees on that job will not be exposed in excess of PELs, or otherwise makes a negative exposure assessment, the Contractor shall presume that employees are exposed in excess of the PEL-TWA and PEL-Excursion Limit.

3.7.3 Preabatement Environmental Air Monitoring

Preabatement environmental air monitoring shall be established 1 day prior to the masking and sealing operations for each regulated area to determine background concentrations before abatement work begins. As a minimum, preabatement air samples shall be collected using NIOSH 84-100 Method 7400, PCM at these locations: outside the building; inside the building, but outside the regulated area perimeter; and inside each regulated work area. One sample shall be collected for every 2000 square feet of floor space. At least 2 samples shall be collected outside the utilidors: at the exhaust of the HEPA unit; and downwind from the abatement site. The PCM samples shall be analyzed within 24 hours; and if any result in fiber concentration greater than 0.01 f/cc, asbestos fiber concentration shall be confirmed using NIOSH 84-100 Method 7402 (TEM).

3.7.4 Environmental Air Monitoring During Abatement

Until an exposure assessment is provided to the Contracting Officer, environmental air monitoring shall be conducted at locations and frequencies that will accurately characterize any evolving airborne asbestos fiber concentrations. The assessment shall demonstrate that the product or material containing asbestos minerals, or the abatement involving such product or material, cannot release airborne asbestos fibers in concentrations exceeding 0.01 f/cc as a TWA under those work conditions having the greatest potential for releasing asbestos. The monitoring shall be at least once per shift at locations including, but not limited to, close to the work inside a regulated area; preabatement sampling locations; outside entrances to a regulated area; close to glovebag operations; representative locations outside of the perimeter of a regulated area; inside clean room; and at the exhaust discharge point of local exhaust system ducted to the outside of a containment (if used). If the sampling outside regulated area shows airborne fiber levels have exceeded background or 0.01 f/cc, whichever is greater, work shall be stopped immediately, and the Contracting Officer notified. The condition causing the increase shall be corrected. Work shall not restart until authorized by the Contracting Officer.

3.7.5 Air-Monitoring Results and Documentation

Air sample fiber counting shall be completed and results provided within 24 hours (breathing zone samples), and 48 hours (environmental monitoring) after completion of a sampling period. The Contracting Officer shall be notified immediately of any airborne levels of asbestos fibers in excess of established requirements. Written sampling results shall be provided within 5 working days of the date of collection. The written results shall be signed by testing laboratory analyst, testing laboratory principal and the Contractor's Designated IH. The air sampling results shall be documented on a Contractor's daily air monitoring log. The daily air monitoring log shall contain the following information for each sample:

a. Sampling and analytical method used;

b. Date sample collected;

c. Sample number;

d. Sample type: BZ = Breathing Zone (Personal), P = Preabatement, E = Environmental;

e. Location/activity/name where sample collected;

f. Sampling pump manufacturer, model and serial number, beginning flow rate, end flow rate, average flow rate (L/min);

g. Calibration date, time, method, location, name of calibrator, signature;

h. Sample period (start time, stop time, elapsed time (minutes);

i. Total air volume sampled (liters);

j. Laboratory name, location, analytical method, analyst, confidence level. In addition, the printed name and a signature and date block for the Industrial Hygienist who conducted the sampling and for the Industrial Hygienist who reviewed the daily air monitoring log verifying the accuracy of the information.

3.8 CLEARANCE CERTIFICATION

When asbestos abatement is complete, ACM waste is removed from the regulated areas, and final clean-up is completed, the Contracting Officer will certify the areas as safe before allowing the warning signs and boundary warning tape to be removed. After final clean-up, but before the HEPA unit is turned off and the containment removed, the Contractor shall remove all pre-filters on the building HVAC system and provide new pre-filters. The Contractor shall dispose of such filters as asbestos contaminated materials. HVAC, mechanical, and electrical systems shall be re-established in proper working order. The Contractor and the Contracting Officer shall visually inspect all surfaces within the containment for residual material or accumulated debris. The Contractor shall reclean all areas showing dust or residual materials. The Contracting Officer will certify in writing that the area is safe before unrestricted entry is permitted. The Government will have the option to perform monitoring to certify the areas are safe before entry is permitted.

3.9 CLEANUP AND DISPOSAL

3.9.1 Title to ACM Materials

ACM material resulting from abatement work, except as specified otherwise, shall become the property of the Contractor and shall be disposed of as specified and in accordance with applicable federal, state and local regulations and policies.

3.9.2 Collection and Disposal of Asbestos

All ACM waste, including contaminated wastewater filters, scrap, debris, bags, containers, equipment, and asbestos contaminated clothing shall be collected and placed in leak-tight containers such as double plastic bags sealed double wrapped polyethylene sheet; sealed fiberboard boxes; or other approved containers. Waste within the containers shall be wetted in case the container is breeched. Asbestos-containing waste shall be disposed of at an EPA, state and local approved asbestos landfill. Eielson Air Force Base will accept asbestos containing materials for disposal only if the asbestos containing materials are segregated from all non-asbestos containing materials. Whole building or composited waste streams will not

be accepted for disposal as ACM. For temporary storage, sealed impermeable containers shall be stored in an asbestos waste load-out unit or in a storage/transportation conveyance (i.e., dumpster, roll-off waste boxes, etc.) in a manner acceptable to and in an area assigned by the Contracting Officer. Procedure for hauling and disposal shall comply with 40 CFR 61, Subpart M, state, regional, and local standards.

3.9.3 Scale Weight Measurement

If used or required by the landfill, scales used for measurement shall be public scales. Weighing shall be at a point nearest the work at which a public scale is available. Scales shall be standard truck scales of the beam type; scales shall be equipped with the type registering beam and an "over and under" indicator; and shall be capable of accommodating the entire vehicle. Scales shall be tested, approved and sealed by an inspector of the State of Alaska. Scales shall be calibrated and resealed as often as necessary and at least once every three months to ensure continuous accuracy. Vehicles used for hauling ACM shall be weighed empty daily at such time as directed and each vehicle shall bear a plainly legible identification mark.

3.9.4 Weigh Bill and Delivery Tickets

If used or required by the landfill, copies of weigh bills and delivery tickets shall be submitted to the Contracting Officer during the progress of the work. The Contractor shall furnish the Contracting Officer scale tickets for each load of ACM weighed and certified. These tickets shall include tare weight; identification mark for each vehicle weighed; and date, time and location of loading and unloading. Tickets shall be furnished at the point and time individual trucks arrive at the worksite. A master log of all vehicle loading shall be furnished for each day of loading operations. Before the final statement is allowed, the Contractor shall file with the Contracting Officer certified weigh bills and/or certified tickets and manifests of all ACM actually disposed by the Contractor for this contract.

3.9.5 Asbestos Waste Shipment Record

The Contractor shall complete and provide the Contracting Officer final completed copies of the Waste Shipment Record for all shipments of waste material as specified in 40 CFR 61, Subpart M and other required state waste manifest shipment records, within 3 days of delivery to the landfill. Each Waste Shipment Record shall be signed and dated by the Contractor, the waste transporter and disposal facility operator.

TABLE 1

FORMULA FOR CALCULATION OF THE 95 PERCENT CONFIDENCE LEVEL
(Reference: NIOSH 7400)

Fibers/cc(01.95 percent CL) = X + (X) * (1.645) * (CV)

Where: X = ((E)(AC))/((V)(1000))

E = ((F/Nf) - (B/Nb))/Af

CV = The precision value; 0.45 shall be used unless the analytical laboratory provides the Contracting Officer with documentation (Round Robin Program participation and results) that the laboratory's precision is better.

AC = Effective collection area of the filter in square millimeters

V = Air volume sampled in liters

E = Fiber density on the filter in fibers per square millimeter

F/Nf = Total fiber count per graticule field

B/Nb = Mean field blank count per graticule field

Af = Graticule field area in square millimeters

TWA = C1/T1 + C2/T2 = Cn/Tn

Where: C = Concentration of contaminant

T = Time sampled.

TABLE 2

NI0SH METHOD 7400

PCM ENVIRONMENTAL AIR SAMPLING PROTOCOL (NON-PERSONAL)

Sample Location	Minimum No. of Samples	Filter Pore Size (Note 1)	Min. Vol. (Note 2) (Liters)	Sampling Rate (liters/min.)
Inside Abatement Area	0.5/140 Square Meters (Notes 3 & 4)	0.45 microns	3850	2-16
Each Room in 1 Abatement Area Less than 140 Square meters		0.45 microns	3850	2-16
Field Blank	2	0.45 microns	0	0
Laboratory Blank	1	0.45 microns	0	0

Notes:

1. Type of filter is Mixed Cellulose Ester.

2. Ensure detection limit for PCM analysis is established at 0.005 fibers/cc.

3. One sample shall be added for each additional 140 square meters. (The corresponding I-P units are 5/1500 square feet).

4. A minimum of 5 samples are to be taken per abatement area, plus 2 field blanks.

TABLE 3

EPA AHERA METHOD: TEM AIR SAMPLING PROTOCOL

Location Sampled	Minimum No. of Samples	Filter Pore Size	Min. Vol. (Liters)	Sampling Rate (liters/min.)
Inside Abatement Area	5	0.45 microns	1500	2-16
Outside Abatement Area	5	0.45 microns	1500	2-16
Field Blank	2	0.45 microns	0	0
Laboratory Blank	1	0.45 microns	0	0

Notes:

1. Type of filter is Mixed Cellulose Ester.

2. The detection limit for TEM analysis is 70 structures/square mm.

CERTIFICATE OF WORKER'S ACKNOWLEDGMENT

PROJECT NAME _____ CONTRACT NO. _____
PROJECT ADDRESS _____
CONTRACTOR FIRM NAME _____
EMPLOYEE'S NAME _____,_____,_____,
(Print) (Last) (First) (MI)

Social Security Number: _____-_____-_____,

WORKING WITH ASBESTOS CAN BE DANGEROUS. INHALING ASBESTOS FIBERS HAS BEEN LINKED WITH TYPES OF LUNG DISEASE AND CANCER. IF YOU SMOKE AND INHALE ASBESTOS FIBERS, THE CHANCE THAT YOU WILL DEVELOP LUNG CANCER IS GREATER THAN THAT OF THE NONSMOKING PUBLIC.

Your employer's contract for the above project requires that you be provided and you complete formal asbestos training specific to the type of work you will perform and project specific training; that you be supplied with proper personal protective equipment including a respirator, that you be trained in its use; and that you receive a medical examination to evaluate your physical capacity to perform your assigned work tasks, under the environmental conditions expected, while wearing the required personal protective equipment. These things are to be done at no cost to you. By signing this certification, you are acknowledging that your employer has met these obligations to you. The Contractor's Designated Industrial Hygienist will check the block(s) for the type of formal training you have completed. Review the checked blocks prior to signing this certification.

FORMAL TRAINING:
_____ a. For Competent Persons and Supervisors: I have completed EPA's Model Accreditation Program (MAP) training course, "Contractor/Supervisor", that meets this State's requirements.

b. For Workers:
_____ (1) For OSHA Class I work: I have completed EPA's MAP training course, "Worker", that meets this State's requirements.
_____ (2) For OSHA Class II work (where there will be abatement of more than one type of Class II materials, i.e., roofing, siding, floor tile, etc.): I have completed EPA's MAP training course, "Worker", that meets this State's requirements.
(3) For OSHA Class II work (there will only be abatement of one type of Class II material):
_____ (a) I have completed an 8-hour training class on the elements of 29 CFR 1926, Section .1101(k)(9)(viii), in addition to the specific work practices and engineering controls of 29 CFR 1926, Section .1101(g) and hands-on training.
_____ (b) I have completed EPA's MAP training course, "Worker", that meets this State's requirements.
_____ (4) For OSHA Class III work: I have completed at least a 16-hour course consistent with EPA requirements for training of local education agency maintenance and custodial staff at 40 CFR 763, Section .92(a)(2) and the elements of 29 CFR 1926, Section .1101(k)(9)(viii), in addition to the specific work practices and engineering controls at 29 CFR 1926, Section .1101, and hands-on training.

CERTIFICATE OF WORKER'S ACKNOWLEDGMENT

_____ (5) For OSHA Class IV work: I have completed at least a 2-hr course consistent with EPA requirements for training of local education agency maintenance and custodial staff at 40 CFR 763, (a)(1), and the elements of 29 CFR 1926, Section .1101(k)(9)(viii), in addition to the specific work practices and engineering controls at 29 CFR 1926, Section .1101(g) and hands-on training.

_____ c. Workers, Supervisors and the Designated Competent Person: I have completed annual refresher training as required by EPA's MAP that meets this State's requirements.

PROJECT SPECIFIC TRAINING:
_____ I have been provided and have completed the project specific training required by this Contract. My employer's Designated Industrial Hygienist and Designated Competent Person conducted the training.

RESPIRATORY PROTECTION:
_____ I have been trained in accordance with the criteria in the Contractor's Respiratory Protection program. I have been trained in the dangers of handling and breathing asbestos dust and in the proper work procedures and use and limitations of the respirator(s) I will wear. I have been trained in and will abide by the facial hair and contact lens use policy of my employer.

RESPIRATOR FIT-TEST TRAINING:
_____ I have been trained in the proper selection, fit, use, care, cleaning,maintenance, and storage of the respirator(s) that I will wear. I have been fit-tested in accordance with the criteria in the Contractor's Respiratory Program and have received a satisfactory fit. I have been assigned my individual respirator. I have been taught how to properly perform positive and negative pressure fit-check upon donning negative pressure respirators each time.

MEDICAL EXAMINATION:
_____ I have had a medical examination within the last twelve months which was paid for by my employer. The examination included: health history, pulmonary function tests, and may have included an evaluation of a chest x-ray. A physician made a determination regarding my physical capacity to perform work tasks on the project while wearing personal protective equipment including a respirator. I was personally provided a copy and informed of the results of that examination. My employer's Industrial Hygienist evaluated the medical certification provided by the physician and checked the appropriate blank below. The physician determined that there:

_____ were no limitations to performing the required work tasks.
_____ were identified physical limitations to performing the required work tasks.

Date of the medical examination _____

Employee Signature _____ date _____
Contractor's Industrial
Hygienist Signature _____ date _____

-- End of Section --

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DIVISION 13 - SPECIAL CONSTRUCTION

SECTION 13281

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SECTION 13281

LEAD HAZARD CONTROL ACTIVITIES

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

STATE OF ALASKA ADMINISTRATIVE CODE (AAC)

8 AAC 61	(2003) Occupational Safety and Health Standards
18 AAC 60	(2003) Solid Waste Management

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM E 1553	(1993) Practice for Collection of Airborne Particulate Lead During Abatement and Construction Activities
ASTM E 1613	(1999) Standard Test Method for Determination of Lead by Inductivety Coupled Plasma Atomic Emission Spectrometry (ICP-AES), Flame Atomic Absorption Spectrometry (FAAS), or Graphite Furnace Atomic Absorption (GFAAS) Techniques
ASTM E 1729	(1999) Field Collection of Dried Paint Samples for Lead Determination by Atomic Spectrometry Techniques
ASTM E 1741	(2000) Preparation of Airborne Particulate Lead Samples Collected During Abatement and Construction Activities for Subsequent Analysis by Atomic Spectrometry
ASTM E 1792	(1996a) Wipe Sampling Materials for Lead in Surface Dust

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 701	(1999) Methods of Fire Tests for Flame-Resistant Textiles and Films

NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH (NIOSH)

NIOSH 84-100	(1984; Supple 1985, 1987, 1988 & 1990)

NIOSH Manual of Analytical Methods

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2003) U.S. Army Corps of Engineers Safety and Health Requirements Manual

U.S. DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT (HUD)

HUD 6780	(1995; Errata Aug 1996;Rev Ch. 7 - 1997) Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

24 CFR 35	Lead-Based Paint Poisoning Prevention in Certain Residential Structures
29 CFR 1910	Occupational Safety and Health Standards
29 CFR 1926	Safety and Health Regulations for Construction
40 CFR 745	Lead-Based Paint Poisoning Prevention in Certain Residential Structures

1.2 DEFINITIONS

a. Lead Hazard Control Activity - Any construction work where a worker may be occupationally exposed to lead and procedures have to be followed to assure that: 1). Lead inside the lead hazard control area is cleaned up to appropriate levels and 2). Lead dust does not disperse outside the lead hazard control area at unacceptable levels.

b. Public/Commercial Building - Buildings on real property, including residential real property, generally accessible to the public except target housing, child occupied facilities and industrial buildings. Examples include offices, stores/shopping centers, churches, schools, barracks, hospitals, museums, airports, hotels, convention centers.

c. Industrial Building - Any building used for industrial purposes where normal operations inside the building may produce lead aerosol that will settle out on inside surfaces.

d. Target Housing - Residential real property which is housing constructed prior to 1978, except housing for the elderly or persons with disabilities (unless any one or more children age 6 years or under resides or is expected to reside in such housing for the elderly or persons with disabilities) or any 0 bedroom dwelling.

e. Child-occupied Facility - Real property which is a building or portion of a building constructed prior to 1978 visited regularly by the same child, 6 years of age or under, on at least two different days, provided that each day's visit lasts at least 6 hours, and the combined annual visits last at least 60 hours.

Child-occupied facilities include but are not limited to, day-care centers, preschools and kindergarten classrooms.

f. Residential Real Property - Real property on which there is situated one or more residential dwellings used or occupied, or intended to be used or occupied , in whole or in part, as the home or residence of one or more persons.

1.3 DESCRIPTION OF WORK

The work covered by this section includes all work that disturbs lead-containing materials and components. This work includes, but is not limited to the work associated with the demolition of the existing structures and fuel piping systems and connections to utilities. Lead-containing materials that will not be disturbed by demolition, disposal and construction activities, do not need to be abated. All painted items are assumed to be coated with lead-containing paint. TCLP testing of a composite sample representative of all structures, excluding piping components, indicates that the waste stream will not be classified as a hazardous waste. All practical efforts shall be made to minimize the generation of hazardous wastes.

Some work impacting lead-containing materials will likely be performed in confined spaces and around energized utilities. Suitable precautions shall be taken to address all hazards associated with the work.

1.3.1 Protection of Existing Areas To Remain

All project work including, but not limited to, lead hazard work, storage, transportation, and disposal shall be performed without damaging or contaminating adjacent work and areas. Where such work or areas are damaged or contaminated, the Contractor shall restore work and areas to the original condition at no additional cost to the Government.

1.3.2 Coordination with Other Work

The contractor shall coordinate lead hazard control activities with work being performed in adjacent areas. Coordination procedures shall be explained in the Contractor's Accident Prevention Plan and shall describe how the Contractor will prevent lead exposure to other contractors and/or Government personnel performing work unrelated to lead hazard control activities.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Materials and Equipment;
Expendable Supplies;

A description of the materials, equipment and expendable supplies required; including Material Safety Data Sheets (MSDSs) for material brought onsite to perform the work.

Qualifications; G, EN-ES-M

A report providing evidence of qualifications and designating responsibilities for personnel and laboratories.

SD-06 Test Reports

Pressure Differential Log;
Licences, Permits, and Notifications; G, EN-ES-M
Accident Prevention Plan (APP); G, EN-ES-M

A report describing how the Contractor will protect workers, building occupants, and building contents while performing lead hazard control activities; and how project clearance will be performed.

Sampling and Analysis; G, EN-ES-M

A log of the analytical results required for the sampling. The log shall be kept current.

Clearance Report; G, EN-ES-M

Report prepared by the QSHP.

1.5 QUALIFICATIONS

1.5.1 Qualifications and Organization Report

The Contractor shall furnish a qualification and organization report. The report shall describe the qualifications of the qualified safety and health professional (QSHP), onsite safety and health supervisor (OSHS) and labor staff. The report shall include an organization chart showing the Contractor's personnel by name and title and project specific responsibilities and authorities. The report shall describe the qualifications of the laboratories selected for this project. The report shall be signed by the Contractor and the qualified safety and health professional to indicate that all personnel and laboratories comply with certification and experience requirements of this section and that project personnel have been given the authority to complete the tasks assigned to them.

1.5.2 Personnel and Subcontractor Responsibilities and Qualifications

1.5.2.1 Qualified Safety and Health Professional (QSHP)

The QSHP shall be responsible for development of project specific requirements in the Accident Prevention Plan (APP); supervise implementation of the APP requirements; visit the site as needed to verify effectiveness of the APP and to coordinate resolution of unknown situations that may develop as the work progresses; be available to provide consultation to the Onsite Safety and Health Supervisor (OSHS); review sampling and analytical results to evaluate occupational exposure levels, verify effectiveness of controls and determine if clearance requirements have been met. The QSHP shall have demonstrable experience with the implementation of occupational safety and health regulations.

1.5.2.2 Lead Hazard Control Workers

Lead Hazard Control workers shall be responsible for performing the labor necessary to complete the lead hazard control activities required in this contract.

1.5.2.3 Testing Laboratories

The laboratory selected to perform analysis on paint chip, soil or dust wipe samples shall be accredited by EPA's National Lead Laboratory Accreditation Program (NLLAP). The laboratory selected perform analysis on worker exposure (industrial hygiene) samples shall be in the American Industrial Hygiene Association's Industrial Hygiene Laboratory Accreditation Program (IHLAP) and shall be successfully participating in the Proficiency Analytical Testing (PAT) program for lead.

1.5.2.4 Blood Lead Testing

The laboratory selected to perform analysis on worker blood samples shall be approved by OSHA and meet the requirements contained in http://www.osha-slc.gov/OCIS/toc_bloodlead.html.

1.5.2.5 Disposal Facility and Transporter

If the Contractor's means and methods are expected to generate hazardous wastes or to concentrate lead in segregated waste streams, the Contractor shall furnish written evidence that the landfill to be used is approved for lead disposal by USEPA and state and local requirements. Copies of any required signed agreements between the Contractor (including subcontractors and transporters) and the lead disposal facility shall be provided.

1.6 REGULATORY REQUIREMENTS

In addition to the detailed requirements of this specification, work shall be performed in accordance with requirements of EM 385-1-1 and applicable regulations including, but not limited to 29 CFR 1910, 29 CFR 1926, especially Section .62, 8 AAC 61, 18 AAC 60 and the accepted Accident Prevention Plan with Appendices. Matters of interpretation of the standards shall be resolved to the satisfaction of and with the concurrence of, the Contracting Officer before starting work. Where these requirements vary, the most stringent shall apply.

1.7 ACCIDENT PREVENTION PLAN (APP)

1.7.1 APP Content and Organization

The Contractor's Accident Prevention Plan shall be consist of the overall plan and appendices. The overall plan shall address each element in Appendix A of EM 385-1-1 in project specific detail. The elements are: a. Signature Sheet, b. Background Information, c. Statement of Safety and Health Policy, d. Responsibilities and Lines of Authorities, e. Subcontractors and Suppliers, f. Training, g. Safety and Health Inspections, h. Safety and Health Expectations, Incentive Programs and Compliance, i. Accident Reporting, j. Medical Support, k. Corporate Plans and Programs required by this contract, (HAZCOM, Respiratory Protection).

1.7.1.1 Lead Hazard Control Plan Appendix

The Lead Hazard Control Appendix shall address occupational exposure issues

and shall describe the procedures to be followed to protect employees from lead hazards while performing lead hazard control activities. Each of the following elements shall be addressed in the lead hazard control appendix:

a. The location and a brief description of each work activity that will emit lead into the workplace atmosphere. A description of any components containing lead shall be included and keyed to the project drawings.

b. Description of equipment and materials, controls, crew size, worker responsibilities, and operating and maintenance procedures.

c. Description and sketch of the Lead Hazard Control Areas, including decontamination areas.

d. Description of the specific lead control methods and procedures to protect workers and other onsite contractors from lead exposure.

e. Technologic equipment used to keep occupational exposure below the Permissible Exposure Limit and minimize worker exposure to lead (i.e., HEPA-filtered vacuum equipment/cleaners, special negative air enclosure equipment and supplies, etc.).

f. Worker Exposure Assessment including methods and procedures to monitor and document worker exposure to lead. Worker exposure monitoring shall be broken into two parts in the plan. Part A: Initial Determination. The Contractor shall describe worker monitoring (if performed for the "initial determination" described in 29 CFR 1926 (.62) (d). Monitoring for the initial determination may be omitted from the plan if the Contractor has sufficient proof from previous operations as specified in 29 CFR 1926 (.62) (d)(3)(iii) and (iv) that workers will not be exposed over the action level. The Contractor shall substitute objective proof of action level compliance in Part A if "initial determination" monitoring is omitted. Part B: Continued Exposure Monitoring. Worker exposure monitoring after the initial lead exposure determination has been made.

g. Work Practices Program describing the protective clothing to be used to protect workers from lead exposure, house keeping procedures employed to minimize spread on lead contamination in the lead hazard control area, hygiene facilities and practices used to prevent workers from inadvertent ingestion of lead.

h. Administrative Control Procedures, to be used as a last resort, to limit worker exposure to lead. The worker rotation schedule to be employed, should engineering or personal protective equipment precautions fail to be effective, shall be described. This element of the plan shall be omitted if administrative controls will not be used.

i. Medical Surveillance practices and procedures used to monitor worker exposure to lead and to assure fitness for wearing respiratory protection devices.

j. Worker training meeting the requirements of 29 CFR 1926 Sections (.62) and (.59) to assure workers understand hazard associated with working with lead and how to protect themselves.

k. Security: A log book shall be kept documenting entry into and out of the lead hazard control area. Entry into lead hazard control areas shall only be by personnel authorized by the Contractor and the Contracting Officer. Persons entering control areas shall be trained, medically evaluated, and equipped with personal protective equipment required for the specific control area to be entered.

1.7.1.2 Activity Hazard Analyses Appendix

An Activity Hazard Analysis (AHA) shall be prepared for each work task data element specified on the individual work task data element sheets at the end of this section. The AHA shall be submitted to the Contracting Officer prior to beginning specified work. Format shall be in accordance with EM 385-1-1, Figure 1-1. The AHA shall be continuously reviewed and modified, when appropriate, to address changing conditions or operations. Each accepted AHA shall be appended to and become part of the APP.

1.7.1.3 Clearance Plan Appendix

The Contractor shall develop a Clearance Plan describing practices and procedures used to assure that lead hazard control activities are complete and that lead contamination within the lead hazard control area comply with visual clearance criteria.

1.8 PRE-CONSTRUCTION SAFETY CONFERENCE

1.8.1 Conference General Requirements

The Contractor and the QSHP shall attend a pre-construction safety conference prior to starting work. Items required to be submitted shall be reviewed for completeness, and where specified, for acceptance. Details of the APP shall be revised to correct any deficiencies, and resubmitted for acceptance. Onsite work shall not begin until the APP has been accepted, unless otherwise authorized by the Contracting Officer. One copy of the APP shall be maintained in the Contractor's jobsite file, and a second copy shall be posted where it will be accessible to personnel on the site. As work proceeds, the APP shall be adapted to new situations and conditions. Changes to the APP shall be made by the QSHP with acceptance by the Contracting Officer. Should an unforeseen hazard become evident during performance of the work, the QSHP shall inform the Contracting Officer, both verbally and in writing, for immediate resolution. In the interim, the QSHP shall take necessary action to re-establish and maintain safe working conditions; and to safeguard onsite personnel, visitors, the public, and the environment. Disregard for provisions of this specification, or the accepted APP, shall be cause for stopping of work until the matter is rectified.

1.8.2 Preparatory Inspection Meeting

The Contractor shall arrange and hold a preparatory inspection meeting to review completeness and adequacy of the APP immediately prior to beginning each phase of work.

1.9 MEDICAL SURVEILLANCE REQUIREMENTS

The Contractor shall comply with the following medical surveillance requirements:

a. The Contractor shall make every attempt to keep occupational exposure to lead on this project below the action level of 30 micrograms/cubic meter defined in 29 CFR 1926 (.62). If it is not possible, and if occupational exposures could possibly exceed the action level for 30 or more days per year, the Contractor shall institute a medical surveillance program. The program shall meet the examination frequency and content requirements specified in paragraph (j)(1), (j)(2) and (j)(3) of 29 CFR 1926 (.62). Medical removal as specified in paragraph (k) of 29 CFR 1926 (.62), if necessary, shall be at the Contractor's expense.

b. Medical surveillance and biological monitoring shall be in compliance with 29 CFR 1926 (.62) (g) and (j). Initial biological monitoring shall be performed on lead hazard control workers prior to assignment to the project. Workers shall not be assigned to the project if results indicate a need for restricted activities.

c. All lead hazard control workers shall pass the medical examinations necessary to be approved by the occupational physician to wear respiratory protection on this project. Occupational physician's approval shall be given prior to assignment to the project.

1.10 RESPIRATORY PROTECTION PROGRAM

The Contractor shall have a written respiratory protection program and shall be fully capable of implementing the requirement of the respiratory protection program on this project. The respiratory protection program shall meet the requirements of 29 CFR 1926 (.62) and 29 CFR 1910 (.134). Project specific respiratory protection requirements shall be included in the lead hazard control plan appendix of the Contractor's accident prevention plan.

1.11 LICENCES, PERMITS AND NOTIFICATIONS

The Contractor shall certify in writing to the Region X Office of the EPA, the Alaska Department of Environmental Conservation and the Contracting Officer at least 10 days prior to the commencement of lead abatement work that licenses, permits and notifications have been obtained. The Contractor is responsible for all associated fees or costs incurred in obtaining the licenses, permits and notifications.

1.12 TRAINING

1.12.1 OSHA Training Requirements

All Contractor personnel and/or subcontractors performing or responsible for onsite oversight of lead hazard control activities shall meet the following training requirements.

a. Content of 29 CFR 1926 (.62) and its appendices.

b. How operations could result in exposure over the action level.

c. Purpose, selection, fitting, use and limitations of respirators.

d. Purpose and description of the medical surveillance program.

e. Use of engineering controls and good work practices to limit

occupational exposure to lead.

f. Implementation of the lead hazard control plan appendix of the accident prevention plan.

g. Medical supervision for the use of chelating agents.

h. Employee right of access to medical surveillance records as specified in 29 CFR 1910 (.20).

1.12.2 Qualified Safety and Health Professional

The qualified safety and health professional shall meet the training requirements in paragraph 1.12.1 and shall meet the training, experience and authority requirements in 29 CFR 1926 (.62) to be a competent person.

1.12.3 Abatement Worker

Workers shall meet the OSHA Training Requirements specified above.

1.13 SAMPLING AND ANALYSIS

1.13.1 Sampling and Analytical Procedures

1.13.1.1 Sampling and Analysis Methods

Analysis shall conform to NIOSH 84-100 Method 7082, Lead, for personal sampling required by 29 CFR 1926 (.62) Sampling shall conform to ASTM E 1553 or ASTM E 1741, as appropriate.

1.13.1.2 Paint Chip Sampling and Analysis

Sampling shall conform to ASTM E 1729. Analysis shall conform to ASTM E 1613.

1.13.1.3 Dust Wipe Materials, Sampling and Analysis

Sampling shall conform to ASTM E 1792. Analysis shall conform to ASTM E 1613.

1.13.2 Occupational Exposure Assessment

Sampling and analytical procedures to determine compliance with the occupational exposure monitoring requirement of this section shall be described in the lead hazard control plan appendix of the Contractor's accident prevention plan. Monitoring for the initial determination may be omitted if the Contractor has sufficient proof from previous operations as specified in 29 CFR 1926 (.62) (d)(3)(iii) and (iv) that workers will not be exposed over the action level. The following occupational exposure monitoring requirements apply and shall be implemented if the requirements of 29 CFR 1926 (.62)(d)(3) (iii) and (iv) cannot be demonstrated.

a. During Initial Monitoring the Contractor shall representatively sample employees with the greatest potential for exposure to aerosolized lead.

b. Continued/Additional Monitoring shall meet applicable paragraphs in 29 CFR 1926 (.62)(d)(6), Frequency, after the initial determination has been made.

1.13.3 Lead Hazard Control Area/Containment Monitoring

The Contractor shall perform a visual inspection once per day outside the lead hazard control area to assure visual clearance criteria are maintained while lead hazard control activities are performed. The Contractor shall clean at its own expense, and to the Contracting Officer's satisfaction, all contaminated surfaces outside the lead hazard control area, if surfaces fail visual clearance criteria.

1.13.4 Waste Disposal Sampling

The Contractor shall sample each segregated waste stream containing lead for TCLP analysis to determine waste disposal requirements. Segration of wastes shall be described in the lead hazard control plan and be designed to minimize the generation of hazardous wastes.

1.13.5 Analytical Results

The Contractor shall develop and maintain during the course of the project a log of analytical results generated by the above sampling requirements. The log shall clearly describe the reason for which the sample was taken (worker exposure, migration control, clearance) the analytical result for each sample and evaluate if the analytical result passed or failed the action levels. At a minimum, the Contractor shall include analytical results for samples required to be taken in paragraphs Occupational Exposure Assessment and Lead Hazard Control Area/Containment Monitoring.

1.14 CLEARANCE REQUIREMENTS

The Contractor shall describe clearance requirements for this project in the Clearance Plan Appendix of the Accident Prevention Plan. Clearance criterial for lead hazard control areas in industrial facilities shall be by visual clearance criteria.

1.15 PERSONAL PROTECTIVE EQUIPMENT (PPE)

The Contractor shall describe the PPE to be used to protect workers from lead hazards in the Lead Hazard Control Plan Appendix of the Accident Prevention Plan. The Contractor shall furnish, at no cost to the workers, clothing for protection from lead-contaminated dust and debris. An adequate supply of these items shall be available for worker and Government personnel use. Protective clothing shall include:

a. Coveralls : Full-body coveralls shall be provided to lead hazard control workers.

b. Boots: Boots and shoes shall be provided as required by EM 385-1-1 Section 05.A.08 for workers. Boot/shoe covers shall be provided to prevent contamination of boots and shoes.

c. Hand Protection: Gloves, etc., shall be provided as required by EM 385-1-1 Section 05.A.10 for workers.

d. Head Protection: Hard hats shall be provided as required by 29 CFR 1910 (.135) and EM 385-1-1 Section 05.D for workers and authorized visitors.

e e. Eye and Face Protection: Eye and face protection shall be

provided as required by 29 CFR 1910 (.133) and EM 385-1-1 Section 05.B for workers and authorized visitors.

f. Respirators: NIOSH certified air-purifying respirators or filtering face pieces shall be provided for use as respiratory protection for airborne lead and for other hazardous airborne contaminants that may be encountered; as determine by the on-site safety and health supervisor. At a minimum, respirators shall be furnished to each employee required to enter a lead hazard control area where an employee exposure assessment has not yet been performed, or where monitoring data establishes the need for respiratory protection, or if requested by the employee.

g. Respirator Cartridges/Filtering Face Pieces: Respirator cartridges shall be changed out/filtering face pieces properly disposed of when the they become sufficiently loaded with particulate matter that workers experience breathing resistance. Cartridges and filtering face pieces shall be N, R or P 100 rated to assure sufficient protection from lead exposure.

1.16 HYGIENE FACILITIES

The Contractor shall describe the personal hygiene facilities to be used by the workers in the Lead Hazard Control Plan Appendix of the Accident Prevention Plan. The Contractor shall provide hygiene facilities for lead hazard control workers. Hygiene facilities shall comply with the requirements in 29 CFR 1926 (.51) (f).

1.17 POSTED WARNINGS AND NOTICES

The following regulations, warnings, and notices shall be posted at the worksite in accordance with 29 CFR 1926 (.62).

1.17.1 Regulations

At least two copies of 29 CFR 1926 (.62) shall be made available for use by either the Contracting Officer or affected workers; and for the purpose of providing required information and training to the workers involved in the project. One copy shall be maintained in the Contractor's jobsite file, and a second copy shall be posted where it will be accessible to workers on the site.

1.17.2 Warning Signs and Labels

Warning signs shall be posted in each lead hazard control area where worker exposure to lead is undetermined or where the exposures are above the permissible exposure limit as defined in 29 CFR 1926 (.62). Signs shall be located to allow personnel to read the signs and take necessary precautions before entering the lead hazard control area.

1.17.2.1 Warning Signs

Warning signs shall be in English, be of sufficient size to be clearly legible, and display the following:

WARNING
LEAD WORK AREA
POISON
NO SMOKING OR EATING

1.17.2.2 Warning Labels

Warning labels shall be affixed to all lead waste disposal containers used to hold materials, debris and other products contaminated with lead hazards; warning labels shall be in English and be of sufficient size to be clearly legible, and display the following:

CAUTION: CLOTHING CONTAMINATED WITH LEAD. DO NOT REMOVE DUST BY

BLOWING OR SHAKING. DISPOSE OF LEAD CONTAMINATED WASH WATER IN

ACCORDANCE WITH APPLICABLE FEDERAL, STATE OR LOCAL REGULATIONS.

1.17.3 Worker Information

Right-to-know notices shall be placed in clearly visible areas accessible to personnel on the site, to comply with Federal, state, and local regulations.

1.17.4 Air Monitoring Results

Air monitoring results shall be prepared so as to be easily understood by the workers. One copy shall be maintained in the Contractor's jobsite file, and a second copy shall be posted where it will be accessible to the workers as specified in 29 CFR 1926 (.62).

1.17.5 Emergency Telephone Numbers

A list of emergency telephone numbers shall be posted at the site. The list shall include numbers of the local hospital, emergency squad, police and fire departments, Government and Contractor representatives who can be reached 24 hours per day, and professional consultants directly involved in the project.

1.18 MATERIALS AND EQUIPMENT

Sufficient quantities of health and safety materials required by 29 CFR 1926 (.62), and other materials and equipment needed to complete the project, shall be available and kept on the site.

1.18.1 Abrasive Removal Equipment

The use of powered machine for vibrating, sanding, grinding, or abrasive blasting is prohibited unless equipped with local exhaust ventilation systems equipped with high efficiency particulate air (HEPA) filters.

1.18.2 Vacuum Systems

Vacuum systems shall be suitably sized for the project, and filters shall be capable of trapping and retaining all mono-disperse particles as small as 0.3 micrometers at a minimum efficiency of 99.97 percent. Used filters that are being replaced shall be disposed in a proper manner.

1.18.3 Heat Blower Guns

Heat blower guns shall be flameless, electrical, paint-softener type with controls to limit temperature to 1,100 degrees F. Heat blower shall be DI (non-grounded) 120 volts ac, and shall be equipped with cone, fan, glass

protector and spoon reflector nozzles.

1.18.4 Chemical Paint Strippers

Chemical paint strippers shall not contain methylene chloride and shall be formulated to prevent stain, discoloration, or raising of the substrate materials.

1.18.5 Chemical Paint Stripper Neutralizer

Neutralizers for paint strippers shall be compatible with the substrate and suitable for use with the chemical stripper that has been applied to the surface.

1.18.6 Detergents and Cleaners

Detergents or cleaning agents used shall have demonstrated effectiveness in lead control work using cleaning techniques specified by HUD 6780 guidelines.

1.19 EXPENDABLE SUPPLIES

1.19.1 Polyethylene Bags

Disposable bags shall be polyethylene plastic and shall be a minimum of 6 mils thick (4 mils thick if double bags are used) or any other thick plastic material shown to demonstrate at least equivalent performance; and shall be capable of being made leak-tight. Leak-tight means that solids, liquids or dust cannot escape or spill out.

1.19.2 Polyethylene Leak-tight Wrapping

Wrapping used to wrap lead contaminated debris shall be polyethylene plastic that is a minimum of 6 mils thick or any other thick plastic material shown to demonstrate at least equivalent performance.

1.19.3 Polyethylene Sheeting

Sheeting shall be polyethylene plastic with a minimum thickness of 6 mil, or any other thick plastic material shown to demonstrate at least equivalent performance; and shall be provided in the largest sheet size reasonably accommodated by the project to minimize the number of seams. Where the project location constitutes an out of the ordinary potential for fire, or where unusual fire hazards cannot be eliminated, flame-resistant polyethylene sheets which conform to the requirements of NFPA 701 shall be provided.

1.19.4 Tape and Adhesive Spray

Tape and adhesive shall be capable of sealing joints between polyethylene sheets and for attachment of polyethylene sheets to adjacent surfaces. After dry application, tape or adhesive shall retain adhesion when exposed to wet conditions, including amended water. Tape shall be minimum 2 inches wide, industrial strength.

1.19.5 Containers

When used, containers shall be leak-tight and shall be labeled in accordance with EPA, DOT and OSHA standards, as specified in paragraph

WARNING LABELS.

1.19.6 Chemicals

Chemicals, including caustics and paint strippers, shall be properly labeled, used in accordance with the manufacturers recommendations and stored in leak-tight containers. Material Safety Data Sheets (MSDSs) shall be provided and hazard communication procedures implemented in conformance with paragraph HAZARD COMMUNICATION PROGRAM.

1.20 STORAGE OF MATERIALS

Materials shall be stored protected from damage and contamination. During periods of cold weather, plastic materials shall be protected from the cold. Flammable or hazardous materials shall not be stored inside a building. Materials shall be regularly inspected to identify damaged or deteriorating items. Damaged or deteriorated items shall not be used and shall be removed from the site as soon as they are discovered. Stored materials shall not present a hazard or an inconvenience to workers, visitors, and/or other occupants and employees of the facility in which they are located.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 WORK PROCEDURES

The Contractor shall perform work following practices and procedures described accident prevention plan.

3.1.1 Lead Hazard Control Areas, Equipment and Procedures

The Contractor shall set up lead hazard control areas and operate equipment within the lead hazard control area in a manner that will minimize migration of lead dust beyond the lead hazard control area boundaries and minimize exposure to workers.

3.1.2 Lead Hazard Control Areas

Access into lead hazard control areas by the general public shall be prohibited. Workers entering the lead hazard control area shall meet medical surveillance requirements of this contract and shall be required to understand and follow procedures described in the Contractor's accident prevention plan for reducing lead exposure.

3.2 USE OF HYGIENE FACILITIES

a. Personnel and equipment shall be decontaminated when exiting the lead hazard control area. The Contractor shall comply with the following personnel and equipment decontamination procedures:

(1) HEPA vacuum outer garments and equipment.
(2) Wet Wipe Equipment.
(3) Remover outer layer of garments.
(4) Thoroughly wash face and hands, if showering not required.
(5) Shower (if applicable).
(6) Remove Respirator (if applicable).
(7) Exit lead hazard control area.

b. The Contractor shall provide, and workers shall use, a change room to change into work clothing at the beginning of a work shift. At the end of the work shift workers shall change back into street clothing and leave contaminated work clothing at the site for disposal or laundering.

c. The Contractor shall provide an eating facility as free as practical from lead contamination. Workers shall be allowed usage of the eating facility for rest/lunch breaks.

3.3 WASTE DISPOSAL PROCEDURES

3.3.1 Construction Debris and/or Sanitary Landfill Waste

The Contractor shall dispose of the all non-hazardous wastes in one or more properly permitted landfills. Unpainted concrete can be disposed of in the Clean Concrete Disposal areas on Eielson Air Force Base. Hazardous wastes shall be properly tested, packaged, labled and delivered to the Air Force along with the results of analysis. The Air Force will Dispose of the hazardous waste.

3.3.2 Waste Stream Classification

The Contractor shall determine the RCRA waste classification for all waste streams generated by the lead hazard control project. The Contractor shall perform the sampling and analysis specified in paragraph WASTE DISPOSAL, evaluate analytical results and propose waste stream treatment and disposal requirements for the contract. The Contracting Officer will approve waste stream treatment and disposal requirements proposed by the Contractor.

3.3.3 Hazardous Waste Transportation and Disposal

The Contractor shall transport, treat and dispose of hazardous waste in accordance with all applicable regulations.

3.4 LEAD HAZARD CONTROL PROCEDURES, METHODS AND TECHNIQUES.

3.4.1 Paint Removal Methods

Prohibited paint removal methods shall include: open flame burning or torching, including the use of heat guns having operating temperatures greater than 1,100 degrees F; machine sanding or grinding without HEPA exhaust; non-contained hydro blasting or high-pressure water wash; abrasive blasting or sandblasting without HEPA exhaust; dry scraping, except near electrical outlets or when using a heat gun. Chemical paint removers containing methylene chloride are prohibited. Building components and structures adjacent to the removal process shall be appropriately protected from damage due to the removal process employed. Stripping shall be done according to manufacturer's recommendations. Stripped substrates shall be thoroughly washed and neutralized before applying a primer or sealing coat.

3.4.1.1 Low Temperature Heat Gun

Prior to beginning work, electrical fuses and adequate electrical supply shall be verified. Only fuses properly sized for the service, and otherwise permitted by code, shall be used. Properly sized fuses shall not be changed out with larger fuses to increase amperage beyond safe limits. Portable electric generators may be used to safely supply adequate

amperage. An accessible garden hose with a pressure-release spray nozzle; a crowbar to remove smoldering wood; and a long-handled sledgehammer to open up walls exposed to smoldering insulation shall be readily available. A fully charged ABC-type (20 pound minimum) fire extinguisher shall be available within 100 feet of the work area. Adequate ventilation shall be provided for the work area. Worker protection shall include respirators equipped with combination HEPA filter/organic vapor cartridges. The Contractor shall equip heat guns with extension tubes or wire mesh as needed to prevent premature burnout of the heating elements and to minimize paint film scorching or smoking. Optimal heat gun/substrate separation is typically 3 to 6 inches.

3.4.1.2 HEPA Sanding

The HEPA vacuum shall be correctly sized to provide adequate airflow, permitting the system to operate properly. If longer exhaust hoses are used, a larger HEPA vacuum shall be provided to handle the extra pressure drop in the vacuum hose. The HEPA filter shall be operated in accordance with manufacturer's instructions. Worker protection shall include respirators or filtering facepieces equipped with HEPA filters.

3.4.1.3 Wet Scraping

Surfaces near electrical outlets shall not be moistened but shall be dry scraped only. Loose material shall be scraped from the surface and deposited onto the containment plastic. Damp scrapings shall be cleaned up as soon as possible to prevent tracking throughout the work area. Scraper blades shall be kept sharp. Additional scraper blades shall be supplied and shall be selected for the type of surface being scraped.

3.4.1.4 HEPA Vacuum Blasting

The blast head shall be shrouded under a vacuum and exhaust passed through a HEPA filter. The blast head shall remain in continuous contact with the surface to avoid dispersal of both the blast medium and particulate. The equipment shall be equipped with a device that separates the blast media from the material to be removed, effectively recycling the blast material and minimizing the amount of waste. Work shall be positioned to minimize the degree workers must reach above shoulder level, in order to minimize worker fatigue and loss of blast head contact with the surface.

3.4.1.5 HEPA Vacuum Needle Gun

The vacuum needle gun head shall be equipped with a vacuum shroud designed for the surface to be treated. The needle gun shall be operated to maximize surface contact of the vacuum shroud. Work shall be positioned to minimize the degree workers must reach above shoulder level, in order to minimize worker fatigue and loss of needle gun contact with the surface.

3.5 CLEARANCE PROCEDURES

3.5.1 Visual Inspection

QSHP shall perform a visual inspection, using the form at the end of this section, for each lead hazard control area to assure that lead hazard control activities, identified in the individual work task data elements, have been properly completed. The QSHP shall visually verify that lead hazards have been removed, control technology has been appropriately applied/installed and that the lead hazard control area is free of dust and

paint chips generated by lead hazard control activities.

3.6 EVALUATION OF SAMPLING AND MONITORING RESULTS

Analytical results from samples taken during lead hazard control activities shall be evaluated to determine compliance with occupational safety and health standards and project specific control efficiency and clearance/clean up levels.

3.6.1 Occupational Safety and Health

The QSHP shall review the analytical results from samples taken for the initial exposure assessment and continued occupational safety and health monitoring if required. Effectiveness and adequacy of personal protective equipment, respirators, work practices, hygiene facilities and personal decontamination procedures shall be evaluated and upgrades/downgrades in equipment and procedures made. After notifying the Contracting Officer the following shall be applied:

a. Exposures over the PEL (0.05 mg/cubic meter):

(1) Improve work practices to reduce exposures.

(2) Don respirators.

(3) Assure eating facilities and change rooms are clean and are free from settled dust.

(4) Shower as part of personal decontamination.

b. Exposures over the Action Level (0.03 mg/cubic meter):

(1) Assure exposed individuals enrolled in the medical surveillance program.

(2) Assure exposed individuals enrolled in and up to date with lead exposure training requirements.

3.6.2 Control Efficiency of Containment Features

The QSHP shall review and document results of the visual inspection determining visual clearance criteria are being met while lead hazard control activities are being performed. The QSHP shall review analytical results from samples taken to determine if lead is migrating outside lead hazard control areas at levels in excess of clearance criteria. The QSHP shall notify the Contracting Officer and apply the following actions if results exceed project specific clearance levels outside the lead hazard control area:

a. Require/improve containment.

b. Improve work practices to reduce lead aerosol generation.

3.6.3 Removal of Lead Hazard Control Area

Upon acceptance of the final clearance certification by the Contracting Officer, and when authorized, cleared Lead Hazard Control Area boundary controls and warning signs shall be removed.

3.7 CLEARANCE REPORT

The QSHP shall prepare a clearance report including the following information:

a. Start and completion dates of lead hazard control activities.

b. Type of lead hazard control activity performed (i.e., abatement, interim control, renovation, remodeling), locations and lead hazards controlled or abated.

c. The name and address of each firm conducting lead hazard control activities and the name of each supervisor assigned to the project.

d. A detailed written description of the lead hazard control activities performed, including hazard control methods used, locations of rooms and/or components where lead hazard control activities occurred, reason for selecting particular hazard control methods for each component, and any suggested monitoring of encapsulants or enclosures.

e. Hazardous waste disposal documentation.

f. Certification of each Final Cleaning and Visual Inspection performed by the QSHP.

3.8 TITLE TO MATERIALS

Materials resulting from demolition work shall be come the property of the Contractor, and shall be disposed of in accordance with all applicable federal and state regulations.

3.9 PAYMENT FOR HAZARDOUS WASTE

Payment for disposal of hazardous waste will not be made until a signed copy of the manifest from the treatment or disposal facility certifying the amount of lead-containing materials delivered is returned and a copy is furnished to the Government.

3.10 CERTIFICATION OF VISUAL INSPECTION

Certify that the lead hazard control area(s) for each individual work task data elements have passed visual clearance criteria and are ready for clearance sampling. To pass visual clearance, lead hazards have to be removed; control technology appropriately applied/installed; the lead hazard control area must be free from visible dust debris, paint chips or any other residue that may have been generated by the lead hazard control activities.

Signature by the QSHP indicates that the described lead hazard control area(s) have passed visual clearance criteria. Provide detailed description of each Lead Hazard Control Area.

_____

_____

_____

BY:_____
QSHP Date

Print name and title _____

CONTRACTING OFFICER ACCEPTANCE OR REJECTION

The Contracting Officer hereby determines that the Contractor has performed visual inspection of the lead hazard control area and by quality assurance inspection, finds the Contractor's work to be:

_____ Acceptable, ready for performance of clearance sampling

_____ Unacceptable, Contractor instructed to re-clean the lead hazard control area

BY: Contracting Officer's Representative

_____
Signature Date

Print name and title_____

Lead Hazard Control Clearance Sampling Certification Form

Date_____

Name of QSHP or Certified Risk Assessor_____

License No._____

Work Task Data Element _____

Clearance Levels_____
40 CFR 745 Clearance Levels
24 CFR 35 Clearance Levels

Sample quantity and location:
Windows _____
Floors _____
Exterior Soils _____

Date of sample collection_____Date Shipped to lab_____

Shipped by_____
Signature

-- End of Section --

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DIVISION 13 - SPECIAL CONSTRUCTION

SECTION 13851

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SECTION 13851

FIRE DETECTION AND ALARM SYSTEM, ADDRESSABLE

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI S3.41	(1990; R 1996) Audible Emergency Evacuation Signal

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C62.41	(1991; R 1995) Surge Voltages in Low-Voltage AC Power Circuits

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 1221	(1999) Installation, Maintenance and Use of Public Fire Service Communication Systems
NFPA 70	(2002) National Electrical Code
NFPA 72	(1999) National Fire Alarm Code
NFPA 90A	(1999) Installation of Air Conditioning and Ventilating Systems

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

47 CFR 15	Radio Frequency Devices

UNDERWRITERS LABORATORIES (UL)

UL 6	(2000) Rigid Metal Conduit
UL 38	(1999) Manually Actuated Signaling Boxes for Use with Fire-Protective Signaling Systems
UL 268	(1996; Rev thru Jan 1999) Smoke Detectors for Fire Protective Signaling Systems
UL 268A	(1998) Smoke Detectors for Duct Application
UL 464	(1996; Rev thru May 1999) Audible Signal Appliances

UL 521	(1999) Heat Detectors for Fire Protective Signaling Systems
UL 797	(1993; Rev thru Mar 1997) Electrical Metallic Tubing
UL 864	(1996; Rev thru Mar 1999) Control Units for Fire Protective Signaling Systems
UL 1242	(1996; Rev Mar 1998) Intermediate Metal Conduit
UL 1971	(1995; Rev thru Apr 1999) Signaling Devices for the Hearing Impaired

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Fire Alarm Reporting System; G-AE

Detail drawings, prepared and signed by a Registered Professional Engineer or a NICET Level 3 Fire Alarm Technician, consisting of a complete list of equipment and material, including manufacturer's descriptive and technical literature, catalog cuts, and installation instructions. Note that the contract drawings show layouts based on typical detectors. The Contractor shall check the layout based on the actual detectors to be installed and make any necessary revisions in the detail drawings. The detail drawings shall also contain complete wiring and schematic diagrams for the equipment furnished, equipment layout, and any other details required to demonstrate that the system has been coordinated and will properly function as a unit. Detailed point-to-point wiring diagram shall be prepared and signed by a Registered Professional Engineer or a NICET Level 3 Fire Alarm Technician showing points of connection. Diagram shall include connections between system devices, appliances, control panels, supervised devices, and equipment that is activated or controlled by the panel.

SD-03 Product Data

Storage Batteries; G-AE

Substantiating battery calculations for supervisory and alarm power requirements. Ampere-hour requirements for each system component and each panel component, and the battery recharging period shall be included.

Voltage Drop; G-AE

Voltage drop calculations for notification appliance circuits to indicate that sufficient voltage is available for proper appliance

operation.

Special Tools and Spare Parts; G-AO

Spare parts data for each different item of material and equipment specified, not later than 3 months prior to the date of beneficial occupancy. Data shall include a complete list of parts and supplies with the current unit prices and source of supply and a list of the parts recommended by the manufacturer to be replaced after 1 year of service.

Technical Data and Computer Software; G-AO

Technical data which relates to computer software.

Training; G-AO

Lesson plans, operating instructions, maintenance procedures, and training data, furnished in manual format, for the training courses. The operations training shall familiarize designated government personnel with proper operation of the fire alarm system. The maintenance training course shall provide the designated government personnel adequate knowledge required to diagnose, repair, maintain, and expand functions inherent to the system.

Testing; G-AO

Detailed test procedures, prepared and signed by a Registered Professional Engineer or a NICET Level 3 Fire Alarm Technician, for the fire detection and alarm system 60 days prior to performing system tests.

SD-06 Test Reports

Testing; G-AO

Test reports, in booklet form, showing field tests performed to prove compliance with the specified performance criteria, upon completion and testing of the installed system. Each test report shall document readings, test results and indicate the final position of controls. The Contractor shall include the NFPA 72 Certificate of Completion and NFPA 72 Inspection and Testing Form, with the appropriate test reports.

SD-07 Certificates

Equipment; G-AO

Certified copies of current approvals or listings issued by an independent test lab if not listed by UL, FM or other nationally recognized testing laboratory, showing compliance with specified NFPA standards.

Qualifications; G-AO

Proof of qualifications for required personnel. The installer shall submit proof of experience for the Professional Engineer, fire alarm technician, and the installing company.

SD-10 Operation and Maintenance Data

Technical Data and Computer Software; G-AO

Six copies of operating manual outlining step-by-step procedures required for system startup, operation, and shutdown. The manual shall include the manufacturer's name, model number, service manual, parts list, and complete description of equipment and their basic operating features. Six copies of maintenance manual listing routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guide. The manuals shall include conduit layout, equipment layout and simplified wiring, and control diagrams of the system as installed. The manuals shall include complete procedures for system revision and expansion, detailing both equipment and software requirements. Original and backup copies of all software delivered for this project shall be provided, on each type of media utilized. Manuals shall be approved prior to training.

1.3 GENERAL REQUIREMENTS

1.3.1 Standard Products

Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products for at least 2 years prior to bid opening. Equipment shall be supported by a service organization that can provide service within 24 hours of notification.

1.3.2 Nameplates

Major components of equipment shall have the manufacturer's name, address, type or style, voltage and current rating, and catalog number on a noncorrosive and nonheat-sensitive plate which is securely attached to the equipment.

1.3.3 Keys and Locks

Locks shall be keyed alike. Four keys for the system shall be provided.

1.3.4 Tags

Tags with stamped identification number shall be furnished for keys and locks.

1.3.5 Verification of Dimensions

After becoming familiar with details of the work, the Contractor shall verify dimensions in the field and shall advise the Contracting Officer of any discrepancy before performing the work.

1.3.6 Compliance

The fire detection and alarm system and the central reporting system shall be configured in accordance with NFPA 72; exceptions are acceptable as directed by the Contracting Officer. The equipment furnished shall be compatible and be UL listed, FM approved, or approved or listed by a nationally recognized testing laboratory in accordance with the applicable NFPA standards.

1.3.7 Qualifications

1.3.7.1 Engineer and Technician

a. Registered Professional Engineer with verification of experience and at least 4 years of current experience in the design of the fire protection and detection systems.

b. National Institute for Certification in Engineering Technologies (NICET) qualifications as an engineering technician in fire alarm systems program with verification of experience and current NICET certificate.

c. The Registered Professional Engineer may perform all required items under this specification. The NICET Fire Alarm Technician shall perform only the items allowed by the specific category of certification held.

1.3.7.2 Installer

The installing Contractor shall provide the following: Fire Alarm Technicians to perform the installation of the system. A Fire Alarm Technician with a minimum of 4 years of experience shall perform/supervise the installation of the fire alarm system. Fire Alarm Technicians with a minimum of 2 years of experience shall be utilized to assist in the installation and terminate fire alarm devices, cabinets and panels. An electrician shall be allowed to install wire or cable and to install conduit for the fire alarm system. The Fire Alarm technicians installing the equipment shall be factory trained in the installation, adjustment, testing, and operation of the equipment specified herein and on the drawings.

1.3.7.3 Design Services

Installations requiring designs or modifications of fire detection, fire alarm, or fire suppression systems shall require the services and review of a qualified fire protection engineer. For the purposes of meeting this requirement, a qualified fire protection engineer is defined as an individual meeting one of the following conditions:

a. An engineer having a Bachelor of Science or Masters of Science Degree in Fire Protection Engineering from an accredited university engineering program, plus a minimum of 2 years' work experience in fire protection engineering.

b. A registered professional engineer (P.E.) in fire protection engineering.

c. A registered PE in a related engineering discipline and member grade status in the National Society of Fire Protection Engineers.

d. An engineer with a minimum of 10 years' experience in fire protection engineering and member grade status in the National Society of Fire Protection Engineers.

1.4 SYSTEM DESIGN

1.4.1 Operation

The fire alarm and detection system shall be a complete, supervised fire alarm reporting system. The system shall be activated into the alarm mode by actuation of any alarm initiating device. The system shall remain in the alarm mode until the initiating device is reset and the fire alarm control panel is reset and restored to normal. Alarm initiating devices shall be connected to initiating device circuits (IDC), Style D, to signal line circuits (SLC), Style 6, in accordance with NFPA 72. Alarm notification appliances shall be connected to notification appliance circuits (NAC), Style Z in accordance with NFPA 72. A looped conduit system shall be provided so that if the conduit and all conductors within are severed at any point, all IDC, NAC and SLC will remain functional. The conduit loop requirement is not applicable to the signal transmission link from the local panels (at the protected premises) to the Supervising Station (fire station, fire alarm central communication center). Textual, audible, and visual appliances and systems shall comply with NFPA 72. Fire alarm system components requiring power, except for the control panel power supply, shall operate on 24 Volts dc. Addressable system shall be microcomputer (microprocessor or microcontroller) based with a minimum word size of eight bits and shall provide the following features:

a. Sufficient memory to perform as specified and as shown for addressable system.

b. Individual identity of each addressable device for the following conditions: alarm; trouble; open; short; and appliances missing/failed remote detector - sensitivity adjustment from the panel for smoke detectors

c. Capability of each addressable device being individually disabled or enabled from the panel.

d. Each SLC shall be sized to provide 40 percent addressable expansion without hardware modifications to the panel.

1.4.2 Operational Features

The system shall have the following operating features:

a. Monitor electrical supervision of IDC, SLC, and NAC.

b. Monitor electrical supervision of the primary power (ac) supply, battery voltage, placement of alarm zone module (card, PC board) within the control panel, and transmitter tripping circuit integrity.

c. A trouble buzzer and trouble LED/LCD (light emitting diode/liquid crystal diode) to activate upon a single break, open, or ground fault condition which prevents the required normal operation of the system. The trouble signal shall also operate upon loss of primary power (ac) supply, low battery voltage, removal of alarm zone module (card, PC board), and disconnection of the circuit used for transmitting alarm signals off-premises. A trouble alarm silence switch shall be provided which will silence the trouble buzzer, but will not extinguish the trouble indicator LED/LCD. Subsequent trouble and supervisory alarms shall sound the trouble

signal until silenced. After the system returns to normal operating conditions, the trouble buzzer shall again sound until the silencing switch returns to normal position, unless automatic trouble reset is provided.

d. A one person test mode. Activating an initiating device in this mode will activate an alarm for a short period of time, then automatically reset the alarm, without activating the transmitter during the entire process.

e. A transmitter disconnect switch to allow testing and maintenance of the system without activating the transmitter but providing a trouble signal when disconnected and a restoration signal when reconnected.

f. Evacuation alarm silencing switch which, when activated, will silence alarm devices, but will not affect the zone indicating LED/LCD nor the operation of the transmitter. This switch shall be over-ridden upon activation of a subsequent alarm from an unalarmed device and the NAC devices will be activated.

g. Electrical supervision for circuits used for supervisory signal services (i.e., sprinkler systems, valves, etc.). Supervision shall detect any open, short, or ground.

h. Confirmation or verification of all smoke detectors. The control panel shall interrupt the transmission of an alarm signal to the system control panel for a factory preset period. This interruption period shall be adjustable from 1 to 60 seconds and be factory set at 20 seconds. Immediately following the interruption period, a confirmation period shall be in effect during which time an alarm signal, if present, will be sent immediately to the control panel. Fire alarm devices other than smoke detectors shall be programmed without confirmation or verification.

i. The fire alarm control panel shall provide supervised addressable relays for HVAC shutdown. An override at the HVAC panel shall not be provided.

j. Provide one person test mode - Activating an initiating device in this mode will activate an alarm for a short period of time, then automatically reset the alarm, without activating the transmitter during the entire process.

k. The fire alarm control panel shall provide the required monitoring and supervised control outputs needed to accomplish elevator recall.

l. The control panel and field panels shall be software reprogrammable to enable expansion or modification of the system without replacement of hardware or firmware. Examples of required changes are: adding or deleting devices or zones; changing system responses to particular input signals; programming certain input signals to activate auxiliary devices.

1.4.3 Alarm Functions

An alarm condition on a circuit shall automatically initiate the following

functions:

a. Transmission of signals over the station radio fire reporting system. The signal shall be common for any device.

b. Visual indications of the alarmed devices on the fire alarm control panel display .

c. Continuous sounding or operation of alarm notification appliances throughout the building as required by ANSI S3.41.

d. Closure of doors held open by electromagnetic devices.

e. Operation of the smoke control system.

f. Deactivation of the air handling units throughout the building.

1.4.4 Primary Power

Operating power shall be provided as required by paragraph Power Supply for the System. Transfer from normal to emergency power or restoration from emergency to normal power shall be fully automatic and not cause transmission of a false alarm. Loss of ac power shall not prevent transmission of a signal via the fire reporting system upon operation of any initiating circuit.

1.4.5 Battery Backup Power

Battery backup power shall be through use of rechargeable, sealed-type storage batteries and battery charger.

1.4.6 Interface With other Equipment

Interfacing components shall be furnished as required to connect to subsystems or devices which interact with the fire alarm system, such as supervisory or alarm contacts in suppression systems, operating interfaces for smoke control systems, door releases, etc.

1.5 TECHNICAL DATA AND COMPUTER SOFTWARE

Technical data and computer software (meaning technical data which relates to computer software) which is specifically identified in this project, and which may be defined/required in other specifications, shall be delivered, strictly in accordance with the CONTRACT CLAUSES, and in accordance with the Contract Data Requirements List, DD Form 1423. Data delivered shall be identified by reference to the particular specification paragraph against which it is furnished. Data to be submitted shall include complete system, equipment, and software descriptions. Descriptions shall show how the equipment will operate as a system to meet the performance requirements of this contract. The data package shall also include the following:

(1) Identification of programmable portions of system equipment and capabilities.

(2) Description of system revision and expansion capabilities and methods of implementation detailing both equipment and software requirements.

(3) Provision of operational software data on all modes of

programmable portions of the fire alarm and detection system.

(4) Description of Fire Alarm Control Panel equipment operation.

(5) Description of auxiliary and remote equipment operations.

(6) Library of application software.

(7) Operation and maintenance manuals as specified in SD-19 of the Submittals paragraph.

1.6 DELIVERY AND STORAGE

Equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variation, dirt, dust, and any other contaminants.

PART 2 PRODUCTS

2.1 CONTROL PANEL

Control Panel shall comply with the applicable requirements of UL 864. Panel shall be modular, installed in a surface mounted steel cabinet with hinged door and cylinder lock. Control panel shall be a clean, uncluttered, and orderly assembled panel containing components and equipment required to provide the specified operating and supervisory functions of the system. The panel shall have prominent rigid plastic, phenolic or metal identification plates for LED/LCDs, zones, SLC, controls, meters, fuses, and switches. Nameplates for fuses shall also include ampere rating. The LED/LCD displays shall be located on the exterior of the cabinet door or be visible through the cabinet door. Control panel switches shall be within the locked cabinet. A suitable means (single operation) shall be provided for testing the control panel visual indicating devices (meters or LEDs/LCDs). Meters and LEDs shall be plainly visible when the cabinet door is closed. Signals and LEDs/LCDs shall be provided to indicate by zone any alarm, supervisory or trouble condition on the system. Each IDC shall be powered and supervised so that a signal on one zone does not prevent the receipt of signals from other devices. Loss of power, including batteries, shall not require the manual reloading of a program. Upon restoration of power, startup shall be automatic, and shall not require any manual operation. The loss of primary power or the sequence of applying primary or emergency power shall not affect the transmission of alarm, supervisory or trouble signals. Visual annunciation shall be provided for LED/LCD visual display as an integral part of the control panel and shall identify with a word description and id number each device. Cabinets shall be provided with ample gutter space to allow proper clearance between the cabinet and live parts of the panel equipment. If more than one modular unit is required to form a control panel, the units shall be installed in a single cabinet large enough to accommodate units. Cabinets shall be painted red.

2.1.1 Circuit Connections

Circuit conductors entering or leaving the panel shall be connected to screw-type terminals with each conductor and terminal marked for identification.

2.1.2 System Expansion and Modification Capabilities

Any equipment and software needed by qualified technicians to implement future changes to the fire alarm system shall be provided as part of this contract.

2.1.3 Addressable Control Module

The control module shall be capable of operating as a relay (dry contact form C) for interfacing the control panel with other systems, and to control door holders or initiate elevator fire service. The module shall be UL listed as compatible with the control panel. The indicating device or the external load being controlled shall be configured as a Style Y notification appliance circuits. The system shall be capable of supervising, audible, visual and dry contact circuits. The control module shall have both an input and output address. The supervision shall detect a short on the supervised circuit and shall prevent power from being applied to the circuit. The control model shall provide address setting means compatible with the control panel's SLC supervision and store an internal identifying code. The control module shall contain an integral LED that flashes each time the control module is polled.

2.1.4 Addressable Initiating Device Circuits Module

The initiating device being monitored shall be configured as a Style D initiating device circuits. The system shell be capable of defining any module as an alarm module and report alarm trouble, loss of polling, or as a supervisory module, and reporting supervisory short, supervisory open or loss of polling. The module shall be UL listed as compatible with the control panel. The monitor module shall provide address setting means compatible with the control panel's SLC supervision and store an internal identifying code. Monitor module shall contain an integral LED that flashes each time the monitor module is polled. Pull stations with a monitor module in a common backbox are not required to have an LED.

2.2 STORAGE BATTERIES

Storage batteries shall be provided and shall be 24 Vdc sealed, lead-calcium type requiring no additional water. The batteries shall have ample capacity, with primary power disconnected, to operate the fire alarm system for a period of 72 hours. Following this period of battery operation, the batteries shall have ample capacity to operate all components of the system, including all alarm signaling devices in the total alarm mode for a minimum period of 15 minutes. Batteries shall be located at the bottom of the panel or in a separate battery cabinet. Batteries shall be provided with overcurrent protection in accordance with NFPA 72. Separate battery cabinets shall have a lockable, hinged cover similar to the fire alarm panel. The lock shall be keyed the same as the fire alarm control panel. Cabinets shall be painted to match the fire alarm control panel.

2.3 BATTERY CHARGER

Battery charger shall be completely automatic, 24 Vdc with high/low charging rate, capable of restoring the batteries from full discharge (18 Volts dc) to full charge within 48 hours. A pilot light indicating when batteries are manually placed on a high rate of charge shall be provided as part of the unit assembly, if a high rate switch is provided. Charger shall be located in control panel cabinet or in a separate battery cabinet.

2.4 ADDRESSABLE MANUAL FIRE ALARM STATIONS

Addressable manual fire alarm stations shall conform to the applicable requirements of UL 38. Manual stations shall be connected into signal line circuits. Stations shall be installed on surface or semi-flush mounted outlet boxes. Manual stations shall be mounted at 48 inches. Stations shall be double action type. Stations shall be finished in red, with raised letter operating instructions of contrasting color. Stations requiring the breaking of glass or plastic panels for operation are not acceptable. Stations employing glass rods are not acceptable. The use of a key or wrench shall be required to reset the station. Gravity or mercury switches are not acceptable. Switches and contacts shall be rated for the voltage and current upon which they operate. Addressable pull stations shall be capable of being field programmed, shall latch upon operation and remain latched until manually reset. Stations shall have a separate screw terminal for each conductor. Surface mounted boxes shall be matched and painted the same color as the mounting surface.

2.5 FIRE DETECTING DEVICES

Fire detecting devices shall comply with the applicable requirements of NFPA 72, NFPA 90A, UL 268, UL 268A, and UL 521. The detectors shall be provided as indicated. Detector base shall have screw terminals for making connections. No solder connections will be allowed. Detectors located in concealed locations (above ceiling, raised floors, etc.) shall have a remote visible indicator LED/LCD. Addressable fire detecting devices, except flame detectors, shall be dynamically supervised and uniquely identified in the control panel. All fire alarm initiating devices shall be individually addressable, except where indicated. Installed devices shall conform to NFPA 70 hazard classification of the area where devices are to be installed.

2.5.1 Heat Detectors

Heat detectors shall be designed for detection of fire by fixed temperature . Heat detector spacing shall be rated in accordance with UL 521. Detectors located in areas subject to moisture, exterior atmospheric conditions, or hazardous locations as defined by NFPA 70 and as shown on drawings, shall be types approved for such locations. Heat detectors located in attic spaces or similar concealed spaces below the roof shall be intermediate temperature rated.

2.5.1.1 Fixed Temperature Detectors

Detectors shall be designed for surface outlet box mounting and supported independently of wiring connections. Detectors shall be designed to detect high heat. The detectors shall have a specific temperature setting of 135 degrees F. The UL 521 test rating for the fixed temperature detectors shall be rated for 15 by 15 ft.

2.5.2 Smoke Detectors

Smoke detectors shall be designed for detection of abnormal smoke densities. Smoke detectors shall be ionization type. Detectors shall contain a visible indicator LED/LCD that shows when the unit is in alarm condition. Detectors shall not be adversely affected by vibration or pressure. Detectors shall be the plug-in type in which the detector base contains terminals for making wiring connections. Detectors that are to be

installed in concealed (above false ceilings, etc.) locations shall be provided with a remote indicator LED/LCD suitable for mounting in a finished, visible location.

2.5.2.1 Ionization Detectors

Ionization detectors with a dual chamber shall be responsive to both invisible and visible particles of combustion. One chamber shall be a reference chamber and the second a sampling chamber. Detectors containing radium shall not be provided. Detectors shall not cause an alarm condition due to anticipated fluctuations in relative humidity. The sensitivity of the detector shall be field adjustable to compensate for operating conditions. Detector shall require no replacement or readjustment to restore it to normal operation after an alarm condition. Each detector shall be capable of withstanding ambient air velocity up to 300 fpm in accordance with UL 268. Addressable smoke detectors shall be capable of having the sensitivity being remotely adjusted by the control panel.

2.5.2.2 Photoelectric Detectors

Detectors shall operate on a light scattering concept using an LED light source. Failure of the LED shall not cause an alarm condition. Detectors shall be factory set for sensitivity and shall require no field adjustments of any kind. Detectors shall have an obscuration rating in accordance with UL 268. Addressable smoke detectors shall be capable of having the sensitivity being remotely adjusted by the control panel.

2.5.2.3 Duct Detectors

Duct-mounted photoelectric smoke detectors shall be furnished and installed where indicated and in accordance with NFPA 90A. Units shall consist of a smoke detector as specified in paragraph Photoelectric Detectors, mounted in a special housing fitted with duct sampling tubes. Detector circuitry shall be mounted in a metallic enclosure exterior to the duct. Detectors shall have a manual reset. Detectors shall be rated for air velocities that include air flows between 500 and 4000 fpm. Detectors shall be powered from the fire alarm panel. Sampling tubes shall run the full width of the duct. The duct detector package shall conform to the requirements of NFPA 90A, UL 268A, and shall be UL listed for use in air-handling systems. The control functions, operation, reset, and bypass shall be controlled from the fire alarm control panel. Lights to indicate the operation and alarm condition; and the test and reset buttons shall be visible and accessible with the unit installed and the cover in place. Detectors mounted above 6 feet and those mounted below 6 feet that cannot be easily accessed while standing on the floor, shall be provided with a remote detector indicator panel containing test and reset switches. Remote lamps and switches as well as the affected fan units shall be properly identified in etched plastic placards. Detectors shall have auxiliary contacts to provide control, interlock, and shutdown functions specified in Section 15951 DIRECT DIGIT CONTROL FOR HVAC. The detectors shall be supplied by the fire alarm system manufacturer to ensure complete system compatibility.

2.6 NOTIFICATION APPLIANCES

Audible appliances shall conform to the applicable requirements of UL 464. Devices shall be connected into notification appliance circuits. Devices shall have a separate screw terminal for each conductor. Audible appliances shall generate a unique audible sound from other devices provided in the

building and surrounding area. Surface mounted audible appliances shall be painted red . Recessed audible appliances shall be installed with a grill that is painted with a factory finish to match the surface to which it is mounted.

2.6.1 Alarm Bells

Bells shall be surface mounted with the matching mounting back box surface mounted . Bells shall be suitable for use in an electrically supervised circuit. Bells shall be the underdome type producing a minimum output rating of 85 dBA at 10 feet. Bells used in exterior locations shall be specifically listed or approved for outdoor use and be provided with metal housing and protective grilles. Single stroke, electrically operated, supervised, solenoid bells shall be used for coded applications.

2.6.2 Visual Notification Appliances

Visual notification appliances shall conform to the applicable requirements of UL 1971 and the contract drawings. Appliances shall have clear high intensity optic lens, xenon flash tubes, and output white light. Strobe flash rate shall be between 1 to 3 flashes per second and a minimum of 75 candela. Strobe shall be surface mounted.

2.6.3 Combination Audible/Visual Notification Appliances

Combination audible/visual notification appliances shall provide the same requirements as individual units except they shall mount as a unit in standard backboxes. Units shall be factory assembled. Any other audible notification appliance employed in the fire alarm systems shall be approved by the Contracting Officer.

2.7 FIRE DETECTION AND ALARM SYSTEM PERIPHERAL EQUIPMENT

2.7.1 Conduit

Conduit and fittings shall comply with NFPA 70, UL 6, UL 1242, and UL 797.

2.7.2 Wiring

Wiring shall conform to NFPA 70. Wiring for 120 Vac power shall be No. 12 AWG minimum. The SLC wiring shall be copper cable in accordance with the manufacturers requirements. Wiring for fire alarm dc circuits shall be No. 16 AWG minimum. Voltages shall not be mixed in any junction box, housing, or device, except those containing power supplies and control relays. Wiring shall conform to NFPA 70. System field wiring shall be solid copper and installed in metallic conduit or electrical metallic tubing, except that rigid plastic conduit may be used under slab-on-grade. Conductors shall be color coded. Conductors used for the same functions shall be similarly color coded. Wiring code color shall remain uniform throughout the circuit. Pigtail or T-tap connections to initiating device circuits, supervisory alarm circuits, and notification appliance circuits are prohibited. T-tapping using screw terminal blocks is allowed for style 5 addressable systems.

2.7.3 Special Tools and Spare Parts

Software, connecting cables and proprietary equipment, necessary for the maintenance, testing, and reprogramming of the equipment shall be furnished to the Contracting Officer. Two spare fuses of each type and size required

shall be furnished. Two percent of the total number of each different type of detector, but no less than two each, shall be furnished. Spare fuses shall be mounted in the fire alarm panel.

2.8 TRANSMITTERS

2.8.1 Radio Alarm Transmitters

Transmitters shall be compatible with proprietary supervising station receiving equipment. Each radio alarm transmitter shall be the manufacturer's recognized commercial product, completely assembled, wired, factory tested, and delivered ready for installation and operation. Transmitters shall be provided in accordance with applicable portions of NFPA 72, NFPA 1221, and 47 CFR 15. Transmitter electronics module shall be contained within the physical housing as an integral, removable assembly. The proprietary supervising station receiving equipment is Monaco D500 and the transceiver shall be fully compatible with this equipment. At the contractors option, and if UL listed, the transmitter may be housed in the same panel as the fire alarm control panel. The transmitter shall be a Monaco BT2-8 and the frequency will be 139.675 MHz. Provide any programming necessary at the central station in order to properly receive the new signals.

2.8.1.1 Transmitter Power Supply

Each radio alarm transmitter shall be powered by a combination of locally available 120-volt ac power and a sealed, lead-calcium battery.

a. Operation: Each transmitter shall operate from 120-volt ac power. In the event of 120-volt ac power loss, the transmitter shall automatically switch to battery operation. Switchover shall be accomplished with no interruption of protective service, and shall automatically transmit a trouble message. Upon restoration of ac power, transfer back to normal ac power supply shall also be automatic.

b. Battery Power: Transmitter standby battery capacity shall provide sufficient power to operate the transmitter in a normal standby status for a minimum of 72 hours and be capable of transmitting alarms during that period.

2.8.1.2 Radio Alarm Transmitter Housing

Transmitter housing shall be NEMA Type 1. The housing shall contain a lock that is keyed identical to the fire alarm system for the building. Radio alarm transmitter housing shall be factory painted with a suitable priming coat and not less than two coats of a hard, durable weatherproof enamel.

2.8.1.3 Antenna

The Contractor shall provide omnidirectional, coaxial, halfwave dipole antennas for radio alarm transmitters with a driving point impedance to match transmitter output. The antenna and antenna mounts shall be corrosion resistant and designed to withstand wind velocities of 100 mph. Antennas shall not be mounted to any portion of the building roofing system.

PART 3 EXECUTION

3.1 INSTALLATION

All work shall be installed as shown, and in accordance with NFPA 70 and NFPA 72, and in accordance with the manufacturer's diagrams and recommendations, unless otherwise specified. Smoke detectors shall not be installed until construction is essentially complete and the building has been thoroughly cleaned.

3.1.1 Power Supply for the System

A single dedicated circuit connection for supplying power from a branch circuit to each building fire alarm system shall be provided. The power shall be supplied as shown on the drawings. The power supply shall be equipped with a locking mechanism and marked in red with the words "FIRE ALARM CIRCUIT CONTROL".

3.1.2 Wiring

Conduit size for wiring shall be in accordance with NFPA 70. Wiring for the fire alarm system shall not be installed in conduits, junction boxes, or outlet boxes with conductors of lighting and power systems. Not more than two conductors shall be installed under any device screw terminal. The wires under the screw terminal shall be straight when placed under the terminal then clamped in place under the screw terminal. The wires shall be broken and not twisted around the terminal. Circuit conductors entering or leaving any mounting box, outlet box enclosure, or cabinet shall be connected to screw terminals with each terminal and conductor marked in accordance with the wiring diagram. Connections and splices shall be made using screw terminal blocks. The use of wire nut type connectors in the system is prohibited. Wiring within any control equipment shall be readily accessible without removing any component parts. The fire alarm equipment manufacturer's representative shall be present for the connection of wiring to the control panel.

3.1.3 Control Panel

The control panel and its assorted components shall be mounted so that no part of the enclosing cabinet is less than 12 inches nor more than 78 inches above the finished floor. Manually operable controls shall be between 36 and 42 inches above the finished floor. Panel shall be installed to comply with the requirements of UL 864.

3.1.4 Detectors

Detectors shall be located and installed in accordance with NFPA 72. Detectors shall be connected into signal line circuits or initiating device circuits as indicated on the drawings. Detectors shall be at least 12 inches from any part of any lighting fixture. Detectors shall be located at least 3 feet from diffusers of air handling systems. Each detector shall be provided with appropriate mounting hardware as required by its mounting location. Detectors which mount in open space shall be mounted directly to the end of the stubbed down rigid conduit drop. Conduit drops shall be firmly secured to minimize detector sway. Where length of conduit drop from ceiling or wall surface exceeds 3 feet, sway bracing shall be provided. Detectors installed in concealed locations (above ceiling, raised floors, etc.) shall have a remote visible indicator LED/LCD in a finished, visible location.

3.1.5 Notification Appliances

Notification appliances shall be mounted 80 inches above the finished floor or 6 inches below the ceiling, whichever is lower.

3.1.6 Annunciator Equipment

Annunciator equipment shall be mounted where indicated on the drawings.

3.1.7 Addressable Initiating Device Circuits Module

The initiating device circuits module shall be used to connect supervised conventional initiating devices (water flow switches, water pressure switches, manual fire alarm stations, high/low air pressure switches, and tamper switches). The module shall mount in an electrical box adjacent to or connected to the device it is monitoring and shall be capable of Style B supervised wiring to the initiating device. In order to maintain proper supervision, there shall be no T-taps allowed on style B lines. Addressable initiating device circuits modules shall monitor only one initiating device each. Contacts in suppression systems and other fire protection subsystems shall be connected to the fire alarm system to perform supervisory and alarm functions as specified in NFPA 72, as indicated on the drawings and as specified herein.

3.1.8 Addressable Control Module

Addressable and control modules shall be installed in the outlet box or adjacent to the device they are controlling. If a supplementary suppression releasing panel is provided, then the monitor modules shall he mounted in a common enclosure adjacent to the suppression releasing panel and both this enclosure and the suppression releasing panel shall be in the same room as the releasing devices. All interconnecting wires shall be supervised unless an open circuit or short circuit abnormal condition does not affect the required operation of the fire alarm system. If control modules are used as interfaces to other systems, such as HVAC or elevator control, they shall be within the control panel or immediately adjacent to it. Control modules that control a group of notification appliances shall be adjacent to the first notification appliance in the notification appliance circuits. Control modules that connect to devices shall supervise the notification appliance circuits. Control modules that connect to auxiliary systems or interface with other systems (non-life safety systems) and where not required by NFPA 72, shall not require the secondary circuits to be supervised. Contacts in suppression systems and other fire protection subsystems shall be connected to the fire alarm system to perform required alarm functions as specified in NFPA 72, as indicated on the drawings and as specified herein.

3.2 OVERVOLTAGE AND SURGE PROTECTION

3.2.1 Power Line Surge Protection

All equipment connected to alternating current circuits shall be protected from surges per IEEE C62.41 B3 combination waveform and NFPA 70. Fuses shall not be used for surge protection. The surge protector shall be rated for a maximum let thru voltage of 350 Volts ac (line-to-neutral) and 350 Volt ac (neutral-to-ground).

3.2.2 Low Voltage DC Circuits Surge Protection

All IDC , except fiber optics, shall have surge protection installed at each point where it exits or enters a building. Equipment shall be protected from surges per IEEE C62.41 B3 combination waveform and NFPA 70. The surge protector shall be rated to protect the 24 Volt dc equipment. The maximum dc clamping voltages shall be 36 V (line-to-ground) and 72 Volt dc (line-to-line).

3.2.3 Signal Line Circuit Surge Protection

All SLC cables/conductors, except fiber optics, shall have surge protection/isolation circuits installed at each point where it exits or enters a building. The circuit shall be protected from surges per IEEE C62.41 B3 combination waveform and NFPA 70. The surge protector/isolator shall be rated to protect the equipment.

3.3 GROUNDING

Grounding shall be provided by connecting to building ground system.

3.4 SUPERVISING STATION PROVISIONS

The proprietary type Supervising Station (PSS) is located in building 1206.

3.4.1 Revisions to Existing Facilities

Existing supervising components shall be modified as indicated on the drawings and programming shall be updated if required to accommodate the revised configuration. Acceptance testing shall include procedures that would demonstrate that operation of existing equipment has not been degraded and that the revised configuration plus interfacing components operates compatibly with the new fire alarm system at the protected premises. Work on existing equipment shall be performed in accordance with the manufacturer's instructions or under supervision of the manufacturer's representative.

3.5 TESTING

The Contractor shall notify the Contracting Officer at least 10 days before the preliminary and acceptance tests are to be conducted. The tests shall be performed in accordance with the approved test procedures in the presence of the Contracting Officer. The control panel manufacturer's representative shall be present to supervise tests. The Contractor shall furnish instruments and personnel required for the tests.

3.5.1 Preliminary Tests

Upon completion of the installation, the system shall be subjected to functional and operational performance tests including tests of each installed initiating and notification appliance, when required. Tests shall include the meggering of system conductors to determine that the system is free from grounded, shorted, or open circuits. The megger test shall be conducted prior to the installation of fire alarm equipment. If deficiencies are found, corrections shall be made and the system shall be retested to assure that it is functional. After completing the preliminary testing the Contractor shall complete and submit the NFPA 72, Certificate of Completion.

3.5.2 Acceptance Test

Acceptance testing shall not be performed until the Contractor has completed and submitted the Certificate of Completion. Testing shall be in accordance with NFPA 72. The recommended tests in NFPA 72 shall be considered mandatory and shall verify that previous deficiencies have been corrected. The Contractor shall complete and submit the NFPA 72, Inspection and Testing Form. The test shall include all requirements of NFPA 72 and the following:

a. Test of each function of the control panel.

b. Test of each circuit in both trouble and normal modes.

c. Tests of each alarm initiating devices in both normal and trouble conditions.

d. Tests of each control circuit and device.

e. Tests of each alarm notification appliance.

f. Tests of the battery charger and batteries.

g. Complete operational tests under emergency power supply.

h. Visual inspection of wiring connections.

i. Opening the circuit at each alarm initiating device and notification appliance to test the wiring supervisory feature.

j. Ground fault

k. Short circuit faults

l. Stray voltage

m. Loop resistance

3.6 TRAINING

Training course shall be provided for the operations and maintenance staff. The course shall be conducted in the building where the system is installed or as designated by the Contracting Officer. The training period for systems operation shall consist of 1 training days (8 hours per day) and shall start after the system is functionally completed but prior to final acceptance tests. The training period for systems maintenance shall consist of 1 training days (8 hours per day) and shall start after the system is functionally completed but prior to final acceptance tests. The instructions shall cover items contained in the operating and maintenance instructions. In addition, training shall be provided on performance of expansions or modifications to the fire detection and alarm system. The training period for system expansions and modifications shall consist of at least 1 training days (8 hours per day) and shall start after the system is functionally completed but prior to final acceptance tests.

-- End of Section --

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DIVISION 14 - CONVEYING SYSTEMS

SECTION 14602

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SECTION 14602

CRANES, SINGLE-GIRDER BRIDGE

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN BEARING MANUFACTURERS ASSOCIATION (ABMA)

AFBMA Std 9	(1990) Load Ratings and Fatigue Life for Ball Bearings
AFBMA Std 11	(1990) Load Ratings and Fatigue Life for Roller Bearings

AMERICAN GEAR MANUFACTURERS ASSOCIATION (AGMA)

AGMA 9005-D	(1994) Industrial Gear Lubrication

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC Pub No. S329	(1985; Appx A Jun 1994) Allowable Stress Design Specification for Structural Joints Using ASTM A 325 or A 490 Bolts

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 325	(2002) Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
ASTM A 490	(2002) Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength

ASME INTERNATIONAL (ASME)

ASME B30.16	(1999) Overhead Hoists (Underhung)
ASME HST-2M	(1989; R 1995) Hand Chain Manually Operated Chain Hoists

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1	(2000) Structural Welding Code - Steel
AWS D14.1	(1997) Welding Industrial and Mill Cranes and Other Material Handling Equipment

MATERIAL HANDLING INDUSTRY OF AMERICA (MHI)

MHI CMAA 74	(1994) Top Running and Under Running, Single Girder Electric Overhead Traveling Cranes Utilizing Under Running Trolley Hoist

1.2 SYSTEM DESCRIPTION

1.2.1 General Requirements

1.2.1.1 Standard Products

Materials and equipment shall be standard products of manufacturers regularly engaged in the fabrication of cranes and hoists and shall essentially duplicate items which have been in satisfactory use for at least 2 years prior to bid opening. Any company licensed by a crane and hoist manufacturer to manufacture cranes and hoists bearing their name shall have the design and components approved by the licensor prior to submission to the Government for approval.

1.2.1.2 Nameplates

Each major component of equipment shall have the manufacturer's name, address, type or style, model or catalog number, and serial number on a metal plate secured to the equipment.

1.2.1.3 Verification of Dimensions

The Contractor shall verify all dimensions in the field and shall advise the Contracting Officer of any discrepancy before performing any work.

1.2.1.4 Welding

Welding shall be in accordance with qualified procedures using AWS D14.1 as modified herein. Written welding procedures shall specify the Contractor's standard dimensional tolerances for deviation from camber and sweep and such tolerances shall not exceed those specified in AWS D14.1. All welding shall be performed indoors. Welders and welding operators shall be qualified in accordance with AWS D1.1 or AWS D14.1. Allowable stress values shall be in accordance with MHI CMAA 74.

1.2.2 Design Criteria

The bridge crane and hoist shall be designed to operate in the spaces indicated on the structural drawings. The hook coverage and hook vertical travel shall not be less than that indicated.

1.2.2.1 Classification

The crane shall be designed and constructed to MHI CMAA 74 Class A2 service requirements for operation in indoor hazardous environment.

The hoist shall be designed and constructed to ASME HST-2M, service requirements for operation in hazardous environment.

1.2.2.2 Hoist Characteristics

Hoist shall be hand chain operated. Each hoist shall have the capacity, lift-height, suspension, and operating characteristics indicated and as follows:

a. Hoist capacity shall be 1 ton.

b. Hoist shall be a standard lift with a minimum lift of 11 feet.

c. The hoist shall be the lug-suspension type, mounted on an underrunning hand geared trolley.

d. The hoist and suspension shall be the standard or minimum headroom type as required.

e. Components of the hoist shall be designed and constructed for safety of operation and durability of components. Replacement parts shall be interchangeable and readily accessible.

1.2.2.3 Bridge Crane Characteristics

The bridge crane shall be underrunning single-girder overhead traveling crane utilizing an underrunning trolley hoist and a hand operated chain drive.

1.2.2.4 Capacity Plates

Two capacity plates shall be provided, one for each side of the bridge. Each plate shall be lettered to indicate the total rated hoisting capacity of the crane. All lettering shall be of sufficient size to be easily read from the floor. Each lower load block shall be marked with the hoist rated capacity. Rated load of the hoist shall be marked in accordance with ASME B30.16.

1.2.3 Definitions

1.2.3.1 Capacity

Capacity shall mean the rated load in pounds, or tons of 2,000 pounds each, specified by the manufacturer for the hoist and marked plainly on the hoist and loadblock so as to be clearly legible. In determining the applied load, the weight of the handling devices shall be included.

1.2.3.2 Rated Lift

Rated lift shall mean the distance between the upper and lower elevations of travel of the load block.

1.2.3.3 Headroom

Headroom shall be measured with the load hook in the highest position with full load which is the distance between the saddle of the load hook and the following points:

a. The bottom of the beam when S-shape runways are used.

b. The top of the bottom flange for all flat, wheel-bearing flange surfaces.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Bridge Crane and Hoist System; G-AE

Detailed drawings shall be submitted containing details required to demonstrate that the system has been coordinated and will properly function as a unit. Drawings shall show proposed layout, anchorage of equipment and appurtenances, runway beams, suspension of runway beams and equipment relationship to other parts of the work including clearances for maintenance and operation.

SD-03 Product Data

Hoist Hook Assembly;
Heat Treatment;

Record of hook material and any heat treatment performed shall be submitted and shall be stamped on the hook shank or documented in certification papers furnished with the hooks.

Bridge Crane System; G-AE

A complete list of equipment and materials, including manufacturer's descriptive data and technical literature, performance charts and curves, catalog cuts, design calculations for the runway beams and runway beam suspension, and installation instructions shall be submitted.

Hoist; G-AE

Manufacturer's catalog data shall be submitted showing the equipment and accessories to be provided. Diagrams, instructions, and other sheets proposed for posting shall be submitted.

Spare Parts;

Spare parts data shall be submitted and shall include a complete list of parts and supplies, with current unit prices and source of supply.

Bridge Crane System;

Diagrams, instructions, and other sheets proposed for posting shall be submitted.

SD-06 Test Reports

Acceptance Testing;

Test reports in booklet form shall be submitted showing all

field tests performed to adjust each component and all field tests performed to prove compliance with the specified performance criteria, upon completion and testing of the installed system. The report shall include the information as required by paragraph ACCEPTANCE TESTING.

SD-07 Certificates

Hoist;
Track Design;
Trolleys;

Certification shall be submitted attesting that each hoist and hoist trolley and track has been factory tested for rated load capacity and operation, and that each hoist complies with the requirements specified.

SD-10 Operation and Maintenance Data

Operation Manuals;

Six copies of operation manuals shall be furnished for the equipment furnished. Operation manuals shall detail the step-by-step procedures required for system startup, operation, and shutdown. Operation manuals shall include the manufacturer's name, model number, parts list, and brief description of all equipment and their operating features. Operation manuals shall include an overall description of the system describing any unique features that may need special attention.

Maintenance Manuals;

Six copies of maintenance manuals shall be furnished for the equipment furnished. Maintenance manuals shall list routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guides. Maintenance manuals shall include a spare parts list of manufacturers recommended spare parts that should be maintained onsite and any long lead time items should be clearly identified. Maintenance manuals shall contain replacement part numbers for the entire assembly.

1.4 DELIVERY AND STORAGE

Equipment delivered shall be placed in indoor storage, protected from the weather, humidity and temperature variations, dirt and dust, or other contaminants.

PART 2 PRODUCTS

2.1 HOIST MECHANICAL EQUIPMENT

2.1.1 Chain Hoist

2.1.1.1 Hoist Load Chain

Noncorroding, nonsparking roller load chain or link load chain shall be AISC Series 300 chrome-nickel alloy corrosion-resistant steel chain designed for hoist service and of sufficient section, hardness, and strength to meet specification requirements and to withstand the tests

specified in ASME HST-2M.

Load chain shall have a safety factor of not less than 5, based on the minimum ultimate strength of the material.

2.1.1.2 Hoist Load-Chain Wheels

Load-chain wheels and roller-chain sprockets and shafts shall be manufactured from steel or heat-treated nodular cast iron. Wheels shall be pocket or sprocket type, shaped to fit the links of the load chain or to accommodate roller chain. Chain shall operate freely and smoothly over load wheels without binding or jamming. The load-chain shaft may be integral with or rigidly connected to the load-chain wheel. Welding of the wheel to the shaft will not be permitted. Load chain shall be provided with surface-hardened, heat-treated steel guides that surround the load wheel and which will prevent wedging or jamming regardless of angle of pull.

2.1.1.3 Hoist Chain Container

A chain container shall be provided for each chain hoist. Design of chain container shall maintain the headroom and clearance requirements of the hoist and shall not interfere with the operation of the load chain or load chain wheel.

2.1.2 Hoist Hook Assembly

Load blocks and hook assembly shall be the nonsparking, noncorroding type, fabricated of AISC Type 304, 18-8 chrome-nickel corrosion-resistant steel; or they shall be a bronze alloy of suitable strength and section for the rated capacity load.

2.1.3 Hoist Gear Assembly

2.1.3.1 Gears

Gears shall be spur, helical, spiral, or bevel-type, accurately machined, and conforming to AGMA standards for this type of service.

2.1.3.2 Gear Shafts

Gear shafts shall be manufactured from high-carbon steel or alloy steel, machined and ground for accurate fit, and splined for fitting to the mating gear.

2.1.3.3 Gear Train Assembly

Gear train assembly shall be totally enclosed in the hoist frame casting and shall operate in a sealed oil bath. Frame casting shall be provided with lubrication fittings and inspection ports.

2.1.4 Hoist Bearings

2.1.4.1 Factory Sealed Bearings

Sprocket bearings, motor bearings, and load-block bearings shall be prelubricated factory sealed bearings.

2.1.5 Hoist Lubrication

Adequate lubrication shall be provided for moving parts of the hoist and trolley and for filling, draining, and checking the level of the lubricant. Lubricant shall be designed for use in an ambient temperature of 54 to 109 degrees F. Lubrication and mechanism housing shall prevent leaking and shall prevent lubricant from coming into contact with equipment. Lubricant shall conform to AGMA 9005-D.

2.1.6 Hoist Frame and Housing

Operating parts of the hoist shall be mounted and enclosed in a sealed, factory-painted metal frame of malleable iron, cast steel, welded steel, or aluminum. Welded or bolted frames shall carry loads on the fabricated pieces. Welds or bolts shall be used only to hold the fabricated parts in position.

2.1.7 Hoist Paint Finish

Each hoist and accessory shall receive a factory-applied paint finish. Hooks shall not be painted.

2.2 TROLLEYS

2.2.1 Paint

Each trolley assembly shall be factory-painted, designed specifically for use with the specified hoist, and shall be furnished by the hoist manufacturer. Paint finish shall be the same type and quality specified for the hoist.

2.2.2 Wheels

2.2.2.1 Load Distribution

Each trolley assembly shall have not less than four wheels. Sufficient wheels shall be provided to properly distribute the load. The load on a wheel shall not exceed 1,200 DW pounds where D equals the diameter of the wheel in inches and W equals the width of the rail head or the nominal length of bearing on the tread.

2.2.2.2 Design and Type

Wheels shall be single-flange type. Noncorroding, nonsparking trolley wheels shall be AISC Type 304 corrosion-resistant steel or suitable copper alloy. Wheels shall be designed to operate on sloped or flat flange I-beams.

2.2.2.3 Bearings

Trolley wheels shall be carried on sealed, permanently lubricated, antifriction bearings designed for axial and thrust loading. Bearings shall conform to the applicable requirements of AFBMA Std 9 and AFBMA Std 11. Bearings shall have an L-10 life of 3,000 hours or more, as defined by AFBMA Std 9 or AFBMA Std 11 as applicable.

2.2.3 Side Plates, Pins, and Axles

2.2.3.1 Side Plates

Side plates shall be fabricated from structural-quality rolled-steel plate milled to the required profile with integral bosses where necessary to support equalizing pins; side plates shall be fitted with steel end bumpers.

2.2.3.2 Pins and Axles

Equalizing pins and axles shall be heat-treated alloy steel, machined and finish ground to the required size.

2.2.4 Gearing

2.2.4.1 Gears

Gears shall be cut from heat-treated alloy steel accurately machined into spur, helical, and pinion gears, conforming to AGMA requirements.

2.2.4.2 Drive Pinions

Drive pinions shall be carburized alloy steel, malleable iron, or bronze, with cut or cast teeth, conforming to AGMA requirements.

2.2.5 Safety Hangers or Lugs

Safety hangers or lugs shall be steel and shall be integral with, or fastened to, each hoist frame or to trolley frame. They shall ride free above the bottom flange of the beam. Hanger shall be of sufficient capacity to hold the hoist, fully loaded, in the I-beam in case of wheel or axle failure. Safety factor of each part of trolley assembly shall be not less than 5, based on the ultimate strength of the material used.

2.3 TROLLEY TYPE

2.3.1 Geared, Manual-Drive Trolley

Geared, manual-drive trolley shall conform to ASME HST-2M and the requirements specified.

2.3.1.1 Gears

Trolleys shall have gears provided on not less than two wheels to permit propelling the hoist along the rail by a gear mechanism operated by a hand chain and wheel.

2.3.1.2 Hand-Chain Wheel

Hand-chain wheel shall be manufactured from steel, malleable iron, high-strength cast iron, or aluminum alloy, with shaped pockets to receive hand chain and with guides that will permit operation of the hand chain from an angle of 10 degrees from either side of the chain wheel without slipping or jumping the wheel rim.

2.3.1.3 Hand Chain

Noncorroding, nonsparking hand chain shall be endless-coil, link-type, fabricated from AISC Type 304 corrosion-resistant steel or suitable bronze

or aluminum alloy. Hand-chain reach distance shall be standard length for specified lift height of hoist and shall reach approximately 30 inches above the operating floor.

2.4 BRIDGE STRUCTURAL ITEMS

2.4.1 Bolts, Nuts, and Washers

Bolts, nuts, and washers shall conform to ASTM A 325 bolts. High-strength bolted connections shall conform to the requirements of AISC Pub No. S329, except that ASTM A 490 bolts shall not be used. No galvanized bolts shall be used.

2.4.2 Bridge Girders

Bridge girders shall be wide-flange beams, standard I-Beams, reinforced beams or sections fabricated from rolled plates and shapes.

2.4.3 End Ties and Bridge Girder End Connections

Horizontal gusset plates shall be provided at the elevation of the top and bottom end tie flanges for connection to girder ends. End connections shall be made using high-strength bolts. Body-bound bolts fitted in drilled and reamed holes shall be used to maintain the crane square.

2.4.4 Bridge End Trucks

End trucks shall be fabricated from structural steel providing a rigid structure and shall be of the rotating or fixed-axle type. A means shall be provided to prevent the crane from dropping more than one inch in case of axle failure.

2.4.5 Runway Beams

The runway beams for the bridge travel shall be of the size recommended by the crane manufacturer and shall be in accordance with MHI CMAA 74.

2.4.6 Hangers

The Contractor shall provide and install all necessary hangers and bracing members required to properly support the crane runway beams and the maximum service loads. Hangers and bracing shall be secured to the structural steel supports at the points approved using clamps, bolts, and/or welding. All bolts or clamps shall be secured with lock washers or other type fastener which will prevent loosening of connections. Hangers and bracing shall be designed to permit ready alignment of runway beams in each direction. Hanger and bracing forces and location of those forces shall be coordinated with the Metal Building Supplier.

2.4.7 Safety End Stops

All ends of runway beams shall be protected by end stops. The bridge crane shall be provided with rubber bumpers to mate with the end stops.

2.5 BRIDGE MECHANICAL EQUIPMENT

2.5.1 Bridge Drives

Bridge shall have a hand operated chain drive system. Noncorroding,

nonsparking hand chain shall be endless-coil, link-type, fabricated from AISC Type 304 corrosion-resistant steel or suitable bronze or aluminum alloy.

2.5.2 Bridge Crane Gear Assembly

2.5.2.1 Gears

Gears shall be spur, helical, spiral, or bevel type, accurately machined, and conforming to AGMA standards for this type of service.

2.5.2.2 Gear Shafts

Gear shafts shall be manufactured from high-carbon steel or alloy steel, machined and ground for accurate fit, and splined for fitting to the mating gear.

2.5.2.3 Gear Train Assembly

Gear train assembly shall be totally enclosed in the drive housing and shall operate in a sealed oil bath. The drive housing shall be provided with lubrication fittings and inspection ports.

2.5.3 Bridge Wheels

2.5.3.1 Wheels

The bridge assembly shall have not less than four wheels. Sufficient wheels shall be provided to properly distribute the load. The load on a wheel shall not exceed 1,200 DW pounds where D equals the diameter of the wheel in inches and W equals the width of the rail head or the nominal length of bearing on the tread.Wheels shall be constructed or noncorroding, nonsparking AISC Type 304 corrosion-resistant steel or suitable copper alloy. Wheels shall be designed to operate on sloped or flat flange I-beams.

2.5.3.2 Bearings

Wheels shall be carried on sealed, permanently lubricated, antifriction bearings designed for axial and thrust loading. Bearings shall conform to the applicable requirements of the AFBMA Std 9 or AFBMA Std 11. Bearings shall have an L-10 life of 3,000 hours or more, as defined by AFBMA Std 9 or AFBMA Std 11 as applicable.

PART 3 EXECUTION

3.1 ERECTION

Erection shall be in accordance with the manufacturer's instructions.

3.2 ACCEPTANCE TESTING

Acceptance testing shall comply with the following paragraphs.

3.2.1 Acceptance Test

The Contractor shall provide all personnel necessary to conduct the tests including but not limited to operators, riggers, rigging gear, and test weights. Testing shall be performed in the presence of Contracting Officer. The Contractor shall notify the Contracting Officer 7 days prior

to testing operations.

3.2.1.1 Test Sequence

The equipment shall be tested according to the applicable paragraphs of this procedure in the sequence provided.

3.2.1.2 Equipment Monitoring

During the load test, improper operation or poor condition of safety devices, mechanical equipment, and structural assemblies shall be monitored. Observed defects critical to continued testing shall be reported immediately to the Contracting Officer and testing shall be suspended until the deficiency is corrected. During and immediately following each load test, the following inspections shall be made:

a. Inspect for evidence of bending, warping, permanent deformation, cracking, or malfunction of structural components.

b. Check chain sprockets for proper operation, freedom of movement, abnormal noise, or vibration.

c. Inspect external gears for abnormal wear patterns, damage, or inadequate lubrication.

3.2.1.3 Hooks

Hooks shall be measured for hook-throat spread before and after load test. A throat dimension base measurement shall be established by installing two tram points and measuring the distance between these tram points (to within 1/64 inch). This base dimension shall be recorded. The distance between tram points shall be measured before and after load test. An increase in the throat opening by more than 1 percent from the base measurement shall be cause for rejection.

3.2.2 No-Load Testing

3.2.2.1 Hoist Operating and Limit Switch Test

The load hook shall be raised and lowered through the full range of normal travel. The test shall be repeated a sufficient number of times (minimum of three) to demonstrate proper operation. Brake action shall be tested in each direction.

3.2.2.2 Trolley Travel

The trolley shall be operated the full distance of the bridge crane rails. The test shall be repeated a sufficient number of times (minimum of three) to demonstrate proper operation.

3.2.2.3 Bridge Crane Travel

The bridge crane shall be operated the full distance of the runway beams using the geared hand chain drive. The test shall be repeated a sufficient number of times (minimum of three) to demonstrate proper operation.

3.2.3 Load Test

3.2.3.1 Hoist

Unless otherwise indicated, the following tests shall be performed using a test load of 125 percent of rated load.

a. Dynamic Load Test: The test load shall be raised and lowered through the full-range. The machinery shall be completely stopped at least once in each direction to ensure proper brake operation.

b. Trolley Dynamic Load Test: While operating the trolley the full distance of the bridge crane rails in each direction with test load on the hook (one cycle).

3.3 FIELD TRAINING

A field training course shall be provided for designated operating staff members. Training shall be provided for a total period of 2 hours of normal working time and shall start after the system is functionally complete but prior to final acceptance tests. Field training shall cover all of the items contained in the operating and maintenance instructions. The Contracting Officer shall be given at least 2 weeks advance notice of such training.

-- End of Section --

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SECTION 15050
MECHANICAL EQUIPMENT, FUELING

PART 1 GENERAL

1.1 REFERENCES

Waiver to Use MilStds and MilSpecs in Air Force Fuel Projects, HQ AFCESA/CESM (01/29/96).

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ASME INTERNATIONAL (ASME)

ASME B16.5	(2003) Pipe Flanges and Flanged Fittings NPS 1/2 thru NPS 24
ASME B40.100	(2000) Pressure Gauges and Gauge Attachments

AMERICAN PETROLEUM INSTITUTE (API)

API RP 1615	(1996) Installation of Underground Petroleum Storage Systems

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 827	(1995a; R 1997el) Change in Height at Early Ages of Cylindrical Specimens from Cementitious Mixtures

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 30	(2000) Flammable and Combustible Liquids Code
NFPA 70	(2002) National Electrical Code

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-P-24441	(Rev. C; Supp. 1) Paint, Epoxy-Polyamide
MIL-T-83133	(Rev. E) Turbine Fuel, Aviation, Kerosene Types, NATO F-34 (JP-8) and NATO F-35

MILITARY STANDARDS (MIL-STD)

MIL-STD-130	(Rev. G; Notice 1) Identification Marking of U.S. Military Property

MIL-STD-161	(Rev. F; Notice 2) Identification Methods for Bulk Petroleum Products Systems Including Hydrocarbon Missile Fuels

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

SAE AMS 3275	(Rev. B, 1999) Sheet, Acrylonitrile Butadiene (NBR) Rubber and Non-Asbestos Fiber Fuel and Oil Resistant

STEEL TANK INSTITUTE (STI)

STI P3	(2000) Exterior Corrosion Protection of Underground Steel Storage Tanks

UNDERWRITERS LABORATORIES (UL)

UL 58	(1998) Steel Underground Tanks for Flammable and Combustible Liquids

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA 40 CFR Part 280	Underground Storage Tanks; Technical Requirements and State Program Approval, Final Rules

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Detail drawings consisting of illustrations, schedules, performance charts, instructions, brochures, diagrams, and other information to illustrate the requirements and operation of the equipment and systems.

Meter; G-AE.

Venturi Tubes; G-AE.

Water Draw-off System; G-AE.

Hydrant Outlet Pits and Isolation Valve Pits; G-AE.

High Point Vent and Low Point Drain Pits; G-AE.

Bowser Pump; G-AE.

Product Recovery Tank Vault; G-AE.

Provide the drawings as one package with the design analysis. Shop fabrication drawings shall include type of material, configuration, thickness, and necessary details of construction of

the steel tank and vault. Shop drawings shall also show the steel grating and supports.

SD-03 Product Data

Manufacturer's Catalog Data

Pressure Gages; G-AE.

Automatic Pump Controls; G-AE.

Meters; G-AE.

Product Recovery Tank and Accessories; G-AE.

Hydrant Outlet Pits and Isolation Valve Pits; G-AE.

High Point Vent and Low Point Drain Pits; G-AE.

Operating Tank Level Indicator; G-AE.

Water Draw-Off System; G-AE.

Meters; G-AE.

Venturi Tubes; G-AE.

Bowser Pumpoff Pump; G-AE.

SD-06 Test Reports

Leak Detection System; G-AE.

SD-07 Certificates

Coating Products; G-AE.

UL Labeled products; G-AE.

STI-P3 labeled products; G-AE.

Pits; G-AE.

System Supplier Experience and Qualification; G-AE

SD-10 Operation and Maintenance Data

Operation and maintenance information shall be submitted for the equipment items or systems listed below. Automatic pump controls shall include step-by-step procedures required for system startup, operation, and shutdown. Refer to Section 01730 FUEL SYSTEM OPERATION AND MAINTENANCE MANUAL for the information to be submitted for various type of equipment and systems.

Pressure Gauges; G-AE.

Automatic Pump Controls; G-AE.

Product Recovery Tank and Accessories; G-AE.

Operating Tank Level Indicator; G-AE.

Water Draw-off System; G-AE.

Bowser Pumpoff Pump; G-AE.

PART 2 PRODUCTS

2.1 DESIGN CONDITIONS

Components shall be suitable for use with JP-8 turbine fuel; specific gravity 0.81 at 60 degrees F., viscosity 1.62 CS at 60 degrees F., Reid vapor pressure less than 0.05 psi, MIL-T-83133. Components to be ANSI Class 150 (275 PSIG at 100 degrees F.) unless noted otherwise. Components to be located outside, shall be suitable for outside, unsheltered location, and to function normally in ambient temperatures between -60 degrees F. and 100 degrees F. Components to be located inside, shall be suitable for and to function normally in ambient temperatures between 0 degrees F. and 100 degrees F, and will have low temperature 0-rings and diaphragms.

2.2 COMPOSITION OF MATERIALS

Materials in contact with the fuel shall be noncorrosive. No zinc-coated metals, brass, bronze, iron, lead or lead alloys, copper or copper alloys, or other light metal alloys containing more than 4% copper shall be used in contact with the fuel.

2.3 ELECTRICAL WORK

Motors, manual or automatic motor control equipment except where installed in motor control centers, and protective or signal devices required for the operation specified herein shall be provided under this section in accordance with Section 16415 ELECTRICAL WORK, INTERIOR. Any wiring required for the operation specified herein, but not shown on the electrical plans, shall be provided under this section in accordance with Section 16415 ELECTRICAL WORK, INTERIOR.

2.4 MATERIALS AND EQUIPMENT

All items of material and equipment shall be new and of the best quality used for the purpose in commercial practice and shall be products of reputable manufacturers. Each major component of equipment shall have the manufacturer's name, address and catalog number on a plate securely affixed in a conspicuous place. The nameplate of a distributing agent only will not be acceptable. The gears, couplings, projecting set screws, keys and other rotating parts located so that any person may come in close proximity thereto shall be fully enclosed or properly guarded. Equipment, assemblies and parts shall be marked for identification in accordance with MIL-STD-130 and MIL-STD-161. Identification tags made of brass, stainless steel, or engraved anodized aluminum, indicating valve number and normally open (NO) or normally closed (NC) shall be installed on valves. Tags shall be 1-3/8 inch minimum diameter, and marking shall be stamped or engraved. Indentations shall be black, for reading clarity. Tags shall be attached to valves with No 12 AWG, copper wire, stainless or aluminum hanging wires, or chrome-plated beaded chain designed for that purpose.

2.4.1 Supplier

The Contractor's attention is directed to the fact that the pump control system, including but not limited to pump control panel, venturi tubes, transmitters, flow switches, fueling system pumps, all field instrumention, and control valves with all hardware and software is an integrated system, shall be furnished by a single systems supplier regularly engaged in the supplying of this equipment. System Supplier shall be a company who's regular, normal, and primary business is representing manufacturers in the distribution and start-up of aviation fueling facilities, and have no affiliation with the contractor other than as a seller to the contractor.Supplier shall provide all equipment and appurtenances regardless of manufacture, be a factory authorized certified representative, and be responsible to the Contractor for satisfactory operation of the entire system, and shall oversee the installation of the equipment. Substitutions of functions specified will not be acceptable. The Contractor and the System Supplier shall be present at the system commissioning, and shall coordinate and schedule the work during construction, testing, calibration, and acceptance of the system.The System Supplier shall be responsible to the Contractor for scheduling all Contractor, Sub-contractor, and manufacturer's service personnel during system start-up and final commissioning.

2.4.1.1 Experiences and Qualifications

Submit the following data for approval:

a. Certification stating that the system supplier has provided and installed at least five PLC-based pump control systems in the five years, for automatic cycling of pumps based upon varying dispensing demands, utilizing multiple pumps. These systems shall be for dispensing jet fuel.

b. Certification that six systems have successfully operated over the last three years and are currently in service.

c. Project names, locations, system description, and items provided at these installations. Include user point-of-contact and current telephone numbers.

2.5 PRESSURE GAGES

Pressure gages shall conform to ASME B40.100 with metal cases and 4-inch diameter white dials. Gages shall be bottom connected, without back flanges. A pulsation dampener, adjustable to the degree of dampening required, shall be provided for each gage. Range of gages shall be as indicated. A ball valve shall be provided for each pressure gage. Gages shall have all parts immersed in silicone oil, except the gauges located outside shall not be filled with silicone oil. Gages shall be labeled with the calibration date.

2.6 GASKETS

Gaskets shall be in accordance with Section 15060 PIPE, MANUAL VALVES, AND FITTINGS, FUELING SYSTEM.

2.7 BOLTS AND NUTS

Bolts and nuts shall be in accordance with Section 15060 PIPE, MANUAL

VALVES, AND FITTINGS, FUELING SYSTEM.

2.8 AUTOMATIC PUMP CONTROLS

The pressure and flow transmitters specified in this paragraph shall be obtained from a single supplier of such products. The same supplier shall also furnish the associated venturi tubes and GPM meter. The supplier shall be responsible for furnishing components that are compatible and that operate as a system to perform the required pump control functions. Control tubing between controls/instruments and fuel lines shall be installed to eliminate air entrapment. Control tubing shall be as specified in Section 15060 PIPE, MANUAL VALVES, AND FITTINGS, FUELING SYSTEM. Each item of equipment specified hereafter shall have manufacturer's authorized service personnel present to assist in PERFORMANCE TESTING as specified in Section 15899 SYSTEM START-UP, FUELING SYSTEM. Items specified under this paragraph shall be submitted for approval concurrently with items specified in Section 15970 PUMP CONTROL AND ANNUNCIATION SYSTEM.

2.8.1 Pressure Indicating Transmitters

Pressure indicating transmitters shall consist of a capacitance sensor operating on a differential in pressure of fuel (one side being open to atmospheric pressure). The output shall be a 4 - 20 mA dc, linear signal between 0 - 100% of the input. It simultaneously will produce a digital HART (Highway Addressable Remote Transducer) output signal. Loop power shall be provided from remote power supply located in the pump control panel (PCP).

a. Transmitter body shall be stainless steel with stainless steel diaphragm capsule process connecting to a 1/2 inch NPT. Drain and vent valves to be stainless steel. Accuracy shall be ± 20 percent of calibrated span including combined effects of linearity, hysteresis and repeatability.

b. Display at the pressure transmitter shall be LCD, one per each transmitter. The digital scale shall be a 4 digit LCD capable of being read in low light/no light conditions. Indicator scale shall be in pounds per square inch gage.

c. Pressure transmitters shall be UL, FM, or CSA listed for Class 1, Division 1, Group D hazardous environment as defined by NFPA 70, with maximum temperature rating T2D (419 degrees F). Each transmitter and dial shall be supplied with a factory assembled two valve stainless steel manifold. Vent valves shall be furnished on upper ports of each transmitter and dial. Pressure transmitters and the indicating dial shall be suitable for mounting on a 2-inch pipe stand. Complete installation shall be in accordance with manufacturer's recommendations.

d. Provide a HART (Highway Addressable Remote Transducer) protocol interface handheld calibration device.

2.8.2 Flow Switches

Switches shall be actuating vane type flow switch with single adjustable set-point. Switches shall mount on ASME B16.5 Class 150 raised face flange. Provide snap action switch mechanism U.L. listed for Class I, Division 1, Group D hazardous locations. Switches to be double pole double throw (DPDT). Switch power shall be 120 volts, single phase, 60 hertz, 10

amps minimum.

2.8.3 Venturi Tubes

a. The venturi tubes shall be provided in conjunction with Section 15970 PUMP CONTROL AND ANNUNCIATION SYSTEM.

b. Start-up, adjustments and calibration, and instruction of personnel in the operation and maintenance of the venturi tubes shall be considered as a required portion of the controls package.

c. The venturi tubes shall be low loss differential pressure producers consisting of a short housing piece and a fully machined, contoured throat section providing a restriction at the center, with both inlet approach and exit having geometrically symmetrical curves. They shall be velocity head, impact, differential producing devices designed to measure differential pressure of JP-8 fuel. They shall be constructed of 304L stainless steel with ANSI Class 150 flanges on each end and be suitable for operation of 275 psig at 100 degrees F. They shall be of sufficient thickness to with-stand the same stresses as the upstream and downstream piping. Each venturi tube shall have a minimum of four 1/2-inch connections. An individual head-capacity curve shall be furnished for each venturi tube.

d. Operating conditions for the venturi tubes shall be as follows:

(1) Issue Venturi Tube. Minimum inlet-to-throat differential pressure at 2,400 gpm: 200 in. H2O.

(2) Return Venturi Tube. Minimum inlet-to-throat differential pressure at 600 gpm: 200 in. H2O.

(3) Venturi tubes discharge coefficient "C" to be greater than or equal to 0.97 over pipe Reynolds number range between 200,000 and 1,000,000 and shall be independent of Beta over a Beta range of 0.4 to 0.75. Pressure loss shall be less than 24 percent of differential pressure generated by the venturi tube. Repeatability of the discharge coefficient "C" shall be 2 percent for Reynolds number range of 10,000 to 1,000,000.

(4) Provide two portable GPM Meters, one for each size of venturi. The meters shall be complete with valves, hoses and connecting disconnects, and carrying case. The meters shall have stainless steel bellows, mounting bracket, 500 psi swp, 6-inch dial with 270 degrees arc. Dial shall read GPM Jet Fuel. Range of scale shall be 1.5 times GPM flow requirement. The venturi manufacturer shall provide the portable meters with the venturi in order to be compatible. The venturi tubes shall also be provided with a suitable table to convert inches differential pressure to gallons per minute.

2.8.4 Differential Pressure Transmitter

Differential pressure transmitter shall consist of a capacitance sensor operating on a differential in pressure of fuel. The output shall be a 4 - 20mA dc, square root signal between a minimum of 4 - 100% of the input. It may be linear between 0 - 4%. It simultaneously will produce a digital HART (Highway Addressable Remote Transducer) output signal. Loop power shall be provided from remote power supply located in the pump control panel (PCP).

a. Transmitter body shall be stainless steel with stainless steel diaphragm capsule process connecting to a 1/2 inch NPT. Drain and vent valves to be stainless steel. Accuracy shall be " 0.20 percent of calibrated span including combined effects of linearity, hysteresis and repeatability.

b. Display at the transmitter shall be LCD, one per each differential pressure transmitter. The digital scale shall be a 4 digit LCD, capable of being read in low light/no light conditions. Indicator scale shall be in gallons per minute.

c. Differential pressure ranges shall be selected as necessary to operate in conjunction with associated venturi tube:

(1) Issue Venturi Tube - 0 to 2400 GPM (full range)

(2) Return Venturi Tube - 0 to 800 (full range)

Each venturi tube shall have two transmitters and one indicating dial per function and shall be installed as indicated on the drawings.

d. Differential pressure transmitters shall be UL, FM, or CSA listed for Class 1, Division 1, Group D hazardous environment as defined by NFPA 70, with maximum temperature rating T2D (419 degrees F). Each transmitter and indicating dial shall be supplied with a factory assembled five valve stainless steel manifold. Vent valves shall be furnished on upper ports of each transmitter and indicating dial. Differential pressure transmitters and the indicating dial shall be suitable for mounting on a 2-inch pipe stand. Complete installation shall be in accordance with manufacturer's recommendations.

2.8.5 Pressure Sensor

Sensor shall be UL, FM, or CSA listed for Class 1, Division 1, Group D hazardous environment as defined by NFPA 70, with maximum temperature rating T3 (392 degrees F). Excitation voltage shall be 12-28 VDC. Output signal shall be 4-20 mA. Unit shall have 0.25% accuracy and have built-in high pressure snubbers, minimum pressure range shall be 0-300 PSI. Wetted material shall be stainless steel.

2.9 METERS

Meter shall be a one-way flow, positive displacement type meter designed for a continuous flow of 600 GPM at the truck fill stand. Meter shall have

ANSI Class 150 flanges and body working pressure of not less than 200 psig and shall be suitable for hydrostatic testing of 275 psig. Meter shall be factory calibrated for JP-8 jet fuel and capable of being calibrated in the field. The register shall have a non-setback total indicator and a setback type run indicator so that individual runs can be registered without affecting the total of all runs as shown on the indicator. The total indicator shall have a minimum of seven figures and the setback run indicator shall have a minimum of six figures. The register shall read in gallons and the smallest unit of indicated delivery shall be 1 gallon. Accuracy shall be within +0.3 percent between ten percent and maximum rated flow. Meters shall be provided with a suitable drain at the bottom, equipped with a ball valve.

2.9.1 Pressure Loss

Pressure loss through the meter shall not exceed 3 psi at 600 gpm flow rate.

2.9.2 Materials of Construction

Materials of construction shall be stainless steel, aluminum or nonferrous material except meter case may be steel with electrolyses nickel plated internals coated to 3 mil thickness. No ferrous or zinc-coated material bronze, brass or other copper bearing alloys shall be used in contact with the fuel.

2.10 RECEIPT FLOW METER

Flow meter shall consist of corner tapped office flanges, office flange plate, differential pressure transducer and flow computer capable of square root extraction for calculating flow rate in gpm. The normal flow range for flow meter is 600 to 1200 gpm. Office flanges shall be ANSI Class 150 and shall be constructed of Type 304 or 304L stainless steel. Beta value shall be 0.70. Maximum pressure loss shall be 3 psi at 1200 gpm. Differential pressure transducer shall have a calibrated range of 0-300" w.c. with a 4-20mA output. Accuracy shall be 0.25% of the calibrated range or better. Flow computer shall calculate flow in gpm, from the differential pressure transducer output. Flow computer and pressure transducer shall be located in the pump room and shall be suitable for the installation in Class 1, Division 1, Group D hazardous locations. Flow computer shall have a digital display giving a local readout in gpm, minimum four figures, with a 4-20 mA output to the process control system.

2.11 PRODUCT RECOVERY TANK AND ACCESSORIES

2.11.1 Tank Construction

Product recovery tank shall be a U.L. labeled, double wall, steel tank, with interstitial monitor. Tank shall be provided with calibrated gage stick and strapping chart. Tank shall be provided with a steel vault attached to tank. Vault shall be provided with a vault cover and removable access grating. Minimum inner and outer tank wall thickness shall be 0.167 inches.

2.11.1.1 Steel Tank With Vault

a. The design, fabrication, erection, testing, and inspection of the double wall tank shall conform to the requirements of UL 58, Standard for Safety, Steel Underground Tanks for Flammable and Combustible Liquids, Type II. The exterior tank walls shall be separated from the interior walls by

standoffs.

b. Material shall be carbon steel plate.

c. Lifting lugs shall be located at the balance points.

d. Provide anchor straps to attach tank to hold down slab. Straps shall be separated from the tank by a pad made of inert insulating material. Number and location of straps shall be as indicated on the drawings.

e. Tank capacity, connections and appurtenance shall be as shown on the drawings and as described under "Monitor."

f. A complete system of cathodic protection shall be provided for the tank and vault in accordance with Section 13110 CATHODIC PROTECTION SYSTEM (SACRIFICIAL ANODE) .

g. The interior and exterior surfaces of tank and vault shall be coated for corrosion protection. The interior surface shall be coated in accordance with MIL-P-24441, Formulas 150, 151, and 152. The exterior surface shall be coated in accordance with STI-P3 and the tank shall bear the STI P3 label.

2.11.1.2 Leak Detection Monitor

a. An annular space shall be provided between the primary and secondary shells to allow for the free flow and containment of all leaked product from the primary tank.

b. The tank shall be provided with a leak monitoring system capable of sensing leaks in the secondary containment space and in the vault. The system shall detect a leak of fuel through the inner shell to the area between the inner and outer shells or a leak of ground water through the outer shell into the area between the inner and outer shells. The detector and any equipment in the area of the fuel tanks and valve pits shall be explosion proof. The system shall be a continuous surveillance type. The sensor shall be electronic or hydraulic type and shall be connected to a remote panel. Totally flooded containment space reservoir system shall not be permitted. The panel shall provide an audible and visible alarm if a leak is detected and shall indicate if the leak is fuel or water. The alarm shall be manually reset at the panel. An inert gas that is heavier than air shall be used in containment space of the tanks to prevent the forming of condensation. The tank monitoring system shall be compatible with the tank furnished and shall be as recommended by the tank manufacturer. Contractor shall provide instructions and equipment required for calibration of the monitoring system. Contractor shall also provide calibration maintenance schedule. Access shall be provided to the tank sensor for testing and maintenance. The control panel shall be located where shown on the plans. Remote alarm shall be provided at the pump control panel(PCP), see section 15970. This control panel shall have a sign located adjacent to it indicating that the alarm indicates a leak in the fuel tank or the vault. The Contractor shall provide system operating instructions inside of the control panel.

c. Monitoring shall be continuous and shall be remotely indicated. The control console shall generate a visual and audible alarm and shall provide one DPDT contact closure on alarm for remote alarm annunciation.

2.11.1.3 Tank Appurtenances and Fittings

Tank appurtenances and fittings shall be provided as indicated. Nozzles for appurtenances and steel vault shall be as indicated or per manufacturer's recommendations and shall be installed plumb with all above grade flange faces level. Gravity fill line shall be provided with locking cap. The flange on the Fuel Transfer Pump pumpway shall be an ASME Class 150 flange.

2.11.1.4 Tank Vents

Tank vents shall be standard weight steel pipe with malleable iron fittings. Vent outlets shall be equipped with pressure-vacuum vents .

2.11.1.5 Manway

A 36-inch round manway shall have U.L. listed gasket with bolted cover. A fiberglass or stainless steel ladder shall be provided inside the tank at the manway.

2.11.1.6 Sampling and Gauging hatch

A sampling and gauging hatch shall be provided and shall consist of a foot-operated, hinged cover with a flexible sealing ring and provision for padlocking. The hatch shall be non-sparking and shall have a flanged connection for installation on 4-inch steel pipe. Provide a datum plate beneath gauge opening, and stencil reference height on gauge/sampling hatch piping.

2.11.1.7 Liquid-level Indicator

Liquid-level indicator shall as indicated for the OPERATING TANK LEVEL INDICATOR.

a. Construction

The unit shall mount on a 6 inch ASME Class 150 flange. The unit shall be constructed of a drum compartment and a servo compartment with terminal box. The servo compartment shall be Factory Mutual approved or U.L. listed for use in Class I, Division 1, Group D hazardous locations, Group T2D (419 degrees F) and shall be provided with a thermostatically controlled electric heater for condensate and freeze protection. Measuring cable shall be 316 stainless steel and the measuring drum shall be grooved to receive the cable. Servo and drum compartment shall be cast aluminum with stainless steel trim and Buna-N O-rings. Provide RTD and self compensating temperature converter.

b. Service and Signal

Unit shall receive 120V/1 PHASE/60 Hz power and shall consume maximum 60VA.

c. Performance

The displacer shall be suspended from the measuring drum. The drum shaft shall be coupled to a weighing balance with a capacitive type detector. The detector shall operate the servo motor via an integration circuit, raising or lowering the displacer until balance is attained, thereby sensing the liquid level. Accuracy shall be $\pm$ 0.01 inch. Repeatability

shall be ± 0.01 inch. Wave integration time shall be 1 to 10s, adjustable.

2.11.1.8 Float Switch Assembly

The float switch assembly shall be the top mounted, float operated type with vertical float rod. The switch assembly shall be suitable for flange mounting and float and trim shall be stainless steel. The switch shall be magnetically latching reed or actuated mercury switch suitable for operation on 120 volt, 60 hertz AC power. Rating of the switch contacts shall be adequate for the indicated functions shown on the drawings. This float switch assembly shall be used to start and stop the Fuel Transfer Pump and to indicate a high level and activate an alarm in the PCP.

2.11.1.9 Fuel Transfer Pump (FTP-1)

Refer to Section 15140 PUMPS, FUELING SYSTEM

2.11.1.10 Electric Pump

The electric pump shall be a sliding vane type rotary pump. The pump construction shall permit the removal of the rotor and sliding vanes without disconnecting the pump. Pump capacity shall be 5 gallons per minute with a differential head of 40 feet. The pump and motor shall be mounted on a cast iron or steel subbase. The motor shall have sufficient power for the service required, shall be of a type approved by the manufacturer of the pump, shall be suitable for available electric service, shall be totally enclosed, fan cooled, TEFC, and shall conform to the requirements specified in Section 16415 ELECTRICAL WORK, INTERIOR. Pump shall be provided with stainless suction screen, stainless steel pipe, and aluminum 1 1/2-inch cam type quick disconnect with dust cap.

2.11.1.11 Lockable Cap

A shall be provided for the 2-inch gravity fill line.

2.11.1.12 Overfill Valve (OV-1)

Refer to Section 15101 CONTROL VALVES, FUELING SYSTEM

2.11.1.13 Tank Calibration

Provide a certified tank calibration chart in 1/8 inch increments reading in gallons.

2.12 HYDRANT OUTLET PITS AND ISOLATION VALVE PITS

Hydrant hose truck hydrant outlet pits and isolation valve pits shall be prefabricated units that are the standard products of a firm regularly engaged in the manufacture of such products and shall essentially duplicate items that have been in satisfactory use for at least (3) years prior in sub-arctic conditions to bid opening. The basic pit shall consist of .50-inch-thick fiberglass walls and floor with main body dimensions as shown on the drawings. The pit shall contain twelve (minimum) integral concrete anchors or two integral anchors that run continuous on three sides of pit. The integral fiberglass top flange shall require no exposed corrosive material, weldments, or strongbacks within the pit to support the aluminum cover assembly. The manufacturer shall have had a minimum of three years successful experience in the production and usage of their fiberglass service pits and shall supply proof of experience at time of submittals.

Pits shall be provided with a 2-inch pump-out line terminating with a male cam type bronze connector with female dustcap. Pits shall be provided with removable aluminum grating platform suitable for loading of 400 pounds per square foot. The grating shall cover the entire opening when the lid is in the open position.The inside of the lid shall have a 10" by 14" permanently attached sign which says "WARNING CONFINED ENTRY". The sign shall be white with black letters, made of PVC, completely and permanently encapsulateld 50-mil plastic.

2.12.1 Pit Cover

The pit cover assembly shall consist of a completely removable one-piece aluminum lid attached to a rigid frame which is an integral part of the fiberglass pit. The lid shall be attached to the frame with hinges which do not carry wheel loads applied to the top surface of the lid in its closed position. The lid shall be equipped with a device to hold the lid in its fully-opened position. This lid-staying device shall automatically engage when the lid is opened to its fully-opened position. The device shall also be provided with a quick-release mechanism designed to be operated with one hand. The lid shall be considered fully-open when it is rotated approximately 90 degrees from its closed position. Each cover lid shall move smoothly through its entire range of motion and shall be counterbalanced sufficiently to require an externally-applied opening force of 35 pounds (maximum) to be applied to the center of the long side of the cover (opposite the hinge side). Similarly, the maximum closing force required to be applied at the same point shall be approximately 50 pounds. In addition, the cover shall be counterbalanced in such a fashion that the cover will not close under its own weight if released when open to any angle greater than 70 degrees (from its closed position). Operation of the lid will not have spring assist. Lifting handles (two minimum) shall be provided for each lid. Each handle shall provide comfortable, secure grip for and average adult male's full (gloved) hand. All covers shall be provided with a latch, operable from the exterior of the vault, to securely hold the lid to the frame in the closed position. The latch will be capable of being released from either lifting handle. Tools shall not be required to engage (or disengage) the latch or the lid lifting handles. Latch and handle designs shall be weather-resistant with features to prelude freeze-up and the collection of dirt and precipitation. The pit and cover assemblies shall present a surface which is 2-inch below the concrete pavement upon completing their installation. Projections of the lid's hinges, lifting handles, or latches above the plane of the lid, whether temporary or permanent, shall not be allowed. The weight bearing flange surfaces of both the fiberglass pit liner and the aluminum cover lid shall be machined flat to assure uniform weight distribution. The word FUEL shall be integrally cast in raised letters on the top surface of each lid. The lettering shall be a minimum of 1-inch high and raised to 0.0625-inch.

2.12.2 Pit Cover Materials, Design, and Testing

All cover lids and frames shall be designed using an appropriate cast aluminum alloy or rolled aluminum plate to support an aircraft wheel load simulated by a roving 200,000-pound test-load applied perpendicular to a 200-square-inch contact area (10 inches by 20 inches) of the cover's top surface. The aluminum alloy material selected for design shall be ductile, corrosion-resistant, impact-resistant, and suitable for the intended use. All covers shall be non-skid surface construction and free of injurious defects. Welding for the purpose of structural repair of casting defects shall not be allowed. Minor cosmetic welding is acceptable. The cover

shall be capable of supporting the test-load without failure regardless of the location or orientation of the load. Localized yielding or cracking or excessive deformations shall be considered as failure. Actual load-tests shall be performed on a minimum of 10 percent of all the covers supplied. Load-tested units shall be randomly selected. Load-test conditions shall model field-installed conditions as nearly as practicable. The 200 Kip test-load shall be applied to the cover for a minimum duration of 5 minutes. Absolute maximum deflection of the cover lid under the test-load shall not exceed 1/180th of the minimum interior opening dimension of the fiberglass pit body. Maximum deflection of the cover lids) remaining after removal of the test load shall be ± 0.010-inches to assure that no permanent set has taken place. Upon removal of the test-load, the cover lid and frame shall be carefully examined for cracks or localized areas of permanent deformation. All results shall be submitted for review and approval. A single failure to meet any of the stated criteria shall be considered sufficient grounds for the testing of 50 percent of the units.

2.12.3 Pipe Seal

The pipe penetrations through the pit floor or wall shall be sealed by means of a Buna-N boot. The boot shall be secured to a metal collar welded to the pipe riser and to a flange at the pit penetration by stainless steel clamps. Collar shall be fabricated from the same material as the pipe. Buna-N (Nitrile Butadiene) material shall be in accordance with SAE AMS 3275.

2.12.4 Hydrant Outlet Pit Equipment

At the Contractor's option, hydrant pits may be furnished complete with hydrant control valves and shutoff valves assembled in a pipe riser. All valves and piping furnished by the pit manufacturer shall comply with the requirements specified herein. All control valves shall be of the same manufacturer.

2.13 HIGH POINT VENT AND LOW POINT DRAIN PITS

2.13.1 Pit Assembly

Each pit shall incorporate the following items built into a self-contained assembly.

2.13.2 Pit

The basic pit shall consist of 0.25-inch wall fiberglass liner with a main body approximately 23-inches in diameter and a minimum of 37-inches deep. The pit shall contain four integral concrete anchors. The fiberglass top flange shall require no exposed corrosive material, weldments, or strongbacks within the pit to support the cast aluminum ring and cover assembly. The pits shall be the standard products of a firm regularly engaged in the manufacture of such product and shall essentially duplicate items that have been in satisfactory use for at least three (3) years prior to bid opening. Proof of experience will be submitted.

2.13.3 Pit Cover, General Requirements

The pit cover shall include a removable outer ring frame and an interior 18-inch diameter (clear opening) hinged lid that opens 180 degrees. Each cover lid shall move smoothly through it entire range of motion and shall require a maximum opening force of 25 pounds to be applied at a single lifting handle. Each handle shall provide a comfortable, secure grip for

an average adult male's full gloved hand. Tools shall not be required to engage the lifting handle. Projections of the lid's hinges or handles above the plane of the lid, whether temporary or permanent, shall not be allowed. The pit service shall be integrally cast in raised letters on the top surface of each lid. The lettering shall be a minimum of 1-inch high and raised to 0.0625-inch. The weight bearing flanges of the fiberglass pit liner and the aluminum cover frame (and lid) shall be machined to assure uniform weight distribution.

2.13.4 Pit Cover Materials, Design, and Testing

The cover frames and lids shall be designed and manufactured by a qualified company having a minimum of five years successful experience in the production of similar airport apron slab fixtures. All cover lids and frames shall be designed using an appropriate cast aluminum alloy or rolled aluminum plate to support an aircraft wheel load simulated by a roving 200,000-pound test-load applied perpendicular to a 200-square-inch contact area (10 inches by 20 inches) of the cover's top surface. The aluminum alloy material selected for design shall be ductile, corrosion-resistant, impact-resistant, and suitable for the intended use. All covers shall be non-skid surface construction and free of injurious defects. Welding for the purpose of structural repair of casting defects shall not be allowed. Minor cosmetic welding is acceptable. The cover shall be capable of supporting the test-load without failure regardless of the location or orientation of the load. Localized yielding or cracking or excessive deformations shall be considered as failure. Actual load-tests shall be performed on a minimum of 10 percent of all the covers supplied. Load-tested units shall be randomly selected. Load-test conditions shall model field-installed conditions as nearly as practicable. The 200 Kip test-load shall be applied to the cover for a minimum duration of 5 minutes. Absolute maximum deflection of the cover lid under the test-load shall not exceed 1/180th of the interior diameter of the fiberglass pit body. Maximum deflection of the cover lids) remaining after removal of the test load shall be $\pm$ 0.010-inches to assure that no permanent set has taken place. Upon removal of the test-load, the cover lid and frame shall be carefully examined for cracks or localized areas of permanent deformation. All results shall be submitted for review and approval. A single failure to meet any of the stated criteria shall be considered sufficient grounds for the testing of 50 percent of the units.

2.13.5 Pipe Riser Seal

The riser pipe penetration through the pit floor shall be sealed by means of a Buna-N boot. The boot shall be secured to a metal collar welded to the pipe riser and to a flange at the floor opening by stainless steel clamps. Collar shall be fabricated from the same material as the pipe.

2.14 OPERATING TANK LEVEL INDICATOR

The level indicating system must perform hydrostatic tank gauging. The level indicating system must use only a single differential pressure transducer to measure all the various locations required for the primary measurement. The level indicating system must be able to measure and compute fuel level, fuel density, fuel actual volume, fuel and water corrected volume and fuel and ambient temperature. The reference point for all level measurements must be from the tank's datum plate. The level and temperaturing sensing system must attach to the tank's 12 -inch stilling well to minimize the effects of turbulence on the measurements and still allow the government access to take quality control samples. The level

indicating system must be able to measure in underground, aboveground and cut and cover tanks with all floor and roof types. The level indicating system must be able to measure multiple tanks with a single field interface unit. The level indicating system must be able to determine whether the tank is issuing or receiving fuel while in the transfer mode and also with the same unit be able to perform leak detection. The level indicating system must require no periodic calibration after installation is complete. The level indicating system must be approved for installation in a hazardous area and certified intrinsically safe by an approved agency and provide lightning protection. The level indicating system must be able to interface with government owned information systems. The level indicating system must provide five sets of alarm outputs; high intermediate high, low, intermediate low and static tank movement alarm.

Level accuracy ± 0.05 inches
Corrected volume accuracy ± 0.1%
Density accuracy ± 1%
Temperature accuracy ± 1EF

It will be an ENRAF Servo Gauge Model 854 Automatic Tank Gauging System.The system shall include an ENDRESS+HAUSER RTU 8130 and a local display similar or equal to a CP/2500. The RTU shall transmit data to the Base FAS System located in the RCC via telephone lines as shown on the drawings. Base personal shall coordinate reprogramming of the FAS System to accept this new data.

2.15 OPERATING TANK LEVEL SWITCHES

The switches shall be an external mount liquid level switch with a carbon steel float chamber and stainless steel, type 304 or 316, float and trim. Switch contacts shall be two single pole double throw switches factory mutual approved or U.L. listed for use in Class I, Division 1, Group D hazardous location with a maximum temperature rating of T2D (419 degrees F). Units shall have provisions to check level switch operations without increasing the fuel level in the tanks.

2.16 WATER DRAW-OFF SYSTEM

A water draw-off system shall be provided for each Operating Tank. Water draw-off system shall gravity drain. Each system shall include tank, product return pump and all necessary pipe, valves, and fittings.

2.16.1 Tank

Water draw-off tank shall be a 55-gallon fabricated stainless steel tank with supporting legs as shown. Tank and support legs shall be fabricated from Type 304 stainless steel.

2.16.2 Sight Glass

Sight glasses for tank shall be standard tubular gages with density ball and shut-off valves on each end. Wetter parts other than sight glass shall be stainless steel. If glass breakage should occur, a stainless steel ball in the valve shall close preventing product loss. Glass shall be protected by minimum of four guard rods.

2.16.3 Return Pump

Product return pump (PRP-1 and PRP-2) shall have the capacity of not less

than 5 gpm against a total head of 50 feet when driven at 3600 rpm. The pump shall have flange connections and shall be constructed of stainless steel or aluminum so as to have no zinc, brass or other copper bearing alloys in contact with the fuel. The unit shall be explosion-proof, Class I, Division 1, Group D with maximum temperature rating of ("T2D" -419 degrees F). The motor shall not be overloading at any point on the pump curve. Contractor has the option of selecting either centrifugal or positive displacement type pump with the restriction of the positive displacement type pump shall include a pressure relief between the discharge and suction protecting the pump from overloading.

2.16.4 Anchoring

All units of the water draw-off system shall be installed plumb and level and secured in place by anchor bolts.

2.17 BOWSER PUMPOFF PUMP

The pump shall be a sliding vane type rotary pump. The pump construction shall permit the removal of the rotor and sliding vanes without disconnecting the pump. Pump capacity shall be 10 gallons per minute with a differential head of 30 feet. The pump and motor shall be mounted on a cast iron or steel subbase. The motor shall have sufficient power for the service required, shall be of a type approved by the manufacturer of the pump, shall be suitable for available electric service, shall be totally enclosed, fan cooled, TEFC, and shall conform to the requirements specified in Section 16415 ELECTRICAL WORK, INTERIOR. Pump shall be provided with stainless suction screen.

PART 3 EXECUTION

3.1 GENERAL

3.1.1 Installation

Install equipment and components in position, true to line, level and plumb, and measured from established benchmarks or reference points. Follow manufacturer's recommended practices for equipment installation. Provide required clearances between equipment components. Equipment, apparatus, and accessories requiring normal servicing or maintenance to be accessible.

3.1.2 Anchoring

Anchor equipment in place. Check alignment of anchor bolts before installing equipment and clean-out associated sleeves. Do not cut bolts because of misalignment. Notify Contracting Officer of errors and obtain the Contracting Officer's acceptance before proceeding with corrections. Cut anchor bolts of excess length to the appropriate length without damage to threads. Where anchor bolts or like devices have not been installed, provide appropriate self-drilling type anchors for construction condition.

3.1.3 Grouting

Equipment which is anchored to a pad to be grouted in place. Before setting equipment in place and before placing grout, clean surfaces to be in contact with grout, including fasteners and sleeves. Remove standing water, debris, oil, rust, and coatings which impair bond. Clean contaminated concrete by grinding. Clean metal surfaces of mill scale and

rust by hand or power tool methods. Provide necessary formwork for placing and retaining grout. Grout to be non-metallic, non-shrink, fluid precision grout of a hydraulic cementitious system with graded and processed silica aggregate, Portland cement, shrinkage compensating agents, plasticizing and water reducing agents; free of aluminum powder agents, oxidizing agents and inorganic accelerators, including chlorides; proportioned, pre-mixed and packaged at factory with only the addition of water required at the project site. Grouting shall be in accordance with ASTM C 827. Perform all grouting in accordance with equipment manufacturer's and grout manufacturer's published specifications and recommendations.

3.1.4 Leveling and Aligning

Level and align equipment in accordance with respective manufacturer's published data. Do not use anchor bolt, jack-nuts or wedges to support, level or align equipment. Install only flat shims for leveling equipment. Place shims to fully support equipment. Wedging is not permitted. Shims to be fabricated flat carbon steel units of surface configuration and area not less than equipment bearing surface. Shims to provide for full equipment support. Shim to have smooth surfaces and edges, free from burrs and slivers. Flame or electrode cut edges not acceptable.

3.1.5 Direct Drives

Alignment procedure follows:

3.1.5.1 Rotation Direction and Speed

Check and correct drive shaft rotation direction and speed.

3.1.5.2 End Play

Run drive shafts at operational speed. Determine whether axial end play exists. Run drive shaft at operational speed and mark drive shaft axial position when end play exists. Block drive shaft in operating position when aligning drive shaft with driven shaft.

3.1.5.3 Shaft Leveling and Radial Alignment

Check shaft leveling by placing a spirit level across the half faces. Radially align shafts by placing a straightedge across the two coupling half faces in both horizontal and vertical planes.

3.1.5.4 Angular Alignment and End Clearance

Check angular alignment and end clearance by inserting a feeler gage at 4 points, 90 degrees apart around outer edges of coupling halves.

3.1.5.5 Final Recheck

Check adjustments with dial indicator after completing recheck. Align shafts within 0.001 inch tolerance, except as other-wise required by more stringent requirements of equipment manufacturer.

3.1.6 Precautions

Special care shall be taken by the Contractor to insure that equipment and materials are stored properly to prevent damage and maintain cleanliness, and that the completed system is free of rocks, sand, dirt, and foreign

objects. The Contractor shall take the following steps to insure these conditions.

a. Equipment brought to the site and not stored inside, shall be stored on blocks or horses at least 18 inches above ground.

b. Visual inspection shall be made of each piece of equipment to ensure that it is clean prior to installation.

c. The open ends of equipment shall be closed when work with that piece of equipment is not in progress.

3.2 INSTALLATION OF UNDERGROUND TANKS

Installation shall be per tank manufacturer's recommendations, API RP 1615, NFPA 30, EPA 40 CFR Part 280, state and local codes and as specified herein. If recommendations require tank to be filled, only fuel will be allowed in tanks. Water filling is not acceptable. Before being placed in service, tank shall be tightness tested in accordance with NFPA 30.

3.2.1 Coating

The coating shall be examined for flaws and tested for thickness. The Contractor shall provide the facilities, personnel, and equipment for testing for flaws and thickness. Thickness shall be measured electronically. Coating shall be tested directly before placement of the tank with an electric flaw detector, equipped with a bell, buzzer, or other type of audible signal that operates when a flaw is detected. The detector for the type of coating used shall have an operating voltage of 10,000 to 35,000 volts. Check of the holiday detector potential may be made by the Contracting Officer at any time to determine the suitability of the detector. Damaged areas shall be repaired with materials identical to those used originally, and after drying, shall be retested electrically.

3.2.2 Steel Tanks

a. Cover the concrete hold down slab with 6 inches of tank bedding backfill evenly graded and thoroughly compacted, prior to tank placement.

b. Each tank is to be unloaded and placed on the sand bed using cranes and the rigging procedures provided by the tank manufacturer. Use the tank lifting lugs for lifting the tank into place. The use of slings around the tank is not permitted, nor is the use of chock blocks of any sort. During handling, carefully inspect the tanks for coating damage and repair any damage whatsoever before proceeding. After placement, check each tank to ensure it is sloped as required. The elevation shall be confirmed.

c. Before proceeding with backfill, install the hold down straps and tighten the turnbuckles securely and evenly throughout the length of the tanks. The bottom and sides of the tanks to be fully and evenly supported by hand shoveling and tamping. Use tank bedding backfill up to 12 inches above the top of tank. Hand-guided power equipment can be used to place fill in 6-inch layers, compacted to a minimum of 95 percent maximum density, after the bottom quadrant is filled. A minimum of four density tests per tank to be performed. Clean, noncorrosive, well tamped gravel to be used for backfill from a point 12 inches above the tanks to finished

grade.

d. Do not fill the tank, even partially, before the bottom quadrant is backfilled. The level of fuel product not to exceed the level of compacted backfill at any time.

e. Coordinate tank installation with the installation of cathodic protection.

3.3 INSTALLATION OF FIBERGLASS PITS

The Contractor shall submit recommended installation procedures and setting tolerances from the pit manufacturer/supplier for the fiberglass pit and the aluminum cover. These procedures shall indicate recommended methods of supporting the pit in its proper position in the open excavation prior to and during concrete placement operations. Also, required installation tolerances, especially for flatness/levelness of the fiberglass pit lip, shall be provided. The Contractor shall follow these recommendations and shall apply other procedures as required to ensure the integrity of the pit liner and cover assemblies in their installed positions. All penetrations through the fiberglass pit liner shall be tightly sealed by suitable means to preclude water infiltration, with consideration for potential relative movements between the penetrating objects and the pit liner. Reference the Contract drawings for additional installation requirements.

3.4 POSTED OPERATING INSTRUCTIONS

For each designated system or equipment item, provide instructions for guidance of operating and maintenance personnel. Following approval of content, prepare these instructions in a form and scale that will be readily legible when displayed in appropriate locations, to be designated by the Contracting Officer and meet the following requirements:

3.4.1 Each System

For each system, include diagrams of equipment, piping, wiring and control. Define control sequences.

3.4.2 Each Tank

For each tank provide certified tank calibration chart in 1/8-inch increments reading in gallons.

3.4.3 Each Item

For each equipment item, include starting, adjustment, operation, lubrication, safety precautions and shut-down procedures. Identify procedures to be performed in event of equipment failure. Provide other instructions recommended by the manufacturer.

3.4.4 Diagrams

The Contractor shall provide a professionally prepared isometric piping diagram of the fueling system apparatus. Diagram shall be 36 inches x 54 inches and shall be color coded to match PCP color diagrams. Diagram shall show the entire facility and shall include all equipment and the

operational sequences of all equipment with equipment numbers displayed. Diagram shall show all valves along with the valve numbers shown on the drawings and listed as normally open/closed. It shall be wall mounted under glass.

3.4.5 Volume of Fuel

The Contractor shall provide a certified system inventory of fuel in the pipe, tank, pumphouse, etc. The piping will show length of pipe, size of pipe, gallons per foot, and total gallons. Verify during initial fill.

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SECTION 15051

PANTOGRAPHS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ASME INTERNATIONAL (ASME)

ASME/ANSI B16.5	(1996) Pipe Flanges and Flanged Fittings
ASME/ANSI B40.1	(1991) Gauges - Pressure Indicating, Dial Type, Elastic Element

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 36/A 36M	(2001) Carbon Structural Steel
ASTM A 312/A 312M	(2001a) Seamless and Welded Austenitic Stainless Steel Pipe

AMERICAN PETROLEUM INSTITUTE (API)

API 1584	(2001) Four-Inch Hydrant System Components and Arrangements

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

SAE AS5877	(2001) Nozzle, Aircraft Pressure Refueling
SAE J517	(2001) Hydraulic Hose

U.S. AIR FORCE (USAF)

AFI 91-202	(1998) United States Air Force Mishap Prevention Program

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

CID A-A-50696	(Basic) Reels, Static Discharge, Grounding, 50 and 75 Foot Cable Lengths

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Scaled assembly drawings; G-AE

Scaled assembly drawings identifying components and showing dimensions and tolerances.

SD-03 Product Data

Complete technical literature shall be submitted on specific function equipment. Submittals shall include but not necessarily be limited to the following:

Flow meter; G-AE.

Hydrant coupler; G-AE.

Shut-off valve with 60 mesh strainer; G-AE.

Automatic pressure equalizing system; G-AE.

Pressure fueling nozzle; G-AE.

Venturi; G-AO.

Swivel joints - flanged and compact types; G-AE.

Sampling and drain assembly; G-AE.

Pressure gage assembly; G-AE.

Venting assembly; G-AE.

SD-07 Certificates

Materials of construction; G-AE.

SD-10 Operation and Maintenance Data

OMSI information shall be submitted for the equipment items or systems listed below. Refer to Section 01730 "Fuel System Operating and Maintenance Support Information (OMSI)" for the information to be submitted for various types of equipment and systems.

Flow meter; G-AE.

Hydrant coupler; G-AE.

Shut-off valve with 60 mesh strainer; G-AE.

Automatic pressure equalizing system; G-AE.

Pressure fueling nozzle; G-AE.

Venturi; G-AE.

Swivel joints - flanged and compact type; G-AE.

Sampling and drain assembly; G-AE.

Pressure gage assembly; G-AE.

Venting; G-AE.

Aircraft pantograph submitted under this specification shall have been approved by the Air Force System Safety Engineer Analysis (AFSSEA) Team in accordance with AFI 91-202.

PART 2 PRODUCTS

2.1 DESIGN CONDITIONS

Shall be as specified in Section 15050 "Mechanical Equipment, Fueling". Components to be ASME/ANSI B16.5 Class 150 (275 psig at 100 degrees F, except swivel joints and pressure fueling nozzles shall be 125 psig at 100 degrees F).

2.2 CONSTRUCTION FOR AIRCRAFT PANTOGRAPHS (Four are to be provided)

a. The pantograph shall be designed in such a way that all wheel supports rest upon the apron regardless of the different terrain conditions.

b. The pantograph shall consist of three main sections, plus one connecting section and one dispensing end. Total length of the three main sections shall be 49 feet.

c. The connecting section shall consist of a hydrant coupler and flanged swivel joints, which allow the coupler to be connected to the hydrant control valve at levels of -$\pm$ 6 inches from the level of the apron.

d. The connecting section shall be supported by an adjustable spring, counterweight balance or hydraulically actuated cylinders which balances the weight of the hydrant coupler, flanged swivel joints and pipe connecting section.

e. The dispensing end shall be designed to be coupled to the aircraft at heights of 12 inches to 8 feet above the apron.

f. The dispensing end shall be supported by an adjustable spring, weight device or hydraulically actuated cylinder to counter balance the weight of the pressure fueling nozzle, shut-off valve, swivel joints and connecting pipes to ensure that only minimum force occurs when connecting pantograph to aircraft. One person shall be able to operate the dispensing end.

g. Hoses (except fuel sensing hose) shall not be permitted as a part of the pantograph.

h. The pantograph shall be equipped with an adjustable automatic pressure equalizing system, relieving at 125 psig to an equalizing reservoir, to

compensate for thermal expansion and contraction.

i. The equalizing reservoir's vent shall be equipped with a flame arrestor. The reservoir shall be sized for a maximum temperature differential of 144 degrees F.

j. The pantograph shall be equipped with supporting structures each mounted on two spring-loaded casters. The flow meter shall be provided with additional supports.

k. To avoid sagging, reinforcing shall be welded to the underside of the pipe sections.

l. A tow bar shall be attached to the front support of the pantograph. Maximum tow speed is 5 miles per hour. Tow bar to be suitable for mounting to pintle hook.

m. The connecting section and the dispensing end shall be locked to the main sections of the pantograph when in the stored or towing mode.

n. The three main sections of the pantograph shall be locked together when stored or towing.

o. The overall electrical resistance between the hydrant coupler and the pressure fueling nozzle shall not exceed 1 Kilo Ohm. Grounding straps across the swivel joints are not permitted.

p. The pantograph shall be equipped with two self winding grounding cable reels. The cable shall be at least 50 feet long. Each cable reel, the grounding cable and the connection clamp shall be in accordance with CID A-A-50696.

q. The pantograph shall be equipped with a permanent sampling and drain assembly, pressure gage assembly and venting assembly.

r. All pantograph swivel joints (flanged and compact type) shall be stainless steel single plane swivels capable of 360 degree rotation.

s. Pantograph shall be provided with 25 feet of nitrogen powered deadman control hose. Hose shall be provided with stainless steel fittings, nylon stop ball and aluminum deadman control handle. Hose shall be dual type with Buna-N tube, vertically braided textile body with fuel resistant neoprene cover.

2.3 HIGH REACH PANTOGRAPHS (Two are to be provided) (OPTION)

a. The whole unit consists of a steel frame with spring loaded casters and a lifting platform. The pipe sections are interconnected by swivel

joints.Text

b. The platform with the dispensing end shall be easily extended up to a connection height of 16 feet above ground level operated by hand. No electric energy shall be used. An extensionable ladder fixed at the frame allows to reach the platform at any position.

c. The platform must be secured with railing and automatically closing door.

d. The pantograph shall be equipped with devices for draining, pressure gauging and venting.

e. Support structures, counter balance system and all other equipment made of steel shall not be welded to the stainless steel pipe. It shall be only bolted by clamps to the pipe and shall be easily replaceable by common tools in case of repair or maintenance. All repair work at the construction site on the pantograph shall be possible by the LFM personnel.

2.4 CONSTRUCTION FOR TRUCK FILL STAND PANTOGRAPHES

a. The pantograph shall consist of three main sections, plus one connecting section and one dispensing end. Total length of the three main sections shall be 10 feet.

b. The dispensing end shall be designed to coupled to the tank truck at heights of 12 inches to 55 inches above the road.

c. The dispensing end shall be supported by an adjustable spring, weight device or hydraulically actuated cylinder to counter balance the weight of the pressure fueling nozzle, shut-off valve, swivel joints and connecting pipes to ensure that only minimum force occurs when connecting pantograph to tank trucks. One person shall be able to operate the dispensing end. Pantograph shall be provided with a nozzle hanging support.

d. Hoses shall not be permitted as a part of the pantograph.

e. The three main sections of the pantograph shall be locked together when stored.

f. The overall electrical resistance between the hydrant coupler and the pressure fueling nozzle shall not exceed 1 kilo Ohm. Grounding straps across the swivel joints are not permitted.

g. The pantograph shall be equipped with a permanent sampling and drain assembly, pressure gage assembly and venting assembly.

h. All pantograph swivel joints (flange and compact type) shall be stainless steel single plane swivels capable of 360 degree rotation.

2.5 SIZE CRITERIA

Nominal diameters shall be as follows:

Hydrant coupler	4 inch
Piping sections	3 inch and 4 inch
Flanged connection	ASME/ANSI B16.5 125 LB.
Flow meter	4 inch, ANSI B16.5 150 LB.
Shut-off valve with 40 mesh strainer	2-1/2 or 3 inch
Compact swivel joint	2-1/2 or 3 inch
Flanged swivel joints	3 inch and 4 inch
Pressure fueling nozzle	2-1/2 inch outlet

2.6 DESIGN REQUIREMENTS

2.6.1 Flanged Swivel Joints

a. Flanged swivel joints shall be capable of rotating 360 degrees. Welded swivel joints and welding of swivel joints to the pipe and/or elbow is not permitted. Swivel joints shall be of the non-lubricated type with non-lubricated bearings, and shall be arctic-grade.

b. No leakage shall be permitted under positive or negative pressure conditions. No leakage shall be permitted under high or low temperature conditions. Welding of swivel joint to 6-bolt flange connector is permitted. The swivel joints shall be warranted for two years against leakage.

c. There shall be electrical continuity from one flange to the other without the use of ground straps.

2.6.2 Flow Meter

The flow meter shall be stainless steel or aluminum, double case, positive displacement, rotor type, bi-directional, temperature compensating. Provide an adjustor for calibrating the meter. Meter shall have large visible 5-digit reset totalizer and small visible 8-digit non-reset totalizer, and mounted on a swivel. The unit of measurement shall be gallons and the increment of measurement shall be one gallon.

2.6.3 Spring-loaded Casters

The pantograph shall be equipped with a minimum of eight (8) terrain spring loaded casters made of steel or cast steel, galvanized or hot-dip galvanized. The caster swivel head shall be equipped with two lubricated ball bearings with grease nipples. The wheels shall have an overall diameter of at least 12 inches and shall be equipped with two lubricated grooved ball bearings with grease nipples. The wheels shall be coated with rubber.

a. Two of the casters shall be equipped with brakes which positively lock the unit in place once at rest.

b. Two casters shall be equipped with an additional device which can be adjusted to lock automatically for towing the pantograph.

2.6.4 Sampling and Drain Assembly

Assembly shall provide for both sampling and draining of fuel. Materials shall be Type 316 stainless steel. Assembly shall consist of a 1/2-inch ball valve and 1/2-inch quick disconnect coupling with aluminum dust cap. Material for ball valve, quick disconnect coupling shall be Type 316 stainless steel. Structural steel shall conform to ASTM A 36/A 36M, hot dipped galvanized after fabrication and painted a factory standard color. A 3-foot, fuel resistant sampling hose with mating quick disconnect fitting shall be provided.

2.6.5 Pressure gage assembly

Assembly shall consist of 4-inch ASME/ANSI B40.1 pressure gage and pressure gage stop cock. Pressure gage shall be liquid filled type with an indicating range 0-275 psig. Material shall be Type 316 stainless steel.

2.6.6 Venting Assembly

Assembly shall consist of a 1/2 inch ball valve and shall terminate with a 180 degree pipe gooseneck and screwed cap.

2.6.7 Hydrant Coupler

The hydrant coupler is the connection between the hydrant system and the pantograph. It shall comply with API 1584. The coupler shall be provided with suitable, non-lubricated 360 degree rotation swivel joint and shall be suitable for mounting to flanged connection. In addition to the bicycle handle grips, the nozzle shall be provided with a half circle ring handle.

2.6.8 Shut-Off Valve With Strainer

3-inch shutoff valve with 40 mesh strainer. It shall be mounted upstream of the pressure fueling nozzle and shall provide safe shutoff of the pantograph for inspection of the strainer.

2.6.9 Compact Swivel Joint

A 3-inch compact swivel joint shall be mounted between the shut-off valve with strainer and the pressure fueling nozzle. The compact swivel shall be non-lubricated, maintenance free type and shall be arctic-grade . No leakage shall be permitted under positive or negative pressure conditions. No leakage shall be permitted under high or low temperature conditions. Welding of swivel joint to six-bolt flange connector is permitted. The swivel joints shall be warranted for two years against leakage. There must be electrical continuity from one flange to the other without the use of ground straps.

2.6.10 Pressure Fueling Nozzle

SAE AS5877, 2-1/2-inch straight nozzle (D-2), non-swivel, with dry-break 60 mesh strainer shall be provided for the connection between pantograph and aircraft. Design shall be for single point fueling of air crafts at a flow rate of 600 gpm with maximum pressure drop of 30 psig. Nozzle shall be provided with a permanently installed quick disconnect coupler, aluminum dust plug with chain. Gammon GTP-235-3/8 Jet Test QD meets this

specification. Provide pressure gage with 0-100 psig indicating range mounted on actuator for use with quick disconnect coupler.

2.6.11 Venturi

Provide for compensated pressure regulation on each hydrant control valve. Venturi shall be constructed of stainless steel. The venturi shall be sized to compensate for pressure drop of entire pantograph assembly at minimum through maximum design flow rate. The amount of recovery shall be adjustable and the maximum unrecoverable pressure drop at 600 gpm shall be less than 10 psi. Venturi control lines shall be provided with needle valve to be used during final adjustment of pantograph. Venturi control lines shall be provided with pressure gauge and pressure gauge stop cock. Indicating range shall be 0-100 psig. Material shall be Type 316 stainless steel.

2.6.11.1 Fuel Sensing Line and Hose

Venturi shall be provided with a 3/8 inch stainless steel fuel sensing line and 8 feet of 5/16-inch fuel sensing hose. Fuel sensing line and hose shall be provided with a stainless steel plug and socket type quick disconnect for coupling together at the pantograph and opposite end of fuel sensing hose shall be provided with quick disconnect suitable for connection to hydrant control valve's pilot system. Fuel sensing hose tube and cover shall be resistant to the effects of hydrocarbon fuels and shall conform to SAE J517-100R7.

2.6.12 Nitrogen Powered Deadman Control System

Pantographs shall be provided with a 39 cubic foot nitrogen cylinder, adjustable pressure regulator, quick release shuttle for the nitrogen, interconnecting control tubing and all necessary hardware to operate the pneumatic deadman pilot system on the hydrant control valve. The nitrogen bottle shall be mounted to the pantograph. Provide 10 feet of air/nitrogen control hose to connect the deadman control system to the hydrant control valve air deadman connection. Provide stainless steel plug and socket type quick disconnect for coupling together the air control hose at the pantograph and a quick disconnect suitable for connection to the hydrant control valve's pilot system at the other end.

2.7 MATERIALS

The type of materials which come in contact with the fuel shall be noncorrosive. No zinc coated metals, brass, bronze or other copper bearing alloys shall be used in contact with the fuel. Additional requirements are as follows:

2.7.1 Stainless Steel Piping

Schedule 10S, conforming to ASTM A 312/A 312M, seamless only.

2.7.2 Fitting and Bends

Same thickness as adjoining pipe.

2.7.3 Components

Aluminum alloy or stainless steel.

2.7.4 Structural Steel

Structural steel shall conform to ASTM A 36/A 36M, hot dipped galvanized after fabrication and painted a factory standard color.

2.8 ASSEMBLY

The pantograph shall be delivered completely assembled.

PART 3 EXECUTION

3.1 INSTALLATION

The pantograph shall be tested as described in Section 15899 SYSTEM START-UP, FUELING.

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SECTION 15060

PIPE, MANUAL VALVES, AND FITTINGS, FUELING SYSTEM

PART 1 GENERAL

1.1 REFERENCES

Waiver to Use MilStds and MilSpecs in Air Force Fuel Projects, HQ AFCESA/CESM (01/29/96).

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z49.1	(1988) Safety in Welding and Cutting

AMERICAN PETROLEUM INSTITUTE (API)

API SPEC 5L	(2000) Line Pipe
API SPEC 6D	(1994) Pipeline Valves (Gate, Plug, Ball, and Check Valves)
API STD 607	(1993) Fire Test for Soft-Seated Quarter-Turn Valves
API STD 608	(1995) Ball Valves
API RP 1110	(1997) Pressure Testing of Liquid Petroleum Pipeline

ASME INTERNATIONAL (ASME)

ASME-16	(1998) Boiler and Pressure Vessel Code; Section VIII, Pressure Vessels DIVISION 1
ASME-17	(1995) Boiler and Pressure Vessel Code; Section IX, Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators
ASME B1.1	(1989) Unified Inch Screw Threads (UN and UNR Thread Form)
ASME B16.5	(2003) Pipe Flanges and Flanged Fittings NPS 1/2 thru NPS 24
ASME B16.9	(2001) Factory-Made Wrought Steel Buttwelding Fittings
ASME B16.11	(2001) Forged Fittings, Socket-Welding and

	Threaded
ASME B16.21	(1992) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B18.2.1	(1996) Square and Hex Bolts and Screws (Inch Series)
ASME B18.2.2	(1987; R 1999) Square and Hex Nuts (Inch Series)
ASME B31.1	(2001) Power Piping
ASME B31.3	(2002) Process Piping

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 53/A 53M	(2002) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 105/A 105M	(2001) Carbon Steel Forgings for Piping Applications
ASTM A 181/A 181M	(2001) Carbon Steel Forgings for General-Purpose Piping
ASTM A 182/A 182M	(2000b) Forged or Rolled Alloy-Steel Pipe Flanges, Forged Fittings and Valves and Parts for High Temperature Service
ASTM A 193/A 193M	(2001b) Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
ASTM A 194/A 194M	(2000) Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service
ASTM A 234/A 234M	(2002) Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service
ASTM A 269	(2000) Seamless and Welded Austenitic Stainless Steel Tubing for General Service
ASTM A 312/A 312M	(2001a) Seamless and Welded Austenitic Stainless Steel Pipe
ASTM A 358/A 358M	(2000) Electric-Fission-Welded Austenitic Chromium-Nickel Alloy Steel Pipe for High-Temperature Service
ASTM A 403/A 403M	(2000a) Wrought Austenitic Stainless Steel Piping Fittings
ASTM D 229	(1996) Rigid Sheet and Plate Materials Used for Electrical Insulation
ASTM E 94	(2000) Radiographic Testing

ASTM F 436	(1993) Hardened Steel Washers

AMERICAN WELDING SOCIETY (AWS)

AWS A2.4	(1998) Symbols for Welding, Brazing and Nondestructive Examination
AWS A3.0	(1994) Standard Welding Terms and Definitions

FEDERAL SPECIFICATIONS (FS)

FS L-C-530	(Rev. C) Coating, Pipe, Thermoplastic Resin or Thermosetting Epoxy
FS L-T-1512	(Rev. A; Reinst) Tape, Pressure Sensitive Adhesive, Pipe Wrapping

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C62.41	(1991; R 1995) Surge Voltages in Low-Voltage AC Power Circuits

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-58	(1993) Pipe Hangers and Supports - Materials, Design and Manufacture
MSS SP-69	(1999) Pipe Hangers and Supports - Selection and Application

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-PRF-13789	(Rev D) Strainers, Sediment: Pipeline, Basket Type
MIL-P-24441/GEN	(Rev B; Am 1, Supple 1) Paint, Epoxy-Polyamide

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-STD-161	(Rev. F; Notice 2) Identification Methods for Bulk Petroleum Products Systems Including Hydrocarbon Missile Fuels
MIL-STD-271	(Rev. F) Nondestructive Testing Methods
MIL-STD-24484	(Rev. J) Adapter, Pressure Fuel Servicing, Nominal 2.5 inch diameter

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 30	(2000) Flammable and Combustible Liquids Code

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

SAE J 514 (1999) Hydraulic Tube Fittings, Standard

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC SP 3 (1982; Rev. Sep 2000) Power Tool Cleaning

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Piping; G-AE.

Fittings; G-AE.

Valves; G-AE.

Strainers; G-AE.

Flexible Hoses; G-AE.

Lightning Surge Arrester; G-AE.

Protective Coatings; G-AE.

Sample Connections; G-AE.

Isolating Gasket Kits; G-AE.

Gaskets; G-AE.

Purge Blocks; G-AE.

Pigging Accessories; G-AE.

Manufacturer's Catalog Data

SD-06 Test Reports

Pneumatic Test.

Hydrostatic Test.

SD-07 Certificates

Welding Procedures and Qualifications of Welders; G-AE

Pipe.

Fittings.

Valves.

Pipe/Fitting Inspector-Owners (factory).

Pipe Weld Radiograph Inspector's Certification (for field welds).

Isolating Gasket Kits.

Survey of final elevation of buried fuel pipe.

Survey giving elevation at each joint, elbow, and tee.

Pipeline Pigging Verification.

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals; G-AE.

Operation and maintenance information shall be submitted for the equipment items or systems listed below. Refer to Section 01730 FUEL SYSTEM OPERATION AND MAINTENANCE MANUAL for the information to be submitted for various type of equipment and systems.

Manual Valves
Strainers
Protective Coatings
Sample Connections
Isolating Gasket Kits
Gaskets
Flexible Hoses

PART 2 PRODUCTS

2.1 DESIGN CONDITIONS

Design conditions shall be as specified in Section 15050 MECHANICAL EQUIPMENT, FUELING SYSTEM.

2.2 MATERIALS

2.2.1 General

Pipe and fittings in contact with fuel shall be stainless steel, carbon steel as indicated on the drawings. The fuel transfer line is indicated to be carbon steel. All other pipe is stainless steel. No zinc coated metals, brass, bronze or other copper bearing alloys shall be used in contact with the fuel. All carbon steel and stainless steel underground piping shall have a protective coating and shall be cathodically protected in accordance with Section 13110 CATHODIC PROTECTION SYSTEM (SACRIFICAL ANODE). Identification of piping shall be in accordance with MIL-STD-161 unless specified otherwise. Material for manual valves shall be as specified hereinafter.

2.2.2 Carbon Steel Piping

Each length of pipe shall be subjected to factory hydrostatic testing and ultrasonic testing in accordance with their respective pipe specification.

a. Piping 12-Inches and Larger: Seamless, ASTM A 53/A 53M Grade B having a wall thickness of 0.375-inch.

b. Piping 2 1/2-Inches through 10-Inches: Seamless, Schedule 40 API SPEC 5L Grade B or ASTM A 53/A 53M Grade B.

c. Piping Two-Inches and Smaller: Seamless, Schedule 80 API SPEC 5L Grade B or ASTM A 53/A 53M Grade B.

2.2.3 Stainless Steel Piping

Piping 2 1/2-Inches and Larger:

1. ASTM A 358/A 358M, Grade 304L, Class 1 or Class 3 with supplementary requirements of S1, S2 and S3, or ASTM A 312/A 312M Type 304L, seamless (only). Any agreements between the purchaser and the manufacturer or supplier as referenced in the applicable ASTM shall include the Contracting Officer as a party to the agreement. All piping welds will receive 100 percent radiographic inspection, 100 percent liquid penetrant inspection, 100 percent visual inspection and all tests as required by the applicable ASTM Standard. Piping shall be provided with a nominal wall thickness as shown in Table A for ASTM A 358/A 358M with the deviation from the nominal wall thickness less than 0.01-inch. ASTM A 312/A 312M seamless piping shall be provided with a minimum schedule 10S wall thickness.

2. Pipe Ends: All Piping shall be provided with beveled ends per Chapter V, ASME B31.3, and shall be shipped with the ends capped.

3. Seam and End Welds: All sections of the piping provided shall be accepted on the project site if the seam welds meet the requirements of the paragraph K341 of ASME B31.3 and Appendix 4 of ASME-16. One hundred spots may be reinspected at the project site prior to installation and backfilling at the request of the Contracting Officers Representative. End welds shall be properly aligned prior to welding per Chapter V of the ASME B31.3. Welds found to be defective shall be repaired as per Chapter V of the ASME B31.3 at no additional cost to the government. Observation by the Contracting Officers Representatives of the manufacturing and field procedures shall be allowed under this contract.

4. Welders Qualifications: Piping shall be welded in accordance with qualified procedures using performance qualified welders and welding operators. Procedures and welders shall be qualified in accordance with ASME-17. Welding procedures qualified by another employer may be accepted as permitted by ASME B31.1. The Contracting Officer shall be notified 24 hours in advance of tests and the tests shall be performed at the work site if practical. The welder or welding operator shall apply his assigned symbol near each weld he makes as a permanent record.

5. Factory Testing and Inspection Records: Per Table K341.3.2A of Chapter IX of ASME B31.3, visual, radiographic and liquid penetrant tests shall be performed for each section of piping provided as all sections are subjected to cyclic conditions. All testing and inspections records shall be submitted to the Contracting Officers

Representative and shall indicate the pipe mark and installed location of each piping section on the project site. Observation by the contracting Officers Representatives of the manufacturers and the fields testing and inspection procedures shall be allowed under this contract. Pipe certification along with pipe markings shall be submitted before the pipe arrives on the job site.

6. Welding Inspectors for Stainless Steel Piping: The contractor shall submit the qualifications of all the testing personnel that will perform all field tests as requested by the Contracting Officer. The qualifications of all personnel on the job site that will perform welding inspection shall be submitted for approval. These inspectors shall meet the qualifications as defined in Chapter VI of the ASME B31.3, and may use the methods as defined in Table K341.3.2 B of the ASME B31.3.

7. The Contractor shall provide a qualified inspector in accordance with Chapter VI of ASME B31.3 to act as the owner's inspector (for the Government) at the pipe manufacturer's facility in addition to the manufacturer's inspector.

8. Quality Assurance Plan shall be submitted for the welding, inspecting and testing of the welded seam pipe.

TABLE A

Nominal Pipe Size	Nominal (Average) Pipe O.D.	Wall Thickness(tn)
16 in.	16.000 in.	0.312 in.
14 in.	14.000 in.	0.312 in.
12 in.	12.750 in.	0.250 in.
10 in.	10.750 in.	0.250 in.
8 in.	8.625 in.	0.250 in.
6 in.	6.625 in.	0.219 in.
4 in.	4.500 in.	0.219 in.
2 1/2 in.	2.875 in.	0.156 in.

a. Piping Two-Inches and Smaller: Schedule 80 ASTM A 312/A 312M seamless Type 304L for threaded piping and schedule 40 (unless otherwise indicated) ASTM A 312/A 312M seamless Type 304L for welded piping.

b. Stainless Steel Control Tubing: Seamless, fully annealed tubing conforming to ASTM A 269, Grade TP316, Rockwell hardness B80 or less. Wall thickness for 1/2-inch tubing to be 0.049-inch.

2.2.4 Protective Coatings for Aboveground Carbon Steel Piping

Provide coating of aboveground piping, piping in pits, pipe supports, filter separators, and miscellaneous metal and equipment in accordance with MIL-P-24441/GEN, Type III, and the instructions that follow. Color of finish coat shall be white. Do not paint stainless steel or aluminum surfaces. Surfaces including those that have been shop coated, shall be solvent cleaned. Surfaces that contain loose rust, loose mill scale, and other foreign substances shall be cleaned mechanically with power tools according to SSPC SP 3. Cleaning shall be performed in sections or blocks small enough to permit application of the epoxy-polyamide prime coat during the same work shift. Shop-coated surfaces shall be protected from corrosion by treating and touching up corroded areas immediately upon

detection.

2.2.4.1 Coating Description

Epoxy-polyamide coatings consist of a two component system that includes a pigmented polyamide resin portion (A component) and an epoxy resin portion (B component). Once they are mixed together and applied as a paint film, the coating cures to a hard film by chemical reaction between the epoxy and polyamide resins. Epoxy-polyamide coating (MIL-P-24441/GEN) consists of individual formulations, for example, Formula 150 is for green primer, and Formula 152 is for white topcoat.

2.2.4.2 Mixing Epoxy-Polyamide Coatings

Epoxy-polyamide coatings are supplied in measured amounts that must be mixed together in exact proportions to ensure the correct and complete chemical reaction. Mix no more paint than can be applied in the same day. The estimated pot life is 3-4 hours for 5 gallons at 70-80° F. Discard any mixed paint remaining at the end of the day.

a. Mixing Ratio. The mixing ratio of the MIL-P-24441/GEN coatings (except Formula 159) are all 1:1 by volume, for example, 5 gallons of component A to 5 gallons of component B. The mixing ratio of MIL-P-24441/GEN for formula 159 is 1:4 by volume.

b. Mixing Procedures. Each component shall be thoroughly stirred prior to mixing the components together. After mixing equal volumes of the two components, this mixture shall again be thoroughly stirred until well blended. The induction time shall be adhered to, to ensure complete chemical reactions. Induction time is defined as the time immediately following the mixing together of components A and B during which the critical chemical reaction period of these components is initiated until the mixture is ready for application. This reaction period is essential to ensure the complete curing of the coating. Volumetric mixing spray equipment with in-line heaters set at 70 to 80° F (21 to 28° C) may be used without an induction period.

2.2.4.3 Induction Times

The temperature of the paint components in storage should be measured to determine induction time and pot life. Pot life is the usable life of the mixed paint. It is dependent upon the temperature and the volume of the mixed paint. The pot life of a five gallon mixture of the MIL-P-24441/GEN paints at 70-80EF is approximately 4 hours. The job site application temperature will affect the time required for the paint to cure, and must be considered in estimating induction time, cure time, and the effect of batch size on these functions. At 40 to 60° F a 1 hour induction time shall be used. Volumetric mixing spray equipment with in-line heaters set at 70 to 80° F may be used without an induction period. To ensure that the reaction proceeds uniformly, the paint should be manually stirred periodically during its induction period. This prevents localized overheating or hot spots within the paint mixture.

2.2.4.4 Epoxy-Polyamide Coating Application

Epoxy-polyamide coatings, MIL-P-24441/GEN, may be applied by brushing or spraying.

a. Thinning Application. Ordinarily, MIL-P-24441/GEN coatings are not thinned. If necessary, up to one pint of epoxy thinner for each gallon of mixed paint may be added if paint has thickened appreciably during cold temperature application or if necessary to improve application characteristics. When applied at the proper thickness, without thinning, these paints will have no tendency to sag.

b. Application Thickness. Unless otherwise specified, apply each coat of paint to produce approximately 3 mils dry film thickness (DFT). Application which yields in excess of 4.0 mils DFT should be avoided to prevent sagging.

c. Spray Application. MIL-P-24441/GEN paints should be sprayed with conventional spray guns and normal spray-pot pressures. The spray gun should be equipped with a middle-size (D) needle, and nozzle setup. Both conventional and airless spray equipment are suitable for use with or without volumetric mixing capability.

2.2.4.5 Equipment Cleanup

The mixed paint should not be allowed to remain in spray equipment for an extended period, especially in the sun of a warm area. The paint cures more rapidly at higher temperatures. When components A and B are mixed together, the pot life of the mixture (including the induction time is 6 hours at 70° F (21° C). Pot life is longer at lower temperatures and shorter at temperatures above 70° F (21° C). Spray equipment should be cleaned after using by flushing and washing with epoxy thinner or aromatic hydrocarbon thinners (xylene or high flash aromatic naphtha). General cleanup is also done by using these solvents. Brushes and rollers should be given a final cleaning in warm soapy water, rinsed clean with warm fresh water and hung to dry.

2.2.5 Protective Coatings for Buried Steel Piping

Provide pipe with FS L-C-530 coating system of factory-applied adhesive undercoat and continuously extruded plastic resin coating; minimum thickness of plastic resin shall be 36 mils for pipe sizes 6 inches and larger. Fittings, couplings, irregular surfaces, damaged areas of pipe coating, and existing piping affected by the Contractor's operations shall be clean, dry, grease free, and primed before application of tape. Tape shall overlap the pipe coating not less than three inches. Waterproof shrink sleeves may be provided in lieu of tape and shall overlap the pipe coating not less than six inches. Pipe coating and adhesive undercoat surfaces to be wrapped with tape shall be primed with a compatible primer prior to application of tape. Primer shall be as recommended by tape manufacturer and approved by pipe coating manufacturer.

a. Damaged Areas of Pipe Coating: Provide FS L-T-1512, 20 mils nominal thickness of tape over damaged areas. Residual material from damaged areas of pipe coating shall be pressed into the break or trimmed off. Apply tape spirally with one-third overlap as tape is applied. A double wrap of one full width of tape shall be applied at right angles to the axis to seal each end of the spiral wrapping.

b. Fittings, Couplings, and Regular Surfaces: Provide FS L-T-1512, 10 mils nominal thickness tape overlapped not less than 1.0 inch over damaged areas. Initially stretch and apply first layer of tape to conform to component's surface. Then apply and press a second layer of tape over first layer of tape.

c. Testing of Protective Coatings: Perform tests with an approved silicone rubber electric wire brush or an approved electric spring coil flaw tester. Tester shall be equipped with an operating bell, buzzer, or other audible signal which will sound when a holiday is detected at minimum testing voltage equal to 1,000 times the square root of the average coating thickness in mils. Tester shall be a type so fixed that field adjustment cannot be made. Calibration by tester manufacturer shall be required at six-month intervals or at such time as crest voltage is questionable. Certify in writing the calibration date and crest voltage setting. Maintain the battery at ample charge to produce the crest voltage during tests. Areas where arcing occurs shall be repaired by using material identical to original coating or coating used for field joints. After installation, retest the exterior surfaces, including field joints, for holidays. Promptly repair holidays.

2.2.6 Fittings

2.2.6.1 General

Welding ells, caps, tees, reducers, etc., to be of materials compatible for welding to the pipe line in which they are installed, and wall thickness, pressure and temperature ratings of the fittings shall be not less than the adjoining pipe line. Unless otherwise required by the conditions of installation, all elbows shall be the long radius type. Miter joints shall not be acceptable. Make odd angle offsets with pipe bends or elbows cut to the proper angle. Odd Angle cuts shall be made in accordance with the pipe fitters manual. Butt weld fittings to be factory-made wrought fittings manufactured by forging or shaping. Fabricated fittings will not be permitted. Welding branch fittings shall be insert type suitable for radiographic inspections specified herein.

2.2.6.2 Carbon Steel Fittings

a. Fittings 2-1/2 Inches and Larger: Butt weld, conforming to ASTM A 234/A 234M, grade WPB and ASME B16.9 of the same wall thickness as the adjoining pipe. All welds shall be radiographically examined throughout the entire length of each weld. Each fitting shall be subjected to the Supplementary Requirements S3 and S4, Liquid Penetration examination and Magnetis-Particle Examination. Detectable flaws will not be accepted in the supplementary examinations. Fittings shall be identified to relate them to their respective radiograph.

b. Fittings 2 Inches and Smaller. Forged (socket welded or if indicated on drawings, threaded), 2,000-pound W.O.G., conforming to ASTM A 105/A 105M, Grade 2 and ASME B16.11. Threaded fittings shall only be used for above grade applications. Underground low point drain pipe and high point vent pipe shall be butt welded.

c. Flanges: One-hundred-fifty-pound weld neck, forged flanges conforming to ASTM A 181/A 181M, Class 70, and ASME B16.5. Flanges to be 1/16-inch raised face with phonographic finish, except where required otherwise to match equipment furnished. Match flange face to valves or equipment furnished. Flange face shall be machined to match valves or equipment furnished. Use of spacing rings or gaskets discs are not allowed. Flanges shall be subjected to the Supplementary Requirements S4 and S5, Liquid Penetrant Examination, and Magnetic-Particle Examination. Detectable flaws will not be accepted.

2.2.6.3 Stainless Steel Fittings

a. Fittings 2-1/2 Inches and Larger: Butt weld stainless steel conforming to ASTM A 403/A 403M, Class WP, Type 304L, seamless or welded, and ASME B16.9 of the same minimum wall thickness as the adjoining pipe. Welded fittings shall be tested and inspected the same as the welded seam pipe and meet the same requirements as for the pipe. Elbows in the loop pipe, located between the pig launcher and the receiver, shall have a radius three times the pipe diameter. Tees with branches 6-inches and larger, shall have guide bars as detailed on the drawings.

b. Fittings 2-Inches and Smaller: Forged Type 304 or 304L (socket welded or if indicated on drawings, threaded), 2,000-pound W.O.G. conforming to ASTM A 182/A 182M and ASME B16.11. Threaded fittings shall only be used for above grade applications. Underground low point drain pipe and high point vent pipe shall be butt welded.

c. Unions. Conforming to ASTM A 312/A 312M, Grade 304 or 316.

d. Flanges. One-hundred-fifty-pound weld neck, forged Type 304 or 304L stainless steel flanges conforming to ASTM A 182/A 182M and ASME B16.5, except flanges that are to be connected to the fueling/defueling pumps shall be 300-pound. Flanges to be 1/16-inch raised-face with phonographic finish, except where required otherwise to match equipment furnished. Match flange face to valves or equipment furnished. Flanges shall be subjected to the Supplementary Requirements S4, Liquid Penetrant Examination.

e. Stainless Steel Tube Fittings. Flareless, 316 stainless steel fittings conforming to SAE J 514.

2.2.6.4 Isolating Gasket Kits (Insulating) for Flanges

Provide ASTM D 229 electrical insulating material of 1,000 ohms minimum resistance; material shall be resistant to the effects of aviation hydrocarbon fuels. Provide full face insulating gaskets between flanges. Provide full surface 0.03-inch thick wall thickness, spiral-wound mylar insulating sleeves between the bolts and the holes in flanges; bolts may have reduced shanks of a diameter not less than the diameter at the root of threads. Provide 0.125-inch thick high-strength phenolic insulating washers next to flanges and provide flat circular stainless steel washers over insulating washers and under bolt heads and nuts. Provide bolts 0.5-inch longer than standard length to compensate for the thicker insulating gaskets and the washers under bolt heads and nuts. Exterior above grade flanges separated by electrically isolating gasket kits shall be provided with weatherproof lightning surge arrester devices. The surge arrester shall bolt across flanges separated by insulating gasket kits per detail on contract drawings. The arrestor shall have the following features:

a. Weatherproof NEMA 4 enclosure.

b. Bidirectional and bipolar protection.

c. Constructed of solid state components, no lights, fuses or relays shall be used that will require maintenance or replacement.

d. Withstand unlimited number of surges at 50,000 Amperes.

e. Maximum clamping voltage of 700 Volts based on a IEEE C62.41 8x20 microsecond wave form at 50,000 Amperes peak measured at the device terminals (zero lead length).

f. A UL listed arrester for installation in Class 1, Division 2, Group D, hazardous areas is preferred if available.

Install the mounting bracket and leads on the flange side of the bolt insulating sleeve and washer, and size in accordance with this schedule.

Line Size (Inches)	Bolt Size (Inches)
2	5/8
2-1/2	5/8
3	5/8
4	5/8
6	3/4
8	3/4
10	7/8
12	7/8
14	1
16	1

(Note: Allowance must be made for the 1/32-inch thickness of the insulating sleeve around the bolts when sizing the mounting lugs.)

2.2.7 Bolts and Nuts

Bolts and nuts for pipe flanges, flanged fittings, valves and accessories shall conform to ASME B18.2.1 and ASME B18.2.2, except as otherwise specified. Bolts shall be of sufficient length to obtain full bearing on the nuts and shall project no more than two full threads beyond the nuts with the bolts tightened to the required torque. Bolts shall be regular hexagonal bolts conforming to ASME B18.2.1 with material conforming to ASTM A 193/A 193M, Class 2, Grade B8, stainless steel. Bolts shall be threaded in accordance with ASME B1.1, Class 2A fit, Coarse Thread Series, for sizes one inch and smaller and Eight-Pitch Thread Series for sizes larger than one inch. Nuts shall conform to ASME B18.2.2, hexagonal, heavy series with material conforming to ASTM A 194/A 194M, Grade 8, stainless steel. Nuts shall be threaded in accordance with ASME B1.1, Class 2B fit, Coarse Thread Series for sizes one inch and smaller and Eight-Pitch Thread Series for sizes larger than one inch. Provide washers under bolt heads and nuts. Washers to be ASTM F 436, flat circular stainless steel. Torque wrenches shall be used to tighten all flange bolts to the torque recommended by the gasket manufacturer. Tightening pattern shall be as recommended by the gasket manufacturer. Anti-seize compound shall be used on stainless steel bolts.

2.2.8 Gaskets

ASME B16.21, composition ring, using a Buna-N binder, 0.1250-inch thick. Gaskets shall be resistant to the effects of aviation hydrocarbon fuels and manufactured of fire-resistant materials. Full-face gaskets shall be used for flat-face flanged joints. Ring gaskets shall be used for raised-face flanged joints. Gaskets shall be of one piece factory cut.

2.2.9 Relief and Drain System Piping

Pressure relief valve discharge lines and drain lines to the product recovery tank shall be Schedule 40 ASTM A 312/A 312M seamless Type 304L Stainless Steel.

2.2.9.1 Gaskets

See Gaskets specified herein before.

2.2.10 Relief and Drain System Protective Coating

Pipe shall be factory coated as specified herein before for steel piping.

2.2.11 Field Applied Protective Coatings

The field joints and fittings of all underground piping shall be coated as herein specified.

2.2.11.1 Welded Joints

Heat shrinkable radiation-cross-linked polyolefin wraparound type sleeves shall be applied to all welded joints. Joints shall not be coated until pressure testing is complete. Apply sleeves consisting of 40 mil polyolefin backing and 40 mil thermoplastic mastic adhesive in accordance with the manufacturer's instructions.

2.2.11.2 Fittings

Fittings and other irregular surfaces shall be tape wrapped. The tape shall be a plastic mastic laminated tape having 6 mil plastic backing of either polyethylene or polyvinylchlorine and 29 to 44 mil of synthetic elastomer.

2.2.12 Threaded Joints

Threaded joints, if indicated on the drawings, shall be made tight with manufacturer recommended teflon tape or a mixture of graphite and oil, inert filler and oil, or with a graphite compound, applied with a brush to the male threads. Not more than three threads shall show on made up joints. Threaded joints, mechanical couplings and flanges will not be permitted in buried piping. Threaded joints shall not get welded.

2.2.13 Welded Joints

Welded joints in steel pipe shall be as specified in Part 3 "EXECUTION."

2.3 MANUAL VALVES

All portions of a valve coming in contact with fuel shall be of noncorrosive material. Valves shall be Type 304 or Type 316 stainless steel or carbon steel internally plated with chromium or nickel or internally electroless nickel plated. Stem and trim shall be stainless steel for all valves. Manually operated valves six inches and larger shall be worm-gear operated and valves smaller than six inches shall be wrench operated. Valves smaller than two inches shall have lever-type handles. Valves installed more than eight (8) feet above finished floor shall have chain operators and a position indicators visible from ground level. Sprocket wheel for chain operator shall be aluminum. Valves located in the

piggable piping system, the loop piping, shall be full port valves.

2.3.1 Ball Valves

Ball valves shall be fire tested and qualified in accordance with the requirements of API STD 607 and API STD 608. Ball valves shall be nonlubricated valves that operate from fully open to fully closed with 90 degree rotation of the ball. Valves two inches and larger shall conform to applicable construction and dimension requirements of API SPEC 6D, ANSI Class 150 and shall have flanged ends. Valves smaller than 2 inches shall be ANSI class 150 valves with one piece bodies with flanged ends, unless noted otherwise. The balls in valves 10 inches full port and 12 inch regular port and larger shall have trunnion type support bearings. Except as otherwise specified, reduced port or full port valves may be provided at the Contractor's option.

2.3.1.1 Materials

Ball shall be stainless steel. Ball valves shall have tetrafluoroethylene (TFE) or Viton seats, body seals and stem seals. Valves 2 inches and smaller shall have a locking mechanism.

2.3.2 Plug (Double Block and Bleed) Valves

API SPEC 6D, Type III, ANSI Class 150, non-lubricated, resilient, double seated, trunnion mounted, tapered lift plug capable of two-way shutoff. Valve shall have stainless steel or carbon steel body with chrome-plated interior, tapered plug of steel or ductile iron with chrome or nickel plating and plug supported on upper and lower . Sealing slips shall be steel or ductile iron, with Viton seals which are held in place by dovetail connections. Valve design shall permit sealing slips to be replaced from the bottom with the valve mounted in the piping. Valves shall operate from fully open to fully closed by rotation of the handwheel to lift and turn the plug. Valves shall have weatherproof operators with mechanical position indicators. Minimum bore size shall be not less than 65 percent of the internal cross sectional area of a pipe of the same nominal diameter unless bore height of plug equals the nominal pipe diameter and manufacturer can show equal or better flow characteristics of the reduced bore size design, unless otherwise indicated. Valves in the main fuel piping between the pig launcher and the pig receiver shall be full bore, piggable.

2.3.2.1 General

Valves in the operating tank suction lines shall be provided with a factory-installed limit switch that is actuated by the valve closure. Each switch shall have one double pole double throw contacts, and shall be watertight and U.L. listed for Class I, Division 1, Group D hazardous areas with (T2D-419 F) temperature limitation.

2.3.2.2 Valve Operation

Rotation of the handwheel toward open shall lift the plug without wiping the seals and retract the sealing slips so that during rotation of the plug clearance is maintained between the sealing slips and the valve body. Rotation of the handwheel toward closed shall lower the plug after the sealing slips are aligned with the valve body and force the sealing slips against the valve body for positive closure. When valve is closed, the slips shall form a secondary fire-safe metal-to-metal seat on both sides of

the resilient seal. Plug valves located in Isolation Valve Pits shall be provided with handwheel extensions.

2.3.2.3 Relief Valves

ANSI Class 150. Provide plug valves with automatic thermal relief valves to relieve the pressure build up in the internal body cavity when the plug valve is closed. Relief valves shall open at 25 psi differential pressure and shall discharge to the throat of, and to the upstream side, of the plug valve.

2.3.2.4 Bleed Valves

ANSI Class 150, stainless steel body valve. Provide manually operated bleed valves that can be opened to verify that the plug valves are not leaking when in the closed position.

2.3.3 Swing Check Valves

Swing check valves shall conform to applicable requirements of API SPEC 6D, regular type, ANSI Class 150 with flanged end connections. Check valves shall be tilting disc, non-slam type with 316 stainless steel body and trim. Discs and seating rings shall be renewable without removing the valve from the line. The disc shall be guided and controlled to contact the entire seating surface.

2.4 RELIEF VALVES

Relief valves shall be the fully enclosed, spring loaded, angle pattern, single port, hydraulically operated type with plain caps, and shall be labeled in accordance with ASME-16. Valve stems shall be fully guided between the closed and fully opened positions. The valves shall be factory-set to open at 265 psi unless otherwise indicated on the drawings. Operating pressure shall be adjustable by means of an enclosed adjusting screw. The valves shall have a minimum capacity of 20 GPM at 10 percent overpressure and shall operate at rated capacity with a back pressure not exceeding 50 psi. Valves shall have a replaceable seat.

2.4.1 Materials

Valves shall have carbon steel bodies and bonnets with stainless steel springs and trim. Valves shall be Class 150 flanged end connections.

2.4.2 Sight Flow Indicators

Sight flow indicators shall be ANSI Class 150 and shall have flanged end connections. Sight flow indicators shall consist of a housing containing a rotating propeller that is visible through a glass observation port. The housing shall be stainless steel when installed in stainless steel lines and carbon steel when installed in carbon steel lines. The glass in the indicator shall also meet the Class 150 rating. The indicator down stream of the Pressure Control Valve (PCV) shall contain a bi-directional flapper instead of a propeller.

2.5 PIPING ACCESSORIES

2.5.1 Pipe Sleeves

Pipe sleeves shall be installed at all points where the piping passes

through concrete construction. Such sleeves shall be of sufficient inside diameter to provide a minimum clear distance between the pipe and the sleeve of 1/2-inch. Sleeves through concrete pits or slabs shall be standard weight carbon steel pipe with a protective coating. Each sleeve shall extend through the respective pit wall or slab and shall be provided with a Buna-N casing seal. Sleeves where piping passes under roads or piping indicated to be double walled shall be standard weight carbon steel pipe with a protective coating as previously specified. Alignment of the sleeve and piping shall be such that the pipe is accurately centered within the sleeve by a nonconductive centering element. The sleeve shall be securely anchored to prevent dislocation. Closure of space between the pipe and the pipe sleeve shall be by means of a mechanically adjustable segmented elastomeric seal. The seal shall be installed so as to be flush.

2.5.2 Strainers

2.5.2.1 Basket Type

Strainer shall be in compliance with MIL-PRF-13789, except as specified otherwise. Strainer end connections shall be designed in accordance with ASME B16.5, Class 150. Strainers shall have stainless steel bodies, stainless steel shall be Types 304 or 316. Strainers shall have removable baskets of 60 mesh wire screen with larger wire mesh reinforcement; wire shall be stainless steel, Type 316. Pressure drop for clean strainer shall not exceed three psig at maximum design flow rate. The ratio of net effective strainer area to the area of the connecting pipe shall be not less than three to one. Each strainer shall be provided with a suitable drain at the bottom, equipped with a ball valve. Strainer shall be the single inlet, single outlet design. Strainer shall be supplied with a piston type direct reading differential pressure gage as specified in SECTION 15880 FILTER SEPARATOR.

2.5.2.2 Cone Type (Temporary)

Strainer shall be stainless steel type 304 or 316, 60 mesh screen with the ratio of net open area of strainer to the area of the connecting pipe shall be not less than one to one.

2.5.3 Pipe Hangers and Supports

2.5.3.1 General

Pipe hangers and supports shall conform to MSS SP-58 and MSS SP-69. Supports shall be provided at the indicated locations. Support channels for drain lines shall be epoxy coated on all surfaces or hot-dip galvanized after the channels are cut to length. Coated supports shall be coated with fusion bonded epoxy resin applied by the fluidized bed method. Thickness of the coating shall be not less than 10 mils. Surface preparation and coating application shall be in accordance with the epoxy manufacturer's instructions. The coating shall be pinhole free when tested with a low voltage holiday detector set at no more than 100 times the mil thickness of the coating. All pinholes shall be marked, repaired and retested to ensure a pinhole free film. The coating material shall be a 100 percent solids, thermosetting, fusion-bonded, dry powder epoxy resin. The manufacturer shall certify that the material is suitable for fluidized bed application and that it is approved by the Environmental Protection Administration.

2.5.3.2 Adjustable Pipe Supports

Adjustable pipe supports shall consist of a cast iron saddle and a threaded nipple connected to a carbon steel pipe by means of a special reducer conforming to MSS SP-69. The supports shall be provided with neoprene insulation strips.

2.5.3.3 Low Friction Supports

Low friction supports shall be self-lubricating antifriction element composed of reinforced TFE. Units shall be factory designed and manufactured.

2.5.3.4 Concrete and Grout

Concrete and grout for anchors and supports shall comply with SECTION 03300 CAST-IN-PLACE STRUCTURAL CONCRETE.

2.5.4 Sample Connections

Sample connections shall be factory assembled units specifically designed for obtaining representative samples from fuel pipelines. Each connection shall include a 1/4-inch sampling probe where the probe faces upstream, ball valve and 1/4-inch quick disconnect coupling with dust plug, all assembled into a unit that is suitable for installation in a pipe nipple. The sampling probe shall extend not less than one inch into the fuel pipe. All materials in the sample connections shall be stainless steel or aluminum.

2.5.4.1 Sampling Hoses

Furnish two sampling hose assemblies to the Contracting Officer at the project site. Each assembly shall consist of a six-foot length of 1/4-inch clear plastic tubing with internal bonding/grounding wire. One end of the tubing will contain a male connector that actuates flow when inserted into the quick disconnect coupler. Each end of the bonding/grounding wire shall be equipped with clips for attaching to the pipe and metal sample container.

2.5.5 Flanged Swivel Joints

Flanged swivel joints shall be capable of rotating 360 degrees. Welded swivel joints and welding of swivel joints to the pipe and/or elbow is not permitted. Swivel joints shall be of the non-lubricated, maintenance free type with nonlubricated bearings and no lubricating fitting. Swivel joint shall be flanged at the end connecting to the piping system and threaded (female NPT) at the end connecting to the fuel hose. No leakage shall be permitted under positive or negative pressure conditions. No leakage shall be permitted under high or low temperature conditions. Welding of swivel joint to six-bolt flange connector is permitted. The swivel joints shall be warranted for two years against leakage. There must be electrical continuity from one flange to the other without the use of ground straps.

2.5.6 Monitoring Points

At the following locations, provide half-inch pipe, flanged ball valve, and blind flange for future test equipment connections:

a. At the Pantograph Flush, inlet to Hydrant Valve.

b. At the inlet to the Back Pressure Control Valve in the Pumphouse.

c. At both sides of the isolation valve in all the isolation valve pits.

2.5.7 Nozzle Adapter (SPR)

Adapter shall be a nominal 2-1/2 inches with self-closing valve in accordance with MIL-STD-24484. Adapter shall have a 4 inch flange mounting and metal sealing, vacuum tight, locking dust cap using the SPR lugs.

2.5.8 Pigging Accessories

2.5.8.1 Closure Door

The closure shall be hinged, swing bolted closure of the same material as the pipe and for a Class 150 system. Gasket shall be nitrile. Eye bolts shall be pinned to lugs on the hub.

2.5.8.2 Signaller

The pig signaller shall be mechanical flag type with manual reset, and be located on the pig launcher and the pig receiver. Material in contact with the fuel shall be stainless steel. Units shall be suitable for removal and installation under line pressure of 275 psig. Signaller shall be capable of withstanding line pressure of a Class 150 system.

2.5.8.3 Option

If the option for the pig launcher and the pig receiver is not accepted, the contractor shall provide portable units as necessary for the required verifications.

2.6 FLEXIBLE HOSES

Flexible hoses for fueling pumps shall have ANSI Class 300 flanges of stainless steel construction conforming to ASME B16.5. Flexible hoses shall be of stainless steel flexible metal hose consisting of an inner corrugated stainless steel tube with stainless steel braid cover. All components to be suitable for not less than 275 psig. Length and application of flexible hoses shall be per manufacturer's written recommendations.

PART 3 EXECUTION

3.1 WELDING

3.1.1 General

All joints unless indicated otherwise, in carbon steel and stainless steel piping systems shall be welded. Unless otherwise approved, all girth welds shall be complete penetration groove welds made in accordance with qualified welding procedures. Welding operations, qualifications of welders and welding procedures shall comply with the provisions of ASME B31.3 and the requirements specified herein.

The root and hot passes on stainless steel and carbon steel pipe shall be by the GMAW or GTAW process.

a. Definitions shall be in accordance with AWS A3.0.

b. Symbols shall be in accordance with AWS A2.4 for welding and nondestructive testing, unless otherwise indicated.

c. Safety Precautions shall conform to ANSI Z49.1.

d. Weld Preparation shall comply with the requirements of ASME B31.3 and the qualified Welding Procedure Specification. The use of "rice paper" as purge blocks is not permitted. Contractor shall submit alternate method for approval. Back purge gas shall be used for the root pass of all pipe welds. The use of flux-coated or cored welding rod is prohibited in making the root and hot passes.

e. Backing Rings. The use of backing rings for making or repairing welds will not be permitted.

3.1.2 Welding Procedures and Qualifications of Welders

Welders and welding procedures shall be qualified in accordance with requirements of ASME B31.3. Submit qualified procedures, where the procedures will be used, and a list of names and identification symbols of qualified welders and welding operators.

3.1.2.1 Weld Identification

Each qualified welder shall be assigned an identification symbol. All welds shall be permanently marked with the symbol of the individual who made the weld.

3.1.2.2 Defective Work

Welders found making defective welds shall be removed from the work or shall be required to be requalified in accordance with ASME B31.3.

3.1.3 Tests

All steel pipe field welds, including high point vent pipe and low point drain pipe, shall be examined by radiographic methods to determine conformance to the paragraph "Standards of Acceptance." The services of a qualified commercial or testing laboratory approved by the Contracting Officer shall be employed by the Contractor for testing of piping welds. Costs of testing, including retesting or repaired welds, shall be borne by the Contractor.

3.1.3.1 Radiographic Inspection

Procedures for radiographic inspection shall be in accordance with MIL-STD-271 or ASTM E 94. Weld ripples or surface irregularities that might mask or be confused with the radiographic image of any objectional defect shall be removed by grinding or other suitable mechanical means. The weld surface shall be merged smoothly with the base metal surface.

3.1.4 Standards of Acceptance

Interpretation of test results and limitations on imperfections in welds shall comply with the requirements for 100 percent Radiography, per ASME B31.3, Chapter IX, Table K341.3.2A.

3.1.5 Corrections and Repairs

Defects shall be repaired in accordance with approved procedures. Defects discovered between passes shall be repaired before additional weld material is deposited. Whenever a defect is removed and repair by welding is not required, the affected area shall be blended into the surrounding surface so as to avoid sharp notches, crevices, or corners. After a defect is thought to have been removed, and prior to rewelding, the area shall be examined by suitable methods to insure that the defect has been eliminated. After repairs have been made, the repaired area shall be reinspected and shall meet the standards of acceptance for the original weld. Any indication of a defect shall be regarded as a defect unless reevaluation by nondestructive methods and/or by surface conditioning shows that no defect is present.

3.1.5.1 Defect Removal

Defective or unsound weld joints shall be corrected by removing and replacing the entire weld joint, or for the following defects corrections shall be made as follows:

a. Excessive Convexity and Overlap: Reduce by removal of excess metal.

b. Excessive Concavity of Weld, Undersized Welds, Undercutting: Clean and deposit additional weld metal.

c. Excessive Weld Porosity, Inclusions, Lack of Fusion, Incomplete Penetration: Remove defective portions and reweld.

d. Crack in Weld or Base Metal: Remove crack throughout its length, including sound weld metal for a distance of twice the thickness of the base metal or two inches, whichever is less, beyond each end of the crack, followed by the required rewelding. Complete removal shall be confirmed by magnetic particle inspection for carbon steel or liquid penetrant inspection for stainless steel. Inspection procedures shall comply with the requirements of ASME B31.3.

e. Poor Fit-Up: Cut apart improperly fitted parts, and reweld.

3.1.5.2 Methods of Defect Removal

The removal of weld metal or portions of the base metal shall be done preferably by chipping, grinding, sawing, machining, or other mechanical means. Defects also may be removed by thermal cutting techniques. If thermal cutting techniques are used, the cut surfaces shall be cleaned and smoothed by mechanical means. In addition, at least 1/8-inch of metal shall be removed by mechanical means from the cut surfaces of stainless steel.

3.1.5.3 Rewelding

Repair welds shall be made using an electrode or filler wire preferably smaller than that used in making the original weld. Rewelding shall be done using qualified welding procedures. The surface shall be cleaned before rewelding. Repair welds shall meet the requirements of this specification.

3.1.5.4 Peening or Caulking

The use of force (peening) or foreign materials to mask, fill in, seal, or disguise any welding defects shall not be permitted.

3.2 INSTALLATION

3.2.1 Special Requirements

Special care shall be taken by the Contractor to insure that the protective coating on buried pipe is not damaged during installation and that the completed system is free of rocks, sand, dirt, and foreign objects. The Contractor shall take the following steps to insure these conditions.

a. Coated pipe shall be handled only with canvas or nylon slings or padded clamps. Any coating damaged by improper handling or storage shall be repaired as specified.

b. Pipe brought to the site shall be stored on blocks or horses at least 18 inches above the ground. Padded blocks or horses shall be used for coated pipe. The method and height of storing coated pipe shall be in accordance with the coating manufacturer's instructions.

c. Visual inspection shall be made of the inside of each length of pipe to ensure that it is clear and clean prior to installation.

d. The open ends of the pipe system shall be closed at the end of each day's work or when work is not in progress and shall not be opened until the work is resumed.

e. A swab, with a leather or canvas belt disc to fit the inside diameter of pipe, shall be pulled through each length of pipe after welding in place.

f. Obstruction remaining in the pipe after completion of the system shall be removed at the expense of the Contractor.

g. After installation and backfill of the hydrant loop is complete and before fuel is put in the pipe, the pipe will be cleaned using foam pigs and compressed dry gas, residual humidity of not over 20 percent. During this, low point drains and high point vents shall be blown clean. Cleaning with foam pigs will continue until nothing comes out of the pipe ahead of the pig and the foam pig comes out clean.

3.2.2 Protective Coatings

3.2.2.1 Application of Tape Wrapping

Surfaces to receive tape shall be clean, dry, grease-free and dust-free. Extruded polyethylene coating and adhesive undercoat surfaces to be tape wrapped shall be primed with a compatible primer prior to application of the tape. The primer shall be as recommended by the tape manufacturer and approved by the extruded polyethylene coating manufacturer. Weld beads shall be wire brushed. Burrs and weld spatter shall be removed. Weld beads shall be covered with one wrap of tape prior to spiral wrapping. Fittings shall be wrapped spirally beginning with one complete wrap three inches back from each edge of the extruded polyethylene coating. For pipe less than four-inch size, one layer half-lapped shall be used. For pipe four-inch size and larger, two layers half-lapped shall be used, with the

second layer wrapped opposite hand to the first. On irregular surfaces one layer shall be applied half-lapped and stretched to conform to the surface, followed by a second layer half-lapped and applied with the tension as it comes off the roll.

3.2.2.2 Inspection and Testing

The condition of factory field coated and wrapped piping shall be the responsibility of the Contractor and all damage to the protective covering during transit and handling shall be repaired by the Contractor at no additional cost to the Government. All field coating and wrapping shall be subject to approval by the Contracting Officer. The entire pipe shall be inspected as specified in sub-paragraph "Testing of Protective Coatings" under paragraph "Protective Coatings for Buried Carbon Steel and Stainless Steel Piping." The inspection for holidays shall be performed just prior to lowering the pipe into the ditch and every precaution shall be taken during lowering and backfilling to prevent damage to the protective covering.

3.2.2.3 Damage Repair

Damaged areas of extruded polyethylene coating shall be repaired by tape wrapping as specified in the preceding paragraph for fittings. Residual material from the extruded polyethylene coating shall be pressed into the break or shall be trimmed off; all areas to be taped shall be primed, and the tape shall be applied half-lapped.

3.3 VERIFICATION OF DIMENSIONS

The Contractor shall become familiar with details of the work, shall verify dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing any work.

3.4 CLEANING OF PIPING

The Contractor shall keep the interior and ends of all new piping affected by the Contractor's operations thoroughly cleaned of foreign matter and water before and after being installed. Piping systems shall be kept clean during installation by means of plugs or other approved methods. When work is not in progress, open ends of piping and fittings shall be closed so that no water or other foreign substance will enter the pipes or fittings. Piping shall be inspected before placing into position. The interior of each length of pipe shall be cleaned after welding. It shall be the Contractor's responsibility for insuring that the interior of the piping is free of foreign matter when it is connected into the system.

3.5 TRENCHING AND BACKFILLING

Trenching and backfilling shall conform to Section 02314 EARTHWORK FOR UTILITIES SYSTEMS, and the following bedding and backfill requirements. The pipe shall be laid in a bed of sand six inches deep, compacted to the elevation of the bottom of the pipe. The full length of each section of pipe without any protective covering shall be excavated to permit installation of the protective covering. Pipe that has the grade or joint disturbed after laying, shall be taken up and relaid. Pipe shall not be laid in water or when the trench or weather conditions are unsuitable for such work. After testing and application of protective covering to joints, sand backfill shall be placed and compacted around the pipe or protective coating. The remainder of the backfill shall be the same as for other

types of pipe.

3.6 INSTALLATION OF UNDERGROUND PIPE

Underground fuel pipelines shall be pitched as shown on the drawings. Where not indicated they shall be pitched a minimum of 2 inches per 100 feet. Branch lines to the hydrant pits shall slope up to the pit. Two-inch pipe size valved drain connections shall be provided at all low points and 1 1/2-inch pipe size valved outlet vent connections shall be provided at all high points. Vent and drain lines shall terminate in male cam-type locking end dry breaks with matching female dust covers and installed in pits. The pipe shall have cover as shown on the drawings. Drain lines shall be installed at the slopes indicated.

3.6.1 Pipe Assembly

Pipe shall be strung parallel and adjacent to or above a trench. The pipe shall be supported on padded skids during welding and inspection of joints. Protective coating shall be inspected and repaired prior to lowering the pipe into the trench. The pipe shall be lowered using only canvas or nylon slings. The sling shall be dug from underneath the pipe after placements and shall not be pulled from underneath the pipe while in contact with it. Care shall be taken to prevent damage to the pipe, welded joints or coating and any such damage shall be repaired as directed by the Contracting Officer. Pressure testing of the pipe shall be done after it has been placed in final position in the trench.

3.6.2 Warning Tapes in Earth Trenches

For the purpose of early warning and identification of buried pipes outside of building walls during future trenching or other excavation, continuous identification tapes shall be provided in the trench. Tape shall be nonmagnetic plastic tape or aluminum foil plastic backed tape manufactured for the purpose of early warning and identification of utilities buried below the tape. Tape shall be at least three inches in width. Color of tape shall be as standard with the manufacturer with respect to the type of utility buried below the tape. Tape shall have lettering at least one inch high with not less than the following identification on the tape: BURIED JET FUEL PIPING BELOW. Tape shall be installed in accordance with the printed recommendations of the tape manufacturer, as modified herein. Tapes shall be buried at a depth of six inches from the top of the subgrade.

3.6.3 Clearances

Install pipe to be clear of contact with other pipes, pipe sleeves, casings, reinforcing steel, conduits, cables, or other metallic structures. Where pipes cross other pipes or structures with a separation of less than six inches, install an insulating separator. Protect the pipe from contact with a 12-inch square by 1 inch thick bituminous-impregnated canefiber board.

3.6.4 Protective Coating

When the protective coating on pipe is damaged, the Contracting Officer shall be notified and shall inspect the pipe before the coating is patched. If the damage to the pipe is deeper than 0.050-inch, the damage shall be repaired by welding in accordance with paragraph "WELDING". If the pipe is dented, out of round or damaged to the point that welding will not make it good as new, the length of pipe shall be rejected.

3.7 PIPING LAYOUT REQUIREMENTS

3.7.1 Pipe Fabrication

Fabricate piping to measurements established on the project site and position into place without springing or forcing. Make provisions for absorbing expansion and contraction without undue stress in any part of the system.

3.7.2 Interferences and Measurements

Provide offsets, fittings, and accessories required to eliminate interferences and to match actual equipment connection locations and arrangements. Verify measurements before commencing work. Submit discrepancies for clarification before proceeding with the installations to the Contracting Officer.

3.7.3 Space and Access

Keep piping, control tubing, which is not detailed close to structures and columns so as to take up a minimum amount of space. Ensure that access is provided for maintenance of equipment, valves and gauges.

3.7.4 Location

Do not place unions in locations that will be inaccessible after the completion of the work. Place unions on each side of equipment.

3.7.5 Piping and Equipment

Provide anchors where required to absorb or transmit thrust or eliminate vibration or pulsation. Provide hangers and supports near each change of direction. Select support components which do not restrict the movement of the pipe due to thermal expansion. Space hangers uniformly and arrange symmetrically.

3.7.6 Structural Support

Provide supplementary or intermediate steel or other structural members as required for transmission of loads to members forming part of the supporting structure.

3.7.7 Grade

Where profiles of piping lines are shown on the drawings, grade the line uniformly between changes in slope or direction. Maintain gradient to within ± 1/4-inch over the entire length of pipe. When backfilling has been completed to the top of the pipe, the pipe shall be surveyed at each joint and the midpoint between joints, logged by station number, and submitted to the Contracting Officer and approved before backfilling can continue.

3.7.8 Size Changes

Make changes in pipe size with reducing fittings. Do not use bushings. In lieu of welding reducing outlet tees for piping 2 inches and larger, welding branches suitable for 100 percent radiographic inspection may be used. Do not use weldolets unless specifically called out (labeled) on the

drawings.

3.7.9 Direction Changes

Make changes in the horizontal direction of pipes with long radius fittings. Provide special fittings when required. Do not make miter welds. Make odd-angle offsets with pipe bends or elbows cut to the proper angle.

3.8 TESTING

Piping shall be tested by pneumatic and hydrostatic pressure. Testing shall comply with applicable requirements of ASME B31.3, NFPA 30 and the requirements specified herein. Hydrostatic testing shall be performed using fuel as the liquid. Water shall not be introduced into the system for testing. Pressure and hydrostatic testing shall be performed only after welding inspection has been completed.

3.8.1 General

Piping to be installed underground shall not receive field applied protective covering at the joints or be covered by backfill until the piping has passed the pneumatic test described herein. To facilitate the tests, the Contractor shall isolate various sections of the piping system and test each one separately. Where such sections terminate at flanged valve points, the line shall be closed by means of blind flanges in lieu of relying on the valve. The Contractor shall furnish tapped flanges that can be attached to the end of the section of line being tested, and that will permit a direct connection between the piping and the air compressor and/or pressurizing pump. No taps in the permanent line will be permitted. The Contractor shall furnish all necessary equipment for testing; all gauges shall be subject to testing and approval of the Contracting Officer. The air used for pneumatic testing shall have a residual humidity of not over 20 percent. The Contractor shall provide dehumidifying equipment on the suction or discharge side of the air compressor used to provide air for testing. Pressurizing pump shall not exceed 10 cfm.

3.8.1.1 Pneumatic Test Procedure

Special safety measures, including the wearing of face mask, shall be taken during testing under pressure. Only authorized personnel shall be permitted in the area during testing. The pneumatic test pressure shall be applied in increments. A preliminary 25 psig test shall be applied. Examine joints with soap solution. Leaks revealed by this test shall be repaired. The full test pressure shall then be applied. Unless otherwise directed by the Contracting Officer, all piping shall be tested at a pressure of 100 psig for not less than 2 hours, during which time there shall be no drop in pressure, only pressure rises with temperature. The pressure source shall be disconnected during the final test period. Any leaks revealed by the test shall be repaired and the test repeated.

3.8.1.2 Hydrostatic Test Procedure

Upon completion of pneumatic testing and after backfilling, hydrostatically test the piping system in the pumphouse, between the pumphouse and the tanks, the transfer line, and the return pipe from the Pantograph Flush, with fuel at 275 psig in accordance with ASME B31.3 and API RP 1110, with no leakage or reduction in gauge pressure for four hours. The loop piping system and the truck fillstand piping system shall be tested with fuel at

413 psig in accordance with ASME B31.3 and API RP 1110, with no leakage or reduction in gauge pressure for four hours. The piping systems tested to 413 psig shall have all ball valves and equipment removed and spool pieces or blind flanges installed. The Contractor shall furnish electricity, instruments, connecting devices, and personnel for test. Fuel shall be furnished by the Government. Defects in work provided by the Contractor shall be corrected by him at his own expense, and the test repeated until the work is proven to be in compliance with the Contract requirements. Fuel added to the system to bring the system pressure up, shall be mechanically tempered, heated or cooled, to the ground temperatured of the buried pipe.

3.8.2 Performance Testing

The completed fuel system shall be cleaned and performance tested as specified in Section 15899 SYSTEM START UP, FUELING SYSTEM. All control valves, both manual and automatic, shall be checked for leaks (any area wetted with fuel) and proper operation and adjusted, repaired or replaced to correct any defects.

3.9 PIPELINE PIGGING VERIFICATION

3.9.1 Geometry Tool Reports

After the system is installed and prior to performance testing, a field/preliminary report shall be issued and a debrief given to Government personnel on-site on the condition of the fuel hydrant loop. This shall be comprised of raw data in the form of a PC download or equivalent which shows a continuous scan of each data unit output. Results of a preliminary interpretation of the data shall be reported. These shall include as a minimum all critical anomalies. A final report shall include a description of the principle of operation, explanation of raw data, presentation of raw data, data to be clearly marked with distance traveled scale with classified anomaly location and all identifiable pipeline features, and all anomalies to be classified with locations in summary tabular form.

3.9.2 Workmanship

The Contractor shall verify pipe bend radii at pipe locations between pig launchers and receivers. If a pipe bend is less than 3D, the Contractor shall replace the bend.

3.9.3 Pipeline Internal Inspection Operations

3.9.3.1 General

The following pigs will be propelled through the pipeline with product in order to inspect the pipeline: brush, gage, and geometry. Tracking devices shall be used on all pigs. The pipe wall shall be continuously monitored on a real-time basis during the geometry pig run. Anomalies such as patches, couplings, or flanges shall also be identified. A permanent data set of internal inspection survey findings shall be generated.

3.9.3.2 Preparatory Work

The Government will bring to the attention of the Contractor all statutes, rules and regulations relevant to the performance of the work on the site (on Government property) and shall also provide the Contractor with a copy of its own site regulations (if any). The Contractor shall provide the pigging vendors with all-available pipeline records and drawings.

3.9.3.3 Pig Load And Launch

The pig shall be loaded into the pig launcher by the Contractor. The method of loading and lodging the front pig cup into the launcher shall not involve the use of uncontrolled mechanical force applied to the rear of the pig.

3.9.3.4 Pipeline Operation During Pigging

All pig runs shall be made with the line packed with product. The system pumps will be used to propel the pig. The new pig traps will be used for pig launch and retrieval.

3.9.3.5 Brush and Gauging Survey

The Contractor shall run a brush pig at least one time. The brush pig shall be designed and provided by the geometry pig vendor. Additional runs may be required based upon the amount of debris found in the pipeline.The on-site geometry pig vendor's personnel shall determine if additional runs are required. Immediately following the brush pig run and immediately prior to the geometry survey, the Contractor will run, as a minimum, a single batching pig fitted with a gauge plate equal to 90 percent of the pipeline normal inside diameter. The plate is to be a segmented aluminum disk of 1/8 inch thickness. The gauging pig shall also include a tracker and tracking equipment. The Contractor is to track the pig assembly above ground during the operation.

3.9.3.6 Geometry Survey

After a satisfactory gauging pig run, the pipeline geometric defects are to be determined by a geometry tool. The geometry tool shall provide accuracy geometric anomaly detection and bend radius measuring capability. The data obtained shall be presented in a PC software format to allow user friendly analysis and presentation.

The geometry tool assembly shall be capable of:

a. Operating in hydrocarbon liquid environment, specifically jet fuel, at a pressure of up to ANSI 300 rating.

b. Traversing the pipeline with nominal wall thickness and possible bore restrictions down to 90 percent of nominal pipe inside diameter.

c. Traversing the pipeline length at a speed of between 3 and 5 ft/sec when propelled by pumped jet fuel. Pressure differential across pig not to exceed 50 psi.

d. Traversing through smooth pipe bends as small as 3D (3 pipe diameters) radius and single miter bends of up to 10 degrees change of direction.

e. Include a tracker and tracking equipment. The Contractor is to track the pig assembly above ground during the operation. The battery life of the tracker shall not be less than 72 hours.

f. Manual loading into the new horizontal pig trap.

The geometry tool assembly instrumentation performance shall be capable of:

a. Battery life to be minimum 18 hours at operating conditions.

b. Principle of operation to be electronically stored geometry system.

c. Geometry sensing to span full circumference and length of pipe, with associated distance measuring method.

d. Geometry system shall be capable of:

1. positive location and identification of each geometric anomaly.

2. positive location and identification of each bend.

3. positive location and identification of distance marker reference points of either magnetic or electronic type placed on or above the pipe by the Contractor.

e. Classification of geometric anomalies to be as minimum:

1. discrimination between ovality and intrusion anomalies.

2. mechanical damage such as mill defects, dents, internal gouges, and buckles.

3. pipeline weld defects (such as excess weld penetration).

4. geometric thickness anomalies. As a minimum, these shall be reported in the following categories within the listed accuracy.

-magnitude of anomaly (+/- 1 inch)

-span of anomaly (+/- 1 inch)

-ovality (+/- 0.1 inch)

-span of ovality (+/- 1 inch)

-anomaly station (+/- 1:2,000)

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SECTION 15070

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SECTION 15070

SEISMIC PROTECTION FOR MECHANICAL EQUIPMENT

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

SHEET METAL & AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA Seismic Restraint Mnl	(1998) Seismic Restraint Manual Guidelines for Mechanical Systems

U.S. ARMY CORPS OF ENGINEERS (USACE)

TI 809-04	(1998) Seismic Design for Buildings

1.2 SYSTEM DESCRIPTION

1.2.1 General Requirements

The requirements for seismic control measures described in this section shall be applied to the mechanical equipment and systems listed below. Structural requirements shall be in accordance with Section 13080 SEISMIC PROTECTION FOR MISCELLANEOUS EQUIPMENT. Mechanical equipment and systems shall be anchored or braced to resist a seismic design force (Fp) of (1.95) X (Equipment Weight). The force (Fp) shall be applied independently longitudinally and laterally through the center of gravity of the equipment. The seismic force (Fp) can also be calculated using the provisions of TI 809-04, Chapter 10 with the following parameters:

Seismic Design Category	=	D
Seismic Use Group	=	III
S_{DS}	=	.811
I_p	=	1.5

Seismic forces (Fp) determined in accordance with TI 809-04, Chapter 10 may result in lower design forces than those calculated by (1.95) X (Equipment Weight).

1.2.2 Mechanical Equipment

Mechanical equipment to be seismically protected shall include the following items to the extent required on the drawings or in other sections of these specifications:

Storage Tanks for Water

Water Heaters	Steam, and Water Piping
Expansion Air Separator Tanks	Valves and Fittings for Piping
Heat Exchangers	

Thermal Storage Units
Air Compressors

Refrigerant Piping	Air Handling Units
Pumps with Motors	

Ducts

Flash Tanks	Unit Heaters
Accumulator Tank	Exhaust and Return Fans

1.2.3 Mechanical Systems

The following mechanical systems shall be installed as required on the drawings and other sections of these specifications and shall be seismically protected in accordance with this specification:

All Piping Inside the Building Except as Specifically Stated Below Under "Items Not Covered By This Section".
All Water Supply Systems
Storm and Sanitary Sewer Systems
Water Storage Tanks

1.2.4 Contractor Designed Bracing

The Contractor shall design the bracing in accordance with TI 809-04 and additional data furnished by the Contracting Officer. Resistance to lateral forces induced by earthquakes shall be accomplished without consideration of friction resulting from gravity loads.

1.2.5 Items Not Covered By This Section

1.2.5.1 Items Requiring No Seismic Restraints

Seismic restraints are not required for the following items:

a. Piping in mechanical equipment rooms less than 1-1/4 inches inside diameter.

b. All other piping less than 2-1/2inches inside diameter.

c. Rectangular air handling ducts less than 6 square feet in cross sectional area.

d. Round air handling ducts less than 28 inches in diameter.

e. Piping suspended by individual hangers 12 inches or less in length from the top of pipe to the bottom of the supporting structural member where the hanger is attached, except as noted below.

f. Ducts suspended by hangers 12inches or less in length from the top of the duct to the bottom of the supporting structural member, except as noted below.

In exemptions e. and f. all hangers shall meet the length requirements. If the length requirement is exceeded by one hanger in the run, the entire run shall be braced. Interior piping and ducts not listed above shall be seismically protected in accordance with the provisions of this specification.

1.3 EQUIPMENT REQUIREMENTS

1.3.1 Rigidly Mounted Equipment

The following specific items of equipment: Floor mounted and suspended equipment to be furnished under this contract shall be constructed and assembled to withstand the calculated seismic forces.

Air-Handling Units
Surge Tanks

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Coupling and Bracing; G-AE.

Flexible Couplings or Joints; G-AE.

Equipment Requirements; G-AE.

Contractor Designed Bracing; G-AE.

Detail drawings along with catalog cuts, templates, and erection and installation details, as appropriate, for the items listed. Submittals shall be complete in detail; shall indicate thickness, type, grade, class of metal, and dimensions; and shall show construction details, reinforcement, anchorage, and installation with relation to the building construction.

SD-03 Product Data

Coupling and Bracing; G-AE.

Equipment Requirements; G-AE.

Copies of the design calculations with the detail drawings. Calculations shall be stamped by a registered engineer and shall verify the capability of structural members to which bracing is attached for carrying the load from the brace.

Contractor Designed Bracing; G-AE.

Copies of the design calculations with the drawings. Calculations shall be approved, certified, stamped and signed by a registered Professional Engineer. Calculations shall verify the capability of structural members to which bracing is attached for carrying the load from the brace.

PART 2 PRODUCTS

2.1 FLEXIBLE COUPLINGS

Flexible couplings shall have same pressure and temperature ratings as adjoining pipe.

2.2 FLEXIBLE BALL JOINTS

Flexible ball joints shall have cast or wrought steel casing and ball parts capable of 360-degree rotation with not less than 15-degree angular movement.

2.3 FLEXIBLE MECHANICAL JOINTS

a. Mechanical couplings for steel or cast iron pipe shall be of the sleeve type and shall provide a tight flexible joint under all reasonable conditions, such as pipe movement caused by expansion, contraction, slight settling or shifting of the ground, minor variations in trench gradients, and traffic vibrations. Where permitted in other sections of these specifications, joints utilizing split-half couplings with grooved or shouldered pipe ends may be used.

b. Sleeve-type couplings shall be used for joining plain-end pipe sections. The coupling shall consist of one steel middle ring, two steel followers, two gaskets, and necessary steel bolts and nuts to compress the gaskets.

2.4 MANUFACTURED BALL JOINTS

Manufactured ball joints shall be as recommended by the manufacturer for the intended use, and shall be approved by the Contracting Officer before installation.

2.5 SWAY BRACING MATERIALS

Sway bracing materials (e.g. rods, plates, rope, angles, etc.) shall be as specified in Section 13080 SEISMIC PROTECTION FOR MISCELLANEOUS EQUIPMENT.

PART 3 EXECUTION

3.1 COUPLING AND BRACING

Coupling installation shall conform to the details shown on the drawings. Provisions of this paragraph apply to all piping within a 5 foot line around outside of building unless buried in the ground. Piping grouped for support on trapeze-type hangers shall be braced at the most frequent interval as determined by applying the requirements of this specification to each piping run on the common support. Bracing components shall be sized as required for the total load carried by the common supports. Bracing rigidly attached to pipe flanges, or similar, shall not be used where it would interfere with thermal expansion of piping.

3.2 FLEXIBLE COUPLINGS OR JOINTS

3.2.1 Building Piping

Flexible couplings or joints in building piping shall be provided at bottom

of all pipe risers for pipe larger than 3-1/2 inches in diameter. Flexible couplings or joints shall be braced laterally without interfering with the action of the flexible coupling or joint. Cast iron waste and vent piping need only comply with these provisions when caulked joints are used. Flexible bell and spigot pipe joints using rubber gaskets may be used at each branch adjacent to tees and elbows for underground waste piping inside of building to satisfy these requirements.

3.2.2 Underground Piping

Underground piping and 4 inch or larger conduit, except heat distribution system, shall have flexible couplings installed where the piping enters the building. The couplings shall accommodate 2 inche of relative movement between the pipe and the building in any direction. Additional flexible couplings shall be provided where shown on the drawings.

3.3 PIPE SLEEVES

Pipe sleeves in interior non-fire rated walls shall be sized as indicated on the drawings to provide clearances that will permit differential movement of piping without the piping striking the pipe sleeve. Pipe sleeves in fire rated walls shall conform to the requirements in Section 07840 FIRESTOPPING.

3.4 SPREADERS

Spreaders shall be provided between adjacent piping runs to prevent contact during seismic activity whenever pipe or insulated pipe surfaces are less than 4 inches apart. Spreaders shall be applied at same interval as sway braces at an equal distance between the sway braces. If rack type hangers are used where the pipes are restrained from contact by mounting to the rack, spreaders are not required for pipes mounted in the rack. Spreaders shall be applied to surface of bare pipe and over insulation on insulated pipes utilizing high-density inserts and pipe protection shields in accordance with the requirements of Section 15080 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

3.5 SWAY BRACES FOR PIPING

Sway braces shall be provided to prevent movement of the pipes under seismic loading. Braces shall be provided in both the longitudinal and transverse directions, relative to the axis of the pipe. The bracing shall not interfere with thermal expansion requirements for the pipes as described in other sections of these specifications.

3.5.1 Transverse Sway Bracing

Transverse sway bracing for steel and copper pipe shall be provided as specified in Section 13080 SEISMIC PROTECTION FOR MISCELLANEOUS EQUIPMENT. All runs (length of pipe between end joints) shall have a minimum of two transverse braces. Transverse sway bracing for pipes of materials other than steel and copper shall be provided at intervals not to exceed the hanger spacing as specified in Section 15400 PLUMBING, GENERAL PURPOSE.

3.5.2 Longitudinal Sway Bracing

Longitudinal sway bracing shall be provided at 40 foot intervals unless otherwise indicated. All runs (length of pipe between end joints) shall have one longitudinal brace minimum. Sway braces shall be constructed in

accordance with the drawings. Branch lines, walls, or floors shall not be used as sway braces.

3.5.3 Vertical Runs

Run is defined as length of pipe between end joints. Vertical runs of piping shall be braced at not more than 10 foot vertical intervals. Braces for vertical runs shall be above the center of gravity of the segment being braced. All sway braces shall be constructed in accordance with the drawings. Sway branches shall not be connected to branch lines, walls, or floors.

3.5.4 Clamps and Hangers

Clamps or hangers on uninsulated pipes shall be applied directly to pipe. Insulated piping shall have clamps or hangers applied over insulation in accordance with Section 15080 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

3.6 SWAY BRACES FOR DUCTS

3.6.1 Braced Ducts

Bracing details and spacing for rectangular and round ducts shall be in accordance with SMACNA Seismic Restraint Mnl, including Appendix E.

3.6.2 Unbraced Ducts

Hangers for unbraced ducts shall be attached to the duct within 2 inches of the top of the duct in accordance with SMACNA Seismic Restraint Mnl. Unbraced ducts shall be installed with a 6 inch minimum clearance to vertical ceiling hanger wires.

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SECTION 15080

THERMAL INSULATION FOR MECHANICAL SYSTEMS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only. At the discretion of the Government, the manufacturer of any material supplied will be required to furnish test reports pertaining to any of the tests necessary to assure compliance with the standard or standards referenced in this specification.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 580/A 580M	(1998) Stainless Steel Wire
ASTM B 209	(2002a) Aluminum and Aluminum-Alloy Sheet and Plate
ASTM C 1126	(2000) Faced or Unfaced Rigid Cellular Phenolic Thermal Insulation
ASTM C 1136	(1995) Flexible, Low Permeance Vapor Retarders for Thermal Insulation
ASTM C 1290	(2000e1) Flexible Fibrous Glass Blanket Insulation Used to Externally Insulate HVAC Ducts
ASTM C 195	(1995) Mineral Fiber Thermal Insulating Cement
ASTM C 449/C 449M	(2000) Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement
ASTM C 533	(1995; R 2001) Calcium Silicate Block and Pipe Thermal Insulation
ASTM C 534	(2001a) Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form
ASTM C 547	(2000) Mineral Fiber Pipe Insulation
ASTM C 552	(2000) Cellular Glass Thermal Insulation
ASTM C 553	(2000) Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
ASTM C 591	(2001) Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation

ASTM C 610	(1999) Molded Expanded Perlite Block and Pipe Thermal Insulation
ASTM C 612	(2000a) Mineral Fiber Block and Board Thermal Insulation
ASTM C 647	(1995; R 2000) Properties and Tests of Mastics and Coating Finishes for Thermal Insulation
ASTM C 665	(2001e1) Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
ASTM C 795	(1992; R 1998el) Thermal Insulation for Use in Contact with Austenitic Stainless Steel
ASTM C 920	(2002) Elastomeric Joint Sealants
ASTM C 921	(1989; R 1996) Determining the Properties of Jacketing Materials for Thermal Insulation
ASTM D 882	(1997) Tensile Properties of Thin Plastic Sheeting
ASTM E 84	(2001) Surface Burning Characteristics of Building Materials
ASTM E 96	(2000) Water Vapor Transmission of Materials

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-69	(1999) Pipe Hangers and Supports - Selection and Application

MIDWEST INSULATION CONTRACTORS ASSOCIATION (MICA)

MICA Insulation Stds	(1999) National Commercial & Industrial Insulation Standards

1.2 SYSTEM DESCRIPTION

Field-applied insulation and accessories on mechanical systems shall be as specified herein; factory-applied insulation is specified under the piping, duct or equipment to be insulated. Insulation of heat distribution systems and chilled water systems outside of buildings shall be as specified in Section 02559 HEAT DISTRIBUTION SYSTEMS IN UTILIDORS AND MANHOLES. Field applied insulation materials required for use on Government-furnished items as listed in the SPECIAL CONTRACT REQUIREMENTS shall be furnished and installed by the Contractor.

1.3 GENERAL QUALITY CONTROL

1.3.1 Standard Products

Materials shall be the standard products of manufacturers regularly engaged in the manufacture of such products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening.

1.3.2 Installer's Qualifications

Qualified installers shall have successfully completed three or more similar type jobs within the last 5 years.

1.3.3 Surface Burning Characteristics

Unless otherwise specified, insulation not covered with a jacket shall have a flame spread index no higher than 75 and a smoke developed index no higher than 150. Insulation systems which are located in air plenums, in ceiling spaces, and in attic spaces shall have a flame spread index no higher than 25 and a smoke developed index no higher than 50. Insulation materials located exterior to the building perimeter are not required to be fire-rated. Flame spread, and smoke developed indexes, shall be determined by ASTM E 84. Insulation shall be tested in the same density and installed thickness as the material to be used in the actual construction. Material supplied by a manufacturer with a jacket shall be tested as a composite material. Jackets, facings, and adhesives shall have a flame spread index no higher than 25 and a smoke developed index no higher than 50 when tested in accordance with ASTM E 84.

1.3.4 Identification of Materials

Packages or standard containers of insulation, jacket material, cements, adhesives, and coatings delivered for use, and samples required for approval shall have manufacturer's stamp or label attached giving the name of the manufacturer and brand, and a description of the material.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Mica Plates; G-AO.

After approval of materials and prior to applying insulation, a booklet shall be prepared and submitted for approval. The booklet shall contain marked-up MICA Insulation Stds plates (or detail drawings showing the insulation material and insulating system) for each pipe, duct, or piece of equipment that must be insulated per this specification. The MICA plates shall be marked up showing the materials to be installed in accordance with the requirements of this specification for the specific insulation application. The Contractor shall submit all MICA Plates required to show the entire insulating system, including Plates required to

show insulation penetrations, vessel bottom and top heads, legs, and skirt insulation as applicable. If the Contractor elects to submit detailed drawings instead of marked-up MICA Plates, the detail drawings shall show cut-away, section views, and details indicating each component of the insulation system and showing provisions for insulating jacketing, and sealing portions of the equipment. For each type of insulation installation on the drawings, provide a label that identifies each component in the installation (i.e., the duct, insulation, adhesive, vapor retarder, jacketing, tape, mechanical fasteners, etc.) Indicate insulation by type and manufacturer. Three copies of the booklet shall be submitted at the jobsite to the Contracting Officer. One copy of the approved booklet shall remain with the insulation Contractor's display sample and two copies shall be provided for Government use.

SD-03 Product Data

General Materials; G-AO.

A complete list of materials, including manufacturer's descriptive technical literature, performance data, catalog cuts, and installation instructions. The product number, k-value, thickness and furnished accessories for each mechanical system requiring insulation shall be included. Materials furnished under this section of the specification shall be submitted at one time.

SD-04 Samples

Thermal Insulation Materials; G-AO.

After approval of materials actual sections of installed systems, properly insulated in accordance with the specification requirements, shall be displayed. Such actual sections must remain accessible to inspection throughout the job and will be reviewed from time to time for controlling the quality of the work throughout the construction site. Each material used shall be identified, by indicating on an attached sheet the specification requirement for the material and the material by each manufacturer intended to meet the requirement. The Contracting Officer will inspect display sample sections at the jobsite. Approved display sample sections shall remain on display at the jobsite during the construction period. Upon completion of construction, the display sample sections will be closed and sealed.

Pipe Insulation Display Sections: Display sample sections shall include as a minimum an elbow or tee, a valve, dielectric waterways and flanges, a hanger with protection shield and insulation insert, or dowel as required, at support point, method of fastening and sealing insulation at longitudinal lap, circumferential lap, butt joints at fittings and on pipe runs, and terminating points for each type of pipe insulation used on the job, and for hot pipelines and cold pipelines, both interior and exterior, even when the same type of insulation is used for these services.

Duct Insulation Display Sections: Display sample sections for rigid and flexible duct insulation used on the job. A temporary covering shall be used to enclose and protect display sections for

duct insulation exposed to weather.

1.5 STORAGE

Materials shall be delivered in the manufacturer's unopened containers. Materials delivered and placed in storage shall be provided with protection from weather, humidity, dirt, dust and other contaminants. The Contracting Officer may reject insulation material and supplies that become dirty, dusty, wet, or contaminated by some other means.

PART 2 PRODUCTS

2.1 GENERAL MATERIALS

Materials shall be compatible and shall not contribute to corrosion, soften, or otherwise attack surfaces to which applied in either the wet or dry state. Materials to be used on stainless steel surfaces shall meet ASTM C 795 requirements. Materials shall be asbestos free and conform to the following:

2.1.1 Adhesives

2.1.1.1 Mineral Fiber Insulation Cement

Cement shall be in accordance with ASTM C 195.

2.1.1.2 Lagging Adhesive

Lagging is the material used for thermal insulation, especially around a cylindrical object. This may include the insulation as well as the cloth/material covering the insulation. Lagging adhesives shall be nonflammable and fire-resistant and shall have a flame spread rating no higher than 25 and a smoke developed rating no higher than 50 when tested in accordance with ASTM E 84. Adhesive shall be pigmented white and be suitable for bonding fibrous glass cloth to faced and unfaced fibrous glass insulation board; for bonding cotton brattice cloth to faced and unfaced fibrous glass insulation board; for sealing edges of and bonding fibrous glass tape to joints of fibrous glass board; for bonding lagging cloth to thermal insulation; or for attaching fibrous glass insulation to metal surfaces. Lagging adhesives shall be applied in strict accordance with the manufacturer's recommendations.

2.1.2 Contact Adhesive

Adhesives may be dispersed in a volatile organic solvent. Adhesives may be any of, but not limited to, the neoprane based, rubber based, or elastomeric type that have a flame spread index no higher than 25 and a smoke developed index no higher than 50 when tested in the dry state in accordance with ASTM E 84. The adhesive shall not adversely affect, initially or in service, the insulation to which it is applied, nor shall it cause any corrosive effect on metal to which it is applied. Any solvent dispersing medium or volatile component of the adhesive shall have no objectionable odor and shall not contain any benzene or carbon tetrachloride. The dried adhesive shall not emit nauseous, irritating, or toxic volatile matters or aerosols when the adhesive is heated to any temperature up to 212 degrees F. The dried adhesive shall be nonflammable and fire resistant. Natural cross-ventilation, local (mechanical) pickup, and/or general area (mechanical) ventilation shall be used to prevent an accumulation of solvent vapors, keeping in mind the ventilation pattern

must remove any heavier-than-air solvent vapors from lower levels of the workspaces. Gloves and spectacle-type safety glasses are recommended in accordance with safe installation practices.

2.1.3 Caulking

ASTM C 920, Type S, Grade NS, Class 25, Use A.

2.1.4 Corner Angles

Nominal 0.016 inch aluminum 1 x 1 inch with factory applied kraft backing. Aluminum shall be ASTM B 209, Alloy 3003, 3105, or 5005.

2.1.5 Finishing Cement

ASTM C 449/C 449M: Mineral fiber hydraulic-setting thermal insulating and finishing cement. All cements that may come in contact with Austenitic stainless steel must include testing per ASTM C 795.

2.1.6 Fibrous Glass Cloth and Glass Tape

Fibrous glass cloth and glass tape shall have flame spread and smoke developed ratings of no greater than 25/50 when measured in accordance with ASTM E 84. Tape shall be 4 inch wide rolls.

2.1.7 Staples

Outward clinching type monel . Monel is a nickel rich alloy that has high strength, high ductility, and excellent resistance to corrosion.

2.1.8 Jackets

ASTM C 921, Type I, maximum moisture vapor transmission 0.02 perms, (measured before factory application or installation), minimum puncture resistance 50 Beach units on all surfaces except concealed ductwork, where a minimum puncture resistance of 25 Beach units is acceptable. Minimum tensile strength, 35 pounds/inch width. ASTM C 921, Type II, minimum puncture resistance 25 Beach units, tensile strength minimum 20 pounds/inch width. Jackets used on insulation exposed in finished areas shall have white finish suitable for painting without sizing. Based on the application, insulation materials that require factory applied jackets are mineral fiber, cellular glass, and phenolic foam. All non-metallic jackets shall have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E 84.

2.1.8.1 White Vapor Retarder All Service Jacket (ASJ)

For use on hot/cold pipes, ducts, or equipment vapor retarder jackets used on insulation exposed in finished areas shall have white finish suitable for painting without sizing.

2.1.8.2 Aluminum Jackets

Aluminum jackets shall be corrugated, embossed or smooth sheet, 0.016 inch nominal thickness; ASTM B 209, Temper H14, Temper H16, Alloy 3003, 5005, or 3105 with factory applied moisture retarder. Corrugated aluminum jacket shall not be used outdoors. Aluminum jacket securing bands shall be Type 304 stainless steel, 0.015 inch thick, 1/2 inch wide for pipe under 12 inch diameter and 3/4 inch wide for pipe over 12 inch and larger diameter.

Aluminum jacket circumferential seam bands shall be 2 x 0.016 inch aluminum matching jacket material. Bands for insulation below ground shall be 3/4 x 0.020 inch) thick stainless steel, or fiberglass reinforced tape. The jacket may, at the option of the Contractor, be provided with a factory fabricated Pittsburg or "Z" type longitudinal joint. When the "Z" joint is used, the bands at the circumferential joints shall be designed by the manufacturer to seal the joints and hold the jacket in place.

2.1.8.3 Polyvinyl Chloride (PVC) Jackets

Polyvinyl chloride (PVC) jacket and fitting covers shall have high impact strength, UV resistant rating or treatment and moderate chemical resistance with minimum thickness 0.030 inch.

2.1.9 Vapor Retarder Required

2.1.9.1 Vapor Retarder Mastic Coatings

The vapor retarder coating shall be fire and water resistant and appropriately selected for either outdoor or indoor service. Color shall be white. The water vapor permeance of the compound shall be determined according to procedure B of ASTM E 96 utilizing apparatus described in ASTM E 96. The coating shall be a nonflammable, fire resistant type. All other application and service properties shall be in accordance with ASTM C 647.

2.1.9.2 Laminated Film Vapor Retarder

ASTM C 1136, Type I, maximum moisture vapor transmission 0.02 perms, minimum puncture resistance 50 Beach units on all surfaces except concealed ductwork, where Type II, maximum moisture vapor transmission 0.02 perms, a minimum puncture resistance of 25 Beach units is acceptable.

2.1.9.3 Polyvinylidene Chloride (PVDC) Film Vapor Retarder

The PVDC film vapor retarder shall have a maximum moisture vapor transmission of 0.02 perms, minimum puncture resistance of 150 Beach units, a minimum tensile strength in any direction of 30 lb/inch when tested per ASTM D 882, and a maximum flame spread/smoke developed index of 25/50 per ASTM E 84.

2.1.9.4 Polyvinylidene Chloride Vapor Retarder Adhesive Tape

Requirements must meet the same as specified for PVDC Film Vapor Retarder in paragraph 2.1.9.2 above.

2.1.10 Vapor Retarder Not Required

ASTM C 1136, Type III, maximum moisture vapor transmission 0.10 perms, minimum puncture resistance 50 Beach units on all surfaces except ductwork, where Type IV, maximum moisture vapor transmission 0.10, a minimum puncture resistance of 25 Beach units is acceptable.

2.1.11 Wire

Soft annealed ASTM A 580/A 580M, Type 302, 304, or 316 stainless steel, 16 or 18 gauge.

2.1.12 Sealants

Sealants shall be chosen from the butyl polymer type, the styrene-butadiene rubber type, or the butyl type of sealants. Sealants shall have a maximum moisture vapor transmission of 0.02 perms, and a maximum flame spread/smoke developed index of 25/50 per ASTM E 84.

2.2 PIPE INSULATION MATERIALS

The Contractor shall comply with EPA requirements in accordance with Section 01670 RECYCLED / RECOVERED MATERIALS. Pipe insulation materials shall be limited to those listed herein and shall meet the following requirements:

2.2.1 Aboveground Cold Pipeline

Insulation for minus 30 degrees to plus 60 degrees F for outdoor, indoor, exposed or concealed applications, shall be as follows:

a. Cellular Glass: ASTM C 552, Type II, and Type III. Supply the insulation with manufacturer's recommended factory-applied jacket.

b. Flexible Elastomeric Cellular Insulation: ASTM C 534, Type I or II. Type II shall have vapor retarder skin on both sides of the insulation.

c. Phenolic Insulation: ASTM C 1126, Type III. Phenolic insulations shall comply with ASTM C 795 and with the ASTM C 665 paragraph Corrosiveness. Supply the insulation with manufacturer's recommended factory-applied jacket.

d. Polyisocyanurate Insulation: ASTM C 591, type I. Supply the insulation with manufacturer's recommended factory-applied vapor retarder.

2.2.2 Aboveground Hot Pipeline

Insulation for above 60 degrees F, for outdoor, indoor, exposed or concealed applications shall meet the following requirements. Supply the insulation with manufacturer's recommended factory-applied jacket.

a. Mineral Fiber: ASTM C 547, Types I, II or III, supply the insulation with manufacturer's recommended factory-applied jacket.

b. Calcium Silicate: ASTM C 533, Type I indoor only, or outdoors above 250 degrees F pipe temperature. Supply insulation with the manufacturer's recommended factory-applied jacket.

c. Cellular Glass: ASTM C 552, Type II and Type III. Supply the insulation with manufacturer's recommended factory-applied jacket.

d. Flexible Elastomeric Cellular Insulation: ASTM C 534, Type I or II to 200 degrees F service.

e. Phenolic Insulation: ASTM C 1126 Type III to 250 F service shall comply with ASTM C 795. Supply the insulation with manufacturer's recommended factory-applied jacket.

f. Perlite Insulation: ASTM C 610

g. Polyisocyanurate Insulation: ASTM C 591, Type 1, to 300 degrees F service. Supply the insulation with manufacturer's recommended factory applied jacket.

2.2.3 Above Ground Dual Temperature Pipeline - Outdoors, Indoor - Exposed or Concealed

Selection of insulation for use over a dual temperature pipeline system shall be in accordance with the most limiting/restrictive case. Find an allowable material from paragraph PIPE INSULATION MATERIALS and determine the required thickness from the most restrictive case. Use the thickness listed in paragraphs INSULATION THICKNESS for cold & hot pipe applications.

2.3 DUCT INSULATION MATERIALS

Duct insulation materials shall be limited to those listed herein and shall meet the following requirements:

2.3.1 Rigid Mineral Fiber

ASTM C 612: Type IA, IB, II, III, & IV.

2.3.2 Flexible Mineral Fiber

ASTM C 553: Type I,or Type II up to 250 F. ASTM C 1290 Type III.

2.3.3 Cellular Glass

ASTM C 552, Type I.

2.3.4 Phenolic Foam

ASTM C 1126: Type II shall comply with ASTM C 795.

2.3.5 Flexible Elastomeric Cellular

ASTM C 534: Type II.

2.3.6 Polyisocyanurate

ASTM C 591: Type 1. Supply the insulation with manufacturer's recommended factory-applied jacket.

2.4 EQUIPMENT INSULATION MATERIALS

Equipment insulation materials shall be limited to those listed herein and shall meet the following requirements:

2.4.1 Cold Equipment Insulation

For equipment operating temperatures below 60 degrees F.

2.4.1.1 Cellular Glass

ASTM C 552: Type I, Type III, or Type IV as required.

2.4.1.2 Flexible Elastomeric Cellular Insulation

ASTM C 534, Type II.

2.4.1.3 Phenolic Foam

ASTM C 1126: Type II shall comply with ASTM C 795.

2.4.1.4 Polyisocyanurate Foam

ASTM C 591, Type I. Supply the insulation with manufacturer's factory-applied jacket.

2.4.2 Hot Equipment Insulation

For equipment operating temperatures above 60 degrees F.

2.4.2.1 Rigid Mineral Fiber

ASTM C 612: Type IA, IB, II, III, IV, or V as required for temperatures encountered to 1800 degrees F.

2.4.2.2 Flexible Mineral Fiber

ASTM C 553: Type I, II, III, IV, V, VI or VII as required for temperatures encountered to 1200 degrees F.

2.4.2.3 Calcium Silicate

ASTM C 533, Type I, in-doors only, or outdoors above 250 degrees F. Pipe shape may be used on diesel engine exhaust piping and mufflers to 1200 degrees F.

2.4.2.4 Cellular Glass

ASTM C 552: Type I, Type III, or Type IV as required.

2.4.2.5 Flexible Elastomeric Cellular Insulation

ASTM C 534, Type II, to 200 degrees F.

2.4.2.6 Phenolic Foam

ASTM C 1126, Type II, to 250 degrees F shall comply with ASTM C 795.

2.4.2.7 Molded Expanded Perlite

ASTM C 610.

2.4.2.8 Polyisocyanurate Foam:

ASTM C 591, Type I to 300 degrees F service. Supply the insulation with manufacturer's recommended factory-applied jacket.

PART 3 EXECUTION

3.1 APPLICATION - GENERAL

Insulation shall only be applied to unheated and uncooled piping and

equipment. Flexible elastomeric cellular insulation shall not be compressed at joists, studs, columns, ducts, hangers, etc. The insulation shall not pull apart after a one hour period; any insulation found to pull apart after one hour, shall be replaced.

3.1.1 Installation

Except as otherwise specified, material shall be installed in accordance with the manufacturer's written instructions. Insulation materials shall not be applied until tests specified in other sections of this specification are completed. Material such as rust, scale, dirt and moisture shall be removed from surfaces to receive insulation. Insulation shall be kept clean and dry. Insulation shall not be removed from its shipping containers until the day it is ready to use and shall be returned to like containers or equally protected from dirt and moisture at the end of each workday. Insulation that becomes dirty shall be thoroughly cleaned prior to use. If insulation becomes wet or if cleaning does not restore the surfaces to like new condition, the insulation will be rejected, and shall be immediately removed from the jobsite. Joints shall be staggered on multi layer insulation. Mineral fiber thermal insulating cement shall be mixed with demineralized water when used on stainless steel surfaces. Insulation, jacketing and accessories shall be installed in accordance with MICA Insulation Stds plates except where modified herein or on the drawings.

3.1.2 Fire-stopping

Where pipes and ducts pass through fire walls, fire partitions, above grade floors, and fire rated chase walls, the penetration shall be sealed with fire stopping materials as specified in Section 07840 FIRESTOPPING.

3.1.3 Painting and Finishing

Painting shall be as specified in Section 09900 PAINTS AND COATINGS.

3.1.4 Installation of Flexible Elastomeric Cellular Insulation

Flexible elastomeric cellular insulation shall be installed with seams and joints sealed with rubberized contact adhesive. Insulation with pre-applied adhesive is not permitted. Flexible elastomeric cellular insulation shall not be used on surfaces greater than 200 degrees F. Seams shall be staggered when applying multiple layers of insulation. Insulation exposed to weather and not shown to have jacketing shall be protected with two coats of UV resistant finish as recommended by the manufacturer after the adhesive is dry. A brush coating of adhesive shall be applied to both butt ends to be joined and to both slit surfaces to be sealed. The adhesive shall be allowed to set until dry to touch but tacky under slight pressure before joining the surfaces. Insulation seals at seams and joints shall not be capable of being pulled apart one hour after application. Insulation that can be pulled apart one hour after installation shall be replaced.

3.1.5 Welding

No welding shall be done on piping, duct or equipment without written approval of the Contracting Officer. The capacitor discharge welding process may be used for securing metal fasteners to duct.

3.1.6 Pipes/Ducts/Equipment which Require Insulation

Insulation is required on all pipes, ducts, or equipment, except for omitted items, as specified.

3.2 PIPE INSULATION INSTALLATION

3.2.1 Pipe Insulation

3.2.1.1 General

Pipe insulation shall be installed on aboveground hot and cold pipeline systems as specified below to form a continuous thermal retarder, including straight runs, fittings and appurtenances unless specified otherwise. Installation shall be with full length units of insulation and using a single cut piece to complete a run. Cut pieces or scraps abutting each other shall not be used. Pipe insulation shall be omitted on the following:

a. Pipe used solely for fire protection.

b. Chromium plated pipe to plumbing fixtures. However, fixtures for use by the physically handicapped shall have the hot water supply and drain, including the trap, insulated where exposed.

c. Sanitary drain lines.

d. Air chambers.

3.2.1.2 Pipes Passing Through Walls, Roofs, and Floors

a. Pipe insulation shall be continuous through the sleeve.

b. An aluminum jacket with factory applied moisture retarder shall be provided over the insulation wherever penetrations require sealing.

c. Where pipes penetrate interior walls, the aluminum jacket shall extend 2 inches beyond either side of the wall and shall be secured on each end with a band.

d. Where penetrating floors, the aluminum jacket shall extend from a point below the backup material to a point 10 inches above the floor with one band at the floor and one not more than 1 inch from the end of the aluminum jacket.

e. Where penetrating waterproofed floors, the aluminum jacket shall extend from below the backup material to a point 2 inchesabove the flashing with a band 1 inch from the end of the aluminum jacket.

f. Where penetrating exterior walls, the aluminum jacket required for pipe exposed to weather shall continue through the sleeve to a point 2 inches beyond the interior surface of the wall.

g. Where penetrating roofs, pipe shall be insulated as required for interior service to a point flush with the top of the flashing and sealed with vapor retarder coating. The insulation for exterior application shall butt tightly to the top of flashing and interior insulation. The exterior aluminum jacket shall extend 2 inches down beyond the end of the insulation to form a counter flashing. The flashing and counter flashing shall be sealed underneath with

caulking.

h. For hot water pipes supplying lavatories or other similar heated service that requires insulation, the insulation shall be terminated on the backside of the finished wall. The insulation termination shall be protected with two coats of vapor barrier coating with a minimum total thickness of 1/16 inch applied with glass tape embedded between coats (if applicable). The coating shall extend out onto the insulation 2 inches and shall seal the end of the insulation. Glass tape seams shall overlap 1 inch. The annular space between the pipe and wall penetration shall be caulked with approved fire stop material. The pipe and wall penetration shall be covered with a properly sized (well fitting) escutcheon plate. The escutcheon plate shall overlap the wall penetration at least 3/8 inches.

i. For domestic cold water pipes supplying lavatories or other similar cooling service that requires insulation, the insulation shall be terminated on the finished side of the wall (i.e., insulation must cover the pipe throughout the wall penetration). The insulation shall be protected with two coats of vapor barrier coating with a minimum total thickness of 1/16 inch. The coating shall extend out onto the insulation 2 inches and shall seal the end of the insulation. The annular space between the outer surface of the pipe insulation and the wall penetration shall be caulked with an approved fire stop material having vapor retarder properties. The pipe and wall penetration shall be covered with a properly sized (well fitting) escutcheon plate. The escutcheon plate shall overlap the wall penetration by at least 3/8 inches.

3.2.1.3 Pipes Passing Through Hangers

a. Insulation, whether hot or cold application, shall be continuous through hangers. All horizontal pipes 2 inches and smaller shall be supported on hangers with the addition of a Type 40 protection shield to protect the insulation in accordance with MSS SP-69. Whenever insulation shows signs of being compressed, or when the insulation or jacket shows visible signs of distortion at or near the support shield, insulation inserts as specified below for piping larger than 2 inches shall be installed.

b. Horizontal pipes larger than 2 inches at 60 degrees F and above shall be supported on hangers in accordance with MSS SP-69, and Section 15400 PLUMBING, GENERAL PURPOSE.

c. Horizontal pipes larger than 2 inches and below 60 degrees F shall be supported on hangers with the addition of a Type 40 protection shield in accordance with MSS SP-69. An insulation insert of cellular glass, calcium silicate (or perlite above 80 F), or the necessary strength polyisocyanurate shall be installed above each shield. The insert shall cover not less than the bottom 180-degree arc of the pipe. Inserts shall be the same thickness as the insulation, and shall extend 2 inches on each end beyond the protection shield. When insulation inserts are required per the above, and the insulation thickness is less than 1 inch, wooden or cork dowels or blocks may be installed between the pipe and the shield to prevent the weight of the pipe from crushing the insulation, as an option to installing insulation inserts. The insulation jacket shall be continuous over the wooden dowel,

wooden block, or insulation insert.

d. Vertical pipes shall be supported with either Type 8 or Type 42 riser clamps with the addition of two Type 40 protection shields in accordance with MSS SP-69 covering the 360-degree arc of the insulation. An insulation insert of cellular glass or calcium silicate shall be installed between each shield and the pipe. The insert shall cover the 360-degree arc of the pipe. Inserts shall be the same thickness as the insulation, and shall extend 2 inches on each end beyond the protection shield. When insulation inserts are required per the above, and the insulation thickness is less than 1 inch, wooden or cork dowels or blocks may be installed between the pipe and the shield to prevent the hanger from crushing the insulation, as an option instead of installing insulation inserts. The insulation jacket shall be continuous over the wooden dowel, wooden block, or insulation insert. The vertical weight of the pipe shall be supported with hangers located in a horizontal section of the pipe. When the pipe riser is longer than 30 feet, the weight of the pipe shall be additionally supported with hangers in the vertical run of the pipe that are directly clamped to the pipe, penetrating the pipe insulation. These hangers shall be insulated and the insulation jacket sealed as indicated herein for anchors in a similar service.

e. Inserts shall be covered with a jacket material of the same appearance and quality as the adjoining pipe insulation jacket, shall overlap the adjoining pipe jacket 1-1/2 inches, and shall be sealed as required for the pipe jacket. The jacket material used to cover inserts in flexible elastomeric cellular insulation shall conform to ASTM C 1136, Type 1, and is allowed to be of a different material than the adjoining insulation material.

3.2.1.4 Flexible Elastomeric Cellular Pipe Insulation

Flexible elastomeric cellular pipe insulation shall be tubular form for pipe sizes 6 inches and less. Type II sheet insulation used on pipes larger than 6 inches shall not be stretched around the pipe. On pipes larger than 12 inches, the insulation shall be adhered directly to the pipe on the lower 1/3 of the pipe. Seams shall be staggered when applying multiple layers of insulation. Sweat fittings shall be insulated with miter-cut pieces the same size as on adjacent piping. Screwed fittings shall be insulated with sleeved fitting covers fabricated from miter-cut pieces and shall be overlapped and sealed to the adjacent pipe insulation.

3.2.1.5 Pipes in high abuse areas.

In high abuse areas such as the mechanical room, aluminum jackets shall be utilized. Pipe insulation to the 6 foot level shall be protected.

3.2.2 Aboveground Cold Pipelines

The following cold pipelines shall be insulated per Table I minus 30 degrees to plus 60 degrees F:

a. Domestic cold.

b. Make-up water.

c. Horizontal and vertical portions of interior roof drains.

d. Refrigerant suction lines.

e. Air conditioner condensate drains.

3.2.2.1 Insulation Thickness

Insulation thickness for cold pipelines shall be determined using Table I.

Table I - Cold Piping Insulation Thickness
Pipe Size (inches)

Type of Service	Material	Run-outs up to 2 in*	1 in & less	1.25 - 2 in	2.5 - 4 in	5 - 6 in	8 in & larger
Refrigerant suction piping	CG		1.5	1.5	1.5	1.5	1.5
	FC		1.0	1.0	1.0	1.0	1.0
	PF		1.5	1.5	1.5	1.5	1.5
	PC		1.0	1.0	1.0	1.0	1.0
Cold domestic water, above and below ceilings	CG	1.5	1.5	1.5	1.5	1.5	1.5
	FC	3/8	3/8	3/8	3/8	3/8	3/8
	PF	1.5	1.5	1.5	1.5	1.5	1.5
	PC	1.0	1.0	1.0	1.0	1.0	1.0
Air conditioning condensate drain located inside building	FC		3/8	0.5	0.5	N/A	N/A
	PF		1.5	1.5	1.5	N/A	N/A
	PC		1.0	1.0	1.0	N/A	N/A

*When run-outs to terminal units exceed 12 feet, the entire length of run-out shall be insulated like main feed pipe. Insulations may not be applied if their flame and smoke developed ratings exceed the requirements of 25/50 established in this guide specification. Layered insulations, or installation where multiple layers of the same insulation are used, must be checked for this (in particular if the insulation has been rated per ASTM E 84 for one thickness).

LEGEND:

PF - Phenolic Foam
CG - Cellular Glass
MF - Mineral Fiber
FC - Flexible Elastomeric Cellular
PC - Polyisocyanurate Foam

3.2.2.2 Jacket for Mineral Fiber, Cellular Glass, Phenolic Foam, and Polyisocyanurate Foam Insulated Pipe

Insulation shall be covered with a factory applied vapor retarder jacket or field applied seal welded PVC jacket. Insulation inside the building, to be protected with an aluminum jacket, shall have the insulation and vapor retarder jacket installed as specified herein. The aluminum jacket shall be installed as specified for piping exposed to weather, except sealing of

the laps of the aluminum jacket is not required. In high abuse areas such as the mechanical room, aluminum jackets shall be utilized. Pipe insulation to the 6 ft level shall be protected.

3.2.2.3 Insulation for Straight Runs (Mineral Fiber, Cellular Glass, Phenolic Foam and Polyisocyanurate Foam)

a. Insulation shall be applied to the pipe with joints tightly butted. All butted joints and ends shall be sealed with joint sealant and sealed with a vapor retarder coating or PVDC adhesive tape.

b. Longitudinal laps of the jacket material shall overlap not less than 1-1/2 inches. Butt strips 3 inches wide shall be provided for circumferential joints.

c. Laps and butt strips shall be secured with adhesive and stapled on 4 inch centers if not factory self-sealing. If staples are used, they shall be sealed per item "e." below. Note that staples are not required with cellular glass systems.

d. Factory self-sealing lap systems may be used when the ambient temperature is between 40 degrees and 120 degrees F during installation. The lap system shall be installed in accordance with manufacturer's recommendations. Stapler shall be used only if specifically recommended by the manufacturer. Where gaps occur, the section shall be replaced or the gap repaired by applying adhesive under the lap and then stapling.

e. All Staples, including those used to repair factory self-seal lap systems, shall be coated with a vapor retarder coating or PVDC adhesive tape. All seams, except those on factory self-seal systems shall be coated with vapor retarder coating or PVDC adhesive tape.

f. Breaks and punctures in the jacket material shall be patched by wrapping a strip of jacket material around the pipe and securing it with adhesive, stapling, and coating with vapor retarder coating or PVDC adhesive tape. The patch shall extend not less than 1-1/2 inches past the break.

g. At penetrations such as thermometers, the voids in the insulation shall be filled and sealed with vapor retarder coating or PVDC adhesive tape.

3.2.2.4 Insulation for Fittings and Accessories

a. Pipe insulation shall be tightly butted to the insulation of the fittings and accessories. The butted joints and ends shall be sealed with joint sealant and sealed with a vapor retarder coating or PVDC adhesive tape.

b. Precut or preformed insulation shall be placed around all fittings and accessories and shall conform to MICA plates except as modified herein: 5 for anchors; 10, 11, and 13 for fittings; 14 for valves; and 17 for flanges and unions. Insulation shall be the same insulation as the pipe insulation, including same density, thickness, and thermal conductivity. Where precut/preformed is unavailable, rigid preformed pipe insulation

sections may be segmented into the shape required. Insulation of the same thickness and conductivity as the adjoining pipe insulation shall be used. If nesting size insulation is used, the insulation shall be overlapped 2 inches or one pipe diameter. Elbows insulated using segments shall conform to MICA Tables 12.20 "Mitered Insulation Elbow'.

c. Upon completion of insulation installation on flanges, unions, valves, anchors, fittings and accessories, terminations, seams, joints and insulation not protected by factory vapor retarder jackets or PVC fitting covers shall be protected with PVDC adhesive tape or two coats of vapor retarder coating with a minimum total thickness of 1/16 inch, applied with glass tape embedded between coats. Tape seams shall overlap 1 inch. The coating shall extend out onto the adjoining pipe insulation 2 inches. Fabricated insulation with a factory vapor retarder jacket shall be protected with PVDC adhesive tape or two coats of vapor retarder coating with a minimum thickness of 1/16 inch and with a 2 inch wide glass tape embedded between coats. Where fitting insulation butts to pipe insulation, the joints shall be sealed with a vapor retarder coating and a 4 inch wide ASJ tape which matches the jacket of the pipe insulation.

d. Anchors attached directly to the pipe shall be insulated for a sufficient distance to prevent condensation but not less than 6 inches from the insulation surface.

e. Insulation shall be marked showing the location of unions, strainers, and check valves.

3.2.2.5 Optional PVC Fitting Covers

At the option of the Contractor, premolded, one or two piece PVC fitting covers may be used in lieu of the vapor retarder and embedded glass tape. Factory precut or premolded insulation segments shall be used under the fitting covers for elbows. Insulation segments shall be the same insulation as the pipe insulation including same density, thickness, and thermal conductivity. The covers shall be secured by PVC vapor retarder tape, adhesive, seal welding or with tacks made for securing PVC covers. Seams in the cover, and tacks and laps to adjoining pipe insulation jacket, shall be sealed with vapor retarder tape to ensure that the assembly has a continuous vapor seal.

3.2.3 Aboveground Hot Pipelines

The following hot pipelines above 60 degrees F shall be insulated per Table II:

a. Domestic hot water supply.

b. Steam.

c. Condensate & compressed air discharge.

d. Hot water heating.

3.2.3.1 Insulation Thickness

Insulation thickness for hot pipelines shall be determined using Table II.

LEGEND:

PF - Phenolic Foam
CG - Cellular Glass
CS - Calcium Silicate
MF - Mineral Fiber
FC - Flexible Elastomeric Cellular
PL - Perlite
PC - Polyisocyanurate Foam

Table II - Hot Piping Insulation Thickness
Pipe Size (inches)

Type of Service (degrees F)	Material	Run-outs up to 2 in *	1 in & less	1.25 - 2 in	2.5 - 4 in	5 - 6 in	8 in & larger
Hot domestic water supply	CG	1.5	1.5	1.5	1.5	1.5	1.5
	FC	0.5	0.5	1.0	1.0	1.5	1.5
	PF	0.5	0.5	1.0	1.0	1.0	1.0
	MF	0.5	1.5	1.5	1.5	1.5	1.5
	PC	1.0	1.0	1.0	1.0	1.0	1.0
(200 F max)**							
Compressed Air discharge steam & condensate return (201-250 F)	CG		1.5	2.0	2.0	2.0	3.5
	PF		1.0	1.0	1.0	1.0	1.5
	MF		1.5	1.5	2.0	2.0	2.5
	CS/PL		1.5	2.0	2.5	2.5	3.5
	PC		1.0	1.0	1.0	1.0	1.0
Heating hot water, supply & return,	CG	1.5	1.5	2.0	2.0	2.5	3.0
	PF	0.5	1.0	1.0	1.0	1.0	1.5
	MF	0.5	1.5	1.5	2.0	2.5	3.0
	CS	1.0	1.5	2.0	2.5	2.5	3.0
(250 F max)	PC	1.0	1.0	1.0	1.0	1.0	1.0

* When run-outs to terminal units exceed 12 feet, the entire length of run-out shall be insulated like the main feed pipe.

** Applies to re-circulating sections of service or domestic hot water systems and first 8 feet from storage tank for non-re-circulating systems.

3.2.3.2 Jacket for Insulated Hot Pipe, Except Pipe Insulated with Flexible Elastomeric Cellular

Insulation shall be covered, in accordance with manufacturer's recommendations, with a factory applied Type II jacket or field applied aluminum where required or seal welded PVC.

3.2.3.3 Insulation for Straight Runs

a. Insulation shall be applied to the pipe with joints tightly butted.

b. Longitudinal laps of the jacket material shall overlap not less than 1-1/2 inches, and butt strips 3 inches wide shall be provided

for circumferential joints.

c. Laps and butt strips shall be secured with adhesive and stapled on 4 inch centers if not factory self-sealing. Adhesive may be omitted where pipe is concealed.

d. Factory self-sealing lap systems may be used when the ambient temperature is between 40 degrees and 120 degrees F and shall be installed in accordance with manufacturer's instructions. Laps and butt strips shall be stapled whenever there is non-adhesion of the system. Where gaps occur, the section shall be replaced or the gap repaired by applying adhesive under the lap and then stapling.

e. Breaks and punctures in the jacket material shall be patched by either wrapping a strip of jacket material around the pipe and securing with adhesive and staple on 4 inch centers (if not factory self-sealing), or patching with tape and sealing with a brush coat of vapor retarder coating. Adhesive may be omitted where pipe is concealed. Patch shall extend not less than 1-1/2 inches past the break.

f. Installation of flexible elastomeric cellular pipe insulation shall be by slitting the tubular sections and applying them onto the piping or tubing. Alternately, whenever possible slide un-slit sections over the open ends of piping or tubing. All seams and butt joints shall be secured and sealed with adhesive. When using self seal products only the butt joints shall be secured with adhesive. Insulation shall be pushed on the pipe, never pulled. Stretching of insulation may result in open seams and joints. All edges shall be clean cut. Rough or jagged edges of the insulation shall not be permitted. Proper tools such as sharp knives shall be used. Type II sheet insulation when used on pipe larger than 6 inches shall not be stretched around the pipe. On pipes larger than 12 inches, adhere sheet insulation directly to the pipe on the lower 1/3 of the pipe.

3.2.3.4 Insulation for Fittings and Accessories

a. Pipe insulation shall be tightly butted to the insulation of the fittings and accessories.

b. Precut or preformed insulation shall be placed around all fittings and accessories and shall conform to MICA plates, except as modified herein: 5 for anchors; 10, 11, 12,and 13 for fittings; 14, 15 and 16 for valves; 17 for flanges and unions; and 18 for couplings. Insulation shall be the same as the pipe insulation, including same density, thickness, and thermal conductivity. Where precut/preformed is unavailable, rigid preformed pipe insulation sections may be segmented into the shape required. Insulation of the same thickness and conductivity as the adjoining pipe insulation shall be used. If nesting size insulation is used, the insulation shall be overlapped 2 inches or one pipe diameter. Elbows insulated using segments shall conform to MICA Tables 12.20 "Mitered Insulation Elbow".

c. Upon completion of installation of insulation on flanges, unions, valves, anchors, fittings and accessories, terminations and insulation not protected by factory jackets or PVC fitting covers

shall be protected with two coats of adhesive applied with glass tape embedded between coats. Tape seams shall overlap 1 inch. Adhesive shall extend onto the adjoining insulation not less than 2 inches. The total dry film thickness shall be not less than 1/16 inch.

d. Insulation terminations shall be tapered to unions at a 45-degree angle.

e. At the option of the Contractor, factory pre-molded one- or two-piece PVC fitting covers may be used in lieu of the adhesive and embedded glass tape. Factory pre-molded segments or factory or field cut blanket insert insulation segments shall be used under the cover and shall be the same thickness as adjoining pipe insulation. The covers shall be secured by PVC vapor retarder tape, adhesive, seal welding or with tacks made for securing PVC covers.

3.2.4 Piping Exposed to Weather

Piping exposed to weather shall be insulated and jacketed as specified for the applicable service inside the building. After this procedure, an aluminum jacket or PVC jacket shall be applied. PVC jacketing requires no factory-applied jacket beneath it, however an all service jacket shall be applied if factory applied jacketing is not furnished. Flexible elastomeric cellular insulation exposed to weather shall be treated in accordance with paragraph INSTALLATION OF FLEXIBLE ELASTOMERIC CELLULAR INSULATION.

3.2.4.1 Aluminum Jacket

The jacket for hot piping may be factory applied. The jacket shall overlap not less than 2 inches at longitudinal and circumferential joints and shall be secured with bands at not more than 12 inch centers. Longitudinal joints shall be overlapped down to shed water and located at 4 or 8 o'clock positions. Joints on piping 60 degrees F and below shall be sealed with caulking while overlapping to prevent moisture penetration. Where jacketing on piping 60 degrees F and below abuts an un-insulated surface, joints shall be caulked to prevent moisture penetration. Joints on piping above 60 degrees F shall be sealed with a moisture retarder.

3.2.4.2 Insulation for Fittings

Flanges, unions, valves, fittings, and accessories shall be insulated and finished as specified for the applicable service. Two coats of breather emulsion type weatherproof mastic (impermeable to water, permeable to air) recommended by the insulation manufacturer shall be applied with glass tape embedded between coats. Tape overlaps shall be not less than 1 inch and the adjoining aluminum jacket not less than 2 inches. Factory preformed aluminum jackets may be used in lieu of the above. Molded PVC fitting covers shall be provided when PVC jackets are used for straight runs of pipe. PVC fitting covers shall have adhesive welded joints and shall be weatherproof.

3.2.4.3 PVC Jacket

PVC jacket shall be ultraviolet resistant and adhesive welded weather tight with manufacturer's recommended adhesive. Installation shall include provision for thermal expansion.

3.3 DUCT INSULATION INSTALLATION

Except for oven hood exhaust duct insulation, corner angles shall be installed on external corners of insulation on ductwork in exposed finished spaces before covering with jacket.

3.3.1 Duct Insulation Thickness

Duct insulation thickness shall be in accordance with Table III. Maximum thickness for flexible elastomeric cellular insulation shall not exceed 25 mm, and maximum thickness for polyisocyanurate foam insulation shall not exceed 40 mm to comply with ASTM E 84 flame spread/smoke developed ratings of 25/50

Table III - Minimum Duct Insulation (inches)

Cold Air Ducts	2.0
Relief Ducts	1.5
Fresh Air Intake Ducts	1.5
Warm Air Ducts	2.0
Relief Ducts	1.5
Fresh Air Intake Ducts	1.5

Maximum thickness for flexible elastomeric cellular insulation shall not exceed 1 inch and maximum thickness for polyisocyanurate foam insulation shall not exceed 1.5 inch, to comply with ASTM E 84 flame spread/smoke developed ratings of 25/50.

3.3.2 Insulation and Vapor Retarder for Cold Air Duct

Insulation and vapor retarder shall be provided for the following cold air ducts and associated equipment.

a. Supply ducts.

b. Return air ducts.

c. Relief ducts.

d. Flexible run-outs (field-insulated).

e. Duct-mounted coil casings.

f. Coil headers and return bends.

g. Coil casings.

h. Fresh air intake ducts.

i. Filter boxes.

j. Mixing boxes (field-insulated).

k. Supply fans (field-insulated).

Insulation for rectangular ducts shall be flexible type where concealed, minimum density 3/4 pcf and rigid type where exposed, minimum density 3 pcf.

Insulation for round/oval ducts shall be flexible type, minimum density 3/4 pcf with a factory Type I or II jacket; or, a semi rigid board, minimum density 3 pcf, formed or fabricated to a tight fit, edges beveled and joints tightly butted and staggered, with a factory applied Type I or II all service jacket. Insulation for exposed ducts shall be provided with either a white, paint-able, factory-applied Type I jacket or a vapor retarder jacket coating finish as specified. Insulation on concealed duct shall be provided with a factory-applied Type I or II vapor retarder jacket. The total dry film thickness shall be approximately 1/16 inch.. Duct insulation shall be continuous through sleeves and prepared openings except firewall penetrations. Duct insulation terminating at fire dampers, shall be continuous over the damper collar and retaining angle of fire dampers, which are exposed to unconditioned air and which may be prone to condensate formation. Duct insulation and vapor retarder shall cover the collar, neck, and any un-insulated surfaces of diffusers, registers and grills. Vapor retarder materials shall be applied to form a complete unbroken vapor seal over the insulation. Sheet Metal Duct shall be sealed in accordance with Section 15895 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEM.

3.3.2.1 Installation on Concealed Duct

a. For rectangular, oval or round ducts, insulation shall be attached by applying adhesive around the entire perimeter of the duct in 6 inch wide strips on 12 inch centers.

b. For rectangular and oval ducts, 24 inches and larger insulation shall be additionally secured to bottom of ducts by the use of mechanical fasteners. Fasteners shall be spaced on 16 inch centers and not more than 16 inches from duct corners.

c. For rectangular, oval and round ducts, mechanical fasteners shall be provided on sides of duct risers for all duct sizes. Fasteners shall be spaced on 16 inch centers and not more than 16 inches from duct corners.

d. Insulation shall be impaled on the mechanical fasteners (self stick pins) where used and shall be pressed thoroughly into the adhesive. Care shall be taken to ensure vapor retarder jacket joints overlap 2 inches. The insulation shall not be compressed to a thickness less than that specified. Insulation shall be carried over standing seams and trapeze-type duct hangers.

e. Self-locking washers shall be installed where mechanical fasteners are used. The pin shall be trimmed back and bent over.

f. Jacket overlaps shall be secured with staples and tape as necessary to ensure a secure seal. Staples, tape and seams shall be coated with a brush coat of vapor retarder coating or PVDC adhesive tape.

g. Breaks in the jacket material shall be covered with patches of the same material as the vapor retarder jacket. The patches shall extend not less than 2 inches beyond the break or penetration in all directions and shall be secured with tape and staples. Staples and tape joints shall be sealed with a brush coat of vapor retarder coating or PVDC adhesive tape.

h. At jacket penetrations such as hangers, thermometers, and damper operating rods, voids in the insulation shall be filled and the penetration sealed with a brush coat of vapor retarder coating or PVDC adhesive tape.

i. Insulation terminations and pin punctures shall be sealed and flashed with a reinforced vapor retarder coating finish or tape with a brush coat of vapor retarder coating.. The coating shall overlap the adjoining insulation and un-insulated surface 2 inches. Pin puncture coatings shall extend 2 inches from the puncture in all directions.

j. Where insulation standoff brackets occur, insulation shall be extended under the bracket and the jacket terminated at the bracket.

3.3.2.2 Installation on Exposed Duct Work

a. For rectangular ducts, rigid insulation shall be secured to the duct by mechanical fasteners on all four sides of the duct, spaced not more than 12 inches apart and not more than 3 inches from the edges of the insulation joints. A minimum of two rows of fasteners shall be provided for each side of duct 12 inches and larger. One row shall be provided for each side of duct less than 12 inches.

b. Duct insulation shall be formed with minimum jacket seams. Each piece of rigid insulation shall be fastened to the duct using mechanical fasteners. When the height of projections is less than the insulation thickness, insulation shall be brought up to standing seams, reinforcing, and other vertical projections and shall not be carried over. Vapor retarder jacket shall be continuous across seams, reinforcing, and projections. When height of projections is greater than the insulation thickness, insulation and jacket shall be carried over.

c. Insulation shall be impaled on the fasteners; self-locking washers shall be installed and the pin trimmed or bent over.

d. Joints in the insulation jacket shall be sealed with a 4 inchwide strip of tape. Tape seams shall be sealed with a brush coat of vapor retarder coating.

e. Breaks and ribs or standing seam penetrations in the jacket material shall be covered with a patch of the same material as the jacket. Patches shall extend not less than 2 inches beyond the break or penetration and shall be secured with tape and stapled. Staples and joints shall be sealed with a brush coat of vapor retarder coating.

f. At jacket penetrations such as hangers, thermometers, and damper operating rods, the voids in the insulation shall be filled and the penetrations sealed with a brush coat of vapor retarder coating.

g. Insulation terminations and pin punctures shall be sealed and flashed with a reinforced vapor retarder coating finish. The coating shall overlap the adjoining insulation and un-insulated

surface 2 inches. Pin puncture coatings shall extend 2 inches from the puncture in all directions.

h. Oval and round ducts, flexible type, shall be insulated with factory Type I jacket insulation with minimum density of 3/4 pcf, attached as per MICA standards.

3.3.3 Insulation for Warm Air Duct

Insulation and vapor barrier shall be provided for the following warm air ducts and associated equipment:.

a. Supply ducts.

b. Return air ducts

c. Relief air ducts

d. Duct-mounted coil casings

e. Coil-headers and return bends

f. Coil casings.

g. Fresh air intake ducts

h. Filter boxes

i. Mixing boxes

j. Supply fans

Insulation for rectangular ducts shall be flexible type where concealed, minimum density 3/4 pcf; and rigid type where exposed, minimum density 3 pcf. Insulation on exposed ducts shall be provided with a white, paint-able, factory-applied Type II jacket, or finished with adhesive finish. Flexible type insulation shall be used for round ducts, minimum density 3/4 pcf with a factory-applied Type II jacket. Insulation on concealed duct shall be provided with a factory-applied Type II jacket. Adhesive finish where indicated to be used shall be accomplished by applying two coats of adhesive with a layer of glass cloth embedded between the coats. The total dry film thickness shall be approximately 1/16 inch. Duct insulation shall be continuous through sleeves and prepared openings. Duct insulation shall terminate at fire dampers and flexible connections.

3.3.3.1 Installation on Concealed Duct

a. For rectangular, oval and round ducts, insulation shall be attached by applying adhesive around the entire perimeter of the duct in 6 inch wide strips on 12 inch centers.

b. For rectangular and oval ducts 24 inches and larger, insulation shall be secured to the bottom of ducts by the use of mechanical fasteners. Fasteners shall be spaced on 18 inch centers and not more than 18 inches from duct corner.

c. For rectangular, oval and round ducts, mechanical fasteners shall be provided on sides of duct risers for all duct sizes. Fasteners shall be spaced on 18 inch centers and not more than 18 inches

from duct corners.

d. The insulation shall be impaled on the mechanical fasteners where used. The insulation shall not be compressed to a thickness less than that specified. Insulation shall be carried over standing seams and trapeze-type hangers.

e. Self-locking washers shall be installed where mechanical fasteners are used and the pin trimmed and bent over.

f. Insulation jacket shall overlap not less than 2 inches at joints and the lap shall be secured and stapled on 4 inch centers.

3.3.3.2 Installation on Exposed Duct

a. For rectangular ducts, the rigid insulation shall be secured to the duct by the use of mechanical fasteners on all four sides of the duct, spaced not more than 16 inches apart and not more than 6 inches from the edges of the insulation joints. A minimum of two rows of fasteners shall be provided for each side of duct 12 inches and larger and a minimum of one row for each side of duct less than 12 inches.

b. Duct insulation with factory-applied jacket shall be formed with minimum jacket seams, and each piece of rigid insulation shall be fastened to the duct using mechanical fasteners. When the height of projection is less than the insulation thickness, insulation shall be brought up to standing seams, reinforcing, and other vertical projections and shall not be carried over the projection. Jacket shall be continuous across seams, reinforcing, and projections. Where the height of projections is greater than the insulation thickness, insulation and jacket shall be carried over the projection.

c. Insulation shall be impaled on the fasteners; self-locking washers shall be installed and pin excess clipped and bent over.

d. Joints on jacketed insulation shall be sealed with a 4 inch wide strip of tape and brushed with vapor retarder coating.

e. Breaks and penetrations in the jacket material shall be covered with a patch of the same material as the jacket. Patches shall extend not less than 2 inches beyond the break or penetration and shall be secured with adhesive and stapled.

f. Insulation terminations and pin punctures shall be sealed with tape and brushed with vapor retarder coating.

g. Oval and round ducts, flexible type, shall be insulated with factory Type I jacket insulation, minimum density of 3/4 pcf attached by staples spaced not more than 16 inches and not more than 6 inches from the degrees of joints. Joints shall be sealed in accordance with item "d." above.

3.3.4 Ducts Handling Air for Dual Purpose

For air handling ducts for dual purpose below and above 60 degrees F, ducts shall be insulated as specified for cold air duct.

3.3.5 Duct Test Holes

After duct systems have been tested, adjusted, and balanced, breaks in the insulation and jacket shall be repaired in accordance with the applicable section of this specification for the type of duct insulation to be repaired.

3.4 EQUIPMENT INSULATION INSTALLATION

3.4.1 General

Removable insulation sections shall be provided to cover parts of equipment that must be opened periodically for maintenance including vessel covers, fasteners, flanges and accessories. Equipment insulation shall be omitted on the following:

a. Hand-holes.

b. Cleanouts.

c. ASME stamps.

d. Manufacturer's nameplates.

3.4.2 Insulation for Cold Equipment

Cold equipment below 60 degrees F: Insulation shall be furnished on equipment handling media below 60 degrees F including the following:

a. Pumps.

b. Refrigeration equipment parts that are not factory insulated.

c. Drip pans under chilled equipment.

d. Cold water storage tanks.

e. Duct mounted coils.

f. Air handling equipment parts that are not factory insulated.

g. Expansion and air separation tanks.

3.4.2.1 Insulation Type

Insulation shall be suitable for the temperature encountered. Thicknesses shall be as follows:

a. Equipment handling media between 35 and 60 degrees F: 1.5 inch thick cellular glass, 1 inch thick flexible elastomeric cellular, 1.5 inch thick phenolic foam, or 1 inch thick polyisocyanurate foam.

b. Equipment handling media between 0 degree F and 34 degrees F: 3 inch thick cellular glass, 1 1/2 inch flexible elastomeric cellular, 1 1/2 inch thick phenolic foam, or 1 1/2 inch thick polyisocyanurate foam.

c. Equipment handling media between minus 30 degrees F and 1 degree

F: 3 1/2 inch thick cellular glass 1 3/4 inch thick flexible elastomeric cellular, 1 1/2 inch thick phenolic foam, or 1 1/2 inch thick polyisocyanurate foam.

3.4.2.2 Other Equipment

a. Insulation shall be formed or fabricated to fit the equipment. To ensure a tight fit on round equipment, edges shall be beveled and joints shall be tightly butted and staggered.

b. Insulation shall be secured in place with bands or wires at intervals as recommended by the manufacturer but not more than 12 inch centers except flexible elastomeric cellular which shall be adhered. Insulation corners shall be protected under wires and bands with suitable corner angles.

c. Phenolic foam insulation shall be set in a coating of bedding compound and joints shall be sealed with bedding compound as recommended by the manufacturer. Cellular glass shall be installed in accordance with manufacturer's instructions. Joints and ends shall be sealed with joint sealant, and sealed with a vapor retarder coating.

d. Insulation on heads of heat exchangers shall be removable. Removable section joints shall be fabricated using a male-female shiplap type joint. The entire surface of the removable section shall be finished by applying two coats of vapor retarder coating with a layer of glass cloth embedded between the coats. The total dry thickness of the finish shall be 1/16 inch.

e. Exposed insulation corners shall be protected with corner angles.

f. Insulation on equipment with ribs shall be applied over 6 x 6 inches by 12 gauge welded wire fabric which has been cinched in place, or if approved by the Contracting Officer, spot welded to the equipment over the ribs. Insulation shall be secured to the fabric with J-hooks and 2 x 2 incheswashers or shall be securely banded or wired in place on 12 inch centers.

3.4.2.3 Vapor Retarder

Upon completion of installation of insulation, penetrations shall be caulked. Two coats of vapor retarder coating shall be applied over insulation, including removable sections, with a layer of open mesh synthetic fabric embedded between the coats. The total dry thickness of the finish shall be 1/16 inch. Caulking shall be applied to parting line between equipment and removable section insulation.

3.4.3 Insulation for Hot Equipment

Insulation shall be furnished on equipment handling media above 60 degrees F including the following:

a. Converters.

b. Heat exchangers.

c. Water heaters.

d. Pumps handling media above 130 degrees F.

e. Hot water storage tanks.

f. Air separation tanks.

g. Surge tanks.

h. Flash tanks.

i. Condensate receivers.

3.4.3.1 Insulation

Insulation shall be suitable for the temperature encountered. Shell and tube-type heat exchangers shall be insulated for the temperature of the shell medium.

Insulation thickness for hot equipment shall be determined using Table IV:

Legend

RMF: Rigid Mineral Fiber
FMF: Flexible Mineral Fiber
CS: Calcium Silicate
PL: Perlite
CG: Cellular Glass
FC: Flexible Elastomeric Cellular
PF: Phenolic Foam
PC: Polyisocyanurate Foam

TABLE IV
Insulation Thickness for Hot Equipment (Inches)

Equipment handling steam or media to indicated pressure or temperature limit:	Material	Thickness
15 psig	RMF	2.0 inches
or	FMF	2.0 inches
250F	CS/PL	4.0 inches
	CG	3.0 inches
	PF	1.5 inches
	FC (<200F)	1.0 inches
	PC	1.0 inches
200 psig	RMF	3.0 inches
or	FMF	3.0 inches
400 F	CS/PL	4.0 inches
	CG	4.0 inches
600 F	RMF	5.0 inches
	FMF	6.0 inches
	CS/PL	6.0 inches
	CG	6.0 inches

>600 F: Thickness necessary to limit the external temperature of the

insulation to 120F, except that diesel engine exhaust piping and mufflers shall be covered with 6.0 inch thick material suitable for 1200 degrees F service. Heat transfer calculations shall be submitted to substantiate insulation and thickness selection.

3.4.3.2 Insulation of Pumps

Insulate pumps by forming a box around the pump housing. The box shall be constructed by forming the bottom and sides using joints that do not leave raw ends of insulation exposed. Bottom and sides shall be banded to form a rigid housing that does not rest on the pump. Joints between top cover and sides shall fit tightly. The top cover shall have a joint forming a female shiplap joint on the side pieces and a male joint on the top cover, making the top cover removable. Two coats of Class I adhesive shall be applied over insulation, including removable sections, with a layer of glass cloth embedded between the coats. A parting line shall be provided between the box and the removable sections allowing the removable sections to be removed without disturbing the insulation coating. The total dry thickness of the finish shall be 1/16 inch. Caulking shall be applied to parting line of the removable sections and penetrations.

3.4.3.3 Other Equipment

a. Insulation shall be formed or fabricated to fit the equipment. To ensure a tight fit on round equipment, edges shall be beveled and joints shall be tightly butted and staggered.

b. Insulation shall be secured in place with bands or wires at intervals as recommended by the manufacturer but not greater than 12 inch centers except flexible elastomeric cellular which shall be adhered. Insulation corners shall be protected under wires and bands with suitable corner angles.

c. On high vibration equipment, cellular glass insulation shall be set in a coating of bedding compound as recommended by the manufacturer, and joints shall be sealed with bedding compound. Mineral fiber joints shall be filled with finishing cement.

d. Insulation on heads of heat exchangers shall be removable. The removable section joint shall be fabricated using a male-female shiplap type joint. Entire surface of the removable section shall be finished as specified.

e. Exposed insulation corners shall be protected with corner angles.

f. On equipment with ribs, insulation shall be applied over 6 x 6 inch by 12 gauge welded wire fabric which has been cinched in place, or if approved by the Contracting Officer, spot welded to the equipment over the ribs. Insulation shall be secured to the fabric with J-hooks and 2 x 2 inch washers or shall be securely banded or wired in place on 12 inch (maximum) centers.

g. On equipment handling media above 600 degrees F, insulation shall be applied in two or more layers with joints staggered.

h. Upon completion of installation of insulation, penetrations shall be caulked. Two coats of adhesive shall be applied over insulation, including removable sections, with a layer of glass cloth embedded between the coats. The total dry thickness of the

finish shall be 1/16 inch. Caulking shall be applied to parting line between equipment and removable section insulation.

3.4.4 Equipment Handling Dual Temperature Media

Below and above 60 degrees F: equipment handling dual temperature media shall be insulated as specified for cold equipment.

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SECTION 15101

CONTROL VALVES, FUELING SYSTEM

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ASME INTERNATIONAL (ASME)

ASME B16.5	(2003) Pipe Flanges and Flanged Fittings NPS 1/2 thru NPS 24
ASME BPV VIII Div 1	(1998) Boiler and Pressure Vessel Code; Section VIII, Pressure Vessels Division 1 - Basic Coverage

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 194/A 194M	(2000) Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service
ASTM A 216/A 216M	(1993; R1998) Steel Castings, Carbon, Suitable for Fusion Welding, for High Temperature Service
ASTM A 269	(2000) Seamless and Welded Austenitic Stainless Steel Tubing for General Service
ASTM A 320/A 320M	(2000a) Alloy Steel Bolting Materials for Low-Temperature Service
ASTM A 743/A 743M	(1998ael) Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Application
ASTM B 26/B 26M	(1999) Aluminum-Alloy Sand Castings
ASTM D 751	(2000) Coated Fabrics
ASTM D 2000	(2001) Rubber Products in Automotive Applications

DEFENSE LOGISTICS AGENCY HANDBOOK

MS MIL-A-8625	(1989; Rev E, Am. 1) Anodic Coatings, for Aluminum and Aluminum Alloys

MS MIL-I-17563	(1985; Rev B)Impregnants for Aluminum, Copper, Iron, Magnesium and Zinc Alloy Castings

MILITARY STANDARDS (MIL-STD)

MIL-STD 276	(1956; Basic) Impregnation of Porous NonFerrous Metal Castings

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2002) National Electrical Code

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

SAE J 200	(1991) Classification System for Rubber Materials
SAE J 429	(1983) Mechanical and Material Requirements for Externally Threaded Fasteners

1.2 AVAILABILITY

Control valves specified herein shall be of one manufacturer. The valve manufacturer shall also produce the hydraulically-operated pilots.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Control Valves; G-AE.

For each type control valve required and specified, submit sectional drawings of main valve and control pilot systems.

SD-03 Product Data

Control Valves; G-AE.

For each type control valve required and specified, submit the following:

a. Flow diagrams.

b. Operational description of the control valve and pilot control system.

c. Complete valve assembly list of materials, along with material Certificates of Conformance, used in the manufacture of the control valves and pilot systems.

SD-06 Test Reports

Control Valves; .

Before shipment, each individual control valve shall be operationally tested and adjusted by manufacturer under actual flow conditions utilizing a hydrocarbon test fluid with a specific gravity comparable to JP-8 fuel. Manufacturer shall submit certified records of test data.

SD-07 Certificates

Proof of Experience on Previous Air Force/Military Projects; G-AE.

Qualified Engineers; G-AE.

Field Assistance; G-AE.

Provide the following:

a. Proof of experience on previous Air Force/Military projects.

b. Number of qualified (factory trained) engineers available to provide startup support.

c. Written assurance as to ability to respond to specified time for field assistance.

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals; G-AE.

Operation and maintenance information shall be submitted for each individual type control valve specified herein. Refer to Section 01730 Fuel System OPERATION AND MAINTENANCE MANUAL for the information to be submitted.

PART 2 PRODUCTS

2.1 DESIGN CONDITIONS

Shall be as specified in Section 15050 MECHANICAL EQUIPMENT, FUELING. Components to be suitable for ANSI Class 150 (275 psig at 100 degrees F.).

2.2 CONTROL VALVE CONSTRUCTION

2.2.1 General

Control valves shall be single-seated globe type, diaphragm actuated, hydraulically operated valves. Valves shall consist of three (3) major components: the valve body, valve cover, and diaphragm assembly. The diaphragm assembly shall be the only moving part. In the event of diaphragm failure, valve shall fail closed against flow, unless otherwise indicated. The main valve shall be drip-tight when closed. Each valve shall have an external indicator to show the position of the valve disc at all times. Control valves shall be shipped from the factory as a complete assembly with all pilot controls and pilot auxiliary piping properly

installed on the main valve. Materials which come in contact with the fuel shall be resistant to the effects of and not harmful to aircraft engine fuel and shall be aluminum or stainless steel unless noted otherwise. Materials for control valves, and items to be mounted on the valves shall be as follows:

2.2.1.1 Bodies, Bonnets, and Covers

Shall be constructed of one of the following materials:

a. Aluminum conforming to ASTM B 26/B 26M, Type 356-T6 anodized in accordance with MS MIL-A-8625, Type II and surface coated in accordance with MIL-STD 276/MS MIL-I-17563.

b. Cast steel conforming to ASTM A 216/A 216M, Grade WCB internally plated with chromium, nickel or internally electroless nickel plated.

c. Cast stainless steel conforming to ASTM A 743/A 743M.

d. Bodies shall have flanged inlet and outlet connections. Valve shall have a screwed bottom drain plug.

2.2.1.2 Valve Seats

Shall be stainless steel in accordance with ASTM A 743/A 743M. It shall be possible to remove the valve seat while the valve is connected in the line. Valve seat and upper stem bearing shall be removable and screwed in the body and/or cover. The lower stem bearing must be concentrically contained in the valve seat and shall be exposed to flow on all sides. The diameter of the valve seat shall be the same size as the inlet and/or outlet flanges of the main valve.

2.2.1.3 Valve Discs

Shall contain a resilient, synthetic rubber disc conforming to ASTM D 2000 (SAE J 30200) having a rectangular cross section, contained on three and one-half (3-1/2) sides by a disc retainer and a disc guide, forming a drip tight seal against the seat. The disc shall be usable on either side. The disc guide shall be the contoured type capable of holding disc firmly in place during high differential pressure conditions that may develop across the seating surface. The disc retainer shall be capable of withstanding rapid closing shocks.

2.2.1.4 Diaphragm Assembly

Shall form a sealed chamber in the upper portion of the valve, separating the operating fluid from the line pressure. The diaphragm assembly shall contain a valve stem which is fully guided at both ends by a bearing in the valve cover and an integral bearing in the valve seat. Valve body and cover shall be sealed by the diaphragm. Valve stem shall be stainless steel. The bearing material shall be compatible with the fuel specified and shall not contain zinc coated metals, brass, bronze, or other copper bearing alloys. The diaphragm shall be of a nonwicking material or design, with a minimum of two (2) layers of nylon fabric bonded with a minimum of three (3) layers of synthetic rubber (valves 2-1/2 inches and smaller one layer of nylon fabric). The edge area of the center hole for the valve stem shall be sealed by vulcanization. Materials to be resistant to aromatics of up to 50 percent in accordance with ASTM D 2000 (SAE J 200).

The diaphragm must have a MULLINS-burst rating according to ASTM D 751 of a minimum of 600 psi per layer of nylon fabric. All diaphragm sizes must be cycle tested to a minimum of 100,000 cycles, by alternately applying pressure under the diaphragm (main valve pressure) and above the diaphragm (cover chamber pressure). That test shall be certified by the manufacturer. The diaphragm shall not be used as a seating surface. The diaphragm must be fully supported by the body and cover in either the open or closed position.

2.2.1.5 Bolts, Screws and Nuts

a. For Cast Aluminum and Cast Steel Body Valves.

(1) Bolts and Screws, cadmium plated steel in accordance with SAE J 429, Grade 5.

(2) Nuts, cadmium plated steel in accordance with ASTM A 194/A 194M, Grade 2 H.

b. For Stainless Steel Body Valves. Bolts, Screws and Nuts, ASTM A 320/A 320M, Grade B8M C.1.1.

2.2.1.6 Pilot Control System and Auxiliary Piping

Shall be stainless steel, seamless, fully annealed tubing conforming to ASTM A 269, Grade TP316, Rockwell hardness B80 or less. Wall thickness for 1/2-inch tubing to be 0.049-inch.. All screwed connections shall be made by conic unions (NPT). Tubing connections shall not be welded or sealed with O-ring.

2.2.1.7 Pilot Valves

Shall have stainless steel bodies conforming to ASTM A 743/A 743M with stainless steel internal working parts. Disc and diaphragm assemblies shall be as specified herein before. The setting of adjustable type pressure operated pilot valves shall be easily adjusted by means of a single adjusting screw. The adjusting screw shall be protected by a threaded cap drilled to accommodate a lead-seal wire and a lock nut shall be provided on the adjusting screw to lock it in position at the desired setting. The lead seal wire shall be installed after final acceptance of the system.

2.2.1.8 Solenoids

Solenoids for operation of pilot valves shall be housed in an explosion-proof case suitable for Class I, Division 1, Group D with maximum temperature rating of ("T2D" -419 degrees F), hazardous locations as defined in NFPA 70. Solenoids shall operate on 120 volts, 60 cycle, single phase, alternating current. A manual type operator or needle valve to bypass the solenoid valve shall be provided for emergency manual operation.

2.2.2 Serviceability of Main Valve Internal Parts

Main valve movable parts including strainers, valve seat, stem bearings, and control system shall be replaceable without removing the main valve from the line. All nonmetallic parts shall be replaceable.

2.2.3 Total Lengths

The total valve length does not include the orifice plate flange (when used). If the control valve being supplied has the orifice plate built into its flange, the spacer provided shall bring the valve face-to-face dimension equal to those listed below plus 0.0875 of an inch. The lengths of the valves shall be equal for the following materials: cast stainless steel, cast steel and cast aluminum.

SIZE INCHES	VALVE LENGTH (INCHES)
1-1/2	8.5
2	9.375
3	12
4	15
6	20
8	25.4
10	29.8
12	34
14	39
16	41.375

Tolerance shall be ±0.030 of an inch for size one and one-half inches (1-1/2") through eight inches (8") and ±0.060 on an inch for size 10 thru 16 inches.

Control valves not meeting these face to face dimensions shall be supplied with spacers suitable for the proper installation of the valve.

2.2.4 Flanges

	MATERIAL	SEALING SURFACE
A:	Cast Steel, ASME B16.5 Class 150	Raised Face
B:	Cast Stainless Steel, ASME B16.5 Class 150	Raised Face
C:	Cast Aluminum, Suitable for minimum working pressure of 275 psig at 100 degrees F.	Flat Face

The mating flange shall be made the same as above.

2.2.5 Identification

2.2.5.1 Main Valve Body

The following shall be cast into the main valve body:

a. Pressure Class
b. Size
c. Material
d. Foundry Heat Number and Identification

e. Manufacturer
f. Flow Pattern

2.2.5.2 Main Valve Cover

The following shall be cast into the main valve cover:

a. Size
b. Material
c. Foundry Heat Number and Identification

2.2.5.3 Brass Name Plates

Brass name plates shall be fastened to the valve. Body name plates shall list the following:

a. Size
b. Model Number
c. Stock Number
d. Manufacturer/Supplier
e. Manufacturer's Inspection Stamp

2.2.5.4 Inlet Name Plate

Inlet name plate shall list the following:

a. Size
b. "Inlet" Marking
c. Assembly Model Number
d. Part Number

2.2.5.5 Outlet Name Plate

Outlet name plate shall list the "Outlet" Marking.

2.2.5.6 Pilot Valves

Pilot valves shall be tag identified. The tag shall also have the field adjusted start up setting stamped on it.

2.3 MATERIALS

The type of materials which come in contact with the fuel, if not specified herein before, shall be noncorrosive.

2.4 INDIVIDUAL CONTROL VALVE OPERATIONAL REQUIREMENTS

Operation, performance, and special features of the individual control valves shall be as specified herein.

2.4.1 High Liquid Level Shut-Off Valve (HLV-1 AND HLV-2)

2.4.1.1 Size

Eight-inch (8")

2.4.1.2 Flow

1200 GPM

2.4.1.3 Operation

High liquid level shut-off valve shall be hydraulically operated and shall be provided with a tank exterior mounted float. Activation point of the float for opening and closing the high liquid level shut-off valve shall be as shown on the drawings. Upon a rise in fluid level to the float activation point, the float control system shall cause the main valve to close tightly. The main valve shall remain closed until a drop in tank fluid level occurs. Upon a drop in fluid level beneath the float activation point, the float control shall cause the main valve to open completely.

2.4.1.4 Check Valve Feature

Valve shall close rapidly when outlet pressure exceeds inlet pressure.

2.4.1.5 Manual Test Feature

Manual testing of high level shut-off valve and exterior mounted float's automatic opening and closing feature shall be possible.

2.4.1.6 Strainer

A 40-mesh stainless steel wire, self-cleaning strainer shall be provided in the pilot valve supply piping.

2.4.1.7 Pressure Sensitive Close Feature

If the upstream pressure rises to 150 psi or above while closing, the valve will stop closing or open slightly until the pressure is less than 150 psi.

2.4.1.8 Minimum Differential Pressure Feature

The valve shall be equipped with a minimum differential pressure pilot to maintain a differential pressure across the valve. Pressure shall be adjustable with a range of 15 psi to 75 psi.

2.4.2 Non-Surge Check Valve (CV-1 THRU CV-6)

2.4.2.1 Size

Six-inch (6"); two-inch (2") for FTP-1

2.4.2.2 Flow

650 GPM; 50 GPM for FTP-1.

2.4.2.3 Operation

Nonsurge check valve shall open slowly. Opening speed shall be adjustable from two (2) to 30 seconds without affecting closing of valve. Factory set for 15 seconds. The nonsurge check vales shall fail closed against reverse flow in check condition.

2.4.2.4 Quick closure

Valve closure to be rapid, closing quickly when outlet pressure exceeds inlet pressure.

2.4.2.5 Flow Control

Valve to limit flow to 650 GPM (CV-1 thru CV-5), 50 GPM (CV-6). Sensing shall be by orifice. Valve to modulate to limit flow without hunting. Rate of flow to be manually adjustable.

2.4.2.6 Strainer

A 40-mesh, stainless steel wire, self-cleaning strainer shall be provided in the pilot valve supply piping.

2.4.3 Issue and Receiving Filter Separator Control Valve (FSCV-1 Thru FSCV-7)

2.4.3.1 Size

Six-inch (6") for FSCV-1 thru FSCV-5, Eight-inch (8") for FSCV-6 and FSCV-7

2.4.3.2 Flow

600 GPM for the 6", 1200GPM for the 8"

2.4.3.3 Operation

Filter Separator Control Valve shall limit flow to 600 GPM/1200GPM. Controlling to be by orifice. Rate of flow to be manually adjustable.

2.4.3.4 Check Valve Feature

Valve shall close rapidly when outlet pressure exceeds inlet pressure.

2.4.3.5 Water Slug Shut-Off

Valve shall close rapidly when water is sensed at filter separator sump high level as indicated by Float Control Valve float position. Manual testing of operation shall be possible.

2.4.3.6 Emergency Shut-off Operation (for FSCV- thru FSCV-5)

Open/closed valve, solenoid operated. Closure shall be accomplished within 10 seconds upon power failure or activation of an emergency-stop pushbutton.

2.4.3.7 Solenoid Control

Solenoid control shall be as indicated on the drawings.

2.4.4 Issue and Receiving Filter Separator Float Control Valve with Manual Tester (FC-1 THRU FC-7)

2.4.4.1 Operation

Float shall ride on the fuel-water interface inside filter separator sump. Activation shall initiate water slug shutoff of filter separator valve.

2.4.4.2 Float Control Pilot and Tester

The filter separator housing sump shall be fitted with a float control pilot valve assembly made of stainless steel. The pilot valve is connected

to the filter separator control valve. An integral float control tester shall provide a means to remove a portion of the float ball ballast allowing the float to rise, verifying operation of the water slug and flow control valve, the integrity of the float ball.

2.4.5 Back Pressure Control Valve (BPCV-1)

2.4.5.1 Size

Six-inch (6")

2.4.5.2 Flow

0-2400 GPM

2.4.5.3 Operation

Back pressure control valve shall modulate to maintain constant inlet pressure. Set-point shall be adjustable with a range of 20 psig to 200 psig. Factory set at 130 psig.

2.4.5.4 Check Valve Feature

Valve shall close rapidly when outlet pressure exceeds inlet pressure.

2.4.5.5 Solenoid Control

Solenoid control valve shall be as indicated on the drawings.

2.4.5.6 Speed Control

Valve shall close slowly without affecting the opening speed and shall be factory set for eight (8) seconds. Closing time to be adjustable with a range of two (2) to 30 seconds. Valve opening time shall be 1.0 second maximum.

2.4.6 Pressure Control Valve (PCV-1)

2.4.6.1 Size

Two-inch (2").

2.4.6.2 Flow

50 GPM under normal operating conditions.

2.4.6.3 Operation

Pressure control valve shall modulate to control inlet pressure and shall have adjustable set-point with a range of 20 psig to 200 psig. Factory set at 75 psig.

2.4.6.4 Check Valve Feature

Valve shall close rapidly when outlet pressure exceeds inlet pressure.

2.4.6.5 Solenoid Control

Solenoid control of valve shall be as indicated on drawings.

2.4.6.6 Speed Control

Provide separate opening and closing speed controls each adjustable between one (1) and 30 seconds. Factory set at three (3) seconds for opening speed and one (1) second for closing speed.

2.4.7 Defuel/Flush Valve (D/FV-1)

2.4.7.1 Size

Eight-inch (8").

2.4.7.2 Flow

300 to 2400 GPM.

2.4.7.3 Operation

Valve shall modulate to control inlet pressure and shall have adjustable set-point with a range of 20 psig to 200 psig. Factory set at 80 psig.

2.4.7.4 Check Valve Feature

Valve shall close rapidly when outlet pressure exceeds inlet pressure.

2.4.7.5 Solenoid Control

The valve shall be provided with two (2) solenoid controls and shall operate as indicated on drawings.

2.4.7.6 Speed Control

Valve shall open slowly without affecting the closing speed and shall be factory set for three seconds. Opening time to be adjustable with a range of 2 to 30 seconds.

2.4.8 Hydrant Control Valve (HCV)

2.4.8.1 Size

Four-inch (4") .

2.4.8.2 Flow

600 GPM.

2.4.8.3 Operation

Hydrant control valve shall modulate, by use of a liquid sensing line from refueler venturi, and regulate at a maximum pressure at the skin of the aircraft of 45 psig at any flow rate from 50 GPM to 600 GPM. Pressure to be adjustable with a range of 15 psi to 75 psi. Valve, adapter and 90-degree hydrant coupler pressure drop shall not exceed 9 psi at 600 GPM with the valve fully open.

2.4.8.4 Quick Closure

Valve shall close rapidly when outlet pressure exceeds control set-point.

Valve shall limit the surge pressure on the aircraft to a maximum of 120 psig when fueling at 600 GPM with an aircraft tank valve closure of 0.5 of a second . The valve shall reopen when the outlet pressure drops below the set-point of the pilot if the deadman control lever is still depressed.

2.4.8.5 Deadman Control

Deadman shall be pneumatically connected to the pilot system of main valve. Valve shall open when deadman control lever is pressed and shall close valve when the lever is released to bleed air from the hydrant hose truck. On rupture of the deadman hose between outlet of deadman control and main valve pilot system, there shall be no fuel leakage. Main valve shall close in five (5) seconds maximum when deadman is released or when one of the deadman hose couplers is disconnected.

2.4.8.6 Defuel

Valve shall be capable of reverse flow at the rate of 300 GPM at 165 psig.

2.4.8.7 Speed Control

Valve shall open slowly without affecting the closure rate. Provide adjustable speed control with a range of two (2) to 30 seconds.

2.4.8.8 Thermal Relief

Valve to open for pressure equalization and return flow when downstream pressure exceeds upstream pressure.

2.4.8.9 Minimum Differential Pressure Feature

The valve shall be equipped with a minimum differential pressure pilot to maintain a differential pressure across the valve. Pressure shall be adjustable with a range of 15 psi to 75 psi.

2.4.8.10 Adapter

Valves shall be provided with type adapter as indicated on drawings. Provide metal sealing cover connected to the adapter. Adapter shall have pressure equalizing feature.

2.4.8.11 Strainer

A 40-mesh stainless steel wire, self-cleaning strainer shall be provided in the pilot valve supply piping.

2.4.9 Overfill Valve for Product Recovery Tank (OV-1)

2.4.9.1 Size

Two-inch (2").

2.4.9.2 Capacity

50 GPM.

2.4.9.3 Operation

Hydraulically operated overfill valve shall close automatically upon rising

to Product Recovery Tank 80 percent fill level. Valve shall open automatically upon falling below Product Recovery Tank 80 percent fill level.

2.4.9.4 Control Float

Automatic opening and closing of the valve shall be initiated by a control float located within the Product Recovery Tank. Control float shall be provided with a manual tester, mounted external to the tank, for testing of overfill valve operation.

2.4.9.5 Pressure Reservoir

Valve shall be provided with a pressure reservoir to supply required hydraulic pressure for operation. Reservoir pressure to be supplied by Fuel Transfer Pump (FTP-1). Valve shall close upon loss of reservoir pressure. Reservoir shall be a one gallon capacity bladder-type tank, ductile iron constructed, tested and stamped in accordance with ASME BPV VIII Div 1 for a working pressure of 125 psi and precharged with air. The tank will be epoxy lined. The tank will be fitted with an air charging valve and pressure gauge.

2.4.9.6 Thermal Relief

Overfill valve shall be provided with a pressure sustaining control valve that shall automatically, upon inlet pressure rising to 200 psig, open allowing thermal relief around overfill valve. Pressure sustaining valve shall automatically close upon inlet pressure dropping below 200 psig.

2.4.9.7 Limit Switch

Limit switch shall be provided with valve for remote indication of valve open or closed position. Valve closed position will become an alarm condition the pump control panel (PCP).

2.4.9.8 Strainer

Pressure reservoir inlet line shall be provided with a shut-off valve, strainer and check valve.

2.4.10 Truck Fill Stand Control Valve (TFV)

2.4.10.1 Size

Four-inch (4").

2.4.10.2 Flow

600 GPM.

2.4.10.3 Operation

Valve shall modulate to regulate downstream to 35 psig at a flow rate of 50 GPM to 600 GPM. Pressure shall be adjustable with a range of 15 psi TO 75 psi.

2.4.10.4 Quick Closure

Valve shall close rapidly when outlet pressure exceeds control set-point.

Valve shall limit the surge pressure on the bottom loader of a tank truck to a maximum of 85 psig when filling at 600 GPM with a tank truck valve closure of 0.5 of a second. The valve shall reopen when the outlet pressure drops below the set-point of the pilot if the deadman control lever is still depressed.

2.4.10.5 Opening Speed Control

Valve shall control the opening speed of the main valve. The control shall be adjustable with a range of two (2) to 30 seconds. Factory set at ten (10) seconds.

2.4.10.6 Deadman Control

Deadman shall be hydraulically connected to the pilot system of the main valve. Valve shall open when deadman control lever is pressed and shall close the valve when the lever is released. On rupture of the deadman hose between outlet of deadman control and main valve pilot system, there shall be no fuel leakage. Main valve shall close in two (2) seconds maximum when one of the deadman hose couplers is disconnected. Length of hose shall be 10 feet.

2.4.10.7 Thermal Relief

Valve to open for pressure equalization and return flow when downstream pressure exceeds upstream pressure.

2.4.10.8 Strainer

A 40-mesh stainless steel wire, self-cleaning strainer shall be provided in the pilot valve supply piping.

PART 3 EXECUTION

3.1 VALVE TESTING AND START-UP SUPPORT

The Contractor shall provide the services of a factory trained and certified service engineer employed by the valve manufacturer to verify that each valve has been properly installed and to verify valves were factory operationally tested, adjusted and set per these specifications. The service engineer shall assist the Contractor in the valve start-up adjustment process and will remain on site until all control valves function as required by the contract documents.

3.1.1 Standard 1-Year Warranty Period

If a problem attributable to the valve's manufacturer or installation arises after the initial system start-up has been accomplished, and after system final acceptance date, the Contractor shall have 48 hours from the time of notification that a problem exists to solve the problem. The problem shall be solved to the satisfaction of the Contracting Officer, the Base Civil Engineer and/or the Command Fuel Facilities Engineer . If the Contractor cannot effectuate a proper resolution to the problem as outlined above in the 48 hour period, the Contractor shall provide a factory trained engineer from the manufacturer of the valve within 48 hours after the expiration of the Contractor's initial 48 hour period to effectuate a resolution of the problem above. All services provided by the valve manufacturer shall be at no cost to the Government. When it has been determined by the Contractor, Contracting Officer, and the valve

manufacturer's representative that the valve(s) cannot be repaired in its installed position in the fuel system, it shall be replaced with a new valve and pilot assembly within 48 hours after the initial 96-hour period listed above expires and at no cost to the Government.

3.2 TRAINING

The manufacturer shall conduct two eight- (8-) hour training classes for Liquid Fuels Maintenance Technicians which include valve overhaul procedures, pilot overhaul procedures, valve adjustments, and valve diagnostics. The manufacturer shall provide a four-inch (4") valve mock-up with various trim components (i.e., rate of flow, solenoid control, and speed control features) to be used during training. Video taping of training shall be allowed. The four-inch (4") valve mock-up shall become the property of the Government and shall be turned over to the Contracting Officer.

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DIVISION 15 - MECHANICAL

SECTION 15140

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SECTION 15140

PUMPS, FUELING SYSTEM

PART 1 GENERAL

(Waiver to Use MilStds and MilSpecs in Air Force Fuel Projects, HQ AFCESA/CESM (01/29/96))

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN BEARING MANUFACTURERS ASSOCIATION (ABMA)

ABMA 7	(1995) Shaft and Housing Fits for Metric Radial Ball and Roller Bearings (Except Tapered Roller Bearings) Conforming to Basic Boundry Plan

ASME INTERNATIONAL (ASME)

ASME B16.5	(2003) Pipe Flanges and Flanged Fittings NPS 1/2 thru NPS 24

AMERICAN PETROLEUM INSTITUTE (API)

API STD 610	(1995; 8th Edition) Centrifugal Pumps for General Refining Service

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 182/A 182M	(2000b) Forged or Rolled Alloy-Steel Pipe Flanges, Forged Fittings and Valves and Parts for High Temperature Service
ASTM A 276	(2000a) Stainless Steel Bars and Shapes
ASTM A 356/A 356M	(1998e1) Heavy-Walled, Carbon Low Alloy, and Stainless Steel Castings or Steam Turbines
ASTM A 487/A 487M	(1993; R1998) Steel Casing for Pressure Service
ASTM A 582/A 582M	(1995b) Free-Machining Stainless Steel Bars
ASTM A 743/A 743M	(1998ael) Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Application

ASTM C 827	(1995a; R 1997el) Change in Height at Early Ages of Cylindrical Specimens from Cementitious Mixtures

HYDRAULIC INSTITUTE (HI)

HI-01	(1983; 14th Ed.) Standard for Centrifugal, Rotary, and Standard Reciprocating Pumps

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE Std 112	(1996) Test Procedure for Polyphase Induction Motors and Generators

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-P-24441	(Rev. C; Supp. 1) Paint, Epoxy-Polyamide

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 1	(2003) Motors and Generators

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2002) National Electrical Code

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC PA 1	(2000) Shop, Field, and Maintenance Painting
SSPC SP 10	(2000) White Metal Blast Cleaning

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Fueling Pump (FP-1 through FP-5); G-AE.

Fuel Transfer Pump (FTP-1); G-AE.

SD-03 Product Data

Fueling Pump (FP-1 through FP-5); G-AE.

Fuel Transfer Pump (FTP-1); G-AE.

SD-06 Test Reports

Certified Test Curves;

Hydrostatic, performance, and NPSH tests shall be conducted at the

factory on each pump in accord with Hydraulic Institute Standard for Centrifugal, Rotary and Reciprocating Pumps. Test each pump with the actual motor which will drive the pump in the field. Test reports shall bear the serial number of both pump and driver. Submit manufacturer's certified reports of hydrostatic, performance, and NPSH tests. Submit manufacturer's certified test curve. All tests shall be observed by the Contracting Officer or his designated representative. The Contractor shall give the Contracting Office 21 days notice prior to conductance of factory tests in order to schedule observing of factory test.

SD-07 Certificates

Fueling Pump (FP-1 through FP-5); G-AE.

Fuel Transfer Pump (FTP-1); G-AE.

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals; G-AE.

Operation and maintenance information shall be submitted for the pumps and appurtenance specified herein. Refer to Section 01730 FUEL SYSTEM OPERATION AND MAINTENANCE MANUAL for the information to be submitted.

1.2.1 Submittal Sequence

Performance testing shall not occur prior to acceptance of shop drawing submittal.

1.3 ELECTRICAL WORK

Motors, manual or automatic motor control equipment except where installed in motor control centers, and protective or signal devices required for the operation specified herein shall be provided under this section in accordance with Section 16415 ELECTRICAL WORK, INTERIOR. Any wiring required for the operation specified herein, but not shown on the electrical plans, shall be provided under this section in accordance with Section 16415 ELECTRICAL WORK, INTERIOR. Motors shall be high efficiency type and in accordance with Section 16415 ELECTRICAL WORK, INTERIOR.

PART 2 PRODUCTS

2.1 DESIGN CONDITIONS

Shall be as specified in Section 15050 MECHANICAL EQUIPMENT, FUEL SYSTEM.

2.2 FUELING PUMP (FP-1 through FP-5)

2.2.1 Capacity

Capacity shall be 600 gpm against a total head of 470 feet when driven at 3600 rpm. Overall efficiency at design conditions of pump and driver, connected, shall be minimum of 60 percent. Pump head capacity shall be continually rising and shall be free of dips and valleys from design point to shut-off head. Pump shut-off head shall have a 10 percent to 20 percent head rise to shut off. Pump shall be capable of at least a 10 percent head increase at rated conditions by installing a new impeller. Pumps shall not

overheat or be damaged in any way while operating continuously at a minimum flow condition of 150 gpm and continuously at a maximum flow condition of 125 percent required capacity GPM. The unit will also be required to operate at a flow of 12.5 percent required capacity GPM without exceeding the vibration limits given in API STD 610. These pumps are for parallel operation and shall have equal head at minimum continuous stable flow, plus or minus 2 percent.

2.2.2 General Requirements

a. The pumps for this service shall meet the requirements of API STD 610, latest edition. Whenever the information contained herein conflicts with said standard, the information here in shall govern. The pumps for this service shall run at a nominal 3600 rpm and shall be single stage centrifugals, horizontally mounted, vertical or radial split case, enclosed impeller, with end suction and top vertical discharge. Pumps shall be of the back pull-out design to permit removing case half from rear for access to internal parts without disturbing the suction or discharge piping or the driver. All parts shall be factory inspected so that parts are interchangeable. Pumps and motors shall be furnished as complete units as herein specified. Pump assembly shall be statically and dynamically balanced for all flow rates from no flow to 120 percent of design flow.

b. The pump shall require no more than 15-feet of net positive suction head (NPSHR) when it is operated with water at a capacity of 600 gpm at rated head and speed. A hydrocarbon reduction or correction factor shall not be used. Pump suction specific speed shall be less than 12,000.

c. The pump shall be horizontal, single stage, single suction with double volute construction to assure radial balance. It shall be designed to permit removal of the impeller, shaft, bearings and bearing housing as an assembly, without disconnecting the suction or discharge piping.

d. The pump case shall be end suction, centerline discharge type for ease of piping alignment. Flange ratings shall be class 300-pound per ASME B16.5. The case shall be designed for maximum discharge pressure at pumping temperature but not less than 550 psig, with a minimum corrosion allowance of 1/8-inch. The suction and discharge flanges as well as the cover bolting surfaces shall be backfaced or spotfaced for positive bolt seating. The radial case to cover split shall be a metal-to-metal fit with a confined, controlled compression gasket.

e. The pump cover shall contain a stuffing box designed to accept an unbalanced mechanical seal. The stuffing box shall have a minimum of three-inch studs for seal gland bolting. The gasket fit for seal gland to stuffing box shall be of the controlled compression type with metal-to-metal joint contact.

f. Both case and cover are to be fitted with renewable wear rings.

g. The impeller shall be of the enclosed type, dynamically and hydraulically balanced. It shall be key driven, held in place by a positive lock, threaded against rotation. The running clearance between the impeller and case-cover wear rings shall be no less than .018-inches.

h. Mechanical Seal. A single unbalanced mechanical seal per API STD 610 code USTFM of multiple spring design shall be supplied. The seal gland shall be taped for three connections and each shall be stamped for identification as follows: Q for quench; F for flush; and D for drain. A

non-sparking throttle bushing pressed into the seal end plate against an outside shoulder shall be provided to minimize leakage on complete seal failure.

i. Bearing Housing. Oil lubricated anti-friction, radial and thrust bearings of standard design shall be supplied. The bearings shall be selected to give a minimum L-10 rating life of 25,000 hours in continuous operation. Bearings shall be retained on the shaft and fitted into housings in accordance with ABMA 7. Locking of the ball thrust bearing to the shaft shall be by series W tank type washer. Minimum spacing between bearing centerlines shall be 6.5-inches.

j. A sight glass for checking oil level with a permanent indication of proper oil level shall be supplied.

k. Bearing housings shall be equipped with labyrinth type end seals and deflectors where the shaft passes through the housing; lip-type seals shall not be used. Deflectors shall be made of non-sparking material. The deflector design shall effectively retain oil in the housing and prevent entry of foreign material into the housing.

l. Shafts shall be of ample size to transmit the maximum torque required under specified operating conditions, and to withstand continuously all stresses resulting from supported weights, thrusts and starting, including across-the-line motor starting. It shall be key seated to provide positive drive for the coupling, shaft sleeve and impeller. The shaft stiffness factor shall be under 70. The radial bearing centerline to impeller centerline, distance and the pump shaft diameter under the sleeve shall be provided to calculate the factor.

m. A replaceable hooked-type shaft sleeve, locked in place by the impeller shall extend under the mechanical seal and gland.

n. A spacer coupling shall be supplied. The spacer length shall permit the removal of the assembled pullout element without disturbing the driver or the suction and discharge piping. Couplings shall be properly keyed in place. Cylindrical fits shall be light enough to permit easy removal of the hub in the field without the need for heating. A service factor of at least 1.5 shall be used in selecting couplings based on manufacturer's ratings.

o. Removable coupling guards of the non-sparking type shall be supplied. They shall comply with the requirements of OSHA.

p. Total indicated shaft runout at coupling end shall be 0.001-inches or less. Total shaft deflection shall be no more than 0.002-inches at face of stuffing box.

q. Baseplate. The baseplate shall be of fabricated steel construction. It shall be of the drain pan style, sloping from back to front. Connections for a drain shall be tapped (1-inch minimum) at the pump end and located to accomplish complete drainage. A grout hole of at least 8-inches minimum diameter shall be supplied and shall have 1/2-inch minimum raised lip edge.

r. Materials. No zinc, brass, bronze or other copper bearing alloy shall come in contact with the fuel.

s. The case and cover shall be constructed of stainless steel ASTM A

487/A 487M GR CF8M or ASTM A 487/A 487M GR CA6NM or aluminum ASTM A 356/A 356M GR T6.

t. Impeller material shall be stainless steel ASTM A 487/A 487M GR CF8M or ASTM A 743/A 743M CA 6NM.

u. Wear rings shall be stainless steel ASTM A 182/A 182M GR F6 or ASTM A 276 TP410 or 416.

v. Shaft shall be stainless steel ASTM A 276 type 410 or 416 or ASTM A 582/A 582M Type 410 or 416 with renewable shaft sleeve of ASTM A 276 type 316L with hard facing under mechanical seal gasket.

w. Testing. All shop testing shall be performed in accordance with the HI-01.

2.2.3 Service Nameplate

A pump service nameplate, of type 18-8 stainless steel or monel, attached by stainless steel pins at an accessible point on the pump, shall be furnished in addition to the identification nameplate. The pump service nameplate shall be stamped with the following information:

Manufacturer's name
Serial number of pump
Capacity, gpm
Pumping head, ft.
Maximum specific gravity of fluid to be pumped
Revolutions per minute
Horsepower of driver

2.2.4 Identification Nameplate

A pump identification nameplate of Type 18-8 stainless steel or monel shall be provided and securely attached by stainless steel pins to a conspicuous place on the pump head. Tagging in letters 1/4-inch high shall bear the equipment number as shown on the drawings.

2.2.5 Exterior Primer Coat

Exterior surfaces of the baseplate shall be primed by the manufacturer. Coating shall be applied meeting requirements of SSPC PA 1. Surface cleaning shall meet requirements of SSPC SP 10. Metal primer shall be zinc rich paint conforming to specification MIL-P-24441, Type 1, Class 3. Dry film thickness shall be 2 to 4 mils.

2.2.6 Exterior Topcoat

Manufacturer's standard exterior topcoat shall be applied at factory to the base plate.

2.2.7 Motors

a. Motor shall be furnished by the pump manufacturer and shall be suitable for the environment and operating conditions to which it will be subjected. Provide space heaters suitable for operation on 460 or 120 volts as indicated on the drawings within the motor enclosure to prevent moisture condensation after shut-down. Motor shall be UL listed for use in Class I, Division 1, Group D hazardous areas, and shall have a maximum

temperature rating of "T2D - 419 degrees F" as defined by NFPA 70. The motor nameplate shall include the temperature rating of the motor and locked-rotor indicating code letters in accordance with NFPA 70, Table 430-7(b).

b. Voltage rating shall be 460 volts, 3 phase, 60HZ. Motor nominal speed shall match pump. Motors shall be capable of delivering rated horsepower output successfully and continuously under conditions of voltage variations of 10% above or below rated voltage.

c. Pump manufacturer shall assure the specified output and proper operation of the pump without being overloaded at unity service factor when operating at any point on the pump performance curve. In addition to having sufficient horsepower-output rating at rated speed, motor shall have performance characteristics which will allow, without injurious overheating of the motor, accelerating the load from standstill to rated speed under conditions of ten (10) starts per hour. Attention is specifically directed to the fact that thermal characteristics of motors with regard to capability for accelerating the load may vary greatly from motor manufacturer to motor manufacturer, notwithstanding that the horsepower rating may be the same. It is the pump manufacturer's responsibility to provide motors with adequate thermal starting characteristics as well as adequate rated-speed operating characteristics. Service factors shall conform with NEMA standards; however, service factors are only applicable at rated nameplate voltage and frequency. Since all system voltages are subject to variation, service factors above unity shall not be applied in sizing motor.

d. Motor shall be squirrel-cage induction type. Motor shall be NEMA Design B (normal-torque, low starting current).

e. Motor insulation shall be non-hydroscopic, NEMA Class H, 180 degrees C for motors over 10 hp and NEMA Class F, 150 degrees C for 10 hp and smaller. Stator windings shall be epoxy impregnated. The impregnations shall be applied by the vacuum and pressure process.

f. Winding temperature rise, (based on a maximum ambient temperature of 40 degrees C at 3300-feet altitude) shall not exceed 80 degrees C.

g. Bearings shall be ABMA minimum L10 life of 60,000 hours or L50 life of 300,000 hours suitable for the size, type, and application when the pump is operating at the specified flow and head.

h. Motor enclosures shall be totally enclosed, weather sealed, fan cooled, explosion-proof and shall be listed and labeled for Class I, Group D areas. Provide bronze ground bolt on motor enclosure. All motor external electrical connections shall be terminated within a single terminal housing.

i. The dynamic balance, overspeed withstand capability, and sound power levels of the motor shall conform with NEMA standard requirements.

j. The pump manufacturer shall furnish the Contracting Officer with the recommended minimum run time for the motor.

k. Pump motor shall be provided with temperature limiting thermostats within the motor frame when required to meet Class I, Group D requirements.

l. Pump motor shall be furnished with lifting lugs on the motor casing.

m. Unless indicated otherwise, motors for conventional applications over 15 horsepower shall be the energy efficient type. This requirement is not applicable to hermetically sealed motors, integrally mounted motors, motors specified as part of energy efficient equipment, wound rotor motors, or any application involving special construction or performance. Guaranteed minimum full load efficiencies shall be (based on 1800 rpm, open drip proof):

20 hp	92.0%	75 hp	95.5%
25 hp	92.0%	100 hp	93.5%
30 hp	92.0%	125 hp	94.5%
40 hp	92.0%	150 hp	94.5%
50 hp	92.5%	200 hp	94.5%
60 hp	92.5%	600 hp	94.5%

n. Other motors of different speed or housing classification shall also be of the energy efficient type, as advertised by the motor manufacturer, with efficiency greater than the standard line. Motor efficiencies shall have been verified in accordance with NEMA MG 1, 12.53.a., and determined using the dynamometer method as described in IEEE Std 112, Method B. All shop drawing submittals on motor driven equipment shall include the motor efficiency.

2.3 FUEL TRANSFER PUMP (FTP-1)

2.3.1 Capacity

Capacity shall be 50 gpm against a total head of 120 feet when driven at 1800 rpm. Overall efficiency at design conditions of pump and driver, connected, shall be minimum 60 percent. Pump head capacity shall be continually rising and shall be free of dips and valleys from design point to shut-off head. Pump shall be capable of at least 10% head increase at rated conditions by installing a new impeller.

2.3.2 Assembly

The pump for this service shall meet the requirements of \-API STD 610-\, latest edition. Wherever the information contained herein conflicts with said standard, the information herein shall govern. The pump for this service shall run at a nominal 1800 rpm and shall be a multi-stage, vertical turbine pump. Pump and motor shall be furnished as a complete unit as herein specified. Pump assembly shall be statically and dynamically balanced for all flow rates from no flow to 120 percent of design flow.

2.3.3 Materials

The materials of construction for the pump shaft shall be stainless steel. All other materials shall be of non-corrosion materials.

2.3.3.1 Mechanical Seal

Balanced type.

2.3.4 Construction

Castings used for any part of pumps shall be sound and free of shrink or blow holes, scale, blisters, and other similar casting defects. The surfaces of casting shall be cleaned by sand or shot blasting, pickling, or other standard methods used by the manufacturer. All mold parting fins and remains of gates and risers shall be either chipped, filed, or ground flush with the surface of the casting. The repair of casting leaks and defects by peening or by the use of cement compounds is prohibited.

2.3.4.1 Couplings

Couplings shall be flexible and self-aligning. The couplings shall be of the spacer-type with a spacer of sufficient length to permit replacement of the mechanical seal assembly without removing the motor. The pump half coupling shall be of such design that it can be removed without the use of heat. Coupling halves shall fit tightly to the shafts of the pump and the driver so as not to become loose during operation. The coupling shall be provided with an OSHA approved coupling guard.

2.3.4.2 Impeller

Impeller shall be keyed to the shaft for radial loads and fixed in the axial position by shaft sleeve nuts, or other positive positioning device. Impellers shall be held to the shaft so that the impeller will not become loose should the pump accidentally rotate in reverse direction. The impeller shall be statically and dynamically balanced and be provided with anti-reversing rachet.

2.3.4.3 Wear Rings

Renewable wearing rings shall be positively locked on the impeller. Wearing rings shall fit with close tolerances so as to permit a minimum of recirculation. Positive locking case wearing rings shall be provided so that the case wearing rings will not rotate or change position in the case.

2.3.4.4 Shaft

Shaft shall be designed with a high safety factor to easily withstand the torsional loads and other stresses to which it may be subjected. It shall be so designed that there will be no detrimental vibration stresses. Surfaces shall be ground to accurate dimensions. Shaft deflection shall be limited to 0.0020-inch maximum when measured at the face of the mechanical seal under the operating condition of zero flow at shut off head. Shaft shall be protected through the mechanical seal by means of a shaft sleeve. Seal piping from the discharge to the mechanical seal shall be provided.

2.3.4.5 Finishing

Passageways and impellers shall be finished to permit maximum efficiency and provide noise reduction. Overall sound levels shall not exceed OSHA limits.

2.3.4.6 Bearings

Bearings shall be product-lubricated. Heavy duty ballbearings with a high safety factor shall be provided. Provide double row thrust bearing to handle thrust and limit end play and provide graphite alloy throat bushing to assist in maintaining shaft alignment and to prevent contaminants from

entering the mechanical seal area.

2.3.4.7 Drilling and Tapping

Casting shall be drilled and tapped for drain and seal recirculation lines. All connections shall be provided with plugs.

2.3.4.8 Baseplate

Baseplate shall be suitable for pedestal mounting. Anchor bolt holes shall be 7/8-inch diameter.

2.3.4.9 Special Tools

Pumps shall be furnished with special tools necessary to dismantle and reassemble the unit.

2.3.4.10 Service Nameplate

A pump service nameplate, of type 18-8 stainless steel or monel, securely attached by stainless steel pins at an easily accessible point on the pump, shall be furnished in addition to the identification nameplate. The pump service nameplate shall be stamped with the following information:

Manufacturer's name
Serial number of pump
Capacity, gpm
Pumping head, ft.
Maximum specific gravity of fluid to be pumped
Revolutions per minute
Horsepower of driver

2.3.4.11 Identification Nameplate

A pump identification nameplate of Type 18-8 stainless steel or monel shall be provided and securely attached by stainless steel pins to a conspicuous place on the pump head. Tagging in letters 1/4-inch high shall be the equipment number as shown on the drawings.

2.3.4.12 Exterior Primer Coat

Exterior surfaces of the pump and baseplate shall be primed by the manufacturer. Surface cleaning shall meet requirements of SSPC SP 10. Metal primer shall be zinc rich paint conforming to specification \-MS MIL-P-24441-\ Type 1, Class 3. Dry film thickness shall be 2 to 4 mils.

2.3.4.13 Exterior Topcoat

Manufacturer's standard exterior topcoat shall be factory applied and shall be white.

2.3.5 Motor

Refer to paragraph, Motors for the Fueling Pumps.

PART 3 EXECUTION

3.1 PREPARATION FOR SHIPMENT

3.1.1 Rust Preventative

Exterior machine surfaces shall be coated with a rust preventative. Pumps shall be disassembled after the shop running tests and inspected, and internal parts shall be coated with a rust preventative before reassembling.

3.1.2 Closure of Openings

Threaded openings shall be provided with metallic plugs or caps. Flanges shall be gasketed with rubber and closed with 3/16-inch thick plate of the same outside diameter as the match flange. A minimum of four full-diameter bolts shall hold closure in place.

3.1.3 Assembly

Pumps shall be shipped assembled or a field service engineer shall be furnished to supervise the field assembly at no additional cost to the Government.

3.1.4 Bracing

Each unit shall be suitably prepared for shipment, supported and braced, with auxiliary equipment secured to prevent damage during shipment.

3.1.5 Vapor Inhibiting Wraps

Exposed shafts and shaft couplings shall be wrapped with waterproof moldable waxed cloth or vapor inhibitor paper. The seams shall be sealed with adhesive tape.

3.1.6 Shipping Identification

Each pump shall be identified with a metal tag showing the item number. Material shipped separately shall be marked with a metal tag indicating the item number for which it is intended.

3.2 INSTALLATION

Install equipment and components true to line, level and plumb, and measured from established benchmarks or reference points. Follow manufacturer's recommended practices for equipment installation. Provide required clearances between equipment components. Equipment, apparatus, and accessories requiring normal servicing or maintenance shall be easily accessible.

3.2.1 Anchoring

Anchor equipment in place as indicated on the drawings or per manufacturer's recommendations. Check alignment of anchor bolts and/or bolt holes before installing equipment and clean-out associated sleeves. Do not cut bolts due to misalignment. Notify the Contracting Officer of errors and obtain the Contracting Officer's acceptance before proceeding with corrections. Cut anchor bolts of excess length to the appropriate length without damage to threads.

3.2.2 Grouting

Equipment which is anchored to a pad shall be grouted in place. Before setting equipment in place and before placing grout, clean surfaces to be in contact with grout, including fasteners and sleeves. Remove standing water, debris, oil, rust, coatings and other materials which impair bond. Clean contaminated concrete by grinding. Clean metal surfaces of mill scale and rust by hand or power tool methods. Provide formwork for placing and retaining grout. Grout to be non-metallic, non-shrink, fluid precision grout of a hydraulic cementitious system with graded and processed silica aggregate, portland cement, shrinkage compensating agents, plasticizing and water reducing agents; free of aluminum powder agents, oxidizing agents and inorganic accelerators, including chlorides; proportioned, pre-mixed and packaged at factory with only the addition of water required at the project site. Grouting to meet requirements of ASTM C 827. Perform all grouting in accord with equipment manufacturer's and grout manufacturer's published specifications and recommendations.

3.2.3 Leveling and Aligning

Level and align equipment in accord with respective manufacturer's published data. Do not use anchor bolt, jack-nuts or wedges to support, level or align equipment. Install only flat shims for leveling equipment. Place shims to fully support equipment. Wedging is not permitted. Shims to be fabricated flat carbon steel units of surface configuration and area not less than equipment bearing surface. Shims to provide for full equipment support. Shim to have smooth surfaces and edges, free from burrs and slivers. Flame or electrode cut edges not acceptable.

3.2.4 Direct Drives

Alignment procedure follows.

3.2.4.1 Rotation Direction and Speed

Check and correct drive shaft rotation direction and speed.

3.2.4.2 End Play

Run drive shafts at operational speed. Determine whether axial end play exists. Run drive shaft at operational speed and mark drive shaft axial position when end play exists. Block drive shaft in operating position when aligning drive shaft with driven shaft.

3.2.4.3 Shaft Leveling and Radial Alignment

Check shaft leveling by placing a straightedge across the two coupling half faces in both horizontal and vertical planes.

3.2.4.4 Angular Alignment and End Clearance

Check angular alignment and en clearance by inserting a feeler gage at 4 points, 90 degrees apart around outer edges of coupling halves.

3.2.4.5 Final Recheck

Check adjustments with dial indicator after completing recheck. Align shafts within 0.002-inch tolerance, except as otherwise required by more stringent requirements of equipment manufacturer.

3.2.5 Start-up Representative

A manufacturer's field service representative shall be provided at no additional cost to the Government to check the pumps for proper operation prior to start-up and also to witness as a minimum the first two days of operation. Any additional time required due to delays or corrections by the Contractor shall be provided at no additional cost to the Government. The manufacturer's field service representative shall also instruct the required personnel in the proper operation and maintenance of the pumps.

-- End of Section --

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DIVISION 15 - MECHANICAL

SECTION 15176

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SECTION 15176

FUEL STORAGE TANK AND COMPONENTS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN PETROLEUM INSTITUTE (API)

API Std 650	(1998) Welded Steel Tanks for Oil Storage
API Std 2000	(1992) Venting Atmospheric and Low Pressure Storage Tanks: Nonrefrigerated and Refrigerated
API Std 2550	(1965; R 1992) Measurement and Calibration of Upright Cylindrical Tanks

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 36/A 36M	(2001) Carbon Structural Steel
ASTM A 131	(1989) Structural Steel for Ships
ASTM A 176	(1994) Stainless and Heat-Resisting Chromium Steel Plate, Sheet, and Strip
ASTM A 193	(1996) Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
ASTM A 240	(1996) Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels
ASTM A 283	(1993a) Low and Intermediate Tensile Strength Carbon Steel Plates
ASTM A 285	(1990) Pressure Vessel Plates, Carbon Steel, Low- and Intermediate-Tensile Strength
ASTM A 307	(2002) Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
ASTM A 325	(2002) Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength

ASTM A 492	(1995) Stainless and Heat-Resisting Steel Rope Wire
ASTM B 62	(2002) Composition Bronze or Ounce Metal Castings
ASTM B 209	(2002a) Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B 221	(2000) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM B 241	(1995a) Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube
ASTM B 247	(1995a) Aluminum and Aluminum-Alloy Die Forgings, Hand Forgings, and Rolled Ring Forgings
ASTM B 345	(1995) Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube for Gas and Oil Transmission and Distribution Piping Systems
ASTM C 33	(1999ae1) Concrete Aggregates
ASTM C 88	(1999a) Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM D 1785	(1999) Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
ASTM D 2467	(1994) Socket-Type Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D 2564	(1996a) Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
ASTM D 2855	(1996) Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings
ASTM D 3083	(1989) Flexible Poly(Vinyl Chloride) Plastic Sheeting for Pond, Canal, and Reservoir Lining
ASTM D 3453	(1991) Flexible Cellular Materials - Urethane for Furniture and Automotive Cushions, Bedding, and Similar Applications

ASME INTERNATIONAL (ASME)

ASME BPV IX	(1998) Boiler and Pressure Vessel Code; Section IX, Welding and Brazing Qualifications
ASME B31.3	(2002) Process Piping

AMERICAN WELDING SOCIETY (AWS)

AWS A5.10	(1992) Aluminum and Aluminum Alloy Bare Welding Rods and Electrodes

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS SS-S-1614	(Rev A; Am 1; Notice 1) Sealants, Joint, Jet-Fuel-Resistant, Hot-Applied, for Portland Cement and Tar Concrete Pavements

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-G-3056	(Rev. F; Int Am 3) Gasoline, Automotive, Combat
MIL-DTL-83133	(Rev. E) Turbine Fuel, Aviation, Kerosene Types, NATO F-34 (JP-8), NATO F-35 and JP-8+100
MIL-STD 621	(Rev. A; Notice 1 & 2) Subgrade, Subbase, and Test Method for Pavement Base Course Materials

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 30	(2000) Flammable and Combustible Liquids Code

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

SAE AMS 3275	(Rev. B, 1999) Sheet, Acrylonitrile Butadiene (NBR) Rubber and Non-Asbestos Fiber Fuel and Oil Resistant

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC SP 6	(1994) Commercial Blast Cleaning

1.2 SYSTEM DESCRIPTION

This specification provides the requirements for the construction and installation of a field-fabricated, aboveground, vertical, steel storage tank with indicated accessories.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Welding; G-AO.

A letter, at least 5 working days in advance of any welding tests, advising the Contracting Officer of the tests.

Tests; G-AO.

A letter, at least 10 working days in advance of each test, advising the Contracting Officer of the date proposed date for each individual test.

Inspections; G-AO.

A letter, at least 10 working days in advance of each inspection, advising the Contracting Officer of the date proposed date for each individual inspection.

SD-02 Shop Drawings

Fuel Storage System; G-AE.

Detail drawings shall be full size folded blue lines, with the title block visible. Alternative materials, dimensions, methods or departures from the Contract Drawings shall be clearly stated and be labeled as exceptions. The drawings shall include the following:

a. Tank erection details showing dimensions, sizes, thickness, gauges, materials, finishes, and erection procedures including a description of bottom plate welding sequence to minimize distortion of plates.

b. Tank component details to include as a minimum:

(1) Sand Cushion

(2) Floating pan (including details of support legs, manways, joint attachments, anti-rotation cable, and grounding cables)

(3) Internal pipe and fittings

(4) Locations of floating pan pressure/vacuum vents, and rim seals

(5) Stairs, Railings and Internal Ladder

(6) Location of alarm and control switches

(7) Location of gauges

SD-03 Product Data

Fuel Storage System; G-AE.

Manufacturer's standard catalog data, prior to the purchase or installation of the particular component, shall be highlighted to show brand name, model number, size, options, performance charts and curves, etc. in sufficient detail to demonstrate compliance with contract requirements on all parts and equipment including storage tanks, storage tank components, piping components , and monitoring well piping.

Gauge Table; G-AO.

The original and two laminated reproductions of the table for each

tank along with the accuracy certifications.

SD-04 Samples

Special Tools; G-AO.

Two sets of special tools required for maintenance. Special tools are those that only the manufacturer can provide for special purposes such as reaching otherwise inaccessible parts. The tools shall be supplied complete with a suitable tool box.

SD-05 Design Data

Calculations - Tank; G-AE.

Calculations that indicate each tank's maximum and minimum operating pressures in accordance with API Std 650 Appendix F. The calculations shall also include the buoyancy of the floating pan and the structural stability of the floating pan when resting on the support legs. These calculations shall be prepared and sealed by a registered professional structural engineer.

SD-06 Test Reports

Steel Mill Reports; G-AE.

Mill reports covering chemical and physical properties of steel used in the storage tank construction.

Fire Test; G-AE.

Four copies of the information described below in bound 8-1/2 by 11-inch booklets. Drawings shall be folded blue lines with the title block visible.

(1) A list of equipment used along with calibration certifications.

(2) A copy of measurements taken.

(3) The date of testing.

(4) The parameters to be verified.

(5) The condition specified for the parameter.

(6) The test results, signed and dated by the manufacturer's representative.

Tests; G-AO.

Four copies of each test containing the information described below in bound 8-1/2 by 11-inch booklets. Individual reports shall be submitted for the sand cushion tests, the storage tank tests, the floating pan tests, and the piping tests. Drawings shall be folded blue lines with the title block visible.

(1) A list of equipment used along with calibration certifications.

(2) A copy of measurements taken.

(3) The date of inspection.

(4) The parameters to be verified.

(5) The condition specified for the parameter.

(6) The inspection results, signed, dated, and certified by the field engineer. The certification shall state that all required procedures were accomplished, that the procedures were conducted in compliance with the plans and specifications.

(7) A description of adjustments performed.

Inspections; G-AO.

Four copies of each inspection containing the information described below in bound 8-1/2 by 11-inch booklets. Individual reports shall be submitted for the storage tank inspections, the floating pan inspections, and the piping inspections. Drawings shall be folded blue lines with the title block visible.

(1) A list of equipment used along with calibration certifications.

(2) A copy of measurements taken.

(3) The date of the inspection.

(4) The parameters and conditions to be verified.

(5) The inspection results, signed, dated, and certified by the installation Contractor. The certification shall state that all required procedures were accomplished and conducted in compliance with the plans and specifications.

(6) A description of adjustments performed.

(7) The film and inspection reports of radiographic inspections.

SD-07 Certificates

Welding; G-AO.

A letter listing the qualifying procedures for each welder. The letter shall include supporting data such as test procedures used, what was tested to, etc. and a list of the names of qualified welders and their identification symbols.

Verification of Dimensions;

A letter stating the date the site was visited and a listing of discrepancies found.

Floating Pan;

A letter providing locations and points of contact where the floating pan design has been used in previous construction sites.

Radiographic Inspections; G-AO.

A letter identifying each inspector and their corresponding qualifications.

Experience; G-AO.

Evidence of the installation Contractor's experience, training, and licensing.

SD-08 Manufacturer's Instructions

Installation; .

The manufacturer's installation instructions and procedures for all equipment and components.

1.4 QUALIFICATIONS

1.4.1 Experience

The installation Contractor shall have successfully completed manufacturer's training courses on the installation of storage tanks, piping, and tank management systems; have at least 5 years experience in the erection of aboveground vertical steel tanks with floating pans and fixed roofs; and meet the licensing requirements in the state.

1.4.2 Welding

Welding shall be in accordance with qualifying procedures using performance qualified welders and welding operators. Welding tests shall be performed at the work site. Procedures and welders shall be qualified in accordance with ASME BPV IX. Welding procedures qualified by others, and welders and welding operators qualified by a previously qualified employer are not acceptable. Each welder or welding operator shall apply his assigned symbol near each weld he makes as a permanent record. Structural members shall be welded in accordance with Section 05120 STRUCTURAL STEEL.

1.4.3 Radiographic Inspections

Inspectors to perform radiographic inspections on tank welds shall have qualifications in accordance with API Std 650.

1.5 REGULATORY REQUIREMENTS

The design, fabrication, and installation of the entire fueling system shall be in accordance with this specification as well as meet all federal, state, and local code requirements.

1.6 SAFETY REQUIREMENTS

Exposed moving parts, parts that produce high operating temperatures, pressures, parts which may be electrically energized, and parts that may be a hazard to operating personnel shall be insulated, fully enclosed, guarded, or fitted with other types of safety devices. Safety devices shall be installed so that proper operation of equipment is not impaired.

1.7 DELIVERY, STORAGE, AND HANDLING

Stored items shall be protected from the weather and contamination. Proper protection and care of all material before, during, and after installation is the Contractor's responsibility. Any materials found to be damaged shall be replaced at the Contractor's expense. During installation, piping and similar openings shall be capped to keep out dirt and other foreign matter.

1.8 PROJECT/SITE CONDITIONS

1.8.1 Verification of Dimensions

The Contractor shall become familiar with all details of the work, verify dimensions in the field, and advise the Contracting Officer of any discrepancy before performing any work.

1.8.2 Testing and Flushing

The Air Force will provide the necessary water, and fuel required for tank testing at the request of the contracting officer. Water from hydrostatic testing will be disposed of in accordance with the requirements of Section 01355 ENVIRONMENTAL PROTECTION.

PART 2 PRODUCTS

2.1 STANDARD PRODUCTS

System components shall be environmentally suitable for the locations shown and shall be the manufacturer's standard as offered in catalogs for commercial or industrial use. Any non-standard product or component and the reason for its use shall be specifically identified by the Contractor in any required submittal.

2.2 NAMEPLATES

A tank nameplate shall be provided in accordance with API Std 650.

2.3 MATERIALS

2.3.1 Fuels

Galvanized materials (zinc coated) shall not be allowed direct contact with any type fuel. Materials which come in contact with aviation fuel shall be noncorrosive (i.e., stainless steel, aluminum). Fuels as required by this specification shall be in accordance with the following:

2.3.1.1 Motor Gasoline (Mogas)

Mogas shall be in accordance with MIL-G-3056.

2.3.1.2 JP-8

Fuel shall be in accordance with MIL-DTL-83133.

2.3.2 Gaskets

Gaskets shall be factory cut from one piece of material.

2.3.2.1 Nitrile Butadiene (Buna-N)

Buna-N material shall be in accordance with SAE AMS 3275.

2.3.2.2 Acrylonitrile Butadiene Rubber (NBR)

NBR material shall be made of material conforming to SAE AMS 3275.

2.3.3 Structural Steel Shapes

Fabricated structural steel shapes shall be in accordance with ASTM A 36/A 36M.

2.3.4 Bolts

Bolts used for structural steel connections shall be in accordance with ASTM A 307 and ASTM A 325.

2.3.5 Bird Screens

Vents, ports and similar openings shall be screened with flattened 3/4-inch expanded metal bird screen.

2.3.6 PVC Mounting Strip

The PVC mounting strip used to mount the FML shall be in accordance with ASTM D 3083.

2.4 STORAGE TANKS

Materials used in the construction of a storage tank shall be aluminum, carbon steel, stainless steel, or a combination of each.

2.4.1 Aluminum

Bars, rods, shapes and tubes shall be extruded and conform to the requirements of ASTM B 221. Plates and sheets shall conform to the requirements of ASTM B 209.

2.4.2 Carbon Steel

Plates and structural members shall conform to the requirements of API Std 650, Section 2 - "Materials". Storage tank appurtenances not covered by API Std 650 shall be in accordance with ASTM A 36/A 36M, ASTM A 131, ASTM A 283, or ASTM A 285 as applicable.

2.4.3 Stainless Steel

Stainless steel plates shall be Type 304 in accordance with ASTM A 240. Stainless steel plates for miscellaneous use shall be in accordance with ASTM A 176.

2.5 STORAGE TANK COMPONENTS

2.5.1 Sand Cushion

Cushion shall be located on top of the flexible membrane liner (FML) and beneath the tank bottom plates. Cushion shall be a minimum of 8-inches thick and be fine sand aggregate in accordance with ASTM C 33. Cushion

shall contain no more than 25 parts per million (ppm) chlorides, no more than 30 ppm sulfates, and have a pH greater than 7. Magnesium sulfate shall be used in the ASTM C 88 soundness test.

2.5.2 Floating Pan

The floating pan shall be naturally buoyant by means of non-perforated, individually sealed, closed cell type honeycomb cells (maximum horizontal plane dimensions of 1 inch by 1 inch). A rim shall be provided around the floating pan periphery and penetrations and extend a minimum of 6-inches above the free liquid surface. The rim shall contain turbulence and prevent fuel from splashing up onto the top surface of the floating pan.

2.5.2.1 Pan Integrity

The floating pan shall support the following loading conditions without causing damage to the pan, sinking the pan, or allowing product to spill onto the top surface of the pan in the event the pan is punctured.

(1) A uniform load of three times the weight of the pan.

(2) A point load of 500 pounds on a one square foot area anywhere on the floating pan while it is floating or resting on the legs.

2.5.2.2 Joint Connections

Aluminum sandwich panels shall be joined together by means of a gasketed joint that transmits loads without structural failure or leakage.

2.5.2.3 Aluminum Extrusions

Extrusions shall be made from alloy 6063-T6 in accordance with ASTM B 209.

2.5.2.4 Aluminum Sandwich Panels

Panels shall be made from alloy 3003 H14, 3003 H16, 3105 H14, 5010 H24, or 5052 H32 in accordance ASTM B 209. The skin of the panels shall have a minimum thickness of 0.014-inches. The core of the panels shall be 1-inch aluminum honeycomb, non-perforated.

2.5.2.5 Support Legs

Floating pan shall be provided with two position self draining legs that are designed to support a uniform load of 12.5 pounds per square foot. The legs shall be tubular structural members of aluminum or stainless steel at least 2-inches in diameter and ride with the pan when the fuel level is above the high position. The low position shall be 36-inches and high position 75-inches. The exact location and number of the support legs shall be as recommended by the floating pan manufacturer. The legs shall be capable of allowing a person, standing on top of the floating pan while the tank is in service, to perform the following functions:

(1) Change from the high to the low position.

(2) Change from the low to the high position.

(3) Completely remove the legs.

(4) Adjust the legs vertically a distance equal of plus or minus 3-

inches.

2.5.2.6 Periphery Seals

Periphery seals shall be made of flexible polyurethane foam in accordance with ASTM D 3453 and be covered with a polyurethane coated polyester fabric wrap at least 0.025-inch thick. The periphery seal shall fit the space between the tank shell and the outer edge of the floating pan with two flexible seals, a primary and a secondary. The seals, primary and secondary as a unit, shall accommodate a deviation between the path of the floating pan relative to the tank shell of an additional 4-inches of compression and an additional extension of 2-inches from its normal compressed position at any fluid level. The primary seal shall be above the liquid level and be free draining without trapping any liquid. The secondary seal shall be above the primary seal. Seals shall be capable of being replaced during tank operations, be durable in the tank's environment, be abrasion resistant, and not discolor or contaminate the liquid stored in the tank.

2.5.2.7 Penetration Seals

Penetration seals shall be made of Buna-N. Vertical appurtenances such as gauge wells, ladders, cable, etc. that penetrate the floating pan shall have seals that permit a local deviation of plus or minus 5-inches and have a rim that extends a minimum of 6-inches above the free liquid to contain product turbulence and prevent the tank product from splashing up onto the top surface of the floating pan.

2.5.2.8 Manway

A manway shall be provided for each floating pan to provide access to the tank interior when the floating pan is on its supports and the tank is empty. Manway shall be co-located with the ladder. Manway shall have an clear inside dimensions of at least 36-inches.

2.5.2.9 Grounding Cables

Two or more 1/8-inch diameter grounding cable made of 304 stainless steel aircraft cable conforming to ASTM A 492, with a maximum resistance of 8.5 ohms per 100 feet shall be provided for each tank. The exact location and number of grounding cables shall be as recommended by the floating pan manufacturer.

2.5.2.10 Anti-Rotation Cable

One 1/4-inch diameter anti-rotation cable made of 304 stainless steel conforming to ASTM A 492 shall be provided for each tank. Fittings for anti-rotation cables including cable clamps, pins, sockets, turnbuckles, U-bolts and nuts, etc. shall be 304 stainless steel. Cable shall be made taut by means of the turnbuckle. The exact location of the anti-rotation cable shall be as recommended by the floating pan manufacturer.

2.5.2.11 Fire Test

The floating pan design shall be fire tested by both of the following tests being applied to a test floating pan. The test floating pan shall be floated in gasoline. Successful conclusion of each fire test shall show that the design is adequate if no significant damage occurs to the pan, the pan continues to float, and the fire did not spread to the entire surface

of the fuel.

(1) Hole Fire: The test floating pan shall have a 12-inch or larger diameter hole cut through it. After being lit, the fuel in the hole shall burn for a minimum of two hours.

(2) Rim Fire: After being lit, the fuel in the test rim section shall burn for a minimum of two hours.

2.5.3 Access Ladder

Ladder shall have a safety rail system with three safety belts and trolleys. The rail shall have a removable extension with clamps. Aluminum piping for ladder shall be in accordance with ASTM B 241 or ASTM B 345, alloy 6061-T6. Pipe 2-inches and larger shall be Schedule 40 or thicker.

2.5.3.1 Welding Process

The welding process for aluminum piping shall be a gas tunston arc or gas metal arc process in accordance with ASME B31.3.

2.7.7.3 Welding Electrodes

Welding electrodes shall be ER5356 conforming to AWS A5.10.

2.5.4 Shell Manhole

Manhole shall be gasketed fuel tight with a Buna-N or full face NBR gasket.

2.5.5 Fixed Roof

The roof-to-shell joint shall be the frangible type as defined in API Std 650 Appendix F, NFPA 30, and API Std 2000 to satisfy emergency venting requirements. Tank roof shall have a bolted rectangular opening suitable for installation of floating pan panels.

2.5.6 Roof Manway

Manway shall be gasketed fuel tight, with a Buna-N gasket and include a gauge hatch. The gauge hatch shall be made of aluminum conforming to ASTM B 247 or bronze conforming to ASTM B 62, have a cover that is foot-operated to open, self-closing, lockable, and gasketed fuel tight with a Buna-N gasket.

2.5.7 Roof Inspection Hatch

A minimum of 4 hatches are required per tank. The maximum space between hatches shall be 32 feet.

2.5.8 Emergency Overflow Slot

Slot shall comply with API Std 650, Appendix H.

2.5.9 Circulation Vent

Venting for tanks shall comply with API Std 650, Appendix H.

2.5.10 Stairway

Stairway shall be supported completely on the shell of the tank with ends of the stringers clear of the ground and be constructed entirely of steel. At platform access openings, any space wider than 6-inches between the tank and the platform shall be floored.

2.5.11 Handrails

A continuous handrail shall be provided around the full perimeter of the tank roof, around the platforms, and down the stairway. The handrail shall be non-continuous only at access platforms and at roof vent/inspection hatches. Provide removable safety chain at roof vent/inspection hatches.

2.5.12 Interior Tank Coating

Interior tank coating shall be applied to all interior surfaces including piping and appurtenances in accordance with Section 09973 Interior Coating System for Welded Steel Petroleum Storage Tanks. Tank shall have the interior coating applied following the completion of the water fill tightness test. The exterior of carbon steel piping inside the tank shall be coated equal to the tank interior coating. Areas between the underside of the tank roof and the top surface of the rafters shall be coated. Contractor will be allowed to insert small wooden blocks between the roof and the rafters, sandblast the area, and then apply the coating. After the coating has dried, remove the blocks to allow the blocked areas to be sandblasted, coated, and dried.

2.5.13 Exterior Tank Coating

External tank coating shall be in accordance with Section 09971 Exterior Coating System for Welded Steel Petroleum Storage Tanks.

2.5.14 Foundation Ring Wall Mastic Seal

The mastic seal for sealing the foundation ring wall shall be a jet fuel-resistant sealant conforming to the requirements of FS SS-S-1614.

2.5.15 Water Draw-Off System

The Water Draw-Off System shall be in accordance with paragraph "Water Draw-Off System" in Section 15050 Mechanical Equipment, Fueling. A water draw-off system shall be provided for each bulk and operating storage tank. Each system shall include tank, product return pump and all necessary pipe, valves and fittings. Components of the water draw-off system shall be installed and secured in place by anchor bolts.

2.6.16 Level Alarm System

The Level Alarm System shall be in accordance with paragraph "Operating Tank Level Switches" in Section 15050 Mechanical Equipment, Fueling.

2.5.16 Mechanical Tape Level Gauge

The mechanical tape gauge shall be complete with all necessary incidental pipe, pulleys, fittings, supports, support brackets, tension spring, and guide wire assemblies. The gauge shall automatically provide the location of the floating pan within plus or minus 1/16-inch of the actual liquid level. The head shall be made of aluminum and be mounted on the exterior

of the tank shell approximately 4'-0" feet above the tank bottom. The head shall contain a glass covered window complete with an inside wiper. The seals shall be made of Teflon. The shafts, graduated tape, and tape drum assembly shall be made of stainless steel. The tape shall be of sufficient length to measure the liquid level from the bottom to the top of the storage tank. Gauge measurements shall be graduated in 1/16-inch increments. The tape shall be carried over pulleys housed in elbow assemblies at each change of direction.

2.5.17 Automatic Tank Gauge

The Automatic Tank Gauge shall be in accordance with paragraph "Operating Tank Level Indicator" in Section 15050 Mechanical Equipment, Fueling.

2.6 PIPING COMPONENTS

Pipe and fittings shall be installed and tested in accordance with Section 15060 Pipe, Manual Valves, and Fittings, Fueling System. Interior piping shall not be anchored to its supports or to the tank bottom.

2.6.1 Fill and Withdrawal Piping

Pipe internal to a storage tank shall be epoxy coated carbon steel. Interior of piping shall be factory coated.

2.6.2 Water Draw-Off Piping

Water draw-off pipe internal and external to a storage tank shall be stainless steel.

2.6.3 Monitoring Well Piping

Monitoring well piping shall be schedule 80 PVC pipe that is commercially manufactured to have between 0.010-inch and 0.015-inch wide slots with a minimum total open area OF 0.5 square-inches per foot.

2.6.4 PVC

PVC pipe shall conform to ASTM D 1785, Schedule 80. PVC pipe fittings shall be socket fittings conforming to ASTM D 2467. PVC joints and fittings shall be solvent-cemented to conform with ASTM D 2855 using solvent cement conforming to ASTM D 2564.

2.6.5 Pipe Supports

2.6.5.1 Exterior to Tanks

Exterior pipe supports shall be as shown on the drawings.

2.6.5.2 Interior to Tanks

The assembly shall be constructed of steel angle frames with slotted bolt holes. The frames shall be in accordance with ASTM A 36/A 36M. The assembly shall be held together with ASTM A 193 stainless steel nuts and bolts. Each leg of the assembly shall be welded to a 6-inch circular sheet of steel, which in turn shall be welded to the tank bottom. The entire assembly shall be coated with the same material as specified for the interior of the tank.

2.7 SUPPLEMENTAL COMPONENTS/SERVICES

2.7.1 Earthwork

Excavation and backfill shall be as specified in Section 02319, "EARTHWORK FOR VEHICLE TRAFFIC AREAS, STRUCTURES, SIDEWALKS AND CURBS, AND AREA GRADING"., except as modified herein.

2.7.2 Cathodic Protection

Cathodic protection of a storage tank's bottom shall be in accordance with Section 13110 CATHODIC PROTECTION SYSTEM (SACRIFICIAL ANODE).

2.7.3 Exterior Coatings for Miscellaneous Items

Painting required for exterior surfaces not otherwise specified, including items only primed at the factory, shall be painted as specified in Section 09900 Paints and Coatings. Steel surfaces to be externally coated or painted shall be cleaned to a commercial grade blast cleaning finish in accordance with SSPC SP 6 prior to the application of the coating.

2.7.4 Identification Markings

Tanks, pipe, equipment, etc. supplied under this section shall have identification markings applied in accordance with Section 15060 Pipe, Manual Valves, and Fittings, Fueling System.

2.7.5 Concrete

Concrete, including the ring wall, shall be supplied and installed in accordance with Section 03100 STRUCTURAL CONCRETE FORMWORK, Section 03200 CONCRETE REINFORCEMENT, and 03300 CAST-IN-PLACE STRUCTURAL CONCRETE.

2.7.6 Flexible Membrane Liner

FML shall be in accordance with Section 02218 FLEXIBLE MEMBRANE LINER.

PART 3 EXECUTION

3.1 INSTALLATION

The installation Contractor shall supervise the complete installation of the fueling system and perform all inspections and tests.

3.1.1 Sand Cushion

Cushion shall be spread, leveled, thoroughly compacted, and graded to provide a 5 percent sloped bottom to the center sump. Cushion shall be compacted to 100 percent of maximum density per MIL-STD 621, Test Method 100, Compaction Effort Designation CE55. Cushion shall be dampened with water to aid in compaction. Any damage to the finished sand cushion shall be repaired prior to the erection of the tank.

3.1.2 Storage Tank

Openings larger than 2-inches through the shell of the tank shall be reinforced. Shop and field fabrication shall meet the requirement of API Std 650 as adjusted herein. Spacing distances between weld seams and all shell penetrations (including manways) shall be in accordance with API Std

650. Work shall be fabricated and erected in accordance with the fabricator's approved erection drawings. Vertical appurtenances shall be plumb within a tolerance of 3-inches at one end over its length.

3.1.2.1 Outer Shell

The outer shell plates shall be approximately of equal length and preformed to the curvature of the tank, a compensating allowance in performing being made at the welding edges of 1/4-inch thick plates to produce a finished shell without distortion from a true cylindrical surface at the welded joint. The maximum distortion tolerances shall not exceed the requirements in API Std 650. Plates shall be aligned, shaped and clamped in place prior to welding by press, roll or drawbar methods. Plates shaped by hammering shall not be accepted. Shell joints shall be butted and welded on each side to have complete penetration and fusion. Interior welds on the inside of the shell plates shall be smoothed by grinding or other suitable mechanical process to the extent that no sharp or abrupt irregularities remain and the welds present a smooth crown surface. Special care shall be taken to prevent excessive build up in all welded horizontal and vertical seams which may come in contact with the floating pan seals; rough spots, overbuild, reinforcing welds, spatter and or projections that may cause undue wear on the floating pan seals shall be removed.

3.1.2.2 Bottom

Bottom plate joints shall be lap welded in accordance with API Std 650. Bottom plates shall be installed with the lower plates under the upper plates to permit drainage to center sump. Tank bottom plates shall be welded in a sequence which has been found to result in the least disortion from shrinkage. Interior welds on the tank bottom plates shall be smoothed by grinding or other suitable mechanical process to the extent that no sharp or abrupt irregularities remain. Welds shall present a smooth crown surface for painting.

3.1.2.3 Defect Removal

The determination of limits of defective welding and repair of defective welds shall be in accordance with API Std 650. Grind off rough surfaces on weld seams, sharp edges and corners to a radius of not less than 1/8-inch.

3.1.2.4 Welding Procedures

Welding shall be done using qualified welding procedures. The surface shall be cleaned before welding. Repair welds shall be made using an electrode or filler wire preferably smaller than that used in making the original weld. Repair welds shall meet the original weld's requirements.

3.1.2.5 Floor and Roof Welded Appurtenance Connections

Appurtenance connections to be welded to the floor or roof of a storage tank shall be made prior to application of the interior coating.

3.1.3 Floating Pan

After the tank fuel piping connections are completed, the interior and exterior coating has been inspected, approved, and the interior coating system has had at least 14 days to cure after the final coating was applied, the floating pan shall be installed. The floating pan shall be installed to have unrestricted vertical movement from its normal bottom to

top position without damaging the tank, interior tank coating, or the floating pan.

3.2 TESTS

3.2.1 Sand Cushion Tests

A test of the sand shall be performed, prior to installing any storage tank bottom, to verify the amount of chlorides (ppm) and sulfates (ppm) within the sand. The test shall also determine the pH value of the sand.

3.2.2 Storage Tank Tests

3.2.2.1 Vacuum Box

Field welds performed on the bottom of any storage tank shall be subjected to a vacuum box test. Vacuum box test shall be performed immediately upon completion of welding the tank bottom. A glass topped vacuum box which has a Hypalon and neoprene sealing gasket shall be used. The following procedures shall be followed:

(1) Apply a commercial bubble forming solution to the weld or area to be tested.

(2) Position the vacuum box over the area and slowly apply vacuum until a differential pressure of about 1 psi is achieved and held for at least 5 seconds while observing the solution for bubble formation.

(3) Continue to apply vacuum until a maximum differential pressure of 5 psi (11.5 feet of water or 10.2-inches of mercury) plus or minus 0.25 psi is achieved and held for at least 20 seconds while observing the solution for bubble formation.

3.2.2.2 Liquid Penetrant

The tank shell-to-bottom inside corner welds shall be subjected to a liquid penetrant test in accordance with the procedures in API Std 650 paragraph 5.2.4.1. The initial weld pass inside the shell shall be examined for its entire circumference using a liquid penetrant prior to welding the first weld pass outside the shell.

3.2.2.3 Water Fill Tightness

Following the successful completion of the radiographic inspection of tank and internal piping welds, the tank shall be subjected to a hydrostatic water fill tightness test. The test shall include the following in sequential order:

(1) Prior to connecting water fill lines to the tank, not less than 6 equally spaced points shall be selected and marked on the ring wall. Grade elevations shall be taken at the top of the ring wall at each marked point.

(2) Water shall be flushed from the tank through each tank/pipe connection into the diked area to ensure any accumulated dirt and sediment is not flushed into the tank.

(3) The tank shall be filled in four increments equal to

twenty-five percent of total capacity. At the end of each fill increment, two hours shall pass before grade elevations are taken at the top of the ring wall at each marked point. The tank shall also be visually inspected for leakage. Settlement values shall be calculated from the elevation differences. The appearance of damp spots shall be considered evidence of leakage, the Contracting Officer shall be notified and the water remove immediately. Defects found during the test shall be corrected and the tank retested.

(4) The tank shall be maintained full of water until the settlement of the tank stabilizes or a period not less than less than 24 hours. After the water is removed, obtain grade elevations and determine settlement at each of the marked ring wall locations.

(5) The tank shall be emptied by draining the water in accordance with Section 01355 ENVIRONMENTAL PROTECTION.

(6) The tank bottom shall be inspected for standing water. No standing water shall be allowed anywhere on the sloped floor. If action has to be taken to correct standing water the water fill test shall again be conducted.

3.2.2.4 Tank Fuel Fill Tightness

Following the installation of the liquid level gauging equipment, the tank shall be subjected to a fuel fill tightness test. The tank shall be filled to one-half of total capacity and held at that level for an initial 12 hour period. The tank shall then be filled to total capacity and held at that level for a second 12 hour period. Following the temperature stabilization of the fuel, daily readings of the fuel levels shall be taken for a period of 10 days. Visual inspections and liquid level gauge readings shall be performed hourly to detect leaks during the initial and the second 12 hour periods of the test. Upon the acknowledgment of a leak, the Contracting Officer shall be notified immediately, the fuel shall be removed, the fuel vapor within the tank shall be removed, the tank interior and the tank site shall be cleaned, all defects corrected, and the fill test repeated. In the event fuel is removed from the tank, the internal coating system shall be visually inspected for damage before the tank is refilled.

3.2.2.5 Tracer Gas Test

The tracer gas test shall be performed preceding the vacuum box test and be in accordance with the following:

(1) The test shall be conducted using an analytical method which can detect vapor movement through any void in the tank bottom.

(2) The testing company shall locate the leaks to within 3-inches of actual leak location by attempting to force or draw a detectable gas through the tank bottom.

(3) The gas used shall be non-explosive, non-toxic, and shall not be damaging to the ozone layer.

(4) The instrumentation shall be able to detect the leak as being used at the accuracy described below.

(5) The test shall be conducted before application of any coating.

(6) A leak is characterized by the detection of 1 tenth (0.10) part per billion in air of the detectable gas on the opposite side from its point of injection.

(7) The tracer gas will be introduced to the underside of the tank using the monitoring well leak system piping. Gas release shall be pressure-regulated to prevent uplift and damage to the tank bottom.

3.2.3 Floating Pan Tests

Following the installation of a floating pan, the deck penetrations and rim area shall be subjected to a visual inspection for seal tightness. Leaks or seal deformations shall be corrected according to manufacturer's recommendations. Following the seal inspection, the floating pan shall be subjected to a flotation test. The tank shall be filled to 25 percent of the total capacity with fuel. While filling the tank, the top of the floating pan shall be visually inspected for fuel leakage. The appearance of damp spots on the top of the floating pan shall be considered evidence of leakage, the Contracting Officer shall be notified and the fuel remove immediately. Leaks shall be repaired and the flotation test performed again.

3.3 INSPECTIONS

3.3.1 Storage Tank

3.3.1.1 Visual Inspection of Welds

Following the tank construction, each tank welded joint shall be visually inspected for defects. Welds with excess convexity and overlap shall be have excess metal removed. Welds with excess concavity, that are undersized, or show undercutting shall be cleaned and additional metal added. Welds with excess porosity, inclusions, lack of fusion, or incomplete penetration shall have the defective portions removed and re-welded. Cracks in a weld or a tank plate shall be removed by cutting around the entire crack and re-welding the defect. Welds with poor fit-up shall be cut apart and re-welded.

3.3.1.2 Radiographic Inspections

Radiographic inspection procedures shall be in accordance with API Std 650. Defective welds shall be repaired and followed with a new radiographic inspection to the newly repaired area. If defects are identified in a radiograph, additional radiographs shall be performed in accordance with the requirements of API Std 650. In addition, when a defect is identified in a radiograph, two additional locations shall be radiographically examined in the same weld increment at locations away from the original spot. The locations of these additional spots shall be determined by the Inspector or Contracting Officer. The use of force (peening) or foreign materials to mask, fill in, seal, or disguise any welding defects shall not be permitted.

3.4 CLEANING AND ADJUSTING

3.4.1 Tank Interior

After completion of the tank coating but prior to the floating pan tests, interior surfaces within the tank shall be cleaned to eliminate any foreign matter such as water, dirt, debris, grease, oils, etc.

3.4.2 Tank Calibration

3.4.2.1 Tank Strapping

Tank strapping shall be performed on each storage tank and be performed in strict accordance with applicable recommendations and requirements of the API Std 2550. Circumferential measurements shall be determined by the critical measurements method, as defined by API Std 2550. Tank strapping shall cover the entire height of the tank extending to the overflow port and take into account all deadwood, including the floating pan, per the requirements of API Std 2550

3.4.2.2 Gauge Table

A gauge table and two laminated reproductions shall be provided for each tank based on the tank strapping results. The gauge table shall read in feet and inches with the smallest increment of measure being 1/8-inch. Table shall indicate the capacity of the tank in gallons to the nearest gallon for each 1/8-inch increment when measured by a steel tape lowered through the roof at the manual gauge well. The master gauge table shall be typed on tracing cloth or other transparency suitable for reproduction. The gauge table shall be certified for accuracy by the firm which prepared the table and the installation Contractor.

3.4.3 Final Adjustments

Following system completion but prior to the demonstration, the entire system shall be adjusted to meet final design requirements. Each electronic level sensing alarm shall be tested for proper operation. Fuel level gauges shall be adjusted and calibrated in accordance with the manufacturer's instructions. Calibration of level gauges shall be supervised by a manufacturer's representative. The tank's water draw-off system shall be tested to verify proper operation. The draw-off system shall be filled with a water and fuel mixture. The separation of the water and fuel shall be verified through the system's sight glass.

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SECTION 15177

PETROLEUM TANK CLEANING

PART 1 GENERAL

Attachments: A - Contractors Qualification Statement

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN PETROLEUM INSTITUTE (API)

API 2015	(1994) Safe Entry and Cleaning of Petroleum Storage Tanks, Planning and Managing Tank Entry From Decommissioning Through Decommissioning.

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2002) National Electrical Code

OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA)

29 CFR 1910.28	Safety Standards for Scaffolding

U.S. AIR FORCE (USAF)

AFM 85-16	Maintenance of Petroleum Systems
AFOSHSTD 48-137	(1998) Respiratory Protection Program
AFOSHSTD 91-38	(1997) Hydrocarbon Fuels - General
AFOSHSTD 91-66	(1977 General Industrial Operations

U.S. Code (USC)

USC Title 42	The Public Health and Welfare

1.2 CONTRACTOR QUALIFICATIONS

All prospective contractors shall submit a contractor's qualification (see Attachment A). This specification is for cleaning the new above ground tanks after system flushing.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When

used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-07 Certificates

Contractor's Qualification Statement; G-AO

Contractor's Qualification Statement shall include:

The name and qualifications of the Contractor's Representative who will be in charge of the work and be present at the job site when any tank work is being accomplished.

A complete list of equipment, with adequate nomenclature by item, to be used or available at the job site.

Contractor's Plan of Operations.

1.4 GOVERNMENT FURNISHED SERVICES

1.4.1 Fuel Removal

The base fuel officer will remove the fuel within 18 inches of the bottom with the fixed pumping system. The Contractor shall remove the remaining fuel by pumping into a Government tank truck. Any fuel remaining in the tank, after the tank has been released to the Contractor, shall be considered as contaminated and disposed of by the Contractor. The Contractor shall remove the fuel from the base and dispose of it in a manner consistent with applicable pollution control regulations, and all local, state, and federal EPA regulations.

1.4.2 Utilities

Water and electricity will be made available to the Contractor as described in Section 00800 SPECIAL CONTRACT REQUIREMENTS.

1.4.3 Electrical Equipment Approval

All electrical equipment and conductors used by the Contractor within 50 feet of any fuel pipes or storage tanks shall be approved for use in Class 1, Division 1, Group C, hazardous areas.

1.5 TANK ENTRY EQUIPMENT

The Contractor shall furnish all necessary clothing and equipment required for the work and protection of personnel, regardless of whether they enter a tank or handle materials outside the tank. Before any tank cleaning work is performed, the Contractor's equipment will be inspected and approved at the job site, by the Contracting Officer, to insure that the equipment includes, but is not necessarily limited to the following:

1.5.1 Air Movers

Air-movers, either explosion proof and electrically operated, or air driven, eductor type only. One air driven type is listed in the MSA catalog as a "Lamb Air-Mover Ventilator." All air-movers used will be the educing type capable of educing vapors from the tank. Air-movers blowing air into the tank will not be used during the vapor freeing or cleaning

periods of work.

1.5.2 Combustible Gas Indicator

One (1) combustible gas indicator.

1.5.3 Lights

Explosion proof portable battery powered lights (Mining Enforcement and Safety Administration approved).

1.5.4 Miscellaneous Supplies

Buckets for soapy water, adequate supply of a denatured alcohol, and cotton swabs.

1.6 PRECAUTIONS TO FOLLOW

1.6.1 Tank Cleaning

All tanks being cleaned, regardless of the type of fuel stored therein, shall be considered leaded and explosive until all sludge and loosely adhering rust scale have been removed.

1.6.2 Tank Entry Permission

Prior to entry into any tank, Contractor will obtain permission from the Contracting Officer and the liquid fuels maintenance officer. This permission will be granted only when , or after:

(a) The Contractor's qualified supervisor is present.

(b) The contractor personnel have been briefed by the supervisor on what is to be done; what each employee is to do in the event of an emergency; and how long each man or cleaning crew will remain in the tank under normal conditions.

(c) All required equipment is approved and properly located.

(d) Personnel are equipped with properly fitted protective equipment.

(e) The entire area adjacent to the tank is secured.

(f) Air-movers, eductor type only, have been operating continuously for at least one (1) hour, and will continue to operate throughout the entire period personnel are cleaning the tank. The Contracting Officer may allow air-movers to be turned off after one (1) hour with continuous monitoring of the vapor level below 20 percent of the Lower Explosive Limit (LEL).

1.6.3 Physical Contact

Physical contact shall be avoided and maximum care shall be taken to prevent contamination of water supplies or streams. Physical contact with leaded sludge is dangerous due to the toxicity of the lead alkyd compounds, either in liquid or gaseous state.

a. Tests for lead in the air above any sludge which is deposited on the open ground have shown that values are low at all times, even with

no apparent wind. The sludge, therefore, is safe with regard to air contamination as soon as it is spread in the open. Industrial standards of 20 ppm of organic lead is the limit in the sludge that can be considered safe after sludge has been weathered. If weathering is a treatment process, it must be done in accordance with RCRA. If this disposal method is used, maximum care shall be taken to insure that there is no runoff to contaminate water supplies or streams before the end of the weathering period.

b. There shall be no smoking; matches or cigarette lighters shall not be carried by the tank crew or other persons entering the tank area. Brooms or brushes that have plastic synthetic bristles shall not be used.

c. All Government equipment shall be protected against dirt, water, chemical, or mechanical injury.

1.7 TANK VENTILATION

1.7.1 Air Movers

Air-movers of the eductor type described earlier shall be used. Tank fuel vapors are heavier than air and except on hot days (80 Degrees F. to 110 Degrees F.), accumulate in the bottom portion of the tank. Blowing air into the tank tends to "stir" the vapors, requiring a long period of time before any appreciable drop in vapor-air ratio is noted. Eductor type air-movers, with flexible oil proof canvas hoses attached, inserted in the tank near the bottom will educt vapors from the tank in a short period of time. On hot days, a fog type water spray over the opening, admitting fresh air into the tank will condense vapors and facilitate removal. All tank openings, except the one used to insert the oil proof flexible hose and the one admitting fresh air into the tank, should be kept closed until workmen have entered the tank.

1.7.2 Precautions

Although eductors may be used through bottom manholes on an above ground tank, it is preferred that top manholes or vent piping be used on above ground tanks. Using eductors on top of the tank will allow for dissipation of the vapors, thus preventing them from settling in low places at ground level. All other manholes and tank openings should be closed when the tank is initially ventilated. They should be opened, however, when work is started to take advantage of the light these openings let into the tank.

1.8 PREPARATION AND TANK CLEANING

1.8.1 Blind Flanges

The Contractor shall provide and install blind flanges or spectacle blinds on each pipeline connected to the tank. When blind flanges are used, they will be placed on the end of the pipe and not on the tank opening. Spectacle blinds shall, if used, be inserted between the tank valve and the flange nearest the tank. Gaskets shall be inserted on both sides of the spectacle blind. CAUTION: DO NOT REMOVE VALVES OR DISCONNECT PIPING FROM ANY TANK UNTIL POSITIVELY CERTAIN THE LINE HAS BEEN EMPTIED OF FUEL. DO NOT REMOVE BLIND OR SPECTACLE FLANGES UNTIL ALL INTERIOR WORK IS COMPLETE AND THE SYSTEM IS READY TO BE PUT BACK INTO SERVICE.

1.8.2 Tank Survey

The Contractor, by physically surveying the area within 50 feet of the tank to be entered or cleaned, shall assure that no vapors are present in pits or low places, and that unauthorized personnel are cleared from the area. The Contractor shall provide this area with "No Smoking" signs. All personnel entering the area shall leave all cigarettes and flame producing devices at a previously determined location.

1.8.3 Equipment Placement

The Contractor shall place all equipment upwind of the tank openings. Equipment shall be placed at the highest elevation possible; never in an area lower than the surrounding terrain. Internal combustion engine driven equipment shall be equipped with flame arresters and protected ignition systems and must be positioned a minimum of 50 feet from an open manhole.

1.8.4 Contractor Responsibility

The Contractor shall be responsible for reviewing the drawings of the tank to be cleaned. The Contractor shall brief his personnel on the location of floor pits, sumps, or other tank appurtenances considered hazardous to personnel. The Contractor shall work in accordance with API 2015, AFM 85-16, AFOSHSTD 48-137, AFOSHSTD 91-38, and AFOSHSTD 91-66, 29 CFR 1910.28 and USC Title 42 Section 6901. Whenever the information contained herein conflicts with the previously listed standards, the information here shall govern.

1.8.5 Lighting

Explosion proof battery powered safety flashlights, or safety lanterns may be used inside the tank or within 50 feet of the tank during any tank cleaning operation. Explosion proof lights approved for use under Class I, Division I, Group C and D, as defined by NFPA 70, may be used inside the tank during tank coating operations.

1.8.6 Cleaning

After waste fuel has been removed from the tank, and with personnel wearing protective equipment, the bottom of the tank and three (3) feet up on the sides shall be scraped until all loosely adhering rust and scale have been removed and placed with waste fuel removed from the tank. The remainder of the tank sides, and all metal supports and braces, shall be washed down with a high pressure water hose until the water flowing or pumped out of the tank is clean. Decks or tops of vertical tanks shall also be washed.

1.8.7 Water Usage and Disposal

Water used to wash down a scraped tank shall be contained. It may be channeled or pumped from the tank through a spillway into a drainage system having an oil/water separator of adequate capacity. The discharge effluent containing the petroleum products is processed in this manner to prevent the fuel products from entering any above or below ground water sources. All water shall be discharged into the sanitary sewer or industrial waste only. The separated petroleum products shall be disposed of with the fuel tailings by the Contractor. Running or pumping waste fuel into natural waterways, sewers, storm drains, or on to ground is prohibited.

1.8.8 Floor Drying

After the tank has been washed, the floor will be dried out.

1.8.9 Potential Explosive Vapors

Pipes used for center poles, and braces, pontoons, and leaking bottoms are a potential source of explosive vapors even after then tank is cleaned. The tank may be determined to be vapor free below four (4) percent of lower explosive limit; but after one (1) or two (2) hours, explosive readings may again be obtained from these sources. Because of this, the Contractor shall take readings at least every one-half (1/2) of an hour when working in tanks after they have been cleaned and each floating roof or pan pontoon shall be checked individually with a combustible gas indicator.

1.9 CLEANUP AND ACCEPTANCE

After all water and sludge materials have been removed from the tank and the Contracting Officer has inspected and accepted the tank cleaning, all valves, piping, manhole covers, etc. (removed at start of the job to facilitate ventilation), shall be reinstalled with new gasket material (resistant to aircraft fuel) and shall not be less than the thickness of the gasket removed. The entire tank area shall be restored to its original condition.

1.10 STENCILING TANK

At the completion of the exterior tank painting work, Contractor shall stencil the tank in 3/4- to 1-inch letters adjacent to the manhole openings with the essential information as shown in the following example:

```
DATE CLEANED:      1/16/71
  CONTRACTOR:      JOHN DOE
     ADDRESS:      1017 CHESTNUT STREET
                   CHICAGO, ILLINOIS
```

1.11 QUALIFIED PETROLEUM TANK CONTRACTORS

All prospective contractors must submit a contractor's qualification statement similar to attachment A. To qualify, the Contractor must:

a. Show proof of having completed similar work on three (3) previous projects. The work falls into three (3) categories; tank entry, coating, and petroleum system welding.

b. Submit proof that welders are API certified.

c. Certify that before commencing work, the contractor supervisor on the job site will be thoroughly familiar with JP-8 fuel characteristics and worker safety requirements.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

ATTACHMENT A

CONTRACTORS QUALIFICATION STATEMENT

1. Name of Firm:

2. State briefly why firm is qualified to clean strap, calibrate, repair, or coat petroleum storage tanks.

3. List the size of tank(s) the firm has successfully completed work on; also, give the location of each tank, the owner's name, and the name of a person(s) that may be contacted regarding the tank(s) listed.

4. Since gauge charts are to be individually certified by the firm, what guarantee backs the firm's certificate?

5. The Owner/Owners must furnish the following statements, signed and dated:

(NOTE: If the statements to Items a and b are positive, furnish a detailed explanation.)

a. I (We) _____ have (have not) has a loss of life or injury requiring hospitalization of any employee of this or any other contracting firm that I (we) have owned or managed separately or together.

b. I (We) _____ have (have not) been involved in a contract where a loss of property occurred under this or any other company name.

c. I (We) _____ have completed tank cleaning, repair, or calibration of the following Department of Defense installations. This list must be complete for the past eight (8) years.

d. I (have)(will obtain prior to bidding) a copy of the American Petroleum Institute - API 2015, Cleaning Petroleum Storage Tanks.

6. List the make and model numbers of the following pieces of equipment:

a. Respirators.
b. Safety Harness.
c. Combustion Gas Indicators.
d. Air Compressors.
e. Air Purifiers.

7. Furnish at least three (3) letters of competency from contracts accomplished within the last five (5) years.

I hereby certify the foregoing statements are true and complete.

_____

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SECTION 15400

PLUMBING, GENERAL PURPOSE

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AIR CONDITIONING AND REFRIGERATION INSTITUTE (ARI)

ARI 700	(1995; Apx C) Specifications for Fluorocarbon and Other Refrigerants
ARI 1010	(1994) Self-Contained, Mechanically-Refrigerated Drinking-Water Coolers

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z124.5	(1997) Plastic Toilet (Water Closet) Seats
ANSI Z21.22	(1999; A 2001) Relief Valves for Hot Water Supply Systems

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 53/A 53M	(2002) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 74	(1996) Cast Iron Soil Pipe and Fittings
ASTM A 105/A 105M	(2001) Carbon Steel Forgings for Piping Applications
ASTM A 193/A 193M	(2001b) Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
ASTM A 515/A 515M	(2001) Pressure Vessel Plates, Carbon Steel, for Intermediate- and Higher-Temperature Service
ASTM A 516/A 516M	(2001) Pressure Vessel Plates, Carbon Steel, for Moderate- and Lower-Temperature Service
ASTM A 733	(2001) Welded and Seamless Carbon Steel and Austenitic Stainless Steel Pipe Nipples
ASTM B 32	(2000) Solder Metal

ASTM B 42	(1996) Seamless Copper Pipe, Standard Sizes
ASTM B 43	(1996) Seamless Red Brass Pipe, Standard Sizes
ASTM B 88	(2002) Seamless Copper Water Tube
ASTM B 306	(1996) Copper Drainage Tube (DWV)
ASTM B 370	(1998) Copper Sheet and Strip for Building Construction
ASTM B 584	(2000a) Copper Alloy Sand Castings for General Applications
ASTM B 641	(1993) Seamless and Welded Copper Distribution Tube (Type D)
ASTM B 813	(2000) Liquid and Paste Fluxes for Soldering Applications of Copper and Copper Alloy Tube
ASTM B 828	(2000) Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings
ASTM C 564	(1995a) Rubber Gaskets for Cast Iron Soil Pipe and Fittings
ASTM C 920	(2002) Elastomeric Joint Sealants
ASTM D 2822	(1991; R 1997el) Asphalt Roof Cement
ASTM D 3308	(2001) PTFE Resin Skived Tape
ASTM D 3311	(1994) Drain, Waste, and Vent (DWV) Plastic Fittings Patterns
ASTM E 1	(1995) ASTM Thermometers

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 34	(1997) Number Designation and Safety Classification of Refrigerants

ASME INTERNATIONAL (ASME)

ASME A112.6.1M	(1997) Supports for Off-the-Floor Plumbing Fixtures for Public Use
ASME A112.19.1M	(1994) Enameled Cast Iron Plumbing Fixtures
ASME A112.19.2M	(1995; Errata) Vitreous China Plumbing Fixtures
ASME A112.21.1M	(1991) Floor Drains

ASME A112.36.2M	(1991) Cleanouts
ASME B1.20.1	(1983; R 2001) Pipe Threads, General Purpose (Inch)
ASME B16.3	(1998) Malleable Iron Threaded Fittings
ASME B16.4	(1998) Gray Iron Threaded Fittings
ASME B16.5	(2003) Pipe Flanges and Flanged Fittings NPS 1/2 thru NPS 24
ASME B16.12	(1991) Cast Iron Threaded Drainage Fittings
ASME B16.15	(1985; R 1994) Cast Bronze Threaded Fittings Classes 125 and 250
ASME B16.18	(2001) Cast Copper Alloy Solder Joint Pressure Fittings
ASME B16.21	(1992) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B16.22	(2002) Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
ASME B16.23	(1992; Errata Jan 1994) Cast Copper Alloy Solder Joint Drainage Fittings - DWV
ASME B16.24	(2001) Cast Copper Alloy Pipe Flanges, Class 150, 300, 400, 600, 900, 1500, and 2500, and Flanged Fittings, Class 150 and 300
ASME B16.29	(1994) Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV
ASME B16.34	(1996) Valves - Flanged, Threaded, and Welding End
ASME B16.39	(1998) Malleable Iron Threaded Pipe Unions Classes 150, 250, and 300
ASME B31.1	(2001) Power Piping
ASME B31.5	(1992; B31.5a 1994) Refrigeration Piping
ASME B40.1	(1991) Gauges - Pressure Indicating Dial Type - Elastic Element
ASME BPV VIII Div 1	(1998) Boiler and Pressure Vessel Code; Section VIII, Pressure Vessels Division 1 - Basic Coverage
ASME BPV IX	(1998) Boiler and Pressure Vessel Code; Section IX, Welding and Brazing Qualifications
ASME CSD-1	(1995; CSD-1a; CSD-1b) Controls and Safety

Devices for Automatically Fired Boilers

AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)

ASSE 1002	(1986) Water Closet Flush Tank Ball Cocks
ASSE 1005	(1986) Water Heater Drain Valves - 3/4-Inch Iron Pipe Size

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA-01	(2000) Disinfecting Water Mains
AWWA B300	(1999) Hypochlorites
AWWA B301	(1999) Liquid Chlorine
AWWA C105/A21.5	(1993) Polyethylene Encasement for Ductile-Iron Pipe Systems
AWWA C203	(1997) Coal-Tar Protective Coatings and Lining for Steel Water Pipelines - Enamel and Tape - Hot-Applied
AWWA C606	(1997) Grooved and Shouldered Joints
AWWA M20	(1980) Water Chlorination Principles and Practices

AMERICAN WELDING SOCIETY (AWS)

AWS A5.8	(1992) Filler Metals for Brazing and Braze Welding
AWS B2.2	(1991) Brazing Procedure and Performance Qualification

CAST IRON SOIL PIPE INSTITUTE (CISPI)

CISPI HSN-85	(1985) Neoprene Rubber Gaskets for Hub and Spigot Cast Iron Soil Pipe and Fittings

COPPER DEVELOPMENT ASSOCIATION (CDA)

CDA-02	(1995) Copper Tube Handbook

HYDRAULIC INSTITUTE (HI)

HI 1.1-1.5	1994) Centrifugal Nomenclature

INTERNATIONAL CODE COUNCIL (ICC)

CABO A117.1	(1992; Errata Jun 1993) Accessible and Usable Buildings and Facilities

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-25	(1998) Standard Marking System for Valves,

	Fittings, Flanges and Unions
MSS SP-44	(1996) Steel PipeLine Flanges
MSS SP-58	(1993) Pipe Hangers and Supports - Materials, Design and Manufacture
MSS SP-67	(1995) Butterfly Valves
MSS SP-69	(1999) Pipe Hangers and Supports - Selection and Application
MSS SP-70	(1998) Cast Iron Gate Valves, Flanged and Threaded Ends
MSS SP-71	(1997) Gray Iron Swing Check Valves, Flanges and Threaded Ends
MSS SP-72	(1999) Ball Valves with Flanged or Butt-Welding Ends for General Service
MSS SP-73	(1991; R 1996) Brazing Joints for Copper and Copper Alloy Pressure Fittings
MSS SP-78	(1998) Cast Iron Plug Valves, Flanged and Threaded Ends
MSS SP-80	(1997) Bronze Gate, Globe, Angle and Check Valves
MSS SP-83	(1995) Class 3000 Steel Pipe Unions Socket-Welding and Threaded
MSS SP-85	(1994) Cast Iron Globe & Angle Valves, Flanged and Threaded Ends
MSS SP-110	(1996) Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends

NATIONAL ASSOCIATION OF PLUMBING-HEATING-COOLING CONTRACTORS (NAPHCC)

NAPHCC-01	(1996) National Standard Plumbing Code

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250	(1997) Enclosures for Electrical Equipment (1000 Volts Maximum)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 90A	(1999) Installation of Air Conditioning and Ventilating Systems

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

SAE J 1508	(1996) Hose Clamps

UNDERWRITERS LABORATORIES (UL)

UL 174 (1996; Rev thru Nov 1997) Household Electric Storage Tank Water Heaters

1.2 STANDARD PRODUCTS

Specified materials and equipment shall be standard products of a manufacturer regularly engaged in the manufacture of such products. Specified equipment shall essentially duplicate equipment that has performed satisfactorily at least two years prior to bid opening.

1.3 PERFORMANCE REQUIREMENTS

1.3.1 Welding

Piping shall be welded in accordance with qualified procedures using performance-qualified welders and welding operators. Procedures and welders shall be qualified in accordance with ASME BPV IX. Welding procedures qualified by others, and welders and welding operators qualified by another employer, may be accepted as permitted by ASME B31.1. The Contracting Officer shall be notified 24 hours in advance of tests, and the tests shall be performed at the work site if practicable. Welders or welding operators shall apply their assigned symbols near each weld they make as a permanent record.

1.3.2 Cathodic Protection and Pipe Joint Bonding

Cathodic protection and pipe joint bonding systems shall be in accordance with Section 13110 CATHODIC PROTECTION SYSTEM (SACRIFICIAL ANODE) .

1.4 ELECTRICAL WORK

Motors, motor controllers and motor efficiencies shall conform to the requirements of Section 16415 ELECTRICAL WORK, INTERIOR. Electrical motor-driven equipment specified herein shall be provided complete with motors. Equipment shall be rated at 60 Hz, single phase, ac unless otherwise indicated. Where a motor controller is not provided in a motor-control center on the electrical drawings, a motor controller shall be as indicated. Motor controllers shall be provided complete with properly sized thermal-overload protection in each ungrounded conductor, auxiliary contact, and other equipment, at the specified capacity, and including an allowable service factor.

1.5 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Plumbing System; G-AO.

Detail drawings consisting of illustrations, schedules, performance charts, instructions, brochures, diagrams, and other information to illustrate the requirements and operations of each system. Detail drawings for the

complete plumbing system including piping layouts and locations of connections; dimensions for roughing-in, foundation, and support points; schematic diagrams and wiring diagrams or connection and interconnection diagrams. Detail drawings shall indicate clearances required for maintenance and operation. Where piping and equipment are to be supported other than as indicated, details shall include loadings and proposed support methods. Mechanical drawing plans, elevations, views, and details, shall be drawn to scale.

Electrical Schematics; G-AO.

Complete electrical schematic lineless or full line interconnection and connection diagram for each piece of mechanical equipment having more than one automatic or manual electrical control device.

SD-05 Design Data

Welding; G-AO.

A copy of qualified procedures and a list of names and identification symbols of qualified welders and welding operators.

Vibration-Absorbing Features; G-AO.

Details of vibration-absorbing features, including arrangement, foundation plan, dimensions and specifications.

SD-06 Test Reports

Tests, Flushing and Disinfection ; G-AO.

Test reports in booklet form showing all field tests performed to adjust each component and all field tests performed to prove compliance with the specified performance criteria, completion and testing of the installed system. Each test report shall indicate the final position of controls.

Backflow Prevention Assembly Tests; G-AO.

Certification of proper operation shall be as accomplished in accordance with state regulations by an individual certified by the state to perform such tests. If no state requirement exists, the Contractor shall have the manufacturer's representative test the device, to ensure the unit is properly installed and performing as intended. The Contractor shall provide written documentation of the tests performed and signed by the individual performing the tests.

SD-07 Certificates

Materials and Equipment

Where materials or equipment are specified to comply with requirements of AGA, or ASME, proof of such compliance. The label or listing of the specified agency will be acceptable evidence. In lieu of the label or listing, a written certificate may be submitted from an approved, nationally recognized testing organization equipped to perform such services, stating that the items have been tested and conform to the requirements and testing methods of the specified agency. Where equipment is specified to conform to requirements of the ASME Boiler and Pressure Vessel Code, the design, fabrication, and installation shall conform to the

code.

Bolts; G-AO.

Written certification by the bolt manufacturer that the bolts furnished comply with the specified requirements. The certification shall include illustrations of product-required markings, the date of manufacture, and the number of each type of bolt to be furnished based on this certification.

SD-08 Manufacturer's Instructions

Plumbing System; G-AO.

Diagrams, instructions, and other sheets proposed for posting. Manufacturer's recommendations for the installation of bell and spigot and hubless joints for cast iron soil pipe.

SD-10 Operation and Maintenance Data

Plumbing System;

Six copies of the operation manual outlining the step-by-step procedures required for system startup, operation and shutdown. The manual shall include the manufacturer's name, model number, service manual, parts list, and brief description of all equipment and their basic operating features. Six copies of the maintenance manual listing routine maintenance procedures, possible breakdowns and repairs. The manual shall include piping and equipment layout and simplified wiring and control diagrams of the system as installed.

1.6 REGULATORY REQUIREMENTS

Plumbing work shall be in accordance with NAPHCC-01. State licensed plumbers shall install and/or test backflow preventors and cross connections.

1.7 PROJECT/SITE CONDITIONS

The Contractor shall become familiar with details of the work, verify dimensions in the field, and advise the Contracting Officer of any discrepancy before performing any work.

PART 2 PRODUCTS

2.1 MATERIALS

Materials for various services shall be in accordance with TABLES I and II. Pipe schedules shall be selected based on service requirements. Pipe fittings shall be compatible with the applicable pipe materials. Material or equipment containing lead shall not be used in any potable water system. Hubless cast-iron soil pipe shall not be installed . Plastic pipe shall not be installed.

2.1.1 Pipe Joint Materials

Grooved pipe and hubless cast-iron soil pipe shall not be used. Joints and gasket materials shall conform to the following:

a. Coupling for Cast-Iron Pipe: for hub and spigot type ASTM A 74,

AWWA C606.

b. Coupling for Steel Pipe: AWWA C606.

c. Flange Gaskets: Gaskets shall be made of non-asbestos material in accordance with ASME B16.21. Gaskets shall be flat, 1/16 inch thick, and contain Aramid fibers bonded with Styrene Butadiene Rubber (SBR) or Nitro Butadiene Rubber (NBR). Gaskets shall be the full face or self centering flat ring type. Gaskets used for hydrocarbon service shall be bonded with NBR.

d. Neoprene Gaskets for Hub and Cast-Iron Pipe and Fittings: CISPI HSN-85.

e. Brazing Material: Brazing material shall conform to AWS A5.8, BCuP-5.

f. Brazing Flux: Flux shall be in paste or liquid form appropriate for use with brazing material. Flux shall be as follows: lead-free; have a 100 percent flushable residue; contain slightly acidic reagents; contain potassium borides; and contain fluorides. Silver brazing materials shall be in accordance with AWS A5.8.

g. Solder Material: Solder metal shall conform to ASTM B 32 95-5 tin-antimony.

h. Solder Flux: Flux shall be liquid form, non-corrosive, and conform to ASTM B 813, Standard Test 1.

i. PTFE Tape: PTFE Tape, for use with Threaded Metal or Plastic Pipe, ASTM D 3308.

j. Rubber Gaskets for Cast-Iron Soil-Pipe and Fittings (hub and spigot type): ASTM C 564.

k. Flanged fittings including flanges, bolts, nuts, bolt patterns, etc., shall be in accordance with ASME B16.5 class 150 and shall have the manufacturer's trademark affixed in accordance with MSS SP-25. Flange material shall conform to ASTM A 105/A 105M. Blind flange material shall conform to ASTM A 516/A 516M cold service and ASTM A 515/A 515M for hot service. Bolts shall be high strength or intermediate strength with material conforming to ASTM A 193/A 193M.

2.1.2 Miscellaneous Materials

Miscellaneous materials shall conform to the following:

a. Copper, Sheet and Strip for Building Construction: ASTM B 370.

b. Asphalt Roof Cement: ASTM D 2822.

c. Hose Clamps: SAE J 1508.

d. Supports for Off-The-Floor Plumbing Fixtures: ASME A112.6.1M.

e. Metallic Cleanouts: ASME A112.36.2M.

f. Plumbing Fixture Setting Compound: A preformed flexible ring seal

molded from hydrocarbon wax material. The seal material shall be nonvolatile nonasphaltic and contain germicide and provide watertight, gastight, odorproof and verminproof properties.

g. Coal-Tar Protective Coatings and Linings for Steel Water Pipelines: AWWA C203.

h. Hypochlorites: AWWA B300.

i. Liquid Chlorine: AWWA B301.

j. Polyethylene Encasement for Ductile-Iron Piping: AWWA C105/A21.5.

k. Gauges - Pressure and Vacuum Indicating Dial Type - Elastic Element: ASME B40.1 and shall be a minimum 3-inch in diameter.

l. Thermometers: ASTM E 1.

2.1.3 Pipe Insulation Material

Insulation shall be as specified in Section 15080 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

2.2 PIPE HANGERS, INSERTS, AND SUPPORTS

Pipe hangers, inserts, and supports shall conform to MSS SP-58 and MSS SP-69.

2.3 VALVES

Valves shall be provided on supplies to equipment and fixtures. Valves 2-1/2 inches and smaller shall be bronze with threaded bodies for pipe and solder-type connections for tubing. Valves 3 inches and larger shall have flanged iron bodies and bronze trim. Pressure ratings shall be based upon the application. Grooved end valves may be provided if the manufacturer certifies that the valves meet the performance requirements of applicable MSS standard. Valves shall conform to the following standards:

Description	Standard
Butterfly Valves	MSS SP-67
Cast-Iron Gate Valves, Flanged and Threaded Ends	MSS SP-70
Cast-Iron Swing Check Valves, Flanged and Threaded Ends	MSS SP-71
Ball Valves with Flanged Butt-Welding Ends for General Service	MSS SP-72
Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends	MSS SP-110
Cast-Iron Plug Valves, Flanged and Threaded Ends	MSS SP-78
Bronze Gate, Globe, Angle, and Check Valves	MSS SP-80
Steel Valves, Socket Welding and Threaded Ends	ASME B16.34

Description	Standard
Cast-Iron Globe and Angle Valves, Flanged and Threaded Ends	MSS SP-85
Water Heater Drain Valves	ASSE 1005
Temperature and Pressure Relief Valves for Hot Water Supply Systems	ANSI Z21.22
Temperature and Pressure Relief Valves for Automatically Fired Hot Water Boilers	ASME CSD-1 Safety Code No., Part CW, Article 5

2.3.1 Wall Faucets

Wall faucets with vacuum-breaker backflow preventer shall be brass with 3/4 inch male inlet threads, hexagon shoulder, and 3/4 inch hose connection. Faucet handle shall be securely attached to stem.

2.3.2 Wall Hydrants

Wall hydrants with vacuum-breaker backflow preventer shall have a nickle-brass or nickel-bronze wall plate or flange with nozzle and detachable key handle. A brass or bronze operating rod shall be provided within a galvanized iron casing of sufficient length to extend through the wall so that the valve is inside the building, and the portion of the hydrant between the outlet and valve is self-draining. A brass or bronze valve with coupling and union elbow having metal-to-metal seat shall be provided. Valve rod and seat washer shall be removable through the face of the hydrant. The hydrant shall have 3/4 inch exposed hose thread on spout and 3/4 inch male pipe thread on inlet.

2.3.3 Relief Valves

Water heaters and hot water storage tanks shall have a combination pressure and temperature (P&T) relief valve. The pressure relief element of a P&T relief valve shall have adequate capacity to prevent excessive pressure buildup in the system when the system is operating at the maximum rate of heat input. The temperature element of a P&T relief valve shall have a relieving capacity which is at least equal to the total input of the heaters when operating at their maximum capacity. Relief valves shall be rated according to ANSI Z21.22. Relief valves for systems where the maximum rate of heat input is less than 200,000 Btuh shall have 3/4 inch minimum inlets, and 3/4 inch outlets. Relief valves for systems where the maximum rate of heat input is greater than 200,000 Btuh shall have 1 inch minimum inlets, and 1 inch outlets. The discharge pipe from the relief valve shall be the size of the valve outlet.

2.3.4 Emergency Shower/Eyewash Thermostatic Mixing Valves

Mixing valves, thermostatic type, shall be line size and shall be constructed with rough or finish bodies either with or without plating. Each valve shall be constructed to control the mixing of hot and cold water and to deliver water at a temperature of 60-85 degrees F, factory set at 60 degrees F,regardless of pressure or input temperature changes. The control element shall be of an approved type. The body shall be of heavy cast

bronze, and interior parts shall be brass, bronze, or copper. The valve shall be equipped with necessary stops, check valves, unions, and sediment strainers on the inlets. Mixing valves shall maintain water temperature within 5 degrees F of any setting. Valveshall have high temperature limit set at 95 degrees F to prevent scalding.

2.4 FIXTURES

Fixtures shall be water conservation type, in accordance with NAPHCC-01. Fixtures for use by the physically handicapped shall be in accordance with CABO A117.1. Vitreous china, nonabsorbent, hard-burned, and vitrified throughout the body shall be provided. Porcelain enameled ware shall have specially selected, clear white, acid-resisting enamel coating evenly applied on surfaces. No fixture will be accepted that shows cracks, crazes, blisters, thin spots, or other flaws. Fixtures shall be equipped with appurtenances such as traps, faucets, stop valves, and drain fittings. Each fixture and piece of equipment requiring connections to the drainage system, except grease interceptors, shall be equipped with a trap. Brass expansion or toggle bolts capped with acorn nuts shall be provided for supports, and polished chromium-plated pipe, valves, and fittings shall be provided where exposed to view. Fixtures with the supply discharge below the rim shall be equipped with backflow preventers. Internal parts of flush and/or flushometer valves, shower mixing valves, shower head face plates, pop-up stoppers of lavatory waste drains, and pop-up stoppers and overflow tees and shoes of bathtub waste drains may contain acetal resin, fluorocarbon, nylon, acrylonitrile-butadiene-styrene (ABS) or other plastic material, if the material has provided satisfactory service under actual commercial or industrial operating conditions for not less than 2 years. Plastic in contact with hot water shall be suitable for 180 degrees F water temperature. Plumbing fixtures shall be as indicated in paragraph PLUMBING FIXTURE SCHEDULE.

2.5 DRAINS

2.5.1 Floor Drains

Floor drains shall consist of a galvanized body, integral seepage pan, and adjustable perforated or slotted chromium-plated bronze, nickel-bronze, or nickel-brass strainer, consisting of grate and threaded collar. Floor drains shall be cast iron except where metallic waterproofing membrane is installed. Drains shall be of double drainage pattern for embedding in the floor construction. The seepage pan shall have weep holes or channels for drainage to the drainpipe. The strainer shall be adjustable to floor thickness. A clamping device for attaching flashing or waterproofing membrane to the seepage pan without damaging the flashing or waterproofing membrane shall be provided when required. Drains shall be provided with threaded or caulked connection. In lieu of a caulked joint between the drain outlet and waste pipe, a neoprene rubber gasket conforming to ASTM C 564 may be installed, provided that the drain is specifically designed for the rubber gasket compression type joint. Floor drains shall conform to ASME A112.21.1M.

2.6 TRAPS

Unless otherwise specified, traps shall be copper-alloy adjustable tube type with slip joint inlet and swivel. Traps shall be without a cleanout. Tubes shall be copper alloy with walls not less than 0.032 inch thick within commercial tolerances, except on the outside of bends where the thickness may be reduced slightly in manufacture by usual commercial

methods. Inlets shall have rubber washer and copper alloy nuts for slip joints above the discharge level. Swivel joints shall be below the discharge level and shall be of metal-to-metal or metal-to-plastic type as required for the application. Nuts shall have flats for wrench grip. Outlets shall have internal pipe thread, except that when required for the application, the outlets shall have sockets for solder-joint connections. The depth of the water seal shall be not less than 2 inches. The interior diameter shall be not more than 1/8 inch over or under the nominal size, and interior surfaces shall be reasonably smooth throughout. A copper alloy "P" trap assembly consisting of an adjustable "P" trap and threaded trap wall nipple with cast brass wall flange shall be provided for lavatories. The assembly shall be a standard manufactured unit and may have a rubber-gasketed swivel joint.

2.7 WATER HEATERS

Water heater types and capacities shall be as indicated. Each primary water heater shall have controls with an adjustable range that includes 90 to 140 degrees F. The thermal efficiencies and standby heat losses shall conform to TABLE III for each type of water heater specified. The only exception is that storage water heaters and hot water storage tanks having more than 500 gallons storage capacity need not meet the standard loss requirement if the tank surface area is not insulated to R-12.5 and if a standing light is not used. Plastic materials polyetherimide (PEI) and polyethersulfone (PES) are forbidden to be used for vent piping of combustion gases.

2.7.1 Automatic Storage Type

Heaters shall be complete with control system, and shall have ASME rated combination pressure and temperature relief valve.

2.10.1.3 Electric Type

Electric type water heaters shall conform to UL 174.

2.8 PUMPS

2.8.1 Circulating Pumps

Domestic hot water circulating pumps shall be electrically driven, single-stage, centrifugal, with mechanical seals, suitable for the intended service. Pump capacities, efficiencies, motor sizes, speeds, and impeller types shall be as shown. Pump and motor shall be supported by the piping on which it is installed. The shaft shall be one-piece, heat-treated, corrosion-resisting steel with impeller and smooth-surfaced housing of bronze. Motor shall be totally enclosed, fan-cooled and shall have sufficient horsepower for the service required. Pump shall conform to HI 1.1-1.5. Each pump motor shall be equipped with an across-the-line magnetic controller in a NEMA 250, Type 1 enclosure with "START-STOP" switch in cover. Pump motors smaller than Fractional horsepower pump motors shall have integral thermal overload protection in accordance with Section 16415 ELECTRICAL WORK, INTERIOR. Guards shall shield exposed moving parts.

2.9 COMPRESSED AIR SYSTEM

2.9.1 Air Compressors

Air compressor unit shall be a factory-packaged assembly, including single phase, 120 volt motor controls, switches, wiring, accessories, and motor controllers, in a NEMA 250, Type 1 enclosure. Tank-mounted air compressors shall be manufactured to comply with UL listing requirements. Air compressors shall have manufacturer's name and address, together with trade name, and catalog number on a nameplate securely attached to the equipment. Each compressor shall start and stop automatically at upper and lower pressure limits of the system . Guards shall shield exposed moving parts. Each compressor motor shall be provided with an across-the-line-type magnetic controller, complete with low-voltage release. An intake air filter and silencer shall be provided with each compressor. Means shall be provided for draining condensed moisture from the receiver by an automatic float type trap. Capacities of air compressors and receivers shall be as indicated.

2.9.2 Lubricated Compressors

Compressors shall be V-belt drive, capable of operating continuously against their designed discharge pressure, and shall operate at a speed not in excess of 1800 rpm. Compressors shall have the capacity and discharge pressure indicated. Compressors shall be assembled complete on a common subbase. The compressor main bearings shall be either roller or ball. The discharge passage of the high pressure air shall be piped to the air receiver with a copper pipe or tubing. A pressure gauge calibrated to 150 psi and equipped with a gauge cock and pulsation dampener shall be furnished for installation adjacent to pressure switches.

2.9.3 Air Receivers

Receivers shall be designed for 200 psi working pressure. Receivers shall be factory air tested to 1-1/2 times the working pressure. Receivers shall be equipped with safety relief valves and accessories, including pressure gauges and automatic and manual drains. The outside of air receivers may be galvanized or supplied with commercial enamel finish. Receivers shall be designed and constructed in accordance with ASME BPV VIII Div 1 and shall have the design working pressures specified herein. A display of the ASME seal on the receiver or a certified test report from an approved independent testing laboratory indicating conformance to the ASME Code shall be provided.

2.9.4 Intake Air Supply Filter

Dry type air filter shall be provided having a collection efficiency of 99 percent of particles larger than 10 microns. Filter body and media shall withstand a maximum 125 psi, capacity as indicated.

2.9.5 Pressure Regulators

The air system shall be provided with the necessary regulator valves to maintain the desired pressure for the installed equipment. Regulators shall be designed for a maximum inlet pressure of 125 psi and a maximum temperature of 200 degrees F. Regulators shall be single-seated, pilot-operated with valve plug, bronze body and trim or equal, and threaded connections. The regulator valve shall include a pressure gauge and shall be provided with an adjustment screw for adjusting the pressure

differential from 0 to 125 psi. Regulator shall be sized as indicated.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

Piping located in air plenums shall conform to NFPA 90A requirements. Piping located in shafts that constitute air ducts or that enclose air ducts shall be noncombustible in accordance with NFPA 90A. The plumbing system shall be installed complete with necessary fixtures, fittings, traps, valves, and accessories. Water and drainage piping shall be extended 5 feet outside the building, unless otherwise indicated. A gate valve and drain shall be installed on the water service line inside the building approximately 6 inches above the floor from point of entry. Piping shall be connected to the exterior service lines or capped or plugged if the exterior service is not in place. Sewer and water pipes shall be laid in separate trenches, except when otherwise shown. Exterior underground utilities shall be at least 12 inches below the average local frost depth or as indicated on the drawings. If trenches are closed or the pipes are otherwise covered before being connected to the service lines, the location of the end of each plumbing utility shall be marked with a stake or other acceptable means. Valves shall be installed with control no lower than the valve body.

3.1.1 Water Pipe, Fittings, and Connections

3.1.1.1 Utilities

The piping shall be extended to fixtures, outlets, and equipment. The hot-water and cold-water piping system shall be arranged and installed to permit draining. The supply line to each item of equipment or fixture, except faucets, flush valves, or other control valves which are supplied with integral stops, shall be equipped with a shutoff valve to enable isolation of the item for repair and maintenance without interfering with operation of other equipment or fixtures. Supply piping to fixtures, faucets, hydrants, shower heads, and flushing devices shall be anchored to prevent movement. Low points shall have valved drains.

3.1.1.2 Cutting and Repairing

The work shall be carefully laid out in advance, and unnecessary cutting of construction shall be avoided. Damage to building, piping, wiring, or equipment as a result of cutting shall be repaired by mechanics skilled in the trade involved.

3.1.1.3 Protection of Fixtures, Materials, and Equipment

Pipe openings shall be closed with caps or plugs during installation. Fixtures and equipment shall be tightly covered and protected against dirt, water, chemicals, and mechanical injury. Upon completion of the work, the fixtures, materials, and equipment shall be thoroughly cleaned, adjusted, and operated. Safety guards shall be provided for exposed rotating equipment.

3.1.1.4 Mains, Branches, and Runouts

Piping shall be installed as indicated. Pipe shall be accurately cut and worked into place without springing or forcing. Structural portions of the building shall not be weakened. Aboveground piping shall run parallel with

the lines of the building, unless otherwise indicated. Branch pipes from service lines may be taken from top, bottom, or side of main, using crossover fittings required by structural or installation conditions. Supply pipes, valves, and fittings shall be kept a sufficient distance from other work and other services to permit not less than 1/2 inch between finished covering on the different services. Bare and insulated water lines shall not bear directly against building structural elements so as to transmit sound to the structure or to prevent flexible movement of the lines. Water pipe shall not be buried in or under floors unless specifically indicated or approved. Changes in pipe sizes shall be made with reducing fittings. Use of bushings will not be permitted except for use in situations in which standard factory fabricated components are furnished to accommodate specific excepted installation practice. Change in direction shall be made with fittings, except that bending of pipe 4 inches and smaller will be permitted, provided a pipe bender is used and wide sweep bends are formed. The center-line radius of bends shall be not less than six diameters of the pipe. Bent pipe showing kinks, wrinkles, flattening, or other malformations will not be acceptable.

3.1.1.5 Pipe Drains

Pipe drains indicated shall consist of 3/4 inch hose bibb with renewable seat and gate valve ahead of hose bibb. At other low points, 3/4 inch brass plugs or caps shall be provided. Disconnection of the supply piping at the fixture is an acceptable drain.

3.1.1.6 Expansion and Contraction of Piping

Allowance shall be made throughout for expansion and contraction of water pipe. Each hot-water and hot-water circulation riser shall have expansion loops or other provisions such as offsets, changes in direction, etc., where indicated and/or required. Risers shall be securely anchored as required or where indicated to force expansion to loops. Branch connections from risers shall be made with ample swing or offset to avoid undue strain on fittings or short pipe lengths. Horizontal runs of pipe over 50 feet in length shall be anchored to the wall or the supporting construction about midway on the run to force expansion, evenly divided, toward the ends. Sufficient flexibility shall be provided on branch runouts from mains and risers to provide for expansion and contraction of piping. Flexibility shall be provided by installing one or more turns in the line so that piping will spring enough to allow for expansion without straining. If mechanical grooved pipe coupling systems are provided, the deviation from design requirements for expansion and contraction may be allowed pending approval of Contracting Officer.

3.1.2 Compressed Air Piping (Non-Oil Free)

Compressed air piping shall be installed as specified for water piping and suitable for 125 psig working pressure. Compressed air piping shall have supply lines and discharge terminals legibly and permanently marked at both ends with the name of the system and the direction of flow.

3.1.3 Joints

Installation of pipe and fittings shall be made in accordance with the manufacturer's recommendations. Mitering of joints for elbows and notching of straight runs of pipe for tees will not be permitted. Joints shall be made up with fittings of compatible material and made for the specific purpose intended.

3.1.3.1 Threaded

Threaded joints shall have American Standard taper pipe threads conforming to ASME B1.20.1. Only male pipe threads shall be coated with graphite or with an approved graphite compound, or with an inert filler and oil, or shall have a polytetrafluoroethylene tape applied.

3.1.3.2 Union and Flanged

Unions, flanges and mechanical couplings shall not be concealed in walls, ceilings, or partitions. Unions shall be used on pipe sizes 2-1/2 inches and smaller; flanges shall be used on pipe sizes 3 inches and larger.

3.1.3.3 Cast Iron Soil, Waste and Vent Pipe

Bell and spigot compression joints for soil, waste and vent piping shall be installed per the manufacturer's recommendations.

3.1.3.4 Copper Tube and Pipe

The tube or fittings shall not be annealed when making connections. Connections shall be made with a multiflame torch.

a. Brazed. Brazed joints shall be made in conformance with AWS B2.2, MSS SP-73, and CDA-02 with flux and are acceptable for line sizes. Copper to copper joints shall include the use of copper-phosphorus or copper-phosphorus-silver brazing metal without flux. Brazing of dissimilar metals (copper to bronze or brass) shall include the use of flux with either a copper-phosphorus, copper-phosphorus-silver or a silver brazing filler metal.

b. Soldered. Soldered joints shall be made with flux and are only acceptable for lines 2 inches and smaller. Soldered joints shall conform to ASME B31.5 and CDA-02.

c. Copper Tube Extracted Joint. An extracted mechanical joint may be made in copper tube. Joint shall be produced with an appropriate tool by drilling a pilot hole and drawing out the tube surface to form a collar having a minimum height of three times the thickness of the tube wall. To prevent the branch tube from being inserted beyond the depth of the extracted joint, dimpled depth stops shall be provided. Branch tube shall be notched for proper penetration into fitting to ensure a free flow joint. Extracted joints shall be brazed in accordance with NAPHCC-01 using B-Cup series filler metal in accordance with MSS SP-73. Soldered extracted joints will not be permitted.

3.1.3.5 Other Joint Methods

3.1.4 Dissimilar Pipe Materials

Connections between ferrous and non-ferrous copper pipe shall be made with dielectric unions or flange waterways. Connecting joints between plastic and metallic pipe shall be made with transition fitting for the specific purpose.

3.1.5 Corrosion Protection for Buried Pipe and Fittings

3.1.5.1 Cast Iron and Ductile Iron

Pressure pipe shall have protective coating, a cathodic protection system, and joint bonding. Pipe, fittings, and joints shall have a protective coating. The protective coating shall be completely encasing polyethylene tube or sheet in accordance with AWWA C105/A21.5. Joints and fittings shall be cleaned, coated with primer, and wrapped with tape. The pipe shall be cleaned, coated, and wrapped prior to pipe tightness testing. Joints and fittings shall be cleaned, coated, and wrapped after pipe tightness testing. Tape shall conform to AWWA C203 and shall be applied with a 50 percent overlap. Primer shall be as recommended by the tape manufacturer.

3.1.5.2 Steel

Steel pipe, joints, and fittings shall be cleaned, coated with primer, and wrapped with tape. Pipe shall be cleaned, coated, and wrapped prior to pipe tightness testing. Joints and fittings shall be cleaned, coated, and wrapped after pipe tightness testing. Tape shall conform to AWWA C203 and shall be applied with a 50 percent overlap. Primer shall be as recommended by the tape manufacturer.

3.1.6 Pipe Sleeves and Flashing

Pipe sleeves shall be furnished and set in their proper and permanent location.

3.1.6.1 Sleeve Requirements

Pipes passing through concrete or masonry walls or concrete floors or roofs shall be provided with pipe sleeves fitted into place at the time of construction. Sleeves are not required for cast-iron soil pipe passing through concrete slab on grade, except where penetrating a membrane waterproof floor. A modular mechanical type sealing assembly may be installed in lieu of a waterproofing clamping flange and caulking and sealing of annular space between pipe and sleeve. The seals shall consist of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and sleeve with corrosion-protected carbon steel bolts, nuts, and pressure plates. The links shall be loosely assembled with bolts to form a continuous rubber belt around the pipe with a pressure plate under each bolt head and each nut. After the seal assembly is properly positioned in the sleeve, tightening of the bolt shall cause the rubber sealing elements to expand and provide a watertight seal between the pipe and the sleeve. Each seal assembly shall be sized as recommended by the manufacturer to fit the pipe and sleeve involved. Sleeves shall not be installed in structural members, except where indicated or approved. Rectangular and square openings shall be as detailed. Each sleeve shall extend through its respective floor, or roof, and shall be cut flush with each surface, except for special circumstances. Pipe sleeves passing through floors in wet areas such as mechanical equipment rooms, lavatories, kitchens, and other plumbing fixture areas shall extend a minimum of 4 inches above the finished floor. Unless otherwise indicated, sleeves shall be of a size to provide a minimum of 1/4 inch clearance between bare pipe and inside of sleeve or between jacket over insulation and sleeves. Sleeves in bearing walls shall be steel pipe or cast-iron pipe. Sleeves for membrane waterproof floors shall be steel pipe, cast-iron pipe, or plastic pipe. Membrane clamping devices shall be

provided on pipe sleeves for waterproof floors. Sleeves in nonbearing walls or ceilings may be steel pipe, cast-iron pipe, galvanized sheet metal with lock-type longitudinal seam, or moisture-resistant fiber or plastic. Plastic sleeves shall not be used in nonbearing fire walls, roofs, or floor/ceilings. Except as otherwise specified, the annular space between pipe and sleeve, or between jacket over insulation and sleeve, shall be sealed as indicated with sealants conforming to ASTM C 920 and with a primer, backstop material and surface preparation as specified in Section 07900 JOINT SEALING. Pipes passing through sleeves in concrete floors over crawl spaces shall be sealed as specified above. The annular space between pipe and sleeve or between jacket over insulation and sleeve shall not be sealed for interior walls which are not designated as fire rated. Sleeves through below-grade walls in contact with earth shall be recessed 1/2 inch from wall surfaces on both sides. Annular space between pipe and sleeve shall be filled with backing material and sealants in the joint between the pipe and wall as specified above. Sealant selected for the earth side of the wall shall be compatible with dampproofing/waterproofing materials that are to be applied over the joint sealant.

3.1.6.2 Flashing Requirements

Pipes passing through roof or floor waterproofing membrane shall be installed through a 16 ounce copper flashing, each within an integral skirt or flange. Flashing shall be suitably formed, and the skirt or flange shall extend not less than 8 inches from the pipe and shall be set over the roof or floor membrane in a solid coating of bituminous cement. The flashing shall extend up the pipe a minimum of 10 inches. For cleanouts, the flashing shall be turned down into the hub and caulked after placing the ferrule. Pipes passing through pitched roofs shall be flashed, using lead or copper flashing, with an adjustable integral flange of adequate size to extend not less than 8 inches from the pipe in all directions and lapped into the roofing to provide a watertight seal. The annular space between the flashing and the bare pipe or between the flashing and the metal-jacket-covered insulation shall be sealed as indicated. Flashing for dry vents shall be turned down into the pipe to form a waterproof joint. Pipes, up to and including 10 inches in diameter, passing through roof or floor waterproofing membrane may be installed through a cast-iron sleeve with caulking recess, anchor lugs, flashing-clamp device, and pressure ring with brass bolts. Flashing shield shall be fitted into the sleeve clamping device. Pipes passing through wall waterproofing membrane shall be sleeved as described above. A waterproofing clamping flange shall be installed.

3.1.6.3 Waterproofing

Waterproofing at floor-mounted water closets shall be accomplished by forming a flashing guard from soft-tempered sheet copper. The center of the sheet shall be perforated and turned down approximately 1-1/2 inches to fit between the outside diameter of the drainpipe and the inside diameter of the cast-iron or steel pipe sleeve. The turned-down portion of the flashing guard shall be embedded in sealant to a depth of approximately 1-1/2 inches; then the sealant shall be finished off flush to floor level between the flashing guard and drainpipe. The flashing guard of sheet copper shall extend not less than 8 inches from the drainpipe and shall be lapped between the floor membrane in a solid coating of bituminous cement. If cast-iron water closet floor flanges are used, the space between the pipe sleeve and drainpipe shall be sealed with sealant and the flashing guard shall be upturned approximately 1-1/2 inches to fit the outside diameter of the drainpipe and the inside diameter of the water closet floor

flange. The upturned portion of the sheet fitted into the floor flange shall be sealed.

3.1.6.4 Optional Counterflashing

Instead of turning the flashing down into a dry vent pipe, or caulking and sealing the annular space between the pipe and flashing or metal-jacket-covered insulation and flashing, counterflashing may be accomplished by utilizing the following:

a. A standard roof coupling for threaded pipe up to 6 inches in diameter.

b. A tack-welded or banded-metal rain shield around the pipe.

3.1.6.5 Pipe Penetrations of Slab on Grade Floors

Where pipes, fixture drains, floor drains, cleanouts or similar items penetrate slab on grade floors, except at penetrations of floors with waterproofing membrane as specified in paragraphs Flashing Requirements and Waterproofing, a groove 1/4 to 1/2 inch wide by 1/4 to 3/8 inch deep shall be formed around the pipe, fitting or drain. The groove shall be filled with a sealant as specified in Section 07900 JOINT SEALING.

3.1.7 Fire Seal

Where pipes pass through fire walls, fire-partitions, fire-rated pipe chase walls or floors above grade, a fire seal shall be provided as specified in Section 07840 FIRESTOPPING.

3.1.8 Supports

3.1.8.1 General

Hangers used to support piping 2 inches and larger shall be fabricated to permit adequate adjustment after erection while still supporting the load. Pipe guides and anchors shall be installed to keep pipes in accurate alignment, to direct the expansion movement, and to prevent buckling, swaying, and undue strain. Piping subjected to vertical movement when operating temperatures exceed ambient temperatures shall be supported by variable spring hangers and supports or by constant support hangers. In the support of multiple pipe runs on a common base member, a clip or clamp shall be used where each pipe crosses the base support member. Spacing of the base support members shall not exceed the hanger and support spacing required for an individual pipe in the multiple pipe run. Threaded sections of rods shall not be formed or bent.

3.1.8.2 Pipe Supports and Structural Bracing, Seismic Requirements

Piping and attached valves shall be supported and braced to resist seismic loads as specified Section 15070 SEISMIC PROTECTION FOR MECHANICAL EQUIPMENT . Structural steel required for reinforcement to properly support piping, headers, and equipment, but not shown, shall be provided. Material used for supports shall be as specified in Section 05120 STRUCTURAL STEEL.

3.1.8.3 Pipe Hangers, Inserts, and Supports

Installation of pipe hangers, inserts and supports shall conform to MSS

SP-58 and MSS SP-69, except as modified herein.

a. Types 5, 12, and 26 shall not be used.

b. Type 3 shall not be used on insulated pipe.

c. Type 18 inserts shall be secured to concrete forms before concrete is placed. Continuous inserts which allow more adjustment may be used if they otherwise meet the requirements for type 18 inserts.

d. Type 19 and 23 C-clamps shall be torqued per MSS SP-69 and shall have both locknuts and retaining devices furnished by the manufacturer. Field-fabricated C-clamp bodies or retaining devices are not acceptable.

e. Type 20 attachments used on angles and channels shall be furnished with an added malleable-iron heel plate or adapter.

f. Type 24 may be used only on trapeze hanger systems or on fabricated frames.

g. Type 39 saddles shall be used on insulated pipe 4 inches and larger when the temperature of the medium is 60 degrees F or higher. Type 39 saddles shall be welded to the pipe.

h. Type 40 shields shall:

(1) Be used on insulated pipe less than 4 inches.

(2) Be used on insulated pipe 4 inches and larger when the temperature of the medium is 60 degrees F or less.

(3) Have a high density insert for pipe 2 inches and larger and for smaller pipe sizes when the insulation is suspected of being visibly compressed, or distorted at or near the shield/insulation interface. High density inserts shall have a density of 8 pcf or greater.

i. Horizontal pipe supports shall be spaced as specified in MSS SP-69 and a support shall be installed not over 1 foot from the pipe fitting joint at each change in direction of the piping. Pipe supports shall be spaced not over 5 feet apart at valves. Operating temperatures in determining hanger spacing for PVC or CPVC pipe shall be 120 degrees F for PVC and 180 degrees F for CPVC. Horizontal pipe runs shall include allowances for expansion and contraction.

j. Vertical pipe shall be supported at each floor, except at slab-on-grade, at intervals of not more than 15 feet nor more than 8 feet from end of risers, and at vent terminations. Vertical pipe risers shall include allowances for expansion and contraction.

k. Type 40 shields used on insulated pipe shall have high density inserts with a density of 8 pcf or greater.

l. Type 35 guides using steel, reinforced polytetrafluoroethylene (PTFE) or graphite slides shall be provided to allow longitudinal pipe movement. Slide materials shall be suitable for the system

operating temperatures, atmospheric conditions, and bearing loads encountered. Lateral restraints shall be provided as needed. Where steel slides do not require provisions for lateral restraint the following may be used:

(1) On pipe 4 inches and larger when the temperature of the medium is 60 degrees F or higher, a Type 39 saddle, welded to the pipe, may freely rest on a steel plate.

(2) On pipe less than 4 inches a Type 40 shield, attached to the pipe or insulation, may freely rest on a steel plate.

(3) On pipe 4 inches and larger carrying medium less that 60 degrees F a Type 40 shield, attached to the pipe or insulation, may freely rest on a steel plate.

m. Pipe hangers on horizontal insulated pipe shall be the size of the outside diameter of the insulation. The insulation shall be continuous through the hanger on all pipe sizes and applications.

n. Where there are high system temperatures and welding to piping is not desirable, the type 35 guide shall include a pipe cradle, welded to the guide structure and strapped securely to the pipe. The pipe shall be separated from the slide material by at least 4 inches or by an amount adequate for the insulation, whichever is greater.

o. Hangers and supports for plastic pipe shall not compress, distort, cut or abrade the piping, and shall allow free movement of pipe except where otherwise required in the control of expansion/contraction.

3.1.9 Welded Installation

Plumbing pipe weldments shall be as indicated. Changes in direction of piping shall be made with welding fittings only; mitering or notching pipe to form elbows and tees or other similar type construction will not be permitted. Branch connection may be made with either welding tees or forged branch outlet fittings. Branch outlet fittings shall be forged, flared for improvement of flow where attached to the run, and reinforced against external strains. Beveling, alignment, heat treatment, and inspection of weld shall conform to ASME B31.1. Weld defects shall be removed and repairs made to the weld, or the weld joints shall be entirely removed and rewelded. After filler metal has been removed from its original package, it shall be protected or stored so that its characteristics or welding properties are not affected. Electrodes that have been wetted or that have lost any of their coating shall not be used.

3.1.10 Pipe Cleanouts

Pipe cleanouts shall be the same size as the pipe except that cleanout plugs larger than 4 inches will not be required. A cleanout installed in connection with cast-iron soil pipe shall consist of a long-sweep 1/4 bend or one or two 1/8 bends extended to the place shown. An extra-heavy cast-brass or cast-iron ferrule with countersunk cast-brass head screw plug shall be caulked into the hub of the fitting and shall be flush with the floor. Cleanouts in connection with other pipe, where indicated, shall be T-pattern, 90-degree branch drainage fittings with cast-brass screw plugs, except plastic plugs shall be installed in plastic pipe. Plugs shall be

the same size as the pipe up to and including 4 inches. Cleanout tee branches with screw plug shall be installed at the foot of soil and waste stacks, at the foot of interior downspouts, on each connection to building storm drain where interior downspouts are indicated, and on each building drain outside the building. Cleanout tee branches may be omitted on stacks in single story buildings with slab-on-grade construction or where less than 18 inches of crawl space is provided under the floor. Cleanouts on pipe concealed in partitions shall be provided with chromium plated bronze, nickel bronze, nickel brass or stainless steel flush type access cover plates. Round access covers shall be provided and secured to plugs with securing screw. Square access covers may be provided with matching frames, anchoring lugs and cover screws. Cleanouts in finished walls shall have access covers and frames installed flush with the finished wall. Cleanouts installed in finished floors subject to foot traffic shall be provided with a chrome-plated cast brass, nickel brass, or nickel bronze cover secured to the plug or cover frame and set flush with the finished floor. Heads of fastening screws shall not project above the cover surface. Where cleanouts are provided with adjustable heads, the heads shall be cast iron .

3.2 WATER HEATERS AND HOT WATER STORAGE TANKS

3.2.1 Relief Valves

No valves shall be installed between a relief valve and its water heater or storage tank. The P&T relief valve shall be installed where the valve actuator comes in contact with the hottest water in the heater. Whenever possible, the relief valve shall be installed directly in a tapping in the tank or heater; otherwise, the P&T valve shall be installed in the hot-water outlet piping. A vacuum relief valve shall be provided on the cold water supply line to the hot-water storage tank or water heater and mounted above and within 6 inches above the top of the tank or water heater.

3.2.2 Heat Traps

Piping to and from each water heater and hot water storage tank shall be routed horizontally and downward a minimum of 2 feet before turning in an upward direction.

3.2.3 Connections to Water Heaters

Connections of metallic pipe to water heaters shall be made with dielectric unions or flanges.

3.3 FIXTURES AND FIXTURE TRIMMINGS

Angle stops, straight stops, stops integral with the faucets, or concealed type of lock-shield, and loose-key pattern stops for supplies with threaded, sweat or solvent weld inlets shall be furnished and installed with fixtures. Where connections between copper tubing and faucets are made by rubber compression fittings, a beading tool shall be used to mechanically deform the tubing above the compression fitting. Exposed traps and supply pipes for fixtures and equipment shall be connected to the rough piping systems at the wall, unless otherwise specified under the item. Floor and wall escutcheons shall be as specified. Drain lines and hot water lines of fixtures for handicapped personnel shall be insulated and do not require polished chrome finish. Plumbing fixtures and accessories shall be installed within the space shown.

3.3.1 Fixture Connections

Where space limitations prohibit standard fittings in conjunction with the cast-iron floor flange, special short-radius fittings shall be provided. Connections between earthenware fixtures and flanges on soil pipe shall be made gastight and watertight with a closet-setting compound or neoprene gasket and seal. Use of natural rubber gaskets or putty will not be permitted. Fixtures with outlet flanges shall be set the proper distance from floor or wall to make a first-class joint with the closet-setting compound or gasket and fixture used.

3.3.2 Height of Fixture Rims Above Floor

Lavatories shall be mounted with rim 31 inches above finished floor. Wall-hung drinking fountains and water coolers shall be installed with rim 42 inches above floor. Wall-hung service sinks shall be mounted with rim 28 inches above the floor. Installation of fixtures for use by the physically handicapped shall be in accordance with CABO A117.1.

3.3.3 Fixture Supports

Fixture supports for off-the-floor lavatories, and other fixtures of similar size, design, and use, shall be of the chair-carrier type. The carrier shall provide the necessary means of mounting the fixture, with a foot or feet to anchor the assembly to the floor slab. Adjustability shall be provided to locate the fixture at the desired height and in proper relation to the wall. Support plates, in lieu of chair carrier, shall be fastened to the wall structure only where it is not possible to anchor a floor-mounted chair carrier to the floor slab.

3.3.3.1 Support for Steel Stud Frame Partitions

Chair carrier shall be used. The anchor feet and tubular uprights shall be of the heavy duty design; and feet (bases) shall be steel and welded to a square or rectangular steel tube upright. Wall plates, in lieu of floor-anchored chair carriers, shall be used only if adjoining steel partition studs are suitably reinforced to support a wall plate bolted to these studs.

3.3.4 Backflow Prevention Devices

Plumbing fixtures, equipment, and pipe connections shall not cross connect or interconnect between a potable water supply and any source of nonpotable water. Backflow preventers shall be installed where indicated and in accordance with NAPHCC-01 at all other locations necessary to preclude a cross-connect or interconnect between a potable water supply and any nonpotable substance. In addition backflow preventers shall be installed at all locations where the potable water outlet is below the flood level of the equipment, or where the potable water outlet will be located below the level of the nonpotable substance. Backflow preventers shall be located so that no part of the device will be submerged. Backflow preventers shall be of sufficient size to allow unrestricted flow of water to the equipment, and preclude the backflow of any nonpotable substance into the potable water system. Access shall be provided for maintenance and testing. Each device shall be a standard commercial unit installed by a State licensed plumber..

3.3.5 Access Panels

Access panels shall be provided for concealed valves and controls, or any item requiring inspection or maintenance. Access panels shall be of sufficient size and located so that the concealed items may be serviced, maintained, or replaced. Access panels shall be as specified in Section 05500 MISCELLANEOUS METAL.

3.3.6 Sight Drains

Sight drains shall be installed so that the indirect waste will terminate 2 inches above the flood rim of the funnel to provide an acceptable air gap.

3.3.7 Traps

Each trap shall be placed as near the fixture as possible, and no fixture shall be double-trapped. Traps installed on cast-iron soil pipe shall be cast iron. Traps installed on steel pipe or copper tubing shall be recess-drainage pattern, or brass-tube type. Traps installed on plastic pipe may be plastic conforming to ASTM D 3311. Traps for acid-resisting waste shall be of the same material as the pipe.

3.4 IDENTIFICATION SYSTEMS

3.4.1 Identification Tags

Identification tags made of brass, engraved laminated plastic, or engraved anodized aluminum, indicating service and valve number shall be installed on valves, except those valves installed on supplies at plumbing fixtures. Tags shall be 1-3/8 inch minimum diameter, and marking shall be stamped or engraved. Indentations shall be black, for reading clarity. Tags shall be attached to valves with No. 12 AWG, copper wire, chrome-plated beaded chain, or plastic straps designed for that purpose.

3.4.2 Color Coding

Color coding for piping identification shall be as specified in Section 09900 PAINTS AND COATINGS.

3.5 ESCUTCHEONS

Escutcheons shall be provided at finished surfaces where bare or insulated piping, exposed to view, passes through floors, walls, or ceilings, except in boiler, utility, or equipment rooms. Escutcheons shall be fastened securely to pipe or pipe covering and shall be satin-finish, corrosion-resisting steel, polished chromium-plated zinc alloy, or polished chromium-plated copper alloy. Escutcheons shall be either one-piece or split-pattern, held in place by internal spring tension or setscrew.

3.6 PAINTING

Painting of pipes, hangers, supports, and other iron work, either in concealed spaces or exposed spaces, is specified in Section 09900 PAINTS AND COATINGS.

3.7 TESTS, FLUSHING AND DISINFECTION

3.7.1 Plumbing System

The following tests shall be performed on the plumbing system in accordance with NAPHCC-01.

a. Drainage and Vent Systems Tests.

b. Building Sewers Tests.

c. Water Supply Systems Tests.

3.7.1.1 Test of Backflow Prevention Assemblies

Backflow prevention assembly shall be tested using gauges specifically designed for the testing of backflow prevention assemblies. Gauges shall be tested annually for accuracy in accordance with the University of Southern California's Foundation of Cross Connection Control and Hydraulic Research or the American Water Works Association Manual of Cross Connection (Manual M-14). Report form for each assembly shall include, as a minimum, the following:

Data on Device	Data on Testing Firm
Type of Assembly	Name
Manufacturer	Address
Model Number	Certified Tester
Serial Number	Certified Tester No.
Size	Date of Test
Location	
Test Pressure Readings	Serial Number and Test Data of Gauges

If the unit fails to meet specified requirements, the unit shall be repaired and retested.

3.7.1.2 Compressed Air Piping (Nonoil-Free)

Piping systems shall be filled with oil-free dry air or gaseous nitrogen to 150 psig and hold this pressure for 2 hours with no drop in pressure.

3.7.2 Defective Work

If inspection or test shows defects, such defective work or material shall be replaced or repaired as necessary and inspection and tests shall be repeated. Repairs to piping shall be made with new materials. Caulking of screwed joints or holes will not be acceptable.

3.7.3 System Flushing

Before tests, potable water piping shall be flushed. In general, sufficient water shall be used to produce a minimum water velocity of 2.5 feet per second through piping being flushed. Flushing shall be continued until entrained dirt and other foreign materials have been removed and until discharge water shows no discoloration. System shall be drained at low points. Strainer screens shall be removed, cleaned, and replaced in line. After flushing and cleaning, systems shall be prepared for service by immediately filling water piping with clean, fresh potable water. Any stoppage, discoloration, or other damage to the finish, furnishings, or

parts of the building due to the Contractor's failure to properly clean the piping system shall be repaired by the Contractor. When the system flushing is complete, the hot-water system shall be adjusted for uniform circulation. Flushing devices and automatic control systems shall be adjusted for proper operation.

3.7.4 Operational Test

Upon completion of and prior to acceptance of the installation, the Contractor shall subject the plumbing system to operating tests to demonstrate satisfactory functional and operational efficiency. Such operating tests shall cover a period of not less than 8 hours for each system and shall include the following information in a report with conclusion as to the adequacy of the system:

a. Time, date, and duration of test.

b. Water pressures at the most remote and the highest fixtures.

c. Operation of each fixture and fixture trim.

d. Operation of each valve, hydrant, and faucet.

e. Pump suction and discharge pressures.

f. Temperature of each domestic hot-water supply.

g. Operation of each floor and roof drain by flooding with water.

h. Operation of each vacuum breaker and backflow preventer.

i. Complete operation of each water pressure booster system, including pump start pressure and stop pressure.

j. Compressed air readings at each compressor and at each outlet. Each indicating instrument shall be read at 1/2 hour intervals. The report of the test shall be submitted in quadruplicate. The Contractor shall furnish instruments, equipment, and personnel required for the tests; the Government will furnish the necessary water and electricity.

3.7.5 Disinfection

After operational tests are complete, the entire domestic hot- and cold-water distribution system shall be disinfected. System shall be flushed as specified, before introducing chlorinating material. The chlorinating material shall be hypochlorites or liquid chlorine. Water chlorination procedure shall be in accordance with AWWA M20. The chlorinating material shall be fed into the water piping system at a constant rate at a concentration of at least 50 parts per million (ppm). A properly adjusted hypochlorite solution injected into the main with a hypochlorinator, or liquid chlorine injected into the main through a solution-feed chlorinator and booster pump, shall be used. The chlorine residual shall be checked at intervals to ensure that the proper level is maintained. Chlorine application shall continue until the entire main is filled. The water shall remain in the system for a minimum of 24 hours. Each valve in the system being disinfected shall be opened and closed several times during the contact period to ensure its proper disinfection. Following the 24-hour period, no less than 25 ppm chlorine residual shall

remain in the system. Water tanks shall be disinfected by the addition of chlorine directly to the filling water. Following a 6 hour period, no less than 50 ppm chlorine residual shall remain in the tank. The system including the tanks shall then be flushed with clean water until the residual chlorine is reduced to less than one part per million. During the flushing period each valve and faucet shall be opened and closed several times. From several points in the system the Contracting Officer will take samples of water in proper disinfection containers for bacterial examination. The samples of water shall be tested for total coliform organisms (coliform bacteria, fecal coliform, streptococcal, and other bacteria) in accordance with AWWA-01. The testing method used shall be either the multiple-tube fermentation technique or the membrane-filter technique. The sterilizing shall be repeated until tests indicate the absence of coliform organisms (zero mean coliform density per 100 milliliters) in the samples for at least 2 full days. The system will not be accepted until satisfactory bacteriological results have been obtained.

3.8 PLUMBING FIXTURE SCHEDULE

P-1 WATER CLOSET:

Siphon-jet, elongated bowl, top supply spud, ASME A112.19.2M, floor mounted. Floor flange shall be copper alloy, cast iron, or plastic.

Gasket shall be wax type.

Seat - ANSI Z124.5, Type A, white plastic, elongated, open front.

Flush Tank - An adequate quantity of water shall be provided to flush and clean the fixture served. The water supply to flush tanks equipped for manual flushing shall be controlled by a float valve or other automatic device designed to refill the tank after each discharge, and to completely shut off the water flow to the tank when the tank is filled to operational capacity. Water closets having their flush valve seat located below the flood level rim of the closet bowl shall have a ballcock installed within a sheath or in a separate and isolated compartment of the tank, both to have visible discharge onto the floor in case of failure. Provision shall be made to automatically supply water to the fixture so as to refill the trap seal after each flushing. The water supply to flush tanks equipped for automatic flushing shall be controlled by a suitable timing device. Ballcocks shall meet ASSE 1002.

P-5 LAVATORY:

Manufacturer's standard sink depth, enameled cast iron ASME A112.19.1M , countertop, rectangular.

Faucet - Faucets shall be center set combination type. Faucets shall have metal replaceable cartridge control unit or metal cartridge units with diaphragm which can be replaced without special tools. Valves and handles shall be copper alloy. Connection between valve and spout for center-set faucet shall be of rigid metal tubing. Flow shall be limited to 0.25 gallon per cycle at a flowing water pressure of 80 psi if a metering device or fitting is used that limits the period of water discharge such as a foot switch or fixture occupancy sensor. If a metering device is not used, the flow shall be limited to 2.5 gpm at a flowing pressure of 80 psi.

Handles - Lever type. Cast, formed, or drop forged copper alloy.

Drain - Strainer shall be copper alloy or stainless steel . See paragraph FIXTURES for optional plastic accessories.

Drain - Strainer shall be copper alloy or stainless steel.

P-13 Emergency Showers: Head for Emergency and Emergency Eye and Face Wash. Shower control shall be 1 inch or 1-1/2 inch stay-open type control valve. Unit shall be corrosion-resisting steel and shall be pedestal mounted.

P-15 WATER COOLER DRINKING FOUNTAINS:

Water cooler drinking fountains shall: be self contained, conform to ARI 1010, use one of the fluorocarbon gases conforming to ARI 700 and ASHRAE 34 which has an Ozone Depletion Potential of less than or equal to 0.05, have a capacity to deliver 8 gph of water at 50 degrees F with an inlet water temperature of 80 degrees F while residing in a room environment of 90 degrees F, and have self-closing valves. Self-closing valves shall have automatic stream regulators, have a flow control capability, have a push button actuation or have a cross-shaped index metal turn handle without a hood. Exposed surfaces of stainless steel shall have No. 4 general polish finish. Spouts shall provide a flow of water at least 4 inches high so as to allow the insertion of a cup or glass under the flow of water.

Interior Free Standing - Free standing units shall be 40 to 41-1/2 inches high, 12 to 18 inches wide, and 12 to 14 inches deep. The bowl shall be made of corrosion resisting steel and be for interior installation.

3.9 POSTED INSTRUCTIONS

Framed instructions under glass or in laminated plastic, including wiring and control diagrams showing the complete layout of the entire system, shall be posted where directed. Condensed operating instructions explaining preventive maintenance procedures, methods of checking the system for normal safe operation, and procedures for safely starting and stopping the system shall be prepared in typed form, framed as specified above for the wiring and control diagrams and posted beside the diagrams. The framed instructions shall be posted before acceptance testing of the systems.

3.10 TABLES

TABLE I
PIPE AND FITTING MATERIALS FOR
DRAINAGE, WASTE, AND VENT PIPING SYSTEMS

		SERVICE					
Item #	Pipe and Fitting Materials	A	B	C	D	E	F
1	Cast iron soil pipe and fittings, hub and spigot, ASTM A 74 with compression gaskets	X	X	X	X	X	
3	Cast iron drainage fittings, threaded, ASME B16.12 for use with Item 10	X		X	X		
4	Cast iron screwed fittings (threaded) ASME B16.4 for use with Item 10				X	X	
9	Malleable-iron threaded fittings, galvanized ASME B16.3 for use with Item 10				X	X	
10	Steel pipe, seamless galvanized, ASTM A 53/A 53M, Type S, Grade B	X			X	X	
11	Seamless red brass pipe, ASTM B 43		X	X			
12	Bronzed flanged fittings, ASME B16.24 for use with Items 11 and 14				X	X	
13	Cast copper alloy solder joint pressure fittings, ASME B16.18 for use with Item 14				X	X	
14	Seamless copper pipe, ASTM B 42				X		
15	Cast bronze threaded fittings, ASME B16.15				X	X	
16	Copper drainage tube, (DWV), ASTM B 306	X*	X	X*	X	X	
17	Wrought copper and wrought alloy solder-joint drainage fittings. ASME B16.29	X	X	X	X	X	
18	Cast copper alloy solder joint drainage fittings, DWV, ASME B16.23	X	X	X	X	X	

SERVICE:

TABLE I
PIPE AND FITTING MATERIALS FOR
DRAINAGE, WASTE, AND VENT PIPING SYSTEMS

		SERVICE					
Item #	Pipe and Fitting Materials	A	B	C	D	E	F

A - Underground Building Soil, Waste and Storm Drain
B - Aboveground Soil, Waste, Drain In Buildings
C - Underground Vent
D - Aboveground Vent
E - Interior Rainwater Conductors Aboveground
F - Corrosive Waste And Vent Above And Belowground
* - Hard Temper

TABLE II
PIPE AND FITTING MATERIALS FOR PRESSURE PIPING SYSTEMS

		SERVICE			
Item No.	Pipe and Fitting Materials	A	B	C	D
1	Malleable-iron threaded fittings, a. Galvanized, ASME B16.3 for use with Item 4a	X	X	X	X
	b. Same as "a" but not galvanized for use with Item 4b			X	
4	Steel pipe:	X	X	X	X
	b. Seamless, black, ASTM A 53/A 53M, Type S, Grade B			X	
5	Seamless red brass pipe, ASTM B 43	X	X		X
6	Bronze flanged fittings, ASME B16.24 for use with Items 5 and 7	X	X		X
7	Seamless copper pipe, ASTM B 42	X	X		X
8	Seamless copper water tube, ASTM B 88	X**	X**	X**	X***
9	Seamless and welded copper distribution tube (Type D) ASTM B 641	X**	X**	X**	X****
10	Cast bronze threaded fittings, ASME B16.15 for use with Items 5 and 7	X	X		X
11	Wrought copper and bronze solder-joint pressure fittings, ASME B16.22 for use with Items 5 and 7	X	X	X	X
12	Cast copper alloy solder-joint pressure fittings, ASME B16.18 for use with Items 8 and 9	X	X	X	X
13	Bronze and sand castings grooved joint pressure fittings for non-ferrous pipe ASTM B 584, for use with Item 2	X	X	X	
33	Steel pipeline flanges, MSS SP-44			X	X

TABLE II
PIPE AND FITTING MATERIALS FOR PRESSURE PIPING SYSTEMS

		SERVICE			
Item No.	Pipe and Fitting Materials	A	B	C	D
34	Fittings: brass or bronze; ASME B16.15, and ASME B16.18 ASTM B 828	X	X		
35	Carbon steel pipe unions, socket-welding and threaded, MSS SP-83	X	X	X	
36	Malleable-iron threaded pipe unions ASME B16.39	X	X		
37	Nipples, pipe threaded ASTM A 733	X	X	X	

A - Cold Water Aboveground
B - Hot Water 180 degrees F Maximum Aboveground
C - Compressed Air Lubricated
D - Cold Water Service Belowground
Indicated types are minimum wall thicknesses.
** - Type L - Hard
*** - Type K - Hard temper with brazed joints only or type K-soft temper without joints in or under floors
**** - In or under slab floors only brazed joints

-- End of Section --

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DIVISION 15 - MECHANICAL

SECTION 15556

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SECTION 15556

FORCED HOT WATER HEATING SYSTEMS USING WATER AND STEAM HEAT EXCHANGERS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designations only.

AMERICAN WELDING SOCIETY (AWS)

AWS A5.8	(1992) Filler Metals for Brazing and Braze Welding

ASME INTERNATIONAL (ASME)

ASME B1.20.1	(1983; R 2001) Pipe Threads, General Purpose (Inch)
ASME B16.1	(1998) Cast Iron Pipe Flanges and Flanged Fittings Classes 25, 125, and 250
ASME B16.3	(1998) Malleable Iron Threaded Fittings
ASME B16.4	(1998) Gray Iron Threaded Fittings
ASME B16.5	(2003) Pipe Flanges and Flanged Fittings NPS 1/2 thru NPS 24
ASME B16.9	(2001) Factory-Made Wrought Steel Buttwelding Fittings
ASME B16.11	(2001) Forged Fittings, Socket-Welding and Threaded
ASME B16.15	(1985; R 1994) Cast Bronze Threaded Fittings Classes 125 and 250
ASME B16.18	(2001) Cast Copper Alloy Solder Joint Pressure Fittings
ASME B16.21	(1992) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B16.22	(2002) Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
ASME B16.39	(1998) Malleable Iron Threaded Pipe Unions Classes 150, 250, and 300
ASME B31.1	(2001) Power Piping

ASME B40.1	(1991) Gauges - Pressure Indicating Dial Type - Elastic Element
ASME BPVC SEC IX	(2001) Boiler and Pressure Vessel Code; Section IX, Welding and Brazing Qualifications
ASME BPVC SEC VIII D1	(2001) Boiler and Pressure Vessel Code; Section VIII, Pressure Vessels Division 1 - Basic Coverage

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 53/A 53M	(2002) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 105/A 105M	(2001) Carbon Steel Forgings for Piping Applications
ASTM A 106	(2002a) Seamless Carbon Steel Pipe for High-Temperature Service
ASTM A 193/A 193M	(2001b) Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
ASTM A 234/A 234M	(2002) Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service
ASTM A 366/A 366M	(1997e1) Steel, Sheet, Carbon, Cold-Rolled, Commercial Quality
ASTM A 515/A 515M	(2001) Pressure Vessel Plates, Carbon Steel, for Intermediate- and Higher-Temperature Service
ASTM A 516/A 516M	(2001) Pressure Vessel Plates, Carbon Steel, for Moderate- and Lower-Temperature Service
ASTM A 569/A 569M	(1998) Steel, Carbon (0.15 Maximum Percent), Hot-Rolled Sheet and Strip, Commercial
ASTM A 653/A 653M	(2001a) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A 733	(2001) Welded and Seamless Carbon Steel and Austenitic Stainless Steel Pipe Nipples
ASTM B 32	(2000) Solder Metal
ASTM B 75	(2002) Seamless Copper Tube
ASTM B 88	(2002) Seamless Copper Water Tube
ASTM B 395/B 395M	(1995) U-Bend Seamless Copper and Copper

	Alloy Heat Exchanger and Condenser Tubes
ASTM B 395M	(1995) U-Bend Seamless Copper and Copper Alloy Heat Exchanger and Condenser Tubes (Metric)
ASTM B 687	(1999) Brass, Copper, and Chromium-Plated Pipe Nipples
ASTM B 813	(2000) Liquid and Paste Fluxes for Soldering Applications of Copper and Copper Alloy Tube
ASTM B 828	(2000) Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings
ASTM D 1384	(2001) Corrosion Test for Engine Coolants in Glassware
ASTM D 3308	(2001) PTFE Resin Skived Tape

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-25	(1998) Standard Marking System for Valves, Fittings, Flanges and Unions
MSS SP-58	(1993) Pipe Hangers and Supports - Materials, Design and Manufacture
MSS SP-69	(1999) Pipe Hangers and Supports - Selection and Application
MSS SP-70	(1998) Cast Iron Gate Valves, Flanged and Threaded Ends
MSS SP-71	(1997) Gray Iron Swing Check Valves, Flanges and Threaded Ends
MSS SP-80	(1997) Bronze Gate, Globe, Angle and Check Valves
MSS SP-85	(1994) Cast Iron Globe & Angle Valves, Flanged and Threaded Ends

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250	(1997) Enclosures for Electrical Equipment (1000 Volts Maximum)

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Heating System; G-AE

Detail drawings consisting of a complete list of equipment and material, including manufacturer's descriptive and technical literature, performance charts and curves, catalog cuts, and installation instructions. Drawings shall also contain complete wiring and schematic diagrams and any other details required to demonstrate that the system has been coordinated and will properly function as a unit. Drawings shall show proposed layout and anchorage of equipment and appurtenances and equipment relationship to other parts of the work including clearances for maintenance and operation.

SD-03 Product Data

Spare Parts; G-AO

Spare parts data for each different item of material and equipment specified , after approval of the related submittals and not later than 2 months prior to the date of beneficial occupancy. The data shall include a complete list of parts and supplies, with current unit prices and source of supply.

Welding; G-AO

Six copies of qualified procedures and list of names and identification symbols of qualified welders and welding operators, prior to welding operations.

Framed Instructions; G-AO

Proposed diagrams, instructions, and other sheets, prior to posting. The instructions shall show wiring and control diagrams and complete layout of the entire system. The instructions shall include, in typed form, condensed operating instructions explaining preventive maintenance procedures, methods of checking the system for normal safe operation and procedures for safely starting and stopping the system.

SD-06 Test Reports

Testing and Cleaning; G-AO

Performance test reports in booklet form showing all field tests performed to adjust each component and all field tests performed to prove compliance with the specified performance criteria, upon completion and testing of the installed system. Each test report shall indicate the final position of controls.

SD-07 Certificates

Bolts;

Written certification that the bolts furnished comply with the requirements of this specification, provided by the bolt manufacturer. The certification shall include illustrations of

product-required markings, the date of manufacture, and the number of each type of bolt to be furnished based on this certification.

SD-10 Operation and Maintenance Data

Heating System; G-AO

Six copies of operation and six copies of maintenance manuals for the equipment furnished. One complete set, prior to performance testing and the remainder upon acceptance. Operating manuals shall detail the step-by-step procedures required for system startup, operation, and shutdown. Operating manuals shall include the manufacturer's name, model number, parts list, and brief description of all equipment and their basic operating features. Maintenance manuals shall list routine maintenance procedures, water treatment procedures, possible breakdowns and repairs, and troubleshooting guides. Maintenance manuals shall include piping and equipment layout and simplified wiring diagrams, and the controls and control diagrams of the system as installed. Manuals shall be provided prior to the field training course.

1.3 QUALIFICATIONS

Procedures and welders shall be qualified in accordance with the code under which the welding is specified to be accomplished.

1.4 DELIVERY AND STORAGE

All equipment delivered and placed in storage shall be stored with protection from the weather, excessive humidity and excessive temperature variation; and dirt, dust, or other contaminants.

1.5 FIELD MEASUREMENTS

The Contractor shall become familiar with all details of the work, verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing the work.

PART 2 PRODUCTS

2.1 GENERAL MATERIAL AND EQUIPMENT REQUIREMENTS

2.1.1 Standard Products

Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Equipment shall be supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the site.

2.1.2 Nameplates

Each major item of equipment shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a plate secured to the item of equipment.

2.1.3 Equipment Guards and Access

Belts, pulleys, chains, gears, couplings, projecting setscrews, keys, and other rotating parts exposed to personnel contact shall be fully enclosed or guarded in accordance with OSHA requirements. High temperature equipment and piping exposed to contact by personnel or where it creates a potential fire hazard shall be properly guarded or covered with insulation of a type specified.

2.1.4 Asbestos Prohibition

Asbestos and asbestos-containing products shall not be used.

2.1.5 Electrical Work

Electrical motor driven equipment specified shall be provided complete with motors, motor starters, and controls. Electric equipment (including motor efficiencies), and wiring shall be in accordance with Section 16415 ELECTRICAL WORK, INTERIOR. High efficiency motors shall be used. Electrical characteristics shall be as specified or indicated. Motor starters shall be provided complete with thermal overload protection and other appurtenances necessary for the motor control specified. Each motor shall be of sufficient size to drive the equipment at the specified capacity without exceeding the nameplate rating of the motor. Manual or automatic control and protective or signal devices required for the operation specified, and any control wiring, conduit, and connection to power required for controls and devices but not shown shall be provided.

2.2 PIPING, TUBING, AND FITTINGS

2.2.1 General

Piping, tubing, and fittings shall be as follows:

a. Low temperature water piping shall be copper tubing with solder-joint.

b. Steam pipe shall be Schedule 40 black steel with malleable iron or steel fittings.

c. Condensate return piping shall be Schedule 80 black steel with cast iron or malleable iron, Class 250 minimum fittings.

d. Vent piping shall be black steel, Schedule 40, with black malleable iron fittings.

2.2.2 Steel Pipe

Pipe shall conform to ASTM A 53/A 53M, Grade A, black steel, Schedule 40 or Schedule 80, as specified above.

2.2.3 Gauge Piping

Piping shall be copper tubing for low temperature water. Black steel, ASTM A 106, seamless, Grade A pipe shall be used for steam and condensate return.

2.2.4 Copper Tubing

Tubing shall conform to ASTM B 88, Type K or L.

2.2.5 Malleable Iron Pipe Fittings

Fittings shall conform to ASME B16.3, type required to match adjacent piping.

2.2.6 Cast Iron Pipe Fittings

Fittings shall conform to ASME B16.1 or ASME B16.4 type required to match adjacent piping.

2.2.7 Steel Pipe Fittings

Fittings shall have the manufacturer's trademark affixed in accordance with MSS SP-25 so as to permanently identify the manufacturer.

2.2.7.1 Welded Fittings

Welded fittings shall conform to ASTM A 234/A 234M with WPA marking. Butt welded fittings shall conform to ASME B16.9, and socket welded fittings shall conform to ASME B16.11.

2.2.8 Joints and Fittings for Copper Tubing

Wrought copper and bronze fittings shall conform to ASME B16.22 and ASTM B 75. Cast copper alloy fittings shall conform to ASME B16.18 and ASTM B 828. Adaptors may be used for connecting tubing to flanges and threaded ends of valves and equipment. Cast bronze threaded fittings shall conform to ASME B16.15. Grooved mechanical joints and fittings shall be designed for not less than 125 psig service and shall be the product of the same manufacturer.

2.2.9 Steel Flanges

Flanged fittings including flanges, bolts, nuts, bolt patterns., etc. shall be in accordance with ASME B16.5 class 150 and shall have the manufacturers trademark affixed in accordance with MSS SP-25. Flange material shall conform to ASTM A 105/A 105M. Blind flange material shall conform to ASTM A 516/A 516M cold service and ASTM A 515/A 515M for hot service. Bolts shall be high strength or intermediate strength with material conforming to ASTM A 193/A 193M.

2.2.10 Pipe Threads

Pipe threads shall conform to ASME B1.20.1.

2.2.11 Nipples

Nipples shall conform to ASTM A 733 or ASTM B 687, standard weight.

2.2.12 Unions

Unions shall conform to ASME B16.39, type to match adjacent piping.Dielectric unions will not be used. Flanges or nipples will be used instead.

2.2.13 Adapters

Adapters for copper tubing shall be brass or bronze for soldered fittings.

2.2.14 Dielectric Waterways

Dielectric waterways shall conform to the tensile strength and dimensional requirements specified in ASME B16.39. Waterways shall have metal connections on both ends to match adjacent piping. Metal parts of dielectric waterways shall be separated so that the electrical current is below 1 percent of the galvanic current which would exist upon metal-to-metal contact. Dielectric waterways shall have temperature and pressure rating equal to or greater than that specified for the connecting piping. Dielectric waterways shall be internally lined with an insulator specifically designed to prevent current flow between dissimilar metals. Dielectric flanges shall meet the performance requirements described herein for dielectric waterways.

2.2.15 Flexible Pipe Connectors

Flexible pipe connectors shall be designed for 125 psi or 150 psi service as appropriate for the static head plus the system head, and 250 degrees F. Connectors shall be installed where indicated. The flexible section shall be constructed of rubber, tetrafluoroethylene resin, or corrosion-resisting steel, bronze, monel, or galvanized steel. Materials used and the configuration shall be suitable for the pressure, vacuum, temperature, and circulating medium. The flexible section may have threaded, welded, soldered, flanged, or socket ends. Flanged assemblies shall be equipped with limit bolts to restrict maximum travel to the manufacturer's standard limits. Unless otherwise indicated, the length of the flexible connectors shall be as recommended by the manufacturer for the service intended. Internal sleeves or liners, compatible with circulating medium, shall be provided when recommended by the manufacturer. Covers to protect the bellows shall be provided where indicated.

2.3 MATERIALS AND ACCESSORIES

2.3.1 Iron and Steel Sheets

2.3.1.1 Galvanized Iron and Steel

Galvanized iron and steel shall conform to ASTM A 653/A 653M, with general requirements conforming to ASTM A 653/A 653M. Gauge numbers specified are Manufacturer's Standard Gauge.

2.3.1.2 Uncoated (Black) Steel

Uncoated (black) steel shall conform to ASTM A 366/A 366M or ASTM A 569/A 569M, composition, condition, and finish best suited to the intended use. Gauge numbers specified refer to Manufacturer's Standard Gauge.

2.3.2 Solder

Solder shall conform to ASTM B 32, 95-5 tin-antimony. Solder and flux shall be lead free. Solder flux shall be liquid or paste form, non-corrosive and conform to ASTM B 813.

2.3.3 Solder, Silver

Silver solder shall conform to AWS A5.8.

2.3.4 Thermometers

Mercury shall not be used in thermometers. Thermometers shall have brass, malleable iron, or aluminum alloy case and frame, clear protective face, permanently stabilized glass tube with indicating-fluid column, white face, black numbers, and a 9 inch scale, and thermometers shall have rigid stems with straight, angular, or inclined pattern.

2.3.5 Gauges

Gauges shall conform to ASME B40.1 and shall be a minimum 4-inch in diameter.

2.3.6 Gaskets for Flanges

Composition gaskets shall conform to ASME B16.21. Gaskets shall be nonasbestos compressed material in accordance with ASME B16.21, 1/16 inch thickness, full face or self-centering flat ring type. Gaskets shall contain aramid fibers bonded with styrene butadiene rubber (SBR) or nitrile butadiene rubber (NBR). NBR binder shall be used for hydrocarbon service. Gaskets shall be suitable for pressure and temperatures of piping system.

2.3.7 Pipe Hangers, Inserts, and Supports

Pipe hangers, inserts, and supports shall conform to MSS SP-58 and MSS SP-69.

2.4 VALVES FOR LOW TEMPERATURE WATER HEATING AND STEAM SYSTEMS
Everything upstream of the pressure reducing station will be Class 150.

2.4.1 Check Valves

Sizes 2-1/2 inches and less, bronze shall conform to MSS SP-80, Type 3 or 4, Class 125. Sizes 3 inches through 24 inches, cast iron shall conform to MSS SP-71, Type III or IV, Class 125.

2.4.2 Globe Valves

Sizes 2-1/2 inches and less, bronze shall conform to MSS SP-80, Type 1, 2 or 3, Class 125. Sizes 3 inches through 12 inches, cast iron shall conform to MSS SP-85, Type III, Class 125.

2.4.3 Angle Valves

Sizes 2-1/2 inches and less, bronze shall conform to MSS SP-80, Type 1, 2 or 3, Class 125. Sizes 3 inches through 12 inches, cast iron shall conform to MSS SP-85, Type III, Class 125.

2.4.4 Gate Valves

Sizes 2-1/2 inches and less, bronze shall conform to MSS SP-80, Type 1 or 2, Class 125. Sizes 3 inches through 48 inches, cast iron shall conform to MSS SP-70, Type I, Class 125, Design OT or OF (OS&Y), bronze trim.

2.4.5 Air Vents

Automatic air vents shall be float type, cast iron, stainless steel, or forged steel construction, suitable for pressure rating of piping system. Air vents installed in piping in chase walls or other inaccessible places shall be provided with an access panel.

2.4.6 Balancing Valves

Balancing valves shall have meter connections with positive shutoff valves. An integral pointer shall register degree of valve opening. Valves shall be calibrated so that flow in gpm can be determined when valve opening in degrees and pressure differential across valve is known. Each balancing valve shall be constructed with internal seals to prevent leakage and shall be supplied with preformed insulation. Valves shall be suitable for 250 degrees F temperature and working pressure of the pipe in which installed. Valve bodies shall be provided with tapped openings and pipe extensions with shutoff valves outside of pipe insulation. The pipe extensions shall be provided with quick connecting hose fittings for a portable meter to measure the pressure differential. One portable differential meter shall be furnished. The meter suitable for the operating pressure specified shall be complete with hoses, vent, and shutoff valves and carrying case. In lieu of the balancing valve with integral metering connections, a ball valve or plug valve with a separately installed orifice plate or venturi tube may be used for balancing. Plug valves and ball valves 8 inches or larger shall be provided with manual gear operators with position indicators.

2.5 FLASH TANK

Tank shall be sized and installed as indicated, and shall be of welded construction utilizing black steel sheets not less than 11 gauge. Tank shall be provided with a handhole and with tapping for the condensate returns, drip lines, vent line, and condensate discharge line to the condensate receiver. Discharge line shall be equipped with a float trap. Tank shall be ASME rated for 125 psig in accordance with ASME BPVC SEC VIII D1.

2.6 EXPANSION TANK

The hot water pressurization system shall include a bladder-type expansion tank as indicated which will accommodate the expanded water of the system generated within the normal operating temperature range, limiting the pressure increase at all components in the system to the maximum allowable pressure at those components. The only air in the system shall be the permanent sealed-in air cushion contained in the bladder-type tank. The size shall be as indicated. The expansion tank shall be welded steel, constructed, tested, and stamped in accordance with ASME BPVC SEC VIII D1 for a working pressure of 125 psi and precharged to the minimum operating pressure. The tank's air chamber shall be fitted with an air charging valve and pressure gauge. The tank shall be supported by steel legs or bases for vertical installation or steel saddles for horizontal installations. The tank shall have lifting rings and a drain connection. All components shall be suitable for a maximum operating temperature of 250 degrees F.

2.7 AIR SEPARATOR TANK

External air separation tank shall be steel, constructed, tested, and stamped in accordance with ASME BPVC SEC VIII D1 for a working pressure of 125 psi. The capacity of the air separation tank indicated is minimum.

2.8 STEAM TRAPS

2.8.1 Float Traps

Capacity, working pressure, and differential pressure of the traps shall be as indicated.

2.8.2 Float-and-Thermostatic Traps

Traps shall be designed for a steam working pressure of approximately 15 psig, but shall operate with a supply pressure of approximately 5 psig. The capacity of the traps shall be as indicated. Trap capacity shall be based on a pressure differential of 1/4 psi. Each float-and-thermostatic trap shall be provided with a hard bronze, monel, or stainless steel valve seat and mechanism and brass float, all of which can be removed easily for inspection or replacement without disturbing the piping connections. Inlet to each trap shall have a cast iron strainer, either an integral part of the trap or a separate item of equipment.

2.9 HEAT EXCHANGERS

Heat exchangers shall be multiple pass shell and U-tube type as indicated, to provide low temperature hot water for the heating system when supplied with steam at the temperatures and pressures indicated. Temperature and pressure for shell and U-tube exchangers shall not exceed 338 degrees F and 100 psig for steam. Exchangers shall be constructed in accordance with ASME BPVC SEC VIII D1 and certified with ASME stamp secured to unit. U-tube bundles shall be completely removable for cleaning and tube replacement and shall be free to expand with shell. Shells shall be of seamless steel pipe or welded steel construction and tubes shall be seamless tubing as specified below unless otherwise indicated. Tube connections to plates shall be leakproof. Saddles or cradles shall be provided to mount shell and U-tube exchangers.

2.9.1 Steam Heat Exchangers, Shell and U-Tube Type

Exchangers shall operate with steam in shell and low temperature water in tubes. Shell and tube sides shall be designed for 150 psig working pressure and factory tested at 300 psig. Steam, water, condensate, and vacuum and pressure relief valve connections shall be located in accordance with the manufacturer's standard practice. Connections larger than 3 inches shall be ASME 150 pound flanged. Water pressure loss through clean tubes shall not exceed 6 psi and water velocity shall not exceed 6 fps unless otherwise indicated. Minimum water velocity in tubes shall be not less than 1 fps and assure turbulent flow. Tubes shall be seamless copper or copper alloy, constructed in accordance with ASTM B 75 or ASTM B 395/B 395M, ASTM B 395M, suitable for the temperatures and pressures specified. Tubes shall be not less than 3/4 inch unless otherwise indicated. Maximum steam inlet nozzle velocity shall not exceed 6000 fpm.

2.10 CONDENSATE RETURN FLOW METER

The condensate return flow meter shall be the nutating disc, positive displacement type. Meter housing shall be bronze. Meter shall be capable of operating at 250 degrees F and 150 psig. Meter shall have an accuracy of +/-1.5% over the full range of the meter, and repeatability of +/-0.5%. Meter shall be provided with appropriate pulse generator, remote readout, and all necessary wiring and accessories to provide installation as shown on the drawings.

2.11 SYSTEM EQUIPMENT AND ACCESSORIES

2.11.1 Circulating Pumps

Pumps for hot water shall be of the single-stage centrifugal type, electrically driven. Pumps shall be supported on a concrete foundation as indicated. Pumps shall be either integrally mounted with the motor or direct-connected by means of a flexible-shaft coupling on a cast iron, or steel sub-base. Pump housing shall be of close grained cast iron. Shaft shall be carbon or alloy steel, turned and ground. Shaft seal shall be mechanical-seal or stuffing-box type. Impeller, impeller wearing rings, glands, casing wear rings, and shaft sleeve shall be bronze. Bearings shall be ball-, roller-, or oil-lubricated, bronze-sleeve type, and shall be sealed or isolated to prevent loss of oil or entrance of dirt or water. Motor shall be of a type approved by the manufacturer of the pump.

2.11.2 Condensate Pumping Units

2.11.2.1 Building Condensate Pumping Unit

The building condensate pumping unit shall be a duplex unit and pressure powered by steam at 25-35 psig. Pumping unit shall not require any electrical energy. Body construction shall be cast iron. The pressure powered pump shall use a lift type check valve for pumping liquids with a specific gravity of 0.65 and above. The pumps shall contain a float operated snap-acting mechanism with no external seals or packing and stainless steel trim. The unit shall be equipped with a sight glass to monitor operation.

The capacity of each pump, capacity of the receiver, and other characteristics of the pressure powered condensate pumping units shall be as noted on the drawings.

2.11.2.2 Utilidor Condensate Pumping Unit

Pumping unit shall have a minimum capacity, as indicated, when discharging against the specified pressure. The minimum capacity of the tank shall be as indicated. Condensate pumping unit shall be of the duplex, vertical-shaft type, as indicated. Unit shall consist of two pumps, two electric motors and a single receiver. Pumps shall be centrifugal or turbine type, bronze-fitted throughout with impellers of bronze or other corrosion-resistant metal. Pumps shall be free from air-binding when handling condensate with temperatures up to 200 degrees F. Pumps shall be connected directly to dripproof enclosed motors. Receiver shall be cast iron and shall be provided with condensate return, vent, overflow, and pump suction connections, and water level indicator and automatic air vent. Inlet strainer shall be provided in the inlet line to the tank. Vent pipe shall be galvanized steel, and fittings shall be galvanized malleable iron. Vent pipe shall be installed as indicated or directed. Vent piping shall be flashed as specified. Pumps, motors, and receiving tank may be mounted on a single base with the receiver piped to the pumps suctions. A gate valve and check valve shall be provided in the discharge connection from each pump.

2.11.2.3 Factory Testing

The Contractor shall submit a certificate of compliance from the pump manufacturers covering the actual test of the units and certifying that the

equipment complies with the indicated requirements.

2.11.3 Pressure Gauges and Thermometers

Gauges shall be provided for each heat exchanger and piping as indicated. Thermometers shall be separable socket type.

2.11.4 Vacuum Relief Valve

Vacuum relief valve shall be installed on the shell of each shell and U-tube steam heat exchanger. On shutoff of steam supply and condensing of steam, the vacuum relief valve shall automatically admit air to the heat exchanger.

2.11.5 Pressure Relief Valves

One or more pressure relief valves shall be provided for each heat exchanger in accordance with ASME BPVC SEC VIII D1. The aggregate relieving capacity of the relief valves shall be not less than that required by the above code. Discharge from the valves shall be installed as indicated. Pressure relief valves for steam heat exchangers shall be located on the low temperature water supply coming from near the heat exchanger as indicated.

2.11.6 Drains

A drain connection with 3/4 inch hose bib shall be installed at the lowest point in the low temperature water return main near the heat exchanger. In addition, threaded drain connections with threaded cap or plug shall be installed wherever required for thorough draining of the low temperature water system.

2.11.7 Strainers

Basket or Y-type strainer-body connections shall be the same size as the pipe lines in which the connections are installed. The bodies shall have arrows clearly cast on the sides to indicate the direction of flow. Each strainer shall be equipped with an easily removable cover and sediment basket. The body or bottom opening shall be equipped with nipple and gate valve for blowdown. The basket for steam systems shall be of not less than 0.025 inch thick stainless steel, or monel with small perforations of sufficient number to provide a net free area through the basket of at least 2.5 times that of the entering pipe. The flow shall be into the basket and out through the perforations.

2.12 INSULATION

Shop and field applied insulation shall be as specified in Section 15080 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

2.13 FACTORY PAINTED EXPOSED SPACE HEATING EQUIPMENT

All exposed heating equipment shall be painted at the factory with the manufacturer's standard primer and enamel finish.

2.14 UNIT HEATERS

Heaters shall be as specified below, and shall have a heating capacity not in excess of 125 percent of the capacity indicated.

2.14.1 Propeller Fan Heaters

Heaters shall be designed for suspension and arranged for horizontal orverticaldischarge of air as indicated. Casings shall be not less than 20 gauge black steel and finished with lacquer or enamel. Suitable stationary deflectors shall be provided to assure proper air and heat penetration capacity at floor level based on established design temperature. Suspension from heating pipes will not be permitted. Fans for vertical discharge type heaters shall operate at speeds not in excess of 1,200 rpm.Horizontal discharge type unit heaters shall have discharge or face velocities not in excess of the following:

Unit Capacity, cfm	Face Velocity, fpm
Up to 1,000	800
1,001 to 3,000	900
3,001 and over	1,000

2.14.2 Heating Elements

Heating coils shall be as specified in Section 15895 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEM for types indicated. Coils shall be suitable for use with water up to 250 degrees F.

2.14.3 Motors

Motors shall be provided with NEMA 250 general purpose enclosure. Motors and motor controls shall otherwise be as specified in Section 16415 ELECTRICAL WORK, INTERIOR.

2.14.4 Motor Switches

Motors shall be provided with manual selection switches with "Off," and "Automatic" positions and shall be equipped with thermal overload protection.

2.14.5 Controls

Controls shall be provided as specified in Section 15951 DIRECT DIGITAL CONTROLS FOR HVAC.

2.15 HEATING AND VENTILATING UNITS

Heating and ventilating units shall be as specified in Section 15895 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEM.

2.16 GLYCOL SYSTEM

The glycol system shall be capable of manually feeding make-up glycol/water solution into the heating system. The system shall be as shown on the drawings.

2.16.1 Glycol Solutions

A 60 percent concentration by volume of industrial grade ethylene glycol, Dowtherm premix solution, shall be provided. The glycol shall be tested in

accordance with ASTM D 1384 with less than 0.5 mils penetration per year for all system metals. The glycol shall contain corrosion inhibitors. Silicate based inhibitors shall not be used. The solution shall be compatible with pump seals, other elements of the system, and all water treatment chemicals used within the system, formulated specifically for hydronic heating systems.

PART 3 EXECUTION

3.1 INSTALLATION

All work shall be installed as indicated and in accordance with the manufacturer's diagrams and recommendations.

3.2 COLOR CODE MARKING AND FIELD PAINTING

Color code marking, field painting of exposed pipe, and field painting of factory primed equipment shall be as specified in Section 09900 PAINTS AND COATINGS.

3.3 WELDING

Piping shall be welded in accordance with qualified procedures using performance qualified welders and welding operators. Procedures and welders shall be qualified in accordance with ASME BPVC SEC IX. Welding procedures qualified by others, and welders and welding operators qualified by another employer may be accepted as permitted by ASME B31.1. The Contracting Officer shall be notified 24 hours in advance of tests and the tests shall be performed at the work site if practical. The welder or welding operator shall apply his assigned symbol near each weld he makes as a permanent record. Structural members shall be welded in accordance with Section 05120 STRUCTURAL STEEL.

3.4 PIPING

Unless otherwise specified, pipe and fittings installation shall conform to the requirements of ASME B31.1. Pipe shall be cut accurately to measurements established at the job site and worked into place without springing or forcing, completely clearing all windows, doors, and other openings. Cuttings or other weakening of the building structure to facilitate piping installation will not be permitted without written approval. Pipe or tubing shall be cut square, shall have burrs removed by reaming, and shall be so installed as to permit free expansion and contraction without causing damage to building structure, pipe, joints, or hangers. Changes in direction shall be made with factory made fittings. Vent pipes shall be installed through the roof as indicated and shall be flashed as specified. Horizontal mains shall pitch up or down in the direction of flow as indicated. The grade shall be not less than 1 inch in 40 feet. Reducing fittings shall be used for changes in pipe sizes. Open ends of pipelines and equipment shall be capped or plugged during installation to keep dirt or other foreign materials out of the systems. Pipe not otherwise specified shall be uncoated. Unions and other components for copper pipe or tubing shall be brass or bronze. Connections between ferrous and copper piping shall be electrically isolated using dielectric waterways.

3.4.1 Joints

Except as otherwise specified, joints used on steel pipe shall be threaded

for fittings 1 inch and smaller; threaded or welded for 1-1/4 inches up through 2-1/2 inches; and flanged or welded for 3 inches and larger. Joints between sections of copper tubing or copper pipe shall be sweated. Pipe and fittings 1-1/4 inches and larger installed in inaccessible conduits or trenches beneath concrete floor slabs shall be welded. Unless otherwise specified, connections to equipment shall be made with black malleable iron unions for pipe 2-1/2 inches or smaller in diameter, and with flanges for pipe 3 inches or larger in diameter.

3.4.2 Low Temperature Systems

Piping may have threaded or sweated joints as applicable and as specified. Reducing fittings shall be used for changes in pipe sizes. In horizontal lines, reducing fittings shall be the eccentric type to maintain the top of the adjoining pipes at the same level.

3.4.3 Steam Systems

Piping may have threaded, welded, or flanged joints as applicable and as specified. Reducing fittings shall be used for changes in pipe sizes. In horizontal steam lines, reducing fittings shall be the eccentric type to maintain the bottom of the lines at the same level. Grooved mechanical joints shall not be used.

3.4.4 Threaded Joints

Threaded joints shall be made with tapered threads properly cut, and shall be made tight with PTFE tape complying with ASTM D 3308, or equivalent thread joint compound applied to the male threads only, and in no case to the fittings.

3.4.5 Welded Joints

Joints shall be fusion-welded unless otherwise required. Changes in direction of piping shall be made with welding fittings only. Branch connection may be made with either welding tees or branch outlet fittings. Branch outlet fittings shall be forged, flared for improvement of flow where attached to the run, and reinforced against external strains.

3.4.6 Flanged Joints or Unions

Flanged joints or unions shall be provided in each line immediately preceding the connection to each piece of equipment or material requiring maintenance such as coils, pumps, control valves, and similar items. Flanged joints shall be faced true, provided with gaskets, and made square and tight. Full-faced gaskets shall be used with cast iron flanges.

3.4.7 Sweated Pipe and Tubing

Pipe and tubing shall be cut square and burrs shall be removed. Both inside of fittings and outside of tubing shall be cleaned with an abrasive before sweating. Care shall be taken to prevent annealing of fittings and hard drawn tubing when making connection. Installation shall be made in accordance with the manufacturer's recommendations. Changes in direction of piping shall be made with soldered fittings only. Solder and flux shall be lead free. Joints for soldered fittings shall be made with silver solder or 95:5 tin-antimony solder. Cored solder shall not be used. Swing joints or offsets shall be provided on all branch connections, mains, and risers to provide for expansion and contraction forces without undue stress

to the fittings or to short lengths of pipe or tubing.

3.5 CONNECTIONS TO EQUIPMENT

Supply and return connections shall be provided by the Contractor unless otherwise indicated. Valves and traps shall be installed in accordance with the manufacturer's recommendations. Unless otherwise indicated, the size of the supply and return pipes to each piece of equipment shall be not smaller than the connections on the equipment. No bushed connections shall be permitted. Change in sizes shall be made with reducers or increasers only.

3.5.1 Low Temperature Water and Steam and Return Connections

Connections, unless otherwise indicated, shall be made with malleable iron unions for piping 2-1/2 inchesor less in diameter and with flanges for pipe 3 inchesor more in diameter.

3.6 BRANCH CONNECTIONS

Branches shall pitch up or down as indicated, unless otherwise specified. Connection shall be made to insure unrestricted circulation, eliminate air pockets, and permit drainage of the system.

3.6.1 Low Temperature Water Branches

Branches taken from mains shall pitch with a grade of not less than 1 inch in 10 feet.

3.6.2 Steam Supply and Condensate Branches

Branches taken from mains shall pitch with a grade of not less than 1 inch in 10 feet, unless otherwise indicated.

3.7 RISERS

The location of risers is approximate. Exact locations of the risers shall be as approved. Steam supply downfeed risers shall terminate in a dirt pocket and shall be dripped through a trap to the return line.

3.8 SUPPORTS

3.8.1 General

Hangers used to support piping 2 inches and larger shall be fabricated to permit adequate adjustment after erection while supporting the load. Pipe guides and anchors shall be installed to keep pipes in accurate alignment, to direct the expansion movement, and to prevent buckling, swaying, and undue strain. All piping subjected to vertical movement when operating temperatures exceed ambient temperatures, shall be supported by variable spring hangers and supports or by constant support hangers. Where threaded rods are used for support, they shall not be formed or bent.

3.8.1.1 Seismic Requirements for Pipe Supports, Standard Bracing

All piping and attached valves shall be supported and braced to resist seismic loads as specified under Sections 13080 SEISMIC PROTECTION FOR MISCELLANEOUS EQUIPMENT and 15070 SEISMIC PROTECTION FOR MECHANICAL EQUIPMENT. Structural steel required for reinforcement to properly support

piping, headers, and equipment but not shown shall be provided under this section. Material used for supports shall be as specified under Section 05120 STRUCTURAL STEEL.

3.8.1.2 Structural Attachments

Structural steel brackets required to support piping, headers, and equipment, but not shown, shall be provided under this section. Material and installation shall be as specified under Section 05120 STRUCTURAL STEEL. Pipe hanger loads suspended from steel joist panel points shall not exceed 50 pounds. Loads exceeding 50 pounds shall be suspended from panel points.

3.8.1.3 Multiple Pipe Runs

In the support of multiple pipe runs on a common base member, a clip or clamp shall be used where each pipe crosses the base support member. Spacing of the base support members shall not exceed the hanger and support spacing required for any individual pipe in the multiple pipe run.

3.8.2 Pipe Hangers, Inserts, and Supports

Pipe hangers, inserts and supports shall conform to MSS SP-58 and MSS SP-69, except as specified as follows:

a. Types 5, 12, and 26 shall not be used.

b. Type 3 shall not be used on insulated pipe which has a vapor barrier. Type 3 may be used on insulated pipe that does not have a vapor barrier if clamped directly to the pipe and if the clamp bottom does not extend through the insulation and the top clamp attachment does not contact the insulation during pipe movement.

c. Type 18 inserts shall be secured to concrete forms before concrete is placed. Continuous inserts which allow more adjustment may be used if they otherwise meet the requirements for Type 18 inserts.

d. Type 19 and 23 C-clamps shall be torqued per MSS SP-69 and have both locknuts and retaining devices, furnished by the manufacturer. Field-fabricated C-clamp bodies or retaining devices are not acceptable.

e. Type 20 attachments used on angles and channels shall be furnished with an added malleable iron heel plate or adapter.

f. Type 24 may be used only on trapeze hanger systems or on fabricated frames.

g. Where Type 39 saddle or Type 40 shield are permitted for a particular pipe attachment application, the Type 39 saddle shall be used on all pipe 4 inches and larger.

h. Horizontal pipe supports shall be spaced as specified in MSS SP-69 and a support shall be installed not over 1 foot from the pipe fitting joint at each change in direction of the piping. Pipe supports shall be spaced not over 5 feet apart at valves.

i. Vertical pipe shall be supported at each floor, except at slab-on-grade, and at intervals of not more than 15 feet,except

that pipe shall be supported not more than 8 feet from end of risers, and at vent terminations.

j. Type 35 guides using steel, reinforced PTFE or graphite slides shall be provided where required to allow longitudinal pipe movement. Lateral restraints shall be provided as required. Slide materials shall be suitable for the system operating temperatures, atmospheric conditions and bearing loads encountered. Where steel slides do not require provision for restraint or lateral movement, an alternate guide method may be used. On piping 4 inches and larger, a Type 39 saddle may be welded to the pipe and freely rest on a steel plate. On piping under 4 inches, a Type 40 protection shield may be attached to the pipe or insulation and freely rest on a steel slide plate. Where there are high system temperatures and welding to piping is not desirable, then the Type 35 guide shall include a pipe cradle, welded to the guide structure and strapped securely to the pipe. The pipe shall be separated from the slide material by at least 4 inches, or by an amount adequate for the insulation, which ever is greater.

k. Except for Type 3, pipe hangers on horizontal insulated pipe shall be the size of the outside diameter of the insulation.

3.8.3 Piping in Trenches

Piping shall be supported as indicated.

3.9 PIPE SLEEVES

3.9.1 Pipe Passing Through Concrete or Masonry

Pipe passing through concrete or masonry walls or concrete floors or roofs shall be provided with pipe sleeves fitted into place at the time of construction. Sleeves shall not be installed in structural members except where indicated or approved. Rectangular and square openings shall be as detailed. Each sleeve shall extend through its respective wall, floor, or roof, and shall be cut flush with each surface. Unless otherwise indicated, sleeves shall provide a minimum of 1/4 inch annular space between bare pipe or insulation surface and sleeves. Sleeves in bearing walls, waterproofing membrane floors, and wet areas shall be steel pipe or cast iron pipe. Sleeves in nonbearing walls, floors, or ceilings may be steel pipe, cast iron pipe, or galvanized sheet metal with lock-type longitudinal seam and of the metal thickness indicated. Except in pipe chases or interior walls, the annular space between pipe and sleeve or between jacket over insulation and sleeve in nonfire rated walls and floors shall be sealed as indicated and specified in Section 07900 JOINT SEALING. Penetrations in fire walls and floors shall be sealed in accordance with Section 07840 FIRESTOPPING.

3.9.2 Pipes Passing Through Waterproofing Membranes

Pipes passing through waterproofing membranes shall be installed through a 4 pound lead-flashing sleeve, a 16 ounce copper sleeve, or a 0.032 inch thick aluminum sleeve, each having an integral skirt or flange. Flashing sleeve shall be suitably formed, and the skirt or flange shall extend 8 inches or more from the pipe and shall be set over the roof or floor membrane in a troweled coating of bituminous cement. The flashing sleeve shall extend up the pipe a minimum of 2 inches above the highest flood level of the roof or a minimum of 10 inches above the roof, whichever is

greater, or 10 inches above the floor. The annular space between the flashing sleeve and the bare pipe or between the flashing sleeve and the metal-jacket-covered insulation shall be sealed as indicated. At the Contractor's option, pipes up to and including 10 inches in diameter passing through roof or floor waterproofing membrane may be installed through a cast iron sleeve with caulking recess, anchor lugs, flashing clamp device, and pressure ring with brass bolts. Waterproofing membrane shall be clamped into place and sealant shall be placed in the caulking recess.

3.9.3 Mechanical Seal Assembly

In lieu of a waterproofing clamping flange and caulking and sealing of annular space between pipe and sleeve or conduit and sleeve, a modular mechanical type sealing assembly may be installed. The seals shall consist of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe/conduit and sleeve with corrosion protected carbon steel bolts, nuts, and pressure plates. The links shall be loosely assembled with bolts to form a continuous rubber belt around the pipe with a pressure plate under each bolt head and each nut. After the seal assembly is properly positioned in the sleeve, tightening of the bolts shall cause the rubber sealing elements to expand and provide a watertight seal between the pipe/conduit and the sleeve. Each seal assembly shall be sized as recommended by the manufacturer to fit the pipe/conduit and sleeve involved. The Contractor electing to use the modular mechanical type seals shall provide sleeves of the proper diameters.

3.9.4 Counterflashing Alternate

As an alternate to caulking and sealing the annular space between the pipe and flashing sleeve or metal-jacket-covered insulation and flashing sleeve, counterflashing may be by standard roof coupling for threaded pipe up to 6 inches in diameter; lead-flashing sleeve for dry vents and turning the sleeve down into the pipe to form a waterproof joint; or tack-welded or banded-metal rain shield round the pipe and sealing as indicated.

3.9.5 Waterproofing Clamping Flange

Pipe passing through wall waterproofing membrane shall be sleeved as specified. In addition, a waterproofing clamping flange shall be installed as indicated.

3.9.6 Fire Seal

Where pipes pass through fire walls, fire partitions, fire rated pipe chase walls or floors above grade, a fire seal shall be provided as specified in Section 07840 FIRESTOPPING.

3.9.7 Escutcheons

Escutcheons shall be provided at all finished surfaces where exposed piping, bare or covered, passes through floors, walls, or ceilings, except in boiler, utility, or equipment rooms. Escutcheons shall be fastened securely to pipe sleeves or to extensions of sleeves without any part of sleeves being visible. Where sleeves project slightly from floors, special deep-type escutcheons shall be used. Escutcheons shall be chromium-plated iron or chromium-plated brass, either one-piece or split pattern, held in place by internal spring tension or setscrew.

3.10 VALVES AND EQUIPMENT ACCESSORIES

3.10.1 Valves and Equipment

Valves shall be installed at the locations shown or specified, and where required for the proper functioning of the system as directed. Gate valves shall be used unless otherwise indicated, specified, or directed. Valves shall be installed with their stems horizontal to or above the main body of the valve. Valves used with ferrous piping shall have threaded or flanged ends and sweat-type connections for copper tubing.

3.10.2 Thermometer Socket

A thermometer well shall be provided in each return line for each circuit in multicircuit systems.

3.10.3 Air Vents

Vents shall be installed where indicated, and on all high points and piping offsets where air can collect or pocket.

3.10.3.1 Water Air Vents

Water air vents shall be as indicated. Vent discharge lines shall be double-valved with globe valves and shall discharge into a funnel drain.

3.10.3.2 Steam Air Vents

Steam air vents shall be a quick-acting valve that continuously removes air. Valve shall be constructed of corrosion-resisting metal, shall be designed to withstand the maximum piping system pressure, and shall automatically close tight to prevent escape of steam and condensate. Vent shall be provided with a manual isolation valve. A vent shall be provided on the shell of each steam heat exchanger.

3.11 STEAM TRAPS

Float Traps shall be installed in the condensate line as indicated. Other steam traps shall be installed where indicated.

3.12 UNIT HEATERS

Unit heaters shall be installed as indicated and in accordance with the manufacturer's instructions.

3.13 INSULATION

Thickness of insulation materials for piping and equipment and application shall be in accordance with Section 15080 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

3.14 TESTING AND CLEANING

3.14.1 Pressure Testing

The Contractor shall notify the Contracting Officer 14 days before the tests are to be conducted. The tests shall be performed in the presence of the Contracting Officer. The Contractor shall furnish all instruments and personnel required for the tests. Electricity, steam, and water will be

furnished by the Government. All test results shall be accepted before thermal insulation is installed. The entire low temperature heating system, including heat exchanger, radiators and fittings, shall be hydrostatically tested and proved tight under a pressure of 45 psig for a period of four hours.

3.14.2 Test of Backflow Prevention Assemblies

Backflow prevention assemblies shall be tested in accordance with Section 15400 PLUMBING, GENERAL PURPOSE.

3.14.3 Cleaning

After the hydrostatic and backflow prevention tests have been made and prior to the operating tests, the heat exchanger and piping shall be thoroughly cleaned by filling the system with a solution of 1 pound of caustic soda or 1 pound of trisodium phosphate per 50 gallons of water. Observe the proper safety precautions in the handling and use of these chemicals. The water shall be heated to approximately 150 degrees F, and the solution circulated in the system for a period of 48 hours, then drained and the system thoroughly flushed out with fresh water. Equipment shall be wiped clean, with all traces of oil, dust, dirt, or paint spots removed. The Contractor shall be responsible for maintaining the system in a clean condition until final acceptance. Bearings shall be lubricated with oil or grease as recommended by the manufacturer.

3.15 TESTING, ADJUSTING AND BALANCING

Except as specified herein, testing, adjusting, and balancing shall be in accordance with Section 15990 TESTING, ADJUSTING, AND BALANCING OF HVAC SYSTEMS.

3.16 MANUFACTURER'S SERVICES

Services of a manufacturer's representative who is experienced in the installation, adjustment, and operation of the equipment specified shall be provided. The representative shall supervise the installation, adjustment, and testing of the equipment.

3.17 FRAMED INSTRUCTIONS

Framed instructions containing wiring and control diagrams under in laminated plastic shall be posted where directed. Condensed operating instructions, prepared in typed form, shall be framed as specified above and posted beside the diagrams. The framed instructions shall be posted before acceptance testing of the system.

3.18 FIELD TRAINING

A field training course shall be provided for designated operating and maintenance staff members. Training shall be provided for a total period of 4 hours of normal working time and shall start after the system is functionally complete but prior to final acceptance tests. Field training shall cover all of the items contained in the approved operation and maintenance manuals.

-- End of Section --

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SECTION 15653

AIR-CONDITIONING SYSTEM (UNITARY TYPE)

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AIR CONDITIONING AND REFRIGERATION INSTITUTE (ARI)

ARI 210/240	(1994) Unitary Air-Conditioning and Air-Source Heat Pump Equipment
ARI 410	(2001) Forced-Circulation Air-Cooling and Air-Heating Coils
ARI 460	(1994) Remote Mechanical-Draft Air-Cooled Refrigerant Condensers
ARI 500	(1990) Variable Capacity Positive Displacement Refrigerant Compressors and Compressor Units for Air-Conditioning and Heat Pump Applications
ARI 700	(1995; Apx C) Specifications for Fluorocarbon and Other Refrigerants

AIR DIFFUSION COUNCIL (ADC)

ADC 1062:GRD	(1984) Test Codes for Grilles, Registers and Diffusers

AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL (AMCA)

AMCA 500	(1994) Test Methods for Louvers, Dampers and Shutters

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 53/A 53M	(2002) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 307	(2002) Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
ASTM A 653/A 653M	(2001a) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM B 117	(1997) Operating Salt Spray (Fog) Apparatus

ASTM C 534	(2001a) Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form
ASTM C 1071	(1998) Thermal and Acoustical Insulation (Glass Fiber, Duct Lining Material)
ASTM D 520	(1984; R 1995el) Zinc Dust Pigment
ASTM D 3308	(2001) PTFE Resin Skived Tape
ASTM E 437	(1992; R 1997) Industrial Wire Cloth and Screens (Square Opening Series)
ASTM F 104	(1995) Nonmetallic Gasket Materials

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 15	(2001) Safety Code for Mechanical Refrigeration
ASHRAE 34	(1997) Number Designation and Safety Classification of Refrigerants

ASME INTERNATIONAL (ASME)

ASME B31.1	(2001) Power Piping
ASME B31.5	(1992; B31.5a 1994) Refrigeration Piping
ASME B40.1	(1991) Gauges - Pressure Indicating Dial Type - Elastic Element
ASME BPV VIII Div 1	(1998) Boiler and Pressure Vessel Code; Section VIII, Pressure Vessels Division 1 - Basic Coverage
ASME BPV IX	(1998) Boiler and Pressure Vessel Code; Section IX, Welding and Brazing Qualifications

AMERICAN WELDING SOCIETY (AWS)

AWS Brazing Hdbk	(1991) Brazing Handbook
AWS D1.1	(2000) Structural Welding Code - Steel

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-58	(1993) Pipe Hangers and Supports - Materials, Design and Manufacture
MSS SP-69	(1999) Pipe Hangers and Supports - Selection and Application

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 6	(1993) Industrial Control and Systems
NEMA MG 1	(2003) Motors and Generators
NEMA MG 2	(1989) Safety Standard for Construction and Guide for Selection, Installation, and Use of Electric Motors and Generators

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2002) National Electrical Code
NFPA 90A	(1999) Installation of Air Conditioning and Ventilating Systems

SHEET METAL & AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA TAB HVAC Sys	(1993) HVAC Systems - Testing, Adjusting and Balancing

UNDERWRITERS LABORATORIES (UL)

UL 214	(1997; Rev thru Aug 2001) Tests for Flame-Propagation of Fabrics and Films
UL 900	(1994; Rev thru Nov 1999) Test Performance of Air Filter Units
UL 1995	(1995; Rev thru Aug 1999) Heating and Cooling Equipment
UL Bld Mat Dir	(1999) Building Materials Directory
UL Elec Const Dir	(2001) Electrical Construction Equipment Directory

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Drawings; G-AE

Drawings shall provide adequate detail to demonstrate compliance with contract requirements. Drawings shall consist of:

(1) Equipment layouts which identify assembly and installation details.

(2) Piping layouts which identify valves and fittings.

(3) Plans and elevations which identify clearances required for maintenance and operation.

(4) Wiring diagrams which identify each component individually and interconnected or interlocked relationships between components.

(5) Foundation drawings, bolt-setting information, and foundation bolts prior to concrete foundation construction for equipment indicated or required to have concrete foundations.

(6) Details, if piping and equipment are to be supported other than as indicated, which include loadings and type of frames, brackets, stanchions, or other supports.

(7) Automatic temperature control diagrams and control sequences.

(8) Installation details which includes the amount of factory set superheat and corresponding refrigerant pressure/temperature.

SD-03 Product Data

Air-Conditioning/Heat Pump System; G-AE

Manufacturer's standard catalog data, prior to the purchase or installation of a particular component, shall be highlighted to show brand name, model number, size, options, performance charts and curves, etc. in sufficient detail to demonstrate compliance with contract requirements. Data shall be submitted for each specified component. Data shall include manufacturer's recommended installation instructions and procedures. If vibration isolation is specified for a unit, vibration isolator literature shall be included containing catalog cuts and certification that the isolation characteristics of the isolators provided meet the manufacturer's recommendations.

Spare Parts Data; G-AO

Spare parts data for each different item of equipment specified, after approval of detail drawings and not later than 2 months prior to the date of beneficial occupancy. The data shall include a complete list of parts and supplies, with current unit prices and source of supply, a recommended spare parts list for 1 year of operation, and a list of the parts recommended by the manufacturer to be replaced on a routine basis.

Framed Instructions; G-AO

Framed instructions for posting, at least 2 weeks prior to construction completion.

Qualifications; G-AO

A letter listing the qualifying procedures for each welder. The letter shall include supporting data such as test procedures used, what was tested etc., and a list of the names of qualified welders and their identification symbols.

Verification of Dimensions; G-AO

A letter, at least 2 weeks prior to beginning construction, including the date the site was visited, conformation of existing conditions, and any discrepancies found.

Tests;

A letter, at least 10 working days in advance of each tests, advising the Contracting Officer of the test. Individual letters shall be submitted for the refrigerant system, ductwork leak tests, and the system performance tests. Each letter shall identify the date, time, and location for each test.

Demonstrations; G-AO

A letter, at least 14 working days prior to the date of the proposed training course, which identifies the date, time, and location for the training.

SD-06 Test Reports

Tests; G-AO

Six copies of each test containing the information described below in bound 8-1/2 x 11 inch booklets. Individual reports shall be submitted for the refrigerant system, and the ductwork leak tests.

(1) The date the tests were performed.

(2) A list of equipment used, with calibration certifications.

(3) Initial test summaries.

(4) Repairs/adjustments performed.

(5) Final test results.

System Performance Tests; G-AO

Six copies of the report shall be provided in bound 8-1/2 x 11 inch booklets. The report shall document compliance with the specified performance criteria upon completion and testing of the system. The report shall indicate the number of days covered by the tests and any conclusions as to the adequacy of the system. The report shall also include the following information and shall be taken at least three different times at outside dry-bulb temperatures that are at least 5 degrees F apart:

(1) Date and outside weather conditions.

(2) The load on the system based on the following:

(a) The refrigerant used in the system.
(b) Condensing temperature and pressure.
(c) Suction temperature and pressure.
(d) Ambient, condensing and coolant temperatures.
(e) Running current, voltage and proper phase sequence for each phase of all motors.

(3) The actual on-site setting of operating and safety controls.

(4) Thermostatic expansion valve superheat - value as determined by field test

(5) Subcooling

(6) High and low refrigerant temperature switch set-points

(7) Low oil pressure switch set-point

(8) Defrost system timer and thermostat set-points

(9) Moisture content

(10) Capacity control set-points

(11) Field data and adjustments which affect unit performance and energy consumption.

(12) Field adjustments and settings which were not permanently marked as an integral part of a device.

SD-07 Certificates

Air-Conditioning/Heat Pump System;

Where the system, components, or equipment are specified to comply with requirements of ARI, ASHRAE, ASME, or UL, proof of such compliance shall be provided. The label or listing of the specified agency shall be acceptable evidence. In lieu of the label or listing, a written certificate from an approved, nationally recognized testing organization equipped to perform such services, stating that the items have been tested and conform to the requirements and testing methods of the specified agency may be submitted. When performance requirements of this project's drawings and specifications vary from standard ARI rating conditions, computer printouts, catalog, or other application data certified by ARI or a nationally recognized laboratory as described above shall be included. If ARI does not have a current certification program that encompasses such application data, the manufacturer may self certify that his application data complies with project performance requirements in accordance with the specified test standards.

Service Organizations;

A certified list of qualified permanent service organizations for support of the equipment which includes their addresses and qualifications. The service organizations shall be reasonably convenient to the equipment installation and be able to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

SD-10 Operation and Maintenance Data

Operation; G-AO

Six complete copies of an operation manual in bound 8-1/2 x 11 inch booklets listing step-by-step procedures required for system startup, operation, and shutdown. The booklets shall include the manufacturer's name, model number, and parts list. The manuals shall include the manufacturer's name, model number, service manual, and a brief description of all equipment and their basic operating features.

Maintenance Manuals; G-AO

Six complete copies of maintenance manual in bound 8-1/2 x 11 inch booklets listing routine maintenance procedures, possible breakdowns and repairs, and a trouble shooting guide. The manuals shall include piping and equipment layouts and simplified wiring and control diagrams of the system as installed.

1.3 QUALIFICATIONS

Piping shall be welded in accordance with the qualified procedures using performance qualified welders and welding operators. Procedures and welders shall be qualified in accordance with ASME BPV IX. Welding procedures qualified by others, and welders and welding operators qualified by another employer may be accepted as permitted by ASME B31.1. The Contracting Officer shall be notified 24 hours in advance of tests and the tests shall be performed at the work site if practical. The welder or welding operator shall apply his assigned symbol near each weld he makes as a permanent record.

1.4 DELIVERY, STORAGE, AND HANDLING

Stored items shall be protected from the weather and contamination. Proper protection and care of all material before, during, and after installation shall be the Contractor's responsibility. Any materials found to be damaged shall be replaced at the Contractor's expense. During installation, piping and similar openings shall be capped to keep out dirt and other foreign matter.

1.5 PROJECT/SITE CONDITIONS

1.5.1 Verification of Dimensions

The Contractor shall become familiar with all details of the work, verify dimensions in the field, and advise the Contracting Officer of any discrepancy before performing any work.

1.5.2 Drawings

Because of the small scale of the drawings, it is not possible to indicate all offsets, fittings, and accessories that may be required. The Contractor shall carefully investigate the plumbing, fire protection, electrical, structural and finish conditions that would affect the work to be performed and arrange such work accordingly, furnishing required offsets, fittings, and accessories to meet such conditions. Equipment, ductwork, and piping arrangements shall fit into space allotted and allow adequate acceptable clearances for installation, replacement, entry, servicing, and maintenance.

PART 2 PRODUCTS

2.1 STANDARD COMMERCIAL PRODUCTS

Materials and equipment shall be standard products of a manufacturer regularly engaged in the manufacturing of such products, which are of a similar material, design and workmanship. The standard products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2 year use shall include applications of equipment and materials under similar circumstances and of similar size. The 2 years experience shall be satisfactorily completed by a product which has been sold or is offered for sale on the commercial market through advertisements, manufacturer's catalogs, or brochures. Products having less than a 2 year field service record shall be acceptable if a certified record of satisfactory field operation, for not less than 6000 hours exclusive of the manufacturer's factory tests, can be shown. Products shall be supported by a service organization. System components shall be environmentally suitable for the indicated locations.

2.2 NAMEPLATES

Major equipment including compressors, condensers, receivers, heat exchanges, fans, cooling towers, pumps and motors shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a plate secured to the item of equipment. Plates shall be durable and legible throughout equipment life and made of anodized aluminum. Plates shall be fixed in prominent locations with nonferrous screws or bolts.

2.3 ELECTRICAL WORK

Electrical equipment, motors, motor efficiencies, and wiring shall be in accordance with Section 16415 ELECTRICAL WORK, INTERIOR. Electrical motor driven equipment specified shall be provided complete with motors, motor starters, and controls. Electrical characteristics shall be as shown, and unless otherwise indicated, all motors of 1 horsepower and above with open, dripproof, totally enclosed, or explosion proof fan cooled enclosures, shall be high efficiency type. Field wiring shall be in accordance with manufacturer's instructions. Each motor shall conform to NEMA MG 1 and NEMA MG 2 and be of sufficient size to drive the equipment at the specified capacity without exceeding the nameplate rating of the motor. Motors shall be continuous duty with the enclosure specified. Motor starters shall be provided complete with thermal overload protection and other appurtenances necessary for the motor control indicated. Motors shall be furnished with a magnetic across-the-line or reduced voltage type starter as required by the manufacturer. Motor duty requirements shall allow for maximum frequency start-stop operation and minimum encountered interval between start and stop. Motors shall be sized for the applicable loads. Motor torque shall be capable of accelerating the connected load within 20 seconds with 80 percent of the rated voltage maintained at motor terminals during one starting period. Motor bearings shall be fitted with grease supply fittings and grease relief to outside of enclosure. Manual or automatic control and protective or signal devices required for the operation specified and any control wiring required for controls and devices specified, but not shown, shall be provided.

2.4 MISCELLANEOUS MATERIALS

2.4.1 Gaskets

Gaskets shall conform to ASTM F 104 - classification for compressed sheet with nitrile binder and acrylic fibers for maximum 700 degrees F service.

2.4.2 Bolts and Nuts

Bolts and nuts, except as required for piping applications, shall be in accordance with ASTM A 307. The bolt head shall be marked to identify the manufacturer and the standard with which the bolt complies in accordance with ASTM A 307.

2.4.3 Pipe Hangers, Inserts, and Supports

Pipe hangers, inserts, and supports shall conform to MSS SP-58 and MSS SP-69.

2.4.4 Escutcheons

Escutcheons shall be chromium-plated iron or chromium-plated brass, either one piece or split pattern, held in place by internal spring tension or set screws.

2.4.5 Pressure and Vacuum Gauge

Gauge shall conform to ASME B40.1, Class 1, 2, or 3, Style X, Type I or III as required, 4-1/2 inches in diameter with phenolic or metal case. Each gauge range shall be selected so that at normal operating pressure, the needle is within the middle-third of the range.

2.4.6 Temperature Gauges

Industrial duty thermometers shall be provided for the required temperature range. Thermometers shall have Fahrenheit scale in 2 degree graduations scale on a white face. The pointer shall be adjustable.

2.4.6.1 Stem Cased-Glass

Stem cased-glass case shall be polished stainless steel or cast aluminum, 9 inches long, with clear acrylic lens, and non-mercury filled glass tube.

2.4.6.2 Bimetallic Dial

Bimetallic dial type case shall be not less than 3-1/2 inches, stainless steel, and shall be hermetically sealed with clear acrylic lens. Bimetallic element shall be silicone dampened and unit fitted with external calibrator adjustment. Accuracy shall be one percent of dial range.

2.4.6.3 Liquid-, Solid-, and Vapor-Filled Dial

Liquid-, solid-, and vapor-filled dial type cases shall be not less than 3-1/2 inches, stainless steel or cast aluminum with clear acrylic lens. Fill shall be nonmercury, suitable for encountered cross-ambients, and connecting capillary tubing shall be double-braided bronze.

2.4.6.4 Thermal Well

Thermal well shall be identical size, 1/2 or 3/4 inch NPT connection, brass

or stainless steel. Where test wells are indicated, provide captive plug-fitted type 1/2 inch NPT connection suitable for use with either engraved stem or standard separable socket thermometer or thermostat. Extended neck thermal wells shall be of sufficient length to clear insulation thickness by 1 inch.

2.4.7 Unicellular Plastic Foam

Unicellular plastic foam shall be in accordance with ASTM C 534, Form T, except that D-Factor shall not exceed 0.28 at 75 degrees F mean temperature.

2.4.8 Bird Screen

Screen shall be in accordance with ASTM E 437, Type 1, Class 1, 2 by 2 mesh, 0.063 inch diameter aluminum wire or 0.031 inch diameter stainless steel wire.

2.5 UNITARY EQUIPMENT, SPLIT SYSTEM

Unit shall be an air-cooled, split system which employs a remote condensing unit, a separate indoor unit, and interconnecting refrigerant piping. Unit shall be the air-conditioning type conforming to applicable Underwriters Laboratories (UL) standards including UL 1995. Unit shall be rated in accordance with ARI 210/240. Unit shall be provided with necessary fans, air filters, internal dampers, mixing boxes, supplemental heat, and cabinet construction as specified in paragraph "System Components". The remote unit shall be as specified in paragraph REMOTE CONDENSER OR CONDENSING UNIT. Evaporator or supply fans shall be double-width, double inlet, forward curved, backward inclined, or airfoil blade, centrifugal scroll type. Condenser or outdoor fans shall be the manufacturer's standard for the unit specified and may be either propeller or centrifugal scroll type. Fan and condenser motors shall have totally enclosed enclosures.

2.5.1 Air-to-Refrigerant Coil

Coils shall have nonferrous tubes of 3/8 inch minimum diameter with copper or aluminum fins that are mechanically bonded or soldered to the tubes. Casing shall be galvanized steel or aluminum. Contact of dissimilar metals shall be avoided. Coils shall be tested in accordance with ASHRAE 15 at the factory and be suitable for the working pressure of the installed system. Each coil shall be dehydrated and sealed after testing and prior to evaluation and charging. Each unit shall be provided with a factory operating charge of refrigerant and oil or a holding charge. Unit shipped with a holding charge shall be field charged. Separate expansion devices shall be provided for each compressor circuit.

2.5.2 Refrigeration Circuit

Refrigerant-containing components shall comply with ASHRAE 15 and be factory tested, cleaned, dehydrated, charged, and sealed. Refrigerant charging valves and connections, and pumpdown valves shall be provided for each circuit.

2.5.3 Unit Controls

Unit shall be internally prewired with a 24 volt control circuit powered by an internal transformer. Terminal blocks shall be provided for power wiring and external control wiring. Unit shall have cutoffs for high pressure, and low oil pressure for compressors with positive displacement

oil pumps, , and safety interlocks on all service panels. Head pressure controls shall sustain unit operation with ambient temperature of 30 degrees F. Adjustable-cycle timers shall prevent short-cycling. Multiple compressors shall be staged by means of a time delay. Unit shall be internally protected by fuses or a circuit breaker in accordance with UL 1995. Low cost cooling shall be made possible by means of a control circuit which will modulate dampers to provide 100 percent outside air while locking out compressors.

2.6 EQUIPMENT EFFICIENCY

Unit shall have an efficiency of SEER equal to 10 or EER equal to 9.5 .

2.7 REMOTE CONDENSING UNIT

Saturated refrigerant condensing temperature shall not exceed 120 degrees F at 95 degrees F ambient. Unit shall be provided with low ambient condenser controls to ensure proper operation in an ambient temperature of 30 degrees F. Fan and cabinet construction shall be provided as specified in paragraph "System Components". Fan and condenser motors shall have open enclosures.

2.7.1 Air-Cooled Condenser

Unit shall be rated in accordance with ARI 460 and conform to the requirements of UL 1995. Unit shall be factory fabricated, tested, packaged, and self-contained. Unit shall be complete with casing, propeller or centrifugal type fans, heat rejection coils, connecting piping and wiring, and all necessary appurtenances.

2.7.1.1 Connections

Interconnecting refrigeration piping, electrical power, and control wiring between the condensing unit and the indoor unit shall be provided as required and as indicated. Electrical and refrigeration piping terminal connections between condensing unit and evaporator units shall be provided.

2.7.1.2 Head Pressure Control and Liquid Subcooling

Low ambient control for multi-circuited units serving more than one evaporator coil shall provide independent condenser pressure controls for each refrigerant circuit. Controls shall be set to produce a minimum of 95 degrees F saturated refrigerant condensing temperature. Unit shall be provided with a liquid subcooling circuit which shall ensure proper liquid refrigerant flow to the expansion device over the specified application range of the condenser. Unit shall be provide with manufacturer's standard liquid subcooling. Subcooling circuit shall be liquid sealed.

2.7.1.3 Condensing Coil

Coils shall have nonferrous tubes of 3/8 inch minimum diameter with copper or aluminum fins that are mechanically bonded or soldered to the tubes. Casing shall be galvanized steel or aluminum. Contact of dissimilar metals shall be avoided. Coils shall be tested in accordance with ASHRAE 15 at the factory and be suitable for the working pressure of the installed system. Each coil shall be dehydrated and sealed after testing and prior to evaluation and charging. Each unit shall be provided with a factory operating charge of refrigerant and oil or a holding charge. Unit shipped with a holding charge shall be field charged. Separate expansion devices

shall be provided for each compressor circuit.

2.7.1.4 Unit Controls

The control system shall be complete with required accessories for regulating condenser pressure by fan cycling, solid-state variable fan speed, modulating condenser coil or fan dampers, flooding the condenser, or a combination of the above. Unit mounted control panels or enclosures shall be constructed in accordance with applicable requirements of NFPA 70 and housed in NEMA ICS 6, Class 1 or 3A enclosures. Controls shall include control transformer, overload protective devices, interface with local and remote components, and intercomponent wiring to terminal block points.

2.7.2 Compressor

Unit shall be rated in accordance with ARI 500. Compressor shall be direct drive, semi-hermetic or hermetic reciprocating, or scroll type capable of operating at partial load conditions. Compressor shall be capable of continuous operation down to the lowest step of unloading as specified. Units 120,000 Btuh and larger shall be provided with capacity reduction devices to produce automatic capacity reduction of at least 50 percent. If standard with the manufacturer, two or more compressors may be used in lieu of a single compressor with unloading capabilities, in which case the compressors will operate in sequence, and each compressor shall have an independent refrigeration circuit through the condenser and evaporator. Each compressor shall start in the unloaded position. Each compressor shall be provided with vibration isolators, crankcase heater, thermal overloads, and high pressure safety cutoffs and protection against short cycling.

2.8 SYSTEM COMPONENTS

2.8.1 Refrigerant and Oil

Refrigerant shall be one of the fluorocarbon gases. Refrigerants shall have number designations and safety classifications in accordance with ASHRAE 34. Refrigerants shall meet the requirements of ARI 700 as a minimum. Refrigerants shall have an Ozone Depletion Potential (ODP) of less than or equal to 0.05. Refrigerant shall be R-22, 134A, or 404A. Contractor shall provide and install a complete charge of refrigerant for the installed system as recommended by the manufacturer. Except for factory sealed units, two complete charges of lubricating oil for each compressor crankcase shall be furnished. One charge shall be used during the system performance testing period. Following the satisfactory completion of the performance testing, the oil shall be drained and replaced with a second charge. Lubricating oil shall be of a type and grade recommended by the manufacturer for each compressor. Where color leak indicator dye is incorporated, charge shall be in accordance with manufacturer's recommendation.

2.8.2 Primary/Supplemental Heating

2.8.2.1 Water Coil

Coil shall conform to the provisions of ARI 410. Coil shall be fin-and-tube type constructed of seamless copper tubes and aluminum or copper fins mechanically bonded or soldered to tubes. Headers shall be constructed of cast iron, welded steel or copper. Coil shall be constructed to float within the casing to allow free expansion and

contraction of tubing. Casing and tube support sheets shall not be lighter than 16 gauge galvanized steel formed to provide structural strength. When required, multiple tube supports shall be provided to prevent tube sag. Coil shall be circuited for suitable water velocity without excessive pressure drop and properly pitched for drainage where required or indicated. Each coil shall be tested at the factory under water at not less than 300 psi air pressure, tested hydrostatically after assembly of the unit and proved tight under a gauge pressure of 200 psi. Coil shall be suitable for use with water up to 250 degrees F. Coil shall allow complete coil drainage with a pitch of not less than 1/8 inch per foot slope to drain.

2.8.3 Air Filters

Air filters shall be listed in accordance with requirements of UL 900.

2.8.4 Cabinet Construction

Casings for the specified unitary equipment and remote preheat coil casing,shall be 2-inch sealed washable insulated double wall typeconstructed of galvanized steel or aluminum sheet metal and galvanized or aluminum structural members. Minimum thickness of casing wall surfaces shall be 18 gauge galvanized steel or 071 inch thick aluminum on units with a capacity above 20 tons and 20 gauge galvanized steel or 0.064 inch thick aluminum on units with a capacity less than 20 tons. Casing shall be fitted with lifting provisions, access panels or doors, fan vibration isolators, electrical control panel, corrosion-resistant components, structural support members, insulated condensate drip pan and drain, and internal insulation in the cold section of the casing. Where double-wall insulated construction , minimum exterior galvanized sheet metal thickness shall be 20 gauge. Provisions to permit replacement of major unit components shall be incorporated. Penetrations of cabinet surfaces, including the floor, shall be sealed. Unit shall be fitted with a intergral drain pans . Drain pans shall be fabricated from Type 300 stainless steel, galvanized steel with protective coating as required, or an approved plastic material. Pan insulation shall be water impervious. Extent and effectiveness of the insulation of unit air containment surfaces shall prevent, within limits of the specified insulation, heat transfer between the unit exterior and ambient air, heat transfer between the two conditioned air streams, and condensation on surfaces. Insulation shall conform to ASTM C 1071. Paint and finishes shall comply with the requirements specified in paragraph "Factory Coating".

2.8.4.1 Indoor Cabinet

Indoor cabinets shall be suitable for the specified indoor service and enclose all unit components.

2.9 INSULATION

2.9.1 Field Installed Insulation

Field installed insulation shall be as specified in Section 15080 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

2.9.2 Factory Installed Insulation

Factory applied insulation shall be as specified for the equipment to be insulated except that refrigerant suction lines shall be insulated with

unicellular plastic foam. Insulation shall comply with the fire hazard rating specified in Section 15080 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

2.10 TEMPERATURE CONTROLS

Temperature controls shall be in accordance with Section 15951 DIRECT DIGITAL CONTROL FOR HVAC.

2.11 DUCTWORK COMPONENTS

2.11.1 Metal Ductwork

Every aspect of metal ductwork construction, including fittings and components, shall comply with SMACNA TAB HVAC Sys unless otherwise specified. Elbows shall be radius type with a centerline radius of 1-1/2 times the width or diameter of the duct where space permits. Otherwise, elbows having a minimum radius equal to the width or diameter of the duct or square elbows with factory fabricated turning vanes may be used. Static pressure Class 1/2, 1, and 2 inch w.g. ductwork shall meet the requirements of Seal Class C. Class 3 through 10 inch shall meet the requirements of Seal Class A. Sealants shall conform to fire hazard classification specified in Section 15080 THERMAL INSULATION FOR MECHANICAL SYSTEMS. Pressure sensitive tape shall not be used as a sealant. Spiral lock seam duct, and flat oval shall be made with duct sealant and locked with not less than 3 equally spaced drive screws or other approved methods indicated in SMACNA TAB HVAC Sys. The sealant shall be applied to the exposed male part of the fitting collar so that the sealer will be on the inside of the joint and fully protected by the metal of the duct fitting. One brush coat of the sealant shall be applied over the outside of the joint to at least 2 inch band width covering all screw heads and joint gap. Dents in the male portion of the slip fitting collar will not be acceptable.

2.11.1.1 Transitions

Diverging air flow transitions shall be made with each side pitched out a maximum of 15 degrees, for an included angle of 30 degrees. Transitions for converging air flow shall be made with each side pitched in a maximum of 30 degrees, for an included angle of 60 degrees, or shall be as indicated. Factory-fabricated reducing fittings for systems using round duct sections when formed to the shape of the ASME short flow nozzle, need not comply with the maximum angles specified.

2.11.1.2 General Service Duct Connectors

A flexible duct connector approximately 6 inches in width shall be provided where sheet metal connections are made to fans or where ducts of dissimilar metals are connected. For round/oval ducts, the flexible material shall be secured by stainless steel or zinc-coated, iron clinch-type draw bands. For rectangular ducts, the flexible material locked to metal collars shall be installed using normal duct construction methods. The composite connector system shall comply with UL 214 and be classified as "flame-retarded fabrics" in UL Bld Mat Dir.

2.11.2 Ductwork Insulation

Ductwork insulation and related materials shall conform to the requirements of Section 15080 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

2.11.3 Ductwork Accessories

2.11.3.1 Duct Access Doors

Access doors shall be provided in ductwork where indicated and at all air flow measuring devices, automatic dampers, fire dampers, coils, thermostats, and other apparatus requiring service and inspection in the duct system, and unless otherwise shown, shall conform to SMACNA TAB HVAC Sys. Access doors shall be provided upstream and downstream of air flow measuring primaries and heating and cooling coils. Doors shall be minimum 15 x 18 inches, unless otherwise shown. Where duct size will not accommodate this size door, the doors shall be made as large as practicable. Doors 24 x 24 inches or larger shall be provided with fasteners operable from both sides. Doors in insulated ducts shall be the insulated type.

2.11.3.2 Splitters and Manual Balancing Dampers

Splitters and manual balancing dampers shall be furnished with accessible operating mechanisms. Where operators occur in finished portions of the building, operators shall be chromium plated with all exposed edges rounded. Splitters shall be operated by quadrant operators or 3/16 inch rod brought through the side of the duct with locking setscrew and bushing. Two rods are required on splitters over 8 inches. Manual volume control dampers shall be operated by locking-type quadrant operators. Dampers and splitters shall be 2 gauges heavier than the duct in which installed. Unless otherwise indicated, multileaf dampers shall be opposed blade type with maximum blade width of 12 inches. Access doors or panels shall be provided for all concealed damper operators and locking setscrews. Unless otherwise indicated, the locking-type quadrant operators for dampers, when installed on ducts to be thermally insulated, shall be provided with stand-off mounting brackets, bases, or adapters to provide clearance between the duct surface and the operator not less than the thickness of the insulation. Stand-off mounting items shall be integral with the operator or standard accessory of the damper manufacturer. Volume dampers shall be provided where indicated.

2.11.3.3 Air Deflectors and Branch Connections

Air deflectors shall be provided at all duct mounted supply outlets, at all takeoff or extension collars to supply outlets, at all duct branch takeoff connections, and at all 90 degree elbows, as well as at all locations as indicated on the drawings or shown in the Sheet Metal and Air Contractors National Association manuals. Air deflectors, except those installed in 90 degree elbows, shall be provided with an approved means of adjustment. Adjustment shall be made from easily accessible means inside the duct or from an adjustment with sturdy lock on the face of the duct. When installed on ducts to be thermally insulated, external adjustments shall be provided with stand-off mounting brackets, integral with the adjustment device, to provide clearance between the duct surface and the adjustment device not less than the thickness of the thermal insulation. Air deflectors shall be factory-fabricated units consisting of curved turning vanes or louver blades designed to provide uniform air distribution and change of direction with minimum turbulence or pressure loss. Air deflectors shall be factory or field assembled. Blade air deflectors, also called blade air extractors, shall be approved factory fabricated units consisting of equalizing grid and adjustable blade and lock. Adjustment shall be easily made from the face of the diffuser or by position adjustment and lock external to the duct. Stand-off brackets shall be

provided on insulated ducts and are described herein before. Fixed air deflectors, also called turning vanes, shall be provided in all 90 degree elbows. Turning vanes shall be designed as shown in the Sheet Metal and Air Condition Contractors National Association manuals.

2.11.4 Duct Sleeves, Framed Prepared Openings, Closure Collars

2.11.4.1 Duct Sleeves

Duct sleeves shall be provided for all round ducts 15 inchesin diameter or less passing through floors, walls, ceilings, or roof, and installed during construction of the floor, wall, ceiling, or roof. Round ducts larger than 15 inches in diameter and all square, rectangular, and oval ducts passing through floors, walls, ceilings, or roof shall be installed through framed prepared openings. The Contractor shall be responsible for the proper size and location of sleeves and prepared openings. Sleeves and framed openings are also required where grilles, registers, and diffusers are installed at the openings. Framed prepared openings shall be fabricated from 20 gauge galvanized steel, unless otherwise indicated. Where sleeves are installed in bearing walls or partitions, black steel pipe, ASTM A 53/A 53M, Schedule 20 shall be used. Sleeve shall provide 1 inch clearance between the duct and the sleeve or 1 inch clearance between the insulation and the sleeve for insulated ducts.

2.11.4.2 Framed Prepared Openings

Openings shall have 1 inch clearance between the duct and the opening or 1 inch clearance between the insulation and the opening for insulated ducts.

2.11.4.3 Closure Collars

Collars shall be fabricated of galvanized sheet metal not less than 4 inches wide, unless otherwise indicated, and shall be installed on exposed ducts on each side of walls or floors where sleeves or prepared openings are provided. Collars shall be installed tight against surfaces. Collars shall fit snugly around the duct or insulation. Sharp edges of the collar around insulated duct shall be ground smooth to preclude tearing or puncturing the insulation covering or vapor barrier. Collars for round ducts 15 inches in diameter or less shall be fabricated from 20 gauge galvanized steel. Collars for round ducts larger than 15 inches and all square, and rectangular ducts shall be fabricated from 18 gauge galvanized steel. Collars shall be installed with fasteners on maximum 6 inch centers, except that not less than 4 fasteners shall be used.

2.11.5 Diffusers, Registers, and Grilles

Units shall be factory-fabricated of steel, corrosion-resistant steel, or aluminum and shall distribute the specified quantity of air evenly over space intended without causing noticeable drafts, air movement faster than 50 fpm in occupied zone, or dead spots anywhere in the conditioned area. Outlets for diffusion, spread, throw, and noise level shall be as required for specified performance. Performance shall be certified in accordance with ADC 1062:GRD. Inlets and outlets shall be sound rated and certified in accordance with ADC 1062:GRD. Sound power level shall be as indicated. Diffusers and registers shall be provided with volume damper with accessible operator, unless otherwise indicated; or if standard with the manufacturer, an automatically controlled device will be acceptable. Volume dampers shall be opposed blade type for all diffusers and registers, except linear slot diffusers. Linear slot diffusers shall be provided with

round or elliptical balancing dampers. Where the inlet and outlet openings are located less than 7 feet above the floor, they shall be protected by a grille or screen in accordance with NFPA 90A.

2.11.5.1 Diffusers

Diffuser types shall be as indicated. Ceiling mounted units shall be furnished with antismudge devices, unless the diffuser unit minimizes ceiling smudging through design features. Diffusers shall be provided with air deflectors of the type indicated. Air handling troffers or combination light and ceiling diffusers shall conform to the requirements of UL Elec Const Dir for the interchangeable use as cooled or heated air supply diffusers or return air units. Ceiling mounted units shall be installed with rims tight against ceiling. Sponge rubber gaskets shall be provided between ceiling and surface mounted diffusers for air leakage control. Suitable trim shall be provided for flush mounted diffusers. Duct collar connecting the duct to diffuser shall be airtight and shall not interfere with volume controller. Return or exhaust units shall be similar to supply diffusers.

2.11.5.2 Registers and Grilles

Units shall be four-way directional-control type, except that return and exhaust registers may be fixed horizontal or vertical louver type similar in appearance to the supply register face. Registers shall be provided with sponge-rubber gasket between flanges and wall or ceiling. Wall supply registers shall be installed at least 6 inches below the ceiling unless otherwise indicated. Return and exhaust registers shall be located 6 inches above the floor unless otherwise indicated. Four-way directional control may be achieved by a grille face which can be rotated in 4 positions or by adjustment of horizontal and vertical vanes. Grilles shall be as specified for registers, without volume control damper.

2.11.6 Louvers

Louvers shall be furnished for installation in exterior walls. Louver blades shall be fabricated from anodized aluminum or galvanized steel sheets, and shall be provided with a frame of galvanized steel or aluminum structural shapes. Sheet metal thickness and fabrication shall conform to SMACNA TAB HVAC Sys. Blades shall be accurately fitted and secured to frames. Edges of louver blades shall be folded or beaded for rigidity and baffled to exclude driving rain. Louver shall be provided with bird screen. Louvers shall bear AMCA Certified Ratings Seal for air performance and water penetration ratings as described in AMCA 500.

2.12 DRAIN AND MISCELLANEOUS PIPING

Piping, fittings, valves and accessories for drain and miscellaneous services shall be in accordance with Section 15400 PLUMBING, GENERAL PURPOSE.

2.13 FACTORY COATINGS

Unless otherwise specified, equipment and component items, when fabricated from ferrous metal, shall be factory finished with the manufacturer's standard finish, except that items located outside of buildings shall have weather resistant finishes that will withstand 125 hours exposure to the salt spray test specified in ASTM B 117 using a 25 percent sodium chloride solution. Immediately after completion of the test, the specimen shall

show no signs of blistering, wrinkling, cracking, or loss of adhesion and no sign of rust creepage beyond 1/8 inch on either side of the scratch mark. Cut edges of galvanized surfaces where hot-dip galvanized sheet steel is used shall be coated with a zinc-rich coating conforming to ASTM D 520, Type I.

PART 3 EXECUTION

3.1 INSTALLATION

Work shall be performed in accordance with the manufacturer's published diagrams, recommendations, and equipment warranty requirements. Where equipment is specified to conform to the requirements of ASME BPV VIII Div 1 and ASME BPV IX, the design, fabrication, and installation of the system shall conform to ASME BPV VIII Div 1 and ASME BPV IX.

3.1.1 Equipment

Refrigeration equipment and the installation thereof shall conform to ASHRAE 15. Necessary supports shall be provided for all equipment, appurtenances, and pipe as required, including frames or supports for compressors, and similar items. If mechanical vibration isolators are not provided, vibration absorbing foundations shall be provided. Each support shall include isolation units consisting of machine and support or foundation fastenings, together with intermediate isolation material. Isolators shall be selected and sized based on load-bearing requirements and the lowest frequency of vibration to be isolated. Support drawings, bolt-setting information, and foundation bolts shall be furnished prior to support construction for all equipment indicated or required to have hangers. Equipment shall be properly leveled, aligned, and secured in place in accordance with manufacturer's instructions.

3.1.2 Building Surface Penetrations

Sleeves in nonload bearing surfaces shall be galvanized sheet metal, conforming to ASTM A 653/A 653M, Coating Class G-90, 20 gauge. Sleeves in load bearing surfaces shall be uncoated carbon steel pipe, conforming to ASTM A 53/A 53M, Standard weight. Sealants shall be applied to moisture and oil-free surfaces and elastomers to not less than 1/2 inch depth. Sleeves shall not be installed in structural members.

3.1.2.1 General Service Areas

Each sleeve shall extend through its respective wall, floor, or roof, and shall be cut flush with each surface. Pipes passing through concrete or masonry wall or concrete floors or roofs shall be provided with pipe sleeves fitted into place at the time of construction. Sleeves shall be of such size as to provide a minimum of 1/4 inch all-around clearance between bare pipe and sleeves or between jacketed-insulation and sleeves. Except in pipe chases or interior walls, the annular space between pipe and sleeve or between jacket over-insulation and sleeve shall be sealed in accordance with Section 07900 JOINT SEALING.

3.1.2.2 Escutcheons

Finished surfaces where exposed piping, bare or insulated, pass through floors, walls, or ceilings, except in boiler, utility, or equipment rooms, shall be provided with escutcheons. Where sleeves project slightly from floors, special deep-type escutcheons shall be used. Escutcheon shall be

secured to pipe or pipe covering.

3.1.3 General Piping Installation

3.1.3.1 Brazed Joints

Brazing shall be performed in accordance with AWS Brazing Hdbk, except as modified herein. During brazing, the pipe and fittings shall be filled with a pressure regulated inert gas, such as nitrogen, to prevent the formation of scale. Before brazing copper joints, both the outside of the tube and the inside of the fitting shall be cleaned with a wire fitting brush until the entire joint surface is bright and clean. Brazing flux shall not be used. Surplus brazing material shall be removed at all joints. Steel tubing joints shall be made in accordance with the manufacturer's recommendations. Joints in steel tubing shall be painted with the same material as the baked-on coating within 8 hours after joints are made. Tubing shall be protected against oxidation during brazing by continuous purging of the inside of the piping using nitrogen. Piping shall be supported prior to brazing and not be sprung or forced.

3.1.3.2 Threaded Joints

Threaded joints shall be made with tapered threads and made tight with PTFE tape complying with ASTM D 3308 or equivalent thread-joint compound applied to the male threads only. Not more than three threads shall show after the joint is made.

3.1.3.3 Welded Joints

Welded joints in steel refrigerant piping shall be fusion-welded. Changes in direction of piping shall be made with welded fittings only; mitering or notching pipe or other similar construction to form elbows or tees will not be permitted. Branch connections shall be made with welding tees or forged welding branch outlets. Steel pipe shall be thoroughly cleaned of all scale and foreign matter before the piping is assembled. During welding, the pipe and fittings shall be filled with a pressure regulated inert gas, such as nitrogen, to prevent the formation of scale. Beveling, alignment, heat treatment, and inspection of weld shall conform to ASME B31.1. Weld defects shall be removed and rewelded at no additional cost to the Government. Electrodes shall be stored and dried in accordance with AWS D1.1 or as recommended by the manufacturer. Electrodes that have been wetted or that have lost any of their coating shall not be used.

3.1.3.4 Flanged Joints

Flanged joints shall be assembled square end tight with matched flanges, gaskets, and bolts. Gaskets shall be suitable for use with the refrigerants to be handled. When steel refrigerant piping is used, union or flange joints shall be provided in each line immediately preceding the connection to each piece of equipment requiring maintenance, such as compressors, coils, refrigeration equipment, control valves, and other similar items.

3.1.3.5 Flared Connections

When flared connections are used, a suitable lubricant shall be used between the back of the flare and the nut in order to avoid tearing the flare while tightening the nut.

3.1.4 Flanges and Unions

Except where copper tubing is used, union or flanged joints shall be provided in each line immediately preceding the connection to each piece of equipment or material requiring maintenance such as coils, pumps, control valves, and other similar items.

3.1.5 Refrigeration Piping

Unless otherwise specified, pipe and fittings installation shall conform to requirements of ASME B31.5. Pipe shall be cut accurately to measurement established at the jobsite and worked into place without springing or forcing. Cutting or otherwise weakening of the building structure to facilitate piping installation will not be permitted without written approval. Pipes shall be cut square, shall have burrs removed by reaming, and shall be installed in a manner to permit free expansion and contraction without damage to joints or hangers. Filings, dust, or dirt shall be wiped from interior of pipe before connections are made.

3.1.5.1 Directional Changes

Changes in direction shall be made with fittings, except that bending of pipe 4 inches and smaller will be permitted, provided a pipe bender is used and wide-sweep bends are formed. The centerline radius of bends shall not be less than 6 diameters of the pipe. Bent pipe showing kinks, wrinkles, or other malformations will not be accepted.

3.1.5.2 Functional Requirements

Piping shall be installed 1/2 inch per 10 feet of pipe in the direction of flow to ensure adequate oil drainage. Open ends of refrigerant lines or equipment shall be properly capped or plugged during installation to keep moisture, dirt, or other foreign material out of the system. Piping shall remain capped until installation. Equipment piping shall be in accordance with the equipment manufacturer's recommendations and the contract drawings.

3.1.6 Thermometers

Thermometers located within 5 feet of floor may be rigid stem type. Where thermal well is located above 5 feet above floor, thermometer shall be universal adjustable angle type or remote element type to 7 feet above floor and remote element type where thermal well is 7 feet or more above floor. Thermometers shall be located in coolant supply and return or waste lines at each heat exchanger, condenser water lines entering and leaving the condenser, at each automatic temperature control device without an integral thermometer, refrigerant liquid line leaving receiver, refrigerant suction line at each evaporator or liquid cooler, and where indicated or required for proper operation of equipment.

3.1.7 Piping Supports

Refrigerant pipe supports shall be in accordance with ASME B31.5. Hangers used to support piping 2 inches and larger shall be fabricated to permit adequate adjustment after erection while still supporting the load. Pipe guides and anchors shall be installed to keep pipes in accurate alignment, to direct the expansion movement, and to prevent buckling, swaying, and undue strain. Piping subjected to vertical movement, when operating temperatures exceed ambient temperatures, shall be supported by variable spring hangers and supports or by constant support hangers.

3.1.7.1 Seismic Requirements

Piping and attached valves shall be supported and braced to resist seismic loads as specified under Sections 13080 SEISMIC PROTECTION FOR MISCELLANEOUS EQUIPMENT and 15070 SEISMIC PROTECTION FOR MECHANICAL EQUIPMENT . Structural steel required for reinforcement to properly support piping, headers, and equipment but not shown shall be provided under this section. Material used for support shall be as specified under Section 05120 STRUCTURAL STEEL.

3.1.7.2 Structural Attachments

Attachment to building structure concrete and masonry shall be by cast-in concrete inserts, built-in anchors, or masonry anchor devices. Inserts and anchors shall be applied with a safety factor not less than 5. Supports shall not be attached to metal decking. Masonry anchors for overhead applications shall be constructed of ferrous materials only. Material used for support shall be as specified under Section 05210 STRUCTURAL STEEL.

3.1.8 Pipe Hangers, Inserts, and Supports

Pipe hangers, inserts, and supports shall conform to MSS SP-58 and MSS SP-69, except as modified herein. Pipe hanger types 5, 12, and 26 shall not be used.

3.1.8.1 Hangers

Type 3 shall not be used on insulated piping. Type 24 may be used only on trapeze hanger systems or on fabricated frames.

3.1.8.2 Inserts

Type 18 inserts shall be secured to concrete forms before concrete is placed. Continuous inserts which allow more adjustments may be used if they otherwise meet the requirements for Type 18 inserts.

3.1.8.3 C-Clamps

Type 19 and 23 C-clamps shall be torqued per MSS SP-69 and have both locknuts and retaining devices, furnished by the manufacturer. Field-fabricated C-clamp bodies or retaining devices are not acceptable.

3.1.8.4 Angle Attachments

Type 20 attachments used on angles and channels shall be furnished with an added malleable-iron heel plate or adapter.

3.1.8.5 Saddles and Shields

Where Type 39 saddle or Type 40 shield are permitted for a particular pipe attachment application, the Type 39 saddle, connected to the pipe, shall be used on all pipe 4 inches and larger when the temperature of the medium is 60 degrees F or higher. Type 40 shields shall be used on all piping less than 4 inches and all piping 4 inches and larger carrying medium less than 60 degrees F. A high density insulation insert of cellular glass shall be used under the Type 40 shield for piping 2 inches and larger.

3.1.8.6 Horizontal Pipe Supports

Horizontal pipe supports shall be spaced as specified in MSS SP-69 and a support shall be installed not over 1 foot from the pipe fitting joint at each change in direction of the piping. Pipe supports shall be spaced not over 5 feet apart at valves.

3.1.8.7 Vertical Pipe Supports

Vertical pipe shall be supported at each floor, except at slab-on-grade, and at intervals of not more than 15 feet, not more than 8 feet from end of risers, and at vent terminations.

3.1.8.8 Pipe Guides

Type 35 guides using, steel, reinforced polytetrafluoroethylene (PTFE) or graphite slides shall be provided where required to allow longitudinal pipe movement. Lateral restraints shall be provided as required. Slide materials shall be suitable for the system operating temperatures, atmospheric conditions, and bearing loads encountered.

3.1.8.9 Steel Slides

Where steel slides do not require provisions for restraint of lateral movement, an alternate guide method may be used. On piping 4 inches and larger, a Type 39 saddle shall be used. On piping under 4 inches, a Type 40 protection shield may be attached to the pipe or insulation and freely rest on a steel slide plate.

3.1.8.10 Multiple Pipe Runs

In the support of multiple pipe runs on a common base member, a clip or clamp shall be used where each pipe crosses the base support member. Spacing of the base support members shall not exceed the hanger and support spacing required for an individual pipe in the multiple pipe run.

3.1.9 Pipe Alignment Guides

Pipe alignment guides shall be provided where indicated for expansion loops, offsets, and bends and as recommended by the manufacturer for expansion joints, not to exceed 5 feet on each side of each expansion joint, and in lines 4 inches or smaller not more than 2 feet on each side of the joint.

3.1.10 Pipe Color Code Marking

Color code marking of piping shall be as specified in Section 09900 PAINTING, GENERAL.

3.1.11 Metal Ductwork

Installation shall be in accordance with SMACNA TAB HVAC Sys unless otherwise indicated. Duct supports for sheet metal ductwork shall be in accordance with SMACNA TAB HVAC Sys, unless otherwise specified. Friction beam clamps indicated in SMACNA TAB HVAC Sys will not be used. Supports on the risers shall allow free vertical movement of the duct. Supports shall be attached only to structural framing members and concrete slabs. Supports shall not be anchored to metal decking unless a means is provided and approved for preventing the anchor from puncturing the metal decking.

Where supports are required between structural framing members, suitable intermediate metal framing shall be provided. Where C-clamps are used, retainer clips shall be provided.

3.1.12 Field Applied Insulation

Field applied insulation shall be as specified in Section 15080 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

3.1.13 Factory Applied Insulation

Refrigerant suction lines between an evaporator and compressors shall be insulated with not less than 3/4 inch thick unicellular plastic foam.

3.1.14 Framed Instructions

Framed instructions shall be framed under laminated plastic and be posted where directed. Instructions shall include equipment layout, wiring and control diagrams, piping, valves and control sequences, and typed condensed operation instructions. The condensed operation instructions shall include preventative maintenance procedures, methods of checking the system for normal and safe operation, and procedures for safely starting and stopping the system. The instructions shall be posted before acceptance testing of the system.

3.2 TESTS

Tests shall be conducted in the presence of the Contracting Officer. Utilities for testing shall be provided as specified in the SPECIAL CONTRACT REQUIREMENTS. Water and electricity required for the tests will be furnished by the Government. Any material, equipment, instruments, and personnel required for the test shall be provided by the Contractor. The services of a qualified technician shall be provided as required to perform all tests and procedures indicated herein.

3.2.1 System Performance Tests

After the foregoing tests have been completed and before each refrigeration system is accepted, tests to demonstrate the general operating characteristics of all equipment shall be conducted by a registered professional engineer or an approved manufacturer's start-up representative experienced in system start-up and testing, at such times as directed. Tests shall cover a period of not less than 48 hours for each system and demonstrate that the entire system is functioning in accordance with the drawings and specifications. Corrections and adjustments shall be made as necessary and tests shall be re-conducted to demonstrate that the entire system is functioning as specified. Prior to acceptance, service valve seal caps and blanks over gauge points shall be installed and tightened. Any refrigerant lost during the system startup shall be replaced. If tests do not demonstrate satisfactory system performance, deficiencies shall be corrected and the system shall be retested.

3.3 INSPECTIONS

At the conclusion of the one year period, cooling towers and condensers shall be inspected for problems due to corrosion, scale, and biological growth. If the cooling tower and condenser are found not to conform to the manufacturers recommended conditions, assuming the water treatment company recommendations have been followed; the water treatment company shall

provide all chemicals and labor for cleaning or repairing the equipment as required by the manufacturer's recommendations.

3.4 CLEANING AND ADJUSTING

3.4.1 Piping

Prior to testing, pipes shall be cleaned free of scale and thoroughly flushed of all foreign matter. A temporary bypass shall be provided for water coils to prevent flushing water from passing through coils. Strainers and valves shall be thoroughly cleaned. Prior to testing and balancing, air shall be removed from each water system through the use of the air vents. Temporary measures, such as piping the overflow from vents to a collecting vessel shall be taken to avoid water damage during the venting process. Air vents shall be plugged or capped after the system has been vented.

3.4.2 Ductwork

Prior to testing, inside of ducts, plenums, and casing shall be thoroughly cleaned of all debris and blown free of small particles of rubbish and dust and then vacuum cleaned before installing outlet faces. Temporary filters shall be provided for fans that are operated during construction. New filters shall be installed after all construction dirt has been removed from the building and the ducts, plenum, casings, and other items specified have been vacuum cleaned. Fans shall be adjusted to the speed indicated by the manufacturer to meet specified conditions.

3.4.3 Equipment

Equipment shall be wiped clean, with all traces of oil, dust, dirt, or paint spots removed. System shall be maintained in this clean condition until final acceptance. Bearings shall be lubricated with oil or grease as recommended by the manufacturer. Belts shall be tightened to proper tension. Control valves and other miscellaneous equipment requiring adjustment shall be adjusted to setting indicated or directed.

3.4.4 Testing, Adjusting, and Balancing

Testing, adjusting, and balancing shall be as specified in Section 15990 TESTING, ADJUSTING AND BALANCING OF HVAC SYSTEMS.

3.5 DEMONSTRATIONS

Contractor shall conduct a training course for the operating staff as designated by the Contracting Officer. The training period shall consist of a total 2 hours of normal working time and start after the system is functionally completed but prior to final acceptance tests. The field instructions shall cover all of the items contained in the approved operation and maintenance manuals as well as demonstrations of routine maintenance operations.

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SECTION 15880

FILTER SEPARATOR, FUELING SYSTEM

PART 1 GENERAL

Waiver to Use MilStds and MilSpecs in Air Force Fuel Projects, HQ AFCESA/CESM (01/29/96).

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN PETROLEUM INSTITUTE (API)

API Pub 1581	(July 2002) Specifications and Qualification Procedures-Aviation Jet Fuel Filter/Separator

ASME INTERNATIONAL (ASME)

ASME 16	(1998) Boiler and Pressure Vessel Section VIII, Pressure Vessels Division 1
ASME B16.5	(2003) Pipe Flanges and Flanged Fittings NPS 1/2 thru NPS 24
ASME B31.3	(2002) Process Piping

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 827	(1995a; R 1997el) Change in Height at Early Ages of Cylindrical Specimens from Cementitious Mixtures

DEFENSE LOGISTICS AGENCY HANDBOOK

MIL-HNDBK-831	Preparation of Test Reports

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

SAE-AMS-P-5315	(Rev. B; Notice 1) Packing Preformed, Hydrocarbon Fuel Resistant

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-PRF-4556	(Rev. F; Am 1) Coating Kit, Epoxy, for Interior of Steel Fuel Tanks
MIL-PRF-25017	(Rev. E) Inhibitor, Corrosion/Lubricity Improver, Fuel Soluble

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

CID A-A-1923	(Rev. A; Notice 1) Shield, Expansion (Lag, Machine and Externally Threaded Wedge Bolt Anchors)

MILITARY STANDARDS (MIL-STD)

MIL-STD-130	(Rev. G; Notice 1) Identification Marking of U.S. Military Property

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Filter Separator; G-AE.

Submit scaled drawings showing dimensions, tolerances, connection sizes of the vessel and accessories. Submit shop drawings for elements. Shop drawings shall include number and arrangement of elements. Shop drawings for this Section shall be submitted for Government approval. Submit technical literature on the vessel, elements, and accessories, which is the manufacturer's published literature.

SD-07 Certificates

Filter Separator.

If product has been previously tested and approved by the Government, submit certification of qualification under API Pub 1581, Category M, Type S/LD. Include description of qualification, which contains element types and quantities, and provide details of the configurations of vessels tested. Include name of Government Agency and date of approval.

SD-10 Operation and Maintenance Data

Filter Separator; G-AE.

Operation and maintenance information shall be submitted for equipment specified herein. Refer to Section 01730 FUEL SYSTEM OPERATION AND MAINTENANCE MANUAL.

1.3 PREPRODUCTION TESTING

1.3.1 Preproduction Testing

Prior to construction of filter separators (FSI-1 THROUGH FSI-5, FSR-6, AND FSR-7) for the project, preproductions tests shall have been conducted in the presence of a Det 3, WR-ALC/AFTH Technical Assistance Team Air Force Petroleum Office Wright-Patterson AFB, OH representative. The Contractor shall give the Contracting Officer 30 days notice prior to conductance of

factory tests in order to schedule witnessing by representative.

1.3.1.1 Inspection and Testing

The inspection and testing of the preproduction filter separator shall be conducted on a full-scale test system in accordance with API Pub 1581 and as specified herein. The test sample shall consist of a complete filter separator with elements installed. Elements shall be representative of a production lot. The filter separator, coalescers, and separator screens shall be identified with the manufacturer's part number.

1.3.1.2 Deviations from API Publ 1581

The following are deviations to API Pub 1581 for test requirements Category M, Type S/LD all tests 1, 2, 3, and 4.

The allowable effluent fuel contamination limit for free water shall be as follows:

(a) The average free water content in a test set shall not exceed 5 parts per million.

(b) Additive D shall be Stadis 450 manufactured by E.I. DuPont & Nemours Co. in lieu of ASA 3.

(c) Additive C shall be DCI-4A conforming to MIL-PRF-25017.

1.3.1.3 Data Required Prior to Tests

Submit installation data to enable Government representative to verify that the equipment has been installed and operated correctly. Submit certification from the manufacturer that the test vessel has passed a hydrostatic pressure test, and that the design conforms to API Pub 1581, Category M, Type S/LD. Submit two sets of assembly drawings of the test vessel and accessories for approval.

1.3.1.4 Submittal of Test Documents

The test report shall be submitted to the Command Fuel Facilities Engineer or Det 3, WR-ALC/AFTH for Government approval. Prepare report in accordance with MIL-HNDBK-831. In addition to results, the report shall contain complete records of the tests including data sheets, performance curves, chronological test records, photographs, sample calculations, test procedures, and a description of the test apparatus. Submit color photographs of the sample elements before and after tests. Submit one new coalescer element and one new separator element.

1.3.1.5 Required Preproduction Tests

a. Examination. A visual examination of the filter separator housing and each element shall be performed to ensure compliance with the drawings and verify workmanship requirements.

b. Hydrostatic Pressure Tests. The filter separator shall be subjected to a hydrostatic pressure of 338 pounds per square inch gage (PSIG) per requirements of the ASME 16. In addition, the inlet manifold or chamber (after installation) shall be blanked off and tested to 115 PSIG.

c. Full Scale Performance Test. The filter separator with a full

set of coalescer and separator elements shall be tested to the API Pub 1581 Category M, Type S/LD at 600 GPM for FSI-1 through FSI-5, and 1200 GPM for FSR-6 and FSR-7 in accordance with API Pub 1581 Test Method Group II, Test Series No. 2, except as otherwise specified.

d. Single Element Test. Test 1, 2, 3, and 4 to M level shall be run in an appropriate scale single element test vessel per API Pub 1581, as modified by paragraph "Deviations from API Pub 1581."

e. Coalescer Structural Test. A minimum of three coalescer elements, after being subjected to the full scale test described in paragraph entitled "Full Scale Performance Test", above, shall be subjected to a differential pressure test until rupture to determine structural strength. Each element shall be capable of withstanding a differential pressure of at least 75 PSI without rupture or bypassing of seals.

f. Disassembly Inspection. Upon completion of the tests specified above, the filter separator shall be disassembled and inspected to determine the condition of the coalescer and separator elements. Defects in the element such as swelling of the elements, or damaged gaskets shall be noted. Swelling of or damage to the elements or other parts shall be cause for rejection.

PART 2 PRODUCTS

2.1 DESIGN CONDITIONS

Design conditions shall be as specified in Section 15050 MECHANICAL EQUIPMENT, FUELING and as modified herein.

2.2 WORKMANSHIP

Each filter separator, including all parts and accessories, shall be free from blemishes, defects, burrs and sharp edges. The vessel shall exhibit accuracy of dimensions, accurate radii of fillets and complete marking of parts and assemblies.

2.3 CLEANING

Components of the filter separators shall be cleaned to remove dirt; excess soldering; brazing, and welding flux; welding slag; loose, spattered, or excess solder; metal chips; and other foreign materials before, during and after assembly.

2.4 WELDING

Welding shall be in accordance with ASME B31.3.

2.5 MATERIALS OF CONSTRUCTION

2.5.1 Housing

a. Carbon steel with internal epoxy coating.
b. FLOAT ASSEMBLY. Stainless steel.
c. MANUAL DRAIN VALVE. Stainless steel.
d. SIGHT GLASS. Armored clear pyrex with nickel-copper alloy ball checks.
e. DIFFERENTIAL GAUGE. Corrosion resistant piston with stainless steel valves.

f. SEPARATORS. 200 mesh stainless steel, coated on both sides with Teflon.

2.6 FILTER SEPARATOR CONSTRUCTION

2.6.1 Housing Vessel

Each filter separator housing shall be fabricated from carbon steel and shall be internally coated with an epoxy coating in accord with MIL-PRF-4556. Coat the exterior with alkalyd resin primer (universal metal primer). Each unit shall be constructed and labeled in accordance with ASME 16. The housing shall be designed for a working pressure of 225 PSIG. Each unit shall be horizontal, end-opening type with coalescers and separators mounted side-by-side (coalescers at the bottom of the vessel and separators at the top). The head opening shall be equipped with a hinged or pivoting device to facilitate swinging the head to one side for servicing. The hinges or pivots shall support the head during servicing without distortion or misalignment. Swing-type bolts shall be used on all main closures. Unit shall be provided with 3-inch inside diameter lifting eyes spaced to support a weight of 2-1/2 times the gross weight of the filter separator. The configuration of the pressure vessel shall be as shown on the drawings. The housing shall be provided with a 3/4-inch inlet compartment fuel drain plug. A hand hole access plate shall be provided in the inlet compartment. The head shall be sealed to the body by means of an O-ring, meeting requirements of SAE-AMS-P-5315, mounted in a circular groove at the point of closure. Threaded base mounting adapters shall be provided for the coalescers. The separators shall be mounted on adapters with blunted Vee-type knife edges. Height of Vee section to be 0.06 inches, plus or minus 10 percent. Deck mounting plates shall have at least a 3% positive slope. Weld ridges shall not prevent liquid from draining. The filter separator vessel shall be able to withstand a force of 2,400 pounds and a moment of 2,400 foot-pounds at the flanges.

2.6.2 Legs

Four 3 x 3 x 1/4 inch angle-shaped legs shall be welded to the housing. Each leg shall be fitted with a 4 x 4 x 1/2-inch base plate drilled through with a 3/4-inch hole.

2.6.3 Inlet and Outlet Connections

The inlet and outlet connections shall be 6 inch nominal pipe size for FSI-1 through FSI-5 and 8 inch nominal pipe size for FSR-6 and FSR-7 and shall be located parallel to each other as shown on the drawings. Inlet connection shall be provided with raised face flanges, faced and drilled in compliance with ASME B16.5, Class 150. Outlet connection flange face shall match Filter Separator Control Valve (FSCV).

2.6.4 Manual Drain Valve

Each filter separator shall be equipped with a 1-inch stainless steel manual ball valve water and fuel drain. The valve shall be capable of draining all water, fuel and sediment from the filter separator by gravity. The valve shall be installed below the sump of the housing as shown on the drawings.

2.6.5 Sight Gauge

A 1/2-inch armored, clear pyrex liquid level gauge shall be provided for

observing the water accumulation in the sump. The gauge shall be equipped with stainless steel ball checks in both the upper and lower fittings, an upper and lower shutoff valve, and a bottom blowoff cock. The gauge will contain a colored density sensitive ball.

2.6.6 Differential Pressure Gauge

The housing shall be equipped with a direct-reading, piston type differential pressure gauge that measures the differential pressure across both coalescers and separators. The gauge shall consist of a spring-supported, corrosion resistant piston moving inside a glass cylinder, with high pressure applied on top of the piston and low pressure applied below it. Under a differential pressure of 30 PSI, leakage past the piston shall not exceed 120 drops per minute. The cylinder shall have stainless steel and flanges with Viton O-ring seals. The high pressure inlet of the gauge shall have a 10-micron pleated paper filter and the low pressure connection shall have a fine mesh stainless steel strainer. The gauge shall have an operating pressure of 300 PSI. Differential pressure range of the gauge through approximately 3 inches of piston movement shall be 0-30 PSI with an accuracy of $\pm$ 0.5 PSI, calibrated linearly with one PSI scale graduations. High and low pressure connections shall be 1/4 inch NPT female with a stainless steel bar stock valve at each connection. Construction of the gauge shall be such that a 3-valve manifold is not necessary. If only one bar stock valve is closed, the gauge shall not be damaged by up to 300 PSI differential pressure in either direction. The differential pressure gauge shall be attached to the filter separator by a gauge panel. A pressure gauge shall be attached to the differential pressure gauge to indicate the high pressure and have a range of 300 psi.

2.6.7 Automatic Air Eliminator and Pressure Relief Valves

A 1-inch angle pattern pressure relief valve shall be provided on top of each vessel. An automatic air eliminator shall be installed on the highest point of the vessel and shall have check valve feature. The air eliminator shall release at pressures up to 150 psi with no fuel leakage allowed.

2.6.8 Sampling Connections

Sampling connections shall be provided at the inlet and outlet connections to the housing. Each sampling connection shall consist of a 1/4-inch sampling probe where the probe faces upstream, ball valve, a quick disconnect coupling and aluminum dust cap. The sampling connections shall be capable of accepting a sampling kit for drawing the samples required to assure fuel quality.

2.6.9 Spider Assembly

Each filter separator shall contain a spider assembly to hold the coalescers and separators in position, to support them firmly against vibration. The method of stabilization shall assure an electrical bond between the spider and the vessel.

2.6.10 Coalescer and Separator Cartridges

Each filter separator shall be provided with coalescers and separators that have been qualified to the performance requirements of API Pub 1581, Group Category M, Type S/LD. Coalescers shall have a minimum capacity of 2.27 gpm per inch of length, and separators shall have a minimum capacity of 8.33 gpm per inch of length.

2.6.11 Control Valve Accessories

Provide each filter separator with a control valve (FSCV), manual water drain valve, and float control valve (FC) with manual tester as specified in Section entitled "Control Valves" and shall be of the same manufacturer.

2.6.11.1 Float Control Pilot and Tester

Each housing sump shall be fitted with a float control pilot and tester specified in Section 15101 CONTROL VALVES and shall be of the same manufacturer as the control valves.

2.6.12 Identification of Product

Equipment, assemblies, and parts shall be marked for identification in accordance with MIL-STD-130. The main equipment nameplate shall be mounted on the housing, and in addition to the usual MIL-STD-130 requirements, shall include the following markings in letters 3/32 inch high or larger:

Filter Separator, Liquid Fuel_____

Design Flow-Rate_____

Design Pressure_____

Elements_____

First Stage _____ Mfg. Part No. *_____

Second Stage _____ Mfg. Part No. *_____

Contract No. *_____

Manufacturer *_____

Specification*_____

*Applicable information shall be entered by the Contractor.
*Applicable information shall be stenciled by LFM personnel.

2.6.13 Assembly

Each filter separator shall come assembled with all accessories and shall be ready for use. The functions of all components shall be tested prior to shipment and no assembly or field adjustment of valves or components shall be required.

2.7 MICRONIC PREFILTER CONSTRUCTION

2.7.1 Housing Vessel

Each prefilter housing shall be fabricated from carbon steel and shall be internally coated with an epoxy coating in accord with MIL-PRF-4556. Coat the exterior with alkalyd resin primer (universal metal primer). Each unit shall be constructed and labeled in accordance with ASME 16. The housing shall be designed for a working pressure of 225 PSIG. Each unit shall be horizontal, end-opening type with filters mounted side-by-side. The head opening shall be equipped with a hinged or pivoting device to facilitate

swinging the head to one side for servicing. The hinges or pivots shall support the head during servicing without distortion or misalignment. Swing-type bolts shall be used on all main closures. Unit shall be provided with 3-inch inside diameter lifting eyes spaced to support a weight of 2-1/2 times the gross weight of the filter separator. The configuration of the pressure vessel shall be as shown on the drawings. The housing shall be provided with a 3/4-inch inlet compartment fuel drain plug. A hand hole access plate shall be provided in the inlet compartment. The head shall be sealed to the body by means of an O-ring, meeting requirements of SAE-AMS-P-5315, mounted in a circular groove at the point of closure. The filter cartridges shall be mounted on adapters with blunted Vee-type knife edges. Height of Vee section to be 0.06 inches, plus or minus 10 percent.

2.7.2 Legs

Four 3 x 3 x 1/4 inch angle-shaped legs shall be welded to the housing. Each leg shall be fitted with a 4 x 4 x 1/2-inch base plate drilled through with a 3/4-inch hole.

2.7.3 Inlet and Outlet Connections

The inlet and outlet connections shall be 8 inch nominal pipe size and shall be located parallel to each other as shown on the drawings. Connections shall be provided with raised face flanges, faced and drilled in compliance with ASME B16.5, Class 150.

2.7.4 Manual Drain Valve

Each filter separator shall be equipped with a 1-inch stainless steel manual ball valve water and fuel drain. The valve shall be capable of draining all water, fuel and sediment from the filter separator by gravity. The valve shall be installed below the sump of the housing as shown on the drawings.

2.7.5 Sight Gauge

A 1/2-inch armored, clear pyrex liquid level gauge shall be provided for observing the water accumulation in the sump. The gauge shall be equipped with stainless steel ball checks in both the upper and lower fittings, an upper and lower shutoff valve, and a bottom blowoff cock. The gauge will contain a colored density sensitive ball.

2.7.6 Differential Pressure Gauge

The housing shall be equipped with a direct-reading, piston type differential pressure gauge that measures the differential pressure across both coalescers and separators. The gauge shall consist of a spring-supported, corrosion resistant piston moving inside a glass cylinder, with high pressure applied on top of the piston and low pressure applied below it. Under a differential pressure of 30 PSI, leakage past the piston shall not exceed 120 drops per minute. The cylinder shall have stainless steel and flanges with Viton O-ring seals. The high pressure inlet of the gauge shall have a 10-micron pleated paper filter and the low pressure connection shall have a fine mesh stainless steel strainer. The gauge shall have an operating pressure of 300 PSI. Differential pressure range of the gauge through approximately 3 inches of piston movement shall be 0-30 PSI with an accuracy of $\pm$ 0.5 PSI, calibrated linearly with one PSI scale graduations. High and low pressure connections shall be 1/4 inch NPT

female with a stainless steel bar stock valve at each connection. Construction of the gauge shall be such that a 3-valve manifold is not necessary. If only one bar stock valve is closed, the gauge shall not be damaged by up to 300 PSI differential pressure in either direction. The differential pressure gauge shall be attached to the filter separator by a gauge panel. A pressure gauge shall be attached to the differential pressure gauge to indicate the high pressure and have a range of 300 psi.

2.7.7 Automatic Air Eliminator and Pressure Relief Valves

A 1-inch angle pattern pressure relief valve shall be provided on top of each vessel. An automatic air eliminator shall be installed on the highest point of the vessel and shall have check valve feature. The air eliminator shall release at pressures up to 150 psi with no fuel leakage allowed.

2.7.8 Sampling Connections

Sampling connections shall be provided at the inlet and outlet connections to the housing. Each sampling connection shall consist of a 1/4-inch sampling probe where the probe faces upstream, ball valve, a quick disconnect coupling and aluminum dust cap. The sampling connections shall be capable of accepting a sampling kit for drawing the samples required to assure fuel quality.

2.7.9 Spider Assembly

The prefilter shall contain a spider assembly to hold the filter cartridges in position, to support them firmly against vibration. The method of stabilization shall assure an electrical bond between the spider and the vessel.

2.7.10 Filter Cartridges

The prefilter shall be provided with 5 micron pleated media filter cartridges. Filter cartridges shall have a minimum efficiency of 98% and a minimum collapse strength of 75 psig.

2.7.11 Identification of Product

Equipment, assemblies, and parts shall be marked for identification in accordance with MIL-STD-130. The main equipment nameplate shall be mounted on the housing, and in addition to the usual MIL-STD-130 requirements, shall include the following markings in letters 3/32 inch high or larger:

Micronic Prefilter, Liquid Fuel_____

Design Flow-Rate_____

Design Pressure_____

Elements_____

First Stage _____ Mfg. Part No. *_____

Second Stage _____ Mfg. Part No. *_____

Contract No. *_____

Manufacturer *_____

Specification*_____

*Applicable information shall be entered by the Contractor.
*Applicable information shall be stenciled by LFM personnel.

2.7.12 Assembly

The prefilter shall come assembled with all accessories and shall be ready for use. The functions of all components shall be tested prior to shipment and no assembly or field adjustment of valves or components shall be required.

PART 3 EXECUTION

3.1 INSTALLATION

Install equipment and components in position, true to line, level and plumb and measured from established benchmarks or reference points. Follow manufacturer's recommended practices for equipment installation. Provide required clearance between equipment components. Equipment apparatus, and accessories requiring normal servicing or maintenance to be accessible.

3.1.1 Anchoring

Anchor equipment in place. Check alignment of anchor bolts before installing equipment and cleanout associated sleeves. Do not cut bolts because of misalignment. Notify Contracting Officer of errors and obtain the Contracting Officer's acceptance before proceeding with corrections. Cut anchor bolts of excess length to the appropriate length without damage to threads. Where anchor bolts or like devices have not been installed, provide appropriate self-drilling type anchors for construction condition. Expansion bolt anchors provided shall be in accordance with CID A-A-1923, Type 4, Class One, half-inch size.

3.1.2 Grouting

Equipment, which is anchored to a pad, shall be grouted in place where applicable. Before setting equipment in place and before placing grout, clean surfaces to be in contact with grout, including fasteners and sleeves. Remove standing water, debris, oil, rust, coatings and other materials which impair bond. Clean contaminated concrete by grinding or other acceptable means. Provide necessary formwork for placing and retaining grout. Grout to be nonmetallic, nonshrink, fluid precision grout of a hydraulic cementitious system with graded and processed silica aggregate, Portland cement, shrinkage compensating agents, plasticizing and water reducing agents; free of aluminum power agents, oxidizing agents and inorganic accelerators, including chlorides; proportioned, premixed and packaged at factory with only the addition of water required at the project site. Grouting to meeting requirements of ASTM C 827. Perform grouting in accord with ACI, equipment manufacturer's, and grout manufacturer's published specifications and recommendations.

3.1.3 Leveling and Aligning

Level and align equipment in accordance with respective manufacturer's published data. Do not use anchor bolts, jack-nuts or wedges to support, level or align equipment. Install only flat shims for leveling equipment. Place shims to fully support equipment. Wedging is not permitted. Shims

to be fabricated flat carbon steel units of surface configuration and area not less than equipment bearing surface. Shims to provide for full equipment support. Shims to have smooth surfaces and edges, free from burrs and slivers. Flame or electrode cut edges not acceptable.

3.1.4 Painting

Equipment painting shall be specified in Section 15060 PIPE, MANUAL VALVES, AND FITTINGS, FUELING SYSTEM.

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DIVISION 15 - MECHANICAL

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SECTION 15895

AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEM

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AIR CONDITIONING AND REFRIGERATION INSTITUTE (ARI)

ARI 410	(2001) Forced-Circulation Air-Cooling and Air-Heating Coils
ARI 430	(1999) Central-Station Air-Handling Units
ARI Guideline D	(1996) Application and Installation of Central Station Air-Handling Units

AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL (AMCA)

AMCA 210	(1999) Laboratory Methods of Testing Fans for Rating
AMCA 300	(1996) Reverberant Room Method for Sound Testing of Fans
AMCA 500	(1994) Test Methods for Louvers, Dampers and Shutters

AMERICAN BEARING MANUFACTURERS ASSOCIATION (ABMA)

AFBMA Std 9	(1990) Load Ratings and Fatigue Life for Ball Bearings
AFBMA Std 11	(1990) Load Ratings and Fatigue Life for Roller Bearings

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 53/A 53M	(2002) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 123/A 123M	(2002) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 181/A 181M	(2001) Carbon Steel Forgings for General-Purpose Piping
ASTM A 193/A 193M	(2001b) Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service

ASTM A 234/A 234M	(2002) Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service
ASTM A 733	(2001) Welded and Seamless Carbon Steel and Austenitic Stainless Steel Pipe Nipples
ASTM A 924/A 924M	(1999) General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
ASTM B 62	(2002) Composition Bronze or Ounce Metal Castings
ASTM B 75	(2002) Seamless Copper Tube
ASTM B 88	(2002) Seamless Copper Water Tube
ASTM B 117	(1997) Operating Salt Spray (Fog) Apparatus
ASTM B 813	(2000) Liquid and Paste Fluxes for Soldering Applications of Copper and Copper Alloy Tube
ASTM C 1071	(1998) Thermal and Acoustical Insulation (Glass Fiber, Duct Lining Material)
ASTM D 520	(1984; R 1995el) Zinc Dust Pigment
ASTM D 1384	(2001) Corrosion Test for Engine Coolants in Glassware
ASTM D 1654	(1992; R 2000) Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
ASTM D 3359	(1997) Measuring Adhesion by Tape Test
ASTM E 437	(1992; R 1997) Industrial Wire Cloth and Screens (Square Opening Series)
ASTM F 1200	(1988; R 1998) Fabricated (Welded) Pipe Line Strainers (Above 150 psig and 150 degrees F)

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 52.1	(1992) Gravimetric and Dust-Spot Procedures for Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter
ASHRAE 68	(1997) Laboratory Method of Testing In-Duct Sound Power Measurement Procedures for Fans
ASHRAE 70	(1991) Method of Testing for Rating the

Performance of Air Outlets and Inlets

ASME INTERNATIONAL (ASME)

ASME B1.20.1	(1983; R 2001) Pipe Threads, General Purpose (Inch)
ASME B16.3	(1998) Malleable Iron Threaded Fittings
ASME B16.5	(2003) Pipe Flanges and Flanged Fittings NPS 1/2 thru NPS 24
ASME B16.9	(2001) Factory-Made Wrought Steel Buttwelding Fittings
ASME B16.11	(2001) Forged Fittings, Socket-Welding and Threaded
ASME B16.18	(2001) Cast Copper Alloy Solder Joint Pressure Fittings
ASME B16.21	(1992) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B16.22	(2002) Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
ASME B16.26	(1988) Cast Copper Alloy Fittings for Flared Copper Tubes
ASME B16.39	(1998) Malleable Iron Threaded Pipe Unions Classes 150, 250, and 300
ASME B31.1	(2001) Power Piping
ASME B40.1	(1991) Gauges - Pressure Indicating Dial Type - Elastic Element
ASME BPV IX	(1998) Boiler and Pressure Vessel Code; Section IX, Welding and Brazing Qualifications

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1	(2000) Structural Welding Code - Steel

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-25	(1998) Standard Marking System for Valves, Fittings, Flanges and Unions
MSS SP-58	(1993) Pipe Hangers and Supports - Materials, Design and Manufacture
MSS SP-69	(1999) Pipe Hangers and Supports - Selection and Application
MSS SP-70	(1998) Cast Iron Gate Valves, Flanged and

	Threaded Ends
MSS SP-71	(1997) Gray Iron Swing Check Valves, Flanges and Threaded Ends
MSS SP-72	(1999) Ball Valves with Flanged or Butt-Welding Ends for General Service
MSS SP-80	(1997) Bronze Gate, Globe, Angle and Check Valves
MSS SP-85	(1994) Cast Iron Globe & Angle Valves, Flanged and Threaded Ends
MSS SP-110	(1996) Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 1	(2003) Motors and Generators

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 90A	(1999) Installation of Air Conditioning and Ventilating Systems

SHEET METAL & AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA HVAC Duct Const Stds	(1995; Addenda Nov 1997; 6th Printing 2001) HVAC Duct Construction Standards - Metal and Flexible
SMACNA Install Fire Damp HVAC	(1992; 5th edition, 2002) Fire, Smoke and Radiation Damper Installation Guide for HVAC Systems

UNDERWRITERS LABORATORIES (UL)

UL 181	(1996; Rev Dec 1998) Factory-Made Air Ducts and Air Connectors
UL 214	(1997; Rev thru Aug 2001) Tests for Flame-Propagation of Fabrics and Films
UL 555	(1999; Rev thru Jan 2002) Fire Dampers
UL 586	(1996; Rev thru Apr 2000) High-Efficiency, Particulate, Air Filter Units
UL 900	(1994; Rev thru Nov 1999) Test Performance of Air Filter Units
UL Bld Mat Dir	(1999) Building Materials Directory
UL Elec Const Dir	(2001) Electrical Construction Equipment Directory

UL Fire Resist Dir (2001) Fire Resistance Directory (2 Vol.)

1.2 COORDINATION OF TRADES

Ductwork, piping offsets, fittings, and accessories shall be furnished as required to provide a complete installation and to eliminate interference with other construction.

1.3 DELIVERY AND STORAGE

Equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variations, dirt and dust, or other contaminants.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Drawings; G-AE
Installation; G-AO

Drawings shall consist of equipment layout including assembly and installation details and electrical connection diagrams; ductwork layout showing the location of all supports and hangers, typical hanger details, gauge reinforcement, reinforcement spacing rigidity classification, and static pressure and seal classifications; and piping layout showing the location of all guides and anchors, the load imposed on each support or anchor, and typical support details. Drawings shall include any information required to demonstrate that the system has been coordinated and will properly function as a unit and shall show equipment relationship to other parts of the work, including clearances required for operation and maintenance.

SD-03 Product Data

Components and Equipment; G-AE

Manufacturer's catalog data shall be included with the detail drawings for the following items. The data shall be highlighted to show model, size, options, etc., that are intended for consideration. Data shall be adequate to demonstrate compliance with contract requirements for the following:

a. Piping Components

b. Ductwork Components

c. Air Systems Equipment

d. Air Handling Units

Test Procedures; G-AO

Proposed test procedures for piping hydrostatic test, ductwork leak test, and performance tests of systems, at least 2 weeks prior to the start of related testing.

Welding Procedures; G-AO

A copy of qualified welding procedures, at least 2 weeks prior to the start of welding operations.

System Diagrams; G-AO

Proposed diagrams, at least 2 weeks prior to start of related testing. System diagrams that show the layout of equipment, piping, and ductwork, and typed condensed operation manuals explaining preventative maintenance procedures, methods of checking the system for normal, safe operation, and procedures for safely starting and stopping the system shall be framed under glass or laminated plastic. After approval, these items shall be posted where directed.

Similar Services; G-AO,

Statement demonstrating successful completion of similar services on at least 5 projects of similar size and scope, at least 2 weeks prior to submittal of other items required by this section.

Welding Joints;

A list of names and identification symbols of qualified welders and welding operators, at least 2 weeks prior to the start of welding operations.

Testing, Adjusting and Balancing; G-AO

Proposed test schedules for hydrostatic test of piping, ductwork leak test, and performance tests, at least 2 weeks prior to the start of related testing.

Field Training;

Proposed schedule for field training, at least 2 weeks prior to the start of related training.

SD-06 Test Reports

Performance Tests; G-AO

Test reports for the piping hydrostatic test, ductwork leak test, and performance tests in booklet form, upon completion of testing. Reports shall document phases of tests performed including initial test summary, repairs/adjustments made, and final test results.

SD-07 Certificates

Bolts;

Written certification from the bolt manufacturer that the bolts furnished comply with the requirements of this specification. The certification shall include illustrations of product markings, and the number of each type of bolt to be furnished.

SD-10 Operation and Maintenance Data

Operating and Maintenance Instructions; G-AO

Six manuals listing step-by-step procedures required for system startup, operation, shutdown, and routine maintenance, at least 2 weeks prior to field training. The manuals shall include the manufacturer's name, model number, parts list, list of parts and tools that should be kept in stock by the owner for routine maintenance including the name of a local supplier, simplified wiring and controls diagrams, troubleshooting guide, and recommended service organization (including address and telephone number) for each item of equipment. Each service organization submitted shall be capable of providing 4 hour onsite response to a service call on an emergency basis.

PART 2 PRODUCTS

2.1 STANDARD PRODUCTS

Components and equipment shall be standard products of a manufacturer regularly engaged in the manufacturing of products that are of a similar material, design and workmanship. The standard products shall have been in satisfactory commercial or industrial use for 2 years before bid opening. The 2-year experience shall include applications of components and equipment under similar circumstances and of similar size. The 2 years must be satisfactorily completed by a product which has been sold or is offered for sale on the commercial market through advertisements, manufacturers' catalogs, or brochures. Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation, for not less than 6000 hours exclusive of the manufacturer's factory tests, can be shown. The equipment items shall be supported by a service organization.

2.2 ASBESTOS PROHIBITION

Asbestos and asbestos-containing products shall not be used.

2.3 NAMEPLATES

Equipment shall have a nameplate that identifies the manufacturer's name, address, type or style, model or serial number, and catalog number.

2.4 EQUIPMENT GUARDS AND ACCESS

Belts, pulleys, chains, gears, couplings, projecting setscrews, keys, and other rotating parts exposed to personnel contact shall be fully enclosed or guarded according to OSHA requirements. High temperature equipment and piping exposed to contact by personnel or where it creates a potential fire hazard shall be properly guarded or covered with insulation of a type specified.

2.5 PIPING COMPONENTS

2.5.1 Steel Pipe

Steel pipe shall conform to ASTM A 53/A 53M, Schedule 40, Grade A or B, Type E or S.

2.5.2 Joints and Fittings For Steel Pipe

Joints shall be welded, flanged, threaded, or grooved as indicated. If not otherwise indicated, piping 1 inch and smaller shall be threaded; piping larger than 1 inch and smaller than 3 inches shall be either threaded, grooved, or welded; and piping 3 inches and larger shall be grooved, welded, or flanged. Rigid grooved mechanical joints and fittings may only be used in serviceable aboveground locations where the temperature of the circulating medium does not exceed 230 degrees F. Flexible grooved joints shall be used only as a flexible connector with grooved pipe system. Unless otherwise specified, grooved piping components shall meet the corresponding criteria specified for the similar welded, flanged, or threaded component specified herein. The manufacturer of each fitting shall be permanently identified on the body of the fitting according to MSS SP-25.

2.5.2.1 Welded Joints and Fittings

Welded fittings shall conform to ASTM A 234/A 234M, and shall be identified with the appropriate grade and marking symbol. Butt-welded fittings shall conform to ASME B16.9. Socket-welded fittings shall conform to ASME B16.11.

2.5.2.2 Flanged Joints and Fittings

Flanges shall conform to ASTM A 181/A 181M and ASME B16.5, Class 150. Gaskets shall be nonasbestos compressed material according to ASME B16.21, 1/16 inch thickness, full face or self-centering flat ring type. The gaskets shall contain aramid fibers bonded with styrene butadiene rubber (SBR) or nitrile butadiene rubber (NBR). Bolts, nuts, and bolt patterns shall conform to ASME B16.5. Bolts shall be high or intermediate strength material conforming to ASTM A 193/A 193M.

2.5.2.3 Threaded Joints and Fittings

Threads shall conform to ASME B1.20.1. Unions shall conform to ASME B16.39, Class 150. Nipples shall conform to ASTM A 733. Malleable iron fittings shall conform to ASME B16.3, type as required to match piping.

2.5.2.4 Dielectric Unions and Flanges

Dielectric unions shall have the tensile strength and dimensional requirements specified. Unions shall have metal connections on both ends threaded to match adjacent piping. Metal parts of dielectric unions shall be separated with a nylon insulator to prevent current flow between dissimilar metals. Unions shall be suitable for the required operating pressures and temperatures. Dielectric flanges shall provide the same pressure ratings as standard flanges and provide complete electrical isolation.

2.5.3 Copper Tube

Copper tube shall conform to ASTM B 88, Type K or L.

2.5.4 Joints and Fittings For Copper Tube

Wrought copper and bronze solder-joint pressure fittings shall conform to ASME B16.22 and . ASTM B 75. Cast copper alloy solder-joint pressure fittings shall conform to ASME B16.18. Cast copper alloy fittings for flared copper tube shall conform to ASME B16.26 and ASTM B 62. Brass or bronze adapters for brazed tubing may be used for connecting tubing to flanges and to threaded ends of valves and equipment. Extracted brazed tee joints produced with an acceptable tool and installed as recommended by the manufacturer may be used.

2.5.5 Valves

Valves shall be Class 125 and shall be suitable for the intended application. Valves shall meet the material, fabrication and operating requirements of ASME B31.1. Chain operators shall be provided for valves located 10 feet or higher above the floor. Valves in sizes larger than 1 inch and used on steel pipe systems, may be provided with rigid grooved mechanical joint ends. Such grooved end valves shall be subject to the same requirements as rigid grooved mechanical joints and fittings and, shall be provided by the same manufacturer as the grooved pipe joint and fitting system.

2.5.5.1 Gate Valves

Gate valves 2-1/2 inches and smaller shall conform to MSS SP-80 and shall be bronze with rising stem and threaded, solder, or flanged ends. Gate valves 3 inches and larger shall conform to MSS SP-70 and shall be cast iron with bronze trim, outside screw and yoke, and flanged or threaded ends.

2.5.5.2 Globe Valves

Globe valves 2-1/2 inches and smaller shall conform to MSS SP-80, bronze, threaded, soldered, or flanged ends. Globe valves 3 inches and larger shall conform to MSS SP-85 and shall be cast iron with bronze trim and flanged, or threaded ends.

2.5.5.3 Check Valves

Check valves 2-1/2 inches and smaller shall conform to MSS SP-80 and shall be bronze with threaded, soldered, or flanged ends. Check valves 3 inches and larger shall conform to MSS SP-71and shall be cast iron with bronze trim and flanged or threaded ends.

2.5.5.4 Angle Valves

Angle valves 2-1/2 inches and smaller shall conform to MSS SP-80 and shall be bronze with threaded, soldered, or flanged ends. Angle valves 3 inches and larger shall conform to MSS SP-85and shall be cast iron with bronze trim and flanged, or threaded ends.

2.5.5.5 Ball Valves

Ball valves 1/2 inch and larger shall conform to MSS SP-72 or MSS SP-110, and shall be ductile iron or bronze with threaded, soldered, or flanged ends.

2.5.5.6 Balancing Valves

Balancing valves 2 inches or smaller shall be bronze with NPT connections for black steel pipe and brazed connections for copper tubing. Valves 1 inch or larger may be all iron with threaded or flanged ends. The valves shall have a square head or similar device and an indicator arc and shall be designed for 250 degrees F. Iron valves shall be lubricated, nonlubricated, or tetrafluoroethylene resin-coated plug valves. In lieu of plug valves, ball valves may be used. Plug valves and ball valves 8 inches or larger shall be provided with manual gear operators with position indicators. In lieu of balancing valves specified , automatic flow control valves may be provided to maintain constant flow, and shall be designed to be sensitive to pressure differential across the valve to provide the required opening. Valves shall be selected for the flow required and provided with a permanent nameplate or tag carrying a permanent record of the factory-determined flow rate and flow control pressure levels. Valves shall control the flow within 5 percent of the tag rating. Valves shall be suitable for the maximum operating pressure of 125 psig or 150 percent of the system operating pressure, whichever is the greater. Where the available system pressure is not adequate to provide the minimum pressure differential that still allows flow control, the system pump head capability shall be appropriately increased. Where flow readings are provided by remote or portable meters, valve bodies shall be provided with tapped openings and pipe extensions with shutoff valves outside of pipe insulation. The pipe extensions shall be provided with quick connecting hose fittings for a portable meter to measure the pressure differential across the automatic flow control valve. A portable meter furnished with accessory kit as recommended by the automatic valve manufacturer shall be provided. Automatic flow control valve specified may be substituted for venturi tubes or orifice plate flow measuring devices.

2.5.5.7 Air Vents

Automatic air vents shall be float type, cast iron, stainless steel, or forged steel construction, suitable for pressure rating of piping system. Air vents installed in piping in chase walls or other inaccessible places shall be provided with an access panel.

2.5.6 Strainers

Strainer shall be in accordance with ASTM F 1200, except as modified herein. Strainer shall be the cleanable, basket or "Y" type, the same size as the pipeline. The strainer bodies shall be fabricated of cast iron with bottoms drilled, and tapped. The bodies shall have arrows clearly cast on the sides indicating the direction of flow. Each strainer shall be equipped with removable cover and sediment screen. The screen shall be made of minimum 22 gauge corrosion-resistant steel, with small perforations numbering not less than 400 per square inch to provide a net free area through the basket of at least 3.3 times that of the entering pipe. The flow shall be into the screen and out through the perforations.

2.5.7 Water or Steam Heating System Accessories

Water or steam heating accessories such as expansion tanks and steam traps shall be as specified in Section 15556 FORCED HOT WATER HEATING SYSTEMS USING WATER AND STEAM HEAT EXCHANGERS.

2.5.8 Glycol

The glycol shall be tested according to ASTM D 1384 and shall cause less than 0.5 mils penetration per year for all system metals. The glycol shall contain corrosion inhibitors. Silicon based inhibitors shall not be used. The solution shall be compatible with all wetted items within the system.

2.5.9 Flexible Pipe Connectors

Flexible pipe connectors shall be designed for 125 psi or 150 psi service as appropriate for the static head plus the system head, and 250 degrees F, 230 degrees F for grooved end flexible connectors. The flexible section shall be constructed of rubber, tetrafluoroethylene resin, or corrosion-resisting steel, bronze, monel, or galvanized steel. The flexible section shall be suitable for intended service with end connections to match adjacent piping. Flanged assemblies shall be equipped with limit bolts to restrict maximum travel to the manufacturer's standard limits. Unless otherwise indicated, the length of the flexible connectors shall be as recommended by the manufacturer for the service intended. Internal sleeves or liners, compatible with circulating medium, shall be provided when recommended by the manufacturer. Covers to protect the bellows shall be provided where indicated.

2.5.10 Pressure Gauges

Gauges shall conform to ASME B40.1 and shall be provided with throttling type needle valve or a pulsation dampener and shut-off valve. Gauge shall be a minimum of 3-1/2 inches in diameter and shall have a range from 0 psig to approximately 1.5 times the maximum system working pressure.

2.5.11 Thermometers

Thermometers shall have brass, malleable iron, or aluminum alloy case and frame, clear protective face, permanently stabilized glass tube with indicating-fluid column, white face, black numbers, and a 9 inch scale, and shall have rigid stems with straight, angular, or inclined pattern.

2.5.12 Escutcheons

Escutcheons shall be chromium-plated iron or chromium-plated brass, either one piece or split pattern, held in place by internal spring tension or setscrews.

2.5.13 Pipe Hangers, Inserts, and Supports

Pipe hangers, inserts, and supports shall conform to MSS SP-58 and MSS SP-69.

2.5.14 Insulation

Shop and field applied insulation shall be as specified in Section 15080 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

2.5.15 Condensate Drain Lines

Condensate drainage shall be provided for each item of equipment that generates condensate as specified for drain, waste, and vent piping systems in Section 15400 PLUMBING, GENERAL PURPOSE.

2.6 ELECTRICAL WORK

Electrical motor-driven equipment specified shall be provided complete with motor, motor starter, and controls. Unless otherwise specified, electric equipment, including wiring and motor efficiencies, shall be according to Section 16415 ELECTRICAL WORK, INTERIOR. Electrical characteristics and enclosure type shall be as shown. Unless otherwise indicated, motors of 1 hp and above shall be high efficiency type. Motor starters shall be provided complete with thermal overload protection and other appurtenances necessary. Each motor shall be according to NEMA MG 1 and shall be of sufficient size to drive the equipment at the specified capacity without exceeding the nameplate rating of the motor. Manual or automatic control and protective or signal devices required for the operation specified, and any control wiring required for controls and devices, but not shown, shall be provided. Where two-speed or variable-speed motors are indicated, solid-state variable-speed controller may be provided to accomplish the same function. Solid-state variable-speed controllers shall be utilized for motors rated 10 hp or less. Adjustable frequency drives shall be used for larger motors.

2.7 CONTROLS

Controls shall be provided as specified in Section 15951 DIRECT DIGITAL CONTROL FOR HVAC.

2.8 DUCTWORK COMPONENTS

2.8.1 Metal Ductwork

All aspects of metal ductwork construction, including all fittings and components, shall comply with SMACNA HVAC Duct Const Stds unless otherwise specified. Elbows shall be radius type with a centerline radius of 1-1/2 times the width or diameter of the duct where space permits. Otherwise, elbows having a minimum radius equal to the width or diameter of the duct or square elbows with factory fabricated turning vanes may be used. Static pressure Class 1/2, 1, and 2 inch w.g. ductwork shall meet the requirements of Seal Class C. Class 3 through 10 inch shall meet the requirements of Seal Class A. Sealants shall conform to fire hazard classification specified in Section 15080 THERMAL INSULATION FOR MECHANICAL SYSTEMS. Pressure sensitive tape shall not be used as a sealant. Spiral lock seam duct, and flat oval shall be made with duct sealant and locked with not less than 3 equally spaced drive screws or other approved methods indicated in SMACNA HVAC Duct Const Stds. The sealant shall be applied to the exposed male part of the fitting collar so that the sealer will be on the inside of the joint and fully protected by the metal of the duct fitting. One brush coat of the sealant shall be applied over the outside of the joint to at least 2 inch band width covering all screw heads and joint gap. Dents in the male portion of the slip fitting collar will not be acceptable. Outdoor air intake ducts and plenums shall be fabricated with watertight soldered or brazed joints and seams.

2.8.1.1 Transitions

Diverging air flow transitions shall be made with each side pitched out a maximum of 15 degrees, for an included angle of 30 degrees. Transitions for converging air flow shall be made with each side pitched in a maximum of 30 degrees, for an included angle of 60 degrees, or shall be as indicated. Factory-fabricated reducing fittings for systems using round duct sections when formed to the shape of the ASME short flow nozzle, need

not comply with the maximum angles specified.

2.8.1.2 Metallic Flexible Duct

Metallic type duct shall be single-ply galvanized steel . Duct shall be of corrugated/interlocked, folded and knurled type seam construction, bendable without damage through 180 degrees with a throat radius equal to 1/2 duct diameter. Duct shall conform to UL 181and shall be rated for positive or negative working pressure of 15 inches water gauge at 350 degrees F when duct is aluminum, and 650 degrees F when duct is galvanized steel or stainless steel.

2.8.1.3 General Service Duct Connectors

A flexible duct connector approximately 6 inches in width shall be provided where sheet metal connections are made to fans or where ducts of dissimilar metals are connected. For round/oval ducts, the flexible material shall be secured by stainless steel or zinc-coated, iron clinch-type draw bands. For rectangular ducts, the flexible material locked to metal collars shall be installed using normal duct construction methods. The composite connector system shall comply with UL 214 and be classified as "flame-retarded fabrics" in UL Bld Mat Dir.

2.8.2 Ductwork Accessories

2.8.2.1 Duct Access Doors

Access doors shall be provided in ductwork and plenums where indicated and at all air flow measuring primaries, automatic dampers, fire dampers, coils, thermostats, and other apparatus requiring service and inspection in the duct system, and unless otherwise shown, shall conform to SMACNA HVAC Duct Const Stds. Access doors shall be provided upstream and downstream of air flow measuring primaries and heating and cooling coils. Doors shall be minimum 15 x 18 inches, unless otherwise shown. Where duct size will not accommodate this size door, the doors shall be made as large as practicable. Doors 24 x 24 inches or larger shall be provided with fasteners operable from both sides. Doors in insulated ducts shall be the insulated type.

2.8.2.2 Fire Dampers

Fire dampers shall be 1-1/2 hour fire rated unless otherwise indicated. Fire dampers shall conform to the requirements of NFPA 90A and UL 555. The Contractor shall perform the fire damper test as outlined in NFPA 90A. A pressure relief damper shall be provided upstream of the fire damper. If the ductwork connected to the fire damper is to be insulated then this pressure relief damper shall be factory insulated. Fire dampers shall be automatic operating type and shall have a dynamic rating suitable for the maximum air velocity and pressure differential to which it will be subjected. Fire dampers shall be approved for the specific application, and shall be installed according to their listing. Fire dampers shall be equipped with a steel sleeve or adequately sized frame installed in such a manner that disruption of the attached ductwork, if any, will not impair the operation of the damper. Sleeves or frames shall be equipped with perimeter mounting angles attached on both sides of the wall or floor opening. Ductwork in fire-rated floor-ceiling or roof-ceiling assembly systems with air ducts that pierce the ceiling of the assemblies shall be constructed in conformance with UL Fire Resist Dir. Fire dampers shall be curtain type with damper blades or multi-blade type. Dampers shall not

reduce the duct or the air transfer opening cross-sectional area. Dampers shall be installed so that the centerline of the damper depth or thickness is located in the centerline of the wall, partition or floor slab depth or thickness. Unless otherwise indicated, the installation details given in SMACNA Install Fire Damp HVAC and in manufacturer's instructions for fire dampers shall be followed.

2.8.2.3 Splitters and Manual Balancing Dampers

Splitters and manual balancing dampers shall be furnished with accessible operating mechanisms. Where operators occur in finished portions of the building, operators shall be chromium plated with all exposed edges rounded. Splitters shall be operated by quadrant operators or 3/16 inch rod brought through the side of the duct with locking setscrew and bushing. Two rods are required on splitters over 8 inches. Manual volume control dampers shall be operated by locking-type quadrant operators. Dampers and splitters shall be 2 gauges heavier than the duct in which installed. Unless otherwise indicated, multileaf dampers shall be opposed blade type with maximum blade width of 12 inches. Access doors or panels shall be provided for all concealed damper operators and locking setscrews. Unless otherwise indicated, the locking-type quadrant operators for dampers, when installed on ducts to be thermally insulated, shall be provided with stand-off mounting brackets, bases, or adapters to provide clearance between the duct surface and the operator not less than the thickness of the insulation. Stand-off mounting items shall be integral with the operator or standard accessory of the damper manufacturer. Volume dampers shall be provided where indicated.

2.8.2.4 Air Deflectors and Branch Connections

Air deflectors shall be provided at duct mounted supply outlets, at takeoff or extension collars to supply outlets, at duct branch takeoff connections, and at 90 degree elbows, as well as at locations as indicated on the drawings or otherwise specified. Conical branch connections or 45 degree entry connections may be used in lieu of deflectors or extractors for branch connections. All air deflectors, except those installed in 90 degree elbows, shall be provided with an approved means of adjustment. Adjustment shall be made from easily accessible means inside the duct or from an adjustment with sturdy lock on the face of the duct. When installed on ducts to be thermally insulated, external adjustments shall be provided with stand-off mounting brackets, integral with the adjustment device, to provide clearance between the duct surface and the adjustment device not less than the thickness of the thermal insulation. Air deflectors shall be factory-fabricated units consisting of curved turning vanes or louver blades designed to provide uniform air distribution and change of direction with minimum turbulence or pressure loss. Air deflectors shall be factory or field assembled. Blade air deflectors, also called blade air extractors, shall be approved factory fabricated units consisting of equalizing grid and adjustable blade and lock. Adjustment shall be easily made from the face of the diffuser or by position adjustment and lock external to the duct. Stand-off brackets shall be provided on insulated ducts and are described herein. Fixed air deflectors, also called turning vanes, shall be provided in 90 degree elbows.

2.8.3 Duct Sleeves, Framed Prepared Openings, Closure Collars

2.8.3.1 Duct Sleeves

Duct sleeves shall be provided for round ducts 15 inches in diameter or less passing through floors, walls, ceilings, or roof, and installed during construction of the floor, wall, ceiling, or roof. Round ducts larger than 15 inches in diameter and square, rectangular, and oval ducts passing through floors, walls, ceilings, or roof shall be installed through framed prepared openings. The Contractor shall be responsible for the proper size and location of sleeves and prepared openings. Sleeves and framed openings are also required where grilles, registers, and diffusers are installed at the openings. Framed prepared openings shall be fabricated from 20 gauge galvanized steel, unless otherwise indicated. Where sleeves are installed in bearing walls or partitions, black steel pipe, ASTM A 53/A 53M, Schedule 20 shall be used. Sleeve shall provide 1 inch clearance between the duct and the sleeve or 1 inch clearance between the insulation and the sleeve for insulated ducts.

2.8.3.2 Framed Prepared Openings

Openings shall have 1 inch clearance between the duct and the opening or 1 inch clearance between the insulation and the opening for insulated ducts.

2.8.3.3 Closure Collars

Collars shall be fabricated of galvanized sheet metal not less than 4 inches wide, unless otherwise indicated, and shall be installed on exposed ducts on each side of walls or floors where sleeves or prepared openings are provided. Collars shall be installed tight against surfaces. Collars shall fit snugly around the duct or insulation. Sharp edges of the collar around insulated duct shall be ground smooth to preclude tearing or puncturing the insulation covering or vapor barrier. Collars for round ducts 15 inches in diameter or less shall be fabricated from 20 gauge galvanized steel. Collars for round ducts larger than 15 inches and square, and rectangular ducts shall be fabricated from 18 gaugegalvanized steel. Collars shall be installed with fasteners on maximum 6 inch centers, except that not less than 4 fasteners shall be used.

2.8.4 Diffusers, Registers, and Grilles

Units shall be factory-fabricated of steel, corrosion-resistant steel, or aluminum and shall distribute the specified quantity of air evenly over space intended without causing noticeable drafts, air movement faster than 50 fpm in occupied zone, or dead spots anywhere in the conditioned area. Outlets for diffusion, spread, throw, and noise level shall be as required for specified performance. Performance shall be certified according to ASHRAE 70. Inlets and outlets shall be sound rated and certified according to ASHRAE 70. Sound power level shall be as indicated. Diffusers and registers shall be provided with volume damper with accessible operator, unless otherwise indicated; or if standard with the manufacturer, an automatically controlled device will be acceptable. Volume dampers shall be opposed blade type for all diffusers and registers, except linear slot diffusers. Linear slot diffusers shall be provided with round or elliptical balancing dampers. Where the inlet and outlet openings are located less than 7 feet above the floor, they shall be protected by a grille or screen according to NFPA 90A.

2.8.4.1 Diffusers

Diffuser types shall be as indicated. Ceiling mounted units shall be furnished with anti-smudge devices, unless the diffuser unit minimizes ceiling smudging through design features. Diffusers shall be provided with air deflectors of the type indicated. Air handling troffers or combination light and ceiling diffusers shall conform to the requirements of UL Elec Const Dir for the interchangeable use as cooled or heated air supply diffusers or return air units. Ceiling mounted units shall be installed with rims tight against ceiling. Sponge rubber gaskets shall be provided between ceiling and surface mounted diffusers for air leakage control. Suitable trim shall be provided for flush mounted diffusers. Duct collar connecting the duct to diffuser shall be airtight and shall not interfere with volume controller. Return or exhaust units shall be similar to supply diffusers.

2.8.4.2 Registers and Grilles

Units shall be four-way directional-control type, except that return and exhaust registers may be fixed horizontal or vertical louver type similar in appearance to the supply register face. Registers shall be provided with sponge-rubber gasket between flanges and wall or ceiling. Wall supply registers shall be installed at least 6 inches below the ceiling unless otherwise indicated. Return and exhaust registers shall be located 6 inches above the floor unless otherwise indicated. Four-way directional control may be achieved by a grille face which can be rotated in 4 positions or by adjustment of horizontal and vertical vanes. Grilles shall be as specified for registers, without volume control damper.

2.8.5 Louvers

Louvers shall be furnished for installation in exterior walls. Louver blades shall be fabricated from anodized aluminum or galvanized steel sheets, and shall be provided with a frame of galvanized steel or aluminum structural shapes. Sheet metal thickness and fabrication shall conform to SMACNA HVAC Duct Const Stds. Blades shall be accurately fitted and secured to frames. Edges of louver blades shall be folded or beaded for rigidity and baffled to exclude driving rain. Louver shall be provided with bird screen. Louvers shall bear AMCA Certified Ratings Seal for air performance and water penetration ratings as described in AMCA 500.

2.8.6 Air Vents, Penthouses, and Goosenecks

Air vents, penthouses, and goosenecks shall be fabricated from galvanized steel sheets with galvanized structural shapes. Sheet metal thickness, reinforcement, and fabrication shall conform to SMACNA HVAC Duct Const Stds. Louver blades shall be accurately fitted and secured to frames. Edges of louver blades shall be folded or beaded for rigidity and baffled to exclude driving rain. Air vents, penthouses, and goosenecks shall be provided with bird screen.

2.8.7 Bird Screens and Frames

Bird screens shall conform to ASTM E 437, No. 2 mesh, aluminum stainless steel. Aluminum screens shall be rated "medium-light". Stainless steel screens shall be rated "light". Frames shall be removable type, or stainless steel or extruded aluminum.

2.9 AIR SYSTEMS EQUIPMENT

2.9.1 Fans

Fans shall be tested and rated according to AMCA 210. Fans may be connected to the motors either directly or indirectly with V-belt drive. V-belt drives shall be designed for not less than 120 percent of the connected driving capacity. Motor sheaves shall be variable pitch for 15 hp and below and fixed pitch as defined by ARI Guideline D. Variable pitch sheaves shall be selected to drive the fan at a speed which will produce the specified capacity when set at the approximate midpoint of the sheave adjustment. When fixed pitch sheaves are furnished, a replaceable sheave shall be provided when needed to achieve system air balance. Motors for V-belt drives shall be provided with adjustable rails or bases. Removable metal guards shall be provided for all exposed V-belt drives, and speed-test openings shall be provided at the center of all rotating shafts. Fans shall be provided with personnel screens or guards on both suction and supply ends, except that the screens need not be provided, unless otherwise indicated, where ducts are connected to the fan. Fan and motor assemblies shall be provided with vibration-isolation supports or mountings as indicated. Vibration-isolation units shall be standard products with published loading ratings. Each fan shall be selected to produce the capacity required at the fan static pressure indicated. Sound power level shall be as indicated. The sound power level values shall be obtained according to AMCA 300. Standard AMCA arrangement, rotation, and discharge shall be as indicated.

2.9.1.1 In-Line Centrifugal Fans

In-line fans shall have centrifugal backward inclined blades, stationary discharge conversion vanes, internal and external belt guards, and adjustable motor mounts. Fans shall be mounted in a welded tubular casing. Air shall enter and leave the fan axially. Inlets shall be streamlined with conversion vanes to eliminate turbulence and provide smooth discharge air flow. Fan bearings and drive shafts shall be enclosed and isolated from the air stream. Fan bearings shall be sealed against dust and dirt and shall be permanently lubricated, and shall be precision self aligning ball or roller type. Bearing life shall be L50 rated at not less than 200,000 hours as defined by AFBMA Std 9 and AFBMA Std 11. Motors shall have totally enclosed enclosure.

2.9.1.2 Ceiling Exhaust Fans

Suspended cabinet-type ceiling exhaust fans shall be centrifugal type, direct-driven. Fans shall have acoustically insulated housing. Integral backdraft damper shall be chatter-proof. The integral face grille shall be of egg-crate design or louver design. Fan motors shall be mounted on vibration isolators. Unit shall be provided with mounting flange for hanging unit from above. Fans shall be U.L. listed.

2.9.2 Coils

Coils shall be fin-and-tube type constructed of seamless copper tubes and aluminum or copper fins mechanically bonded or soldered to the tubes. Copper tube wall thickness shall be a minimum of 0.020 inches. Casing and tube support sheets shall be not lighter than 16 gauge galvanized steel, formed to provide structural strength. When required, multiple tube supports shall be provided to prevent tube sag. Each coil shall be tested at the factory under water at not less than 400 psi air pressure and shall

be suitable for 200 psi working pressure. Coils shall be mounted for counterflow service. Coils shall be rated and certified according to ARI 410.

2.9.2.1 Water Coils

Water coils shall be installed with a pitch of not less than 1/8 inch per foot of the tube length toward the drain end. Headers shall be constructed of cast iron, welded steel or copper. Each coil shall be provided with a plugged vent and drain connection extending through the unit casing.

2.9.3 Air Filters

Air filters shall be listed according to requirements of UL 900, except high efficiency particulate air filters of 99.97 percent efficiency by the DOP Test method shall be as listed under the Label Service and shall meet the requirements of UL 586.

2.9.3.1 Extended Surface Pleated Panel Filters

Filters shall be 2 inch depth, sectional, disposable type of the size indicated and shall have an average efficiency of 25 to 30 percent when tested according to ASHRAE 52.1. Initial resistance at 500 feet per minute shall not exceed 0.36 inches water gauge. Filters shall be UL Class 2. Media shall be nonwoven cotton and synthetic fiber mat. A wire support grid bonded to the media shall be attached to a moisture resistant fiberboard frame. All four edges of the filter media shall be bonded to the inside of the frame to prevent air bypass and increase rigidity.

2.9.3.2 Filter Gauges

Filter gauges shall be dial type, diaphragm actuated draft and shall be provided for all filter stations, including those filters which are furnished as integral parts of factory fabricated air handling units. Gauges shall be at least 3-7/8 inches in diameter, shall have white dials with black figures, and graduations and shall have a minimum range of 1 inch beyond the specified final resistance for the filter bank on which each gauge is applied. Each gauge shall incorporate a screw operated zero adjustment and shall be furnished complete with two static pressure tips with integral compression fittings, two molded plastic vent valves, two 5 foot minimum lengths of 1/4 inch diameter aluminum tubing, and all hardware and accessories for gauge mounting.

2.10 AIR HANDLING UNITS

2.10.1 Factory-Fabricated Air Handling Units

Units shall be single-zone draw-through type as indicated. Units shall include fans, coils, airtight sealed washable insulated casing with a casing intergral drain pan, filters, prefilters, preheat coils, and adjustable V-belt drives, belt guards for externally mounted motors, access sections where indicated, filter box, vibration-isolators, and appurtenances required for specified operation. Vibration isolators shall be as indicated. Each air handling unit shall have physical dimensions suitable to fit space allotted to the unit and shall have the capacity indicated. Air handling unit shall have published ratings based on tests performed according to ARI 430.

2.10.1.1 Casings

Casing sections shall be 2 inch doublewall type constructed of a minimum 18 gauge galvanized steel, or 18 gauge steel outer casing protected with a corrosion resistant paint finish according to paragraph FACTORY PAINTING. Inner casing of double-wall units shall be minimum 20 gauge solid galvanized steel. Casing shall be designed and constructed with an integral structural steel frame such that exterior panels are non-load bearing. Exterior panels shall be individually removable. Removal shall not affect the structural integrity of the unit. Casings shall be provided with inspection doors, access sections, and access doors as indicated. Inspection and access doors shall be insulated, fully gasketed, double-wall type, of a minimum 18 gauge outer and 20 gauge inner panels. Doors shall be rigid and provided with heavy duty hinges and latches. Inspection doors shall be a minimum 12 inches wide by 12 inches high. Access doors shall be minimum 24 inches wide and shall be the full height of the unit casing or a minimum of 6 ft., whichever is less. Access Sections shall be according to paragraph AIR HANDLING UNITS. Drain pan shall be double-bottom type constructed of 16 gauge galvanized steel , pitched to the drain connection. Drain pans shall be constructed water tight, treated to prevent corrosion, and designed for positive condensate drainage. When 2 or more cooling coils are used, with one stacked above the other, condensate from the upper coils shall not flow across the face of lower coils. Intermediate drain pans or condensate collection channels and downspouts shall be provided, as required to carry condensate to the unit drain pan out of the air stream and without moisture carryover. Each casing section handling conditioned air shall be insulated with not less than 1 inch thick, 1-1/2 pound density coated fibrous glass material having a thermal conductivity not greater than 0.23 Btu/hr-sf-F. Factory applied fibrous glass insulation shall conform to ASTM C 1071, except that the minimum thickness and density requirements do not apply, and shall meet the requirements of NFPA 90A. Foam-type insulation is not acceptable. Foil-faced insulation shall not be an acceptable substitute for use on double-wall access doors and inspections doors and casing sections. Duct liner material, coating, and adhesive shall conform to fire-hazard requirements specified in Section 15080 THERMAL INSULATION FOR MECHANICAL SYSTEMS. Exposed insulation edges and joints where insulation panels are butted together shall be protected with a metal nosing strip or shall be coated to conform to meet erosion resistance requirements of ASTM C 1071. A latched and hinged inspection door, shall be provided in the fan and coil sections.

2.10.1.2 Heating Coils

Coils shall be provided as specified in paragraph AIR SYSTEMS EQUIPMENT, for types indicated.

2.10.1.3 Air Filters

Air filters shall be as specified in paragraph AIR SYSTEMS EQUIPMENT for types and thickness indicated.

2.10.1.4 Fans

Fans shall be double-inlet, centrifugal type with each fan in a separate scroll. Fans and shafts shall be dynamically balanced prior to installation into air handling unit, then the entire fan assembly shall be statically and dynamically balanced at the factory after it has been installed in the air handling unit. Fans shall be mounted on steel shafts

accurately ground and finished. Fan bearings shall be sealed against dust and dirt and shall be precision self-aligning ball or roller type. Bearing life shall be L50 rated at not less than 200,000 hours as defined by AFBMA Std 9 and AFBMA Std 11. Bearings shall be permanently lubricated or lubricated type with lubrication fittings readily accessible at the drive side of the unit. Bearings shall be supported by structural shapes, or die formed sheet structural members, or support plates securely attached to the unit casing. Bearings may not be fastened directly to the unit sheet metal casing. Fans and scrolls shall be furnished with coating indicated. Fans shall be driven by a unit-mounted or a floor-mounted motor connected to fans by V-belt drive complete with belt guard for externally mounted motors. Belt guards shall be the three sided enclosed type with solid or expanded metal face. Belt drives shall be designed for not less than a 1.3 service factor based on motor nameplate rating. Motor sheaves shall be variable pitch for 25 hp and below and fixed pitch above 25 hp as defined by ARI Guideline D. Where fixed sheaves are required, variable pitch sheaves may be used during air balance, but shall be replaced with an appropriate fixed sheave after air balance is completed. Variable pitch sheaves shall be selected to drive the fan at a speed that will produce the specified capacity when set at the approximate midpoint of the sheave adjustment. Motors for V-belt drives shall be provided with adjustable bases. Fan motors shall have splashproof enclosures. Motor starters shall be magnetic across-the-line type with weather-resistant enclosure. Unit fan or fans shall be selected to produce the required capacity at the fan static pressure. Sound power level shall be as indicated. The sound power level values shall be obtained according to AMCA 300 or ASHRAE 68.

2.10.1.5 Access Sections and Filter/Mixing Boxes

Access sections shall be provided where indicated and shall be furnished with access doors as shown. Access sections and filter/mixing boxes shall be constructed in a manner identical to the remainder of the unit casing and shall be equipped with access doors. Mixing boxes shall be designed to minimize air stratification and to promote thorough mixing of the air streams.

2.10.1.6 Dampers

Dampers shall be as specified in paragraph CONTROLS.

2.11 FACTORY PAINTING

Units which are not of galvanized construction according to ASTM A 123/A 123M or ASTM A 924/A 924M shall be factory painted with a corrosion resisting paint finish. Internal and external ferrous metal surfaces shall be cleaned, phosphatized and coated with a paint finish which has been tested according to ASTM B 117, ASTM D 1654, and ASTM D 3359. Evidence of satisfactory paint performance for a minimum of 125 hours for units to be installed indoors and 500 hours for units to be installed outdoors shall be submitted. Rating of failure at the scribe mark shall be not less than 6, average creepage not greater than 1/8 inch. Rating of the inscribed area shall not be less than 10, no failure. On units constructed of galvanized steel which have been welded, exterior surfaces of welds or welds that have burned through from the interior shall receive a final shop docket of zinc-rich protective paint according to ASTM D 520 Type I.

PART 3 EXECUTION

3.1 INSTALLATION

Work shall be installed as shown and according to the manufacturer's diagrams and recommendations.

3.1.1 Piping

Pipe and fitting installation shall conform to the requirements of ASME B31.1. Pipe shall be cut accurately to measurements established at the jobsite, and worked into place without springing or forcing, completely clearing all windows, doors, and other openings. Cutting or other weakening of the building structure to facilitate piping installation will not be permitted without written approval. Pipe or tubing shall be cut square, shall have burrs removed by reaming, and shall permit free expansion and contraction without causing damage to the building structure, pipe, joints, or hangers. Changes in direction shall be made with fittings, except that bending of pipe 4 inches and smaller will be permitted, provided a pipe bender is used and wide sweep bends are formed. The centerline radius of bends shall not be less than 6 diameters of the pipe. Bent pipe showing kinks, wrinkles, flattening, or other malformations will not be accepted. Horizontal supply mains shall pitch down in the direction of flow as indicated. The grade shall be not less than 1 inch in 40 feet. Reducing fittings shall be used for changes in pipe sizes. Open ends of pipelines and equipment shall be capped or plugged during installation to keep dirt or other foreign materials out of the system. Pipe not otherwise specified shall be uncoated. Connections to appliances shall be made with malleable iron unions for steel pipe 2-1/2 inch or less in diameter, and with flanges for pipe 3 inches and larger. Connections between ferrous and copper piping shall be electrically isolated from each other with dielectric unions or flanges. All piping located in air plenums shall conform to NFPA 90A requirements. Pipe and fittings installed in inaccessible conduits or trenches under concrete floor slabs shall be welded.

3.1.1.1 Joints

a. Threaded Joints: Threaded joints shall be made with tapered threads and made tight with a stiff mixture of graphite and oil or polytetrafluoroethylene tape or equivalent thread joint compound or material, applied to the male threads only.

b. Soldered Joints: Joints in copper tubing shall be cut square with ends reamed, and all filings and dust wiped from interior of pipe. Joints shall be soldered with 95/5 solder or brazed with silver solder applied and drawn through the full fitting length. Care shall be taken to prevent annealing of tube or fittings when making connections. Joints 2-1/2 inch and larger shall be made with heat uniformly around the entire circumference of the joint with a multi-flame torch. Connections in floor slabs shall be brazed. Excess solder shall be wiped from joint before solder hardens. Solder flux shall be liquid or paste form, non-corrosive and conform to ASTM B 813.

c. Welded Joints: Welding shall be according to qualified procedures using qualified welders and welding operators. Procedures and welders shall be qualified according to ASME BPV IX. Welding procedures qualified by others and welders and welding operators

qualified by another operator may be permitted by ASME B31.1. All welds shall be permanently identified by imprinting the welder's or welding operator's assigned symbol adjacent to the weld. Welded joints shall be fusion welded unless otherwise required. Changes in direction of piping shall be made with welding fittings only; mitering or notching pipe to form elbows and tees or other similar type construction will not be permitted. Branch connections may be made with either welding tees or branch outlet fittings. Branch outlet fittings shall be forged, flared for improvement of flow where attached to the run, and reinforced against external strains. Beveling, alignment, heat treatment and inspection of weld shall conform to ASME B31.1. Weld defects shall be removed and repairs made to the weld, or the weld joints shall be entirely removed and rewelded. Electrodes shall be stored and dried according to AWS D1.1 or as recommended by the manufacturer. Electrodes that have been wetted or that have lost any of their coating shall not be used.

3.1.1.2 Flanges and Unions

Except where copper tubing is used, union or flanged joints shall be provided in each line immediately preceding the connection to each piece of equipment or material requiring maintenance such as coils, pumps, control valves, and other similar items.

3.1.2 Supports

3.1.2.1 General

Hangers used to support piping 2 inches and larger shall be fabricated to permit adequate adjustment after erection while still supporting the load. Pipe guides and anchors shall be installed to keep pipes in accurate alignment, to direct the expansion movement, and to prevent buckling, swaying, and undue strain. Piping subjected to vertical movement when operating temperatures exceed ambient temperatures shall be supported by variable spring hangers and supports or by constant support hangers.

3.1.2.2 Seismic Requirements (Pipe Supports and Structural Bracing)

Piping and attached valves shall be supported and braced to resist seismic loads as specified under Sections 13080 SEISMIC PROTECTION FOR MISCELLANEOUS EQUIPMENT and 15070 SEISMIC PROTECTION FOR MECHANICAL EQUIPMENT . Structural steel required for reinforcement to properly support piping, headers, and equipment but not shown shall be provided under this section. Material used for support shall be as specified under Section 05210 STEEL JOISTS.

3.1.2.3 Pipe Hangers, Inserts and Supports

Pipe hangers, inserts, and supports shall conform to MSS SP-58 and MSS SP-69, except as modified herein. Types 5, 12, and 26 shall not be used.

a. Hangers: Type 3 shall not be used on insulated piping.

b. Inserts: Type 18 inserts shall be secured to concrete forms before concrete is placed. Continuous inserts which allow more adjustment may be used if they otherwise meet the requirements for Type 18 inserts.

c. C-Clamps: Type 19 and 23 C-clamps shall be torqued per MSS SP-69 and have both locknuts and retaining devices, furnished by the manufacturer. Field-fabricated C-clamp bodies or retaining devices are not acceptable.

d. Angle Attachments: Type 20 attachments used on angles and channels shall be furnished with an added malleable-iron heel plate or adapter.

e. Hangers: Type 24 may be used only on trapeze hanger systems or on fabricated frames.

f. Type 39 saddles shall be used on all insulated pipe 4 inches and larger when the temperature of the medium is above 60 degrees F. Type 39 saddles shall be welded to the pipe.

g. Type 40 shields shall:

(1) be used on all insulated pipes less than 4 inches.

(2) be used on all insulated pipes 4 inches and larger when the temperature of the medium is 60 degrees or less.

(3) have a high density insert for pipe 2 inches and larger, and for smaller pipe when the insulation shows signs of being visibly compressed, or when the insulation or jacket shows visible signs of distortion at or near the type 40 shield. High density inserts shall have a density of 9 pcf or greater.

h. Horizontal Pipe Supports: Horizontal pipe supports shall be spaced as specified in MSS SP-69 and a support shall be installed not over 1 foot from the pipe fitting joint at each change in direction of the piping. Pipe supports shall be spaced not over 5 feet apart at valves.

i. Vertical Pipe Supports: Vertical pipe shall be supported at each floor, except at slab-on-grade, and at intervals of not more than 15 feet, not more than 8 feet from end of risers, and at vent terminations.

j. Pipe Guides: Type 35 guides using steel reinforced polytetrafluoroethylene (PTFE) or graphite slides shall be provided where required to allow longitudinal pipe movement. Lateral restraints shall be provided as required. Slide materials shall be suitable for the system operating temperatures, atmospheric conditions, and bearing loads encountered.

k. Steel Slides: Where steel slides do not require provisions for restraint of lateral movement, an alternate guide method may be used. On piping 4 inches and larger with medium 60 degrees F or greater, a Type 39 saddle may be welded to the pipe and freely rest on a steel plate. On piping under 4 inches, a Type 40 protection shield may be attached to the pipe or insulation and freely rest on a steel slide plate.

l. High Temperature Guides with Cradles: Where there are high system temperatures and welding to piping is not desirable, the Type 35 guide shall include a pipe cradle, welded to the guide structure and strapped securely to the pipe. The pipe shall be separated

from the slide material by at least 4 inches, or by an amount adequate for the insulation, whichever is greater.

m. Insulated Pipe: Insulation on horizontal pipe shall be continuous through hangers for hot and cold piping. Other requirements on insulated pipe are specified in Section 15080 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

3.1.3 Anchors

Anchors shall be provided wherever necessary or indicated to localize expansion or to prevent undue strain on piping. Anchors shall consist of heavy steel collars with lugs and bolts for clamping and attaching anchor braces, unless otherwise indicated. Anchor braces shall be installed in the most effective manner to secure the desired results using turnbuckles where required. Supports, anchors, or stays shall not be attached where they will injure the structure or adjacent construction during installation or by the weight of expansion of the pipeline.

3.1.4 Pipe Sleeves

Sleeves shall not be installed in structural members except where indicated or approved. Rectangular and square openings shall be as detailed. Each sleeve shall extend through its respective wall, floor, or roof, and shall be cut flush with each surface. Pipes passing through concrete or masonry wall or concrete floors or roofs shall be provided with pipe sleeves fitted into place at the time of construction. Unless otherwise indicated, sleeves shall provide a minimum of 1/4 inch all-around clearance between bare pipe and sleeves or between jacket over insulation and sleeves. Sleeves in bearing walls, waterproofing membrane floors, and wet areas shall be steel pipe or cast iron pipe. Sleeves in non-bearing walls, floors, or ceilings may be steel pipe, cast iron pipe, galvanized sheet metal with lock-type longitudinal seam and of the metal thickness indicated, or moisture resistant fiber or plastic. Except in pipe chases or interior walls, the annular space between pipe and sleeve or between jacket over insulation and sleeve, in non-fire rated walls, shall be sealed as indicated and specified in Section 07900 JOINT SEALING. Pipes passing through wall waterproofing membrane shall be sleeved as specified above, and a waterproofing clamping flange shall be installed as indicated.

3.1.4.1 Roof and Floor Sleeves

Pipes passing through roof or floor waterproofing membrane shall be installed through a 17-ounce copper sleeve or a 0.032 inch thick aluminum sleeve, each within an integral skirt or flange. Flashing sleeve shall be suitably formed, and skirt or flange shall extend not less than 8 inches from the pipe and shall be set over the roof or floor membrane in a troweled coating of bituminous cement. Unless otherwise shown, the flashing sleeve shall extend up the pipe a minimum of 2 inches above highest floor level or a minimum of 10 inches above the roof. The annular space between the flashing sleeve and the bare pipe or between the flashing sleeve and the metal-jacket-covered insulation shall be sealed as indicated. Pipes up to and including 10 inches in diameter passing through roof or floor waterproofing membrane may be installed through a cast iron sleeve with caulking recess, anchor lugs, flashing clamp device, and pressure ring with brass bolts. Waterproofing membrane shall be clamped into place and sealant shall be placed in the caulking recess. In lieu of a waterproofing clamping flange and caulking and sealing of annular space between pipe and sleeve or conduit and sleeve, a modular mechanical type

sealing assembly may be installed. Seals shall consist of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe/conduit and sleeve with corrosion protected carbon steel bolts, nuts, and pressure plates. Links shall be loosely assembled with bolts to form a continuous rubber belt around the pipe with a pressure plate under each bolt head and each nut. After the seal assembly is properly positioned in the sleeve, tightening of the bolt shall cause the rubber sealing elements to expand and provide a watertight seal between the pipe/conduit and the sleeve. Each seal assembly shall be sized as recommended by the manufacturer to fit the pipe/conduit and sleeve involved.

3.1.4.2 Fire Seal

Where pipes pass through firewalls, fire partitions, or floors, a fire seal shall be provided as specified in Section 07840 FIRESTOPPING.

3.1.4.3 Escutcheons

Escutcheons shall be provided at finished surfaces where exposed piping, bare or insulated, passes through floors, walls, or ceilings except in boiler, utility, or equipment rooms. Where sleeves project slightly from floors, special deep-type escutcheons shall be used. Escutcheons shall be secured to pipe or pipe covering.

3.1.5 Condensate Drain Lines

Water seals shall be provided in the condensate drain from all units. . The depth of each seal shall be 2 inches plus the number of inches, measured in water gauge, of the total static pressure rating of the unit to which the drain is connected. Water seals shall be constructed of 2 tees and an appropriate U-bend with the open end of each tee plugged. Pipe cap or plug cleanouts shall be provided where indicated. Drains indicated to connect to the sanitary waste system shall be connected by an indirect waste fitting. Air conditioner drain lines shall be insulated as specified in Section 15080 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

3.1.6 Pipe-Alignment Guides

Pipe-alignment guides shall be provided where indicated for expansion loops, offsets, and bends and as recommended by the manufacturer for expansion joints, not to exceed 5 feet on each side of each expansion joint, and in lines 4 inches or smaller not more than 2 feet on each side of the joint.

3.1.7 Air Vents and Drains

3.1.7.1 Vents

Air vents shall be provided at high points, on water coils, and where indicated to ensure adequate venting of the piping system.

3.1.7.2 Drains

Drains shall be provided at low points and where indicated to ensure complete drainage of the piping. Drains shall be accessible, and shall consist of nipples and caps or plugged tees unless otherwise indicated.

3.1.8 Valves

Isolation gate or ball valves shall be installed on each side of each piece of equipment such as pumps, heaters, heating or cooling coils, and other similar items, at the midpoint of all looped mains, and at any other points indicated or required for draining, isolating, or sectionalizing purposes. Isolation valves may be omitted where balancing cocks are installed to provide both balancing and isolation functions. Each valve except check valves shall be identified. Valves in horizontal lines shall be installed with stems horizontal or above.

3.1.9 Equipment and Installation

Frames and supports shall be provided for tanks, compressors, pumps, valves, air handling units, fans, coils, dampers, and other similar items requiring supports. Air handling units shall be floor mounted or ceiling hung, as indicated. The method of anchoring and fastening shall be as detailed. Floor-mounted equipment, unless otherwise indicated, shall be set on not less than 6 inch concrete pads or curbs doweled in place. Concrete foundations for circulating pumps shall be heavy enough to minimize the intensity of the vibrations transmitted to the piping and the surrounding structure, as recommended in writing by the pump manufacturer. In lieu of a concrete pad foundation, a concrete pedestal block with isolators placed between the pedestal block and the floor may be provided. The concrete foundation or concrete pedestal block shall be of a mass not less than three times the weight of the components to be supported. Lines connected to the pump mounted on pedestal blocks shall be provided with flexible connectors. Foundation drawings, bolt-setting information, and foundation bolts shall be furnished prior to concrete foundation construction for all equipment indicated or required to have concrete foundations. Concrete for foundations shall be as specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE.

3.1.10 Access Panels

Access panels shall be provided for concealed valves, vents, controls, dampers, and items requiring inspection or maintenance. Access panels shall be of sufficient size and located so that the concealed items may be serviced and maintained or completely removed and replaced. Access panels shall be as specified in Section 05500 MISCELLANEOUS METALS.

3.1.11 Flexible Connectors

Pre-insulated flexible connectors and flexible duct shall be attached to other components in accordance with the latest printed instructions of the manufacturer to ensure a vapor tight joint. Hangers, when required to suspend the connectors, shall be of the type recommended by the connector or duct manufacturer and shall be provided at the intervals recommended.

3.1.12 Sleeved and Framed Openings

Space between the sleeved or framed opening and the duct or the duct insulation shall be packed as specified in Section 07840 FIRESTOPPING for fire rated penetrations. For non-fire rated penetrations, the space shall be packed as specified in Section 07900 JOINT SEALING.

3.1.13 Metal Ductwork

Installation shall be according to SMACNA HVAC Duct Const Stds unless

otherwise indicated. Duct supports for sheet metal ductwork shall be according to SMACNA HVAC Duct Const Stds, unless otherwise specified. Friction beam clamps indicated in SMACNA HVAC Duct Const Stds shall not be used. Risers on high velocity ducts shall be anchored in the center of the vertical run to allow ends of riser to move due to thermal expansion. Supports on the risers shall allow free vertical movement of the duct. Supports shall be attached only to structural framing members and concrete slabs. Supports shall not be anchored to metal decking unless a means is provided and approved for preventing the anchor from puncturing the metal decking. Where supports are required between structural framing members, suitable intermediate metal framing shall be provided. Where C-clamps are used, retainer clips shall be provided.

3.1.14 Insulation

Thickness and application of insulation materials for ductwork, piping, and equipment shall be according to Section 15080 THERMAL INSULATION FOR MECHANICAL SYSTEMS. Outdoor air intake ducts and plenums shall be externally insulated up to the point where the outdoor air reaches the conditioning unit .

3.1.15 Duct Test Holes

Holes with closures or threaded holes with plugs shall be provided in ducts and plenums as indicated or where necessary for the use of pitot tube in balancing the air system. Extensions, complete with cap or plug, shall be provided where the ducts are insulated.

3.1.16 Power Roof Ventilator Mounting

Foamed 1/2 inch thick, closed-cell, flexible elastomer insulation shall cover width of roof curb mounting flange. Where wood nailers are used, holes shall be pre-drilled for fasteners.

3.1.17 Power Transmission Components Adjustment

V-belts and sheaves shall be tested for proper alignment and tension prior to operation and after 72 hours of operation at final speed. Belts on drive side shall be uniformly loaded, not bouncing. Alignment of direct driven couplings shall be to within 50 percent of manufacturer's maximum allowable range of misalignment.

3.2 FIELD PAINTING AND COLOR CODE MARKING

Finish painting of items only primed at the factory, surfaces not specifically noted otherwise, and color code marking for piping shall be as specified in Section 09900 PAINTS AND COATINGS.

3.3 PIPING HYDROSTATIC TEST

After cleaning, water piping shall be hydrostatically tested at a pressure equal to 150 percent of the total system operating pressure for period of time sufficient to inspect every joint in the system and in no case less than 2 hours. Leaks shall be repaired and piping retested until test is successful. No loss of pressure will be allowed. Leaks shall be repaired by re-welding or replacing pipe or fittings. Caulking of joints will not be permitted. Concealed and insulated piping shall be tested in place before covering or concealing.

3.4 DAMPER ACCEPTANCE TEST

All fire dampers and smoke dampers shall be operated under normal operating conditions, prior to the occupancy of a building to determine that they function properly. Fire dampers equipped with fusible links shall be tested by having the fusible link cut in place. Dynamic fire dampers shall be tested with the air handling and distribution system running. All fire dampers shall be reset with the fusible links replaced after acceptance testing. To ensure optimum operation and performance, the damper must be installed so it is square and free from racking.

3.5 CLEANING AND ADJUSTING

Pipes shall be cleaned free of scale and thoroughly flushed of foreign matter. A temporary bypass shall be provided for water coils to prevent flushing water from passing through coils. Strainers and valves shall be thoroughly cleaned. Prior to testing and balancing, air shall be removed from water systems by operating the air vents. Temporary measures, such as piping the overflow from vents to a collecting vessel shall be taken to avoid water damage during the venting process. Air vents shall be plugged or capped after the system has been vented. Inside of room fan-coil units ducts, plenums, and casing shall be thoroughly cleaned of debris and blown free of small particles of rubbish and dust and then shall be vacuum cleaned before installing outlet faces. Equipment shall be wiped clean, with traces of oil, dust, dirt, or paint spots removed. Temporary filters shall be provided prior to startup of all fans that are operated during construction, and new filters shall be installed after all construction dirt has been removed from the building, and the ducts, plenums, casings, and other items specified have been vacuum cleaned. System shall be maintained in this clean condition until final acceptance. Bearings shall be properly lubricated with oil or grease as recommended by the manufacturer. Belts shall be tightened to proper tension. Control valves and other miscellaneous equipment requiring adjustment shall be adjusted to setting indicated or directed. Fans shall be adjusted to the speed indicated by the manufacturer to meet specified conditions.

3.6 TESTING, ADJUSTING, AND BALANCING

Testing, adjusting, and balancing shall be as specified in Section 15990 TESTING, ADJUSTING AND BALANCING OF HVAC SYSTEMS. Testing, adjusting, and balancing shall begin only when the air supply and distribution, including controls, has been completed, with the exception of performance tests.

3.7 PERFORMANCE TESTS

After testing, adjusting, and balancing has been completed as specified, each system shall be tested as a whole to see that all items perform as integral parts of the system and temperatures and conditions are evenly controlled throughout the building. Corrections and adjustments shall be made as necessary to produce the conditions indicated or specified. Capacity tests and general operating tests shall be conducted by an experienced engineer. Tests shall cover a period of not less than 2- days for each system and shall demonstrate that the entire system is functioning according to the specifications. Coincidental chart recordings shall be made at points indicated on the drawings for the duration of the time period and shall record the temperature at space thermostats or space sensors, the humidity at space humidistats or space sensors and the ambient temperature and humidity in a shaded and weather protected area.

3.8 FIELD TRAINING

The Contractor shall conduct a training course for operating and maintenance personnel as designated by the Contracting Officer. Training shall be provided for a period of 16 hours of normal working time and shall start after the system is functionally complete but prior to the performance tests. The field instruction shall cover all of the items contained in the approved Operating and Maintenance Instructions.

-- End of Section --

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SECTION 15899

SYSTEM START-UP, FUELING SYSTEM

PART 1 GENERAL

Waiver to Use MilStds and MilSpecs in Air Force Fuel Projects, HQ AFCESA/CESM (01/29/96).

ATTACHMENTS: Checklist for Equipment Test

1.1 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

System Start-up Plan; G-AE.

The Contractor shall submit a detailed written plan prepared by the system supplier for implementation of system start-up. The plan shall be submitted for Government approval 28 days prior to system start-up. The plan shall include a list of personnel by trade, list of key personnel, safety equipment, list of miscellaneous equipment such as two-way radios personnel transportation vehicles etc. and detailed procedures and schedules. The Contractor and system supplier shall be responsible for implementing system start-up in coordination with ongoing base operations.

SD-06 Test Reports

Test Reports; G-AE

Submit written test reports to the Contracting Officer prior to the final acceptance procedure. Information reported shall include:

a. Elapsed operating time.

b. Tank liquid level readings.

c. System flow rate and meter readings.

d. System pressure gage readings.

e. Number identification of pumps running.

f. Pump RPM, amperage, and voltage.

g. Condition of fuel samples.

h. Hydrant control valve performance (including flow rate and pressure) during emergency shutoff, downstream valve closure, and relief operation.

Final Reports.

A final report shall be submitted which will include the final settings of the valves and switches and a copy of the strip chart graphs with an explanation of what the graph indicates and what the system is doing.

SD-11 Closeout Submittals

Certification of Entire System; G-AO

Prior to the acceptance of the newly constructed system by the Government, all installed mechanical and electrical equipment shall be inspected and approved by the Contracting Officer. The Contractor shall give the Contracting Officer 28 days notice in order to schedule the Command Fuel Facilities Engineer and the Command Fuels Management Officer (who will act only as a technical consultants to the Contracting Officer and shall not have any contract authority) for participation in the inspection and equipment tests and final acceptance procedures and approval. Any deficiencies observed shall be corrected by the Contractor without cost to the Government.

PART 2 PRODUCTS

2.1 DESIGN CONDITIONS

Temporary flushing lines and equipment shall be equal in strength, stability, and materials to the associated permanent components. However, spools may be carbon steel. Additional design conditions shall be as specified in Section 15050 MECHANICAL EQUIPMENT, FUELING.

2.2 SOURCES OF MATERIAL AND EQUIPMENT

2.2.1 Material and Equipment

The Contractor shall provide material, equipment and labor not specified to be Government-furnished and required for proper start-up of the system. Equipment shall include but not be limited to the following:

a. Temporary strainers.

b. Pipe spools.

c. Flow meters.

d. Pressure gages.

e. Electronic sensors and recorders for pressure and flow recording are included in the PCP, except a sensor and cable will need to be provided for the data from the Hydrant Control Valve and plugged into the PCP. This equipment shall be used to monitor and record the system during the "Equipment Test" and "Performance Testing" portions of this Specification Section. Recorded data shall be used by the Contractor and equipment factory representatives to achieve final control valve and

equipment adjustments. Recorded data shall include:

1. Fueling pumps discharge pressures.

2. Supply Venturi flow rates.

3. Hydrant Control Valve pressures.

4. Back Pressure Control Valve upstream pressures.

5. Back Pressure Control Valve downstream pressures.

6. Return Venturi flow rates.

f. The Contractor must have on hand sufficient filter elements and coalescer cartridges to adequately clean the system. During cleaning operation, Contractor shall provide a flow versus pressure drop graph for each filter separator. Graph format shall be as shown at end of this Section. Contractor shall change coalescers and cartridges upon reaching a differential pressure of 15 psi or when pressure drop is less than previous graph or fails to increase properly. Isolate each filter separator, one at a time and use one fueling pump to obtain rated flow rate (600 GPM). A minimum of one complete set of coalescer elements and separator cartridges for each filter separator shall be turned over to the Government after new coalescer elements and separator cartridges are installed in each filter separator vessel after completion of acceptance testing.

2.2.2 Government-Furnished Material and Equipment

The Government will furnish the following materials, equipment and services during the performance of the work under this section.

2.2.2.1 Aircraft Turbine Fuel

The Government will provide the fuel necessary for system testing. The Contractor shall notify the Contracting Officer a minimum of sixty(60) days in advance of the requirements. Additional fuel will be provided by the Government as required for satisfactory flushing of the system. Upon satisfactory completion of the flushing and cleaning operations, the Government will supply the additional quantities of fuel required to complete the other work under this section. Fuel will not be delivered to the system until the Contractor has satisfactorily completed all work and, in particular, the cleaning and coating of the interior surfaces of the operating storage tanks and the removal of preservatives and foreign matter from those portions coming in contact with the fuel valves, pumps, filter separators and other such equipment. Fuel delivered to the system shall remain the property of the Government and the Contractor shall reimburse the Government for shortages not attributable to normal handling losses. The Government shall be reimbursed for fuel lost as a result of defective materials or workmanship. An empty Operating Tank shall never be filled at a velocity greater than 3-feet per second in the fill line until fuel is 3-feet above the fill nozzle.

2.2.2.2 Tank Trucks

Refueler tank trucks and operation of same will be furnished by the Government.

2.2.2.3 Hydrant Hose Trucks

The Government will furnish and operate the hydrant hose trucks required for ground refueling and defueling of aircraft at hydrant pits.

2.2.2.4 Utilities

Electric power required for the performance of the work under this section will be furnished at no charge to the Contractor.

PART 3 EXECUTION

3.1 PREPARATIONS FOR FLUSHING

Upon completion of the system to the satisfaction of the Contracting Officer and the Command Fuel Facilities Engineer , the Contractor shall make the following preparations for flushing the system.

3.1.1 Protection of Equipment

The following items shall be removed from the system prior to start of flushing operations and, where applicable, replaced with spools of pipe, diameter equal to the item removed.

a. Control valves,including hydrant pit control valves if flushing outlets into tank trucks.

b. Sensors which are exposed to the fluid.

c. Coalescer and separator elements in filter separators.

d. Venturi Tubes and Pressure Indicating Transmitters.

e. Meter.

After flushing, the above items shall be reinstalled in the system and the spool sections turned over to the Contracting Officer.

3.1.2 Strainers

Temporary 40 mesh cone type strainers shall be installed in the suction line ahead of each fueling pump and will be left in place. Any damaged strainers shall be replaced by the Contractor at no additional cost to the Government.

3.1.3 Water Draw-off

Remove any accumulated water from Operating Tanks' sumps and bottoms.

3.2 FLUSHING

Flushing procedures shall precede cleaning procedures. The transfer line, pump house piping, apron loop, supply and return lines to the operating tanks, hydrant laterals, product recovery lines and pantographs and lines shall be flushed with fuel until the fuel being delivered is free of construction debris to the satisfaction of the Contracting Officer. Samples of fuel shall be taken and tested by the designated government agency and shall be free of gross contamination, maximum of 8.0 mg/gallon solids and free water not to exceed 2 ml per quart.

3.2.1 Fueling System Piping

The flushing of apron system pipelines shall be accomplished by pumping fuel from one of the operating tanks through the fueling system piping and back to another tank. Air shall be bled from system high points. The procedure shall be continued until the fuel being delivered into the tanks is acceptable to the Contracting Officer. After the system has been flushed to the satisfaction of the Contracting Officer, the Contractor shall remove any water remaining in the low point drains and remove any accumulated water from Operating Tank sumps and bottoms by means of the Water Draw-off systems. Cone strainers shall be kept clean in order to insure maximum flow rate. Upon completion of the first flushing operations, the cone strainers shall be removed from the system. In addition, baskets from all strainers shall be removed and cleaned.

3.2.1.1 Transfer Line

Flushing of the transfer line shall occur during the filling operations. Samples of the incoming fuel shall be taken at the point of connection with bulk storage supply line. These samples shall be taken at one hour intervals and shall be tested by the designated government agency and turned over to the Contracting Officer.

3.2.1.2 Pump House Piping

Remove equipment as specified in paragraph Protection of Equipment. Perform the following flushing operations by withdrawing fuel from one operating tank and returning it to another tank. Circulate a sufficient amount of fuel for each operation. Bleed air from high points.

a. Position manual valves to circulate fuel through one pump, filter separator combination.

b. Provide a temporary connection between the pantograph,, checkout connection and the single point receptacle. Position manual valves to circulate fuel through the checkout connection and back to the transfer line. Flush the checkout lines using one fueling pump.

c. Position manual valves to circulate fuel through the bypass line. Flush this line using two fueling pumps.

3.2.1.3 Apron Loop Piping

Remove equipment as specified in paragraph Protection of Equipment. Position manual valves to circulate fuel through the apron loop and back to the operating tank. Begin flushing the apron loop at a flow rate of 600 gpm. Increase flushing flow rate one pump at a time to the maximum available number of pumps for a minimum of 8 hours.

3.2.1.4 Hydrant Outlets

Position a tank truck at the hydrant outlet and flush each hydrant lateral. Sample the fuel at the connection to the truck.

3.2.1.5 Product Recovery Tank Lines

During the flushing of apron loop piping, operate all manual drain lines individually to flush their connection to the product recovery tank. Fill

the tank a minimum three times, each time utilizing the fuel transfer pump to drain it by returning the fuel to storage.

3.2.1.6 Pantographs

Utilize the pantograph check-out connection and single point receptacle to flush each pantograph. Sample the fuel at the pressure fueling nozzle with the kit provided for this purpose.

3.3 CLEANING

After initial flushing is completed, the pump house and apron loop piping shall be cleaned in accordance with the procedure specified hereafter. Operating Tanks shall be isolated from system and cleaned as specified in Section 15177 PETROLEUM TANK CLEANING.

3.3.1 Preparation for Cleaning

Filter elements shall be installed in the filter separators. Adjust filter separator flow control valve. Valves and equipment removed for flushing shall be reinstalled. Cone strainers shall be removed. Operating Tanks shall be drained, vapor freed and cleaned. Transfer the contents from one operating tank to the other for the purposes of cleaning.

3.3.2 Cleaning Requirements

Cleaning shall continue until Contracting Officer certifies that the fuel passes the color and particle assessment method as defined in T.O. 42B-1-1 or contains 2 milligrams per gallon or less of particulate. Fuel shall also contain 10 parts per million or less of free water. Sampling and testing shall be done by the Air Force . Also take samples at Hydrant Hose Truck Check-out Station and the truck fill stand.

3.3.3 Cleaning Procedure

During cleaning procedure periodically bleed air through high point vent and drain water through low point drains.

3.3.3.1 Transfer Line

Continue to receive fuel and circulate it until fuel samples taken at the tanks meet the requirements of paragraph 3.3.2.

3.3.3.2 Pump House Piping

Pump house piping shall be cleaned as follows:

a. Position manual valves so that fuel is withdrawn from one operating tank, circulated through one fueling pump and filter separator, then returned to the operating tank through the receiving filter separators.

b. Clean the piping system using one pump at a time. Alternate the fueling pumps and filter separators during the operation to clean the individual fueling pump suction and discharge lines.

c. Provide a temporary connection between the pantograph connection and the nozzle adaptor. Position valves to circulate fuel through the checkout connection and back to the return line. Clean the checkout lines using two fueling pumps.

d. Connect truck fill station to a tank truck and clean the line.

e. Monitor pressure drop through the filter separators during each cleaning operation and provide flow vs. pressure drop graphs as specified herein before.

f. Periodically take samples from all sample connections. Cleaning shall continue until the fuel meets the specified requirements.

3.3.3.3 Apron Loop Piping

Apron loop piping shall be cleaned as follows:

a. Position manual valves to circulate fuel through the apron loop and back to the operating tank through the receiving filter separators.

b. Initially pump fuel through the apron loop at a flow rate of 600 gpm, then increase flow rate up to the full capacity (all pumps running) starting manually one pump at a time. When pumping at a rate greater than 1200 gpm, by-pass receiving filter separators.

c. Monitor pressure drop through the filter separators during the cleaning operation and provide flow vs. pressure drop graphs as specified herein before.

d. Position a tank truck at the hydrant outlet and clean each hydrant lateral,one at a time.

e. Periodically take samples from all sample connections. Cleaning shall continue until the fuel meets specified requirements of paragraph 3.3.2.

3.3.3.4 Product Recovery Lines

Repeat the process described under initial flushing until samples taken at the connection of the pipe line back to storage meet the requirements.

3.3.3.5 Pantographs

Repeat the process described under initial flushing until samples taken at the pressure fueling nozzle meet the requirements.

3.4 CONTROL VALVE AND PANTOGRAPH ADJUSTMENT

All control valve settings shall be checked and field adjusted from the factory settings at start-up as necessary to provide a smooth operation. The filter separator control valves and fueling pump non-surge check valve and needle valve on Pantograph venturi shall be checked and adjusted as follows:

3.4.1 Rate of Flow Control Feature on Fueling Pump Non-Surge Check Valve

Run one pump at a time and adjust rate of flow feature (650 gpm).

3.4.2 Control Valves on Issue Filter Separator Downstream Side

a. Position valves so that one fueling pump can pump through only one filter separator. Close the valve at the entrance of the apron loop,

and open the bypass valve, allowing discharge into the circulating line.

b. Start the pump and adjust the filter separator control valve for the rated flow capacity of the filter separator (600 gpm).

c. Repeat above for each remaining filter separator.

3.4.3 Venturi Needle Valve

Venturi needle valve shall be adjusted to ensure a pressure equal to nozzle pressure at maximum flow possible. After initial setting, valve shall be locked in adjusted position.

3.5 EQUIPMENT TESTS

After completion of flushing, cleaning, and control valve and electrical components adjusting operations, the tests specified hereinafter shall be performed. After cleaning is complete and prior to performance testing, field adjustment of automatic control valves and automatic pump controls while in operation shall be made only by the valve manufacturer's authorized field test engineer. For final adjustment of installed electrical control equipment the Contractor shall provide an experienced electrical engineer, factory representative of PCP manufacturer and factory representative of PIT and DPT manufacturers. Both the mechanical and electrical components shall be adjusted concurrently. Tests will be witnessed by the Contracting Officer, the Command Fuel Facilities Engineer and the Command Fuel Management Officer. Contractor shall complete and submit to Contracting Officer the "CHECK LIST FOR EQUIPMENT TEST" provided hereinafter.

3.5.1 Operating Tank Low Level Alarm

Position valves to transfer fuel between operating tanks. Start one fueling pump and pump sufficient fuel out of the first operating tank to allow the low level alarm (LLA) to stop the fueling pump. This procedure shall be repeated for each fueling pump and each tank until the low level alarm stops the fueling pump due to low liquid level in operating tank.

3.5.2 Fuel Delivery

Deliver fuel to each fueling point against a backpressure at the outlet of the hydrant control valve created by the tank trucks and hoses used during the tests. The flow rate shall be not less than 600 gallons per minute for a 4-inch valve . Flow rates might be affected by aircraft capability.

3.5.3 Fueling Pump Operation

Operation of all pressure and flow devices to start and stop the fueling pumps at the indicated pressure and flow rates shall be demonstrated by the Contractor in the presence of the Contracting Officer. The operating sequence shall be repeated with each of the pumps being selected as lead pump. For this test, the flow rates shall be measured. Flow rates and test results shall be recorded and witnessed by the Contractor.

3.5.4 Defueling Performance

To test the defueling operation in the "automatic" mode, the Government will furnish a defueling cart or a hydrant hose truck with a 300 gpm pump rated at 165 psi to pump fuel from a government furnished tank truck or

bladder back into the system. While this defueling test is in operation, one 600 gpm transfer pump shall be operated providing flow into a tank truck through one hydrant control valve. Demonstrate capability of defueling into the system at the same time a fueling operation is in progress. Also test the defuel capability while in the "Flush" mode.

3.5.5 Emergency Shutdown

With one fueling pump circulating fuel through the system, test each "Emergency Stop" pushbutton station to verify that the pump stops and the filter separator valve closes. Repeat above procedure for each fueling pump and "Emergency Stop" pushbutton station. Conduct tests for both the automatic and manual modes. With all the fueling pumps circulating fuel through the system, push an "Emergency Stop" pushbutton station.

3.5.6 Hydrant Control Valve

Each Hydrant Control Valve shall be operated to demonstrate the following:

a. Surge shut-down capability. (Surge from shut-off of on-board aircraft fill valve can be simulated by closing a fill line valve to the tank truck or bladder, use a three (3) second closure.)

b. Pressure control at setpoint, + 2 psi (Requires use of a pressure gage at the pressure fueling nozzle).

3.5.7 Filter Separator Float Control Valves with Manual Tester

Using the manual float control test level on each Filter Separator, lift the weight from the float ball slowly and observe the following:

Operation and closure of the water slug shut-off feature on the Filter Separator Control Valve.

3.5.8 Overfill Valve

Place fuel transfer pump in the "off" position. Delivery quantity of fuel to Product Recovery Tank to demonstrate capability of valve to close. Place Fuel Transfer Pump in the "Automatic" position to demonstrate capability of valve to open when fuel level drops below set point.

3.6 PERFORMANCE TESTING

Testing as performed under the above paragraphs shall be considered to be part of the performance testing after the Contractor has made the required adjustments to the various equipment and controls and demonstrates to the satisfaction of the Contracting Officer and the Command Fuel Facilities Engineer , that these portions of the systems are working as specified. The Contractor shall notify the Contracting Officer 15 calendar days in advance of the test to permit arrangement for the use of Government-furnished items.

3.6.1 Final Performance Test

The final performance test shall consist of performance of the fueling system during actual fueling and defueling of an aircraft. The maximum rated capacity of the system shall be tested by using several aircraft simultaneously. If it is not possible to use the number of aircraft required to receive the full flow, the test shall be supplemented through

the use of refueling trucks or bladders. Record required data necessary to prepare "Test Reports" specified in paragraph Test Reports.

3.6.1.1 Satisfactory Performance

In the event a portion of the system or any piece of equipment fails to meet the test, the Contractor shall make the necessary repairs or adjustments and repeat the Performance Test until satisfactory performance is obtained. The determination of satisfactory performance shall be made by the Contracting Officer and the Command Fuel Facilities Engineer .

3.6.2 Final Acceptance

The system shall be filled with fuel and shall be operable and leak-free prior to acceptance. Anything wet with fuel is considered to be leaking.

3.6.2.1 Operating Tank High Liquid Level Shut-Off Valve Test and Adjustments

During the final filling of operating tanks, the tank automatic high liquid level shut-off valve shall be checked for proper functioning at least three times by lowering the fuel level and refilling again. Adjust valve to achieve a safe fill level.

3.6.2.2 Tank Level Indicator Adjustments

Also during the final filling of operating tanks, adjust and calibrate the tank level indicators including the final setting of the high high level (HHLA) and high level (HLA) alarms. Since the HHLA is at a point higher than the High Liquid Level Shut-Off Valve float set point, an artificial method of simulating HHL must be used.

3.6.2.3 Water Draw-Off System Test

During the performance testing, Water Draw-off Systems shall be filled from Operating Tank sump to ensure proper operation. After filling system, allow time for fuel/water mixture to separate. Verify liquid separation through system's sight glasses. Proper operation includes capability to drain separated water and capability to pump separated fuel back to a full Operating Tank.

3.7 ATTACHMENT

Checklist for Equipment Test

CHECK LIST FOR EQUIPMENT TEST

(To be completed after flushing, cleaning and control valve and electrical component adjustments)

PROJECT: _____

LOCATION: _____

FUEL PUMP NO.	OPERATING TANK NO. 1	
	SHUTDOWN ON LOW LEVEL	
	YES	NO

DATE: _____

TIME: _____

TEMPERATURE: _____ **F**

TEST CONDUCTED BY: _____

FUEL PUMP NO.	OPERATING TANK NO. 2	
	SHUTDOWN ON LOW LEVEL	
	YES	NO

DATE: _____

TIME: _____

TEMPERATURE: _____ **F**

TEST CONDUCTED BY: _____

ITEM 2 - FUEL DELIVERY - ONE FUELING PUMP RUNNING:

Hydrant Control Valve No.	Size (Inch)	Delivery Pressure At Valve Inlet (PSIG)	Backpressure At Valve Outlet (PSIG)	Hydrant Control Valve Flow Rate (GPM)	Pressure Fueling Nozzle Pressure (PSIG)

DATE: _____

TIME: _____

TEMPERATURE: _____ **F**

TEST CONDUCTED BY: _____

ITEM 3 - FUELING PUMP OPERATION - AUTOMATIC MODE

SELECTED MICROPROCESSOR **1**

SELECTED LEAD PUMP **FP-1**

[ ] ACTUATION POINTS

Measuring Device	Lead Pump Start	Second Pump Start	Third Pump Start	Fourth Pump Start	Fourth Pump Stop	Third Pump Stop	Second Pump Stop	Lead Pump Stop
PIT-1	_____ PSIG [60]	_____ PSIG	_____ PSIG	_____ PSIG	_____ PSIG	_____ PSIG	_____ PSIG	_____ PSIG
Issue Venturi DPT-1		_____ GPM [≥ 560]	_____ GPM [≥ 1180]	_____ GPM [≥1780]	_____ GPM [≥ 2480]	_____ GPM [≥ 1800]	_____ GPM [≥ 1200±]	
Return Venturi DPT - 3		_____ GPM [≤ 40]	_____ GPM [≤ 40]	_____ GPM [≤ 40]	_____ GPM [≤ 700]	_____ GPM [≤ 700]	_____ GPM [≥ 700]	

DATE: _____

TIME: _____

TEMPERATURE: _____ **F**

TEST CONDUCTED BY: _____

ITEM 3 - FUELING PUMP OPERATION - AUTOMATIC MODE

SELECTED MICROPROCESSOR _____1_____

SELECTED LEAD PUMP ___FP- (Contracting Officer Choice)_____

[ ] ACTUATION POINTS

Measuring Device	Lead Pump Start	Second Pump Start	Third Pump Start	Fourth Pump Start	Fourth Pump Stop	Third Pump Stop	Second Pump Stop	Lead Pump Stop
PIT-1	_____ PSIG [60]	_____ PSIG	_____ PSIG	_____ PSIG	_____ PSIG	_____ PSIG	_____ PSIG	_____ PSIG
Issue Venturi DPT-1		_____ GPM [≥ 560]	_____ GPM [≥ 1180]	_____ GPM [≥ 1780]	_____ GPM [≥ 2480]	_____ GPM [≥ 1800]	_____ GPM [≥1200±]	
Return Venturi DPT - 3		_____ GPM [≤ 40]	_____ GPM [≤ 40]	_____ GPM [≤ 40]	_____ GPM [≤ 700]	_____ GPM [≤ 700]	_____ GPM [≥ 700]	

DATE: _____

TIME: _____

TEMPERATURE: _____F_____

TEST CONDUCTED BY: _____

ITEM 3 - FUELING PUMP OPERATION - AUTOMATIC MODE

SELECTED MICROPROCESSOR _____2_____

SELECTED LEAD PUMP _FP- (Contracting Officer Choice

[ ] ACTUATION POINTS

Measuring Device	Lead Pump Start	Second Pump Start	Third Pump Start	Fourth Pump Start	Fourth Pump Stop	Third Pump Stop	Second Pump Stop	Lead Pump Stop
PIT-1	_____ PSIG1 [60]	_____ PSIG	_____ PSIG	_____ PSIG	_____ PSIG	_____ PSIG	_____ PSIG	_____ PSIG
Issue Venturi DPT-1		_____ GPM [≥ 560]	_____ GPM [≥ 1180]	_____ GPM [≥ 1780]	_____ GPM [≥ 2480]	_____ GPM [≥ 1800]	_____ GPM [≥ 1200+]	
Return Venturi DPT - 3L/3H		_____ GPM [≤ 40]	_____ GPM [≤ 40]	_____ GPM [≤ 40]	_____ GPM [≤ 700]	_____ GPM [≤ 700]	_____ GPM [≥ 700]	

DATE: _____

TIME: _____

TEMPERATURE: _____F_____

TEST CONDUCTED BY: _____

ITEM 4 - DEFUELING PERFORMANCE

FUELING PUMP NO.	AUTOMATIC MODE		
	FLOW RATE THRU ISSUE VENTURI (GPM)	FLOW RATE AT HYDRANT CONTROL VALVE (GPM)	FLOW RATE THRU RETURN VENTURI (GPM)

DATE: _____

TIME: _____

TEMPERATURE: _____ **F**

TEST CONDUCTED BY: _____

FLUSH MODE			
OPERATING TANK NO. _____ LEVEL-START	OPERATING TANK NO. _____ LEVEL-START	PRESSURE GAGE READING AT DEFUEL/ FLUSH VALVE	HYDRANT CONTROL VALVE NO.

DATE: _____

TIME: _____

TEMPERATURE: _____ **F** _____

TEST CONDUCTED BY: _____

ITEM 5 - EMERGENCY SHUTDOWN

AUTOMATIC MODE						
FUELING PUMP NO.	"EMERGENCY STOP" PUSHBUTTON NO.	EMERGENCY SHUT-OFF VALVE CLOSURE			FUELING PUMP STOP	
		YES	TIME (SEC)	NO	YES	NO
FP-						
FP-						
FP-						
FP-						
FP-						
FP-						
FP-						

DATE: _____

TIME: _____

TEMPERATURE: _____ **F**

TEST CONDUCTED BY: _____

ITEM 5 - EMERGENCY SHUTDOWN

AUTOMATIC MODE						
FUELING PUMP NO.	"EMERGENCY STOP" PUSHBUTTON NO.	EMERGENCY SHUT-OFF VALVE CLOSURE			FUELING PUMP STOP	
		YES	TIME (SEC)	NO	YES	NO
FP-						
FP-						
FP-						
FP-						
FP-						
FP-						
FP-						

DATE: _____

TIME: _____

TEMPERATURE: _____ **F**

TEST CONDUCTED BY: _____

MANUAL MODE						
FUELING PUMP NO.	"EMERGENCY STOP" PUSHBUTTON NO.	EMERGENCY SHUT-OFF VALVE CLOSURE			FUELING PUMP STOP	
		YES	TIME (SEC)	NO	YES	NO
FP-						
FP-						
FP-						
FP-						
FP-						
FP-						
FP-						

DATE: _____

TIME: _____

TEMPERATURE: _____ **F**

TEST CONDUCTED BY: _____

MANUAL MODE						
FUELING PUMP NO.	"EMERGENCY STOP" PUSHBUTTON NO.	EMERGENCY SHUT-OFF VALVE CLOSURE			FUELING PUMP STOP	
		YES	TIME (SEC)	NO	YES	NO
FP-						
FP-						
FP-						
FP-						
FP-						
FP-						
FP-						

DATE: _____

TIME: _____

TEMPERATURE: _____ **F**

TEST CONDUCTED BY: _____

ITEM 6 - HYDRANT CONTROL VALVE/TRUCK FILL STAND VALVE TEST

HYDRANT CONTROL VALVE NO.	SURGE SHUTDOWN CAPABILITY		PRESSURE CONTROL AT SETPOINT IS ± 2 PSI		DEADMAN CLOSURE WITHIN 2 SECONDS	
	YES	NO	YES	NO	YES	NO

DATE: _____

TIME: _____

TEMPERATURE: _____ F _____

TEST CONDUCTED BY: _____

ITEM 7 - FILTER SEPARATOR FLOAT CONTROL VALVE MANUAL TEST

FILTER SEPARATOR NO.			WATER SLUG FEATURE ON FILTER SEPARATOR CONTROL VALVE FUNCTIONED	
			YES	NO

DATE: _____

TIME: _____

TEMPERATURE: _____ **F**

TEST CONDUCTED BY: _____

ITEM 8 - OVERVILL VALVE TEST

PRODUCT RECOVERY TANK				
OVERFILL VALVE	CLOSED AT 80% FILL LEVEL		OPENED AS TANK LEVEL DROPS BELOW 80% FILL LEVEL	
	YES	NO	YES	NO

DATE: _____

TIME: _____

TEMPERATURE: _____ F

TEST CONDUCTED BY: _____

I Certify that the values recorded in Items 1-8 are accurate and correct.

DATE: _____

SIGNATURE: _____

ORGANIZATION: _____

I witnessed all tests required to produce values recorded in Items 1-8.

DATE: _____

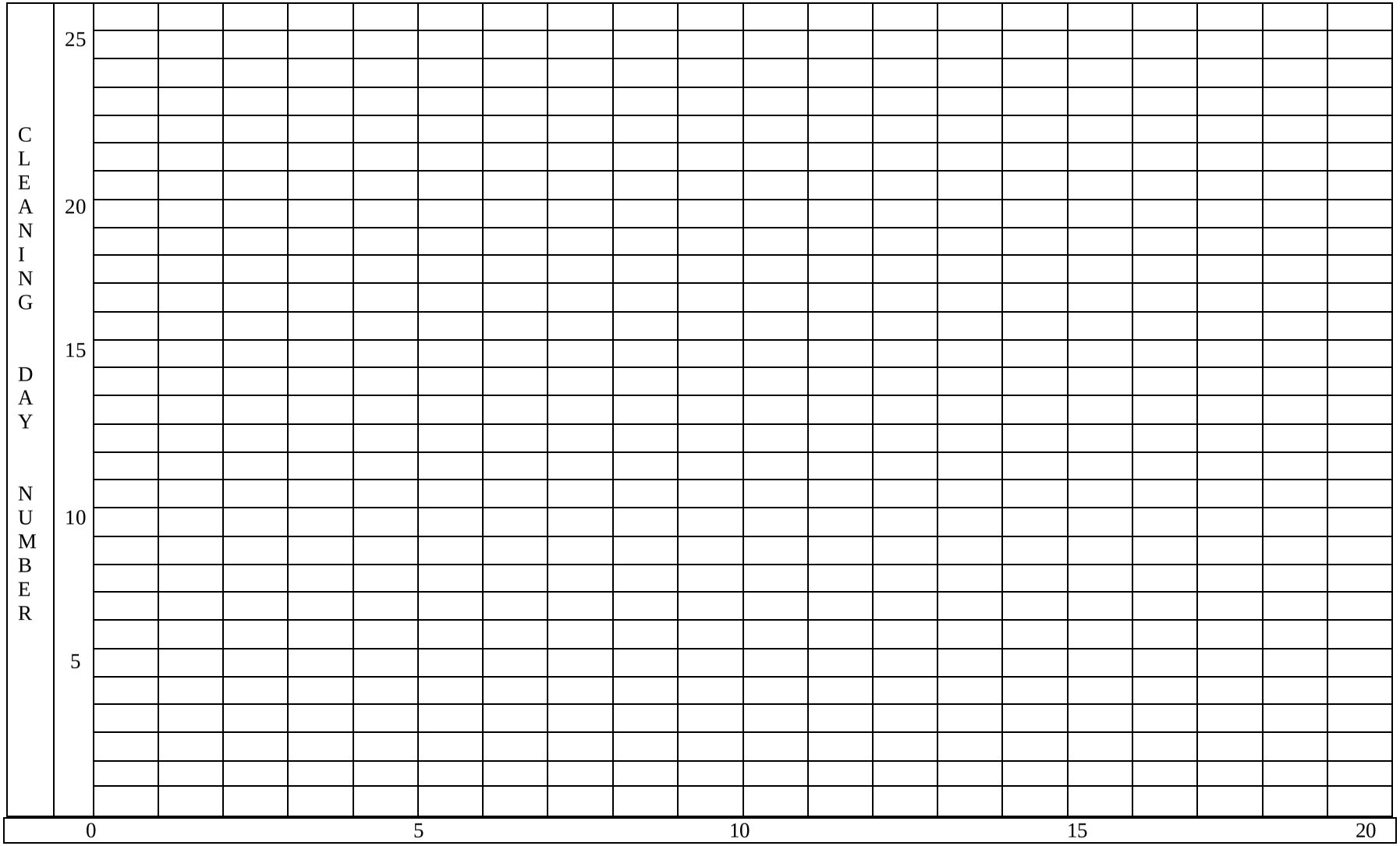
SIGNATURE: _____

ORGANIZATION: _____

PERSONNEL PRESENT DURING EQUIPMENT TEST

NAME	ORGANIZATION	COMMERCIAL PHONE NO.

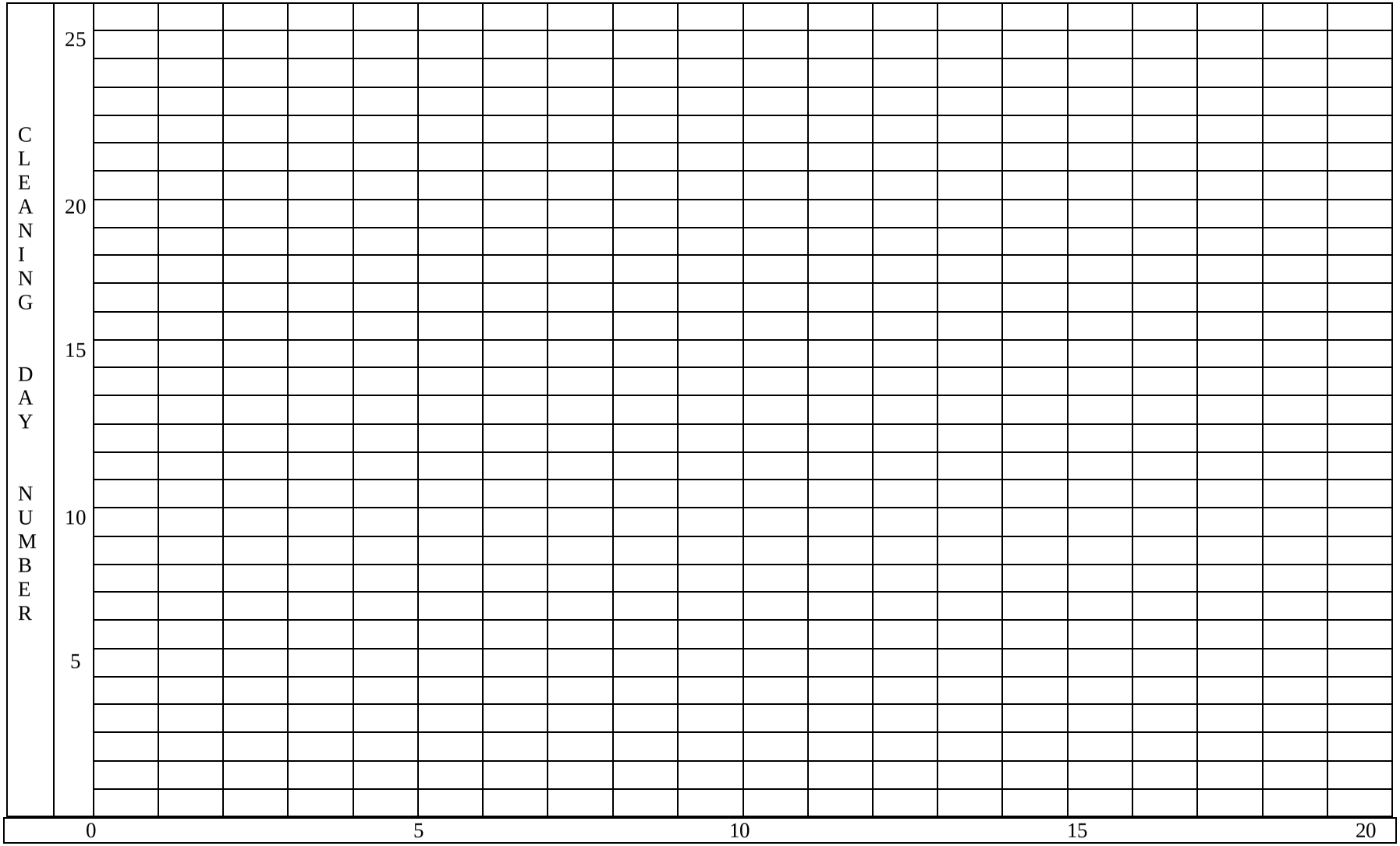
REMARKS:



PRESSURE DROP IN POUNDS PER SQUARE IN (PSI)
CLEANING OPERATION DAILY FLOW VS. PRESSURE DROP GRAPH FOR FILTER SEPARATOR NO. FSI-1

* ELEMENT CHANGE CRITERIA: (1) When pressure drop across filter separator reaches 15 PSI
(2) When pressure drop is less than previous plot or fails to increase properly

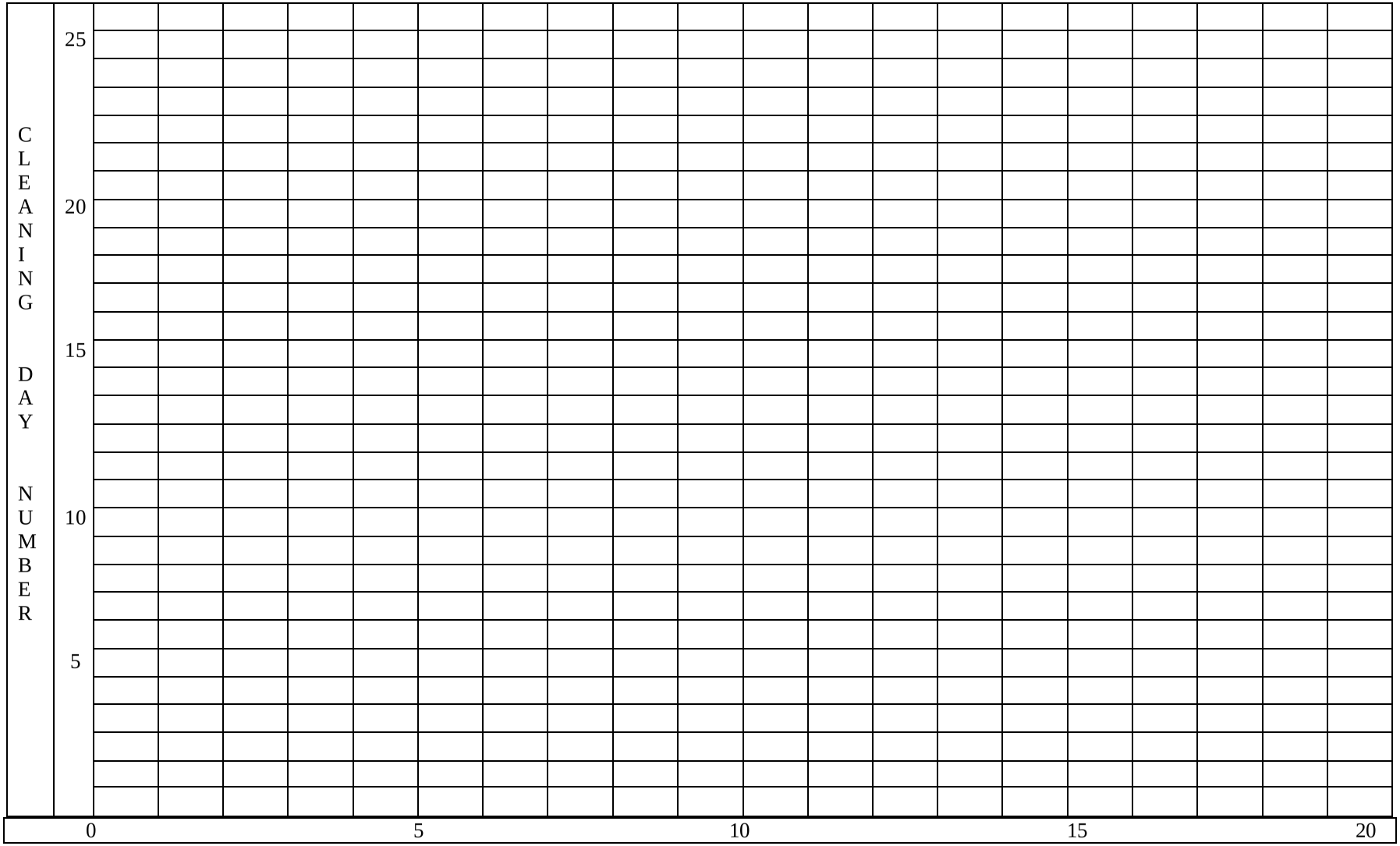
STARTING DATE: _____ SIGNATURE: _____



PRESSURE DROP IN POUNDS PER SQUARE IN (PSI)
CLEANING OPERATION DAILY FLOW VS. PRESSURE DROP GRAPH FOR FILTER SEPARATOR NO. FSI-2

* ELEMENT CHANGE CRITERIA: (1) When pressure drop across filter separator reaches 15 PSI
(2) When pressure drop is less than previous plot or fails to increase properly

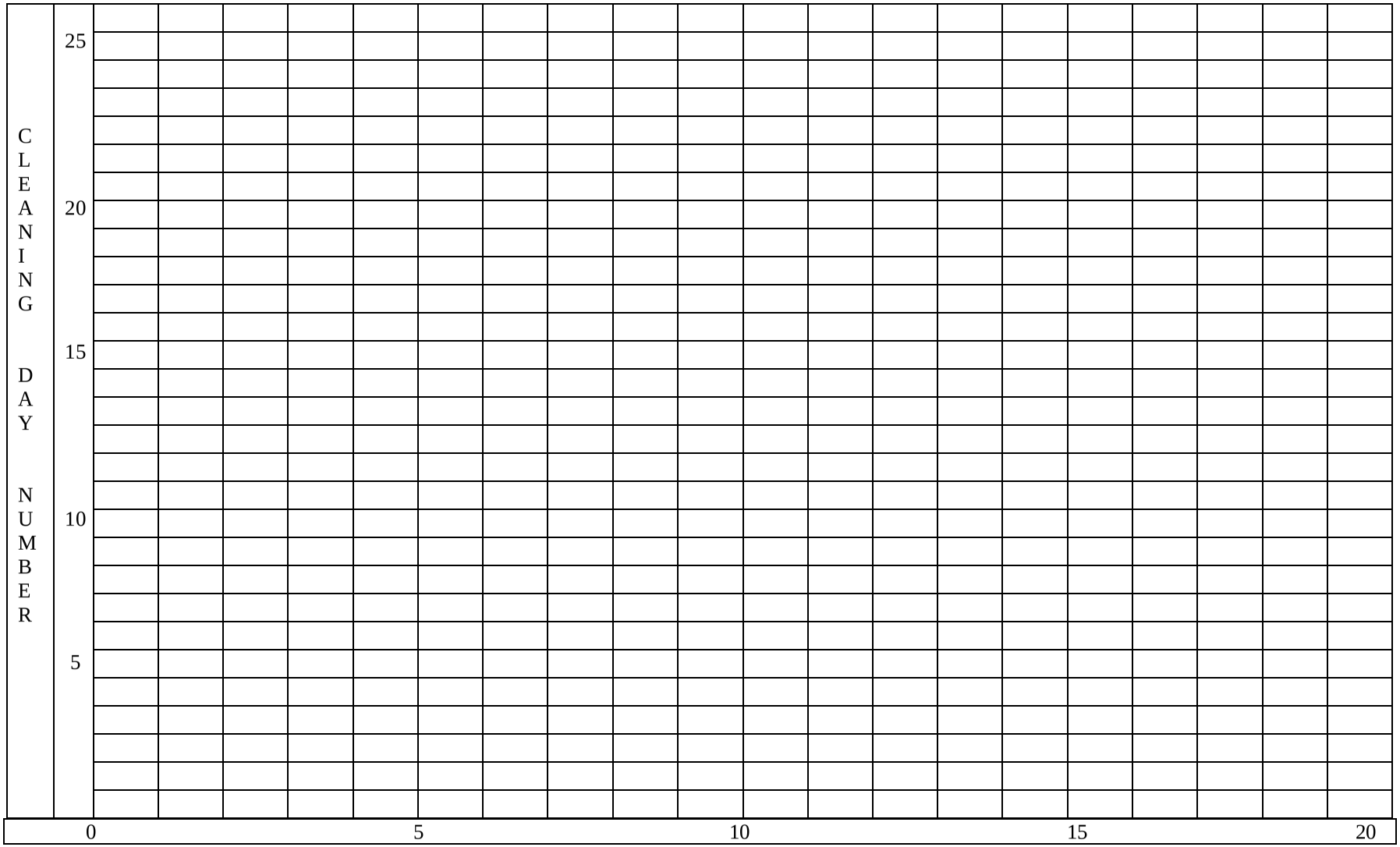
STARTING DATE: _____ SIGNATURE: _____



PRESSURE DROP IN POUNDS PER SQUARE IN (PSI)
CLEANING OPERATION DAILY FLOW VS. PRESSURE DROP GRAPH FOR FILTER SEPARATOR NO. FSI-3

* ELEMENT CHANGE CRITERIA: (1) When pressure drop across filter separator reaches 15 PSI
(2) When pressure drop is less than previous plot or fails to increase properly

STARTING DATE: _____ SIGNATURE: _____

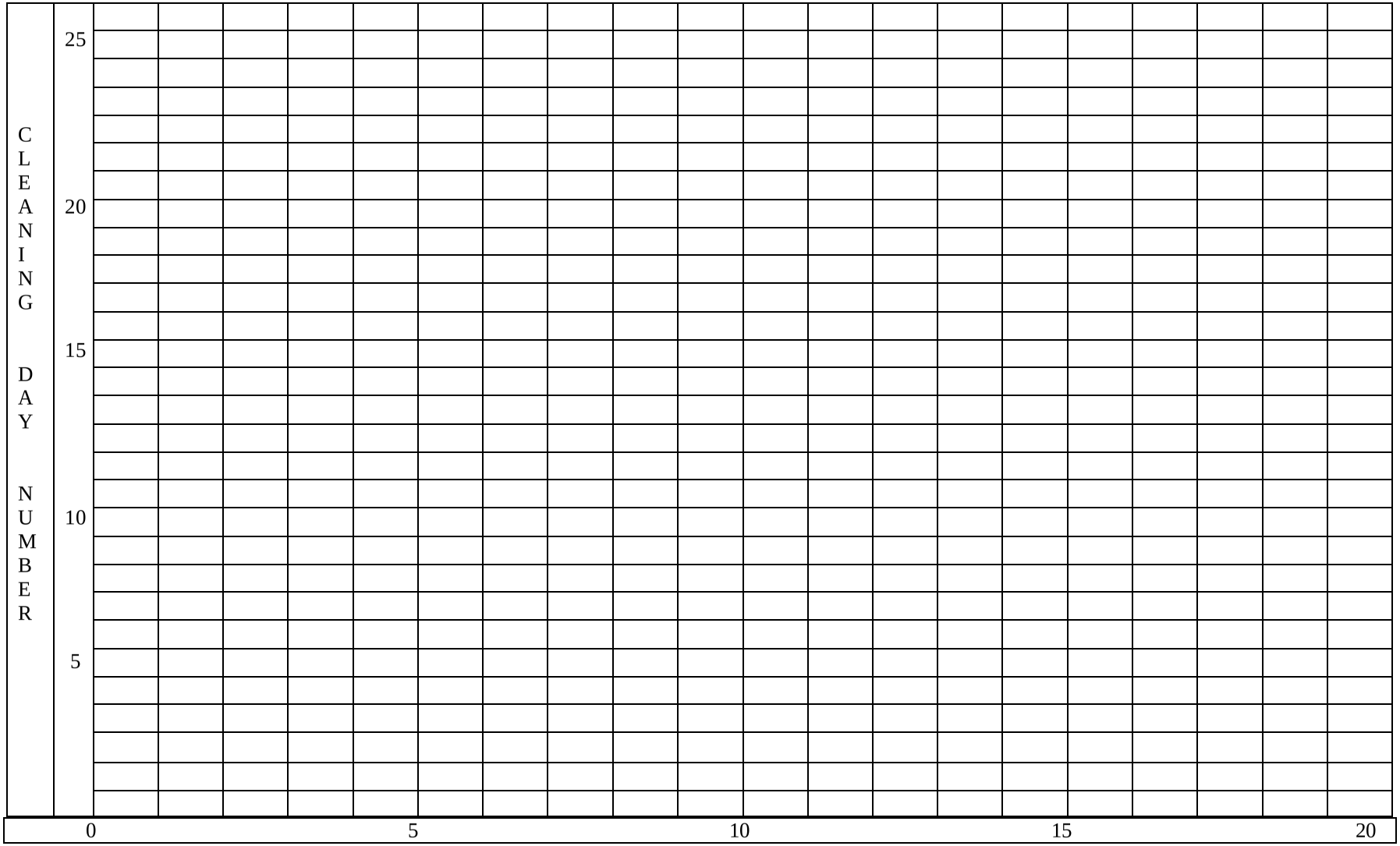


PRESSURE DROP IN POUNDS PER SQUARE IN (PSI)

CLEANING OPERATION DAILY FLOW VS. PRESSURE DROP GRAPH FOR FILTER SEPARATOR NO. FSR-4

* ELEMENT CHANGE CRITERIA: (1) When pressure drop across filter separator reaches 15 PSI
(2) When pressure drop is less than previous plot or fails to increase properly

STARTING DATE: _____ SIGNATURE: _____



PRESSURE DROP IN POUNDS PER SQUARE IN (PSI)
CLEANING OPERATION DAILY FLOW VS. PRESSURE DROP GRAPH FOR FILTER SEPARATOR NO. FSR-5

* ELEMENT CHANGE CRITERIA: (1) When pressure drop across filter separator reaches 15 PSI
(2) When pressure drop is less than previous plot or fails to increase properly

STARTING DATE: _____ SIGNATURE: _____

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SECTION 15951

DIRECT DIGITAL CONTROL FOR HVAC

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL (AMCA)

AMCA 500	(1994) Test Methods for Louvers, Dampers and Shutters

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C12.1	(1995) Code for Electricity Metering

ASME INTERNATIONAL (ASME)

ASME B16.34	(1996) Valves - Flanged, Threaded, and Welding End
ASME B40.1	(1991) Gauges - Pressure Indicating Dial Type - Elastic Element

ELECTRONIC INDUSTRIES ALLIANCE (EIA)

EIA ANSI/EIA/TIA-232-F	(1991) Interface Between Data Technical Equipment and Data Circuit-Terminating Equipment Employing Serial Binary Data Interchange

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C62.41	(1991; R 1995) Surge Voltages in Low-Voltage AC Power Circuits
IEEE Std 142	(1991) IEEE Recommended Practice for Grounding of Industrial and Commercial Power Systems

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250	(1997) Enclosures for Electrical Equipment (1000 Volts Maximum)
NEMA ICS 1	(1993) Industrial Control and Systems
NEMA ST 1	(1988) Specialty Transformers (Except General-Purpose Type)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 90A	(1999) Installation of Air Conditioning and Ventilating Systems

UNDERWRITERS LABORATORIES (UL)

UL 508	(1999; Rev thru Dec 2001) Industrial Control Equipment
UL 555S	(1996) Leakage Rated Dampers for Use in Smoke Control Systems

1.2 GENERAL REQUIREMENTS

The direct digital control (DDC) shall be a complete system suitable for the heating, ventilating and air-conditioning (HVAC) system. The DDC system shall be a Siebe Network 8000, which shall communicate directly with the proprietary front end program located in the shop. Contractor shall connect to and program the signal front end program.

1.2.1 Nameplates, Lens Caps, and Tags

Nameplates and lens caps bearing legends as shown and tags bearing device-unique identifiers as shown shall have engraved or stamped characters. A plastic or metal tag shall be mechanically attached directly to each device or attached by a metal chain or wire. Each airflow measurement station shall have a tag showing flow rate range for signal output range, duct size, and identifier as shown.

1.2.2 Verification of Dimensions

After becoming familiar with all details of the work, the Contractor shall verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing any work.

1.2.3 Drawings

Because of the small scale of the drawings, it is not possible to indicate all offsets, fittings, and accessories that may be required. The Contractor shall carefully investigate the mechanical, electrical, and finish conditions that could affect the work to be performed, shall arrange such work accordingly, and shall furnish all work necessary to meet such conditions.

1.2.4 Power-Line Surge Protection

Equipment connected to ac circuits shall be protected from power-line surges. Equipment protection shall meet the requirements of IEEE C62.41. Fuses shall not be used for surge protection.

1.2.5 Surge Protection for Transmitter and Control Wiring

DDC system control-panel equipment shall be protected against surges induced on control and transmitter wiring installed outside and as shown. The equipment protection shall be tested in the normal mode and in the common mode, using the following two waveforms:

a. A 10-microsecond by 1,000-microsecond waveform with a peak voltage

of 1,500 volts and a peak current of 60 amperes.

b. An eight microsecond by 20-microsecond waveform with a peak voltage of 1,000 volts and a peak current of 500 amperes.

1.2.6 System Overall Reliability Requirement

The system shall be configured and installed to yield a mean time between failure (MTBF) of at least 40,000 hours. Each DDC controller shall be designed, configured, installed and programmed to provide for stand alone operation with minimal performance degradation on failure of other system components to which it is connected or with which it communicates.

1.2.7 DDC System Network Accessibility

Where the systems to be controlled by the DDC system are located in multiple mechanical rooms, each mechanical room shall have at least one communication port for the portable workstation/tester. DDC controllers shall be located in the same room as the equipment being controlled or in an adjacent space which has direct access to the equipment room.

1.2.8 System Accuracy and Display

The system shall maintain an end-to-end accuracy for one year from sensor to operator's console display for the applications specified and shall display the value as specified. Each temperature shall be displayed and printed to nearest 0.1 degree F.

1.2.8.1 Space Temperature

Space temperature with a range of 50 to 85 degrees F plus or minus 0.75 degree F for conditioned space; 30 to 130 degrees F plus or minus 1 degree F for unconditioned space.

1.2.8.2 Duct Temperature

Duct temperature with a range of 40 to 140 degrees F plus or minus 2 degrees F.

1.2.8.3 Outside Air Temperature

Outside air (OA) temperature with a range of minus 60 to plus 130 degrees F plus or minus 2 degrees F; with a subrange of 30 to 100 degrees F plus or minus 1 degree F.

1.2.8.4 Water Temperature

Water temperature with a range of 30 to 100 degrees F plus or minus 0.75 degree F; the range of 100 to 250 degrees F plus or minus 2 degrees F; and water temperatures for the purpose of performing Btu calculations using differential temperatures to plus or minus 0.5 degree F using matched sensors.

1.2.8.5 High Temperature

High temperature with a range of 200 to 500 degrees F plus or minus 2.0 degrees F.

1.2.8.6 Relative Humidity

Relative humidity, within a range of 20 to 80 percent, plus or minus 6.0 percent of range (display and print to nearest 1.0 percent).

1.2.8.7 Pressure

Pressure with a range for the specific application plus or minus 2.0 percent of range (display and print to nearest psi).

1.2.8.8 Flow

Flow with a range for the specific application plus or minus 3.0 percent of range, and flows for the purpose of thermal calculations to plus or minus 2.0 percent of actual flow (display and print to nearest unit, such as gallons per minute).

1.2.8.9 KWh and kW Demand

KWh and kW demand with a range for the specific application plus or minus 1.0 percent of reading (display and print to nearest kWh or kW).

1.2.8.10 Analog Value Input

An analog value input to the system's equipment via an AI with a maximum error of 0.50 percent of range, not including the sensor or transmitter error. This accuracy shall be maintained over the specified environmental conditions.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

HVAC Control System; G-AE

Drawings shall be on 34 by 22 inch sheets in the form and arrangement shown. The drawings shall use the same abbreviations, symbols, nomenclature and identifiers shown. Each control system element on a drawing shall have a unique identifier as shown. The HVAC Control System Drawings shall be delivered together as a complete submittal. Deviations must be approved by the Contracting Officer. Drawings shall be submitted along with Submittal SD-01, Data.

a. HVAC Control System Drawings shall include the following:

Sheet One: Drawing Index, HVAC Control System Legend.

Sheet Two: Valve Schedule, Damper Schedule.

Sheet Three: Compressed Air Station Schematic.

Sheet Four: Control System Schematic and Equipment Schedule.

Sheet Five: Sequence of Operation and Data Terminal Strip Layout.

Sheet Six: Control Loop Wiring Diagrams.

Sheet Seven: Motor Starter and Relay Wiring Diagram.

Sheet Eight: Communication Network and Block Diagram.

Sheet Nine: DDC Panel Installation and Block Diagram.

(Repeat Sheets Four through Seven for each AHU System.)

b. The HVAC Control System Drawing Index shall show the name and number of the building, military site, State or other similar designation, and Country. The Drawing Index shall list HVAC Control System Drawings, including the drawing number, sheet number, drawing title, and computer filename when used. The HVAC Control System Legend shall show generic symbols and the name of devices shown on the HVAC Control System Drawings.

c. The valve schedule shall include each valve's unique identifier, size, flow coefficient Cv, pressure drop at specified flow rate, spring range, positive positioner range, actuator size, close-off pressure data, dimensions, and access and clearance requirements data. Valve schedules may be submitted in advance but shall be included in the complete submittal.

d. The damper schedule shall contain each damper's and each actuator's identifier, nominal and actual sizes, orientation of axis and frame, direction of blade rotation, spring ranges, operation rate, positive positioner ranges, locations of actuators and damper end switches, arrangement of sections in multi-section dampers, and methods of connecting dampers, actuators, and linkages. The Damper Schedule shall include the maximum leakage rate at the operating static-pressure differential. The Damper Schedule shall contain actuator selection data supported by calculations of the torque required to move and seal the dampers, access and clearance requirements. Damper schedules may be submitted in advance but shall be included in the complete submittal.

f. The HVAC control system schematics shall be in the form shown, and shall show all control and mechanical devices associated with the HVAC system. A system schematic drawing shall be submitted for each HVAC system.

g. The HVAC control system equipment Schedule shall be in the form shown. All devices shown on the drawings having unique identifiers shall be referenced in the equipment schedule. Information to be included in the equipment schedule shall be the control loop, device unique identifier, device function, setpoint, input range, and additional important parameters (i.e., output range). An equipment schedule shall be submitted for each HVAC system.

h. The HVAC control system sequence of operation shall reflect the language and format of this specification, and shall refer to

the devices by their unique identifiers as shown. No operational deviations from specified sequences will be permitted without prior written approval of the Contracting Officer. Sequences of operation shall be submitted for each HVAC control system including each type of terminal unit control system.

i. The HVAC control system wiring diagrams shall be functional wiring diagrams which show the interconnection of conductors and cables to HVAC control panel terminal blocks and to the identified terminals of devices, starters and package equipment. The wiring diagrams shall show necessary jumpers and ground connections. The wiring diagrams shall show the labels of all conductors. Sources of power required for HVAC control systems and for packaged equipment control systems shall be identified back to the panel board circuit breaker number, HVAC system control panel, magnetic starter, or packaged equipment control circuit. Each power supply and transformer not integral to a controller, starter, or packaged equipment shall be shown. The connected volt-ampere load and the power supply volt-ampere rating shall be shown. Wiring diagrams shall be submitted for each HVAC control system.

SD-03 Product Data

Service Organizations; G-AO

Six copies of a list of service organizations qualified to service the HVAC control system. The list shall include the service organization name, address, technical point of contact and telephone number, and contractual point of contact and telephone number.

Equipment Compliance Booklet; G-AE

The HVAC Control System Equipment Compliance Booklet (ECB) shall be in booklet form and indexed, with numbered tabs separating the information on each device. It shall consist of, but not be limited to, data sheets and catalog cuts which document compliance of all devices and components with the specifications. The ECB shall be indexed in alphabetical order by the unique identifiers. Devices and components which do not have unique identifiers shall follow the devices and components with unique identifiers and shall be indexed in alphabetical order according to their functional name. The ECB shall include a Bill of Materials for each HVAC Control System. The Bill of Materials shall function as the Table of Contents for the ECB and shall include the device's unique identifier, device function, manufacturer, model/part/catalog number used for ordering, and tab number where the device information is located in the ECB. The ECB shall be submitted along with Submittal SD-04, Drawings.

Commissioning Procedures; G-AO

Six copies of the HVAC control system commissioning procedures, in booklet form and indexed, 60 days prior to the scheduled start of commissioning. Commissioning procedures shall be provided for each HVAC control system, and for each type of terminal unit control system. The Commissioning procedures shall reflect the format and language of this specification, and refer to devices by their unique identifiers as shown. The Commissioning procedures

shall be specific for each HVAC system, and shall give detailed step-by-step procedures for commissioning of the system.

a. The Commissioning procedures shall include detailed, product specific set-up procedures, configuration procedures, adjustment procedures, and calibration procedures for each device. Where the detailed product specific commissioning procedures are included in manufacturer supplied manuals, reference may be made in the HVAC control system commissioning procedures to the manuals.

b. An HVAC control system commissioning procedures equipment list shall be included that lists the equipment to be used to accomplish commissioning. The list shall include manufacturer name, model number, equipment function, the date of the latest calibration, and the results of the latest calibration.

Performance Verification Test Procedures; G-AO

Six copies of the HVAC Control System Performance Verification Test Procedures, in booklet form and indexed, 60 days before the Contractor's scheduled test dates. The performance verification test procedures shall refer to the devices by their unique identifiers as shown, shall explain, step-by-step, the actions and expected results that will demonstrate that the HVAC control system performs in accordance with the sequences of operation, and other contract documents. An HVAC control system performance verification test equipment list shall be included that lists the equipment to be used during performance verification testing. The list shall include manufacturer name, model number, equipment function, the date of the latest calibration, and the results of the latest calibration.

Training; G-AO

An outline for the HVAC control system training course with a proposed time schedule. Approval of the planned training schedule shall be obtained from the Government at least 60 days prior to the start of the training. Six copies of HVAC control system training course material 30 days prior to the scheduled start of the training course. The training course material shall include the operation manual, maintenance and repair manual, and paper copies of overheads used in the course.

SD-06 Test Reports

Commissioning Report; G-AO

Six copies of the HVAC Control System Commissioning Report, in booklet form and indexed, within 30 days after completion of the system commissioning. The commissioning report shall include data collected during the HVAC control system commissioning procedures and shall follow the format of the commissioning procedures. The commissioning report shall include all configuration checksheets with final values listed for all parameters, setpoints, P, I, D setting constants, calibration data for all devices, results of adjustments, and results of testing.

Performance Verification Test; G-AO

Six copies of the HVAC Control System Performance Verification Test Report, in booklet form and indexed, within 30 days after completion of the test. The HVAC control system performance verification test report shall include data collected during the HVAC control system performance verification test. The original copies of all data gathered during the performance verification test shall be turned over to the Government after Government approval of the test results.

SD-10 Operation and Maintenance Data

Operation Manual; G-AO
Maintenance and Repair Manual; G-AO

Six copies of the HVAC Control System Operation Manual and HVAC Control System Maintenance and Repair Manual, for each HVAC control system, 30 days before the date scheduled for the training course.

1.4 DELIVERY AND STORAGE

Products shall be stored with protection from the weather, humidity and temperature variations, dirt and dust, and other contaminants, within the storage condition limits published by the equipment manufacturer. Dampers shall be stored so that seal integrity, blade alignment and frame alignment are maintained.

1.5 OPERATION MANUAL

An HVAC control system operation manual in indexed booklet form shall be provided for each HVAC control system. The operation manual shall include the HVAC control system sequence of operation, and procedures for the HVAC system start-up, operation and shut-down. The operation manual shall include as-built HVAC control system detail drawings. The operation manual shall include the as-built configuration checksheets, the procedures for changing HVAC control system setpoints, and the procedures for placing HVAC system controllers in the manual control mode.

a. The procedures for changing HVAC control system setpoints shall describe the step-by-step procedures required to change the process variable setpoints, the alarm setpoints, the bias settings, and setpoint reset schedules.

b. The procedures for placing HVAC system controllers in the manual control mode shall describe step-by-step procedures required to obtain manual control of each controlled device and to manually adjust their positions.

1.6 MAINTENANCE AND REPAIR MANUAL

An HVAC control system maintenance and repair manual in indexed booklet form in hardback binders shall be provided for each HVAC control system. The maintenance and repair manual shall include the routine maintenance checklist, a recommended repair methods list, a list of recommended maintenance and repair tools, the qualified service organization list, the as-built commissioning procedures and report, the as-built performance verification test procedures and report, and the as-built equipment data booklet.

a. The routine maintenance checklist shall be arranged in a columnar format. The first column shall list all devices listed in the equipment compliance booklet, the second column shall state the maintenance activity or state no maintenance required, the third column shall state the frequency of the maintenance activity, and the fourth column for additional comments or reference.

b. The recommended repair methods list shall be arranged in a columnar format and shall list all devices in the equipment data compliance booklet and state the guidance on recommended repair methods, either field repair, factory repair, or whole-item replacement.

c. The as-built equipment data booklet shall include the equipment compliance booklet and manufacturer supplied user manuals and information.

d. If the operation manual and the maintenance and repair manual are provided in a common volume, they shall be clearly differentiated and separately indexed.

PART 2 PRODUCTS

2.1 GENERAL EQUIPMENT REQUIREMENTS

Units of the same type of equipment shall be products of a single manufacturer. Each major component of equipment shall have the manufacturer's name and address, and the model and serial number in a conspicuous place. Materials and equipment shall be standard products of a manufacturer regularly engaged in the manufacturing of such products, which are of a similar material, design and workmanship. The standard products shall have been in a satisfactory commercial or industrial use for two years prior to use on this project. The two years' use shall include applications of equipment and materials under similar circumstances and of similar size. The two years' experience shall be satisfactorily completed by a product which has been sold or is offered for sale on the commercial market through advertisements, manufacturers' catalogs, or brochures. Products having less than a two-year field service record will be acceptable if a certified record of satisfactory field operation, for not less than 6,000 hours exclusive of the manufacturer's factory tests, can be shown. The equipment items shall be supported by a service organization. Items of the same type and purpose shall be identical, including equipment, assemblies, parts and components. Automatic temperature controls shall be direct digital controls that will provide the required sequence of operation.

2.1.1 Electrical and Electronic Devices

Electrical, electronic, and electropneumatic devices not located within a DDC panel shall have a NEMA ICS 1 enclosure in accordance with NEMA 250 unless otherwise shown.

2.1.2 Standard Signals

Except for air distribution terminal unit control equipment, the output of all analog transmitters and the analog input and output of all DDC controllers shall be 4-to-20 mAdc signals. The signal shall originate from current-sourcing devices and shall be received by current-sinking devices.

2.1.3 Ambient Temperature Limits

DDC panels shall have ambient condition ratings of 35 to 120 degrees F and 10 to 95 percent relative humidity, noncondensing. Devices installed outdoors shall operate within limit ratings of minus 35 to plus 150 degrees F. Instrumentation and control elements shall be rated for continuous operation under the ambient environmental temperature, pressure, humidity, and vibration conditions specified or normally encountered for the installed location.

2.1.4 Year 2000 Compliance

All equipment and software shall be Year 2000 compliant and shall be able to accurately process date/time data (including, but not limited to, calculating, comparing, and sequencing) from, into, and between the twentieth and twenty-first centuries, including leap year calculations, when used in accordance with the product documentation provided by the contractor, provided that all products (e.g. hardware, software, firmware) used in combination with other information technology, shall accurately process date/time data if other information technology properly exchanges date/time data with it.

2.2 WIRING

2.2.1 Terminal Blocks

Terminal blocks shall be insulated, modular, feed-through, clamp style with recessed captive screw-type clamping mechanism, shall be suitable for rail mounting, and shall have end plates and partition plates for separation or shall have enclosed sides.

2.2.2 Control Wiring for 24-Volt Circuits

Control wiring for 24-volt circuits shall be 18 AWG minimum, stranded copper and shall be rated for 300-volt service.

2.2.3 Wiring for 120-Volt Circuits

Wiring for 120-volt circuits shall be 18 AWG minimum, stranded copper and shall be rated for 600-volt service.

2.2.4 Instrumentation Cable

Instrumentation cable shall be 18 AWG, stranded copper, single- or multiple-twisted, minimum 2 inch lay of twist, 100 percent shielded pairs, and shall have a 300-volt insulation. Each pair shall have a 20 AWG tinned-copper drain wire and individual overall pair insulation. Cables shall have an overall aluminum-polyester or tinned-copper cable-shield tape, overall 20 AWG tinned-copper cable drain wire, and overall cable insulation.

2.2.5 Transformers

Step down transformers shall be utilized where control equipment operates at lower than line circuit voltage. Transformers, other than transformers in bridge circuits, shall have primaries wound for the voltage available and secondaries wound for the correct control circuit voltage. Transformer shall be sized so that the connected load is 80 percent of the rated capacity or less. Transformers shall conform to UL 508 and NEMA ST 1.

2.3 ACTUATORS

Actuators shall be electric or electronic as shown and shall be provided with mounting and connecting hardware. Electric or electronic actuators shall be used for variable air volume (VAV) air terminal units. Actuators shall fail to their spring-return positions on signal or power failure . The actuator stroke shall be limited in the direction of power stroke by an adjustable stop. Actuators shall have a visible position indicator. Actuators shall smoothly open or close the devices to which they are applied and shall have a full stroke response time of 90 seconds or less. Electric actuators shall have an oil-immersed gear train. Electric or electronic actuators operating in series shall have an auxiliary actuator driver. Electric or electronic actuators used in sequencing applications shall have an adjustable operating range and start point. Pneumatic actuators shall be rated for 25 psig operating pressure except for high-pressure cylinder-type actuators.

2.3.1 Valve Actuators

Valve actuators shall be selected to provide a minimum of 125 percent of the motive power necessary to operate the valve over its full range of operation.

2.3.2 Positive Positioners

Positive positioners are required for pneumatic actuators. Each positive positioner shall be a pneumatic relay with a mechanical feedback mechanism and an adjustable operating range and starting point.

2.4 AUTOMATIC CONTROL VALVES

Valves shall have stainless-steel stems and stuffing boxes with extended necks to clear the piping insulation. Unless otherwise stated, valves shall have globe style bodies. Valve bodies shall be designed for not less than 125 psig working pressure or 150 percent of the system operating pressure, whichever is greater. Valve leakage rating shall be 0.01 percent of rated Cv. Unless otherwise specified, bodies for valves 1-1/2 inches and smaller shall be brass or bronze, with threaded or union ends; bodies for 2 inch valves shall have threaded ends; and bodies for valves 2 to 3 inches shall be of brass, bronze or iron. Bodies for valves 2-1/2 inches and larger shall be provided with flanged-end connections. Valve Cv shall be within 100 to 125 percent of the Cv shown.

2.4.1 Butterfly Valve Assembly

Butterfly valves shall be threaded lug type suitable for dead-end service and modulation to the fully-closed position, with carbon-steel bodies and noncorrosive discs, stainless steel shafts supported by bearings, and EPDM seats suitable for temperatures from minus 20 to plus 250 degrees F. Valves shall have a manual means of operation independent of the actuator. The rated Cv for butterfly valves shall be the value Cv at 70% open (60 degrees open).

2.4.2 Two-Way Valves

Two-way modulating valves shall have equal-percentage characteristics.

2.4.3 Three-Way Valves

Three-way valves shall provide linear flow control with constant total flow throughout full plug travel.

2.4.4 Duct-Coil and Terminal-Unit-Coil Valves

Control valves with either flare-type or solder-type ends shall be provided for duct or terminal-unit coils. Flare nuts shall be furnished for each flare-type end valve.

2.4.5 Valves for Chilled-Water, Condenser-Water, and Glycol Service

Internal valve trim shall be bronze except that valve stems may be type 316 stainless steel. Valve Cv shall be within 100 to 125 percent of the Cv shown. Valves 4 inches and larger shall be butterfly.

2.4.6 Valves for Hot-Water and Dual Temperature Service

For hot water service below 250 degrees F and dual-temperature service, internal trim (including seats, seat rings, modulating plugs, and springs) of valves controlling water hotter than 210 degrees F shall be Type 316 stainless steel. Internal trim for valves controlling water 210 degrees F or less shall be brass or bronze. Nonmetallic parts of hot-water control valves shall be suitable for a minimum continuous operating temperature of 250 degrees F or 50 degrees F above the system design temperature, whichever is higher. Valves 4 inches and larger shall be butterfly valves.

2.4.7 Valves for Steam Service

Bodies for valves 4 inches and larger shall be iron. Internal valve trim shall be Type 316 stainless steel. Valve Cv shall be not less than shown nor greater than the Cv of the manufacturer's next larger size.

2.4.8 Valves for High-Temperature Hot-Water Service

For high-temperature hot water service above 250 Degrees F, valve bodies shall be rated ANSI Class 300, as specified in ASME B16.34. Valve and actuator combination shall be normally closed. Bodies shall be carbon steel, globe type with welded ends on valves 1 inch and larger. Valves smaller than 1 inch shall have socket-weld ends. Packing shall be virgin polytetrafluoroethylene (PTFE). Internal valve trim shall be Type 316 stainless steel. Valve Cv shall be within 100 to 125 percent of the Cv shown.

2.5 DAMPERS

2.5.1 Damper Assembly

A single damper section shall have blades no longer than 48 inches and shall be no higher than 72 inches. Maximum damper blade width shall be 8 inches. Larger sizes shall be made from a combination of sections. Dampers shall be steel, or other materials where shown. Flat blades shall be made rigid by folding the edges. Blade-operating linkages shall be within the frame so that blade-connecting devices within the same damper section shall not be located directly in the air stream. Damper axles shall be 0.5 inch minimum, plated steel rods supported in the damper frame by stainless steel or bronze bearings. Blades mounted vertically shall be supported by thrust bearings. Pressure drop through dampers shall not

exceed 0.04 inch water gauge at 1,000 feet per minute in the wide-open position. Frames shall not be less than 2 inches in width. Dampers shall be tested in accordance with AMCA 500.

2.5.2 Operating Links

Operating links external to dampers, such as crankarms, connecting rods, and line shafting for transmitting motion from damper actuators to dampers, shall withstand a load equal to at least twice the maximum required damper-operating force. Rod lengths shall be adjustable. Links shall be brass, bronze, zinc-coated steel, or stainless steel. Working parts of joints and clevises shall be brass, bronze, or stainless steel. Adjustments of crankarms shall control the open and closed positions of dampers.

2.5.3 Damper Types

Dampers shall be parallel-blade type.

2.5.3.1 Outside Air, Return Air, and Relief Air Dampers

Outside air, return air and relief air dampers shall be provided where shown. Blades shall have interlocking edges and shall be provided with compressible seals at points of contact. The channel frames of the dampers shall be provided with jamb seals to minimize air leakage. Dampers shall not leak in excess of 20 cfm per square foot at 4 inches water gauge static pressure when closed. Seals shall be suitable for an operating temperature range of minus 60 to plus 200 degrees F. Dampers shall be rated at not less than 2,000 feet per minute air velocity.

2.5.3.2 Mechanical and Electrical Space Ventilation Dampers

Mechanical and electrical space ventilation dampers shall be as shown. Dampers shall not leak in excess of 80 cfm square foot at 4 inches water gauge static pressure when closed. Dampers shall be rated at not less than 1,500 feet per minute air velocity.

2.5.3.3 Smoke Dampers

Smoke-damper and actuator assembly required per NFPA 90A shall meet the Class II leakage requirements of UL 555S. Dampers shall be rated at not less than 2000 fpm air velocity.

2.5.4 Damper End Switches

Each end switch shall be a hermetically sealed switch with a trip lever and over-travel mechanism. The switch enclosure shall be suitable for mounting on the duct exterior and shall permit setting the position of the trip lever that actuates the switch. The trip lever shall be aligned with the damper blade.

2.6 INSTRUMENTATION

2.6.1 Measurements

Transmitters shall be calibrated to provide the following measurements, over the indicated ranges, for an output of 4 to 20 mAdc:

a. Conditioned space temperature, from 50 to 85 degrees F.

b. Duct temperature, from 40 to 140 degrees F.

c. High-temperature hot-water temperature, from 200 to 500 degrees F.

d. Chilled-water temperature, from 30 to 100 degrees F.

e. Dual-temperature water, from 30 to 240 degrees F.

f. Heating hot-water temperature, from 50 to 250 degrees F.

g. Condenser-water temperature, from 30 to 130 degrees F.

h. Outside-air temperature, from minus 60 to 130 degrees F.

i. Relative humidity, 0 to 100 percent for space and duct high-limit applications.

j. Differential pressure for VAV supply-duct static pressure from 0 to 2.0 inches water gauge.

k. Pitot-tube air-flow measurement station and transmitter, from 0 to 0.1 inch water gauge for flow velocities of 700 to 1200 fpm, 0 to 0.25 inch water gauge for velocities of 700 to 1800 fpm, or 0 to 0.5 inch water gauge for velocities of 700 to 2500 fpm.

l. Electronic air-flow measurement station and transmitter, from 125 to 2500 fpm.

2.6.2 Temperature Instruments

2.6.2.1 Resistance Temperature Detectors (RTD)

Temperature sensors shall be 100 ohms 3- or 4-wire RTD. Each RTD shall be platinum with a tolerance of 0.54 degrees F at 32 degrees F with a temperature coefficient of resistance (TCR) of .00214 ohms/ohm/deg F and shall be encapsulated in epoxy, series 300 stainless steel, anodized aluminum, or copper. Each RTD shall be furnished with an RTD transmitter as specified, integrally mounted unless otherwise shown.

2.6.2.2 Continuous Averaging RTD

Continuous averaging RTDs shall have a tolerance of plus or minus 1.0 degree F at the reference temperature, and shall be of sufficient length to ensure that the resistance represents an average over the cross section in which it is installed. The sensing element shall have a bendable copper sheath. Each averaging RTD shall be furnished with an RTD transmitter to match the resistance range of the averaging RTD.

2.6.2.3 RTD Transmitter

The RTD transmitter shall match the resistance range of the RTD. The transmitter shall be a two-wire, loop powered device. The transmitter shall produce a linear 4-to-20 mAdc output corresponding to the required temperature measurement. The output error shall not exceed 0.1 percent of the calibrated measurement.

2.6.3 Differential Pressure Instruments

The instrument shall be a pressure transmitter with an integral sensing element. The instrument over pressure rating shall be 300 percent of the operating pressure. The sensor/transmitter assembly accuracy shall be plus or minus two percent of full scale. The transmitter shall be a two-wire, loop-powered device. The transmitter shall produce a linear 4-to-20 mAdc output corresponding to the required pressure measurement.

2.6.4 Thermowells

Thermowells shall be Series 300 stainless steel with threaded brass plug and chain, 2 inch lagging neck and extension type well. Inside diameter and insertion length shall be as required for the application.

2.6.5 Sunshields

Sunshields for outside air temperature sensing elements shall prevent the sun from directly striking the temperature sensing elements. The sunshields shall be provided with adequate ventilation so that the sensing element responds to the ambient temperature of the surroundings. The top of each sunshield shall have a galvanized metal rainshield projecting over the face of the sunshield. The sunshields shall be painted white.

2.7 THERMOSTATS

Thermostat ranges shall be selected so that the setpoint is adjustable without tools between plus or minus 10 degrees F of the setpoint shown. Thermostats shall be electronic or electric.

2.7.1 Nonmodulating Room Thermostats

Contacts shall be single-pole double-throw (SPDT), hermetically sealed, and wired to identified terminals. Maximum differential shall be 5 degrees F. Room thermostats shall be enclosed with separate locking covers (guards).

2.7.2 Microprocessor Based Room Thermostats

Microprocessor based thermostats shall have built-in keypads for scheduling of day and night temperature settings. When out of the scheduling mode, thermostats shall have continuous display of time, with AM and PM indicator, continuous display of day of week, and either continuous display of room temperature with display of temperature setpoint on demand, or continuous display of temperature setpoint with display of room temperature on demand. In the programmable mode, the display shall be used for interrogating time program ON-OFF setpoints for all seven days of the week. The time program shall allow two separate temperature setback intervals per day. The thermostats shall have a means for temporary and manual override of the program schedule, with automatic program restoration on the following day. Thermostats shall have a replaceable battery to maintain the timing and maintain the schedule in memory for one year in the event of a power outage. Maximum differential shall be 2 degrees F. When used for heat pump applications, the thermostat shall have an emergency heat switch.

2.7.3 Modulating Room Thermostats

Modulating room thermostats shall have either one output signal, two output signals operating in unison, or two output signals operating in sequence, as required for the application. Each thermostat shall have an adjustable

throttling range of 4 to 8 degrees F for each output. Room thermostats shall be enclosed with separate locking covers (guards).

2.7.4 Nonmodulating Capillary Thermostats and Aquastats

Each thermostat shall have a capillary length of at least 5 feet, shall have adjustable direct-reading scales for both setpoint and differential, and shall have a differential adjustable from 6 to 16 degrees F. Aquastats shall be of the strap on type, with 10 degrees F fixed differential.

2.7.5 Freezestats

Freezestats shall be manual reset, low temperature safety thermostats, with NO and NC contacts and a 20 foot element which shall respond to the coldest 18 inch segment.

2.7.6 Modulating Capillary Thermostats

Each thermostat shall have either one output signal, two output signals operating in unison, or two output signals operating in sequence, as required for the application. Thermostats shall have adjustable throttling ranges of 4 to 8 degrees F for each output.

2.8 INDICATING DEVICES

2.8.1 Thermometers

Mercury shall not be used in thermometers.

2.8.1.1 Piping System Thermometers

Piping system thermometers shall have brass, malleable iron or aluminum alloy case and frame, clear protective face, permanently stabilized glass tube with indicating-fluid column, white face, black numbers, and a 9 inch scale. Thermometers for piping systems shall have rigid stems with straight, angular, or inclined pattern.

2.8.1.2 Piping System Thermometer Stems

Thermometer stems shall have expansion heads as required to prevent breakage at extreme temperatures. On rigid-stem thermometers, the space between bulb and stem shall be filled with a heat-transfer medium.

2.8.1.3 Nonaveraging Air-Duct Thermometers

Air-duct thermometers shall have perforated stem guards and 45-degree adjustable duct flanges with locking mechanism.

2.8.1.4 Averaging Air-Duct Thermometers

Averaging thermometers shall have a 3-1/2 inch (nominal) dial, with black legend on white background, and pointer traveling through a 270-degree arc.

2.8.1.5 Accuracy

Thermometers shall have an accuracy of plus or minus one percent of scale range. Thermometers shall have a range suitable for the application.

2.8.2 Pressure Gauges

Gauges shall be 2 inch (nominal) size, back connected, suitable for field or panel mounting as required, shall have black legend on white background, and shall have a pointer traveling through a 270-degree arc. Accuracy shall be plus or minus three percent of scale range. Gauges shall meet requirements of ASME B40.1.

2.8.2.1 Hydronic System Gauges

Gauges for hydronic system applications shall have ranges and graduations as shown.

2.8.3 Low Differential Pressure Gauges

Gauges for low differential pressure measurements shall be a minimum of 3.5 inch (nominal) size with two sets of pressure taps, and shall have a diaphragm-actuated pointer, white dial with black figures, and pointer zero adjustment. Gauges shall have ranges and graduations as shown. Accuracy shall be plus or minus two percent of scale range.

2.9 CONTROL DEVICES AND ACCESSORIES

2.9.1 Relays

Control relay contacts shall have utilization category and ratings selected for the application, with a minimum of two sets of contacts (two normally open, two normally closed) enclosed in a dustproof enclosure. Relays shall be rated for a minimum life of one million operations. Operating time shall be 20 milliseconds or less. Relays shall be equipped with coil transient suppression devices to limit transients to 150 percent of rated coil voltage. Time delay relays shall be 2PDT with eight-pin connectors, dust cover, and a matching rail-mounted socket. Adjustable timing range shall be 0 to 5 minutes. Power consumption shall not be greater than three watts.

2.9.2 Current to Pneumatic (IP) Transducers

The transducers shall be two-wire current-to-pressure transmitters that convert a 4-to-20 mAdc input signal to a 3 to 15 psig, or a 15 to 3 psig, pneumatic output, with a conversion accuracy of plus or minus two percent of full scale, including linearity and hysteresis. Input impedance shall not exceed 250 ohms. Air consumption shall not be greater than 0.25 scfm.

2.9.3 Joule or Watthour Meters

Watthour meters shall be in accordance with ANSI C12.1 and have pulse initiators for remote monitoring of Watthour consumption. Pulse initiator shall consist of form C contacts with a current rating not to exceed two amperes and voltage not to exceed 500 V, with combinations of VA not to exceed 100 VA, and a life rating of one billion operations. Meter sockets shall be in accordance with ANSI C12.1.

2.9.4 Joule or Watthour Meters with Demand Register

Meters shall be in accordance with ANSI C12.1 and shall have pulse initiators for remote monitoring of Watthour consumption and instantaneous demand. Pulse initiators shall consist of form C contacts with a current rating not to exceed two amperes and voltage not to exceed 500 V, with

combinations of VA not to exceed 100 VA, and a life rating of one billion operations. Meter sockets shall be in accordance with ANSI C12.1

2.9.5 Joule or Watthour Transducers

Watthour transducers shall have an accuracy of plus or minus 0.25 percent for kW and kWh outputs from full lag to full lead power factor. Input ranges for kW and kWh transducers shall be selectable without requiring the changing of current or potential transformers. The output shall be 4 to 20 mAdc.

2.9.6 Current Sensing Relays

Current sensing relays shall provide a normally-open contact rated at a minimum of 50 volts peak and 1/2 ampere or 25 VA, noninductive. There shall be a single hole for passage of current carrying conductors. The devices shall be sized for operation at 50 percent rated current based on the connected load. Voltage isolation shall be a minimum of 600 volts.

2.9.7 Power-Line Conditioners (PLC)

Power line conditioners shall be furnished for each DDC panel. The PLCs shall provide both voltage regulation and noise rejection. The PLCs shall be of the ferro-resonant design, with no moving parts and no tap switching, while electrically isolating the secondary from the power-line side. The PLCs shall be sized for 125 percent of the actual connected kVA load. Characteristics of the PLC shall be as follows:

a. At 85 percent load, the output voltage shall not deviate by more than plus or minus one percent of nominal when the input voltage fluctuates between minus 20 percent to plus 10 percent of nominal.

b. During load changes of zero to full load, the output voltage shall not deviate by more than plus or minus three percent of nominal voltage. Full correction of load switching disturbances shall be accomplished within five cycles, and 95 percent correction shall be accomplished within two cycles of the onset of the disturbance.

c. Total harmonic distortion shall not exceed 3-1/2 percent at full load.

2.10 DIRECT DIGITAL CONTROL (DDC) HARDWARE

All functions, constraints, data base parameters, operator developed programs and any other data shall be downloadable from a portable workstation/tester to network control panels, RIU's, universal programmable controllers, and unitary controllers. Download shall be accomplished through both the primary network and the local DDC portable workstation/tester port.

2.10.1 Network Control Panel

Network control panels shall be microcomputer-based with sufficient memory provided to perform all specified and shown network control panel functions and operations, including spare capacity for all spares and its I/O functions specified. Each network control panel and remote I/O units (RIU) shall have a minimum of 10% of its I/O functions as spare capacity but not less than 2 of each type used in each. The type of spares shall be in the same proportion as the implemented I/O functions on the panel, but in no

case shall there be less than two spare points of each type. The panel I/O functions shall be furnished complete, with no changes or additions necessary to support implementation of spare functions. Output relays associated with digital signals shall be considered part of the I/O function, whether physically mounted in the enclosure or separately mounted. Implementation of spare points shall necessitate only providing the additional field sensor or control device, field wiring including connection to the system, and point definition assignment by the operator using the central workstation/tester or portable workstation/tester. The panel shall contain all necessary I/O functions to connect to field sensors and control panels. I/O function operation shall be fully supervised to detect I/O function failures. Network control panels shall operate in an independent stand-alone mode, which is defined as all network control panel operations performed by the network control panel without any continuing input from other Direct digital controls or portable workstation/tester. The network control panel shall be capable of controlling a mix of at least 32 RIUs, unitary controllers, and universal programmable controllers.

2.10.1.1 Integral Features

The network control panel shall include:

a. Main power switch.

b. Power on indicator.

c. Portable workstation/tester port, connector, and if necessary power supply.

d. Manufacturers control network port.

e. An intrusion detection device, connected as an alarm.

2.10.1.2 Communication Interfaces

The following communication capabilities shall function simultaneously.

a. Manufacturers Control Network. Manufacturers control network communications interfaces for each data transmission systems (DTS) circuit between network control panels and RIUs, unitary controllers, and universal programmable controllers, shall be provided. Communication interfaces shall be provided between each network control panel and associated I/O functions. The DTS will provide for transmission speeds necessary to comply with performance requirements specified. DTS equipment shall be installed in the network control panel enclosure.

b. Portable Workstation/Tester Port. A communications port for interfacing to a portable workstation/tester shall be provided. Network control panel workstation/tester port other than RS-232,shall be converted to RS-232, including cabling and power supply, and shall be permanently installed in the panel.

c. Primary Network Port. The network control panel shall either have a built in primary network Port or be capable of accepting a primary network port expansion card for future networking to a base wide utility monitoring and control system (UMCS). The primary network port expansion card shall be either Ethernet (IEEE802.3) or ARCNET.

2.10.1.3 Memory and Real Time Clock (RTC) Backup

The network control panel memory and real time clock functions shall continue to operate for a minimum of 72 hours in the event of a power failure. If rechargeable batteries are provided, automatic charging of batteries shall be provided. Whenever a either a permanent workstation/tester or portable workstation/tester is monitoring the network control panel, a low battery alarm message shall be sent to it.

2.10.1.4 Duplex Outlet

A single phase, 120 Vac electrical service outlet for use with test equipment shall be furnished either inside or within 6 feet of the network control panel enclosure.

2.10.1.5 Locking Enclosures

Locking type mounting cabinets with common keying shall be furnished for each network control panel.

2.10.1.6 Failure Mode

Upon failure of the network control panel, either due to failure of the network control panel hardware or of the manufacturers control network, the network control panel shall revert to the failure mode as shown.

a. Manufacturers Control Network Failure: Upon failure of the manufacturers control network, the network control panel shall operate in an independent stand-alone mode.

b. Network Control Panel Hardware Failure: Upon failure of the network control panel hardware, the network control panel shall cease operation and stop communications with other network control panels, RIUs, unitary controllers and universal programmable controllers connected to the affected network control panel. The affected network control panel shall respond to this failure as specified and shown.

2.10.2 Universal Programmable Controller (UPC)

The universal programmable controller shall be a microprocessor based controller designed and programmed to control and monitor systems as shown. Resident programs shall be contained in reprogrammable nonvolatile memory. Each universal programmable controller shall contain necessary power supplies, transformers, memory, I/O functions and communications interfaces necessary to perform its required functions and to provide control and monitoring of connected equipment and devices. It shall contain all necessary I/O functions to connect to field sensors and controls. I/O operation shall be fully supervised to detect I/O function failures. It shall provide for operation as a device connected to the system via the manufacturers control network.

2.10.2.1 Integral Features

The universal programmable controller shall include as a minimum:

a. Main power switch.

b. Power on indicator.

c. Portable workstation/tester port, connector, and if necessary power supply.

d. Manufacturers control network port.

e. I/O functions

(1) 8 DI

(2) 4 DO

(3) 8 AI

(4) 4 AO

(5) 1 PA

2.10.2.2 Communication Interfaces

The UPC shall have the following communication capabilities which shall function simultaneously.

a. Manufacturers Control Network. The manufacturers control network communications interface for a data transmission systems (DTS) circuit between the UPC and a network control panels shall be provided. The DTS will provide for transmission speeds necessary to comply with performance requirements specified. DTS equipment shall be installed in the UPC Panel enclosure.

b. Portable Workstation/Tester Port. A communications port for interfacing to a portable workstation/tester shall be provided. A UPC workstation/tester port other than RS-232, shall be converted to RS-232, including cabling and power supply, and shall be permanently installed in the panel.

2.10.2.3 Memory and RTC Backup

The UPC memory and real time clock functions shall continue to operate for a minimum of 72 hours in the event of a power failure. If rechargeable batteries are provided, automatic charging of batteries shall be provided. Whenever a either a permanent workstation/tester or portable workstation/tester is monitoring the network control panel, a low battery alarm message shall be sent to it.

2.10.2.4 Specific Requirements

Each universal programmable controller shall be accessible for purposes of application selection, control parameters, set point adjustment, and monitoring from any DDC controller connected to the same manufacturers control network as the universal programmable controller. This shall be done using a portable workstation/tester connected to a portable workstation/tester port either directly or via modem.

2.10.2.5 Locking Enclosures

Locking type mounting cabinets with common keying shall be furnished for each enclosure.

2.10.2.6 Failure Mode

Upon failure of the universal programmable controller, it shall revert to the failure mode of operation as shown.

2.10.3 Unitary Controller

The unitary controller shall be a microprocessor based, stand-alone, dedicated purpose controller, communicating with the network control panel, designed and programmed to control air distribution system mixing boxes, terminal units, heat pumps, fan coil units, self-contained DX units or VAV boxes as shown. Each unitary controller shall contain resident programs in nonvolatile memory for each specific application implemented. Each unitary controller shall contain necessary power supplies, transformers, memory, I/O functions and communications interfaces necessary to perform its required functions and to provide control and monitoring of connected equipment and devices. It shall contain all necessary I/O functions to connect to field sensors and controls. I/O operation shall be fully supervised to detect I/O function failures and shall provide for operation as a device connected to the network control panel via the manufacturers control network.

2.10.3.1 Integral Features

The unitary controller shall include:

a. Main power switch.

b. Power on indicator.

c. Portable workstation/tester port, connector, and power supply.

d. Manufacturers control network port.

e. All I/O functions required to implement the requirements as shown.

2.10.3.2 Communication Interfaces

The unitary controller shall have the following communication capabilities which shall function simultaneously.

a. Manufacturers Control Network. The manufacturers control network communications interface for a data transmission systems (DTS) circuit between the unitary controller and a network control panel shall be provided. The DTS will provide for transmission speeds necessary to comply with performance requirements specified. DTS equipment shall be installed in the unitary control panel enclosure.

b. Portable Workstation/Tester Port. A communications port for interfacing to a portable workstation/tester shall be provided. A unitary controller workstation/tester port other than RS-232, shall be converted to RS-232, including cabling and power supply, and shall be permanently installed in the panel. For unitary controller applications where the controller is not mounted in an enclosure, such as for fan-coil units or VAV terminal units, a portable conversion device for an RS-232 connection to the portable workstation/tester may be provided.

2.10.3.3 Failure Mode

Upon failure of the unitary controller, it shall revert to the failure mode of operation as shown.

2.10.4 I/O Functions

2.10.4.1 DDC Hardware I/O Functions

I/O Functions shall be provided as part of the DDC system and shall be in accordance with the following:

a. The analog input (AI) function shall monitor each analog input, perform A-to-D conversion, and hold the digital value in a buffer for interrogation. The A-to-D conversion shall have a minimum resolution of 10 bits plus sign. Signal conditioning shall be provided for each analog input. Analog inputs shall be individually calibrated for zero and span, in hardware or in software. The AI shall incorporate common mode noise rejection of 50 dB from 0 to 100 Hz for differential inputs, and normal mode noise rejection of 20 dB at 60 Hz from a source impedance of 10,000 ohms. Input ranges shall be within the range of 4-to-20 mAdc.

b. The analog output (AO) function shall accept digital data, perform D-to-A conversion, and output a signal within the range of 4-to-20 mAdc. D-to-A conversion shall have a minimum resolution of eight bits plus sign. Analog outputs shall be individually calibrated for zero and span. Short circuit protection on voltage outputs and open circuit protection on current outputs shall be provided.

c. The digital input (DI) function shall accept on-off, open-close, or other change of state (two state data) indications. Isolation and protection against an applied steady-state voltage up to 180 Vac peak shall be provided.

d. The digital output (DO) function shall provide contact closures for momentary and maintained operation of output devices. Closures shall have a minimum duration of 0.1 second. DO relays shall have an initial breakdown voltage between contacts and coil of at least 500 V peak. Electromagnetic interference suppression shall be furnished on all output lines to limit transients to nondamaging levels. Protection against an applied steady-state voltage up to 180 Vac peak shall be provided. Minimum contact rating shall be one ampere at 24 Vac.

e. The pulse accumulator function shall have the same characteristics as the DI. In addition, a buffer shall be provided to totalize pulses and allow for interrogation by the DDC system. The pulse accumulator shall accept rates up to 20 pulses per second. The totalized value shall be reset to zero upon operator's command.

f. Signal conditioning for sensors shall be provided as specified.

g. The binary coded decimal (BCD) function: The BCD function shall have the same characteristics as the DI, except that, in addition, a buffer shall be provided to totalize inputs and allow for interrogation by the network control panel. The BCD function shall have 16-channel optically isolated buffered inputs to read four digit numbers. The BCD function shall accumulate inputs at rates up to 10 inputs per second.

2.10.4.2 Failure Mode

Upon failure of the I/O function, including data transmission failure, logic power supply failure, DDC processor malfunction, software failure, interposing relay power failure, or any other failure which prevents stand alone operation of any DDC normally capable of stand alone operation, connected outputs shall be forced to the failure mode shown.

2.10.5 Portable Workstation/Tester

A portable workstation/tester shall be provided and shall be able to connect to any DDC hardware. The portable workstation/tester shall consist of a portable computer with a nominal 10 inch active color matrix liquid crystal display, capable of displaying up to 256 colors at a minimum resolution of 640 X 480 pixels, an external VGA monitor port, 32 bit microprocessor operating at a minimum of 100 MHZ. The portable workstation/tester shall have, as a minimum, a 1200 MB hard drive, 16 megabytes of memory, integral pointing device, serial and parallel ports, color VGA video port for an external color monitor, 3.5 inch floppy disk drive, modem, PCMCIA type 3 slot, rechargeable battery, battery charger and 120 Vac power supply. It shall include carrying case, extra battery, charger and a compatible network adapter. The workstation/tester shall:

a. Run DDC diagnostics.

b. Load all DDC memory resident programs and information, including parameters and constraints.

c. Display any AI, DI, AO, DO, or PA point in engineering units for analog points or status for digital points.

d. Control any AO or DO.

e. Provide an operator interface, contingent on password level, allowing the operator to use full English language words and acronyms, or an object oriented graphical user interface.

f. Display database parameters.

g. Modify database parameters.

h. Accept DDC software and information for subsequent loading into a specific DDC. Provide all necessary software and hardware required to support this function, including an EIA ANSI/EIA/TIA-232-F port.

i. Disable/enable each DDC.

j. Perform all workstation functions as specified.

2.11 DDC SOFTWARE

All DDC software described in this specification shall be furnished as part of the complete DDC System.

2.11.1 Operating System

Each DDC shall contain an operating system that controls and schedules that DDC's activities in real time. The DDC shall maintain a point database in its memory that includes all parameters, constraints, and the latest value

or status of all points connected to that DDC. The execution of DDC application programs shall utilize the data in memory resident files. The operating system shall include a real time clock function that maintains the seconds, minutes, hours, date and month, including day of the week. Each DDC real time clock shall be automatically synchronized with the network control panel real time clock at least once per day to plus or minus 10 seconds. When the network control panel is connected to a central workstation/tester, the network control panel RTC shall be updated by the central workstation/tester RTC. The time synchronization shall be accomplished without operator intervention and without requiring system shutdown. The operating system shall allow loading of software, data files data entry, and diagnostics from the central workstation/tester both locally through the central workstation/tester port and remotely through a network control panel and the manufacturers control network.

2.11.1.1 Startup

The DDC shall have startup software that causes automatic commencement of operation without human intervention, including startup of all connected I/O functions. A DDC restart program based on detection of power failure at the DDC shall be included in the DDC software. Upon restoration of power to the DDC, the program shall restart equipment and restore loads to the state at time of power failure, or to the state as commanded by time programs or other overriding programs. The restart program shall include start time delays between successive commands to prevent demand surges or overload trips. The startup software shall initiate operation of self-test diagnostic routines. Upon failure of the DDC, if the database and application software are no longer resident or if the clock cannot be read, the DDC shall not restart and systems shall remain in the failure mode indicated until the necessary repairs are made. If the database and application programs are resident, the DDC shall resume operation after an adjustable time delay of from 0 to 600 seconds. The startup sequence for each DDC shall include a unique time delay setting for each control output when system operation is initiated.

2.11.1.2 Operating Mode

Each DDC shall control and monitor functions as specified, independent of communications with other DDC. This software shall perform all DDC functions and DDC resident application programs as specified using data obtained from I/O functions and based upon the DDC real time clock function. When communications circuits between the DDC are operable, the DDC shall obtain real time clock updates and any required global data values transmitted from other network control panels. The DDC software shall execute commands after performing constraints checks in the DDC. Status and analog values, including alarms and other data shall be transmitted from other network control panels when communications circuits are operable. If communications are not available, each DDC shall function in stand-alone mode and operational data, including the latest status and value of each point and results of calculations, normally transmitted from other network control panels shall be stored for later transmission to the network control panel. Storage for the latest 256 values shall be provided at each network control panel. Each DDC shall accept software downloaded from the network control panel. Constraints shall reside at the DDC.

2.11.1.3 Failure Mode

Upon failure for any reason, each DDC shall perform an orderly shutdown and force all DDC outputs to a predetermined (failure mode) state, consistent

with the failure modes shown and the associated control device.

2.11.2 Functions

The Contractor shall provide software necessary to accomplish the following functions, as appropriate, fully implemented and operational, within each network control panel, RIU, unitary controller and universal programmable controller.

a. Scanning of inputs.

b. Control of outputs.

c. Reporting of analog changes outside a selectable differential.

d. Reporting of unauthorized digital status.

e. Reporting of alarms automatically to network control panel.

f. Reporting of I/O status to network control panel upon request.

g. Maintenance of real time, updated by the network control panel at least once a day.

h. Communication with the network control panel.

i. Execution of DDC resident application programs.

j. Averaging or filtering of AIs.

k. Constraints checks (prior to command issuance).

l. Diagnostics.

m. Portable workstation/tester operation as specified.

n. Reset of PA by operator based on time and value.

2.11.2.1 Analog Monitoring

The system shall measure and transmit analog values including calculated analog points. An analog change in value is defined as a change exceeding a preset differential value as specified. The record transmitted for each analog value shall include a readily identifiable flag which indicates the abnormal status of the value when it deviates from operator selectable upper and lower analog limits. Analog values shall be expressed in proper engineering units with sign. Engineering units conversions shall be provided for each measurement. Each engineering units conversion set shall include range, span, and conversion equation. A vocabulary of engineering unit descriptors shall be provided, using at least three alphanumeric characters to identify information in the system. The system shall support 255 different engineering units.

2.11.2.2 Logic (Virtual) Points

Logic (virtual) points shall be software points entered in the point database which are not directly associated with a physical I/O function. Logic (virtual) points shall be analog or digital points created by calculation from any combination of digital and analog points, or other

data having the properties of real points, including alarms, without the associated hardware. Logic (virtual) points shall be defined or calculated and entered into the database by the Contractor. The calculated analog point shall have point identification in the same format as any other analog point. The calculated point shall be used in any program where the real value is not obtainable directly. Constants used in calculations shall be changeable on-line by the operator. Calculated point values shall be current for use by the system within 10 seconds of the time of any input changes.

2.11.2.3 State Variables

If an analog point represents more than two (up to eight) specific states, each state shall be nameable. For example, a level sensor shall be displayed at its measured engineering units plus a state variable with named states usable in programs or for display such as low alarm/low/normal/high/high alarm.

2.11.2.4 Analog Totalization

Any analog point shall be operator assignable to the totalization program. Up to eight analog values shall be totalized within a selectable time period. At the end of the period, the totals shall be stored. Totalization shall then restart from zero for the next time period. The program shall keep track of the peak and total value measured during the current period and for the previous period. The operator shall be able to set or reset each totalized value individually. The time period shall be able to be operator defined, modified or deleted on-line.

2.11.2.5 Energy Totalization

The system shall calculate the heat energy in Btus, for each energy source consumed by the mechanical systems specified, totalize the calculated Btus, the instantaneous rate in Btus per hour, and store totals in thousands of Btus (MBtu). The Btus calculated shall be totalized for an adjustable time period. The time period shall be defined uniquely for each Btu totalization.

2.11.2.6 Trending

Any analog or calculated point shall be operator assignable to the trend program. Up to eight points shall be sampled at individually assigned intervals, selectable between one minute and two hours. A minimum of the most recent 128 samples of each trended point shall be stored. The sample intervals shall be able to be defined, modified, or deleted on-line.

2.11.3 I/O Point Database/Parameter Definition

Each I/O point shall be defined in a database residing in the DDC. The definition shall include all physical parameters associated with each point. Each point shall be defined and entered into the database by the Contractor, including as applicable:

a. Name.

b. Device or sensor type (i.e., sensor, control relay, motors).

c. Point identification number.

d. Unit.

e. Building number.

f. Area.

g. Island.

h. DDC number and channel address.

i. KW (running).

j. KW (starting).

k. Sensor range.

l. Controller range.

m. Sensor span.

n. Controller span.

o. Engineering units conversion (scale factor).

p. Setpoint (analog).

q. High reasonableness value (analog).

r. Low reasonableness value (analog).

s. High alarm limit differential (return to normal).

t. Low alarm limit differential (return to normal).

u. High alarm limit (analog).

v. Low alarm limit (analog).

w. Alarm disable time period upon startup or change of setpoint.

x. Analog change differential (for reporting).

y. Alarm class and associated primary message text.

z. High accumulator limit (pulse).

aa. Status description.

bb. Run time target.

cc. Failure mode as specified and shown.

dd. Constraints as specified.

2.11.4 Alarm Processing

Each DDC shall have alarm processing software for AI, DI, and PA alarms for all real and virtual points connected to that DDC.

2.11.4.1 Digital Alarms Definition

Digital alarms are those abnormal conditions indicated by DIs as specified and shown.

2.11.4.2 Analog Alarms Definition

Analog alarms are those conditions higher or lower than a defined value, as measured by an AI. Analog readings shall be compared to predefined high and low limits, and alarmed each time a value enters or returns from a limit condition. Unique high and low limits shall be assigned to each analog point in the system. Analog alarm limits shall be stored in the DDC database. Each analog alarm limit shall have an associated unique limit differential specifying the amount by which a variable must return into the proper operating range before being annunciated as a return-to-normal-state. All limits and differentials shall be entered on-line by the operator in limits of the measured variable, without interruption or loss of monitoring of the point concerned. The program shall automatically change the high or low limits or both, of any analog point, based on time scheduled operations as specified, allowing for a time interval before the alarm limit becomes effective. In CPA applications, key the limit to a finite deviation traveling with the setpoint. The system shall automatically suppress analog alarm reporting associated with a digital point when that digital point is turned off.

2.11.4.3 Pulse Accumulator Alarms Definition

Pulse accumulator alarms are those conditions calculated from totalized values of accumulator inputs or PA input rates that are outside defined limits as specified and shown. PA totalized values shall be compared to predefined limits and alarmed each time a value enters a limit condition. Unique limits shall be assigned to each PA point in the system. Limits shall be stored in the DDC database.

2.11.5 Constraints

2.11.5.1 Equipment Constraints Definitions

Each control point in the database shall have DDC resident constraints defined and entered by the Contractor, including as applicable:

a. Maximum starts (cycles) per hour.

b. Minimum off time.

c. Minimum on time.

d. High limit (value in engineering units).

e. Low limit (value in engineering units).

2.11.5.2 Constraints Checks

Control devices connected to the system shall have the DDC memory resident constraints checked before each command is issued to insure that no equipment damage will result from improper operation. Each command shall be executed by the DDC only after all constraints checks have been passed. Each command point shall have unique constraints assigned. High and low "reasonableness" values or one differential "rate-of-change" value shall be

assigned to each AI. Values outside the reasonableness limits shall be rejected and an alarm message sent to the network control panel or portable workstation/tester. Status changes and analog point values shall be reported to the workstation upon operator request, such as for reports, alphanumeric displays, graphic displays, and application programs. Each individual point shall be capable of being selectively disabled by the operator from a workstation/tester. Disabling a point shall prohibit monitoring and automatic control of that point.

2.11.6 Diagnostics

Each DDC shall have self-test diagnostic routines implemented in firmware. The tests shall include routines that exercise memory. Diagnostic software shall be usable in conjunction with the central workstation/tester and portable workstation/tester. The software shall display messages in English to inform the tester's operator of diagnosed problems.

2.11.7 Summer-Winter Operation Monitoring

The system shall provide software to automatically change the operating parameters, monitoring of alarm limits, and start-stop schedules for each mechanical system from summer to winter and vice-versa. The software shall provide automatic commands to applications programs to coordinate proper summer or winter operation. Change over setpoints shall be operator selectable and settable.

2.11.8 Control Sequences and Control Loops

Sufficient memory shall be provided to implement the requirements specified and shown for each DDC. Specific functions to be implemented are defined in individual system control sequences and database tables shown in the drawings, and shall include, as applicable, the following:

a. PI Control: This function shall provide proportional control and proportional plus integral control.

b. Two Position Control: This function shall provide control for a two state device by comparing a set point against a process variable and an established deadband.

c. Floating Point Control: This function shall exercise control when an error signal exceeds a selected deadband, and shall maintain control until the error is within the deadband limits.

d. Signal Selection: This function shall allow the selection of the highest or lowest analog value from a group of analog values as the basis of control. The function shall include the ability to cascade analog values so that large numbers of inputs can be reduced to one or two outputs.

e. Signal Averaging: This function shall allow the mathematical calculation of the average analog value from a group of analog values as the basis of control. The function shall include the ability to "weight" the individual analog values so that the function output can be biased as necessary to achieve proper control.

f. Reset Function: This function shall develop an AO based on up to two AIs and one operator specified reset schedule.

g. Cooling/Heating Operation Program: Software shall be provided to

change, either automatically or on operator command, the operating parameters, monitoring of alarm limits, and start-stop schedules for each mechanical system where such a change from cooling to heating and vice versa is meaningful. The software shall provide commands to application programs to coordinate cooling or heating mode operation. Software shall automatically switch facilities from cooling to heating, and vice versa, based on schedules or temperatures. All HVAC equipment and systems shall be assigned to the program.

2.11.9 Command Priorities

A scheme of priority levels shall be provided to prevent interaction of a command of low priority with a command of higher priority. The system shall require the latest highest priority command addressed to a single point to be stored for a period of time longer than the longest time constraint in the on and off states, insuring that the correct command shall be issued when the time constraint is no longer in effect or report the rejected command. Override commands entered by the operator shall have higher priority than those emanating from applications programs.

2.11.10 Resident Application Software

The Contractor shall provide resident applications programs to achieve the sequences of operation, parameters, constraints, and interlocks necessary to provide control of the systems connected to the DDC system. Application programs shall be resident and shall execute in the DDC, and shall coordinate with each other, to insure that no conflicts or contentions remain unresolved. The Contractor shall coordinate the application programs specified with the equipment and controls operation, and other specified requirements. A scheme of priority levels shall be provided to prevent interaction of a command of low priority with a command of higher priority. The system shall require the latest highest priority command addressed to a single point to be stored for a period of time longer than the longest time constraint in the ON and OFF states, insuring that the correct command shall be issued when the time constraint is no longer in effect or the rejected command shall be reported. Override commands entered by the operator shall have higher priority than those emanating from application programs.

2.11.10.1 Program Inputs and Outputs

The Contractor shall select the appropriate program inputs listed for each application program to calculate the required program outputs. Where the specific program inputs are not available, a "default" value or virtual point appropriate for the equipment being controlled and the proposed sequence of operation shall be provided to replace the missing input, thus allowing the application program to operate. AIs to application programs shall have an operator adjustable deadband to preclude short cycling or hunting. Program outputs shall be real analog or digital outputs or logic (virtual) points as required to provide the specified functions. The Contractor shall select the appropriate input and output signals to satisfy the requirements for control of systems as shown.

2.11.10.2 DDC General Conditions

The Contractor shall provide software required to achieve the sequences of operation, parameters, constraints, and interlocks shown. Application software shall be resident in the DDC in addition to any other required software. In the event of a DDC failure, the controlled equipment shall

continue to function in the failure mode shown.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION CRITERIA

3.1.1 HVAC Control System

The HVAC control system shall be completely installed and ready for operation. Dielectric isolation shall be provided where dissimilar metals are used for connection and support. Penetrations through and mounting holes in the building exterior shall be made watertight. The HVAC control system installation shall provide clearance for control system maintenance by maintaining access space between coils, access space to mixed-air plenums, and other access space required to calibrate, remove, repair, or replace control system devices. The control system installation shall not interfere with the clearance requirements for mechanical and electrical system maintenance.

3.1.2 Software Installation

Software shall be loaded for an operational system, including databases for all points, operational parameters, and system, command, and application software. The Contractor shall provide original and backup copies of source, excluding the general purpose operating systems and utility programs furnished by computer manufacturers and the non-job-specific proprietary code furnished by the system manufacturer, and object modules for software on each type of media utilized, within 30 days of formal Government acceptance. In addition, a copy of individual floppy disks of software for each DDC panel shall be provided.

3.1.3 Device Mounting Criteria

Devices mounted in or on piping or ductwork, on building surfaces, in mechanical/electrical spaces, or in occupied space ceilings shall be installed in accordance with manufacturer's recommendations and as shown. Control devices to be installed in piping and ductwork shall be provided with required gaskets, flanges, thermal compounds, insulation, piping, fittings, and manual valves for shutoff, equalization, purging, and calibration. Strap-on temperature sensing elements shall not be used except as specified.

3.1.4 Wiring Criteria

Wiring external to control panels, including low-voltage wiring, shall be installed in metallic raceways. Wiring shall be installed without splices between control devices and DDC panels. Instrumentation grounding shall be installed as necessary to prevent ground loops, noise, and surges from adversely affecting operation of the system. Ground rods installed by the contractor shall be tested as specified in IEEE Std 142. Cables and conductor wires shall be tagged at both ends, with the identifier shown on the shop drawings. Electrical work shall be as specified in Section 16415 ELECTRICAL WORK, INTERIOR and as shown.

3.2 CONTROL SYSTEM INSTALLATION

3.2.1 Damper Actuators

Actuators shall not be mounted in the air stream. Multiple actuators

operating a common damper shall be connected to a common drive shaft. Actuators shall be installed so that their action shall seal the damper to the extent required to maintain leakage at or below the specified rate and shall move the blades smoothly.

3.2.2 Local Gauges for Actuators

Pneumatic actuators shall have an accessible and visible receiver gauge installed in the tubing lines at the actuator as shown.

3.2.3 Room Instrument Mounting

Room instruments , such as wall mounted thermostats, shall be mounted 60 inches above the floor unless otherwise shown. Temperature setpoint devices shall be recess mounted.

3.2.4 Freezestats

For each 20 square feet of coil face area, or fraction thereof, a freezestat shall be provided to sense the temperature at the location shown. Manual reset freezestats shall be installed in approved, accessible locations where they can be reset easily. The freezestat sensing element shall be installed in a serpentine pattern.

3.2.5 Averaging Temperature Sensing Elements

Sensing elements shall have a total element minimum length equal to 1 linear foot per square foot of duct cross-sectional area.

3.2.6 Foundations and Housekeeping Pads

Foundations and housekeeping pads shall be provided for the HVAC control system air compressors.

3.2.7 Duct Static Pressure Sensing Elements and Transmitters

The duct static pressure sensing element and transmitter sensing point shall be located at 75% to 100% of the distance between the first and last air terminal units.

3.2.8 Indication Devices Installed in Piping and Liquid Systems

Gauges in piping systems subject to pulsation shall have snubbers. Gauges for steam service shall have pigtail fittings with cock. Thermometers and temperature sensing elements installed in liquid systems shall be installed in thermowells.

3.3 CONTROL SEQUENCES OF OPERATION

3.3.1 General Requirements - HVAC Systems

Shall be as shown in the drawings.

3.4 COMMISSIONING PROCEDURES

3.4.1 Evaluations

The Contractor shall make the observations, adjustments, calibrations, measurements, and tests of the control systems, set the time schedule, and

make any necessary control system corrections to ensure that the systems function as described in the sequence of operation.

3.4.1.1 Item Check

Signal levels shall be recorded for the extreme positions of each controlled device. An item-by-item check of the sequence of operation requirements shall be performed using Steps 1 through 4 in the specified control system commissioning procedures. Steps 1, 2, and 3 shall be performed with the HVAC system shut down; Step 4 shall be performed after the HVAC systems have been started. External input signals to the DDC system (such as starter auxiliary contacts, and external systems) may be simulated in steps 1, 2, and 3. With each operational mode signal change, DDC system output relay contacts shall be observed to ensure that they function.

3.4.1.2 Weather Dependent Test Procedures

Weather dependent test procedures that cannot be performed by simulation shall be performed in the appropriate climatic season. When simulation is used, the actual results shall be verified in the appropriate season.

3.4.1.3 Two-Point Accuracy Check

A two-point accuracy check of the calibration of each HVAC control system sensing element and transmitter shall be performed by comparing the DDC system readout to the actual value of the variable measured at the sensing element and transmitter or airflow measurement station location. Digital indicating test instruments shall be used, such as digital thermometers, motor-driven psychrometers, and tachometers. The test instruments shall be at least twice as accurate as the specified sensing element-to-DDC system readout accuracy. The calibration of the test instruments shall be traceable to National Institute Of Standards And Technology standards. The first check point shall be with the HVAC system in the shutdown condition, and the second check point shall be with the HVAC system in an operational condition. Calibration checks shall verify that the sensing element-to-DDC system readout accuracies at two points are within the specified product accuracy tolerances. If not, the device shall be recalibrated or replaced and the calibration check repeated.

3.4.1.4 Insertion and Immersion Temperatures

Insertion temperature and immersion temperature sensing elements and transmitter-to-DDC system readout calibration accuracy shall be checked at one physical location along the axis of the sensing element.

3.4.1.5 Averaging Temperature

Averaging temperature sensing element and transmitter-to-DDC system readout calibration accuracy shall be checked every 2 feet along the axis of the sensing element in the proximity of the sensing element, for a maximum of 10 readings. These readings shall then be averaged.

3.4.2 Systems

Systems shall be checked to perform the sequence of controls.

3.5 BALANCING, COMMISSIONING, AND TESTING

3.5.1 Coordination with HVAC System Balancing

Commissioning of the control system, except for tuning of controllers, shall be performed prior to or simultaneous with HVAC system balancing. The contractor shall tune the HVAC control system after all air system and hydronic system balancing has been completed, minimum damper positions set and a report has been issued.

3.5.2 Control System Calibration, Adjustments, and Commissioning

Control system commissioning shall be performed for each HVAC system, using test plans and procedures previously approved by the Government. The Contractor shall provide all personnel, equipment, instrumentation, and supplies necessary to perform commissioning and testing of the HVAC control system. All instrumentation and controls shall be calibrated and the specified accuracy shall be verified using test equipment with calibration traceable to NIST standards. Wiring shall be tested for continuity and for ground, open, and short circuits. Tubing systems shall be tested for leaks. Mechanical control devices shall be adjusted to operate as specified. HVAC control panels shall be pretested off-site as a functioning assembly ready for field connections, calibration, adjustment, and commissioning of the operational HVAC control system. Control parameters and logic (virtual) points including control loop setpoints, gain constants, and integral constraints, shall be adjusted before the system is placed on line. Communications requirements shall be as indicated. Written notification of any planned commissioning or testing of the HVAC Control systems shall be given to the Government at least 14 calendar days in advance.

3.5.3 Performance Verification Test

The Contractor shall demonstrate compliance of the HVAC control system with the contract documents. Using test plans and procedures previously approved by the Government, the Contractor shall demonstrate all physical and functional requirements of the project. The performance verification test shall show, step-by-step, the actions and results demonstrating that the control systems perform in accordance with the sequences of operation. The performance verification test shall not be started until after receipt by the Contractor of written permission by the Government, based on Government approval of the Commissioning Report and completion of balancing.

3.5.4 Endurance Test

The endurance test shall be used to demonstrate the specified overall system reliability requirement of the completed system. The endurance test shall not be started until the Government notifies the Contractor in writing that the performance verification test is satisfactorily completed. The Government may terminate the testing at any time when the system fails to perform as specified. Upon termination of testing by the Government or by the Contractor, the Contractor shall commence an assessment period as described for Phase II. Upon successful completion of the endurance test, the Contractor shall deliver test reports and other documentation as specified to the Government prior to acceptance of the system.

a. Phase I (Testing). The test shall be conducted 24 hours per day, 7 days per week, for 15 consecutive calendar days, including holidays, and the system shall operate as specified. The Contractor shall make no

repairs during this phase of testing unless authorized by the Government in writing.

b. Phase II (Assessment). After the conclusion of Phase I, the Contractor shall identify failures, determine causes of failures, repair failures, and deliver a written report to the Government. The report shall explain in detail the nature of each failure, corrective action taken, results of tests performed, and shall recommend the point at which testing should be resumed. After delivering the written report, the Contractor shall convene a test review meeting at the jobsite to present the results and recommendations to the Government. As a part of this test review meeting, the Contractor shall demonstrate that all failures have been corrected by performing appropriate portions of the performance verification test. Based on the Contractor's report and test review meeting, the Government may require that the Phase I test be totally or partially rerun. After the conclusion of any retesting which the Government may require, the Phase II assessment shall be repeated as if Phase I had just been completed.

3.5.5 Posted and Panel Instructions

Posted and Panel Instructions, showing the final installed conditions, shall be provided for each system. The posted instructions shall consist of laminated half-size drawings and shall include the control system schematic, equipment schedule, sequence of operation, wiring diagram, communication network diagram, and valve and damper schedules. The posted instructions shall be permanently affixed, by mechanical means, to a wall near the control panel. Panel instructions shall consist of laminated letter-size sheets and shall include a Routine Maintenance Checklist and as-built configuration check sheets. Panel instructions and one copy of the Operation and Maintenance Manuals, previously described herein, shall be placed inside each control panel or permanently affixed, by mechanical means, to a wall near the panel.

3.6 TRAINING

3.6.1 Training Course Requirements

A training course shall be conducted for 4 operating staff members designated by the Contracting Officer in the maintenance and operation of the system, including specified hardware and software. The training period, for a total of 32 hours of normal working time, shall be conducted within 30 days after successful completion of the performance verification test. The training course shall be conducted at the project site. Audiovisual equipment and 6 sets of all other training materials and supplies shall be provided. A training day is defined as 8 hours of classroom instruction, including two 15 minute breaks and excluding lunchtime, Monday through Friday, during the daytime shift in effect at the training facility.

3.6.2 Training Course Content

For guidance in planning the required instruction, the Contractor shall assume that attendees will have a high school education or equivalent, and are familiar with HVAC systems. The training course shall cover all of the material contained in the Operating and Maintenance Instructions, the layout and location of each HVAC control panel, the layout of one of each type of unitary equipment and the locations of each, the location of each control device external to the panels, the location of the compressed air

station, preventive maintenance, troubleshooting, diagnostics, calibration, adjustment, commissioning, tuning, and repair procedures. Typical systems and similar systems may be treated as a group, with instruction on the physical layout of one such system. The results of the performance verification test and the calibration, adjustment and commissioning report shall be presented as benchmarks of HVAC control system performance by which to measure operation and maintenance effectiveness.

-- End of Section --

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SECTION 15970

PUMP CONTROL AND ANNUNCIATION SYSTEM

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C37.90	(1989; R 1994) Relays and Relay Systems Associated with Electric Power Apparatus

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C62.41	(1991; R 1995) Surge Voltages in Low-Voltage AC Power Circuits

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250	(1997) Enclosures for Electrical Equipment (1000 Volts Maximum)
NEMA IA 2	(1993) Programmable Controllers
NEMA ICS 1	(1993) Industrial Control and Systems
NEMA ICS 2	(1993) Industrial Control and Systems Controllers, Contactors, and Overload Relays, Rated Not More Than 2,000 Volts AC or 750 Volts DC
NEMA ICS 3	(1993) Industrial Control and Systems Factory Built Assemblies
NEMA ICS 4	(1993; Rev. 1, 1997) Industrial Control and Systems Terminal Blocks
NEMA ICS 6	(1993) Industrial Control and Systems
NEMA LS 1	(1992; R2000) Low Voltage Surge Protective Devices

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2002) National Electrical Code

ISA - THE INSTRUMENTATION, SYSTEMS AND AUTOMATION SOCIETY (ISA)

ISA S18.1	(1979; R 1992) Annunciator Sequences and Specifications

UNDERWRITERS LABORATORIES (UL)

UL 508	(1999; Rev thru Dec 2001) Industrial Control Equipment
UL 1012	(1994) Power Units Other than Class 2
UL 1449	(1996; Rev thru Dec 1999) Transient Voltage Surge Suppressors

1.2 GENERAL REQUIREMENTS

Section 16415 ELECTRICAL WORK, INTERIOR applies to this section, with the additions and modifications specified herein. The control system shall be furnished by a single supplier. See specification 15050 MECHANICAL EQUIPMENT, FUELING for other required components of the control system. The control system supplier shall be responsible for providing a fully functional control system, in accordance with the drawings and specifications, including the field devices. Installation shall be in accordance with NFPA 70. The control system will under go a cold weather verification test in late January or early February after the final system check out if the final system check out does not occur in this time frame. This is to ensure that all control system components will function normally in the extreme cold at this location. The contractor shall provide paper copies of control wire information to be stored in the PCP and at each terminal box to include a conductor identification number, its origination terminal point, its destination terminal point, the wire size, color, and type. All of this data shall be arranged in a neat tabular form.

1.3 SUBMITTALS

1.3.1 GENERAL

Data shall be submitted in accordance with the overall requirements detailed in Section 01330 SUBMITTAL PROCEDURES and the specific requirements of this section. Documents shall consist of a complete list of equipment and materials, manufacturer's descriptive and technical literature, brochures, catalog cuts, performance specifications, diagrams, and other material as stated in subsequent subparagraphs. The Contractor shall submit additional material if the listed items are not adequate to identify intent or conformance to technical requirements. Any delays associated with resubmittals of incomplete or ambiguous initial submittals will be the Contractor's responsibility.

1.3.2 Submittals

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Shop Drawing; G-AE.

SD-03 Product Data

Pump Control Panel (PCP) and Components; G-AE.

Programmable Logical Controller (PLC) Hardware and Software; G-AE.

Personal Computer (PC); G-AE.

Documents demonstrating the accuracy and completeness of the list of material and components, that items proposed comply fully with contract requirements, and are otherwise suitable for the application indicated. Documents shall consist of all data or drawings published by the manufacturer of individual items listed including manufacturer's descriptive and technical literature, performance data, catalog cuts, and installation instructions.

Tools and Spare Parts.

SD-06 Test Reports

Certified Pump Control Panel (PCP) Shop Test Report.

Record of Test.

SD-07 Certificates

Experience and Qualifications; G-AE.

Plan for Instructing Personnel; G-AO.

Testing Plan; G-AE.

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals; G-AO.

Six copies of Operational and Maintenance manuals, within 7 calendar days following the completion of factory tests.

Operational and Maintenance manuals shall be furnished following the completion of shop tests and shall include:

a. Pump Control Panel including interior and exterior equipment layout.

b. All documents previously submitted and approved with all comments and field changes annotated.

c. Complete description of the sequence of operation including that described in Paragraphs 3.6 through 3.13 of this specification and any subsystems not controlled by the PLC (e.g. annunciator panel, EPDS, etc.)

d. Complete listing of all programming of the PLCs, laptop computer, and Personal Computer.

e. Complete relay ladder logic diagrams, PLC input/output

diagrams and control power distribution diagrams for the complete control system.

f. Complete guide outlining step-by-step procedures for system startup and operation.

g. Complete troubleshooting guide, which lists possible operational problems and corrective action to be taken.

h. Complete maintenance and installation manual for all equipment supplied.

i. Spare parts data, which provides supplier name, current cost, catalog order number, and a recommended list of spare parts to be stocked.

j. The above shall incorporate all as-built conditions.

Documents shall be bound in a suitable binder adequately marked or identified on the spine and front cover. A table of contents page shall be included and marked with pertinent contract information and contents of the manual. Tabs shall be provided to separate different types of documents, such as catalog ordering information, drawings, instructions, and spare parts data. Index sheets shall be provided for each section of the manual when warranted by the quantity of documents included under separate tabs or dividers.

1.4 SYSTEM OVERVIEW

1.4.1 General

The Hydrant Fueling System consists of fueling pumps that pump fuel to a Hydrant Hose Truck Check-out Pad, Truck Fill Stands, and fuel pits located on the airfield apron. Automatic pump starts and stops are based on system pressure and flow. Programmable Logic Controllers (PLCs) receive information from pressure transmitters and other devices to control the pumps and control valves. There are two PLCs that are connected in a redundant configuration if one fails. The Hydrant Fueling System also includes above ground fuel storage tanks and product recovery tanks. The pump control panel and annunciator are located in the Control Room of the Pumphouse.

1.5 EXPERIENCE AND QUALIFICATIONS

Submit the following data for approval:

a. Certification stating that the manufacturer has manufactured, installed, and successfully completed at least three PLC-based systems for automatic cycling of pumps based upon varying dispensing demands ranging from 0 to 2400 gallons per minute utilizing multiple pumps. At least one of the three PLC-based systems shall be for dispensing jet fuel into a pressurized, constant pressure, flow demand aircraft hydrant system.

b. Certification that the control systems have successfully operated over the last 2 years and are currently in service.

c. Project names, locations, and system description of these

installations. Include user point-of-contact and current telephone numbers.

1.6 WARRANTY

The Pump Control and Annunciation System including devices, hardware and software shall be warranted for a period of 1 year from the date of acceptance of the system by the Government. This warranty service shall include parts and labor service for equipment supplied under this specification. Upon notification by the Government of system or component failure, the Contractor shall respond at the site with necessary parts within 48 HOURS of notification.

PART 2 PRODUCTS

2.1 PUMP CONTROL PANEL (PCP) AND COMPONENTS

2.1.1 Enclosure

NEMA ICS 1, NEMA ICS 6, NEMA 250, and UL 508. The PCP enclosure shall be a freestanding NEMA Type 12, smooth, gasketed enclosure constructed of 12 gauge steel. All seams shall be continuously welded and there shall be no drilled holes or knockout prior to delivery to the job site. The pump control panel dimensions shall be a maximum of 90 inches high, maximum 72 inches wide, and a maximum of 24 inches deep and shall have removable lifting eyes. The interior surfaces of the panel shall be properly cleaned, primed, and spray painted with white high-gloss enamel. Exterior surfaces shall have standard factory finish. Access for the PCP shall be front only and shall consist of hinged doors having 3-point latching mechanisms. The doors shall open approximately 120 degrees. Rack mounting angles, swing-out panels and other component mounting hardware shall be installed such that servicing of one component shall not require removal or disconnection of other components. No clearance shall be required between the back of the panel and the room walls. Terminal facilities shall be arranged for entrance of external conductors from the top or bottom of the enclosure.

2.1.2 Ventilation System

Two supply fans, single phase, 115 volt, shall be provided. Each fan shall supply a minimum of 100 CFM. The supply and exhaust grill shall contain a filter that is easily removed from the exterior of the enclosure. Three thermostats with an adjustable set point range of 70 degrees F to 140 degrees F shall also be provided. The thermostats shall be located near the top in the interior of the PCP.

2.1.3 Ground Bar

The control panel shall have a tin plated copper equipment ground bar. The bar shall have a minimum of twenty grounding screws.

2.1.4 Standard Indicator Lights

NEMA ICS 1, NEMA ICS 2, and UL 508. Lights shall be heavy duty, NEMA 13, 22.5 mm mounting hole, round indicating lights operating at 120 volts ac/dc or 24 volts ac/dc. Long life bulbs shall be used. Indicator lights shall have a legend plate with words as shown on drawings. Lens color as indicated on the drawings. Lights shall be "push to test (lamp)" type.

2.1.5 Selector Switches

NEMA ICS 1, NEMA ICS 2, and UL 508. Non-illuminated lever operated selector switches shall be heavy duty, NEMA 13, round, and utilize a 22.5mm mounting hole. They shall have the number of positions as indicated on the drawings. Switches shall be rated 600 volt, 10 amperes continuous. Legend plates shall be provided with each switch with words as indicated on the drawings.

2.1.6 Pushbuttons

NEMA ICS 1, NEMA ICS 2, and UL 508. Non-illuminated pushbuttons shall be heavy duty, NEMA 13, round, utilize a 22.5mm mounting hole, and have the number and type of contacts as indicated on the drawings or elsewhere in the specifications. The emergency stop switch shall be a red mushroom head, 1.5 inch diameter, momentary contact type. Pushbuttons shall be rated 600 volt, 10 amperes continuous. Legend plates shall be provided with each switch with words as indicated on the drawings.

2.1.7 Relays

ANSI C37.90, NEMA ICS 2, UL 508.

2.1.8 Nameplates

Nameplates shall be made of laminated plastic with black outer layers and a white core. Edges shall be chamfered. Nameplates shall be fastened with black-finished round-head drive screws or approved nonadhesive metal fasteners.

2.1.9 Transient Voltage Surge Suppression Devices

IEEE C62.41 for Category "B" transients, NEMA LS 1, UL 1449.

2.1.10 Terminal Blocks

NEMA ICS 4. Terminal blocks for conductors exiting the PCP shall be two-way type with double terminals, one for internal wiring connections and the other for external wiring connections. Terminal blocks shall be made of bakelite or other suitable insulating material with full deep barriers between each pair of terminals. A terminal identification strip shall form part of the terminal block and each terminal shall be identified by a number in accordance with the numbering scheme on the approved wiring diagrams.

2.1.11 Uninteruptable Power Supplies

UL 1012. Input voltage shall be 120 volts (nominal), 1 phase, 60 Hertz.

Output voltage regulation shall be +/-5.0% for the following conditions:

a. 20% to 100% load on output.
b. Input voltage variation of -15% to +10%.
c. Constant load power factor between 80% and 100%.

Response time shall be 1.5 cycles or less. Battery capacity shall be such as to provide an orderly shut down of operating programs or as a minimum 10 minutes.

2.1.12 Miscellaneous Power Supplies

UL 1012. Certain field devices may require power other than 120VAC (i.e. 24VDC). The power supplies shall be convection cooled, have fully isolated independent outputs, have constant voltage, have short circuit and overvoltage protection, and have automatic current limiting.

2.1.13 Alarm Annunciator

UL 508 and ISA S18.1. The Alarm Annunciator shall provide visual annunciation, local and remote monitoring, constant or flashing visual and audible alarm as specified herein. The annunciator shall be completely solid state with no moving parts. The annunciator shall be furnished with cabinet and hardware appropriate for flush mounting on the control panel. A power supply either integral or separately mounted shall operate on 120 volts, 60 Hertz. The annunciator shall have windows arranged in a matrix configuration (rows and columns). Each window shall be at least 15/16 inch high by 1-5/8 inches wide and shall have rear illuminated translucent engraved nameplate. Lettering shall be at least 5/32 inches high. System lamp voltage shall be 24 to 28 volts dc.

2.1.14 Alarm Horns

UL 508. The alarm horns shall consist of 2-vibrating horns and 1-resonating horn. One vibrating horn is to be mounted in the PCP, and one vibrating and one resonating horn shall be mounted outside of the control room as shown on the drawings. The exterior horns shall each produce 100db at 10 feet and shall be provided in a weather proof housing. The PCP horn shall produce 70db at 10 feet.

2.1.14.1 2 Pen Recorder

UL 508. The recorder shall be totally enclosed in a case suitable for flush or semiflush mounting and have:

a. Two channels for continuous analog recording of input data
b. Digital printer for periodic printout of chart speed, date, time, channel tags, scale, engineering units, etc.
c. 5 x 7 dot matrix, 20 character (minimum digital display) for display of input values, engineering units, setup parameters, etc.
d. Function keys for setup and control
e. Power on/off switch.

The recorder shall meet or exceed the following:

a. Input Signal	4-20mA
b. Accuracy	0.5% of calibrated span
c. Repeatability	0.25% of calibrated span
d. Input/Pen Motion	linear/continuous
e. Speed of Response	less than 2 seconds for full scale travel
f. Pen Drive	Servo motor with overrange protection
g. Pens	long lasting disposable marker in highly visible contrasting colors
h. Chart Speed	Variable with 1 inch/hour to 8 inches/hour minimum
i. Plotting Chart	Removable chart cassette with 4" nominal width Z-fold strip chart, minimum 50 feet

long

Alternately the contractor may supply an electronic 2-channel recorder that downloads to a floppy disk rather than the 2 pin recorder. This electronic recorder shall have an integral display on its front a minimum of 4" square.

2.1.16 Operator Interface Panel

UL 508. The operator interface panel shall be a NEMA 4/12, 14" color VGA CRT with sealed membrane keypads for data entry. It shall include a Pentium CPU operating at a minimum of 133MHz. It shall be mounted through the PCP door as shown on the drawings. The operator interface shall communicate with the PLCs to display system status and change system set points. The operator interface shall have run-time graphical software to display the graphical screens that were downloaded from the Laptop computer and change set points. The Operator Interface Panel shall have the ability to send any of its pre-programmed screens to be displayed on the wall-mounted Graphic Display Panel regardless of which screen is being displayed on itself.

2.1.15 Laptop Computer

2.1.15.1 Hardware

The following are the minimum hardware requirements for the laptop computer:

a. Latest Pentium CPU operating at 500Mz or faster
b. 64 MB RAM
c. 24 GB hard drive
d. 3 1/2" floppy drive & CD-ROM drive built in
e. Color VGA LCD screen 12.1"
f. Keyboard
g. Pointing device (e.g. mouse, track ball)
h. Parallel communication port
i. Serial communication port compatible with PLC (e.g. RS-232-C, RS-485)
j. 120VAC and Battery power supply
k. All cables and connectors for interfacing with PLC and personal computer
l. Modem compatible for remote troubleshooting of the system

2.1.15.2 Software

The following is the minimum software to be loaded on the laptop. The software shall be the most current versions and compatible with each other to make a complete and usable system.

a. Operating system (e.g. Windows PC)
b. Software for programming the PLC
c. Software for programming the personal computer

2.2 PROGRAMMABLE LOGICAL CONTROLLER (PLC) HARDWARE AND SOFTWARE

2.2.1 General

a. NEMA IA 2. Each PLC shall be able to receive discrete and analog inputs and through its programming it shall control discrete and analog output functions, perform data handling operations and communicate with external devices and remote I/O racks. The PLCs shall be a modular, field

expandable design allowing the system to be tailored to the process control application. The capability shall exist to allow for expansion to the system by the addition of hardware and/or user software. At a minimum the PLCs shall include mounting backplanes, power supply modules, CPU module, communication modules, and I/O modules.

b. Each PLC provided shall be designed and tested for use in the high electrical noise environment of an industrial plant. The PLC modules shall comply with the Federal Communication Commission's Standard 15J Part A for radio noise emissions. The programmable controller processor shall be able to withstand conducted susceptibility tests as outlined in NEMA ICS 2, NEMA ICS 3, ANSI C37.90.

c. The PLCs shall function properly at temperatures between 32 and 122 degrees F, at 5 to 95 percent relative humidity non-condensing and have storage temperatures between -40 and +140 degrees F at 5 to 95 percent relative humidity non-condensing.

d. The PLCs shall have manufacturer's standard system status indicators (e.g. power supply status, system fault, run mode status, back-up battery status).

2.2.2 Central Processing Unit Module

The CPU shall be a modular self-contained unit that will provide time of day, scanning, application (ladder rung logic) program execution, storage of the application program, storage of numerical values related to the application process and logic, I/O bus traffic control, peripheral and external device communications and self-diagnostics.

2.2.3 Power Supply Module

a. The power supply module shall be plugged into the backplane not separately mounted. The power supply shall be wired to utilize 120 VAC, 60 Hz power, the system shall function properly within the range of -10% to +15% of nominal voltage. The power supply shall provide an output to the backplane at a wattage and voltage necessary to support the attached modules. A single main power supply module shall have the capability of supplying power to the CPU module and local communication and I/O modules. Auxiliary power supplies shall provide power to remote racks.

b. Each power supply shall have an integral on/off disconnect switch to the module. If the manufacturers standard power supply does not have an on/off disconnect switch a miniature toggle type switch shall be installed near the PLC and clearly labeled as to its function.

c. The power supply shall monitor the incoming AC line voltage for proper levels and have provisions for both over current and over voltage protection. If the voltage level is detected as being out of range the system shall have adequate time to complete a safe and orderly shutdown.

2.2.4 Program Storage/Memory Requirements

a. The PLC shall have the manufacturers standard nonvolatile executive memory for the operating system. The PLC shall also have EEPROM (Electrically Erasable Programmable Read Only Memory) for storage of the user program and battery backup RAM for application memory. The EEPROM shall be loaded by use of the laptop computer or the personal computer.

b. The contractor shall submit a calculation of the required amount of EEPROM and RAM (random access memory) needed for this application plus an extra 50 percent.

c. The number of times a normally open (N.O.) and/or normally closed (N.C.) contact of an internal output can be programmed shall be limited only by the memory capacity to store these instructions.

2.2.5 Input/Output (I/O) Modules

a. The Contractor shall provide all required I/O modules (analog input, analog output, discrete input, discrete output, and isolated discrete output) to manipulate the types of inputs and outputs as shown on the drawings and to comply with the sequence of operations. The Contractor shall also provide a minimum of 20% (round up for calculation) spare input and output points of each type provided, but not less than 2 of each type.

b. I/O modules shall be a self-contained unit housed within an enclosure to facilitate easy replacement. All user wiring to I/O modules shall be through a heavy-duty terminal strip. Pressure-type screw terminals shall be used to provide fast, secure wire connections. The terminal block shall be removable so it is possible to replace any input or output module without disturbing field wiring.

c. During normal operation, a malfunction in any remote input/output channel shall affect the operation of only that channel and not the operation of the CPU or any other channel.

d. Isolation shall be used between all internal logic and external power circuits. This isolation shall meet the minimum specification of 1500 VRMS. Provide optically isolated I/O components which are compatible with field devices.

e. Each I/O module shall contain visual indicators to display ON/OFF status of individual input or output points.

f. Discrete output modules shall be provided with self-contained fuses for overload and short circuit protection of the module.

g. All input/output modules shall be color coded and titled with a distinctive label.

2.2.6 Interfacing

The PLC shall have communication ports and communication modules using the manufacturers standard communication architecture for connections of the Personal computer, Laptop Computer, remote I/O racks and interconnections between SYS 1 PLC and SYS 2 PLC for the redundant backup system of the PLCs.

2.2.7 Program Requirements

a. The programming format shall be ladder diagram type as defined by NEMA IA 2.

b. There shall be a means to indicate contact or output status of the contact or output on the CRT (of the personal computer) or LCD screen (of the laptop computer). Each element's status shall be shown independently, regardless of circuit configuration.

c. The program shall be full featured in its editing capabilities (e.g. change a contact from normally open to normally closed, add instructions, change addresses, etc.).

2.2.8 Diagnostics

The CPU shall continuously perform self-diagnostic routines that will provide information on the configuration and status of the CPU, memory, communications and I/O. The diagnostic routines shall be regularly performed during normal system operation. A portion of the scan time of the controller should be dedicated to perform these housekeeping functions. In addition, a more extensive diagnostic routine should be performed at power up and during normal system shutdown. The CPU shall log I/O and system faults in fault tables, which shall be accessible for display. When a fault shuts down a CPU, a sequence shall be initiated that will automatically switch over to the other CPU. When a fault affects I/O or communication modules the CPU shall shut down only the hardware affected and continue operation by utilizing healthy system components. All faults shall be annunciated on the alarm annunciator.

2.3 GRAPHICS DISPLAY PANEL

2.3.1 Enclosure

The Graphics Display Panel (GDP) shall be a 42" Plasma Panel Display suitable for wall mounting and capable of accepting input from the Operator Interface Panel. The Operator Interface Panel shall be set up to normally display it's screen number four on the graphic Display Panel, but it shall be capable of sending any of its other screens to the display panel. Any combination of the screens shall be capabile of being displayed on the Operator Interface Panel and the Graphic Display Panel.

2.3.2 Display Presentation

The process schematic graphic representation shall be as shown on the drawings. Red, green, amber, etc. colors should display on the screen as indicated on the drawings. The indicated lights on the drawing shall display approx. a 1/2" (12 millimeters) in diameter.

2.3.3 Digital Net Flow and Level Indicators

Digital indicators as shown on the drawings shall also be displayed on the Plasma Panel to provide the net, issue, and return flow in GPM and pressure in psi of the system and the level in the product recovery tank. The digital indicators shall display the indicated number of digits as shown on the drawings. Each digit shall be approximately 0.6-inches high.

PART 3 EXECUTION

3.1 PUMP CONTROL PANEL (PCP) AND COMPONENTS

3.1.1 General

a. Wiring methods and practices shall be in accordance with NEMA ICS 1,2,3,4, and 6 recommendations as applicable. Where two or more pieces of equipment performing the same function are required, they shall be exact duplicates produced by the same manufacturer. All display instruments of each type shall represent the same outward appearance, having the same physical size and shape, and the same size and style of numbers,

characters, pointers, and lamp lenses.

b. The PCP shall include all required resident software programs and hardware to provide the specified sequence of operation. All software floppy disks including programming manuals shall be turned over to the Government at the completion of start-up so modification can be done in the field with no outside assistance.

c. It is intended that process controlling devices except field devices, and motor controllers be attached to or mounted within the PCP enclosure and all interconnecting wiring installed prior to shipment to the job site. This is to allow shop testing of the system and to decrease field labor requirements.

d. The PCP shall be shipped fully assembled in one piece after the completion of the shop tests and all defects corrected.

3.1.2 Shop Tests

Certified Pump Control Panel (PCP) Shop Test Report

The manufacturer shall shop test the PCP, Personal computer, and lap top computer. The procedure shall include simulation of field components and shall provide for fully testing the pump control and annunciator system as a unit before delivery to the project site. The test shall, reveal system defects, including, but not limited to, functional deficiencies, operating program deficiencies, algorithm errors, timing problems, wiring errors, loose connections, short circuits, failed components and misapplication of components. The test shall be performed prior to shipment to the site and problems detected shall be corrected. The final testing and correction sequence shall be repeated until no problems are revealed and then two additional successful tests shall be performed. Submit certified test report within 15 days after completion of the test. The report shall include a statement that the Pump Control Panel performs as specified. The Contractor shall notify the Governments Contracting Officer and the Command Fuels Engineer 30 days prior to the final shop testing date. The Contracting Officer may require a Government witness at the final test before the PCP is shipped to the site.

3.1.3 Ventilation System

Thermostat T-1, shall control fan F-1 and thermostat T-2 shall control fan F-2. T-1 and T-2 shall be set at 80 degrees F to maintain interior air temperature to 20 degrees F above ambient. Thermostat T-3, set at 100 degrees F, shall provide a non-critical PCP HIGH TEMPERATURE alarm to the alarm annunciator.

3.1.4 Grounding

The PCP ground bar shall be connected to the building counterpoise via a #10 AWG conductor. Within the enclosure all I/O racks, processor racks, and power supplies, etc. shall be grounded to meet the manufacturer's specifications.

3.1.5 Indicator Lights, Switches, and Pushbuttons

Indicator lights, switches, and pushbuttons shall be mounted through the PCP enclosure and shall be arranged to allow easy vision and operation of each device. Each device shall have a nameplate and/or legend plate as

indicated on the drawings. Nameplate wordings shall be as indicated on the drawings.

3.1.6 Transient Voltage Surge Suppression Devices

Transient voltage surge suppression (TVSS) devices shall be installed in the PCP to minimize effects of nearby lightning strikes, switching on and off motors and other inductive loads. TVSS shall be provided for each control circuit ladder. Each ladder may contain any combination of the following devices: PLCs, power supplies (e.g., 24 volt), fans, relays, lights, switches etc. TVSS shall also be provided for PLC I/O originating outside of the building.

3.1.7 Terminal Blocks

As a minimum, any PCP device that connects to a field device (devices not located in the PCP) shall be connected to a terminal block. A connection diagram similar to the drawings shall be provided to the field contractor for field connections to the PCP.

3.1.8 Uninteruptable Power supplies

The Pump Control Panel (PCP) shall contain three uninteruptable power supplies (UPS) each connected to a dedicated circuit. As shown on the drawings one UPS shall supply PLC System 1, one UPS shall supply PLC System 2, and the third UPS shall supply the miscellaneous device power. The UPSs output capacity shall be sufficient to drive all the equipment connected plus 25%.

3.1.9 Power Supplies

The Contractor shall provide and install all 120VAC and 24VDC power supplies as required. The power supplies shall be sized for the load plus 25%. All field devices, which require power and are controlled or monitored from the PCP, shall be supplied from power supplies in the pump control panel. A 120V receptacle shall be provided in the PCP for use by the Laptop computer. Interconnecting wiring between UPSs and PLC power supplies shall be completely installed prior to shipment to the job site.

3.1.10 Alarm Annunciator and Horns

Signals shall be initiated by hardwired field contacts or by PCP outputs as required. The annunciator shall energize alarm horns, both an integral panel mounted vibrating horn and remote horns, and flash the appropriate annunciator lamp. The minimum number of windows shall correspond to the number of alarm points, plus 15 percent spare. The drawings indicate panel layout and the alarms to be annunciated.

3.1.10.1 Non-critical Alarms

Non-critical alarm windows shall be white with black lettering and shall sound the PCP mounted vibrating horn and the exterior mounted vibrating horn.

3.1.10.2 Critical Alarms

Critical alarm windows shall be red with white lettering and shall sound the PCP mounted vibrating horn and the exterior mounted resonating horn. Critical alarms shall also cancel all automatic pump starts in the PLC.

3.1.10.3 Alarm Sequence

Alarm sequence for each alarm shall be as follows (ISA S18.1 sequence 'A').

a. For a normal condition, visual indicator and horns will be off.
b. For an alarm condition, visual indicator will flash and horns will sound (this condition will be locked in).
c. Upon acknowledgment of the alarm condition, visual indicator will be steady on and the horns will be off.
d. If, after acknowledgment of an alarm condition, another alarm condition is established, the new alarm will cause the appropriate window to flash and the horn to sound.
e. When condition returns to normal after acknowledgment, the visual indicator and the horn will be off.

3.1.11 Operator Interface Panel

The operator interface panel shall be mounted through the front panel of the PCP. Conductor routing shall allow the door to swing to the fully open position. The operator interface panel shall download system parameters from the PLC for display. The operator interface shall also upload new set point values that the operator has changed using the operator interface key pad, after a password has been entered.

3.1.11.1 Screen Number 1

This shall be a general opening screen. As a minimum it shall display the name and location of the installation (e.g. Eielson Air Force Base, Alaska), name of the project (e.g., Construct Type III Hydrant Fueling System) and screen navigation information.

3.1.11.2 Screen Number 2

At a minimum the following items shall be displayed. The values shall be continuously updated, a 2 second delay maximum between updates will be acceptable.

a. System Issue Rate	xxxx GPM	
b. System Return Rate	xxxx GPM	
c. System Net Flow	xxxx GPM	
d. System Pressure	xxxx PSI	
e. System Operation Mode	Auto/Off/Flush/WPTM	
f. Active System	Sys-1/Sys-2	
g. Lead Pump	1/2/3/4/5	
h. Fuel Pump #1	On/Off	xxxxx.x HOURS
i. Fuel Pump #2	On/Off	xxxxx.x HOURS
j. Fuel Pump #3	On/Off	xxxxx.x HOURS
k. Fuel Pump #4	On/Off	xxxxx.x HOURS
l. Fuel Pump #5	On/Off	xxxxx.x HOURS
m. Backpressure Control Valve	Closed/Enabled	
n. Pressure Control Valve	Closed/Enabled	
o. Defuel/Flush Valve	Closed/Defuel	
p. Tank #1 Outlet Valve	Open/Closed	
q. Tank #2 Outlet Valve	Open/Closed	

Only one of the words separated by a slash (/) shall be displayed. The xxxxx.x HOURS is the fuel pumps elapsed run time and the value shall not be

lost when the lead PLC is switched. The pump and valve status words shall be color coded to match the colors used on the graphic display screen.

3.1.11.3 Screen Number 3

The following table shall be displayed. The table lists the set points that can be adjusted using the operator interface. A password shall be entered before the "current value" can be adjusted. The value entered can only be a number within the "set point range". The "default value" is the value held in the program that is loaded into EEPROM memory (This screen may require more than one display screen.).

SET POINT DESCRIPTION	SET POINT RANGE	DEFAULT VALUE	CURRENT VALUE
Lead pump starting pressure	30 to 150 psi	60 psi	xxx psi
Issue flow to start second pump in the sequence	450 to 650 gpm	560 gpm	xxx gpm
Issue flow to start third pump in the sequence	1000 to 1300 gpm	1160 gpm	xxxx gpm
Issue flow to start fourth pump in the sequence	1600 to 1900 gpm	1760 gpm	xxxx gpm
Return flow to enable next pump in sequence to start	10 to 100 gpm	40 gpm	xxx gpm
Return flow to stop fourth third, and second pump in the sequence (lag pump)	500 to 800 gpm	700 gpm	xxx gpm
Return flow to initiate lead pump shutdown sequence	500 to 800 gpm	560 gpm	xxx gpm
Timer to enable start-up of lead pump	0 to 120 seconds	0 seconds	xx seconds
Timer to enable second, third and fourth pumps to start	0 to 120 seconds	10 seconds	xx seconds
Timer to stop fourth, third, and second pumps	0 to 120 seconds	15 seconds	xx seconds
Timer to stop first pump	0 to 60 seconds	2 seconds	xx seconds
Timer to disable Back Pressure Control Valve	0 to 360 seconds	300 seconds	xx seconds
Timer to establish fueling pump failure	5 to 30 seconds	15 seconds	xx seconds
System pressure to stop lead pump	130 to 190 psig	140 psig	xxx psig

3.1.11.4 Screen Number 4

This screen shall be a duplicate of the Graphic Display Drawing showing a schematic of the process flow. This screen shall be referred to as the graphical display. Many operating parameters shall be displayed here as required in later paragraphs of this specification.

3.1.11.5 Screen Number 5

This screen shall be a duplicate of the Alarm Annunciator and it shall be superimposed over the current active screen when an alarm is activated.

3.1.11.6 Screen Number 6

This screen shall be a screen designed solely for assisting the testing team during initial start up to watch all of the significant parameters of the systems operation simultaneously on one screen. This screen shall include the system parameters i.e. (flows, pressures, and status) from screen 2, the set points from screen 3, and timers for all of the actions that will take place following a delay function.

3.1.11.7 Screen Number 7

This screen shall be a screen designed solely for displaying the seven graphs as described in the System Start-Up, Fueling System Specification 15899. The following values shall be displayed concurrently against time: Issue flow, Issue pressure, Return flow, Pump #1 discharge pressure, Pressure upstream of BPCV, Pressure downstream of BPCV, and Hydrant Pit Pressure. The Operator Interface Panel shall be capable of storing up to 1 week of data corresponding to the above values. The system will be able to produce graphs on the screen of this data and be able to download the data to floppy disk or print the data in seven colors if a color printer was installed.

3.1.12 Laptop Computer

The Laptop computer shall be used to create, edit, and load the ladder logic program into the PLCs and the operator interface panel. The Laptop shall also be used to monitor the PLCs memory and ladder logic program. The computer shall be stored in a lockable cabinet located within the Pump Control Panel.

3.2 PROGRAMMABLE LOGICAL CONTROLLER (PLC) HARDWARE AND SOFTWARE

3.2.1 General

The basic operation of the redundant PLC system is (Reference "Control System Block Diagram" on the drawings):

a. CPU-1 and it's associated I/O rack (I/O-1) sends system outputs to appropriate devices and receive input signals from System-1 redundant field devices (PIT-1, DPT-1, DPT-3, flow switches, valve limit switches), System-2 redundant field devices (PIT-2, DPT-2, DPT-4, flow switches, valve limit switches), and all nonredundant field devices as listed on the drawings.

b. CPU-2 and it's associated I/O rack (I/O-2) sends system outputs to appropriate devices and receive input signals from System-1 redundant field devices (PIT-1, DPT-1, DPT-3, flow switches, valve limit switches),

System-2 redundant field devices (PIT-2, DPT-2, DPT-4, flow switches, valve limit switches), and all nonredundant field devices as listed on the drawings.

c. Within each rack (I/O-1 and I/O-2) System-1, System-2, and nonredundant inputs and outputs shall not be mixed on the same input/output module.

d. Under normal operation: The system input select switch is in the "SYS-1" position. CPU-1 is controlling the system using System-1 and nonredundant inputs from I/O-1 and any set point changes from the personal computer. CPU-2 is being updated by CPU-1 or concurrently monitoring System-1 inputs from I/O-2.

e. If under normal operation CPU-1 recognizes that a System-1 input has failed (see note below) it shall change over to the System-2 redundant input on I/O-1 and report the failure to the personal computer alarm screen.

Note: The pressure indicating transmitters and the differential pressure transmitters are the only devices that the PLC can monitor for a possible failure. A failure shall be defined by the transmitter going out of range on the low side (i.e. a signal less than 4mA).

f. During normal operation there are two ways for CPU-2 to take control of the system: 1) CPU-1 identifies its own internal fault and hands over control to CPU-2. 2) CPU-2 identifies a fault in CPU-1 and takes control from CPU-1. When CPU-2 is in control of the system it shall annunciate the fault condition and shall be using any updated inputs from the personal computer and shall use System-1 inputs. If CPU-2 senses a fault on a System-1 input it shall then switch over to the appropriate System-2 input. If power is lost to System-1 inputs then CPU-2 shall use all of the System-2 inputs.

g. CPU-2 shall also report any of its internal faults to CPU-1 and CPU-1 shall report any faults it detects in CPU-2.

h. When the operators think the system is not working and the PLCs do not detect any faults the operator can move the system input select switch from the "SYS-1" position to the "SYS-2" position. With the switch in the "SYS-2" position the PLCs are using System-2 inputs.

3.2.2 Programs

a. The Contractor shall provide two copies of all working programs (i.e. PLC logic, personal computer) on read only CDs as well as a printed program listing.

b. The Contractor (programmer) shall provide rung comments (documentation) in the ladder logic program. Each device, on the ladder, shall be identified as to the type of device, i.e. limit switch XX, flow indicator XX, motor starter XX, etc. Rung comments shall be provided for input and output rungs. The programmer shall also provide a comment describing the function of each rung or group of rungs that accomplish a specific function.

3.3 GRAPHICS DISPLAY PANEL

3.3.1 General

The graphic display panel shall be shipped fully assembled in one piece

after it has been shop tested as an integral part of the pump control panel and all defects corrected.

3.3.2 Display Presentation

The Graphic Display shall depict the process fuel flow schematically as indicated on the drawings. Red, green, and amber lights shall be integrated with the process schematic to provide current equipment status graphically. Lights shall be located immediately adjacent to related equipment symbol.

3.3.3 Process Schematic

The process schematic graphic representation shall utilize conventional symbols when possible. Symbols and flow lines shall be sized and spaced so as to provide a clear representation of the system process. The Graphic Display shall be suitable for supervised field modification when future items are added. Minor changes may be incorporated to allow proper line width and spacing. Component arrangement, piping routing, and location of valves shall match the flow diagram. The GDP layout shall be approved by the Government.

3.3.4 Digital Net Flow and Level Indicators

Digital indicators shall appear on the screen as shown on the drawings and indicate net, issue, and return flow in gpm, pressure in psi, and level in feet.

3.4 INSTALLATION

Installation shall conform to the manufacturer's drawings, written recommendations and directions.

3.4.1 Shop Drawing

The shop drawing shall be clear and readable and preferably drawn using a computer aided drafting package. At the conclusion of the project the diagram drawings shall be redrafted to include all as-built conditions. These updated drawings shall be included in the O&M Manuals and appropriate section of the drawings placed in a data pocket located in each of the enclosures. The shop drawing at a minimum shall show:

a. Overall dimensions, front, side and interior elevation views of the PCP showing size, location and labeling of each device.

b. Power ladder diagram indicating power connections between TVSS, power conditioners, PLCs, power supplies and field and panel devices. Any terminal block connection numbers used shall be indicated.
c. Control ladder diagram indicating control connections between field and devices and PLC I/O modules. Terminal block connection numbers and PLC terminal numbers shall be indicated
d. Communication connections between PLCs and I/O racks. Communication channel numbers shall be indicated.
e. Bill of materials.
f. Written control sequence covering all inputs, outputs, and control scheme.

3.4.2 System Start-Up and Testing

a. At PCP start-up and testing the Contractor shall provide personnel, on site, to provide technical assistance, program fine tuning, and to start-up and test the system. Start-up and testing shall be coordinated with the overall fueling system start-up test specified in Section 15899, SYSTEM START-UP, FUELING SYSTEM. Prior to this test, all connections shall have been made between the PCP, the personal computer, the motor control center, and all field devices. In addition, wiring shall have been checked for continuity and short circuits. The Contractor shall adjust set point values, timing values, and program logic as required to provide a functional hydrant fuel control system. Once the system has been fine tuned and passed the system test, the new system default values, shall be loaded into the PLC EEPROM and the personal computer screens adjusted to indicate the new values.

b. A step-by-step testing procedure of the PCP shall be submitted, Testing Plan. The test shall be designed to show that every device (lights, switches, personal computer display screens, alarms, etc.) on the PCP and personal computer is in working order and that the PLC program controls the system per specifications. The test shall be performed in conjunction with Section 15899. The plan shall include a place for the contractor and government representative to initial each step of the plan after satisfactory completion and acceptance of each step. The complete initialed testing plan shall be certified by the contractor and then submitted, Record of Test.

3.4.3 Training Plan for Instructing Personnel

a. Upon completion of the system start-up a competent technician regularly employed by the PCP manufacturer shall hold a training class for the instruction of Government personnel in the operation and maintenance of the system. Provide both classroom type theory instruction and hands-on instruction using operating equipment provided. The period of instruction shall be a minimum of three 8-hour working days. The training shall be designed to accommodate 8 operators, 4 maintenance personnel, and 2 programmers. The Government shall receive written notice (via Contracting Officer) a minimum of 14 days prior to the date of the scheduled classes.

b. Furnish a written lesson plan and training schedule for Government approval at least 60 days prior to instructing operating, maintenance and programming personnel. Concurrently submit above to the MAJCOM for their input into the review process. Approval of lesson plan will be based on both Government and MAJCOM concurrence. This plan shall be tailored to suit the requirements of the Government. The training shall be divided into three separate classes. Each class shall be tailored to a specific group of personnel. The groups are: 1) Operators, those that will use the control system on a day to day basis; 2) Maintenance personnel, those that will perform routine and non-routine maintenance and trouble shooting of the control system; 3) Programmers, those that will make changes to and trouble shoot the PLC and personal computer programs. The training program shall provide:

(1) a detailed overview of the control system including the complete step-by-step procedures for start-up, operation and shut-down of the control system.
(2) a general overview of programmable logic controllers
(3) the maintenance of equipment installed
(4) the programming of the PLC and Personal Computer

(5) trouble shooting of the system

c. Complete approved Operation and Maintenance manuals for Specification 15970 PUMP CONTROL AND ANNUNCIATION SYSTEM and 16415 ELECTRICAL WORK,INTERIOR (specifically pertaining to the motor control center and its relay ladder diagrams) shall be used for instructing operating personnel. Training shall include both classroom and hands-on field instruction. The class shall be video taped in the VHS format.

d. The contractor shall also provide VHS formatted video taped training courses covering system overview, operation, maintenance, trouble shooting, and programming. These tapes shall be produced off-site by the contractor using the supplied Pump Control Panel as the teaching aid, or commercially produced tapes by the PLC manufacturer or third party who specializes in training on PLC systems. Along with the tapes, provide workbooks, which follow along with the tapes.

3.5 TOOLS AND SPARE PARTS*\

The following shall be provided:

a. any special tools necessary for maintenance of the equipment
b. one spare set of fuses of each type and size
c. recommended manufacturer list of spare parts. Include part number, current unit price, and source of supply.
d. one spare power supply module
e. one spare I/O module (for discrete devices)
f. one spare I/O module (for analog devices)
g. 2 PLC RAM back-up batteries

h. minimum of 10 spare lamps for the Alarm Annunciator
i. minimum of 10 spare lamps of each type of non-LED lamps used on the Pump Control Panel

3.6 PLC CONTROL SYSTEM SEQUENCE OF OPERATION

3.6.1 General

The following describes general functions of the fueling system components.

3.6.1.1 Abbreviations

a. SYS-1: components of System #1 including power conditioner, power supplies, CPU-1, I/O-1, and system #1 input and outputs.
b. SYS-2: components of System #2 including power conditioner, power supplies, CPU-2, I/O-2, and system #2 input and outputs.
c. CPU-1: SYS-1 PLC CPU.
d. CPU-2: SYS-2 PLC CPU.
e. I/O-1: SYS-1 PLC input/output modules.
f. I/O-2: SYS-2 PLC input/output modules.
g. PCP: Pump Control Panel.
h. GDP: Graphical Display Panel
i. OI: Operator Interface Panel

3.6.2 Operating Tanks

3.6.2.1 Level Control

Each operating tank has three level float switches to measure low, high and

high-high levels. The switches are DPDT for the redundancy and each pole shall be connected to both SYS-1 and SYS-2 as indicated on the Terminal Block Connection drawing.

a. Low Level

When the low level float is activated the associated tank's graphic display low level light shall light. If the outlet valve is not fully closed the alarm annunciator's critical alarm sequence activates, fueling pumps running in automatic mode shall be disabled and no pump shall be allowed to start automatically. If all tanks are at low level, no fueling pumps shall start automatically.

b. High Level

When the high level float is activated the associated tank's graphic display high level light shall light and the alarm annunciator's non-critical alarm sequence activates.

c. High-High Level

When the high-high level float is activated the associated tank's graphic display high-high level light shall light, the alarm annunciator's critical alarm sequence activates, fueling pumps running in automatic mode shall be disabled and no pump shall be allowed to start automatically.

3.6.2.2 Outlet Valve

Each operating tank's outlet valve has a limit switch to indicate valve position. The switch is DPDT for redundancy and each pole shall be connected to both SYS-1 and SYS-2 as indicated on the Terminal Block Connection drawing. The switch shall close when the valve is fully closed. When the limit switch is closed the associated tank's valve graphic display closed light shall activate. When the limit switch is open, the associated tank's valve graphic display open light shall activate.

3.6.3 Product Recovery Tank

3.6.3.1 Fuel Transfer Pump (FTP)

The pump's motor controller has a status relay to indicate the on/off status of the pump. The status relay shall be connected to both SYS-1 and SYS-2 as indicated on the Terminal Block Connection drawing. When status relay is open the pump's graphic display off light shall light. When the status relay is closed the pump's graphic display on light shall light. The status relay state shall also be used to start and stop the pumps elapsed run time timer.

3.6.3.2 Overfill Valve (OV)

The tank's overfill valve has a limit switch to indicate valve position. The switch is SPST and shall be connected to both SYS-1 and SYS-2 as indicated on the Terminal Block Connection drawing. The switch shall close when the valve is fully closed. When the limit switch is closed the tank's graphic display valve closed light shall light and the alarm annunciator's non-critical alarm sequence activates. When the limit switch is open the tank's graphic display valve open light shall light.

3.6.3.3 High Level Alarm

The tank has a high level alarm float switch. The switch is SPST and shall be connected to both SYS-1 and SYS-2 as indicated on the Terminal Block Connection drawing. When the high level alarm float is activated the tank's graphic display high level light shall light and the alarm annunciator's non-critical alarm sequence activates.

3.6.3.4 Leak Detection

The tank has a leak detection system. The leak detection systems alarm relay shall be connected to both SYS-1 and SYS-2 as indicated on the Terminal Block Connection drawing. When the leak alarm is activated the alarm annunciator's non-critical alarm sequence activates.

3.6.4 Fueling Pumps (FP)

There are five fueling pumps with a maximum of four pumps running at one time. The lead pump selector switch shall select the pump starting sequence. Each pump's motor controller has a status relay to indicate the on/off status of the pump. The status relay shall be connected to both SYS-1 and SYS-2 as indicated on the Terminal Block Connection drawing. When status relay is open the associated pump's graphic displayoff light shall activate and screen number 2 shall indicate on. When the status relay is closed the associated pump's graphic display on light shall activate and screen number 2 shall indicate off. The status relay state shall also be used to start and stop the pumps elapsed run time timer and shall be displayed on screen number 2.

3.6.5 Flow Switch, Fueling Pump

On the discharge side of each pump is a flow switch to indicate positive flow (fail safe feature). The flow switch is DPDT for redundancy and each pole shall be connected to both SYS-1 and SYS-2 as indicated on the Terminal Block Connection drawing. If the PLC has given a signal to start a pump and the flow switch has not closed before the set point timer expires or if the flow switch opens after the pump has been running then the pump shall be in a failure state and it shall be disabled (taken out of the starting sequence), the alarm annunciator's non-critical alarm sequence shall also be activated, and the next pump in the start sequence started. After the PLC has stopped all of the pumps, any failed pump shall be added back into the start sequence.

3.6.6 Transmitters

3.6.6.1 Pressure Indicating Transmitter (PIT)

The PIT's measure system pressure in psi. There are two PITs for redundancy. PIT-1 and PIT-2 are connected to both SYS-1 and SYS-2 as indicated on the Terminal Block Connection drawing. The system pressure is sent to personal computer display.

3.6.6.2 Differential Pressure Transmitter (DPT)

The DPT's measure flow in gpm. There are two issue DPTs (DPT-1 and DPT-2) and two return DPTs (DPT-3 and DPT-4) for redundancy. The DPTs are connected to both SYS-1 and SYS-2 as indicated on the Terminal Block Connection drawing. The net flow is sent to the personal computer display. The issue rate, return rate and net flow shall be displayed on the personal

computer.

3.6.6.3 Pressure Sensors (PS)

The PS's measure system pressure in psi. There are three PSs installed on the system and there are PCP preparations made for a fourth PS to be temporarily wired in from a Hydrant Pit. PS-1, PS-2, and PS-3 are connected to SYS-1 only as indicated on the Terminal Block Connection drawing. These sensors will report various system pressures to the personal computer to be used only for the creation of the system graphs as required for screen 7 and described in Specification Section 15899 SYSTEM START-UP, FUELING SYSTEM.

3.6.7 Control Valves

3.6.7.1 Defuel/Flush Valve (D/FV)

The D/FV shall be connected to I/O-1, I/O-2 and power conditioner #3 as indicated on the Terminal Block Connection drawing. The graphical display open and closed lights and screen number 2 status shall activate based on the PLC's output status for the valve. The valve status shall be based on the table listed below.

Defuel/Flush Valve Operation - Two Solenoids				
Fueling Mode per PCP Selector Switch	Valve Action	Solenoid A	Solenoid B	Graphical Display
Flush Mode	Open	De-Energized	Energized	Open
Automatic Mode Pump(s) On	Closed	De-Energized	De-Energized	Closed
Automatic Mode Pumps Off	Enabled	Energized	De-Energized	Closed
Off Mode Pump(s) On	Closed	De-energized	De-Energized	Closed
Off Mode Pumps Off	Enabled	Energized	De-Energized	Closed
WPTM	Closed	De-energized	De-Energized	Closed

3.6.7.2 Pressure Control Valve (PCV)

The PCV shall be connected to I/O-1, I/O-2 and power conditioner #3 as indicated on the Terminal Block Connection drawing. The graphical display enabled and closed lights and screen number 2 status shall activate based on the PLC's output status for the valve. The valve status shall be based on the table listed below.

Pressure Control Valve Operation - One Solenoid			
Fueling Mode per PCP Selector Switch	Valve Action	Solenoid	Graphical Display

Automatic Mode Pumps Off	Enabled	De-Energized	Enabled
Automatic Mode Pump(s) On	Closed	Energized	Closed
Flush Mode Pumps On	Closed	Energized	Closed
Flush Mode Pumps Off	Enabled	De-Energized	Enabled
Off Mode Pump(s) On	Closed	Energized	Closed
Off Mode Pumps Off	Enabled	De-Energized	Enabled
WPTM	Closed	Energized	Closed

3.6.7.3 Backpressure Control Valve (BPCV)

The BPCV shall be connected to I/O-1, I/O-2 and power conditioner #3 as indicated on the Terminal Block Connection drawing. The graphical display enabled and closed lights and screen number 2 status shall activate based on the PLC's output status for the valve. The valve status shall be based on the table listed below.

Backpressure Control Valve Operation - One Solenoid			
Fueling Mode per PCP Selector Switch	Valve Action	Solenoid	Graphical Display
Automatic Mode Pump Start-up	Enabled	Energized	Enabled
Automatic Mode Prior to Lead Pump Shutoff	Closed	De-Energized	Closed
Flush Mode	Closed	De-Energized	Closed
Off Mode Pump(s) On	Enabled	Energized	Enabled
Off Mode Pumps Off	Closed	De-Energized	Closed
WPTM	Enabled	Energized	Enabled

3.6.8 Safety Circuit

3.6.8.1 Emergency Stop Status

The emergency stop circuit status relay (ER1) N.O. contact shall be connected to I/O-1, I/O-2 and UPS #3 as indicated on the Terminal Block Connection drawing. When the circuit is activated the alarm annunciator's critical alarm sequence is activated and any calls to start fueling pumps shall be canceled and no additional pump start signals shall be sent until the circuit has been reset. The fueling pumps will actually be stopped by a emergency stop circuit status relay (ER2) N.O. contact in the fuel pump motor control circuit located in the motor control center.

3.6.8.2 Emergency Shutoff Valves (ESO) Status

The ESO status relay (ER2) N.O. contact shall be connected to I/O-1, I/O-2 and UPS #3 as indicated on the Terminal Block Connection drawing. When the relay is closed the Graphic Display valve open lights shall light. When the relay is open the Graphic Display valve closed lights shall light.

3.6.8.3 Circuit Power Status

The safety circuit power status relay (ER3) N.O. contact shall be connected to I/O-1, I/O-2 and power conditioner #3 as indicated on the Terminal Block Connection drawing. When the relay is closed the PCP emergency circuit power on light shall light.

3.6.9 Pump Control Panel

3.6.9.1 CPU Faults

The PCP mounted CPU-1 and CPU-2 on lights are connected to both SYS-1 and SYS-2. The associated CPU light shall light when no system faults are detected. When a fault is detected by the CPU or it's redundant CPU the faulted CPU's on light shall be turned off and the alarm annunciator's non-critical alarm sequence shall be activated.

3.6.9.2 Input Select Switch

The 2-position input select switch shall control which inputs (System-1 or System-2) are being used. Each switch position shall be connected to both SYS-1 and SYS-2. The OI display shall indicate the active system.

3.6.9.3 Mode Select Switch

The 4-position switch selects what mode of fueling is active: automatic, flush, WPTM or off. Each switch position shall be connected to both SYS-1 and SYS-2. The screen number 2 status shall indicate the active mode.

3.6.9.4 Lead Pump Selector Switch

The 5-position switch selects which pump shall be the lead pump. The switch position shall fix the starting sequence for all pumps. The sequences shall be 1-2-3-4-5, 2-3-4-5-1, 3-4-5-1-2, 4-5-1-2-3, and 5-1-2-3-4. The off sequence shall be the reverse of the start sequence, therefore, first on will be last off. A maximum of four pumps will be allowed to run at one time. If a pump fails to start or fails during operation, that pump will be disabled and the next pump in the sequence started. The screen number 2 status display shall indicate the lead pump.

3.6.9.5 PCP Temperature Alarm

The alarm thermostat when activated shall activate the alarm annunciator's non-critical alarm sequence.

3.7 OPERATING PROGRAM REQUIREMENTS

The control system's logic program shall be stored on a EEPROM chip. Default values of operator adjustable parameters shall be permanently stored on the chip with the capability of resetting the values in RAM to the values with in the range specified below. The default values can be

changed through the use of the personal computer (after the correct password has been entered). After loss of power and battery failure the adjustable settings shall revert back to the default values located on the chip. The default values shown here shall be reset to the values determined during the system start up and test.

SET POINT DESCRIPTION	SET POINT RANGE	DEFAULT VALUE
Lead pump starting pressure	30 to 150 psi	60 psi
Issue flow to start second pump in sequence	450 to 650 gpm	560 gpm
Issue flow to start third pump in sequence	1000 to 1300 gpm	1160 gpm
Issue flow to start fourth pump in sequence	1600 to 1900 gpm	1760 gpm
Return flow to enable next pump in sequence to start	10 to 100 gpm	40 gpm
Return flow to stop fourth, third, and second pump in sequence (lag pump)	500 to 800 gpm	700 gpm
Return flow to initiate lead pump shutdown sequence	500 to 800 gpm	560 gpm
Timer to enable start-up of lead pump	0 to 120 seconds	0 seconds
Timer to enable second, third, and fourth pumps to start	0 to 120 seconds	10 seconds
Timer to stop fourth, third, and second pumps	0 to 120 seconds	15 seconds
Timer to stop first pump	0 to 60 seconds	2 seconds
Timer to de-energize (close) Back Pressure Control Valve	0 to 360 seconds	300 seconds
Timer to establish fueling pump failure	5 to 30 seconds	15 seconds
System pressure to stop lead pump	130 to 190 psig	140 psig

Should the operator enter a value not within the range for that parameter, the personal computer shall indicate "INVALID ENTRY" and revert back to the previous value.

3.8 AUTOMATIC MODE - IDLE CONDITION

The fueling system is intended to remain continuously pressurized while in the idle condition. This allows the system to respond immediately to

aircraft refueling and defueling requirements. Periodically, in the idle condition, the system will lose minimal pressure. When this occurs, the control system will automatically repressurize in the following sequence:

a. The lead pump will start when the system pressure is less than <60> psig continuously for <0> seconds. If the pressure then rises above <60> psig before the timer expires, the timer shall reset.

b. After the timer expires:

(1) The BPCV solenoid shall be energized to enable the valve to modulate the system pressure at it's set point.

(2) The PCV solenoid shall be energized to close the valve.

(3) The D/FV solenoid 'A' shall be de-energized so the valve is closed and solenoid 'B' shall be de-energized.

c. With the lead pump running, "600 gpm will flow through the issue venturi. The system pressure upstream of the BPCV will increase to the BPCV set point of 130 psig. At this pressure the BPCV will start to open and the valve will modulate as required to pass sufficient flow through the return venturi to maintain pressure upstream of the valve.

d. With the lead pump running and no fueling demand the return venturi flow rate will equal the issue venturi flow rate. When the return venturi flow rate is greater than <560> gpm a <300> second timer shall start. If the flow rate drops below <560> before the timer expires, the timer shall reset, and no changes shall be made to the pump and valve status.

e. After the timer expires:

(1) The BPCV solenoid shall be de-energized to close the valve.

(2) The PCV solenoid shall be de-energized to bleed system pressure to 75 psig.

(3) When system pressure rises to 140 psig a <2> second timer shall start. After the timer has expired, the lead pump shall be stopped.

(4) The Defuel/Flush valve solenoid "A" shall be energized 30 seconds after lead pump shut down to allow it to open at 80 psig for defuel operations.

f. The system has now returned to a pressurized and idle condition.

g. When a fueling pump is called to start, a 15 second timer shall start. If the timer expires before the flow switch closes the pump shall be called off, the alarm annunciator's associated non-critical alarm sequence shall activate and the next pump in the sequence shall be called to start.

h. If a fueling pumps flow switch opens after the pump has successfully started the pump shall be called off, the alarm annunciator's associated non-critical alarm sequence shall activate and the next pump in the sequence shall be called to start.

3.9 AUTOMATIC MODE - REFUELING CONDITION

To start an aircraft fueling operation, an operator connects fueling equipment such as a hydrant hose truck to an aircraft and to a hydrant control valve. When the operator opens the hydrant control valve by use of an hydraulic operated "Deadman", the following sequence occurs:

a. The lead pump will start when the PIT senses a pressure less than <60> psig continuously for <0> seconds. If the pressure then rises above <60> psig before the timer expires, the timer shall reset.

b. After the timer expires:

(1) The BPCV solenoid shall be energized to enable the valve to modulate the system pressure at it's set point.

(2) The PCV solenoid shall be energized to close the valve.

(3) The D/FV solenoid 'A' shall be de-energized so the valve is closed and solenoid 'B' shall be de-energized.

c. With the lead pump running, ±600 gpm will flow through the issue venturi. The system pressure upstream of the BPCV will increase to the BPCV set point of 130 psig. At this pressure the BPCV will start to open and the valve will modulate as required to pass sufficient flow through the return venturi to maintain pressure upstream of the valve.

d. With lead pump running and a issue venturi flow rate greater than <560> gpm and a return venturi flow rate greater than <40> gpm and less than <560> gpm the lead pump will continue to run and the BPCV will modulate to pass flow as necessary to maintain upstream system pressure.

e. With the lead pump running and a issue venturi flow rate greater than <560> gpm and a return venturi flow rate greater than <560> gpm a <300> second timer shall start. If issue venturi flow rate falls below <560> gpm or the return venturi flow rate falls below <560> before the timer expires, the timer shall reset, and no changes shall be made to the pump and valve status.

f. After the timer expires:

(1) The BPCV solenoid shall be de-energized to close the valve.

(2) The PCV solenoid shall be de-energized to bleed system pressure to 75 psig.

(3) When system pressure rises to 140 psig a <2> second timer shall start. After the timer has expired, the lead pump shall be stopped.

(4) The Defuel/Flush valve solenoid "A" shall be energized 30 seconds after lead pump shut-down to allow it to open at 80 psig for defuel operations.

g. With the lead pump running and a issue venturi flow rate greater than <560> gpm and a return venturi flow rate less than <40> gpm a <10> second timer shall start. If the issue venturi flow rate falls below <560> gpm or the return venturi flow rate rises above <40> gpm before the timer expires, the timer shall reset, and no changes shall be made to the pump

and valve status.

h. After the timer expires: The second pump shall start.

i. With the lead and second pumps running and a issue venturi flow rate greater than <1160> gpm and a return venturi flow rate of greater than <40> gpm and less than <700> gpm the lead and second pumps shall continue to run and the BPCV shall modulate as necessary to maintain system pressure.

j. With the lead and second pumps running and a issue venturi flow rate greater than <1160> gpm and a return venturi flow rate greater than <700> gpm a <15> second timer shall start. If issue venturi flow rate falls below <1160> gpm or the return venturi flow rate falls below <700> gpm before the timer expires, the timer shall reset and no changes shall be made to the pump and valve status.

k. After the timer expires: The second pump shall be stopped.

l. With the lead and second pump running and a issue venturi flow rate greater than <1160> gpm and a return venturi flow rate less than <40> gpm a <10> second timer shall start. If the issue venturi flow rate falls below <1160> gpm or the return venturi flow rate rises above <40> gpm before the timer expires, the timer shall reset, and no changes shall be made to the pump and valve status.

m. After the timer expires: The third pump shall start.

n. With the lead, second and third pumps running and a issue venturi flow rate greater than <1760> gpm and a return venturi flow rate of greater than <40> gpm and less than <700> gpm the lead, second and third pumps shall continue to run and the BPCV shall modulate as necessary to maintain system pressure.

o. With the lead, second and third pumps running and issue venturi flow rate greater than <1760> gpm and a return venturi flow rate greater than <700> gpm a <15> second timer shall start. If the issue venturi flow rate falls below <1760> gpm or the return venturi flow rate falls below <700> gpm before the timer expires, the timer shall reset and no changes shall be made to the pump and valve status.

p. After the timer expires: The third pump shall be stopped.

q. With the lead, second and third pumps running and a issue venturi flow rate greater than <1760> gpm and a return venturi flow rate less than <40> gpm a <10> second timer shall start. If the issue venturi flow rate falls below <1760> gpm or the return venturi flow rate rises above <40> gpm before the timer expires, the timer shall reset, and no changes shall be made to the pump and valve status.

r. After the timer expires: The fourth pump shall start.

s. With the lead, second, third and fourth pumps running and a issue venturi flow rate greater than 2360 gpm and a return venturi flow rate of greater than <40> gpm and less than <700> gpm the lead, second, third and fourth pumps shall continue to run and the BPCV shall modulate as necessary to maintain system pressure.

t. With the lead, second, third and fourth pumps running and a issue venturi flow rate greater than 2368 gpm and a return venturi flow rate

greater than <700> gpm a <15> second timer shall start. If the issue venturi flow rate falls below 2360 gpm or the return venturi flow rate falls below <700> gpm before the timer expires, the timer shall reset and no changes shall be made to the pump and valve status.

u. After the timer expires: The fourth pump shall be stopped.

v. When a fueling pump is called to start, a 15 second timer shall start. If the timer expires before the flow switch closes the pump shall be called off, the alarm annunciator's associated non-critical alarm sequence shall activate and the next pump in the sequence shall be called to start.

w. If a fueling pumps flow switch opens after the pump successfully started the pump shall be called off, the alarm annunciator's associated non-critical alarm sequence shall activate and the next pump in the sequence shall be called to start.

3.10 AUTOMATIC MODE - DEFUELING CONDITION

To start an aircraft defuel operation, an operator connects a hydrant hose truck to an aircraft and a fuel sense line and an air sense line to the hydrant control valve. The hydrant hose truck has an on-board defuel pump capable of delivering 300 gpm at 165 psig. When the operator starts the defuel operation one of the following occurs:

a. If the fueling pumps are running (D/FV closed) the fuel being removed from the aircraft will either go to the other aircraft(s) connected to the system or be returned to the pumphouse where the BPCV will modulate to control system pressure and the fuel will be returned to the operating tanks. The return venturi flow rate will control the number of pumps that are on as discussed in paragraph "AUTOMATIC MODE - FUELING CONDITION".

b. If the fueling pumps are off (D/FV enabled) the fuel being removed from the aircraft will be returned to the pumphouse and both the D/FV and the PCV will modulate to return the fuel to the operating tanks.

3.11 FLUSH MODE

This mode shall be used when the system need to be flushed of water or sediment. The operators shall first place the manual valve in the desired position to select the appropriate flow path. Placing the selector switch in "flush" the following shall occur:

a. The BPCV solenoid shall be de-energized to force it closed.

b. The D/FV solenoid 'A' shall be de-energized to allow the valve to open and the D/FV solenoid 'B' shall be energized to force it open.

c. Start the fueling pump(s) manually using the Hand-Off-Auto or Hand-Auto switch to obtain the desired flow rate. The automatic pump starts shall be disabled in this mode.

d. The PCV solenoid shall be energized when pump(s) are on and de-energized when the pumps are off.

e. When a fueling pump is started, a 15 second timer shall start. If the timer expires before the flow switch closes the alarm annunciator's associated non-critical alarm sequence shall activate.

f. If a fueling pumps flow switch opens after the pump successfully started the alarm annunciator's associated non-critical alarm sequence shall activate.

3.12 WEEKLY PRESSURE TEST MODE (WPTM)

This mode shall be used on a continuing basis to perform weekly pressure tests. The operators shall first place the manual valves into the desired positions. Placing the selector switch to "WPTM" the following shall occur:

a. The BPCV solenoid shall be energized to be enabled.

b. The D/FV solenoid 'A' shall be de-energized and the D/FV solenoid 'B' shall be de-energized to force it closed.

c. Automatically start the lead fueling pump to obtain flow.

d. The PCV solenoid shall be energized to close the valve.

e. When a fueling pump is started, a 15 second timer shall start. If the timer expires before the flow switch closes the alarm annunciator's associated non-critical alarm sequence shall activate.

f. If a fueling pumps flow switch opens after the pump successfully started the alarm annunciator's associated non-critical alarm sequence shall activate.

g. The pump will continue to run until such time as the mode switch is returned to the OFF or Auto Mode s.

3.13 OFF MODE

a. Automatic starting of fueling pumps shall be disabled. All other functions (GDP, alarm annunciator, 2-pen recorder, operator interface, control valve solenoids, etc.) shall be active to allow manual control of the fueling pumps using the Hand-Off-Auto or Hand-Auto switch.

b. When the first pump has been started:

(1) The BPCV solenoid shall be energized to enable the valve to modulate the system pressure at it's set point.

(2) The PCV solenoid shall be energized to close the valve.

(3) The D/FV solenoid 'A' shall be de-energized so the valve is closed and solenoid 'B' shall be de-energized.

c. The second, third and fourth pumps maybe started or stopped manually as needed by the operator.

d. After the last pump has been stopped:

(1) The BPCV solenoid shall be de-energized.

(2) The PCV solenoid shall be de-energized.

(3) The D/FV solenoid 'A' shall be energized and D/FV solenoid 'B' shall be de-energized.

3.14 MANUAL OPERATION OF FUELING PUMPS

a. If the PLC system is still active see Paragraph "OFF MODE".

b. If the PLC system has no power or both CPUs have faulted (CPU lights on PCP off) the pumping system will be in a completely manual mode. The safety circuit will need power so that the ESO solenoids on the non-surge check valves will be open and fuel can flow. The solenoids on the other solenoid controlled valves will be de-energized so the valves will have to be manually opened or enabled for the system to run. Other valves may need to be opened or closed manually by the operators for the system to work properly.

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SECTION 15990

TESTING, ADJUSTING, AND BALANCING OF HVAC SYSTEMS

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SECTION 15990

TESTING, ADJUSTING, AND BALANCING OF HVAC SYSTEMS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ASSOCIATED AIR BALANCE COUNCIL (AABC)

AABC MN-1	(1989) National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems

NATIONAL ENVIRONMENTAL BALANCING BUREAU (NEBB)

NEBB Procedural Stds	(1991) Procedural Standards for Testing Adjusting Balancing of Environmental Systems

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

TAB Schematic Drawings and Report Forms; G-AO

Three copies of the TAB Schematic Drawings and Report Forms, no later than 21 days prior to the start of TAB field measurements.

SD-03 Product Data

TAB Related HVAC Submittals; G-AO

A list of the TAB Related HVAC Submittals, no later than 7 days after the approval of the TAB Specialist.

TAB Procedures; G-AO

Proposed procedures for TAB, submitted with the TAB Schematic Drawings and Report Forms.

Calibration; G-AO

List of each instrument to be used during TAB, stating calibration requirements required or recommended by both the TAB

Standard and the instrument manufacturer and the actual calibration history of the instrument, submitted with the TAB Procedures. The calibration history shall include dates calibrated, the qualifications of the calibration laboratory, and the calibration procedures used.

Systems Readiness Check; G-AO

Proposed date and time to begin the Systems Readiness Check, no later than 7 days prior to the start of the Systems Readiness Check.

TAB Execution; G-AO

Proposed date and time to begin field measurements, making adjustments, etc., for the TAB Report, submitted with the Systems Readiness Check Report.

TAB Verification; G-AO

Proposed date and time to begin the TAB Verification, submitted with the TAB Report.

SD-06 Test Reports

Design Review Report; G-AO

A copy of the Design Review Report, no later than 14 days after approval of the TAB Firm and the TAB Specialist.

Systems Readiness Check; G-AO

A copy of completed checklists for each system, each signed by the TAB Specialist, at least 7 days prior to the start of TAB Execution. All items in the Systems Readiness Check Report shall be signed by the TAB Specialist and shall bear the seal of the Professional Society or National Association used as the TAB Standard.

TAB Report; G-AO

Three copies of the completed TAB Reports, no later that 7 days after the execution of TAB. All items in the TAB Report shall be signed by the TAB Specialist and shall bear the seal of the Professional Society or National Association used as the TAB Standard.

TAB Verification Report; G-AO

Three copies of the completed TAB Verification Report, no later that 7 days after the execution of TAB Verification. All items in the TAB Verification Report shall be signed by the TAB Specialist and shall bear the seal of the Professional Society or National Association used as the TAB Standard.

SD-07 Certificates

Ductwork Leak Testing, G-AO

A written statement signed by the TAB Specialist certifying that the TAB Specialist witnessed the Ductwork Leak Testing, it was successfully completed, and that there are no known deficiencies related to the ductwork installation that will prevent TAB from producing satisfactory results.

TAB Firm; G-AO

Certification of the proposed TAB Firm's qualifications by either AABC or NEBB to perform the duties specified herein and in other related Sections, no later than 21 days after the Notice to Proceed. The documentation shall include the date that the Certification was initially granted and the date that the current Certification expires. Any lapses in Certification of the proposed TAB Firm or disciplinary action taken by AABC or NEBB against the proposed TAB Firm shall be described in detail.

TAB Specialist; G-AO

Certification of the proposed TAB Specialist's qualifications by either AABC or NEBB to perform the duties specified herein and in other related Sections, no later than 21 days after the Notice to Proceed. The documentation shall include the date that the Certification was initially granted and the date that the current Certification expires. Any lapses in Certification of the proposed TAB Specialist or disciplinary action taken by AABC or NEBB against the proposed TAB Specialist shall be described in detail.

1.3 SIMILAR TERMS

In some instances, terminology differs between the Contract and the TAB Standard primarily because the intent of this Section is to use the industry standards specified, along with additional requirements listed herein to produce optimal results. The following table of similar terms is provided for clarification only. Contract requirements take precedent over the corresponding AABC or NEBB requirements where differences exist.

SIMILAR TERMS

Contract Term	AABC Term	NEBB Term
TAB Standard	National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems	Procedural Standards for Testing Adjusting Balancing of Environmental Systems.
TAB Specialist	TAB Engineer	TAB Supervisor
Systems Readiness Check	Construction Phase Inspection	Field Readiness Check & Preliminary Field Procedures.

1.4 TAB STANDARD

TAB shall be performed in accordance with the requirements of the standard under which the TAB Firm's qualifications are approved, i.e., AABC MN-1 or

NEBB Procedural Stds, unless otherwise specified herein. All recommendations and suggested practices contained in the TAB Standard shall be considered mandatory. The provisions of the TAB Standard, including checklists, report forms, etc., shall, as nearly as practical, be used to satisfy the Contract requirements. The TAB Standard shall be used for all aspects of TAB, including qualifications for the TAB Firm and Specialist and calibration of TAB instruments. Where the instrument manufacturer calibration recommendations are more stringent than those listed in the TAB Standard, the manufacturer's recommendations shall be adhered to. All quality assurance provisions of the TAB Standard such as performance guarantees shall be part of this contract. For systems or system components not covered in the TAB Standard, TAB procedures shall be developed by the TAB Specialist. Where new procedures, requirements, etc., applicable to the Contract requirements have been published or adopted by the body responsible for the TAB Standard used (AABC or NEBB), the requirements and recommendations contained in these procedures and requirements shall be considered mandatory.

1.5 QUALIFICATIONS

1.5.1 TAB Firm

The TAB Firm shall be either a member of AABC or certified by the NEBB and certified in all categories and functions where measurements or performance are specified on the plans and specifications, including building systems commissioning . The certification shall be maintained for the entire duration of duties specified herein. If, for any reason, the firm loses subject certification during this period, the Contractor shall immediately notify the Contracting Officer and submit another TAB Firm for approval. Any firm that has been the subject of disciplinary action by either the AABC or the NEBB within the five years preceding Contract Award shall not be eligible to perform any duties related to the HVAC systems, including TAB. All work specified in this Section and in other related Sections to be performed by the TAB Firm shall be considered invalid if the TAB Firm loses its certification prior to Contract completion and must be performed by an approved successor. These TAB services are to assist the prime Contractor in performing the quality oversight for which it is responsible. The TAB Firm shall be a subcontractor of the prime Contractor, and shall report to and be paid by the prime Contractor.

1.5.2 TAB Specialist

The TAB Specialist shall be either a member of AABC or an experienced technician of the Firm certified by the NEBB. The certification shall be maintained for the entire duration of duties specified herein. If, for any reason, the Specialist loses subject certification during this period, the Contractor shall immediately notify the Contracting Officer and submit another TAB Specialist for approval. Any individual that has been the subject of disciplinary action by either the AABC or the NEBB within the five years preceding Contract Award shall not be eligible to perform any duties related to the HVAC systems, including TAB. All work specified in this Section and in other related Sections performed by the TAB Specialist shall be considered invalid if the TAB Specialist loses its certification prior to Contract completion and must be performed by the approved successor.

1.6 TAB SPECIALIST RESPONSIBILITIES

All TAB work specified herein and in related sections shall be performed

under the direct guidance of the TAB Specialist. The TAB Specialist shall participate in the commissioning process specified in Section 15995 COMMISSIONING OF HVAC SYSTEMS.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 DESIGN REVIEW

The TAB Specialist shall review the Contract Plans and Specifications and advise the Contracting Officer of any deficiencies that would prevent the HVAC systems from effectively operating in accordance with the sequence of operation specified or prevent the effective and accurate TAB of the system. The TAB Specialist shall provide a Design Review Report individually listing each deficiency and the corresponding proposed corrective action necessary for proper system operation.

3.2 TAB RELATED HVAC SUBMITTALS

The TAB Specialist shall prepare a list of the submittals from the Contract Submittal Register that relate to the successful accomplishment of all HVAC TAB. The submittals identified on this list shall be accompanied by a letter of approval signed and dated by the TAB Specialist when submitted to the Government. The TAB Specialist shall also ensure that the location and details of ports, terminals, connections, etc., necessary to perform TAB are identified on the submittals.

3.3 TAB SCHEMATIC DRAWINGS AND REPORT FORMS

A schematic drawing showing each system component, including balancing devices, shall be provided for each system. Each drawing shall be accompanied by a copy of all report forms required by the TAB Standard used for that system. Where applicable, the acceptable range of operation or appropriate setting for each component shall be included on the forms or as an attachment to the forms. The schematic drawings shall identify all testing points and cross reference these points to the report forms and procedures.

3.4 DUCTWORK LEAK TESTING

The TAB Specialist shall witness the Ductwork Leak Testing specified in Section 15895 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEM and approve the results as specified in Paragraph TAB RELATED HVAC SUBMITTALS.

3.5 TESTING, ADJUSTING, AND BALANCING

3.5.1 TAB Procedures

Step by step procedures for each measurement required during TAB Execution shall be provided. The procedures shall be oriented such that there is a separate section for each system. The procedures shall include measures to ensure that each system performs as specified in all operating modes, interactions with other components (such as exhaust fans, kitchen hoods, fume hoods, relief vents, etc.) and systems, and with all seasonal operating differences, diversity, simulated loads, and pressure relationships required.

3.5.2 Systems Readiness Check

The TAB Specialist shall inspect each system to ensure that it is complete, including installation and operation of controls, and that all aspects of the facility that have any bearing on the HVAC systems, including installation of ceilings, walls, windows, doors, and partitions, are complete to the extent that TAB results will not be affected by any detail or touch-up work remaining. The TAB Specialist shall also verify that all items such as ductwork and piping ports, terminals, connections, etc., necessary to perform TAB shall be complete during the Systems Readiness Check.

3.5.3 Preparation of TAB Report

Preparation of the TAB Report shall begin only when the Systems Readiness Report has been approved. The Report shall be oriented so that there is a separate section for each system. The Report shall include a copy of the appropriate approved Schematic Drawings and TAB Related Submittals, such as pump curves, fan curves, etc., along with the completed report forms for each system. The operating points measured during successful TAB Execution and the theoretical operating points listed in the approved submittals shall be marked on the performance curves and tables. Where possible, adjustments shall be made using an "industry standard" technique which would result in the greatest energy savings, such as adjusting the speed of a fan instead of throttling the flow. Any deficiencies outside of the realm of normal adjustments and balancing during TAB Execution shall be noted along with a description of corrective action performed to bring the measurement into the specified range. If, for any reason, the TAB Specialist determines during TAB Execution that any Contract requirement cannot be met, the TAB Specialist shall immediately provide a written description of the deficiency and the corresponding proposed corrective action necessary for proper system operation to the Contracting Officer.

3.5.4 TAB Verification

The TAB Specialist shall recheck ten percent of the measurements listed in the Tab Report and prepare a TAB Verification Report. The measurements selected for verification and the individuals that witness the verification will be selected by the Contracting Officer's Representative (COR). The measurements will be recorded in the same manner as required for the TAB Report. All measurements that fall outside the acceptable operating range specified shall be accompanied by an explanation as to why the measurement does not correlate with that listed in the TAB Report and a description of corrective action performed to bring the measurement into the specified range. The TAB Specialist shall update the original TAB report to reflect any changes or differences noted in the TAB verification report and submit the updated TAB report. If over 20 percent of the measurements selected by the COR for verification fall outside of the acceptable operating range specified, the COR will select an additional ten percent for verification. If over 20 percent of the total tested (including both test groups) fall outside of the acceptable range, the TAB Report shall be considered invalid and all contract TAB work shall be repeated beginning with the Systems Readiness Check.

3.5.5 Marking of Setting

Following approval of TAB Verification Report, the setting of all HVAC adjustment devices including valves, splitters, and dampers shall be permanently marked by the TAB Specialist so that adjustment can be restored

if disturbed at any time.

3.5.6 Identification of Test Ports

The TAB Specialist shall permanently and legibly identify the location points of duct test ports. If the ductwork has exterior insulation, the identification shall be made on the exterior side of the insulation. All penetrations through ductwork and ductwork insulation shall be sealed to prevent air leakage or to maintain integrity of vapor barrier.

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SECTION 15995

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SECTION 15995

COMMISSIONING OF HVAC SYSTEMS

PART 1 GENERAL

1.1 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Commissioning Team; G-AO

List of team members who will represent the Contractor in the pre-commissioning checks and functional performance testing, at least 2 weeks prior to the start of pre-commissioning checks. Proposed revision to the list, prior to the start of the impacted work.

Test Procedures; G-AO

Detailed procedures for pre-commissioning checks and functional performance tests, at least 4 weeks prior to the start of pre-commissioning checks.

Test Schedule; G-AO

Schedule for pre-commissioning checks and functional performance tests, at least 2 weeks prior to the start of pre-commissioning checks.

SD-06 Test Reports

Test Reports; G-AO

Completed pre-commissioning checklists and functional performance test checklists organized by system and by subsystem and submitted as one package. The results of failed tests shall be included along with a description of the corrective action taken.

1.2 SEQUENCING AND SCHEDULING

The work described in this Section shall begin only after all work required in related Sections, including Section 15951 DIRECT DIGITAL CONTROL FOR HVAC and Section 15990 TESTING, ADJUSTING, AND BALANCING OF HVAC SYSTEMS, has been successfully completed, and all test and inspection reports and operation and maintenance manuals required in these Sections have been submitted and approved. Seismic details shall be in accordance with Sections 13080 SEISMIC PROTECTION FOR MISCELLANEOUS EQUIPMENT and 15070

SEISMIC PROTECTION FOR MECHANICAL EQUIPMENT.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 COMMISSIONING TEAM AND CHECKLISTS

The Contractor shall designate team members to participate in the pre-commissioning checks and the functional performance testing specified herein. In addition, the Government will be represented by a representative of the Contracting Officer, the Design Agent's Representative, and the Using Agency. The team members shall be as follows:

Designation	Function
Q	Contractor's Chief Quality Control Representative
M	Contractor's Mechanical Representative
E	Contractor's Electrical Representative
T	Contractor's Testing, Adjusting, and Balancing Representative
C	Contractor's Controls Representative
D	Design Agent's Representative
O	Contracting Officer's Representative
U	Using Agency's Representative

Each checklist shown in appendices A and B shall be completed by the commissioning team. Acceptance by each commissioning team member of each pre-commissioning checklist item shall be indicated by initials and date unless an "X" is shown indicating that participation by that individual is not required. Acceptance by each commissioning team member of each functional performance test checklist shall be indicated by signature and date.

3.2 TESTS

The pre-commissioning checks and functional performance tests shall be performed in a manner which essentially duplicates the checking, testing, and inspection methods established in the related Sections. Where checking, testing, and inspection methods are not specified in other Sections, methods shall be established which will provide the information required. Testing and verification required by this section shall be performed during the Commissioning phase. Requirements in related Sections are independent from the requirements of this Section and shall not be used to satisfy any of the requirements specified in this Section. The Contractor shall provide all materials, services, and labor required to perform the pre-commissioning checks and functional performance tests. A pre-commissioning check or functional performance test shall be aborted if any system deficiency prevents the successful completion of the test or if any participating non-Government commissioning team member of which participation is specified is not present for the test. The Contractor shall reimburse the Government for all costs associated with effort lost due to tests that are aborted. These costs shall include salary, travel costs and per diem (where applicable) for Government commissioning team members.

3.2.1 Pre-Commissioning Checks

Pre-commissioning checks shall be performed for the items indicated on the

checklists in Appendix A. Deficiencies discovered during these checks shall be corrected and retested in accordance with the applicable contract requirements.

3.2.2 Functional Performance Tests

Functional performance tests shall be performed for the items indicated on the checklists in Appendix B. Functional performance tests shall begin only after all pre-commissioning checks have been successfully completed. Tests shall prove all modes of the sequences of operation, and shall verify all other relevant contract requirements. Tests shall begin with equipment or components and shall progress through subsystems to complete systems. Upon failure of any functional performance test checklist item, the Contractor shall correct all deficiencies in accordance with the applicable contract requirements. The checklist shall then be repeated until it has been completed with no errors.

APPENDIX A

PRE-COMMISSIONING CHECKLISTS

Pre-commissioning checklist - Piping

For _____ Piping System

Checklist Item	Q	M	E	T	C	D	O	U
Installation								
a. Piping complete.	___	___	X	___	X	___	___	___
b. As-built shop drawings submitted.	___	___	X	___	X	___	___	___
c. Piping flushed and cleaned.	___	___	X	___	X	___	___	___
d. Strainers cleaned.	___	___	X	___	X	___	___	___
e. Valves installed as required.	___	___	X	___	X	___	___	___
f. Piping insulated as required.	___	___	X	___	X	___	___	___
g. Thermometers and gauges installed as required.	___	___	X	___	X	___	___	___
h. Verify operation of valves.	___	___	X	___	___	___	___	___
i. Air vents installed as specified.	___	___	X	X	X	___	___	___
j. Flexible connectors installed as specified	__	___	X	X	X	___	___	___
k. Verify that piping has been labeled and valves identified as specified.	___	___	X	___	___	___	___	___
Testing, Adjusting, and Balancing (TAB)								
a. Hydrostatic test complete.	___	___	X	___	X	___	___	___
b. TAB operation complete.	___	___	X	___	___	___	___	___

Pre-commissioning Checklist - Ductwork

For Air Handler: _____

Checklist Item	Q	M	E	T	C	D	O	U
Installation								
a. Ductwork complete.	___	___	X	___	X	___	___	___
b. As-built shop drawings submitted.	___	___	X	___	X	___	___	___
c. Ductwork leak test complete.	___	___	X	___	X	___	___	___
d. Fire dampers, smoke dampers, and access doors installed as required with installation of each verified by the specified team members initialing each location on a copy of the as-built drawings.	___	___	X	___	X	___	___	___
e. Ductwork insulated as required.	___	___	X	___	X	___	___	___
f. Thermometers and gauges installed as required.	___	___	___	___	___	___	___	___
g. Verify open/closed status of dampers.	___	___	X	___	X	___	___	___
h. Verify smoke dampers operation.	___	___	X	___	___	___	___	___
i. Flexible connectors installed as specified	__	___	X	___	X	___	___	___
Testing, Adjusting, and Balancing (TAB)								
a. TAB operation complete.	___	___	X	___	X	___	___	___

Pre-commissioning Checklist - Ductwork

For Air Handler: _____

Checklist Item	Q	M	E	T	C	D	O	U

Pre-commissioning Checklist - DX Air Cooled Condensing Unit

For Condensing Unit: _____

Checklist Item	Q	M	E	T	C	D	O	U
Installation	___	___	X	X	X	___	___	___
b. Refrigerant pipe leak tested.	___	___	X	X	X	___	___	___
c. Refrigerant pipe evacuated and charged in accordance with manufacturer's instructions.	___	___	X	X	X	___	___	___
d. Check condenser fans for proper rotation.	___	___	X	___	X	___	___	___
e. Any damage to coil fins has been repaired.	___	___	X	___	X	___	___	___
f. Manufacturer's required maintenance/ operational clearance provided.	___	___	X	X	X	___	___	___
Electrical								
a. Power available to unit disconnect.	___	___	___	X	X	___	___	___
b. Power available to unit control panel.	___	___	___	X	___	___	___	___
c. Verify that power disconnect is located within sight of the unit it controls	___	___	___	X	___	___	___	___
Controls								
a. Unit safety/protection devices tested.	___	___	X	X	___	___	___	___
b. Control system and interlocks installed.	___	___	X	X	___	___	___	___
c. Control system and interlocks operational.	___	___	X	X	___	___	___	___

Pre-commissioning Checklist - Pumps

For Pump: _____

Checklist Item	Q	M	E	T	C	D	O	U
Installation								
a. Pumps grouted in place.	___	___	X	X	X	___	___	___
b. Pump vibration isolation devices functional.	___	___	X	X	X	___	___	___
c. Pump/motor coupling alignment verified.	___	___	X	X	X	___	___	___
d. Piping system installed.	___	___	X	X	X	___	___	___
e. Piping system pressure tested.	___	___	X	X	X	___	___	___
f. Pump not leaking.	___	___	X	X	X	___	___	___
g. Field assembled couplings aligned to meet manufacturer's prescribed tolerances.	___	___	X	X	X	___	___	___
Electrical								
a. Power available to pump disconnect.	___	___	___	X	X	___	___	___
b. Pump rotation verified.	___	___	___	X	X	___	___	___
c. Control system interlocks functional.	___	___	___	X	___	___	___	___
d. Verify that power disconnect is located within sight of the unit it controls.	___	___	___	X	___	___	___	___
Testing, Adjusting, and Balancing (TAB)								
a. Pressure/temperature gauges installed.	___	___	X	___	X	___	___	___
b. Piping system cleaned.	___	___	X	X	X	___	___	___
c. Chemical water treatment complete.	___	___	X	X	X	___	___	___
d. Water balance complete.	___	___	X	___	X	___	___	___
e. Water balance with design maximum flow.	___	___	X	___	X	___	___	___
f. TAB Report submitted.	___	___	X	___	X	___	___	___

Pre-commissioning Checklist - Pumps

For Pump: _____

Checklist Item	Q	M	E	T	C	D	O	U

Pre-commissioning Checklist - Steam/Hot Water Converter

For Converter: _____

Checklist Item	Q	M	E	T	C	D	O	U
Installation								
a. Converter steam piping installed.	___	___	X	___	X	___	___	___
b. Converter steam piping tested.	___	___	X	X	X	___	___	___
c. Hot water piping installed.	___	___	X	___	___	___	___	___
d. Hot water piping tested.	___	___	X	X	X	___	___	___
e. Makeup water piping installed.	___	___	X	X	X	___	___	___
f. Vacuum breaker installed on shell of shell and tube unit.	___	___	X	X	X	___	___	___
g. Air vent installed as specified.	___	___	X	X	X	___	___	___
h. Manufacturer's required maintenance clearance provided.	___	___	X	X	X	___	___	___
Startup								
a. Hot water system cleaned and filled.	___	___	X	X	X	___	___	___
b. All steam traps operational.	___	___	X	X	X	___	___	___
c. All condensate return pumps operational.	___	___	___	X	___	___	___	___
d. Converter safety/protection devices tested.	___	___	X	X	X	___	___	___
e. Converter startup and checkout complete.	___	___	X	X	X	___	___	___
Controls								
a. Control valves/actuators properly installed.	___	___	X	___	___	___	___	___
b. Control valves/actuators operable.	___	___	X	___	___	___	___	___

Pre-commissioning Checklist - Steam/Hot Water Converter

For Converter: _____

Checklist Item	Q	M	E	T	C	D	O	U

Pre-commissioning Checklist - Unit Heater

For Unit Heater: _____

Checklist Item	Q	M	E	T	C	D	O	U
Installation								
a. Hot water piping properly connected.	___	___	X	___	___	___	___	___
b. Hot water piping pressure tested.	___	___	X	___	___	___	___	___
c. Air vent installed on hot water coil with shutoff valve as specified.	___	___	X	X	X	___	___	___
d. Any damage to coil fins has been repaired.	___	___	X	___	X	___	___	___
e. Manufacturer's required maintenance/ operational clearance provided.	___	___	X	X	X	___	___	___
Electrical								
a. Power available to unit disconnect.	___	___	___	X	___	___	___	___
b. Proper motor rotation verified.	___	___	___	X	X	___	___	___
c. Verify that power disconnect is located within sight of the unit it controls.	___	___	___	X	___	___	___	___
d. Power available to electric heating coil.	___	___	___	X	___	___	___	___
Controls								
a. Control valves properly installed.	___	___	X	___	___	___	___	___
b. Control valves operable.	___	___	X	X	___	___	___	___
c. Verify proper location and installation of thermostat.	___	___	X	___	___	___	___	___
Testing, Adjusting, and Balancing (TAB)								
a. TAB Report submitted.	___	___	X	___	X	___	___	___

Pre-commissioning Checklist - Exhaust Fan

For Exhaust Fan: _____

Checklist Item	Q	M	E	T	C	D	O	U
Installation								
a. Fan belt adjusted.	___	___	X	___	X	___	___	___
Electrical								
a. Power available to fan disconnect.	___	___	___	X	___	___	___	___
b. Proper motor rotation verified.	___	___	___	___	X	___	___	___
c. Verify that power disconnect is located within sight of the unit it controls.	___	___	___	X	___	___	___	___
Controls								
a. Control interlocks properly installed.	___	___	___	X	___	___	___	___
b. Control interlocks operable.	___	___	___	X	___	___	___	___
c. Dampers/actuators properly installed.	___	___	X	___	___	___	___	___
d. Dampers/actuators operable.	___	___	X	___	___	___	___	___
e. Verify proper location and installation of thermostat.	___	___	X	___	___	___	___	___
Testing, Adjusting, and Balancing (TAB)								
a. TAB results +10%/-0% to cfm shown on drawings	___	___	X	___	X	___	___	___
b. TAB Report submitted.	___	___	X	___	X	___	___	___

Pre-commissioning Checklist - Exhaust Fan

For Exhaust Fan: _____

Checklist Item	Q	M	E	T	C	D	O	U

Pre-commissioning Checklist - HVAC System Controls

For HVAC System: _____

Checklist Item	Q	M	E	T	C	D	O	U
Installation								
a. As-built shop drawings submitted.	___	___	X	X	___	___	___	___
b. Layout of control panel matches drawings.	___	___	X	X	___	___	___	___
c. Framed instructions mounted in or near control panel.	___	___	X	X	___	___	___	___
d. Components properly labeled (on inside and outside of panel).	___	___	X	X	___	___	___	___
e. Control components piped and/or wired to each labeled terminal strip.	___	___	X	X	___	___	___	___
f. EMCS connection made to each labeled terminal strip as shown.	___	___	X	X	___	___	___	___
g. Control wiring and tubing labeled at all terminations, splices, and junctions.	___	___	X	X	___	___	___	___
h. Shielded wiring used on electronic sensors.	__	__	X	X	___	___	___	___
Main Power								
a. 110 volt AC power available to panel.	___	___	___	X	___	___	___	___
Testing, Commissioning, and Balancing								
a. Testing, Commissioning, and Balancing Report submitted.	___	___	X	___	___	___	___	___

Pre-commissioning Checklist - Single Zone Air Handling Unit

For Air Handling Unit: _____

Checklist Item	Q	M	E	T	C	D	O	U
Installation								
a. Vibration isolation devices installed.	__	___	X	X	X	___	___	___
b. Inspection and access doors are operable and sealed.	__	___	X	___	X	___	___	___
c. Casing undamaged.	__	___	X	X	X	___	___	___
d. Insulation undamaged.	__	___	X	X	X	___	___	___
e. Condensate drainage is unobstructed.	__	___	X	X	X	___	___	___
f. Fan belt adjusted.	__	___	X	___	X	___	___	___
g. Any damage to coil fins has been repaired.	__	__	X	___	X	___	___	___
h. Manufacturer's required maintenance clearance provided.	__	___	X	X	X	___	___	___
Electrical								
a. Power available to unit disconnect.	__	___	___	X	X	___	___	___
b. Power available to unit control panel.	__	___	___	X	___	___	___	___
c. Proper motor rotation verified.	___	___	___	__	X	___	___	___
d. Verify that power disconnect is located within sight of the unit it controls.	___	___	__	X	___	___	___	___
Coils								
a. Refrigerant piping properly connected.	__	___	X	X	X	___	___	___
b. Refrigerant piping pressure tested.	__	___	X	X	X	___	___	___
c. Hot water piping properly connected.	__	___	X	___	___	___	___	___
d. Hot water piping pressure tested.	___	___	X	X	__	___	___	___
e. Air vents installed on water coils with shutoff valves as specified.	___	___	X	X	X	__	___	___
f. Any damage to coil fins has been repaired.	___	___	X	___	X	___	___	___
Controls								
a. Control valves/actuators properly installed.	___	___	X	___	___	___	___	___
b. Control valves/actuators operable.	___	___	X	___	___	___	___	___

Pre-commissioning Checklist - Single Zone Air Handling Unit

For Air Handling Unit: _____

Checklist Item	Q	M	E	T	C	D	O	U
c. Dampers/actuators properly installed.	___	___	X	___	___	___	___	___
d. Dampers/actuators operable.	___	___	X	___	___	___	___	___
e. Verify proper location and installation of thermostat.	___	___	X	___	___	___	___	___
Testing, Adjusting, and Balancing (TAB)								
a. Construction filters removed and replaced.	___	___	X	___	X	___	___	___
b. TAB results +10%/-0% cfm shown on drawings.	___	___	X	___	X	___	___	___
c. TAB Report submitted.	___	___	X	___	X	___	___	___

Pre-commissioning Checklist - Single Zone Air Handling Unit

For Air Handling Unit: _____

Checklist Item	Q	M	E	T	C	D	O	U

APPENDIX B

FUNCTIONAL PERFORMANCE TESTS CHECKLISTS

Functional Performance Test Checklist - Pumps

For Pump: _____

Prior to performing this checklist, ensure that for closed loop systems, system is pressurized and the make-up water system is operational or, for open loop systems, that the sumps are filled to the proper level.

1. Activate pump start using control system commands (all possible combination, on/auto, etc.). ON_____ AUTO_____ OFF_____

a. Verify pressure drop across strainer:

Strainer inlet pressure _____ psig
Strainer outlet pressure _____ psig

b. Verify pump inlet/outlet pressure reading, compare to Testing, Adjusting, and Balancing (TAB) Report, pump design conditions, and pump manufacturer's performance.

	DESIGN	SYSTEM TEST	ACTUAL
Pump inlet pressure (psig)	_____	_____	_____
Pump outlet pressure (psig)	_____	_____	_____

c. Operate pump at shutoff and at 100 percent of designed flow when all components are in full flow. Plot test readings on pump curve and compare results against readings taken from flow measuring devices.

	SHUTOFF	100 percent
Pump inlet pressure (psig)	_____	_____
Pump outlet pressure	_____	_____
Pump flow rate (gpm)	_____	_____

d. Operate pump at shutoff and at minimum flow or when all components are in full by-pass. Plot test readings on pump curve and compare results against readings taken from flow measuring devices.

	SHUTOFF	100 percent
Pump inlet pressure (psig)	_____	_____
Pump outlet pressure	_____	_____
Pump flow rate (gpm)	_____	_____

2. Verify motor amperage each phase and voltage phase to phase and phase to ground for both the full flow and the minimum flow conditions.

a. Full flow:

	PHASE 1	PHASE 2	PHASE 3
Amperage	_____	_____	_____
Voltage	_____	_____	
Voltage	_____		
Voltage to ground	_____	_____	_____

b. Minimum flow:

Functional Performance Test Checklist - Pumps

For Pump: _____

	PHASE 1	PHASE 2	PHASE 3
Amperage	_____	_____	_____
Voltage		_____	_____
Voltage		_____	
Voltage to ground	_____	_____	_____

3. Unusual vibration, noise, etc.

_____

_____

4. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

Signature and Date

Contractor's Chief Quality Control Representative _____

Contractor's Mechanical Representative _____

Contractor's Electrical Representative _____

Contractor's Testing, Adjusting and Balancing Representative _____

Contractor's Controls Representative _____

Contracting Officer's Representative _____

Using Agency's Representative _____

Functional Performance Test Checklist - Single Zone Air Handling Unit

For Air Handling Unit: _____

1. Functional Performance Test: Contractor shall verify operation of air handling unit as per specification including the following:

a. The following shall be verified when the supply fan operating mode is initiated:

(1) All dampers in normal position. _____

(2) All valves in normal position. _____

(3) System safeties allow start if safety conditions are met. _____

b. Occupied mode of operation - economizer de-energized.

(1) Outside air damper at minimum position. _____

(2) Return air damper open. _____

(3) Relief air damper closed. _____

(4) Hot water control valve modulating to maintain space heating temperature set point input from outside air temperature controller. _____

c. Occupied mode of operation - economizer energized.

(1) Outside air damper modulated to maintain mixed air temperature set point. _____

(2) Relief air damper open. _____

e. The following shall be verified when the supply fan off and return fans off mode is initiated:

(1) All dampers in normal position. _____

(2) All valves in normal position. _____

(3) Fan de-energizes. _____

f. Verify heating coil operation by varying thermostat set point._____

g. Verify safety shut down initiated by smoke detectors. _____

h. Verify safety shut down initiated by low temperature protection thermostat. _____

2. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

Signature and Date

Contractor's Chief Quality Control Representative

_____

Functional Performance Test Checklist - Single Zone Air Handling Unit

For Air Handling Unit: _____

Contractor's Mechanical Representative _____

Contractor's Electrical Representative _____

Contractor's Testing, Adjusting and Balancing Representative
_____

Contractor's Controls Representative _____

Contracting Officer's Representative _____

Using Agency's Representative _____

Functional Performance Test Checklist - Air Cooled Condensing Unit

For Condensing Unit: _____

1. Functional Performance Test: Contractor shall demonstrate operation of refrigeration system as per specifications including the following: Start building air handler to provide load for condensing unit. Activate controls system start sequence as follows.

a. Start air handling unit. Verify control system energizes condensing unit start sequence. _____

b. Shut off air handling equipment to verify condensing unit de-energizes. _____

c. Restart air handling equipment one minute after condensing unit shut down. Verify condensing unit restart sequence. _____

2. Verify condensing unit amperage each phase and voltage phase to phase and phase to ground.

	PHASE 1	PHASE 2	PHASE 3
Amperage	_____	_____	_____
Voltage	_____	_____	
Voltage	_____		
Voltage to ground	_____	_____	_____

3. Record the following information:

Ambient dry bulb temperature	_____	degrees F
Ambient wet bulb temperature	_____	degrees F
Suction pressure	_____	psig
Discharge pressure	_____	psig

4. Unusual vibration, noise, etc.

_____

_____

5. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

Signature and Date

Contractor's Chief Quality Control Representative _____

Contractor's Mechanical Representative _____

Contractor's Electrical Representative Representative _____

Contractor's Testing, Adjusting and Balancing _____

Contractor's Controls Representative _____

Contracting Officer's Representative _____

Functional Performance Test Checklist - Air Cooled Condensing Unit

For Condensing Unit: _____

Using Agency's Representative _____

Functional Performance Test Checklist - Unit Heaters

The Contracting Officer will select unit heaters to be spot-checked during the functional performance test.

1. Functional Performance Test: Contractor shall demonstrate operation of selected unit heaters as per specifications including the following:

a. Verify unit heater response to room temperature set point adjustment. Changes to be heating set point to heating set point minus 10 degrees and return to heating set point. _____

b. Check blower fan speed. _____rpm

c. Check heating mode inlet air temperature. Check heating mode inlet air temperature. _____ degrees F

d. Check heating mode outlet air temperature. Check heating mode outlet air temperature. _____ degrees F

2. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

Signature and Date

Contractor's Chief Quality Control Representative _____

Contractor's Mechanical Representative _____

Contractor's Electrical Representative _____

Contractor's Testing, Adjusting and Balancing Representative _____

Contractor's Controls Representative _____

Contracting Officer's Representative _____

Using Agency's Representative _____

Functional Performance Test Checklist - Steam/Hot Water Converter

For Converter: _____

1. Functional Performance Test: Contractor shall demonstrate operation of heating system as per specifications including the following: Start building heating equipment to provide load for converter.

a. Verify control system energizes. _____

b. Verify converter senses hot water temperature below set point and control system modulates steam valve. _____

c. Shut off building heating equipment to remove load on heating system. Verify converter steam valve closes after load is removed. _____

2. Verify converter inlet/outlet pressure reading, compare to converter design conditions and manufacturer's performance data.

	DESIGN	ACTUAL
Converter inlet water temp (degrees F)	_____	_____
Converter outlet water temp (degrees F)	_____	_____
Converter inlet steam pressure (psig)	_____	_____
Determine water flow rate based on pressure drop through converter	_____	_____
Determine water flow rate with flow measuring device	_____	_____
Verify that temperature of water is in accordance with outdoor air reset schedule	_____	_____

3. Verify proper operation of converter safeties. _____

4. Check and report unusual vibration, noise, etc.

_____

_____

5. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

Signature and Date

Contractor's Chief Quality Control Representative _____

Contractor's Mechanical Representative _____

Contractor's Electrical Representative _____

Contractor's Testing, Adjusting and Balancing Representative _____

Contractor's Controls Representative _____

Contracting Officer's Representative _____

Functional Performance Test Checklist - Steam/Hot Water Converter

For Converter: _____
Using Agency's Representative _____

Functional Performance Test Checklist - HVAC Controls

For HVAC System: _____

The Contracting Officer will select HVAC control systems to undergo functional performance testing.

1. Functional Performance Test: Contractor shall verify operation of HVAC controls by performing the following tests:

a. Verify that controller is maintaining the set point by manually measuring the controlled variable with a thermometer, sling psychrometer, inclined manometer, etc.

b. Verify sensor/controller combination by manually measuring the controlled medium. Take readings from control panel display and compare readings taken manually. Record all readings.

Sensor _____
Manual measurement _____
Panel reading value _____

c. Verify system stability by changing the controller set point as follows:

(1) Air temperature - 10 degrees F

(2) Water temperature - 10 degrees F

(3) Static pressure - 10 percent of set point

(4) Relative humidity - percent (RH)

The control system shall be observed for 10 minutes after the change in set point. Instability or excessive hunting will be unacceptable.

d. Verify interlock with other HVAC controls.

e. Verify interlock with fire alarm control panel.

f. Verify interlock with EMCS.

g. Change controller set point 10 percent with EMCS and verify correct response.

2. Verify that operation of control system conforms to that specified in the sequence of operation.

3. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

Signature and Date

Contractor's Chief Quality Control Representative _____

Contractor's Mechanical Representative _____

Functional Performance Test Checklist - HVAC Controls

For HVAC System: _____

Contractor's Electrical Representative _____

Contractor's Testing, Adjusting and Balancing Representative _____

Contractor's Controls Representative _____

Contractor's Officer's Representative _____

Using Agency's Representative _____

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DIVISION 16 - ELECTRICAL

SECTION 16070

SEISMIC PROTECTION FOR ELECTRICAL EQUIPMENT

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SECTION 16070

SEISMIC PROTECTION FOR ELECTRICAL EQUIPMENT

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM E 580	(2000) Application of Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels in Areas Requiring Moderate Seismic Restraint

U.S. ARMY CORPS OF ENGINEERS (USACE)

TI 809-04	(1998) Seismic Design for Buildings

UNDERWRITERS LABORATORIES (UL)

UL 1570	(1995; Rev thru Nov 1999) Fluorescent Lighting Fixtures
UL 1571	(1995; Rev thru Nov 1999) Incandescent Lighting Fixtures

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Lighting Fixtures in Buildings; G-AE
Equipment Requirements; G-AE

Detail drawings along with catalog cuts, templates, and erection and installation details, as appropriate, for the items listed. Submittals shall be complete in detail; shall indicate thickness, type, grade, class of metal, and dimensions; and shall show construction details, reinforcement, anchorage, and installation with relation to the building construction.

SD-03 Product Data

Lighting Fixtures in Buildings; G-AE
Equipment Requirements; G-AE

Copies of the design calculations with the detail drawings. Calculations shall be stamped by a registered engineer and shall verify the capability of structural members to which bracing is attached for carrying the load from the brace.

Contractor Designed Bracing; G-AE

Copies of the Design Calculations with the Drawings. Calculations shall be approved, certified, stamped and signed by a Registered Professional Engineer. Calculations shall verify the capability of structural members to which bracing is attached for carrying the load from the brace.

1.3 SYSTEM DESCRIPTION

1.3.1 General Requirements

The requirements for seismic control measures described in this section shall be applied to the mechanical equipment and systems listed below. Structural requirements shall be in accordance with Section 13080 SEISMIC PROTECTION FOR MISCELLANEOUS EQUIPMENT. Mechanical equipment and systems shall be anchored or braced to resist a seismic design force (Fp) of (1.95) X (Equipment Weight). The force (Fp) shall be applied independently longitudinally and laterally through the center of gravity of the equipment. The seismic force (Fp) can also be calculated using the provisions of TI 809-04, Chapter 10 with the following parameters:

Seismic Design Category	=	D
Seismic Use Group	=	III
S_{DS}	=	.811
I_p	=	1.5

Seismic forces (Fp) determined in accordance with TI 809-04, Chapter 10 may result in lower design forces than those calculated by (1.95) X (Equipment Weight).

The requirements for seismic protection measures described in this section shall be applied to the electrical equipment and systems listed below. Structural requirements shall be in accordance with Section 13080 SEISMIC PROTECTION FOR MISCELLANEOUS EQUIPMENT.

1.3.2 Electrical Equipment

Electrical equipment shall include the following items to the extent required on the drawings or in other sections of these specifications:

Control Panels	Air Handling Units
Pumps with Motors	
Light Fixtures	
Motor Control Centers	Transformers
Switchboards (Floor Mounted)	

1.3.3 Contractor Designed Bracing

The Contractor shall design the bracing in accordance with TI 809-04 and additional data furnished by the Contracting Officer. Resistance to

lateral forces induced by earthquakes shall be accomplished without consideration of friction resulting from gravity loads.

1.3.4 Conduits Requiring No Special Seismic Restraints

Seismic restraints may be omitted from electrical conduit less than 2-1/2 inches trade size. All other interior conduit, shall be seismically protected as specified.

1.4 EQUIPMENT REQUIREMENTS

1.4.1 Rigidly Mounted Equipment

The following specific items of equipment to be furnished under this contract shall be constructed and assembled to withstand the calculatedseismic forces.

Engine-Generators

Transformers
Switch Boards
Motor Control Centers
Free Standing Electric Motors

PART 2 PRODUCTS

2.1 LIGHTING FIXTURE SUPPORTS

Lighting fixtures and supports shall conform to UL 1570 or UL 1571 as applicable.

2.2 SWAY BRACING MATERIALS

Sway bracing materials (e.g. rods, plates, rope, angles, etc.) shall be as specified in Section 13080 SEISMIC PROTECTION FOR MISCELLANEOUS EQUIPMENT.

PART 3 EXECUTION

3.1 SWAY BRACES FOR CONDUIT

Conduit shall be braced as for an equivalent weight pipe in accordance with Section 15070 SEISMIC PROTECTION FOR MECHANICAL EQUIPMENT.

3.2 LIGHTING FIXTURES IN BUILDINGS

Lighting fixtures and supports shall conform to the following:

3.2.1 Pendant Fixtures

Pendant fixtures shall conform to the requirements of TI 809-04, Chapter 10.

3.2.2 Ceiling Attached Fixtures

3.2.2.1 Recessed Fluorescent Fixtures

Recessed fluorescent individual or continuous-row mounted fixtures shall be supported by a seismic-resistant suspended ceiling support system built in accordance with Section 09510 ACOUSTICAL CEILINGS. Seismic protection for

the fixtures shall conform to the requirements of TI 809-04, Chapter 10. Recessed lighting fixtures not over 56 pounds in weight may be supported by and attached directly to the ceiling system runners using screws or bolts, number and size as required by the seismic design. Fixture accessories, including louvers, diffusers, and lenses shall have lock or screw attachments.

3.2.2.2 Surface-Mounted Fluorescent Fixtures

Surface-mounted fluorescent individual or continuous-row fixtures shall be attached to a seismic-resistant ceiling support system built in accordance with ASTM E 580. Seismic protection for the fixtures shall conform to the requirements of TI 809-04, Chapter 10.

3.2.3 Assembly Mounted on Outlet Box

A supporting assembly, that is intended to be mounted on an outlet box, shall be designed to accommodate mounting features on 4 inch boxes, plaster rings, and fixture studs.

3.2.4 Wall-Mounted Emergency Light Unit

Attachments for wall-mounted emergency light units shall be designed and secured for the worst expected seismic disturbance at the site.

3.2.5 Lateral Force

Structural requirements for light fixture bracing shall be in accordance with Section 13080 SEISMIC PROTECTION FOR MISCELLANIOUS EQUIPMENT.

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SECTION 16264

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SECTION 16264

DIESEL-GENERATOR SET, STATIONARY 15-450 KW, STANDBY APPLICATIONS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C12.11	(1987; R 1993) Instrument Transformers for Revenue Metering, 10 kV BIL through 350 kV BIL (0.6 kV NSV through 69 kV NSV)
ANSI C39.1	(1981; R 1992) Requirements for Electrical Analog Indicating Instruments

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 53/A 53M	(2002) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 106	(2002a) Seamless Carbon Steel Pipe for High-Temperature Service
ASTM A 135	(1997c) Electric-Resistance-Welded Steel Pipe
ASTM A 181/A 181M	(2001) Carbon Steel Forgings for General-Purpose Piping
ASTM A 234/A 234M	(2002) Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service
ASTM D 975	(1998b) Diesel Fuel Oils

ASME INTERNATIONAL (ASME)

ASME B16.3	(1998) Malleable Iron Threaded Fittings
ASME B16.5	(2003) Pipe Flanges and Flanged Fittings NPS 1/2 thru NPS 24
ASME B16.11	(2001) Forged Fittings, Socket-Welding and Threaded
ASME B31.1	(2001) Power Piping
ASME BPVC SEC IX	(2001) Boiler and Pressure Vessel Code;

	Section IX, Welding and Brazing Qualifications

DEFENSE LOGISTICS AGENCY HANDBOOK

MIL-T-83133	(Rev. E) Turbine Fuel, Aviation, Kerosene Types, NATO F-34 (JP-8) and NATO F-35

ELECTRICAL GENERATING SYSTEMS ASSOCIATION (EGSA)

EGSA 101P	(1995a) Engine Driven Generator Sets

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2	(2002) National Electrical Safety Code
IEEE Std 1	(1986; R 1992) General Principles for Temperature Limits in the Rating of Electric Equipment and for the Evaluation of Electrical Insulation
IEEE Std 81	(1983) Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System (Part 1)
IEEE Std 100	(2000) Electrical and Electronics Terms
IEEE Std 120	(1989) Electrical Measurements in Power Circuits
IEEE Std 519	(1992) Harmonic Control in Electrical Power Systems

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-58	(1993) Pipe Hangers and Supports - Materials, Design and Manufacture
MSS SP-69	(1999) Pipe Hangers and Supports - Selection and Application
MSS SP-80	(1997) Bronze Gate, Globe, Angle and Check Valves

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA AB 1	(1993) Molded Case Circuit Breakers and Molded Case Switches
NEMA ICS 2	(1993) Industrial Control and Systems Controllers, Contactors, and Overload Relays, Rated Not More Than 2,000 Volts AC or 750 Volts DC
NEMA ICS 6	(1993) Industrial Control and Systems
NEMA MG 1	(2003) Motors and Generators

NEMA PB 1	(1995) Panelboards
NEMA SG 3	(1995) Power Switching Equipment

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 30	(2000) Flammable and Combustible Liquids Code
NFPA 37	(1998) Installation and Use of Stationary Combustion Engines and Gas Turbines
NFPA 70	(2002) National Electrical Code

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

SAE ARP 892	(1965; R 1994) D-C Starter-Generator, Engine
SAE J 537	(1996) Storage Batteries

UNDERWRITERS LABORATORIES (UL)

UL 489	(1996; Rev thru Dec 1998) Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures
UL 1236	(1994; Rev thru Mar 1999) Battery Chargers for Charging Engine-Starter Batteries

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with SECTION 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Layout; G-AE

Drawings; G-AE

a. Base-mounted equipment, complete with base and attachments including anchor bolt template and recommended clearances for maintenance and operation.

b. Starting system.

c. Fuel system.

d. Cooling system.

e. Exhaust system.

f. Electric wiring of relays, breakers, programmable controllers, and switches including single line and wiring

diagrams.

g. Lubrication system, including piping, pumps, strainers, filters, controls and wiring.

h. Location, type, and description of vibration isolation devices.

i. The safety system, including wiring schematics.

j. One-line schematic and wiring diagrams of the generator, exciter, regulator, governor, and all instrumentation.

k. Panel layouts.

l. Mounting and support for each panel and major piece of electrical equipment.

m. Engine-generator set rigging points and lifting instructions.

Acceptance; G-AO

Drawings which accurately depict the as-built configuration of the installation, upon acceptance of the diesel-generator set installation. Layout drawings shall be revised to reflect the as-built conditions and submitted with the as-built drawings.

SD-03 Product Data

Performance Tests; G-AO

Calculations of the engine and generator output power capability, including efficiency and parasitic load data.

Sound Limitations; G-AO

Sound power level data for the packaged unit operating at 100% load in a free field environment. The data should demonstrate compliance with the sound limitation requirements of this specification.

Generator; G-AE

Each generator KW rating and short circuit capacity (both symmetric and asymmetric).

Integral Main Fuel Storage Tank; G-AE

Calculations for the capacity of each day tank, including allowances for recirculated fuel, usable tank capacity, and duration of fuel supply.

Power Factor; G-AE

Generator capability curve showing generator kVA output (kW vs. kvar) for both leading and lagging power factors ranging from 0 to 1.0.

Time-Delay on Alarms; G-AO

The magnitude of monitored values which define alarm or action setpoints, and the tolerance (plus and/or minus) at which the device activates the alarm or action.

Cooling System; G-AE

a. The maximum and minimum allowable inlet temperatures of the coolant fluid .

b. The maximum allowable temperature rise in the coolant fluid through the engine.

c. The minimum allowable inlet fuel temperature.

Manufacturer's Catalog; G-AE

Manufacturer's standard catalog data describing and depicting each engine-generator set and all ancillary equipment in sufficient detail to demonstrate specification compliance.

Vibration Isolation; G-AE

Vibration isolation system performance data for the range of frequencies generated by the engine-generator set during operation from no load to full load and the maximum vibration transmitted to the floor. Description of seismic qualification of the engine-generator mounting, base, and vibration isolation.

Instructions; G-AO

Instructions including: the manufacturer's pre-start checklist and precautions; startup procedures for test mode, manual-start mode, and automatic-start mode, (as applicable); running checks, procedures, and precautions; and shutdown procedures, checks, and precautions. Instructions shall include procedures for interrelated equipment (such as heat recovery systems, co-generation, load-shedding, and automatic transfer switches). Instructions shall be weatherproof, laminated in plastic, framed, and posted where directed. Posted data shall include wiring and control diagrams showing the key mechanical and electrical control elements, and a diagrammatic layout of the system.

Experience; G-AO

Statement showing that each component manufacturer has a minimum of 3 years experience in the manufacture, assembly and sale of components used with stationary diesel-engine generator sets for commercial and industrial use.

Statement showing that the engine-generator set manufacturer/assembler has a minimum of 3 years experience in the manufacture, assembly and sale of stationary diesel engine-generator sets for commercial and industrial use.

Field Engineer; G-AO

A letter listing the qualifications, schools, formal training, and experience of the field engineer.

Site Welding; G-AO

A letter listing the welder qualifying procedures for each welder, complete with supporting data such as test procedures used, what was tested to, and a list of the names of all welders and their qualifications symbols.

General Installation; G-AO

A complete copy of the manufacturer's installation procedures. A detailed description of the manufacturer's recommended break-in procedure.

Site Visit; G-AO

A site visit letter stating the date the site was visited and listing discrepancies found.

SD-06 Test Reports

Onsite Inspection and Tests; G-AO

a. A letter giving notice of the proposed dates of all onsite inspections and tests at least 14 days prior to beginning tests.

b. A detailed description of the Contractor's proposed procedures for onsite tests including the test including the test plan and a listing of equipment necessary to perform the tests. Submission shall be at least 7 days prior to beginning tests.

c. Six copies of the onsite test data described below in 8-1/2 x 11 inch 3-ring binders with a separate section for each test. Sections shall be separated by dividers with tabs. Data plots shall be full size 8-1/2 x 11 inches minimum), showing all grid lines, with full resolution.

(1) A description of the procedures for onsite tests.

(2) A list of equipment used, with calibration certifications.

(3) A copy of measurements taken, with required plots and graphs.

(4) The date of testing.

(5) The parameters verified.

(6) The condition specified for the parameter.

(7) The test results, signed and dated.

(8) A description of all adjustments made.

SD-07 Certificates

Vibration Isolation; G-AO

Torsional analysis including prototype testing or calculations

which certify and demonstrate that no damaging or dangerous torsional vibrations will occur when the prime mover is connected to the generator, at synchronous speeds, plus/minus 10%.

Prototype Tests; G-AO

Manufacturer's standard certification that prototype tests were performed for the generator model proposed.

Reliability and Durability; G-AO

Documentation which cites engines and generators in similar service to demonstrate compliance with the requirements of this specification. Certification does not exclude annual technological improvements made by a manufacturer in the basic standard model set on which experience was obtained, provided parts interchangeability has not been substantially affected and the current standard model meets all the performance requirements of this specification. For each different set, 2 like sets shall have performed satisfactorily in a stationary power application, independent and separate from the physical location of the manufacturer's and assembler's facilities, for a minimum of 2 consecutive years without any failure to start, including periodic exercise. The certification shall state that for the set proposed to meet this specification, there were no failures resulting in downtime for repairs in excess of 72 hours or any failure due to overheating during 2 consecutive years of service. Like sets are of the same model, speed, bore, stroke, number and configuration of cylinders, and output power rating. Like generators are of the same model, speed, pitch, cooling, exciter, voltage regulator and output power rating. A list shall be provided with the name of the installations, completion dates, and name and telephone number of a point of contact.

Emissions; G-AO

A certification from the engine manufacturer stating that the engine exhaust emissions meet federal, state, and local regulations and restrictions specified. At a minimum, this certification shall include emission factors for criteria pollutants including nitrogen oxides, carbon monoxide, particulate matter, sulfur dioxide, non-methane hydrocarbon, and for hazardous air pollutants (HAPs).

Sound limitations; G-AO

A certification from the manufacturer stating that the sound emissions meet the specification.

Flywheel Balance; G-AO

Manufacturer's certification that the flywheel has been statically and dynamically balanced and is capable of being rotated at 125% of rated speed without vibration or damage.

Materials and Equipment; G-AO

A letter stating that where materials or equipment are specified to comply with requirements of UL, or other standards, written

proof of such compliance has been obtained. The label or listing of the specified agency, or a written certificate from an approved, nationally recognized testing organization equipped to perform such services, stating that the items have been tested and conform to the requirements and testing methods of the specified agency are acceptable as proof.

Factory Inspection and Tests; G-AO

A certification that each engine generator set passed the factory tests and inspections and a list of the test and inspections.

Inspections; G-AO

A letter certifying that all facilities are complete and functional, that each system is fully functional, and that each item of equipment is complete, free from damage, adjusted, and ready for beneficial use.

Cooling System; G-AO

Certification that the engine-generator set and cooling system function properly in the ambient temperatures specified.

1.3 SYSTEM DESCRIPTION

Each engine-generator set shall be provided and installed complete and totally functional, with all necessary ancillary equipment to include air filtration; starting system; generator controls, protection, and isolation; instrumentation; lubrication; fuel system; cooling system; and engine exhaust system. Each engine generator set shall satisfy the requirements specified in the Engine Generator Parameter Schedule.

1.3.1 Engine-Generator Parameter Schedule

ENGINE GENERATOR PARAMETER SCHEDULE

Service Load	450 KW
Power Factor	0.8 lagging
Motor Starting kVA (maximum)	700 kVA
Maximum Speed	1800 rpm
Engine-Generator Application	stand-alone
Engine Cooling Type	water/ethylene glycol
Heat Exchanger Type	fin-tube
Governor Type	Isochronous
Frequency Bandwidth steady state	± 0.4 %
Voltage Regulation (No load to full load)	± 2% (max.)

Voltage Bandwidth (steady state)	± 1 %
Frequency	60 Hz
Voltage	480 volts
Phases	3 Phase, grounded-Wye
Max Step Load Increase	50% of Service Load at .8 PF
Max Step Load Decrease (without shutdown)	100 % of Service Load at .8 PF
Max Time to Start and be Ready to Assume Load	10 seconds
Max Summer Indoor Temp (Prior to Genset Operation)	100 degrees
Min Winter Indoor Temp (Prior to Genset Operation)	50 degrees
Max Summer Outdoor Temp (Ambient)	110 degrees
Min Winter Outdoor Temp (Ambient)	-60 degrees
Installation Elevation	545 above sea level

1.3.2 Output Capacity

Each generator set shall provide power equal to the sum of service load plus the machine's efficiency loss and associated ancillary equipment loads. Rated output capacity shall also consider engine and/or generator oversizing required to meet requirements in paragraph Engine-Generator Parameter Schedule.

1.3.3 Power Rating

Standby ratings shall be in accordance with EGSA 101P.

1.4 GENERAL REQUIREMENTS

1.4.1 Engine-Generator Set

Each set shall consist of one engine, one generator, and one exciter, mounted, assembled, and aligned on one base; and all other necessary ancillary equipment which may be mounted separately. Sets shall be assembled and attached to the base prior to shipping. Set components shall be environmentally suitable for the locations shown and shall be the manufacturer's standard product offered in catalogs for commercial or industrial use. A generator strip heater shall be provided for moisture control when the generator is not operating.

1.4.2 Nameplates

Each major component of this specification shall have the manufacturer's name, type or style, model or serial number, and rating number on a plate secured to the equipment. As a minimum, nameplates shall be provided for: Engines; Relays; Generators; Day tanks; Transformers (CT & PT); Regulators; Pumps and pump motors; Governors; Generator Breaker; Economizers; Heat exchangers (other than base-mounted).

Engines	Relays
Generators	
Regulators	
Pumps and pump motors	Governors
Generator Breaker	

Where the following equipment is provided as a standard component by the diesel-engine generator set manufacturer, the nameplate information may be provided in the maintenance manual in lieu of nameplates.

Battery charger	Heaters
Exhaust mufflers	Exciters
Silencers	
Battery	

1.4.3 Personnel Safety Device

Exposed moving parts, parts that produce high operating temperatures, parts which may be electrically energized, and parts that may be a hazard to operating personnel during normal operation shall be insulated, fully enclosed, guarded, or fitted with other types of safety devices. The safety devices shall be installed so that proper operation of the equipment is not impaired.

1.4.4 Verification of Dimensions

Before performing work, the premises shall be visited and details of the work verified. The Contracting Officer shall be advised in writing of any discrepancies before performing any work.

1.4.5 Conformance to Codes and Standards

Where equipment is specified to conform to requirements of any code or standard such as UL, the design, fabrication and installation shall conform to the code.

1.4.6 Site Welding

Structural members shall be welded in accordance with SECTION 05120 STRUCTURAL STEEL. For all other welding, procedures and welders shall be qualified in accordance with ASME BPVC SEC IX. Welding procedures qualified by others, and welders and welding operators qualified by a previously qualified employer may be accepted as permitted by ASME B31.1. Welder qualification tests shall be performed for each welder whose qualifications are not in compliance with the referenced standards. The Contracting Officer shall be notified 24 hours in advance of qualification

tests. The qualification tests shall be performed at the work site if practical. The welder or welding operator shall apply the assigned personal symbol near each weld made as a permanent record

1.4.7 Engine Generator Set Enclosure

Provide an insulated, skid-mounted, self contained enclosure to house diesel-driven electric generator switchboard and all other accessories and appurtenances. Provide all systems necessary to insure that JP-8 equipment will start and operate in arctic conditions as defined in paragraph entitled SYSTEM DESCRIPTION.

1.4.7.1 Base and Foundation System

A full length skid base will be provided. The skid base will be sized to support the diesel generator and all other equipment. The skid base shall include the following:

a. Wide flange beams for main members.

b. Channel cross members to support diesel generators and other equipment.

c. Full length pipe with extensions on each end of the skid with caps for towing.

d. Angle cross members to support full cover diamond deck floor.

e. Two inch minimum spray foam insulation on underside of floor.

f. Fully welded construction.

g. Fork pockets for lifting.

1.4.7.2 Enclosure Construction

a. Framework for walls to be steel square tubing of welded construction.

b. Framework for roof to be steel tubing of welded construction.

c. Exterior walls and roof to be flat mill finished aluminum, primer and finished painted per base color scheme of riveted construction.

d. Wall and roof insulation to be rigid foam panels of sufficient thickness to fill voids.

e. Interior walls and ceiling to be 1/2" thick marine grade plywood attached to steel framework with screw fasteners. Plywood to be covered with 0.032" stucco embossed mill finished aluminum, riveted construction.

f. Personnel doors to have refrigeration type safety latches and to open to the outside. Minimum 3'-0" clear width.

g. Removable sections shall be provided for installation and removal of equipment.

h. All doors and removable sections to have silicon rubber seals.

1.4.7.3 Enclosure Electrical System

A totally self contained enclosure electrical system will be installed. 277/480 Volt, 3-phase, 4 wire power service will be supplied from transformer. Power will be fed through individual feeder and branch circuit breakers as indicated and as required. Interior electrical shall include:

a. AC lights.

b. AC light switch.

c. Room space heaters, each unit controlled by integral thermostat.

d. Engine room vent fan with thermostat. Inlets and outlets to have motorized shutters.

e. Jacket water heaters for engines, 120 volt.

f. Service for 20 amp DC battery charger, 120 volt.

g. DC emergency lights.

h. Duplex outlets, 120 volt.

i. Controls

j. Day tank

k. Fire Alarm Control Panel

l. Other utilization equipment.

See 16415 ELECTRICAL WORK, INTERIOR for other requirements

1.4.7.4 Module Heating and Venting

The module shall have a dual thermostat to control it's temperature. When the temperature in the engine room is low, space heaters will be turned on. When the engine is running, an air inlet shutter will be opened, to admit combustion and cooling air and a mixed-air plenum will have it's dampered openings modulated to maintain interior temperature at setpoint. When the temperature in the engine room is high, a vent fan and shutter will be turned on to exhaust heat. Both inlet and outlet openings will be provided with weather hoods.

Hoods shall be painted galvanized steel of at least 14 gauge and shall be installed on the exterior of the module at all penetrations made through walls for the purpose of passing air through the walls. Hoods shall be designed, constructed and installed to mitigate entrance of blowing rain and snow and to protect the unit from conditions indicated. Provide sealants, flashing, deflectors, insect/bird screens and all accessories for complete installation.

1.4.7.5 Enclosure Fire Detection and Alarm System

Provide a single-zone, fire alarm panel, heat detectors on the ceiling (fixed temperature), manual pull stations, interior horn and exterior horn/strobe weatherproof alarm unit. Interconnect with FACP in the Pump Control Room. This system shall initiate alarms and trouble signals as a separate zone at the Pump House FACP. Sequence of operation similar to that described in 13851 FIRE DETECTION AND ALARM SYSTEM, ADDRESSABLE.

1.4.7.6 Power Wiring

The generator power wiring will be installed under the floor of the enclosure to the floor mounted, free-standing switchboard on the wall adjacent to the generator. The main circuit breaker and generator instruments will be installed in the switchboard. Provide conduits of size indicated. Interconnect power equipment in this module with the electrical service equipment in the pump house as shown.

1.4.7.7 Control Wiring

Provide conduit(s) of size indicated from generator control panel(s) to interconnect controls, alarms and outputs to remote generator alarm/status panel in the Pump House as shown.

1.4.8 Vibration Isolation

The maximum engine-generator set vibration in the horizontal, vertical and axial directions shall be limited to 6 mils (peak-peak RMS), with an overall velocity limit of RMS, for all speeds through 110% of rated speed. Where the vibration-isolation system does not secure the base to the structure floor or unit foundation, seismic restraints shall be provided in accordance with the seismic parameters specified.

1.4.9 Experience

Each component manufacturer shall have a minimum of 3 years experience in the manufacture, assembly and sale of components used with stationary diesel engine-generator sets for commercial and industrial use. The engine-generator set manufacture/assembler shall have a minimum of 3 years experience in the manufacture, assembly and sale of stationary diesel engine-generator sets for commercial and industrial use.

1.4.10 Field Engineer

The engine-generator set manufacturer or assembler shall furnish a qualified field engineer to supervise the complete installation of the engine-generator set, assist in the performance of the onsite tests, and instruct personnel as to the operational and maintenance features of the equipment. The field engineer shall have attended the engine-generator manufacturer's training courses on installation and operation and maintenance for engine generator sets.

1.4.11 Seismic Requirements

Seismic requirements shall be in accordance with Sections 13080 SEISMIC PROTECTION FOR MISCELLANEOUS EQUIPMENT, 15070 SEISMIC PROTECTION FOR MECHANICAL EQUIPMENT and 16070 SEISMIC PROTECTION FOR ELECTRICAL EQUIPMENT.

1.5 STORAGE AND INSTALLATION

The Contractor shall properly protect material and equipment in accordance with the manufacturers recommended storage procedures, before, during, and after installation. Stored items shall be protected from the weather and contamination. During installation, piping and similar openings shall be capped to keep out dirt and other foreign matter.

1.6 OPERATION AND MAINTENANCE MANUALS

The operation and maintenance manuals shall be submitted and approved prior to commencing onsite tests.

1.6.1 Operation Manual

Three copies of the manufacturers standard operation manual. The manual shall include:

a. Step-by-step procedures for system startup, operation, and shutdown;

b. Drawings, diagrams, and single-line schematics to illustrate and define the electrical, mechanical, and hydraulic systems with their controls, alarms, and safety systems;

1.6.2 Maintenance Manual

Three copies of the manufacturers standard maintenance manual.

a. Procedures for each routine maintenance item.

b. The manufacturer's recommended maintenance schedule.

c. A component list which includes the manufacturer's name, address, type or style, model or serial number, rating, and catalog number for the major components listed in paragraph GENERAL REQUIREMENTS.

d. A list of spare parts for each piece of equipment and a complete list of materials and supplies needed for operation.

1.7 SPECIAL TOOLS AND FILTERS

Two sets of special tools and two sets of filters required for maintenance shall be provided. Special tools are those that only the manufacturer provides, for special purposes, or to reach otherwise inaccessible parts. One handset shall be provided for each electronic governor when required to indicate and/or change governor response settings. Two complete sets of filters shall be supplied in a suitable storage box. these filters shall be in addition to filters replaced after testing.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

Materials and equipment shall be as specified.

2.1.1 Circuit Breakers, Low Voltage

NEMA AB 1, UL 489, and NEMA SG 3.

2.1.2 Filter Elements (Fuel-oil, Lubricating-oil, and Combustion-air)

Manufacturer's standard.

2.1.3 Instrument Transformers

ANSI C12.11.

2.1.4 Pipe (Sleeves, Fuel/Lube-oil, Compressed-Air, Coolant and Exhaust)

ASTM A 53/A 53M, ASTM A 106 or ASTM A 135, steel pipe. Pipe smaller than 2 inches shall be Schedule 80. Pipe 2 inches and larger shall be Schedule 40.

2.1.5 Pipe Flanges and Fittings

a. Pipe Flanges and Flanged Fittings: ASTM A 181/A 181M, Class 60, or ASME B16.5, Grade 1, Class 150.

b. Pipe Welding Fittings: ASTM A 234/A 234M, Grade WPB or WPC, Class 150, or ASME B16.11, 3000 lb.

c. Threaded Fittings: ASME B16.3, Class 150.

d. Valves: MSS SP-80, Class 150.

e. Gaskets: Manufacturers Standard.

2.1.6 Pipe Hangers

MSS SP-58 and MSS SP-69.

2.1.7 Electrical Enclosures

2.1.7.1 General

NEMA ICS 6.

2.1.7.2 Panelboards

NEMA PB 1.

2.1.8 Electric Motors

Electric motors shall conform to the requirements of NEMA MG 1. Motors shall have sealed ball bearings, a maximum speed of 1800 rpm and integral automatic or manual reset thermal overload protectors. Motors used indoors shall have drip proof frames; those used outside shall be totally enclosed. AC motors larger than 1/2 Hp shall be of the squirrel cage induction type for standard voltage of 460 volts, 60 Hz three phase power. AC motors 1/2 Hp or smaller, shall be for standard voltage 230 volts, 60 Hz, single phase power.

2.1.9 Motor Controllers

Motor controllers and starters shall conform to the requirements of NFPA 70 and NEMA ICS 2.

2.2 ENGINE

Each engine shall operate on JP-8 Jet Fuel conforming to MIL-T-83133 and ASTM D 975, shall be designed for stationary applications and shall be complete with ancillaries. The engine shall be a standard production model described in the manufacturer's catalog. The engine shall be naturally aspirated, scavenged, supercharged or turbocharged. The engine shall be two- or four-stroke-cycle and compression-ignition type. The engine shall be vertical inline, V-, or opposed-piston type, with a solid cast block or individually cast cylinders. The engine shall have a minimum of two cylinders. Opposed-piston type engines shall have no less than four cylinders. Each block shall have a coolant drain port. Each engine shall be equipped with an overspeed sensor.

2.3 FUEL SYSTEM

The fuel system for each engine generator set shall conform to the requirements of NFPA 30 and NFPA 37 and contain the following elements.

2.3.1 Pumps

2.3.1.1 Main Pump

Each engine shall be provided with an engine driven pump. The pump shall supply fuel at a minimum rate sufficient to provide the amount of fuel required to meet the performance indicated within the parameter schedule. The fuel flow rate shall be based on meeting the load requirements and all necessary recirculation.

2.3.2 Filter

A minimum of one full flow fuel filter shall be provided for each engine. The filter shall be readily accessible and capable of being changed without disconnecting the piping or disturbing other components. The filter shall have inlet and outlet connections plainly marked.

2.3.3 Relief/Bypass Valve

A relief/bypass valve shall be provided to regulate pressure in the fuel supply line, return excess fuel to a return line, and prevent the build-up of excessive pressure in the fuel system.

2.3.4 Integral Main Fuel Storage Tank

Each engine shall be provided with an integral main fuel tank. Each tank shall be factory installed and provided as an integral part of the diesel generator manufacturer's product. Each tank shall be provided with connections for fuel supply line, fuel return line, local fuel fill port, gauge, vent line, and float switch assembly. A fuel return line cooler shall be provided as recommended by the manufacturer and assembler. The temperature of the fuel returning to the tank shall be below the flash point of the fuel. Each engine-generator set provided with weatherproof enclosures shall have its tank mounted within the enclosure. The fuel fill line shall be accessible without opening the enclosure.

2.3.4.1 Capacity

Each tank shall have capacity to supply fuel to the engine for an uninterrupted 8 hour period at 100% rated load without being refilled.

2.3.4.2 Local Fuel Fill

Each local fuel fill port on the day tank shall be provided with a screw-on cap. The tank shall also have a fuel fill port to receive fuel from a remote tank.

2.3.4.3 Fuel Level Controls

a. Each tank shall have a float-switch assembly to perform the following functions:

(1) Activate the "Low Fuel Level" alarm at 70% of the rated tank capacity.

(2) Activate the "Overfill Fuel Level" alarm at 95% of the rated tank capacity.

2.3.4.4 Remote Tank Receipt Fuel Level Controls

a. Each day tank shall have a float-switch-assembly to perform the following functions:

(1) The main storage tank is located higher than the day tank. Open the solenoid valve located on the fuel supply line entering the day tank and start the supply of fuel into the day tank when the fuel level is at the "Low" level mark, 75% of the rated tank capacity.

(2) The main storage tank is located higher than the day tank. Stop the supply of fuel into the day tank and close the solenoid valve located on the fuel supply line entering the day tank when the fuel level is at 90% of the rated tank capacity.

(3) Activate the "Overfill Fuel Level" alarm at 95% of the rated tank volume.

(4) Activate the "Low Fuel Level" alarm at 70% of the rated tank Capacity.

(5) Activate the automatic fuel supply shut-off valve located on the fill line of the day tank and shut down the fuel pump which supplies fuel to the day tank at 95% of the rated tank volume. The flow of fuel shall be stopped before any fuel can be forced into the fuel overflow line.

2.3.4.5 Arrangement

Integral tanks may allow gravity flow into the engine. Gravity flow tanks and any tank that allows a fuel level above the fuel injectors shall be provided with an internal or external factory installed valve located as near as possible to the shell of the tank. The valve shall close when the engine is not operating. Integral day tanks shall be provided with any necessary pumps to supply fuel to the engine as recommended by the generator set manufacturer. The fuel supply line from the tank to the manufacturer's standard engine connection shall be welded pipe.

2.4 LUBRICATION

Each engine shall have a separate lube-oil system conforming to NFPA 30 and NFPA 37. Each system shall be pressurized by engine-driven oil pumps. Each system shall be furnished with a relief valve for oil pressure regulation (for closed systems) and a dip-stick for oil level indications. The crankcase shall be vented in accordance with the manufacturer's recommendation except that it shall not be vented to the engine exhaust system. Crankcase breathers, if provided on engines installed in buildings or enclosures, shall be piped to vent to the outside. The system shall be readily accessible for service such as draining, refilling, etc. Each system shall permit addition of oil and have oil-level indication with the set operating. The system shall utilize an oil cooler as recommended by the engine manufacturer.

2.4.1 Filter

One full-flow filter shall be provided for each pump. The filter shall be readily accessible and capable of being changed without disconnecting the piping or disturbing other components. The filter shall have inlet and outlet connections plainly marked.

2.4.2 Lube-Oil Sensors

Each engine shall be equipped with lube-oil pressure sensors. Pressure sensors shall be located downstream of the filters and provide signals for required indication and alarms.

2.5 COOLING SYSTEM

Each engine cooling system shall operate automatically while the engine is running. Each cooling system shall be sized for the maximum summer outdoor design temperature and site elevation. Water-cooled system coolant shall use a combination of water and ethylene-glycol ratio of 40 : 60 for freeze protection at the minimum winter outdoor temperature specified. The maximum temperature rise of the coolant across the engine shall be no more than that recommended and submitted in accordance with paragraph SUBMITTALS.

2.5.1 Coolant Pumps

Coolant pumps shall be the centrifugal type. Each engine shall have an engine-driven primary pump.

2.5.2 Heat Exchanger

Each heat exchanger shall be of a size and capacity to limit the maximum allowable temperature rise in the coolant across the engine to that recommended and submitted in accordance with paragraph SUBMITTALS for the maximum summer outdoor design temperature and site elevation. Each heat exchanger shall be corrosion resistant, suitable for service in ambient conditions of application.

2.5.2.1 Fin-Tube-Type Heat Exchanger (Radiator)

Heat exchanger may be factory coated with corrosive resistant film providing that corrosion measures are taken to restore the heat rejection capability of the radiator to the initial design requirement via oversizing, or other compensating methods. Internal surfaces shall be compatible with liquid fluid coolant used. Materials and coolant are

subject to approval by the Contracting Officer. Heat exchangers shall be pressure type incorporating a pressure valve, vacuum valve and a cap. Caps shall be designed for pressure relief prior to removal. Each heat exchanger and the entire cooling system shall be capable of withstanding a minimum pressure of 7 psi. Each heat exchanger shall be protected with a strong grille or screen guard. Each heat exchanger shall have at least two tapped holes. One tapped hole in the heat exchanger shall be equipped with a drain cock, the rest shall be plugged.

2.5.3 Temperature Sensors

Each engine shall be equipped with coolant temperature sensors. Temperature sensors shall provide signals for pre-high and high indication and alarms.

2.6 SOUND LIMITATIONS

The noise generated by the installed diesel generator set operating at 100 percent load shall not exceed the following sound pressure levels in any of the indicated frequencies when measured at a distance of 75 feet from the end of the exhaust and air intake piping directly along the path of intake and discharge for horizontal piping; or at a radius of 75 feet from the engine at 45 degrees apart in all directions for vertical piping.

Frequency Band (Hz)	Maximum Acceptable Pressure Level (Decibels)
31	87
63	87
125	77
250	70
500	64
1,000	61
2,000	60
4,000	60
8,000	62

2.7 AIR INTAKE EQUIPMENT

Filters and silencers shall be provided in locations that are convenient for servicing. The silencer shall be of the high-frequency filter type, located in the air intake system as recommended by the engine manufacturer. Silencer shall be capable of reducing the noise level at the air intake to a point below the maximum acceptable levels specified in paragraph SOUND LIMITATIONS. A combined filter-silencer unit meeting requirements for the separate filter and silencer items may be provided. Expansion elements in air-intake lines shall be rubber.

2.8 EXHAUST SYSTEM

The system shall be separate and complete for each engine. Piping shall be supported so as to minimize vibration. Where a V-type engine is provided, a V-type connector with necessary flexible sections and hardware shall connect the engine exhaust outlets.

2.8.1 Flexible Sections and Expansion Joints

A flexible section at each engine and an expansion joint at each muffler

shall be provided. Flexible sections and expansion joints shall have flanged connections. Flexible sections shall be made of convoluted seamless tube without joints or packing. Expansion joints shall be the bellows type. Expansion and flexible elements shall be stainless steel suitable for diesel-engine exhaust gas at the maximum exhaust temperature that is specified by the engine manufacturer. Expansion and flexible elements shall be capable of absorbing vibration from the engine and compensation for thermal expansion and contraction.

2.8.2 Exhaust Muffler

A chamber type exhaust muffler shall be provided. The muffler shall be constructed of welded steel and designed for outside horizontal mounting. Eyebolts, lugs, flanges, or other items shall be provided as necessary for support in the location and position indicated. Pressure drop through the muffler shall not exceed the recommendations of the engine manufacturer. Outside mufflers shall be zinc coated or painted with high temperature 400 degrees F resisting paint. The muffler and exhaust piping together shall reduce the noise level to less than the maximum acceptable level listed for sound limitations in paragraph SOUND LIMITATIONS. The muffler shall have a drain valve, nipple, and cap at the low-point of the muffler.

2.8.3 Exhaust Piping

Horizontal sections of exhaust piping shall be sloped downward away from the engine to a condensate trap and drain valve. Changes in direction shall be long-radius. Exhaust piping, mufflers and silencers installed inside any building shall be insulated in accordance with paragraph THERMAL INSULATION and covered to protect personnel. Vertical exhaust piping shall be provided with a hinged, gravity operated, self-closing, rain cover.

2.9 EMISSIONS

The finished installation shall comply with Federal, state, and local regulations and restrictions regarding the limits of emissions.

2.10 STARTING SYSTEM

The starting system for engine generator sets used in non-emergency applications shall be as follows.

2.10.1 Controls

An engine control switch shall be provided with functions including: run/start (manual), off/reset, and automatic mode. Start-stop logic shall be provided for adjustable cycle cranking and cool down operation. The logic shall be arranged for manual starting . Electrical starting systems shall be provided with an adjustable cranking limit device to limit cranking periods from 1 second up to the maximum duration.

2.10.2 Capacity

The starting system shall be of sufficient capacity, at the maximum indoor summer temperature specified to crank the engine without damage or overheating. The system shall be capable of providing a minimum of three cranking periods with 15-second intervals between cranks. Each cranking period shall have a maximum duration of 15 seconds.

2.10.3 Functional Requirements

Starting system shall be manufacturers recommended dc system utilizing a negative circuit ground. Starting motors shall be in accordance with SAE ARP 892.

2.10.4 Battery

A starting battery system shall be provided and shall include the battery, battery rack, intercell connectors, and spacers. The battery shall be in accordance with SAE J 537. Critical system components (rack, protection, etc.) shall be sized to withstand the seismic acceleration forces specified. The battery shall be nickel-cadmium type, with sufficient capacity, at the minimum outdoor winter temperature specified to provide the specified cranking periods. Valve-regulated lead-acid batteries are not acceptable.

2.10.5 Battery Charger

A current-limiting battery charger, conforming to UL 1236, shall be provided and shall automatically recharge the batteries. The charger shall be capable of an equalize charging rate for recharging fully depleted batteries within 24 hours and a float charge rate for maintaining the batteries in prime starting condition. An ammeter shall be provided to indicate charging rate. A timer shall be provided for the equalize charging rate setting. A battery is considered to be fully depleted when the output voltage falls to a value which will not operate the engine generator set and its components.

2.10.6 Starting Aids

The manufacturer shall provide one or more of the following methods to assist engine starting.

2.10.6.1 Glow Plugs

Glow plugs shall be designed to provide sufficient heat for combustion of fuel within the cylinders to guarantee starting at an ambient temperature of minus 25 degrees F.

2.10.6.2 Jacket-Coolant Heaters

A thermostatically controlled electric heater shall be mounted in the engine coolant jacketing to automatically maintain the coolant within plus or minus 3 degrees of the control temperature. The heater shall operate independently of engine operation so that starting times are minimized. The control temperature shall be the temperature recommended by the engine manufacturer to meet the starting time specified.

2.11 GOVERNOR

Each engine shall be provided with a governor which maintains the frequency within a bandwidth of the rated frequency, over a steady-state load range of zero to 100% of rated output capacity. The governor shall be configured for safe manual adjustment of the speed/frequency during operation of the engine generator set, without special tools, from 90 to 110 % of the rated speed/frequency, over a steady state load range of zero to 100% of rated capacity. Isochronous governors shall maintain the midpoint of the frequency bandwidth at the same value for steady-state loads over the range

of zero to 100% of rated output capacity.

2.12 GENERATOR

Each generator shall be of the synchronous type, one or two bearing, conforming to NEMA MG 1, equipped with winding terminal housings in accordance with NEMA MG 1, equipped with an amortisseur winding, and directly connected to the engine. Insulation shall be Class F. Generator design shall protect against mechanical, electrical and thermal damage due to vibration, 25 percent overspeeds, or voltages and temperatures at a rated output capacity of 100 percent. Generator ancillary equipment shall meet the short circuit requirements of NEMA MG 1. Frames shall be the drip-proof type.

2.12.1 Current Balance

At 100 percent rated load, and load impedance equal for each of the three phases, the permissible current difference between any two phases shall not exceed 2 percent of the largest current on either of the two phases.

2.12.2 Voltage Balance

At any balanced load between 75 and 100 percent of rated load, the difference in line-to-neutral voltage among the three phases shall not exceed 1 percent of the average line-to-neutral voltage. For a single-phase load condition, consisting of 25 percent load at unity power factor placed between any phase and neutral with no load on the other two phases, the maximum simultaneous difference in line-to-neutral voltage between the phases shall not exceed 3 percent of rated line to neutral voltage. The single-phase load requirement shall be valid utilizing normal exciter and regulator control. The interpretation of the 25 percent load for single phase load conditions means 25 percent of rated current at rated phase voltage and unity power factor.

2.12.3 Waveform

The deviation factor of the line-to-line voltage at zero load and at balanced full rated load at 0.8 power factor shall not exceed 10%. The RMS of all harmonics shall be less than 5.0% and that of any one harmonic less than 3.0% at full rated load. Each engine-generator shall be designed and configured to meet the total harmonic distortion limits of IEEE Std 519.

2.13 EXCITER

The generator exciter shall be of the brushless type. Semiconductor rectifiers shall have a minimum safety factor of 300% for peak inverse voltage and forward current ratings for all operating conditions, including 110% generator output at 104 degrees F ambient. The exciter and regulator in combination shall maintain generator-output voltage within the limits specified.

2.14 VOLTAGE REGULATOR

Each generator shall be provided with a solid-state voltage regulator, separate from the exciter. The regulator shall maintain the voltage within a bandwidth of the rated voltage, over a steady-state load range of zero to 100% of rated output capacity. Regulator shall be configured for safe manual adjustment of the engine generator voltage output without special tools, during operation from 90 to 110% of the rated voltage over the

steady state load range of zero to 100% of rated output capacity. Regulation drift shall not exceed plus or minus 0.5% for an ambient temperature change of 36 degrees F.

2.14.1 Steady State Performance (Regulation or Voltage Droop).

The voltage regulator shall have a maximum droop of 2% of rated voltage over a load range from 0 to 100% of rated output capacity and automatically maintain the generator output voltage within the specified operational bandwidth.

2.15 GENERATOR PROTECTION

Short circuit and overload protection for the generator shall be provided. The generator circuit breaker (IEEE Device 52) ratings shall be consistent with the generator rated voltage and frequency, with continuous, short circuit and interrupting current ratings to match the generator capacity. The manufacturer shall determine the short circuit current interrupting rating of the breaker. The breaker shall be engine generator base mounted by the engine-generator set manufacturer. Molded case breakers shall be provided with shunt trip. Surge protection shall be provided for each phase of the generator, to be mounted at the generator terminals.

2.16 SAFETY SYSTEM

Devices, wiring, local panels, etc., shall be provided and installed as a complete system to automatically activate the appropriate signals and initiate the appropriate actions. The safety system shall be provided with a self-test method to verify its operability. Alarm signals shall have manual acknowledgement and reset devices. The alarm signal systems shall reactivate for new signals after acknowledgment is given to any signal. The systems shall be configured so that loss of any monitoring device shall be dealt with as an alarm on that system element.

2.16.1 Audible Signal

The audible alarm signal shall sound at a frequency of 70 Hz at a volume of at least 90 dB at 10 feet. The sound shall be continuously activated upon alarm and silenced upon acknowledgment. Signal devices shall be located as shown.

2.16.2 Visual Signal Signal

The visual alarm signal shall be a panel light. The light shall be normally off, activated to be blinking upon alarm. The light shall change to continuously light upon acknowledgement. If automatic shutdown occurs, the display shall maintain activated status to indicate the cause of failure and shall not be reset until cause of alarm has been cleared and/or restored to normal condition. Shutdown alarms shall be red; all other alarms shall be amber.

2.16.3 Alarms and Action Logic

2.16.3.1 Shutdown

Simultaneous activation of the audible signal, activation of the visual signal, stopping the engine, and opening the generator main circuit breakers shall be accomplished.

2.16.3.2 Problem

Activation of the visual signal shall be accomplished.

2.16.4 Local Alarm Panel

A local alarm panel shall be provided with the following shutdown and alarm functions in accordance with NFPA 110 level 2 and including the listed Corps of Engineers requirements, mounted either on or adjacent to the engine generator set.

Device/ Condition/ Function	What/Where/Size	NFPA 99	NFPA 110 Level 1	NFPA 110 Level 2	Corps of Engrs Required
Shutdowns W/Alarms					
High engine temperature	Automatic/ jacket water/ cylinder	SD/CP VA	SD/CP VA	SD/CP VA	SD VA
Low lube-oil pressure	Automatic/ pressure/ level	SD/CP VA	SD/CP VA	SD/CP VA	SD VA
Overspeed shutdown $ alarm	(110% (± 2%) of rated speed	SD/CP VA	SD/CP VA	SD/CP VA	SD VA
Overcrank failure to start	Automatic/ Failure to to start	SD/CP VA	SD/CP VA	SD/CP VA	
Air shutdown damper (200-600kW)	When used		SD/CP VA	SD/CP VA	
Day tank overfill limit indication & transfer pump shutdown (95% volume)	Automatic/Day Tank/Level				SD/OPA (Pump)
Red emergency stop switch	Manual Switch		SD/CP VA	SD/CP VA	SD VA
Failure to crank	Corps of Engrs. Required				
Integral Main Fuel Tank low fuel limit Device/ Condition/	Corps of Engrs. Required				

Device/ Condition/ Function	What/Where/Size	NFPA 99	NFPA 110 Level 1	NFPA 110 Level 2	Corps of Engrs Required
indication (70% volume remaining)					
Alarms					
Low lube-oil pressure	Pressure/ level	CP VA	CP VA	CP VAO	CP VA
Low fuel level	Main tank, 3 hours remaining	VA/AA	CP VA	CP VAO	
High fuel level	Integral Main Fuel Storage Tank 95% Volume				CP VA
Low coolant	Jacket water	CP/VA	CP VA	CP VA	
Pre-high temperature	Jacket water/ cylinder	CP VA	CP VA	CP VAO	CP VA
Pre-low lube-oil pressure		CP VA			CP VA
High battery voltage			CP VA	CP VAO	
Low battery voltage			CP VA	CP VAO	
Battery charger AC failure	AC supply not available		CP VA	CP VAO	
Control switch not in AUTO			CP VA	CP VAO	
Low starting air pressure			CP VA	CP VAO	
Low starting hydraulic pressure			CP VA	CP VAO	

SD - Shut Down
CP - On Control Panel
VA - Visual Alarm
AA - Audible Alarm
O - Optional

2.16.5 Time-Delay on Alarms

For startup of the engine-generator set, time-delay devices shall be installed bypassing the low lubricating oil pressure alarm during cranking, and the coolant-fluid outlet temperature alarm. The lube-oil time-delay device shall return its alarm to normal status after the engine starts. The coolant time-delay device shall return its alarm to normal status 5 minutes after the engine starts.

-2.17 ENGINE GENERATOR SET CONTROLS AND INSTRUMENTATION

Devices, wiring, remote panels, local panels, etc., shall be provided and installed as a complete system to automatically activate the appropriate signals and initiate the appropriate actions.

2.17.1 Controls

A local control panel shall be provided with controls in accordance with NFPA 110 level 2 and as follows mounted either on or adjacent to the engine generator set .

Device/Condition/ Function	Corps Requirement	NFPA 110 Level 1	NFPA 110 Level 2	MFG Offering
Controls				
Switch: run/start - off/set - auto	CP			CP/STD
Emergency stop switch & alarm	CP			CP/STD
Lamp test/indicator test	CP	CP VA	CP VA	CP/STD
Common alarm contacts/ fault relay		X	X	CP/O
Panel lighting	CP			CP/STD
Audible alarm & silencing/reset switch	CP			
Voltage adjust for voltage Regulator	CP			CP/STD
Pyrometer display w/selector switch	CP			
Remote emergency stop switch		CP VA	CP VA	
Remote fuel shutoff switch				
Remote lube-oil shutoff switch				

2.17.2 Engine Generator Set Metering and Status Indication

A local panel shall be provided with devices in accordance with NFPA 110 level 2 and as follows mounted either on or adjacent to the engine generator set .

Device/Condition/ Function	Corps Requirement	NFPA 110 Level 1	NFPA 110 Level 2	MFG Offering
Genset Status & Metering				
Genset supplying load		CP VA	CP VAO	CP VAO

Device/Condition/ Function	Corps Requirement	NFPA 110 Level 1	NFPA 110 Level 2	MFG Offering
System ready				CP/STD
Engine oil pressure	CP			CP/STD
Engine coolant temperature	CP			CP/STD
Engine RPM (Tachometer)	CP			CP/STD
Engine run hours	CP			CP/STD
Pyrometer display w/selector switch	CP			
AC volts (generator), 3-phase	CP			CP/STD
AC amps (generator), 3-phase	CP			CP/STD
Generator frequency	CP			CP/STD
Phase selector switches (amps & volts)	CP			CP/STD
Watts/kW				CP/VA-O
Voltage Regulator Adjustment	CP			

CP - On Control Panel
VA - Visual Alarm
AA - Audible Alarm
O - Optional
STD - Manufacturers Standard Offering

2.18 PANELS

Each panel shall be of the type necessary to provide specified functions. Panels shall be mounted on the engine generator set base by vibration/shock absorbing type mountings . Instruments shall be mounted flush or semiflush. Convenient access to the back of instruments shall be provided to facilitate maintenance. Instruments shall be calibrated using recognized industry calibration standards. Each panel shall be provided with a panel identification plate which clearly identifies the panel function as indicated. Each instrument and device on the panel shall be provided with a plate which clearly identifies the device and its function as indicated. Panels can be combined into a single panel.

2.18.1 Enclosures

Enclosures shall be designed for the application and environment, conforming to NEMA ICS 6, and provided with locking mechanisms which are keyed alike.

2.18.2 Analog

Analog electrical indicating instruments shall be in accordance with ANSI C39.1 with semiflush mounting. Switchgear, and control-room panel-mounted instruments shall have 250 degree scales with an accuracy of not less than 1 percent. Unit-mounted instruments shall be the manufacturer's standard with an accuracy of not less than 2 percent. The instrument's operating temperature range shall be minus 20 to plus 65 degrees C. Distorted generator output voltage waveform of a crest factor less than 5 shall not affect metering accuracy for phase voltages, hertz and amps.

2.18.3 Parameter Display

Indication or readouts of the lubricating-oil pressure, ac voltmeter, ac ammeter, frequency meter, and coolant temperature.

2.19 SURGE PROTECTION

Electrical and electronic components shall be protected from, or designed to withstand the effects of surges from switching and lightning.

2.20 MANUAL ENGINE-GENERATOR SET SYSTEM OPERATION

Complete facilities shall be provided for manual starting and testing of each set without load, loading and unloading of each set.

2.21 BASE

The base shall be constructed of steel. The base shall be designed to rigidly support the engine-generator set, ensure permanent alignment of all rotating parts, be arranged to provide easy access to allow changing of lube-oil, and ensure that alignment will be maintained during shipping and normal operation. The base shall permit skidding in any direction during installation and shall be provided with suitable holes for foundation bolts. The base shall also withstand and mitigate the effects of synchronous vibration of the engine and generator, and shall be provided with suitable holes for anchor bolts and jacking screws for leveling.

2.22 PAINTING AND FINISHING

The engine-generator set shall be cleaned, primed and painted in accordance with the manufacturer's standard color and practice.

2.23 FACTORY INSPECTION AND TESTS

Factory inspection and tests shall be performed on each engine-generator set proposed to meet this specification section. Inspections shall be completed and necessary repairs made prior to testing. Inspectors shall look for leaks, looseness, defects in components, and proper assembly. Factory tests shall be NEMA MG 1 routine tests and the manufacturers routine tests.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION

Installation shall provide clear space for operation and maintenance in accordance with NFPA 70 and IEEE C2. Installation of pipe, duct, conduit, and ancillary equipment shall be configured to facilitate easy removal and

replacement of major components and parts of the engine-generator set.

3.2 PIPING INSTALLATION

3.2.1 General

Piping shall be welded. Connections at valves shall be flanged. Connections at equipment shall be flanged except that connections to the diesel engine may be threaded if the diesel-engine manufacturer's standard connection is threaded. Except as otherwise specified, flanged fittings shall be utilized to allow for complete dismantling and removal of each piping system from the facility without disconnecting or removing any portion of any other system's equipment or piping. Connections to all equipment shall be made with flexible connectors. Pipes extending through the roof shall be properly flashed. Piping shall be installed clear of windows, doors, and openings to permit thermal expansion and contraction without damage to joints or hangers, and with a 1/2 inch drain valve at each low point.

3.2.2 Supports

Hangers, inserts, and supports shall be of sufficient size to accommodate any insulation and shall conform to MSS SP-58 and MSS SP-69. Supports shall be spaced not more than 7 feet on center for pipes 2 inches in diameter or less, not more than 12 feet on center for pipes larger than 2 inches but no larger than 4 inches, and not more than 17 feet on center for pipes larger than 4 inches in diameter. Supports shall be provided at pipe bends or change of direction.

3.2.2.1 Ceiling and Roof

Exhaust piping shall be supported with appropriately sized type 41 single pipe roll and threaded rods; all other piping shall be supported with appropriately sized type 1 clevis and threaded rods.

3.2.2.2 Wall

Wall supports for pipe shall be made by suspending the pipe from appropriately sized type 33 brackets with the appropriate ceiling and roof pipe supports.

3.2.3 Flanged Joints

Flanges shall be 125 pound type, drilled, and of the proper size and configuration to match equipment and diesel-engine connections. Gaskets shall be factory cut in one piece 1/16 inch thick.

3.2.4 Cleaning

After fabrication and before assembly, piping interiors shall be manually wiped clean of all debris.

3.2.5 Pipe Sleeves

Pipes passing through construction such as ceilings, floors, or walls shall be fitted with sleeves. Each sleeve shall extend through and be securely fastened in its respective structure and shall be cut flush with each surface. The structure shall be built tightly to the sleeve. The inside diameter of each sleeve shall be 1/2 inch, and where pipes pass through

combustible materials, 1 inch larger than the outside diameter of the passing pipe or pipe covering.

3.3 ELECTRICAL INSTALLATION

Electrical installation shall comply with NFPA 70, IEEE C2, and SECTION 16415 ELECTRICAL WORK, INTERIOR.

3.3.1 Vibration Isolation

Flexible fittings shall be provided for all conduit, cable trays, and raceways attached to engine-generator sets. Metallic conductor cables installed on the engine generator set and from the engine generator set to equipment not mounted on the engine generator set shall be flexible stranded conductor. Terminations of conductors on the engine generator set shall be crimp-type terminals or lugs.

3.4 FIELD PAINTING

Field painting shall be as specified in SECTION 09900 PAINTS AND COATINGS.

3.5 ONSITE INSPECTION AND TESTS

3.5.1 Test Conditions

3.5.1.1 Data

Measurements shall be made and recorded of parameters necessary to verify that each set meets specified parameters. If the results of any test step are not satisfactory, adjustments or replacements shall be made and the step repeated until satisfactory results are obtained. Unless otherwise indicated, data shall be taken during engine-generator set operation and recorded in 15 minute intervals and shall include: readings of engine-generator set meters and gauges for electrical and power parameters; oil pressure; ambient temperature; and engine temperatures available from meters and gauges supplied as permanent equipment on the engine-generator set. In the following tests where measurements are to be recorded after stabilization of an engine-generator set parameter (voltage, frequency, current, temperature, etc.), stabilization is considered to have occurred when measurements are maintained within the specified bandwidths or tolerances, for a minimum of four consecutive readings. Electrical measurements shall be performed in accordance with IEEE Std 120. Definitions and terms are in accordance with IEEE Std 100. Temperature limits in the rating of electrical equipment and for the evaluation of electrical insulation shall be in accordance with IEEE Std 1.

3.5.1.2 Power Factor

Engine-generator set operating tests shall be made utilizing a load with the power factor specified in the engine generator set parameter schedule .

3.5.1.3 Contractor Supplied Items

The Contractor shall provide all equipment and supplies required for inspections and tests including fuel, test instruments, and loadbanks at the specified power factors.

3.5.1.4 Instruments

Readings of panel gauges, meters, displays, and instruments, provided under this specification shall be verified during test runs by test instruments of precision and accuracy greater than the tested items. Test instrument accuracy shall be at least as follows: current, 1.5%; voltage, 1.5%; real power, 1.5%; reactive power, 1.5%; power factor, 3%; frequency, 0.5%. Test instruments shall be calibrated by a recognized standards laboratory within 90 days prior to testing.

3.5.1.5 Sequence

The sequence of testing shall be as specified in the approved testing plan unless variance in authorized by the Contracting Officer. Field testing shall be performed in the presence of the Contracting Officer. Tests may be scheduled and sequenced in order to optimize run-time periods; however the following general order of testing shall be followed: Construction Tests; Inspections; Safety run Tests; and Performance Tests and Final Inspection.

3.5.2 Construction Tests

Individual component and equipment functional tests for fuel piping, coolant piping, and lubricating-oil piping, electrical circuit continuity, insulation resistance, circuit protective devices, and equipment not provided by the engine-generator set manufacturer shall be performed prior to connection to the engine-generator set.

3.5.2.1 Piping Test

a. Lube-oil and fuel-oil piping shall be flushed with the same type of fluid intended to flow through the piping, until the outflowing fluid has no obvious sediment or emulsion.

b. Fuel piping which is external to the engine-generator set shall be tested in accordance with NFPA 30. All remaining piping which is external to the engine generator set shall be pressure tested with air pressure at 150% of the maximum anticipated working pressure, but in no case less than 150 psig, for a period of 2 hours to prove the piping has no leaks. If piping is to be insulated, the test shall be performed before the insulation is applied.

3.5.2.2 Electrical Equipment Tests

a. Low-voltage cable insulation integrity tests shall be performed for cables connecting the generator breaker to the distribution bus . Low-voltage cable, complete with splices, shall be tested for insulation resistance after the cables are installed, in their final configuration, ready for connection to the equipment, and prior to energization. The test voltage shall be 500 volts dc, applied for one minute between each conductor and ground and between all possible combinations conductors in the same trench, duct, or cable, with all other conductors in the same trench, duct, or conduit. The minimum value of insulation shall be:

R in megohms = (rated voltage in kV + 1) x 304,800/(length of cable in meters).

(R in megohms = (rated voltage in kV + 1) x 1000/(length of cable

in feet)

Each cable failing this test shall be repaired or replaced. The repaired cable shall be retested until failures have been eliminated.

b. Ground-Resistance Tests. The resistance of each grounding electrode system shall be measured using the fall-of-potential method defined in IEEE Std 81. Ground resistance measurements shall be made before the electrical distribution system is energized and shall be made in normally dry conditions not less than 48 hours after the last rainfall. Resistance measurements of separate grounding electrode systems shall be made before the systems are bonded together below grade. The combined resistance of separate systems may be used to meet the required resistance, but the specified number of electrodes must still be provided.

1) Single rod electrode - 25 ohms.
2) Multiple rod electrodes - 25 ohms.
3) Ground mat - 25 ohms.

c. Circuit breakers and switchgear shall be examined and tested in accordance with manufacturer's published instructions for functional testing.

3.5.3 Inspections

The following inspections shall be performed jointly by the Contracting Officer and the Contractor, after complete installation of each engine-generator set and its associated equipment, and prior to startup of the engine-generator set. Checks applicable to the installation shall be performed. The results of those which are physical inspections (I) shall be documented by the Contractor and submitted in accordance with paragraph SUBMITTALS. The Contractor shall present manufacturer's data for the inspections designated (D) at the time of inspection. Inspections shall verify that equipment type, features, accessibility, installation and condition are in accordance with the contract specification. Manufacturer's statements shall certify provision of features which cannot be verified visually.

1. Drive belts. (I)
2. Governor type and features. (I)
3. Engine timing mark. (I)
4. Starting motor. (I)
5. Starting aids. (I)
6. Coolant type and concentration. (D)
7. Radiator drains. (I)
8. Block coolant drains. (I)
9. Coolant fill level. (I)
10. Coolant line connections. (I)
11. Coolant hoses. (I)
12. Combustion air filter. (I)
13. Intake air silencer. (I)
14. Lube oil type. (D)
15. Lube oil drain. (I)
16. Lube-oil filter. (I)
17. Lube-oil-fill level. (I)
18. Lube-oil line connections. (I)
19. Lube-oil lines. (I)

20. Fuel type. (D)
21. Fuel-level. (I)
22. Fuel-line connections. (I)
23. Fuel lines. (I)
24. Fuel filter. (I)
25. Access for maintenance. (I)
26. Voltage regulator. (I)
27. Battery-charger connections. (I)
28. Wiring & terminations. (I)
29. Instrumentation. (I)
30. Hazards to personnel. (I)
31. Base. (I)
32. Nameplates. (I)
33. Paint. (I)
34. Exhaust system. (I)
35. Access provided to controls. (I)
36. Enclosure. (I)
37. Engine & generator mounting bolts (proper application). (I)

3.5.4 Safety Run Tests

a. Perform and record engine manufacturer's recommended prestarting checks and inspections.

b. Start the engine, record the starting time, make and record engine manufacturer's after-starting checks and inspections during a reasonable warm-up period.

c. Activate the manual emergency stop switch and verify that the engine stops.

d. Remove the high and pre-high lubricating oil temperature sensing elements from the engine and temporarily install temperature gauge in their normal locations on the engine (required for safety, not for recorded data). Where necessary, provide temporary wiring harness to connect the sensing elements to their permanent electrical leads.

e. Start the engine, record the starting time, make and record engine manufacturer's after-starting checks and inspections and operate the engine generator-set at no load until the output voltage and frequency stabilize. Monitor the temporarily installed temperature gauges. If temperature reading exceeds the value for an alarm condition, activate the manual emergency stop switch.

f. Immerse the elements in a vessel containing controlled-temperature hot oil and record the temperature at which the pre-high alarm activates and the temperature at which the engine shuts down. Remove the temporary temperature gauges and reinstall the temperature sensors on the engine.

g. Remove the high and pre-high coolant temperature sensing elements from the engine and temporarily seal their normal location on the engine and temporarily install temperature gauges in their normal locations on the engine (required for safety, not for recorded data). Where necessary provide temporary wiring harness to connect the sensing elements to their permanent electrical leads.

h. Start the engine, record the starting time, make and record engine

manufacturer's after-starting checks and inspections and operate the engine generator-set at no load until the output voltage and frequency stabilize.

i. Immerse the elements in a vessel containing controlled-temperature hot oil and record the temperature at which the pre-high alarm activates and the temperature at which the engine shuts down. Remove the temporary temperature gauges and reinstall the temperature sensors on the engine.

j. Start the engine, record the starting time, make and record engine manufacturer's after-starting checks and inspections during a reasonable warm-up period.

k. Operate the engine generator-set for at least 30 minutes at 100 percent of service load.

l. Verify proper operation of the governor and voltage regulator.

m. Verify proper operation and setpoints of gauges and instruments.

n. Verify proper operation of ancillary equipment.

o. Manually adjust the governor to increase engine speed past the overspeed limit. Record the RPM at which the engine shuts down.

p. Start the engine, record the starting time, make and record engine manufacturer's after-starting checks and inspections and operate the engine generator-set for at least 15 minutes at 75 percent of rated load.

q. Manually fill the day tank to a level above the overfill limit. Record the level at which the overfill alarm sounds. Verify shutdown of the fuel transfer pump. Drain the day tank down below the overfill limit.

r. Shut down the engine. Remove the time-delay low lube oil pressure alarm bypass and try to start the engine. Record the results.

s. Attach a manifold to the engine oil system (at the oil sensor pressure port) that contains a shutoff valve in series with a connection for the engine's oil pressure sensor followed by an oil pressure gauge ending with a bleed valve. The engine's oil pressure sensor shall be moved from the engine to the manifold and its normal location on the engine temporarily sealed. The manifold shutoff valve shall be open and bleed valve closed.

t. Start the engine, record the starting time, make and record all engine manufacturer's after-starting checks and inspections and operate the engine generator-set for at least 15 minutes at 75 percent of service load.

u. Close the manifold shutoff valve. Slowly allow the pressure in the manifold to bleed off through the bleed valve while watching the pressure gauge. Record the pressure at which the engine shuts down. Catch oil spillage from the bleed valve in a container. Add the oil from the container back to the engine, remove the manifold, and reinstall the engine's oil pressure sensor on the engine.

v. Start the engine, record the starting time, make and record all engine manufacturer's after-starting checks and inspections and operate the engine generator-set for at least 15 minutes at 100% of service load. Record the maximum sound level in each frequency band at a distance of 75 feet from the end of the exhaust and air intake piping directly along the path of intake and discharge horizontal piping; or at a radius of 75 feet from the engine at 45 degrees apart in all directions for vertical piping. The measurements should comply with the paragraph SOUND LIMITATIONS. If a sound limiting enclosure is not provided, the muffler and air intake silencer shall be modified or replaced as required to meet the sound limitations of this specification. If the sound limitations can not be obtained by modifying or replacing the muffler and air intact silencer, the contractor shall notify the Contracting Officer and provide a recommendation for meeting the sound limitations.

w. Manually drain off fuel slowly from the tank to empty it to below the low fuel level limit and record the level at which the audible alarm sounds. Add fuel back to the tank to fill it above low level alarm limits.

3.5.5 Performance Tests

3.5.5.1 Continuous Engine Load Run Test

The engine-generator set and ancillary systems shall be tested at service load to: demonstrate durability; verify that heat of extended operation does not adversely affect or cause failure in any part of the system; and check all parts of the system. If the engine load run test is interrupted for any reason, the entire test shall be repeated. The engine load run test shall be accomplished principally during daylight hours, with an average ambient temperature of 80 degrees F. After each change in load in the following test, measure the vibration at the end bearings (front and back of engine, outboard end of generator) in the horizontal, vertical, and axial directions. Verify that the vibration is within the allowable range. Measurements are to be recorded after stabilization of an engine-generator set parameter (voltage, frequency, current, temperature, etc.). Stabilization is considered to have occurred when measurements are maintained within the specified bandwidths or tolerances, for a minimum of four consecutive readings. Data taken at 15 minutes intervals shall include the following:

a. Electrical: Output amperes, voltage, real and reactive power, power factor, frequency.

b. Pressure: Lube-oil.

c. Temperature: Coolant.
Lube-oil.
Ambient.

(1) Perform and record engine manufacturer's recommended prestarting checks and inspections. Include as a minimum checking of coolant fluid, fuel, and lube-oil levels.

(2) Start the engine; make and record engine manufacturer's after-starting checks and inspections during a reasonable warm-up

period.

(3) Operate the engine generator-set for at least 2 hours at 75 percent of service load.

(4) Increase load to 100%of service load and operate the engine generator-set for at least 2 hours.

(5) Remove load from the engine-generator set.

3.5.5.2 Load Acceptance Test

Engine manufacturer's recommended prestarting checks and inspections shall be performed and recorded. The engine shall be started, and engine manufacturer's after-starting checks and inspections made and recorded during a reasonable warm-up period. For the following steps, the output line-line and line-neutral voltages and frequency shall be recorded after performing each step instruction (after stabilization of voltage and frequency). Stabilization is considered to have occurred when measurements are maintained within the specified bandwidths or tolerances, for a minimum of four consecutive readings.

a. Apply load in steps no larger than the Maximum Step Load Increase to load the engine-generator set to 100 of Service Load.

b. Verify that the engine-generator set responds to the load addition and that the output voltage returns to and stabilizes within the rated bandwidths.

3.6 FINAL INSPECTION AND TESTING

a. Start the engine, record the starting time, make and record all engine manufacturer's after-starting checks and inspections during a reasonable warm-up period.

b. Increase the load in steps no greater than the maximum step load increase to 100% of service load, and operate the engine-generator set for at least 30 minutes. Measure the vibration at the end bearings (front and back of engine, outboard end of generator) in the horizontal, vertical, and axial directions. Verify that the vibration is within the same range as previous measurements and is within the required range.

c. Remove load and shut down the engine-generator set after the recommended cool down period. Perform the pre-test inspections and take necessary corrective actions.

d. Remove the lube oil filter and have the oil and filter examined by the engine manufacturer for excessive metal, abrasive foreign particles, etc. Any corrective action shall be verified for effectiveness by running the engine for 4 hours at service load, then re-examining the oil and filter.

e. Remove the fuel filter and examine the filter for trash, abrasive foreign particles, etc.

f. Visually inspect and check engine and generator mounting bolts for tightness and visible damage.

g. Replace air, oil, and fuel filters with new filters.

3.7 MANUFACTURER'S FIELD SERVICE

3.7.1 Onsite Training

The Contractor shall conduct training course for operating staff as designated by the Contracting Officer. The training period shall consist of a total 4 hours of normal working time and shall start after the system is functionally completed but prior to final acceptance. The course instructions shall cover pertinent points involved in operating, starting, stopping, servicing the equipment, as well as all major elements of the operation and maintenance manuals. Additionally, the course instructions shall demonstrate all routine maintenance operations such as oil change, oil filter change, and air filter change.

3.7.2 Manufacturer's Representative

The engine generator-set manufacturer shall furnish a qualified representative to supervise the installation of the engine generator-set, assist in the performance of the onsite tests, and instruct personnel as to the operational and maintenance features of the equipment.

3.8 INSTRUCTIONS

Two sets of instructions shall be typed in 8 1/2 x 11 inches format, laminated in weatherproof plastic, and placed in three-ring vinyl binders. The binders shall be placed as directed by the Contracting Officer. The instructions shall be in place prior to acceptance of the engine generator set installation. First set of instructions shall include a one-line diagram, wiring and control diagrams and a complete layout of the system. Second set of instructions shall include the condensed operating instructions describing manufacturer's pre-start checklist and precautions; startup procedures for test-mode, manual-start mode, and automatic-start mode (as applicable); running checks, procedures, and precautions; and shutdown procedures, checks, and precautions. Instructions shall include procedures for interrelated equipment (such as heat recovery systems, co-generation, load-shedding, and automatic transfer switches).

3.9 ACCEPTANCE

Final acceptance of the engine-generator set will not be given until the Contractor has successfully completed all tests and after all defects in installation material or operation have been corrected.

-- End of Section --

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SECTION 16370

ELECTRICAL DISTRIBUTION SYSTEM, AERIAL

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C29.1	(1988; R 1996) Electrical Power Insulators - Test Methods
ANSI C29.2	(1992) Insulators - Wet-Process Porcelain and Toughened Glass - Suspension Type
ANSI C29.5	(1984; R 1995) Wet-Process Porcelain Insulators - Low- and Medium-Voltage Types
ANSI C29.6	(1996) Wet-Process Porcelain Insulators - High-Voltage Pin Type
ANSI C29.8	(1985; R 1995) Wet-Process Porcelain Insulators - Apparatus, Cap and Pin Type
ANSI C29.9	(1983; R 1996) Wet-Process Porcelain Insulators - Apparatus, Post-Type
ANSI C57.12.20	(1997) Overhead Type Distribution Transformers, 500 KVA and Smaller: High Voltage 34 500 Volts and Below: Low Voltage, 7970/13 800 Y Volts and Below
ANSI C135.1	(1979) Galvanized Steel Bolts and Nuts for Overhead Line Construction
ANSI C135.2	(1999) Threaded Zinc-Coated Ferrous Strand-Eye Anchor Rods and Nuts for Overhead Line Construction
ANSI C135.4	(1987) Zinc-Coated Ferrous Eyebolts and Nuts for Overhead Line Construction
ANSI C135.14	(1979) Staples with Rolled or Slash Points for Overhead Line Construction
ANSI C135.22	(1988) Zinc-Coated Ferrous Pole-Top Insulator Pins with Lead Threads for Overhead Line Construction

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 123/A 123M	(2002) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 153/A 153M	(2001a) Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A 475	(1998) Zinc-Coated Steel Wire Strand
ASTM A 575	(1996; R 2002) Steel Bars, Carbon, Merchant Quality, M-Grades
ASTM A 576	(1990b; R 2000) Steel Bars, Carbon, Hot-Wrought, Special Quality
ASTM B 1	(2001) Hard-Drawn Copper Wire
ASTM B 8	(1999) Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
ASTM B 117	(1997) Operating Salt Spray (Fog) Apparatus
ASTM B 228	(1998) Concentric-Lay-Stranded Copper-Clad Steel Conductors
ASTM B 232/B 232M	(2001e1) Concentric-Lay-Stranded Aluminum Conductors, Coated-Steel Reinforced (ACSR)
ASTM B 416	(1998) Concentric-Lay-Stranded Aluminum-Clad Steel Conductors
ASTM D 923	(1997) Sampling Electrical Insulating Liquids
ASTM D 1654	(1992; R 2000) Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
ASTM D 4059	(2000) Analysis of Polychlorinated Biphenyls in Insulating Liquids by Gas Chromatography

AMERICAN WOOD-PRESERVERS' ASSOCIATION (AWPA)

AWPA C25	(2001) Sawn Crossarms - Preservative Treatment by Pressure Processes

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2	(2002) National Electrical Safety Code
IEEE C37.41	(2000) Design Tests for High-Voltage Fuses, Distribution Enclosed Single-Pole Air Switches, Fuse Disconnecting Switches, and Accessories
IEEE C57.12.00	(2000) General Requirements for Liquid-Immersed Distribution, Power, and

	Regulating Transformers
IEEE C57.19.00	(1991; R 1997) Standard General Requirements and Test Procedures for Outdoor Power Apparatus Bushings
IEEE C57.19.01	(2000) Performance Characteristics and Dimensions for Outdoor Apparatus Bushings
IEEE C62.1	(1989; R 1994) Surge Arresters for AC Power Circuits
IEEE C62.2	(1987; R 1994) Guide for the Application of Gapped Silicon-Carbide Surge Arresters for Alternating Current Systems
IEEE C62.11	(1999) Metal-Oxide Surge Arresters for AC Power Circuits
IEEE Std 81	(1983) Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System (Part 1)
IEEE Std 100	(2000) Electrical and Electronics Terms

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA HV 2	(1984; R 1996) Application Guide for Ceramic Suspension Insulators
NEMA LA 1	(1992; R 1999) Surge Arresters
NEMA SG 2	(1993) High Voltage Fuses

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2002) National Electrical Code

U.S. DEPARTMENT OF AGRICULTURE (USDA)

RUS REA Bull 1728H-701	(1993) REA Specification for Wood Crossarms (Solid and Laminated), Transmission Timbers and Pole Keys

UNDERWRITERS LABORATORIES (UL)

UL 467	(1993; Rev thru Feb 2001) Grounding and Bonding Equipment
UL 486A	(1997; Rev thru May 2001) Wire Connectors and Soldering Lugs for Use with Copper Conductors
UL 486B	(1997; Rev thru May 2001) Wire Connectors for Use with Aluminum Conductors

1.2 GENERAL REQUIREMENTS

1.2.1 Terminology

Terminology used in this specification is as defined in IEEE Std 100.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with SECTION 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Electrical Distribution System; G-AE

Detail drawings consisting of equipment drawings, illustrations, schedules, instructions, diagrams and other information necessary to define the installation and enable the Government to check conformity with the requirements of the contract drawings. Detail drawings shall as a minimum include:

a. Poles.

b. Crossarms.

c. Transformers.

d. Conductors.

e. Insulators.

f. Surge arresters.

If departures from the contract drawings are deemed necessary by the Contractor, complete details of such departures shall be submitted with the detail drawings. Approved departures shall be made at no additional cost to the Government.

Detail drawings shall show how components are assembled, function together and how they will be installed on the project. Data and drawings for component parts of an item or system shall be coordinated and submitted as a unit. Data and drawings shall be coordinated and included in a single submission. Multiple submissions for the same equipment or system are not acceptable except where prior approval has been obtained from the Contracting Officer. In such cases, a list of data to be submitted later shall be included with the first submission. Detail drawings shall consist of the following:

a. Detail drawings showing physical arrangement, construction details, connections, finishes, materials used in fabrication, provisions for conduit or busway entrance, access requirements for installation and maintenance, physical size, electrical characteristics, foundation and support details, and equipment weight. Drawings shall be drawn to scale and/or dimensioned. Optional items shall be clearly identified as included or excluded.

b. Internal wiring diagrams of equipment showing wiring as actually provided for this project. External wiring connections shall be clearly identified.

As-Built Drawings of the Construction; G-AO

The as-built drawings shall be a record of the construction as installed. The drawings shall include the information shown on the contract drawings as well as deviations, modifications, and changes from the contract drawings, however minor. The as-built drawings shall be kept at the job site and updated daily. The as-built drawings shall be a full sized set of prints marked to reflect deviations, modifications, and changes. The as-built drawings shall be complete and show the location, dimensions, part identification, and other information. Additional sheets may be added. The as-built drawings shall be jointly inspected for accuracy and completeness by the Contractor's quality control representative and by the Contracting Officer prior to the submission of each monthly pay estimate. Upon completion of the work, the Contractor shall submit three full sized sets of the marked prints to the Contracting Officer for approval. If upon review, the as-built drawings are found to contain errors and/or omissions, they will be returned to the Contractor for correction. The Contractor shall correct and return the as-built drawings to the Contracting Officer for approval within ten calendar days from the time the drawings are returned to the Contractor.

SD-03 Product Data

Nameplates; G-AO

Catalog cuts, brochures, circulars, specifications, product data, and printed information in sufficient detail and scope to verify compliance with the requirements of the contract documents.

Material and Equipment; G-AO

A complete itemized listing of equipment and materials proposed for incorporation into the work. Each entry shall include the item number, the quantity of items proposed, and the name of the manufacturer of the item.

General Installation Requirements; G-AO

As a minimum, installation procedures for regulators, transformers and reclosers. Procedures shall include diagrams, instructions, and precautions required to install, adjust, calibrate, and test the devices and equipment.

SD-06 Test Reports

Factory Tests; G-AO

Certified factory test reports shall be submitted when the manufacturer performs routine factory tests, including tests required by standards listed in paragraph REFERENCES. Results of factory tests performed shall be certified by the manufacturer, or an approved testing laboratory, and submitted within 7 days

following successful completion of the tests specified in applicable publications or in these specifications.

Field Testing; G-AO

A proposed field test plan 30 days prior to testing the installed system. No field test shall be performed until the test plan is approved. The test plan shall consist of complete field test procedures including tests to be performed, test equipment required, and tolerance limits.

Operating Tests; G-AO

Six copies of the information described below in 8-1/2 by 11 inch binders having a minimum of 5 rings, and including a separate section for each test. Sections shall be separated by heavy plastic dividers with tabs.

a. A list of equipment used, with calibration certifications.

b. A copy of measurements taken.

c. The dates of testing.

d. The equipment and values to be verified.

e. The condition specified for the test.

f. The test results, signed and dated.

g. A description of adjustments made.

SD-07 Certificates

Material and Equipment; G-AO

Where materials or equipment are specified to conform to the standards of the Underwriters Laboratories (UL) or to be constructed or tested, or both, in accordance with the standards of the American National Standards Institute (ANSI), the Institute of Electrical and Electronics Engineers (IEEE), or the National Electrical Manufacturers Association (NEMA), the Contractor shall submit proof that the items provided under this section of the specifications conform to such requirements. The label of, or listing by, UL will be acceptable as evidence that the items conform thereto. Either a certification or a published catalog specification data statement, to the effect that the item is in accordance with the referenced ANSI or IEEE standard, will be acceptable as evidence that the item conforms thereto. A similar certification or published catalog specification data statement to the effect that the item is in accordance with the referenced NEMA standard, by a company listed as a member company of NEMA, will be acceptable as evidence that the item conforms thereto. In lieu of such certification or published data, the Contractor may submit a certificate from a recognized testing agency equipped and competent to perform such services, stating that the items have been tested and that they conform to the requirements listed, including methods of testing of the specified agencies.

SD-10 Operation and Maintenance Data

Electrical Distribution System; G-AO

Six copies of Operation and Maintenance manuals electrical distribution system shall be provided, within 7 calendar days following the completion of tests and shall include assembly, installation, operation and maintenance instructions, spare parts data which provides supplier name, current cost, catalog order number, and a recommended list of spare parts to be stocked. Manuals shall also include data outlining detailed procedures for system startup and operation, and a troubleshooting guide which lists possible operational problems and corrective action to be taken. A brief description of all equipment, basic operating features, and routine maintenance requirements shall also be included. Documents shall be bound in a binder marked or identified on the spine and front cover. A table of contents page shall be included and marked with pertinent contract information and contents of the manual. Tabs shall be provided to separate different types of documents, such as catalog ordering information, drawings, instructions, and spare-parts data. Index sheets shall be provided for each section of the manual when warranted by the quantity of documents included under separate tabs or dividers. Three additional copies of the instructions manual shall be provided within 30 calendar days following the manuals.

Three additional copies of the instructions manual within 30 calendar days following the approval of the manuals.

1.4 DELIVERY, STORAGE, AND HANDLING

Devices and equipment shall be visually inspected by the Contractor when received and prior to acceptance from conveyance. Stored items shall be protected from the environment in accordance with the manufacturer's published instructions. Damaged items shall be replaced. Oil filled transformers and switches shall be stored in accordance with the manufacturer's requirements.

1.5 EXTRA MATERIALS

One additional spare fuse or fuse element for each furnished fuse or fuse element shall be delivered to the Contracting Officer when the electrical system is accepted. Two complete sets of all special tools required for maintenance shall be provided, complete with a suitable tool box. Special tools are those that only the manufacturer provides, for special purposes (to access compartments, or operate, adjust, or maintain special parts).

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

Products shall conform to the following requirements. Items of the same classification shall be identical including equipment, assemblies, parts, and components.

2.2 STANDARD PRODUCT

Material and equipment shall be the standard product of a manufacturer

regularly engaged in the manufacture of the product and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening.

2.3 NAMEPLATES

2.3.1 General

Each major component shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a nameplate securely attached to the equipment. Equipment containing liquid-dielectrics shall have the type of dielectric on the nameplate. Nameplates shall be made of noncorrosive metal. As a minimum, nameplates shall be provided for transformers, regulators, circuit breakers, capacitors, meters and switches.

2.3.2 Liquid-Filled Transformer Nameplates

Power transformers shall be provided in accordance with IEEE C57.12.00. Nameplates shall indicate the number of gallons and composition of liquid-dielectric, and shall be permanently marked with a statement that the transformer dielectric to be supplied is non-polychlorinated biphenyl. If transformer nameplate is not so marked, the Contractor shall furnish manufacturer's certification for each transformer that the dielectric in non-PCB classified, with less than 2 ppm PCb content in accordance with paragraph LIQUID DIELECTRICS. Certifications shall be related to serial numbers on transformer nameplates. Transformer dielectric exceeding the 2 ppm PCB content or transformers without certification will be considered as PCB insulated and will not be accepted.

2.4 CORROSION PROTECTION

2.4.1 Aluminum Materials

Aluminum shall not be used in contact with earth or concrete. Where aluminum conductors are connected to dissimilar metal, fittings conforming to UL 486B shall be used.

2.4.2 Ferrous Metal Materials

2.4.2.1 Hardware

Ferrous metal hardware shall be hot-dip galvanized in accordance with ASTM A 153/A 153M and ASTM A 123/A 123M.

2.4.2.2 Equipment

Equipment and component items, including but not limited to transformers and ferrous metal luminaires not hot-dip galvanized or porcelain enamel finished, shall be provided with corrosion-resistant finishes which shall withstand 480 hours of exposure to the salt spray test specified in ASTM B 117 without loss of paint or release of adhesion of the paint primer coat to the metal surface in excess of 1/16 inch from the test mark. The described test mark and test evaluation shall be in accordance with ASTM D 1654 with a rating of not less than 7 in accordance with TABLE 1, (procedure A). Cut edges or otherwise damaged surfaces of hot-dip galvanized sheet steel or mill galvanized sheet steel shall be coated with a zinc rich paint conforming to the manufacturer's standard.

2.4.3 Finishing

Painting required for surfaces not otherwise specified and finish painting of items only primed at the factory shall be as specified in SECTION 09900 PAINTS AND COATINGS.

2.5 CONDUCTORS, CONNECTORS, AND SPLICES

2.5.1 Aluminum-Composition Conductors

Aluminum-conductor-steel-reinforced, ACSR, shall comply with ASTM B 232/B 232M.

2.5.2 Copper Conductors

Hard-drawn-copper conductors shall comply with ASTM B 1 and ASTM B 8 as appropriate for the conductor size.

2.5.3 Connectors and Splices

Connectors and splices shall be of copper alloys for copper conductors, aluminum alloys for aluminum-composition conductors, and a type designed to minimize galvanic corrosion for copper to aluminum-composition conductors. Aluminum-composition and aluminum-composition to copper shall comply with UL 486B, and copper-to-copper shall comply with UL 486A.

2.6 MEDIUM-VOLTAGE LINES

2.6.1 Bare Medium-Voltage Lines

Bare medium-voltage line conductors shall be aluminum-conductor-steel-reinforced, ACSR. Conductor types shall not be mixed on any project, unless specifically indicated. Conductors larger than No. 2 AWG shall be stranded.

2.7 POLES AND HARDWARE

Poles shall be of lengths and classes indicated.2.7.1 Pole Line Hardware

Zinc-coated hardware shall comply with ANSI C135.1, ANSI C135.2, ANSI C135.4, ANSI C135.14 ANSI C135.22. Steel hardware shall comply with ASTM A 575 and ASTM A 576. Hardware shall be hot-dip galvanized in accordance with ASTM A 153/A 153M. Pole-line hardware shall be hot-dip galvanized steel. Washers shall be installed under boltheads and nuts on wood surfaces and elsewhere as required. Washers used on through-bolts and double-arming bolts shall be approximately 2-1/4 inches square and 3/16 inch thick. The diameter of holes in washers shall be the correct standard size for the bolt on which a washer is used. Washers for use under heads of carriage-bolts shall be of the proper size to fit over square shanks of bolts. Eye bolts, bolt eyes, eyenuts, strain-load plates, lag screws, guy clamps, fasteners, hooks, shims, and clevises shall be used wherever required to support and to protect poles, brackets, crossarms, guy wires, and insulators.

2.7.2 Guy Assemblies

Guy assemblies shall be aluminum-clad steel in accordance with ASTM B 416, copper-clad steel in accordance with ASTM B 228 or zinc-coated steel in accordance with ASTM A 475. Guy assemblies, including insulators and attachments, shall provide a strength exceeding the required guy strength.

Three-eye thimbles shall be provided on anchor rods to permit attachment of individual primary, secondary, and communication down guys. Anchors shall provide adequate strength to support all loads. Guy strand shall be 7 strand. Guy material shall be Class 30 EHS copper-clad steel Class C zinc-coated-steel high-strength grade or aluminum-clad-steel-strand, with a minimum breaking strength not less than 6000 pounds , except where two or more guys are used to provide the required strength. Guy rods shall be not less than 8 feet in length by 1 inch in diameter.

2.8 INSULATORS

Insulators shall comply with NEMA HV 2 for general requirements. Suspension insulators shall be used at corners, angles, dead-ends, other areas where line insulators do not provide adequate strength, and as indicated. Mechanical strength of suspension insulators and hardware shall exceed the rated breaking strength of the attached conductors.

2.8.1 Medium-Voltage Line Insulators

Medium-voltage line insulators shall comply with ANSI C29.2, ANSI C29.5, and ANSI C29.6, and as applicable. Ratings shall not be lower than the ANSI classes indicated in TABLE I. Horizontal line-post insulators shall be used for armless construction and shall have the same mechanical and electrical ratings as vertical line-post insulators for the ANSI class indicated, but shall be modified to be suitable for horizontal installation. Where line-post insulators are used for angles greater than 15 degrees, clamp-top fittings shall be provided as well as for other locations shown. Conductor clamps for use with clamp-top, line-post insulators shall be hot-dip galvanized malleable iron for copper conductors and aluminum alloy for aluminum-composition conductors. Either line-post or pin insulators may be used for crossarm construction. Pin insulators for use on voltages in excess of 6 kV phase-to-phase shall be radio-interference-freed or else line-post insulators shall be used.

TABLE I

MINIMUM ANSI RATING OF MEDIUM-VOLTAGE INSULATORS BY CLASS

Voltage Level	Line-Post	Pin	Suspension
6 kV to 15 kV	57-1 or 11 57-2 or 12	55-5 56-3	Two 52-2 Two 52-3 or 4

2.8.2 Apparatus Insulators

Apparatus insulators shall comply with IEEE C57.19.00, IEEE C57.19.01, ANSI C29.8, and ANSI C29.9 as applicable.

2.9 CROSSARM ASSEMBLIES

2.9.1 Crossarms

Crossarms shall comply with RUS REA Bull 1728H-701 and shall be solid wood, distribution type, except cross-sectional area with pressure treatment conforming to AWPA C25, and a 1/4 inch, 45 degree chamfer on all top edges. Cross-sectional area minimum dimensions shall be 4-1/4 inches in height by 3-l/4 inches in depth in accordance with IEEE C2 for Grade B construction.

Crossarms shall be 8 feet in length, except that 10 foot crossarms shall be used for crossarm-mounted banked single-phase transformers or elsewhere as indicated. Crossarms shall be machined, chamfered, trimmed, and bored for stud and bolt holes before pressure treatment. Factory drilling shall be provided for pole and brace mounting, for four pin or four vertical line-post insulators, and for four suspension insulators, except where otherwise indicated or required. Drilling shall provide required climbing space and wire clearances. Crossarms shall be straight and free of twists to within 1/10 inch per foot of length. Bend or twist shall be in one direction only.

2.10 FUSES AND SWITCHES, MEDIUM-VOLTAGE

2.10.1 Fuse Cutouts

Medium-voltage fuses and cutouts shall comply with NEMA SG 2 and shall be of the loadbreak open type construction rated 15 kV and of the heavy -duty type. Open-link cut-outs are not acceptable. Fuses shall be either indicating or dropout type. Fuse ratings shall be as indicated. Fuse cutouts shall be equipped with mounting brackets suitable for the indicated installations.

2.11 TRANSFORMERS

Transformers shall comply with IEEE C57.12.00 for general requirements and ANSI C57.12.20 for specific requirements for overhead transformers. Overhead distribution transformers shall be of the outdoor type, mineral-oil-insulated liquid single-phase as indicated and have two separate windings per phase. Transformers shall be provided with necessary auxiliary mounting devices suitable for the indicated installation. Transformers shall have two 2-1/2 percent rated kVA high-voltage taps above and below rated primary voltage. Transformer installations shall include one primary fuse cutout and one surge arrester for each ungrounded phase conductor. Self-protected transformers are not acceptable. Transformer tanks shall have a standard gray finish.

2.12 SURGE ARRESTERS

Surge arresters shall comply with NEMA LA 1 and IEEE C62.1, IEEE C62.2, and IEEE C62.11, and shall be provided for protection of aerial-to-underground transitions, automatic circuit reclosers, capacitor equipment, group-operated load-interrupter switches, transformers and other indicated equipment. Arresters shall be distribution class, rated as shown. Arresters shall be equipped with mounting brackets suitable for the indicated installations. Arresters shall be of the metal-oxide varistor type suitable for outdoor installations.

2.13 GROUNDING AND BONDING

2.13.1 Driven Ground Rods

Ground rods shall be of copper-clad steel conforming to UL 467 not less than 3/4 inch in diameter by 10 feet in length of the sectional type driven full length into the earth.

2.13.2 Grounding Conductors

Grounding conductors shall be bare, except where installed in conduit with associated phase conductors. Insulated conductors shall be of the same

material as the phase conductors and green color-coded, except that conductors shall be rated no more than 600 volts. Bare conductors shall be ASTM B 8 soft-drawn unless otherwise indicated. Aluminum is not acceptable.

2.14 WARNING SIGNS

Warning signs shall be porcelain enameled steel or approved equal. Voltage warning signs shall comply with IEEE C2.

2.15 LIQUID DIELECTRICS

Liquid dielectrics for transformers and other liquid-filled electrical equipment shall be non-polychlorinated biphenyl (PCB) mineral-oil or less-flammable liquid as specified. Nonflammable fluids shall not be used. Tetrachloroethylene (perchloroethylene) and 1, 2, 4 tetrachlorobenzene fluids shall not be used. Liquid dielectrics in retrofitted equipment shall be certified by the manufacturer as having less than 2 parts-per-million (ppm) PCB content. In lieu of the manufacturer's certification, the Contractor may submit a test sample of the dielectric in accordance with ASTM D 923 and have tests performed per ASTM D 4059 at a testing facility approved by the Contracting Officer. Equipment with test results indicating PCB level exceeding 2 ppm shall be replaced.

2.16 FACTORY TESTS

Factory tests shall be performed, as follows, in accordance with the applicable publications and with other requirements of these specifications. The Contracting Officer shall be notified at least 10 days before the equipment is ready for testing.

a. High-Voltage Fuses: Manufacturer's standard tests in accordance with IEEE C37.41.

b. Electric Power Insulators: Manufacturer's standard tests in accordance with ANSI C29.1.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

Equipment and devices shall be installed and energized in accordance with the manufacturer's published instructions. Circuits installed in conduits or underground and splices and terminations for medium-voltage cable shall conform to the requirements of SECTION 16375 ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND. Secondary circuits installed in conduit on poles shall conform to the requirements of SECTION 16415 ELECTRICAL WORK, INTERIOR.

3.1.1 Conformance to Codes

The installation shall comply with the requirements and recommendations of IEEE C2 for heavy loading districts, Grade B construction. No reduction in clearance shall be made. The installation shall also comply with the applicable parts of NFPA 70.

3.1.2 Verification of Dimensions

The Contractor shall become familiar with details of the work, shall verify dimensions in the field, and shall notify the Contracting Officer of any

discrepancy before performing any work.

3.2 POLE INSTALLATION

Joint-use electric/roadway-lighting poles for overhead electric and communication lines shall be poles utilizing crossarm construction. Crossarm construction shall be provided for support of other equipment, except where direct-pole mounting is indicated. Provision for communication services is required on pole-line construction, except where specifically noted otherwise. A vertical pole space of not less than 2 feet shall be reserved at all locations.

3.3 CROSSARM MOUNTING

Crossarms shall be bolted to poles with 5/8 inchthrough-bolts with square washers at each end. Bolts shall extend not less than 1/8 inch nor more than 2 inches beyond nuts. On single crossarm construction, the bolt head shall be installed on the crossarm side of the pole. Metal crossarm braces shall be provided on crossarms. Flat braces may be provided for 8 foot crossarms and shall be 1/4 by 1-1/4 inches, not less than 28 inches in length. Flat braces shall be bolted to arms with 3/8 inch carriage bolts with round or square washers between boltheads and crossarms, and secured to poles with 1/2 by 4 inch lag screws after crossarms are leveled and aligned. Angle braces are required for 10 foot crossarms and shall be 60 inch span by 18 inch drop formed in one piece from 1-1/2 by 1-1/2 by 3/16 inch angle. Angle braces shall be bolted to crossarms with 1/2 inch bolts with round or square washers between boltheads and crossarms, and secured to poles with 5/8 inch through-bolts. Double crossarms shall be securely held in position by means of 5/8 inch double-arming bolts. Each double-arming bolt shall be equipped with four nuts and four square washers.

3.3.1 Line Arms and Buck Arms

Line arms and buck arms shall be set at right angles to lines for straight runs and for angles 45 degrees and greater; and line arms shall bisect angles of turns of less than 45 degrees. Dead-end assemblies shall be used for turns where shown. Buckarms shall be installed, as shown, at corners and junction poles. Double crossarms shall be provided at ends of joint use or conflict sections, at dead-ends, and at angles and corners to provide adequate vertical and longitudinal strength. Double crossarms shall be provided at each line-crossing structure and where lines not attached to the same pole cross each other.

3.3.2 Equipment Arms

Equipment arms shall be set parallel or at right angles to lines as required to provide climbing space. Equipment arms shall be located below line construction to provide necessary wire and equipment clearances.

3.4 GUY INSTALLATION

Guys shall be provided where shown, with loads and strengths as indicated, and wherever conductor tensions are not balanced, such as at angles, corners, and dead-ends. Where a single guy will not provide the required strength, two or more guys shall be provided. Where guys are wrapped around poles, at least two guy hooks shall be provided and pole shims shall be provided where guy tension exceeds 6000 pounds. Guy clamps 6 inches in length with three 5/8 inch bolts, or offset-type guy clamps, or approved guy grips shall be provided at each guy terminal. Guy-strain insulators

shall be provided in each guy for wood poles. Multiple-helix screw anchors shall be provided in marshy ground; rock anchors shall be installed in rock at right angles to guys, elsewhere anchors shall be of an expanding type, except that power installed screw anchors of equivalent holding power are acceptable. A half-round yellow polyvinyl, fiberglass, or other suitable plastic guy marker, not less than 8 feet in length, shall be provided at the anchor end of each guy shown, securely clamped to the guy or anchor at the bottom and top of the marker. Holding capacities for down guys shall be based on a lead angle of 45 degrees.

3.5 CONDUCTOR INSTALLATION

3.5.1 Line Conductors

Unless otherwise indicated, conductors shall be installed in accordance with manufacturer's approved tables of sags and tensions. Proper care shall be taken in handling and stringing conductors to avoid abrasions, sharp bends, cuts, kinks, or any possibility of damage to insulation or conductors. Conductors shall be paid out with the free end of conductors fixed and cable reels portable, except where terrain or obstructions make this method unfeasible. Bend radius for any insulated conductor shall not be less than the applicable NEMA specification recommendation. Conductors shall not be drawn over rough or rocky ground, nor around sharp bends. When installed by machine power, conductors shall be drawn from a mounted reel through stringing sheaves in straight lines clear of obstructions. Initial sag and tension shall be checked by the Contractor, in accordance with the manufacturer's approved sag and tension charts, within an elapsed time after installation as recommended by the manufacturer.

3.5.2 Connectors and Splices

Connectors and splices shall be mechanically and electrically secure under tension and shall be of the nonbolted compression type. The tensile strength of any splice shall be not less than the rated breaking strength of the conductor. Splice materials, sleeves, fittings, and connectors shall be noncorrosive and shall not adversely affect conductors. Aluminum-composition conductors shall be wire brushed and an oxide inhibitor applied before making a compression connection. Connectors which are factory-filled with an inhibitor are acceptable. Inhibitors and compression tools shall be of types recommended by the connector manufacturer. Primary line apparatus taps shall be by means of hot line clamps attached to compression type bail clamps (stirrups). Low-voltage connectors for copper conductors shall be of the solderless pressure type. Noninsulated connectors shall be smoothly taped to provide a waterproof insulation equivalent to the original insulation, when installed on insulated conductors. On overhead connections of aluminum and copper, the aluminum shall be installed above the copper.

3.5.3 Conductor-To-Insulator Attachments

Conductors shall be attached to insulators by means of clamps, shoes or tie wires, in accordance with the type of insulator. For insulators requiring conductor tie-wire attachments, tie-wire sizes shall be as indicated in TABLE II.

TABLE II

TIE-WIRE REQUIREMENTS

CONDUCTOR Copper (AWG)	TIE WIRE Soft-Drawn Copper (AWG)
6	8
4 and 2	6
1 through 3/0	4
4/0 and larger	2
AAC, AAAC, or ACSR (AWG)	AAAC OR AAC (AWG)
Any size	6 or 4

3.5.4 Armor Rods

Armor rods shall be provided for AAC, AAAC, and ACSR conductors. Armor rods shall be installed at supports, except armor rods will not be required at primary dead-end assemblies if aluminum or aluminum-lined zinc-coated steel clamps are used. Lengths and methods of fastening armor rods shall be in accordance with the manufacturer's recommendations. For span lengths of less than 200 feet, flat aluminum armor rods may be used. Flat armor rods, not less than 0.03 by 0.25 inch shall be used on No. 1 AWG AAC and AAAC and smaller conductors and on No. 5 AWG ACSR and smaller conductors. On larger sizes, flat armor rods shall be not less than 0.05 by 0.30 inches..For span lengths of 200 feet or more, preformed round armor rods shall be used.

3.6 TRANSFORMER INSTALLATION

Transformers shall be carefully installed so as not to scratch finishes or damage bushings. Transformers shall be installed in accordance with the manufacturer's instructions. After installation, surfaces shall be inspected and scratches shall be touched up with a finish provided by the transformer manufacturer for this purpose.

3.7 CONNECTIONS TO UTILITY LINES

The Contractor shall coordinate the work with the Contracting Officer and shall provide for final connections to the installation electric lines.

3.8 CONNECTIONS BETWEEN AERIAL AND UNDERGROUND SYSTEMS

Connections between aerial and underground systems shall be made as shown. Underground cables shall be extended up poles in conduit to cable terminations. Conduits shall be secured to poles by conduit supports spaced not more than 10 feet apart and with one support not more than 12 inches from any bend or termination. Cables shall be supported by devices separate from the conduit or guard, near their point of exit from the riser conduit or guard. Risers shall be equipped with bushings to protect cables. Capnut potheads shall be used to terminate medium-voltage multiple-conductor cable.

3.9 CONNECTIONS TO BUILDINGS

3.9.1 Underground Services

Connections to buildings shall be made at the point indicated and shall be terminated at the service entrance equipment terminals. Cable pulling shall be in accordance with SECTION 16375, ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND. Service entrance conduits with termination fittings and conductors within the building shall conform to the requirements of SECTION 16415 ELECTRICAL WORK, INTERIOR.

3.10 GROUNDING

Noncurrent-carrying metal parts of equipment and conductor assemblies, such as luminaires, medium-voltage cable terminations and messengers, metal poles, operating mechanisms of pole top switches, panel enclosures, transformers, capacitors, recloser frames (cases) and other noncurrent-carrying metal items shall be grounded. Additional grounding of equipment, neutral, and surge arrester grounding systems shall be installed at poles where indicated.

3.10.1 Grounding Electrodes

Grounding electrodes shall be installed as follows:

a. Driven rod electrodes - Unless otherwise indicated, ground rods shall be located approximately 3 feet out from base of the pole and shall be driven into the earth until the tops of the rods are approximately 1 foot below finished grade. Multiple rods shall be evenly spaced at least 10 feet apart and connected together 2 feet below grade with a minimum No. 6 bare copper conductor.

b. Ground Resistance - The maximum resistance of a driven ground rod shall not exceed 25 ohms under normally dry conditions. Whenever the required ground resistance is not met, provide additional electrodes interconnected with grounding conductors , to achieve the specified ground resistance. The additional electrodes will be up to three, 8 feet rods spaced a minimum of 10 feet apart, . In high ground resistance, UL listed chemically charged ground rods may be used. If the resultant resistance exceeds 25 ohms measured not less than 48 hours after rainfall, the Contracting Officer shall be notifies immediately. Connections below grade shall be fusion welded. Connections above grade shall be fusion welded or shall use UL 467 approved connectors.

3.10.2 Grounding and Bonding Connections

Connections above grade shall be made by the fusion-welding process or with bolted solderless connectors in compliance with UL 467, and those below grade shall be made by a fusion-welding process. Where grounding conductors are connected to aluminum-composition conductors, specially treated or lined copper-to-aluminum connectors suitable for this purpose shall be used.

3.10.3 Grounding Electrode Conductors

On multi-grounded circuits, as defined in IEEE C2, provide a single continuous vertical grounding electrode conductor. Neutrals, surge arresters, and equipment grounding conductors shall be bonded to this

conductor. For single grounded or ungrounded systems, provide a grounding conductor for the surge arrester and equipment grounding conductors and a separate grounding conductor for the secondary neutrals. Grounding electrode conductors shall be sized as shown. Secondary system neutral conductors shall be connected directly to the transformer neutral bushings, then connected with a neutral bonding jumper between the transformer neutral bushing and the vertical grounding electrode conductor, as shown. Grounding electrode conductors shall be stapled to wood poles at intervals not exceeding 2 feet. Bends greater than 45 degrees in grounding electrode conductor are not permitted.

3.11 FIELD TESTING

3.11.1 General

Field testing shall be performed in the presence of the Contracting Officer. The Contractor shall notify the Contracting Officer 10 days prior to conducting tests. The Contractor shall furnish materials, labor, and equipment necessary to conduct field tests. The Contractor shall perform tests and inspections recommended by the manufacturer unless specifically waived by the Contracting Officer. The Contractor shall maintain a written record of tests which includes date, test performed, personnel involved, devices tested, serial number and name of test equipment, and test results. Field reports will be signed and dated by the Contractor.

3.11.2 Safety

The Contractor shall provide and use safety devices such as rubber gloves, protective barriers, and danger signs to protect and warn personnel in the test vicinity. The Contractor shall replace any devices or equipment which are damaged due to improper test procedures or handling.

3.11.3 Ground-Resistance Tests

The resistance of each pole ground shall be measured using the fall-of-potential method defined in IEEE Std 81. Ground resistance measurements shall be made before the electrical distribution system is energized and shall be made in normally dry conditions not less than 48 hours after the last rainfall. Resistance measurements of separate grounding electrode systems shall be made before the systems are bonded together below grade. The combined resistance of separate systems may be used to meet the required resistance, but the specified number of electrodes shall be provided.

3.11.4 Sag and Tension Test

The Contracting Officer shall be given prior notice of the time schedule for stringing conductors or cables serving overhead medium-voltage circuits and reserves the right to witness the procedures used for ascertaining that initial stringing sags and tensions are in compliance with requirements for the applicable loading district and cable weight.

3.11.5 Operating Tests

After the installation is completed, and at such time as the Contracting Officer may direct, the Contractor shall conduct operating tests for approval. The equipment shall be demonstrated to operate in accordance with the specified requirements. An operating test report shall be submitted in accordance with paragraph SUBMITTALS.

3.12 ACCEPTANCE

Final acceptance of the facility will not be given until the Contractor has successfully completed all tests and after all defects in installation, material or operation have been corrected.

-- End of Section --

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SECTION 16375

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SECTION 16375

ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C37.46	(1981; R 1992) Power Fuses and Fuse Disconnecting Switches
ANSI C57.12.21	(1995) Requirements for Pad-Mounted, Compartmental-Type, Self-Cooled, Single-Phase Distribution Transformers with High-Voltage Bushings; (High-Voltage, 34 500 Grd Y/19 920 Volts and Below; Low-Voltage, 240/120; 167 kVA and Smaller)
ANSI C57.12.26	(1993) Pad-Mounted Compartmental-Type, Self-Cooled, Three-Phase Distribution Transformers for Use with Separable Insulated High-Voltage Connectors, High-Voltage, 34 500 Grd Y/19 920 Volts and Below; 2500 kVA and Smaller
ANSI C80.1	(1995) Rigid Steel Conduit - Zinc Coated
ANSI C119.1	(1986; R 1997) Sealed Insulated Underground Connector Systems Rated 600 Volts

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 123/A 123M	(2002) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 153/A 153M	(2001a) Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A 48	(2000) Gray Iron Castings
ASTM B 3	(1995) Soft or Annealed Copper Wire
ASTM B 8	(1999) Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
ASTM B 117	(1997) Operating Salt Spray (Fog) Apparatus

ASTM B 496	(1999) Compact Round Concentric-Lay-Stranded Copper Conductors
ASTM C 478	(1997) Precast Reinforced Concrete Manhole Sections
ASTM C 478M	(1997) Precast Reinforced Concrete Manhole Sections (Metric)
ASTM D 923	(1997) Sampling Electrical Insulating Liquids
ASTM D 1654	(1992; R 2000) Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
ASTM D 4059	(2000) Analysis of Polychlorinated Biphenyls in Insulating Liquids by Gas Chromatography

ASSOCIATION OF EDISON ILLUMINATING COMPANIES (AEIC)

AEIC CS5	(1994; CS5a-1995) Cross-Linked Polyethylene Insulated Shielded Power Cables Rated 5 Through 46 kV
AEIC CS6	(1996) Ethylene Propylene Rubber Insulated Shielded Power Cables Rated 5 Through 69 kV

FACTORY MUTUAL ENGINEERING AND RESEARCH (FM)

FM P7825a	(1998) Approval Guide Fire Protection

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2	(2002) National Electrical Safety Code
IEEE C57.12.00	(2000) General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers
IEEE C57.98	(1994) Guide for Transformer Impulse Tests
IEEE C62.1	(1989; R 1994) Surge Arresters for AC Power Circuits
IEEE C62.11	(1999) Metal-Oxide Surge Arresters for AC Power Circuits
IEEE C62.2	(1987; R 1994) Guide for the Application of Gapped Silicon-Carbide Surge Arresters for Alternating Current Systems
IEEE Std 48	(1998) Standard Test Procedures and Requirements for Alternating-Current Cable Terminations 2.5 kV through 765 kV
IEEE Std 81	(1983) Guide for Measuring Earth Resistivity, Ground Impedance, and Earth

	Surface Potentials of a Ground System (Part 1)
IEEE Std 100	(2000) Electrical and Electronics Terms
IEEE Std 386	(1995) Separable Insulated Connector Systems for Power Distribution Systems Above 600V
IEEE Std 404	(2000) Cable Joints for Use with Extruded Dielectric Cable Rated 5000 V Through 138 000 V and Cable Joints for Use with Laminated Dielectric Cable Rated 2500 V Through 500 000 V
IEEE Std 592	(1990; R 1996) Exposed Semiconducting Shields on Premolded High Voltage Cable Joints and Separable Insulated Connectors

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA FB 1	(1993) Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies
NEMA FU 1	(1986) Low Voltage Cartridge Fuses
NEMA LA 1	(1992; R 1999) Surge Arresters
NEMA TC 6	(1990) PVC and ABS Plastic Utilities Duct for Underground Installation
NEMA WC 7	(1988; Rev 3 1996) Cross-Linked-Thermosetting-Polyethylene-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy
NEMA WC 8	(1988; Rev 3 1996) Ethylene-Propylene-Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2002) National Electrical Code

UNDERWRITERS LABORATORIES (UL)

UL 6	(2000) Rigid Metal Conduit
UL 198E	(1988; Rev Jul 1988) Class R Fuses
UL 467	(1993; Rev thru Feb 2001) Grounding and Bonding Equipment
UL 486A	(1997; Rev thru May 2001) Wire Connectors and Soldering Lugs for Use with Copper Conductors

UL 486B	(1997; Rev thru May 2001) Wire Connectors for Use with Aluminum Conductors
UL 510	(1994; Rev thru Apr 1998) Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape
UL 514A	(1996; Rev Dec 1999) Metallic Outlet Boxes
UL 651	(1995; Rev thru Oct 1998) Schedule 40 and 80 Rigid PVC Conduit
UL 1072	(1995; Rev Mar 1998) Medium Voltage Power Cables
UL 1242	(1996; Rev Mar 1998) Intermediate Metal Conduit

1.2 GENERAL REQUIREMENTS

1.2.1 Terminology

Terminology used in this specification is as defined in IEEE Std 100.

1.2.2 Service Conditions

Items provided under this section shall be specifically suitable for the following service conditions.

a. Altitude 750 feet

b. Ambient Temperature -60 to 100 degrees F

c. Frequency 60 Hz

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with SECTION 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Electrical Distribution System; G-AE

Detail drawings consisting of equipment drawings, illustrations, schedules, instructions, diagrams manufacturers standard installation drawings and other information necessary to define the installation and enable the Government to check conformity with the requirements of the contract drawings.

If departures from the contract drawings are deemed necessary by the Contractor, complete details of such departures shall be included with the detail drawings. Approved departures shall be made at no additional cost to the Government.

Detail drawings shall show how components are assembled, function together and how they will be installed on the project. Data and drawings for component parts of an item or system shall be coordinated and submitted as a unit. Data and drawings shall be coordinated and included in a single submission. Multiple submissions for the same equipment or system are not acceptable except where prior approval has been obtained from the Contracting Officer. In such cases, a list of data to be submitted later shall be included with the first submission. Detail drawings shall consist of the following:

a. Detail drawings showing physical arrangement, construction details, connections, finishes, materials used in fabrication, provisions for conduit or busway entrance, access requirements for installation and maintenance, physical size, electrical characteristics, foundation and support details, and equipment weight. Drawings shall be drawn to scale and/or dimensioned. All optional items shall be clearly identified as included or excluded.

b. Internal wiring diagrams of equipment showing wiring as actually provided for this project. External wiring connections shall be clearly identified. Detail drawings shall as a minimum depict the installation of the following items:

a. Medium-voltage cables and accessories including cable installation plan.

b. Transformers.

c. Surge arresters.

As-Built Drawings; G-AO

The as-built drawings shall be a record of the construction as installed. The drawings shall include the information shown on the contract drawings as well as deviations, modifications, and changes from the contract drawings, however minor. The as-built drawings shall be a full sized set of prints marked to reflect deviations, modifications, and changes. The as-built drawings shall be complete and show the location, size, dimensions, part identification, and other information. Additional sheets may be added. The as-built drawings shall be jointly inspected for accuracy and completeness by the Contractor's quality control representative and by the Contracting Officer prior to the submission of each monthly pay estimate. Upon completion of the work, the Contractor shall provide three full sized sets of the marked prints to the Contracting Officer for approval. If upon review, the as-built drawings are found to contain errors and/or omissions, they will be returned to the Contractor for correction. The Contractor shall correct and return the as-built drawings to the Contracting Officer for approval within 10 calendar days from the time the drawings are returned to the Contractor.

SD-03 Product Data

Nameplates; G-AO

Catalog cuts, brochures, circulars, specifications, product data, and printed information in sufficient detail and scope to

verify compliance with the requirements of the contract documents.

Material and Equipment; G-AE

A complete itemized listing of equipment and materials proposed for incorporation into the work. Each entry shall include an item number, the quantity of items proposed, and the name of the manufacturer of each such item.

General Installation Requirements; G-AO

As a minimum, installation procedures for transformers, substations, switchgear, and medium-voltage cable terminations and splices.

Procedures shall include cable pulling plans, diagrams, instructions, and precautions required to install, adjust, calibrate, and test the devices and equipment.

SD-06 Test Reports

Factory Tests; G-AO

Certified factory test reports shall be submitted when the manufacturer performs routine factory tests, including tests required by standards listed in paragraph REFERENCES. Results of factory tests performed shall be certified by the manufacturer, or an approved testing laboratory, and submitted within 7 days following successful completion of the tests. The manufacturer's pass-fail criteria for tests specified in paragraph FIELD TESTING shall be included.

Field Testing; G-AO

A proposed field test plan, 30 days prior to testing the installed system. No field test shall be performed until the test plan is approved. The test plan shall consist of complete field test procedures including tests to be performed, test equipment required, and tolerance limits.

Operating Tests; G-AO

Six copies of the information described below in 8-1/2 by 11 inch binders having a minimum of three rings, including a separate section for each test. Sections shall be separated by heavy plastic dividers with tabs.

a. A list of equipment used, with calibration certifications.

b. A copy of measurements taken.

c. The dates of testing.

d. The equipment and values to be verified.

e. The condition specified for the test.

f. The test results, signed and dated.

g. A description of adjustments made.

Cable Installation; G-AO

Six copies of the information described below in 8-1/2 by 11 inch binders having a minimum of three rings from which material may readily be removed and replaced, including a separate section for each cable pull. Sections shall be separated by heavy plastic dividers with tabs, with all data sheets signed and dated by the person supervising the pull.

a. Site layout drawing with cable pulls numerically identified.

b. A list of equipment used, with calibration certifications. The manufacturer and quantity of lubricant used on pull.

c. The cable manufacturer and type of cable.

d. The dates of cable pulls, time of day, and ambient temperature.

e. The length of cable pull and calculated cable pulling tensions.

f. The actual cable pulling tensions encountered during pull.

SD-07 Certificates

Material and Equipment; G-AO

Where materials or equipment are specified to conform to the standards of the Underwriters Laboratories (UL) or to be constructed or tested, or both, in accordance with the standards of the American National Standards Institute (ANSI), the Institute of Electrical and Electronics Engineers (IEEE), or the National Electrical Manufacturers Association (NEMA), the Contractor shall submit proof that the items provided conform to such requirements. The label of, or listing by, UL will be acceptable as evidence that the items conform. Either a certification or a published catalog specification data statement, to the effect that the item is in accordance with the referenced ANSI or IEEE standard, will be acceptable as evidence that the item conforms. A similar certification or published catalog specification data statement to the effect that the item is in accordance with the referenced NEMA standard, by a company listed as a member company of NEMA, will be acceptable as evidence that the item conforms. In lieu of such certification or published data, the Contractor may submit a certificate from a recognized testing agency equipped and competent to perform such services, stating that the items have been tested and that they conform to the requirements listed, including methods of testing of the specified agencies. Compliance with above-named requirements does not relieve the Contractor from compliance with any other requirements of the specifications.

Cable Joints; G-AO

A certification that contains the names and the qualifications of people recommended to perform the splicing and termination of

medium-voltage cables approved for installation under this contract. The certification shall indicate that any person recommended to perform actual splicing and terminations has been adequately trained in the proper techniques and have had at least three recent years of experience in splicing and terminating the same or similar types of cables approved for installation. In addition, any person recommended by the Contractor may be required to perform a practice splice and termination, in the presence of the Contracting Officer, before being approved as a qualified installer of medium-voltage cables. If that additional requirement is imposed, the Contractor shall provide short sections of the approved types of cables along with the approved type of splice and termination kits, and detailed manufacturer's instruction for the proper splicing and termination of the approved cable types.

Cable Installer Qualifications; G-AO

The Contractor shall provide at least one onsite person in a supervisory position with a documentable level of competency and experience to supervise all cable pulling operations. A resume shall be provided showing the cable installers' experience in the last three years, including a list of references complete with points of contact, addresses and telephone numbers.

SD-10 Operation and Maintenance Data

Electrical Distribution System; G-AO

Six copies of operation and maintenance manuals, within 7 calendar days following the completion of tests and including assembly, installation, operation and maintenance instructions, spare parts data which provides supplier name, current cost, catalog order number, and a recommended list of spare parts to be stocked. Manuals shall also include data outlining detailed procedures for system startup and operation, and a troubleshooting guide which lists possible operational problems and corrective action to be taken. A brief description of all equipment, basic operating features, and routine maintenance requirements shall also be included. Documents shall be bound in a binder marked or identified on the spine and front cover. A table of contents page shall be included and marked with pertinent contract information and contents of the manual. Tabs shall be provided to separate different types of documents, such as catalog ordering information, drawings, instructions, and spare parts data. Index sheets shall be provided for each section of the manual when warranted by the quantity of documents included under separate tabs or dividers.

Three additional copies of the instructions manual shall be provided within 30 calendar days following the manuals.

1.4 DELIVERY, STORAGE, AND HANDLING

Devices and equipment shall be visually inspected by the Contractor when received and prior to acceptance from conveyance. Stored items shall be protected from the environment in accordance with the manufacturer's published instructions. Damaged items shall be replaced. Oil filled transformers shall be stored in accordance with the manufacturer's

requirements. Metal poles shall be handled and stored in accordance with the manufacturer's instructions.

1.5 EXTRA MATERIALS

One additional spare fuse or fuse element for each furnished fuse or fuse element shall be delivered to the contracting officer when the electrical system is accepted. Two complete sets of all special tools required for maintenance shall be provided, complete with a suitable tool box. Special tools are those that only the manufacturer provides, for special purposes (to access compartments, or operate, adjust, or maintain special parts).

PART 2 PRODUCTS

2.1 STANDARD PRODUCT

Material and equipment shall be the standard product of a manufacturer regularly engaged in the manufacture of the product and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Items of the same classification shall be identical including equipment, assemblies, parts, and components.

2.2 NAMEPLATES

2.2.1 General

Each major component of this specification shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a nameplate securely attached to the equipment. Nameplates shall be made of noncorrosive metal. Equipment containing liquid dielectrics shall have the type of dielectric on the nameplate. As a minimum, nameplates shall be provided for transformers.

2.2.2 Liquid-Filled Transformer Nameplates

Power transformers shall be provided with nameplate information in accordance with IEEE C57.12.00. Nameplates shall indicate the number of gallons and composition of liquid-dielectric, and shall be permanently marked with a statement that the transformer dielectric to be supplied is non-polychlorinated biphenyl. If transformer nameplate is not so marked, the Contractor shall furnish manufacturer's certification for each transformer that the dielectric is non-PCB classified, with less than 2 ppm PCB content in accordance with paragraph LIQUID DIELECTRICS. Certifications shall be related to serial numbers on transformer nameplates. Transformer dielectric exceeding the 2 ppm PCB content or transformers without certification will be considered as PCB insulated and will not be accepted.

2.3 CORROSION PROTECTION

2.3.1 Aluminum Materials

Aluminum shall not be used.

2.3.2 Ferrous Metal Materials

2.3.2.1 Hardware

Ferrous metal hardware shall be hot-dip galvanized in accordance with ASTM

A 153/A 153M and ASTM A 123/A 123M.

2.3.2.2 Equipment

Equipment and component items, including but not limited to transformer stations and ferrous metal luminaries not hot-dip galvanized or porcelain enamel finished, shall be provided with corrosion-resistant finishes which shall withstand 120 hours of exposure to the salt spray test specified in ASTM B 117 without loss of paint or release of adhesion of the paint primer coat to the metal surface in excess of 1/16 inch from the test mark. The scribed test mark and test evaluation shall be in accordance with ASTM D 1654 with a rating of not less than 7 in accordance with TABLE 1, (procedure A). Cut edges or otherwise damaged surfaces of hot-dip galvanized sheet steel or mill galvanized sheet steel shall be coated with a zinc rich paint conforming to the manufacturer's standard.

2.3.3 Finishing

Painting required for surfaces not otherwise specified and finish painting of items only primed at the factory shall be as specified in SECTION 09900 PAINTS AND COATINGS.

2.4 CABLES

Cables shall be single conductor type unless otherwise indicated.

2.4.1 Medium-Voltage Cables

2.4.1.1 General

Cable construction shall be Type MV, conforming to NFPA 70 and UL 1072 . Cables shall be manufactured for use in duct applications .

2.4.1.2 Ratings

Cables shall be rated for a circuit voltage 15 kV .

2.4.1.3 Conductor Material

Underground cables shall be soft drawn copper complying with ASTM B 3 and ASTM B 8 for regular concentric and compressed stranding or ASTM B 496 for compact stranding.

2.4.1.4 Insulation

Cable insulation shall be ethylene-propylene-rubber (EPR) insulation conforming to the requirements of NEMA WC 8 and AEIC CS6 . A 133 percent insulation level shall be used on 5 kV, 15 kV and 25 kV rated cables.

2.4.1.5 Shielding

Cables rated for 2 kV and above shall have a semiconducting conductor shield, a semiconducting insulation shield, and an overall copper wire shield for each phase.

2.4.1.6 Neutrals

Neutral conductors shall be copper employing the same insulation and jacket materials as phase conductors, except that a 600-volt insulation rating is

acceptable. Concentric neutrals conductors shall be tinned copper, having a combined ampacity 1/3 of the phase conductor ampacity rating as required by the drawings.

2.4.1.7 Jackets

Cables shall be provided with a PVC jacket.

2.4.2 Low-Voltage Cables

Cables shall be rated 600 volts and shall conform to the requirements of NFPA 70, and must be UL listed for the application or meet the applicable section of either ICEA or NEMA standards.

2.4.2.1 Conductor Material

Underground cables shall be annealed copper complying with ASTM B 3 and ASTM B 8. Intermixing of copper and aluminum conductors is not permitted.

2.4.2.2 Insulation

Insulation must be in accordance with NFPA 70, and must be UL listed for the application or meet the applicable sections of either ICEA, or NEMA standards.

2.4.2.3 In Duct

Cables shall be single-conductor cable, in accordance with NFPA 70.

2.5 CABLE JOINTS, TERMINATIONS, AND CONNECTORS

2.5.1 Medium-Voltage Cable Joints

Medium-voltage cable joints shall comply with IEEE Std 404 and IEEE Std 592. Medium-voltage cable terminations shall comply with IEEE Std 48. Joints shall be the standard products of a manufacturer and shall be either of the factory preformed type or of the kit type containing tapes and other required parts. Joints shall have ratings not less than the ratings of the cables on which they are installed. Splice kits may be of the heat-shrinkable type for voltages up to 15 kV, of the premolded splice and connector type, the conventional taped type, or the resin pressure-filled overcast taped type for voltages up to 35 kV; except that for voltages of 7.5 kV or less a resin pressure-filled type utilizing a plastic-tape mold is acceptable. Joints used in manholes, handholes, vaults and pull boxes shall be certified by the manufacturer for waterproof, submersible applications.

2.5.2 Medium-Voltage Separable Insulated Connectors

Separable insulated connectors shall comply with IEEE Std 386 and IEEE Std 592 and shall be of suitable construction or standard splice kits shall be used. Separable insulated connectors are acceptable for voltages up to 35 kV. Connectors shall be of the loadbreak type as indicated, of suitable construction for the application and the type of cable connected, and shall include cable shield adaptors. Separable insulated connectors shall not be used as substitutes for conventional permanent splices. External clamping points and test points shall be provided.

2.5.3 Low-Voltage Cable Splices

Low-voltage cable splices and terminations shall be rated at not less than 600 Volts. Splices in conductors No. 10 AWG and smaller shall be made with an insulated, solderless, pressure type connector, conforming to the applicable requirements of UL 486A. Splices in conductors No. 8 AWG and larger shall be made with noninsulated, solderless, pressure type connector, conforming to the applicable requirements of UL 486A and UL 486B. Splices shall then be covered with an insulation and jacket material equivalent to the conductor insulation and jacket. Splices below grade or in wet locations shall be sealed type conforming to ANSI C119.1 or shall be waterproofed by a sealant-filled, thick wall, heat shrinkable, thermosetting tubing or by pouring a thermosetting resin into a mold that surrounds the joined conductors. Low Voltage splices shall only be allowed in manholes, handholes, at terminations such as at emergency power down stations (EPDS) or lighting poles, or at 500 foot distances in straight runs in a handhole provided only to allow a splice. Splices shall not be allowed in conduit.

2.5.4 Terminations

Terminations shall be in accordance with IEEE Std 48, Class 1 or Class 2; of the molded elastomer, wet-process porcelain, prestretched elastomer, heat-shrinkable elastomer, or taped type. Acceptable elastomers are track-resistant silicone rubber or track-resistant ethylene propylene compounds, such as ethylene propylene rubber or ethylene propylene diene monomer. Separable insulated connectors may be used for apparatus terminations, when such apparatus is provided with suitable bushings. Terminations shall be of the outdoor type, except that where installed inside outdoor equipment housings which are sealed against normal infiltration of moisture and outside air, indoor, Class 2 terminations are acceptable. Class 3 terminations are not acceptable. Terminations, where required, shall be provided with mounting brackets suitable for the intended installation and with grounding provisions for the cable shielding, metallic sheath, and armor.

2.5.4.1 Factory Preformed Type

Molded elastomer, wet-process porcelain, prestretched, and heat-shrinkable terminations shall utilize factory preformed components to the maximum extent practicable rather than tape build-up. Terminations shall have basic impulse levels as required for the system voltage level.

2.5.4.2 Taped Terminations

Taped terminations shall use standard termination kits providing terminal connectors, field-fabricated stress cones, and rain hoods. Terminations shall be at least 20 inches long from the end of the tapered cable jacket to the start of the terminal connector, or not less than the kit manufacturer's recommendations, whichever is greater.

2.6 CONDUIT AND DUCTS

Duct lines shall be concrete-encased, thin-wall type for duct lines between manholes and for other medium-voltage lines. Low-voltage lines or Communication lines run elsewhere may be direct-burial, thick-wall type.

2.6.1 Metallic Conduit

Intermediate metal conduit shall comply with UL 1242. Rigid galvanized steel conduit shall comply with UL 6 and ANSI C80.1. Metallic conduit fittings and outlets shall comply with UL 514A and NEMA FB 1.

2.6.2 Nonmetallic Ducts

2.6.2.1 Concrete Encased Ducts

UL 651 Schedule 40 or NEMA TC 6 Type EB.

2.6.2.2 Direct Burial

UL 651 Schedule 80, or NEMA TC 6 Type DB.

2.6.3 Conduit Sealing Compound

Compounds for sealing ducts and conduit shall have a putty-like consistency workable with the hands at temperatures as low as 35 degrees F, shall neither slump at a temperature of 300 degrees F, nor harden materially when exposed to the air. Compounds shall adhere to clean surfaces of fiber or plastic ducts; metallic conduits or conduit coatings; concrete, masonry, or lead; any cable sheaths, jackets, covers, or insulation materials; and the common metals. Compounds shall form a seal without dissolving, noticeably changing characteristics, or removing any of the ingredients. Compounds shall have no injurious effect upon the hands of workmen or upon materials.

2.7 MANHOLES, HANDHOLES, AND PULLBOXES

Manholes, handholes, and pullboxes shall be as indicated. Strength of manholes, handholes, and pullboxes and their frames and covers shall conform to the requirements of IEEE C2. Precast-concrete manholes shall have the required strength established by ASTM C 478, ASTM C 478M. Frames and covers shall be made of gray cast iron and a machine-finished seat shall be provided to ensure a matching joint between frame and cover. Cast iron shall comply with ASTM A 48, Class 30B, minimum. Handholes for low voltage cables installed in parking lots, sidewalks, and turfed areas shall be fabricated from an aggregate consisting of sand and with continuous woven glass strands having an overall compressive strength of at least 10,000 psi and a flexural strength of at least 5,000 psi. Pullbox and handhole covers in sidewalks, and turfed areas shall be of the same material as the box. Concrete pullboxes shall consist of precast reinforced concrete boxes, extensions, bases, and covers.

2.8 POLES AND HARDWARE

Poles and hardware shall be in accordance with SECTION 16370 ELECTRICAL DISTRIBUTION SYSTEM, AERIAL.

2.9 TRANSFORMERS

Transformers shall be of the outdoor type having the ratings and arrangements indicated. Medium-voltage ratings of cable terminations shall be 15 kV between phases for 133 percent insulation level.

2.9.1 Pad-Mounted Transformers

Pad-mounted transformers shall comply with ANSI C57.12.26 and shall be of

the loop feed type. Pad-mounted transformer stations shall be assembled and coordinated by one manufacturer and each transformer station shall be shipped as a complete unit so that field installation requirements are limited to mounting each unit on a concrete pad and connecting it to primary and secondary lines. Stainless steel pins and hinges shall be provided. Barriers shall be provided between high- and low-voltage compartments. High-voltage compartment doors shall be interlocked with low-voltage compartment doors to prevent access to any high-voltage section unless its associated low-voltage section door has first been opened. Compartments shall be sized to meet the specific dimensional requirements of ANSI C57.12.26. Pentahead locking bolts shall be provided with provisions for a padlock.

2.9.1.1 High-Voltage Compartments

The high-voltage compartment shall be dead-front construction. Primary switching and protective devices shall include loadbreak switching, oil-immersed, current-limiting, bayonet-type fuses, medium-voltage separable loadbreak connectors, universal bushing wells and inserts or integral one piece bushings and surge arresters. Additionally a primary voltage switch will be provided to switch between 12470/7200V wye and 7200V delta primary connections. Fuses shall comply with the requirements of paragraph METERING AND PROTECTIVE DEVICES. The switchs shall be mounted inside transformer tank with switch operating handle located in high-voltage compartment and equipped with metal loop for hook stick operation. Fuses shall be interlocked with switches so that fuses can be removed only when the associated switch is in the "OPEN" position. Adjacent to medium-voltage cable connections, a nameplate or equivalent stencilled inscription shall be provided inscribed "DO NOT OPEN CABLE CONNECTORS UNLESS SWITCH IS OPEN." Surge arresters shall be fully insulated and configured to terminate on a second set of high voltage bushings.

2.9.1.2 Load-Break Switch

Loop feed sectionalizer switches: Provide three, two-position, oil-immersed type switches to permit closed transition loop feed and sectionalizing. Each switch shall be rated at 15 kV, 95 kV BIL, with a continuous current rating and load-break rating of 200 amperes, and a make-and-latch rating of 10,000 rms amperes symmetrical. Locate the switch handle in the high-voltage compartment. Operation of switches shall be as follows:

ARRANGEMENT #	DESCRIPTION OF SWITCH ARRANGEMENT	SWITCH POSITION LINE A SW OPEN	LINE A SW CLOSE	LINE B SW OPEN	LINE B SW CLOSE	XFMR SW OPEN	XFMR SW CLOSE
1	Line A connected to Line B and both lines connected to transformer		X		X		X
2	Transformer connected to Line A only		X	X			X
3	Transformer connected to Line B only	X			X		X

ARRANGEMENT #	DESCRIPTION OF SWITCH ARRANGEMENT	SWITCH POSITION LINE A SW OPEN	LINE A SW CLOSE	LINE B SW OPEN	LINE B SW CLOSE	XFMR SW OPEN	XFMR SW CLOSE
4	Transformer open and loop closed		X		X		X
5	Transformer open and loop open	X		X		X	

2.9.1.3 Transformer Tank Sections

Transformers shall comply with IEEE C57.12.00, ANSI C57.12.21, and ANSI C57.12.26 and shall be of the mineral oil-insulated type. Transformers shall be suitable for outdoor use and shall have 2 separate windings per phase. Standard NEMA primary taps shall be provided. Where primary taps are not specified, 4, 2-1/2 percent rated kVA high-voltage taps shall be provided below rated, primary voltage. Operating handles for primary tap changers for de-energized operation shall be located within high-voltage compartments, externally to transformer tanks. Adjacent to the tap changer operating handle, a nameplate or equivalent stenciled inscription shall be provided and inscribed "DO NOT OPERATE UNDER LOAD." Transformer ratings at 60 Hz shall be as follows:

Three-phase capacity.....AS INDICATED ON DRAWINGS kVA.

Impedance.....5.75%.

Temperature Rise.....65 degrees C.

Dual High-voltage winding.....12470/7200V wye - 7200V DELTA volts.

High-voltage winding connections.....wye and delta.

Low-voltage winding.....480/277 volts.

Low-voltage winding connections..... grounded-wye

2.9.1.4 Low-Voltage Cable Compartments

Neutrals shall be provided with fully-insulated bushings. Clamp type cable terminations, suitable for copper conductors entering from below, shall be provided as necessary.

2.9.1.5 Accessories

High-voltage warning signs shall be permanently attached to each side of transformer stations. Voltage warning signs shall comply with IEEE C2. Copper-faced steel or stainless steel ground connection pads shall be provided in both the high- and low-voltage compartments. Dial-type thermometer, liquid-level gauge, and drain valve with built-in sampling device shall be provided for each transformer station.
Insulated-bushing-type parking stands shall be provided adjacent to each

separable load-break elbow to provide for cable isolation during sectionalizing operations.

2.10 METERING AND PROTECTIVE DEVICES

2.10.1 Fuses, Medium-Voltage, Including Current-Limiting

2.10.1.1 Construction

Units shall be suitable for outdoor use. Fuses shall have integral blown-fuse indicators. All ratings shall be clearly visible.

2.10.1.2 Ratings

Current-limiting power fuses shall have ratings in accordance with ANSI C37.46.

2.10.1.3 E-Rated, Current-Limiting Power Fuses

E-rated, current-limiting, power fuses shall conform to ANSI C37.46.

2.10.1.4 C-Rated, Current-Limiting Power Fuses

C-rated, current-limiting power fuses shall open in 1000 seconds at currents between 170 and 240 percent of the C rating.

2.10.2 Fuses, Low-Voltage, Including Current-Limiting

Low-voltage fuses shall conform to NEMA FU 1. Time delay and nontime delay options shall be as specified. Equipment provided under this contract shall be provided with a complete set of properly rated fuses when the equipment manufacturer utilizes fuses in the manufacture of the equipment, or if current-limiting fuses are required to be installed to limit the ampere-interrupting capacity of circuit breakers or equipment to less than the maximum available fault current at the location of the equipment to be installed. Fuses shall have a voltage rating of not less than the phase-to-phase circuit voltage, and shall have the time-current characteristics required for effective power system coordination.

2.10.2.1 Cartridge Fuses

Cartridge fuses, current-limiting type, Class RK1 shall have tested interrupting capacity not less than 100,000 amperes. Fuse holders shall be the type that will reject Class H fuses.

Class R fuses shall conform to UL 198E.

2.10.2.2 Transformer Circuit Fuses

Transformer circuit fuses shall be Class RK1 or RK5, current-limiting, time-delay with 200,000 amperes interrupting capacity.

2.11 SURGE ARRESTERS

Surge arresters shall comply with NEMA LA 1, IEEE C62.1, IEEE C62.2, and IEEE C62.11 and shall be provided where indicated. Arresters shall be distribution class, rated as shown. Arresters for use at elevations in excess of 6000 feet above mean sea level shall be specifically rated for that purpose. Arresters shall be equipped with mounting brackets suitable

for the indicated installations. Arresters shall be of the metal-oxide varistor type.

2.12 GROUNDING AND BONDING

2.12.1 Driven Ground Rods

Ground rods shall be copper-clad steel conforming to UL 467 not less than 3/4 inch in diameter by 8 feet in length. Sectional type rods may be used.

2.12.2 Grounding Conductors

Grounding conductors shall be bare, except where installed in conduit with associated phase conductors. Insulated conductors shall be of the same material as phase conductors and green color-coded, except that conductors shall be rated no more than 600 volts. Bare conductors shall be ASTM B 8 soft-drawn unless otherwise indicated. Aluminum is not acceptable.

2.13 CONCRETE AND REINFORCEMENT

Concrete work shall have minimum 3000 psi compressive strength and conform to the requirements of SECTION 03300 CAST-IN-PLACE STRUCTURAL CONCRETE. Concrete reinforcing shall be as specified in SECTION 03200 CONCRETE REINFORCEMENT.

2.14 PADLOCKS

Padlocks shall comply with SECTION 08710 DOOR HARDWARE.

2.15 CABLE FIREPROOFING SYSTEMS

Cable fireproofing systems shall be listed in FM P7825a as a fire-protective coating or tape approved for grouped electrical conductors and shall be suitable for application on the type of medium-voltage cables provided. After being fully cured, materials shall be suitable for use where exposed to oil, water, gases, salt water, sewage, and fungus and shall not damage cable jackets or insulation. Asbestos materials are not acceptable.

2.15.1 Fireproof Coating

Cable fireproofing coatings shall be compounded of water-based thermoplastic resins, flame-retardant chemicals, and inorganic noncombustible fibers and shall be suitable for the application methods used. Coatings applied on bundled cables shall have a derating factor of less than 5 percent, and a dielectric strength of 95 volts per mil minimum after curing.

2.15.2 Fireproofing Tape

Fireproofing tape shall be at least 2 inches wide and shall be a flexible, conformable, polymeric, elastomer tape designed specifically for fireproofing cables.

2.15.3 Plastic Tape

Preapplication plastic tape shall be pressure sensitive,10 mil thick, conforming to UL 510.

2.16 LIQUID DIELECTRICS

Liquid dielectrics for transformers, capacitors, reclosers, and other liquid-filled electrical equipment shall be non-polychlorinated biphenyl (PCB) mineral-oil or less-flammable liquid as specified. Nonflammable fluids shall not be used. Tetrachloroethylene (perchloroethylene) and 1, 2, 4 trichlorobenzene fluids shall not be used. Liquid dielectrics in retrofitted equipment shall be certified by the manufacturer as having less than 2 parts per million (ppm) PCB content. In lieu of the manufacturer's certification, the Contractor may submit a test sample of the dielectric in accordance with ASTM D 923 and have tests performed per ASTM D 4059 at a testing facility approved by the Contracting Officer. Equipment with test results indicating PCB level exceeding 2 ppm shall be replaced.

2.17 FACTORY TESTS

Factory tests shall be performed, as follows, in accordance with the applicable publications and with other requirements of these specifications. The Contracting Officer shall be notified at least 10 days before the equipment is ready for testing. The Contracting Officer reserves the right to witness the tests.

a. Transformers: Manufacturer's standard routine tests in accordance with IEEE C57.12.00.

b. Transformers rated 200 kVA and above: Reduced full-wave, chopped-wave, and full-wave impulse test on each line and neutral terminal, in accordance with IEEE C57.98.

c. Factory Preformed Terminations: Wet withstand voltage tests in accordance with IEEE Std 48 for the next higher BIL level.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

Equipment and devices shall be installed and energized in accordance with the manufacturer's published instructions. Circuits installed aerially shall conform to the requirements of SECTION 16370 ELECTRICAL DISTRIBUTION SYSTEM, AERIAL. Steel conduits installed underground shall be installed and protected from corrosion in conformance with the requirements of SECTION 16415 ELECTRICAL WORK, INTERIOR. Except as covered herein, excavation, trenching, and backfilling shall conform to the requirements of SECTION 02314 EARTHWORK FOR UTILITIES. Concrete work shall have minimum 3000 psi compressive strength and conform to the requirements of SECTION 03300 CAST-IN-PLACE STRUCTURAL CONCRETE.

3.1.1 Conformance to Codes

The installation shall comply with the requirements and recommendations of NFPA 70 and IEEE C2 as applicable.

3.1.2 Verification of Dimensions

The Contractor shall become familiar with details of the work, shall verify dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing any work.

3.1.3 Disposal of Liquid Dielectrics

PCB-contaminated dielectrics must be marked as PCB and transported to the DRMO facility located near Fort Wainwright. The Contractor shall furnish certification of proper disposal. Contaminated dielectrics shall not be diluted to lower the contamination level.

3.2 CABLE INSTALLATION

The Contractor shall obtain from the manufacturer an installation manual or set of instructions which addresses such aspects as cable construction, insulation type, cable diameter, bending radius, cable temperature, lubricants, coefficient of friction, conduit cleaning, storage procedures, moisture seals, testing for and purging moisture, etc. The Contractor shall then prepare a checklist of significant requirements which shall be submitted along with the manufacturers instructions in accordance with SUBMITTALS.

3.2.1 Cable Installation Plan and Procedure

Cable shall be installed strictly in accordance with the cable manufacturer's recommendations. Each circuit shall be identified by means of a fiber, laminated plastic, or non-ferrous metal tags, or approved equal, in each manhole, handhole, junction box, and each terminal. Each tag shall contain the following information; cable type, conductor size, circuit number, circuit voltage, cable destination and phase identification.

3.2.1.1 Cable Inspection

The cable reel shall be inspected for correct storage positions, signs of physical damage, and broken end seals. If end seal is broken, moisture shall be removed from cable in accordance with the cable manufacturer's recommendations.

3.2.1.2 Duct Cleaning

Duct shall be cleaned with an assembly that consists of a flexible mandrel (manufacturers standard product in lengths recommended for the specific size and type of duct) that is 1/4 inch less than inside diameter of duct, 2 wire brushes, and a rag. The cleaning assembly shall be pulled through conduit a minimum of 2 times or until less than a volume of 8 cubic inches of debris is expelled from the duct.

3.2.1.3 Duct Lubrication

The cable lubricant shall be compatible with the cable jacket for cable that is being installed. Application of lubricant shall be in accordance with lubricant manufacturer's recommendations.

3.2.1.4 Cable Installation

The Contractor shall provide a cable feeding truck and a cable pulling winch as required. The Contractor shall provide a pulling grip or pulling eye in accordance with cable manufacturer's recommendations. The pulling grip or pulling eye apparatus shall be attached to polypropylene or manila rope followed by lubricant front end packs and then by power cables. A dynamometer shall be used to monitor pulling tension. Pulling tension shall not exceed cable manufacturer's recommendations. The Contractor shall not allow cables to cross over while cables are being fed into duct.

For cable installation in cold weather, cables shall be kept at 50 degrees F temperature for at least 24 hours before installation.

3.2.1.5 Cable Installation Plan

The Contractor shall submit a cable installation plan for all cable pulls in accordance with the detail drawings portion of paragraph SUBMITTALS. Cable installation plan shall include:

a. Site layout drawing with cable pulls identified in numeric order of expected pulling sequence and direction of cable pull.

b. List of cable installation equipment.

c. Lubricant manufacturer's application instructions.

d. Procedure for resealing cable ends to prevent moisture from entering cable.

e. Cable pulling tension calculations of all cable pulls.

f. Cable percentage conduit fill.

g. Cable sidewall thrust pressure.

h. Cable minimum bend radius and minimum diameter of pulling wheels used.

i. Cable jam ratio.

j. Maximum allowable pulling tension on each different type and size of conductor.

k. Maximum allowable pulling tension on pulling device.

3.2.2 Duct Line

Medium-voltage cables Cables shall be installed in duct lines where indicated. Cable splices in low-voltage cables shall be made in manholes and handholes only, except as otherwise noted. Cable joints in medium-voltage cables shall be made in manholes or approved pullboxes only. Neutral and grounding conductors shall be installed in the same duct with their associated phase conductors.

3.2.3 Electric Manholes

Cables shall be routed around the interior walls and securely supported from walls on cables racks. Cable routing shall minimize cable crossover, provide access space for maintenance and installation of additional cables, and maintain cable separation in accordance with IEEE C2.

3.3 CABLE JOINTS

Medium-voltage cable joints shall be made by qualified cable splicers only. Qualifications of cable splicers shall be submitted in accordance with paragraph SUBMITTALS. Shields shall be applied as required to continue the shielding system through each entire cable joint. Shields may be integrally molded parts of preformed joints. Shields shall be grounded at each joint or in accordance with manufacturer's recommended practice.

Cable joints shall provide insulation and jacket equivalent to that of the associated cable. Armored cable joints shall be enclosed in compound-filled, cast-iron or alloy, splice boxes equipped with stuffing boxes and armor clamps of a suitable type and size for the cable being installed.

3.4 FIREPROOFING

Each medium-voltage cable and conductor in manholes shall be fire-proofed for their entire length within the manhole. Where cables and conductors have been lubricated to enhance pulling into ducts, the lubricant shall be removed from cables and conductors exposed in the manhole before fireproofing.

3.4.1 Tape Method

Before application of fireproofing tape, plastic tape wrapping shall be applied over exposed metallic items such as the cable ground wire, metallic outer covering, or armor to minimize the possibility of corrosion from the fireproofing materials and moisture. Before applying fireproofing tape, irregularities of cables, such as at cable joints, shall be evened out with insulation putty. A flexible conformable polymeric elastomer fireproof tape shall be wrapped tightly around each cable spirally in 1/2 lapped wrapping or in 2 butt-jointed wrappings with the second wrapping covering the joints of the first.

3.4.2 Sprayable Method

Manholes shall be power ventilated until coatings are dry and dewatered and the coatings are cured. Ventilation requirements shall be in accordance with the manufacturer's instruction, but not less than 10 air changes per hour shall be provided. Cable coatings shall be applied by spray, brush, or glove to a wet film thickness that reduces to the dry film thickness approved for fireproofing by FM P7825a. Application methods and necessary safety precautions shall be in accordance with the manufacturers instructions. After application, cable coatings shall be dry to the touch in 1 to 2 hours and fully cured in 48 hours, except where the manufacturer has stated that because of unusual humidity or temperature, longer periods may be necessary.

3.5 DUCT LINES

3.5.1 Requirements

Numbers and sizes of ducts shall be as indicated. Duct lines shall be laid with a minimum slope of 4 inches per 100 feet. Depending on the contour of the finished grade, the high-point may be at a terminal, a manhole, a handhole, or between manholes or handholes. Short-radius manufactured 90-degree duct bends may be used only for pole or equipment risers, unless specifically indicated as acceptable. The minimum manufactured bend radius shall be 18 inches for ducts of less than 3 inch diameter, and 36 inches for ducts 3 inches or greater in diameter. Otherwise, long sweep bends having a minimum radius of 25 feet shall be used for a change of direction of more than 5 degrees, either horizontally or vertically. Both curved and straight sections may be used to form long sweep bends, but the maximum curve used shall be 30 degrees and manufactured bends shall be used. Ducts shall be provided with end bells whenever duct lines terminate in manholes or handholes.

3.5.2 Treatment

Ducts shall be kept clean of concrete, dirt, or foreign substances during construction. Field cuts requiring tapers shall be made with proper tools and match factory tapers. A coupling recommended by the duct manufacturer shall be used whenever an existing duct is connected to a duct of different material or shape. Ducts shall be stored to avoid warping and deterioration with ends sufficiently plugged to prevent entry of any water or solid substances. Ducts shall be thoroughly cleaned before being laid. Plastic ducts shall be stored on a flat surface and protected from the direct rays of the sun.

3.5.3 Concrete Encasement

Ducts requiring concrete encasements shall comply with NFPA 70, except that electrical duct bank configurations for ducts 6 inches in diameter shall be determined by calculation and as shown on the drawings. The separation between adjacent electric power and communication ducts shall conform to IEEE C2. Duct line encasements shall be monolithic construction. Where a connection is made to a previously poured encasement, the new encasement shall be well bonded or doweled to the existing encasement. The Contractor shall submit proposed bonding method for approval in accordance with the detail drawing portion of paragraph SUBMITTALS. At any point, except railroad and airfield crossings, tops of concrete encasements shall be not less than the cover requirements listed in NFPA 70. At railroad and airfield crossings, duct lines shall be encased with concrete and reinforced as indicated to withstand specified surface loadings. Tops of concrete encasements shall be not less than 5 feet below tops of rails or airfield paving unless otherwise indicated. Where ducts are jacked under existing pavement, rigid steel conduit will be installed because of its strength. To protect the corrosion-resistant conduit coating, predrilling or installing conduit inside a larger iron pipe sleeve (jack-and-sleeve) is required. For crossings of existing railroads and airfield pavements greater than 50 feet in length, the predrilling method or the jack-and-sleeve method will be used. Separators or spacing blocks shall be made of steel, concrete, plastic, or a combination of these materials placed not farther apart than 4 feet on centers. Ducts shall be securely anchored to prevent movement during the placement of concrete and joints shall be staggered at least 6 inches vertically.

3.5.4 Nonencased Direct-Burial

Top of duct lines shall be not less than 24 inches below finished grade and shall be installed with a minimum of 3 inches of earth around each duct, except that between adjacent electric power and communication ducts, 12 inches of earth is required. Ducts containing communications cables shall be a minimum of 36" below grade. Bottoms of trenches shall be graded toward manholes or handholes and shall be smooth and free of stones, soft spots, and sharp objects. Where bottoms of trenches comprise materials other than sand, a 3 inch layer of sand shall be laid first and compacted to approximate densities of surrounding firm soil before installing ducts. Joints in adjacent tiers of duct shall be vertically staggered at least 6 inches. The first 6 inch layer of backfill cover shall be sand compacted as previously specified. The rest of the excavation shall be backfilled and compacted in 3 to 6 inch layers. Duct banks may be held in alignment with earth. However, high-tiered banks shall use a wooden frame or equivalent form to hold ducts in alignment prior to backfilling.

3.5.5 Installation of Couplings

Joints in each type of duct shall be made up in accordance with the manufacturer's recommendations for the particular type of duct and coupling selected and as approved.

3.5.5.1 Plastic Duct

Duct joints shall be made by brushing a plastic solvent cement on insides of plastic coupling fittings and on outsides of duct ends. Each duct and fitting shall then be slipped together with a quick 1/4-turn twist to set the joint tightly.

3.5.6 Duct Line Markers

Duct line markers shall be provided at the ends of long duct line stubouts or for other ducts whose locations are indeterminate because of duct curvature or terminations at completely below-grade structures. In addition to markers, a 5 mil brightly colored plastic tape, not less than 3 inches in width and suitably inscribed at not more than 10 feet on centers with a continuous metallic backing and a corrosion-resistant 1 mil metallic foil core to permit easy location of the duct line, shall be placed approximately 12 inches below finished grade levels of such lines.

3.6 MANHOLES, HANDHOLES, AND PULLBOXES

3.6.1 General

Manholes shall be constructed approximately where shown. The exact location of each manhole shall be determined after careful consideration has been given to the location of other utilities, grading, and paving. The location of each manhole shall be approved by the Contracting Officer before construction of the manhole is started. Manholes shall be the type noted on the drawings and shall be constructed in accordance with the applicable details as indicated. Top, walls, and bottom shall consist of reinforced concrete. Walls and bottom shall be of monolithic concrete construction. The Contractor may at his option utilize monolithically constructed precast-concrete manholes having the required strength and inside dimensions as required by the drawings or specifications. In paved areas, frames and covers for manhole and handhole entrances in vehicular traffic areas shall be flush with the finished surface of the paving. In unpaved areas, the top of manhole covers shall be approximately 1/2 inch above the finished grade. Where existing grades that are higher than finished grades are encountered, concrete assemblies designed for the purpose shall be installed to elevate temporarily the manhole cover to existing grade level. All duct lines entering manholes must be installed on compact soil or otherwise supported when entering a manhole to prevent shear stress on the duct at the point of entrance to the manhole. Duct lines entering cast-in-place concrete manholes shall be cast in-place with the manhole. Duct lines entering precast concrete manholes through a precast knockout penetration shall be grouted tight with a portland cement mortar. PVC duct lines entering precast manholes through a PVC endbell shall be solvent welded to the endbell. A cast metal grille-type sump frame and cover shall be installed over the manhole sump. A cable-pulling iron shall be installed in the wall opposite each duct line entrance.

3.6.2 Electric Manholes

Cables shall be securely supported from walls by hot-dip galvanized cable

racks with a plastic coating over the galvanizing and equipped with adjustable hooks and insulators. The number of cable racks indicated shall be installed in each manhole and not less than 2 spare hooks shall be installed on each cable rack. Insulators shall be made of high-glazed porcelain. Insulators will not be required on spare hooks.

3.6.3 Handholes

Handholes shall be located approximately as shown. Handholes shall be of the type noted on the drawings and shall be constructed in accordance with the details shown.

3.6.4 Ground Rods

A ground rod shall be installed at the manholes, handholes and pullboxes. Ground rods shall be driven into the earth before the manhole floor is poured so that approximately 4 inches of the ground rod will extend above the manhole floor. When precast concrete manholes are used, the top of the ground rod may be below the manhole floor and a No. 1/0 AWG ground conductor brought into the manhole through a watertight sleeve in the manhole wall.

3.7 PAD-MOUNTED EQUIPMENT INSTALLATION

Pad-mounted equipment, shall be installed on concrete pads in accordance with the manufacturer's published, standard installation drawings and procedures, except that they shall be modified to meet the requirements of this document. Units shall be installed so that they do not damage equipment or scratch painted or coated surfaces. After installation, surfaces shall be inspected and scratches touched up with a paint or coating provided by the manufacturer especially for this purpose. Three-phase transformers shall be installed with a,b,c (left to right) phase sequence. Primary taps shall be set at 0%.

3.7.1 Concrete Pads

3.7.1.1 Construction

Concrete pads for pad-mounted electrical equipment may be either pre-fabricated or poured-in-place. Pads shall be constructed as indicated, except that exact pad dimensions and mounting details are equipment specific and are the responsibility of the Contractor. Tops of concrete pads shall be level and shall project 4 inches above finished paving or grade and sloped to drain. Edges of concrete pads shall have 3/4 inch chamfer. Conduits for primary, secondary, and grounding conductors shall be set in place prior to placement of concrete pads. Where grounding electrode conductors are installed through concrete pads, PVC conduit sleeves shall be installed through the concrete to provide physical protection. To facilitate cable installation and termination, the concrete pad shall be provided with a rectangular hole below the primary and secondary compartments, sized in accordance with the manufacturer's recommended dimensions. Upon completion of equipment installation the rectangular hole shall be filled with masonry grout.

3.7.1.2 Concrete and Reinforcement

Concrete work shall have minimum 3000 psi compressive strength and conform to the requirements of SECTION 03300 CAST-IN-PLACE STRUCTURAL CONCRETE. Concrete pad reinforcement shall be in accordance with SECTION 03200

CONCRETE REINFORCEMENT.

3.7.1.3 Sealing

When the installation is complete, the Contractor shall seal all conduit and other entries into the equipment enclosure with an approved sealing compound. Seals shall be of sufficient strength and durability to protect all energized live parts of the equipment from rodents, insects, or other foreign matter.

3.7.2 Padlocks

Padlocks shall be provided for pad-mounted equipment and for each fence gate. Padlocks shall be keyed as directed by the Contracting Officer.

3.8 CONNECTIONS BETWEEN AERIAL AND UNDERGROUND SYSTEMS

Connections between aerial and underground systems shall be made as shown. Underground cables shall be extended up poles in conduit to cable terminations. Conduits shall be secured to the poles by 2-hole galvanized steel pipe straps spaced not more than 10 feet apart and with 1 strap not more than 12 inches from any bend or termination. Cable guards shall be secured to poles in accordance with the manufacturer's published procedures. Conduits shall be equipped with bushings to protect cables and minimize water entry. Capnut potheads shall be used to terminate medium-voltage multiple-conductor cable. Cables shall be supported by devices separate from the conduit or guard, near their point of exit from the conduit or guard.

3.8.1 Pole Installation

Pole installation shall be in accordance with SECTION 16370 ELECTRICAL DISTRIBUTION SYSTEM, AERIAL.

3.9 CONNECTIONS TO BUILDINGS

Cables shall be extended into the various buildings as indicated, and shall be connected to the first applicable termination point in each building. Interfacing with building interior conduit systems shall be at conduit stubouts terminating 5 feet outside of a building and 2 feet below finished grade as specified and provided under SECTION 16415 ELECTRICAL WORK, INTERIOR. After installation of cables, conduits shall be sealed with caulking compound to prevent entrance of moisture or gases into buildings.

3.10 GROUNDING

A ground ring consisting of the indicated configuration of bare copper conductors and driven ground rods shall be installed around pad-mounted equipment as shown. Equipment frames of metal-enclosed equipment, and other noncurrent-carrying metal parts, such as cable shields, cable sheaths and armor, and metallic conduit shall be grounded. At least 2 connections shall be provided from a transformer, to the ground ring. Metallic frames and covers of handholes and pull boxes shall be grounded by use of a braided, copper ground strap with equivalent ampacity of No. 6 AWG.

3.10.1 Grounding Electrodes

Grounding electrodes shall be installed as shown on the drawings and as follows:

a. Driven rod electrodes - Unless otherwise indicated, ground rods shall be driven into the earth until the tops of the rods are approximately 1 foot below finished grade.

b. Ground ring - A ground ring shall be installed as shown consisting of bare copper conductors installed 18 inches, plus or minus 3 inches, below finished top of soil grade. Ground ring conductors shall be No. 2 AWG, minimum.

c. Additional electrodes - When the required ground resistance is not met, additional electrodes shall be provided interconnected with grounding conductors to achieve the specified ground resistance. The additional electrodes will be up to three, 8 feet rods spaced a minimum of 10 feet apart. In high ground resistance, UL listed chemically charged ground rods may be used. If the resultant resistance exceeds 25 ohms measured not less than 48 hours after rainfall, the Contracting Officer shall be notified immediately.

3.10.2 Grounding and Bonding Connections

Connections above grade shall be made by the fusion-welding process or with bolted solderless connectors, in compliance with UL 467, and those below grade shall be made by a fusion-welding process. Where grounding conductors are connected to aluminum-composition conductors, specially treated or lined copper-to-aluminum connectors suitable for this purpose shall be used.

3.10.3 Grounding and Bonding Conductors

Grounding and bonding conductors include conductors used to bond transformer enclosures and equipment frames to the grounding electrode system. Grounding and bonding conductors shall be sized as shown, and located to provide maximum physical protection. Bends greater than 45 degrees in ground conductors are not permitted. Routing of ground conductors through concrete shall be avoided. When concrete penetration is necessary, nonmetallic conduit shall be cast flush with the points of concrete entrance and exit so as to provide an opening for the ground conductor, and the opening shall be sealed with a suitable compound after installation.

3.10.4 Surge Arrester Grounding

Surge arresters and neutrals shall be bonded directly to the transformer enclosure and then to the grounding electrode system with a bare copper conductor, sized as shown. Lead lengths shall be kept as short as practicable with no kinks or sharp bends.

3.10.5 Manhole, Handhole, or Concrete Pullbox Grounding

Ground rods installed in manholes, handholes, or concrete pullboxes shall be connected to cable racks, cable-pulling irons, the cable shielding, metallic sheath, and armor at each cable joint or splice by means of a No. 4 AWG braided tinned copper wire. Connections to metallic cable sheaths shall be by means of tinned terminals soldered to ground wires and to cable sheaths. Care shall be taken in soldering not to damage metallic cable sheaths or shields. Ground rods shall be protected with a double wrapping of pressure-sensitive plastic tape for a distance of 2 inches above and 6 inches below concrete penetrations. Grounding electrode conductors shall

be neatly and firmly attached to manhole or handhole walls and the amount of exposed bare wire shall be held to a minimum.

3.10.6 Riser Pole Grounding

A single continuous vertical grounding electrode conductor shall be installed on each riser pole and connected directly to the grounding electrodes indicated on the drawings or required by these specifications. All equipment, neutrals, surge arresters, and items required to be grounded shall be connected directly to this vertical conductor. The grounding electrode conductor shall be sized as shown. Grounding electrode conductors shall be stapled to wood poles at intervals not exceeding 2 feet.

3.11 FIELD TESTING

3.11.1 General

Field testing shall be performed in the presence of the Contracting Officer. The Contractor shall notify the Contracting Officer 10 days prior to conducting tests. The Contractor shall furnish all materials, labor, and equipment necessary to conduct field tests. The Contractor shall perform all tests and inspections recommended by the manufacturer unless specifically waived by the Contracting Officer. The Contractor shall maintain a written record of all tests which includes date, test performed, personnel involved, devices tested, serial number and name of test equipment, and test results. Field test reports shall be signed and dated by the Contractor.

3.11.2 Safety

The Contractor shall provide and use safety devices such as rubber gloves, protective barriers, and danger signs to protect and warn personnel in the test vicinity. The Contractor shall replace any devices or equipment which are damaged due to improper test procedures or handling.

3.11.3 Ground-Resistance Tests

The resistance of each grounding electrode system shall be measured using the fall-of-potential method defined in IEEE Std 81. Ground resistance measurements shall be made before the electrical distribution system is energized and shall be made in normally dry conditions not less than 48 hours after the last rainfall. Resistance measurements of separate grounding electrode systems shall be made before the systems are bonded together below grade. The combined resistance of separate systems may be used to meet the required resistance, but the specified number of electrodes must still be provided.

a. Single rod electrode - 25 ohms.

b. Multiple rod electrodes - 25 ohms.

c. Ground ring - 25 ohms.

3.11.4 Medium-Voltage Cable Test

After installation and before the operating test or connection to an existing system, the medium-voltage cable system shall be given a high potential test. Direct-current voltage shall be applied on each phase conductor of the system by connecting conductors as one terminal and

connecting grounds or metallic shieldings or sheaths of the cable as the other terminal for each test. Prior to making the test, the cables shall be isolated by opening applicable protective devices and disconnecting equipment. The test shall be conducted with all splices, connectors, and terminations in place. The method, voltage, length of time, and other characteristics of the test for initial installation shall be in accordance with NEMA WC 7 or NEMA WC 8 for the particular type of cable installed, except that 28 kV and 35 kV insulation test voltages shall be in accordance with either AEIC CS5 or AEIC CS6 as applicable, and shall not exceed the recommendations of IEEE Std 404 for cable joints and IEEE Std 48 for cable terminations unless the cable and accessory manufacturers indicate higher voltages are acceptable for testing. Should any cable fail due to a weakness of conductor insulation or due to defects or injuries incidental to the installation or because of improper installation of cable, cable joints, terminations, or other connections, the Contractor shall make necessary repairs or replace cables as directed. Repaired or replaced cables shall be retested.

3.11.5 Low-Voltage Cable Test

Low-voltage cable, complete with splices, shall be tested for insulation resistance after the cables are installed, in their final configuration, ready for connection to the equipment, and prior to energization. The test voltage shall be 500 volts dc, applied for one minute between each conductor and ground and between all possible combinations conductors in the same trench, duct, or cable, with all other conductors in the same trench, duct, or conduit. The minimum value of insulation shall be:

Each cable failing this test shall be repaired or replaced. The repaired cable shall be retested until failures have been eliminated.

3.11.6 Liquid-Filled Transformer Tests

The following field tests shall be performed on all liquid-filled transformers. Pass-fail criteria shall be in accordance with transformer manufacturer's specifications.

a. Insulation resistance test phase-to-ground.

b. Turns ratio test.

c. Correct phase sequence.

d. Correct operation of tap changer.

3.11.7 Pre-Energization Services

Calibration, testing, adjustment, and placing into service of the installation shall be accomplished by a manufacturer's product field service engineer or independent testing company with a minimum of 2 years of current product experience. The following services shall be performed on the equipment listed below. These services shall be performed subsequent to testing but prior to the initial energization. The equipment shall be inspected to ensure that installation is in compliance with the recommendations of the manufacturer and as shown on the detail drawings. Terminations of conductors at major equipment shall be inspected to ensure the adequacy of connections. Bare and insulated conductors between such terminations shall be inspected to detect possible damage during installation. If factory tests were not performed on completed assemblies,

tests shall be performed after the installation of completed assemblies. Components shall be inspected for damage caused during installation or shipment to ensure packaging materials have been removed. Components capable of being both manually and electrically operated shall be operated manually prior to the first electrical operation. Components capable of being calibrated, adjusted, and tested shall be calibrated, adjusted, and tested in accordance with the instructions of the equipment manufacturer. Items for which such services shall be provided, but are not limited to, are the following:

Pad-mounted transformers

3.11.8 Operating Tests

After the installation is completed, and at such times as the Contracting Officer may direct, the Contractor shall conduct operating tests for approval. The equipment shall be demonstrated to operate in accordance with the requirements herein. An operating test report shall be submitted in accordance with paragraph SUBMITTALS.

3.12 MANUFACTURER'S FIELD SERVICE

3.12.1 Onsite Training

The Contractor shall conduct a training course for the operating staff as designated by the Contracting Officer. The training period shall consist of a total of 8 hours of normal working time and shall start after the system is functionally completed but prior to final acceptance tests. The course instruction shall cover pertinent points involved in operating, starting, stopping, and servicing the equipment, as well as all major elements of the operation and maintenance manuals. Additionally, the course instructions shall demonstrate all routine maintenance operations. A VHS format video tape of the entire training session shall be submitted.

3.12.2 Installation Engineer

After delivery of the equipment, the Contractor shall furnish one or more field engineers, regularly employed by the equipment manufacturer to supervise the installation of the equipment, assist in the performance of the onsite tests, initial operation, and instruct personnel as to the operational and maintenance features of the equipment.

3.13 ACCEPTANCE

Final acceptance of the facility will not be given until the Contractor has successfully completed all tests and after all defects in installation, material or operation have been corrected.

-- End of Section --

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SECTION 16415

ELECTRICAL WORK, INTERIOR

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C12.10	(1997) Electromechanical Watthour Meters
ANSI C12.11	(1987; R 1993) Instrument Transformers for Revenue Metering, 10 kV BIL through 350 kV BIL (0.6 kV NSV through 69 kV NSV)
ANSI C39.1	(1981; R 1992) Requirements for Electrical Analog Indicating Instruments
ANSI C78.1	(1991; C78.1a; R 1996) Fluorescent Lamps - Rapid-Start Types - Dimensional and Electrical Characteristics
ANSI C78.1350	(1990) Electric Lamps - 400-Watt, 100-Volt, S51 Single-Ended High-Pressure Sodium Lamps
ANSI C78.1351	(1989) Electric Lamps - 250-Watt, 100-Volt S50 Single-Ended High-Pressure Sodium Lamps
ANSI C78.1352	(1990) Electric Lamps - 1000-Watt, 250-Volt, S52 Single-Ended High-Pressure Sodium Lamps
ANSI C78.1355	(1989) Electric Lamps - 150-Watt, 55-Volt S55 High-Pressure Sodium Lamps
ANSI C78.1375	(1996) 400-Watt, M59 Single-Ended Metal-Halide Lamps
ANSI C78.1376	(1996) 1000-Watt, M47 Metal-Halide Lamps
ANSI C78.20	(1995) Electric Lamps - Characteristics of Incandescent Lamps A, G, PS, and Similar Shapes with E26 Medium Screw Bases
ANSI C78.21	(1995) Physical and Electrical Characteristics - Incandescent Lamps - PAR and R Shapes
ANSI C78.2A	(1991) 18 & 26-Watt, Compact Fluorescent

	Quad Tube Lamps
ANSI C78.2B	(1992) 9 & 13-Watt, Compact Fluorescent Quad Tube Lamps
ANSI C82.1	(1997) Specifications for Fluorescent Lamp Ballasts
ANSI C82.4	(1992) Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps (Multiple-Supply Type)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM B 1	(2001) Hard-Drawn Copper Wire
ASTM B 8	(1999) Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
ASTM D 709	(2000) Laminated Thermosetting Materials

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C37.20.1	(1993) Metal-Enclosed Low-Voltage Power Circuit-Breaker Switchgear
IEEE C57.13	(1993) Instrument Transformers
IEEE C62.41	(1991; R 1995) Surge Voltages in Low-Voltage AC Power Circuits
IEEE C62.45	(1992) Surge Testing for Equipment Connected to Low-Voltage AC Power Circuits
IEEE Std 81	(1983) Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System (Part 1)
IEEE Std 242	(2001) Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems
IEEE Std 399	(1997) Recommended Practice for Industrial and Commercial Power Systems Analysis

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250	(1997) Enclosures for Electrical Equipment (1000 Volts Maximum)
NEMA AB 1	(1993) Molded Case Circuit Breakers and Molded Case Switches
NEMA FU 1	(1986) Low Voltage Cartridge Fuses
NEMA ICS 1	(1993) Industrial Control and Systems
NEMA ICS 2	(1993) Industrial Control and Systems

	Controllers, Contactors, and Overload Relays, Rated Not More Than 2,000 Volts AC or 750 Volts DC
NEMA ICS 3	(1993) Industrial Control and Systems Factory Built Assemblies
NEMA ICS 6	(1993) Industrial Control and Systems
NEMA LE 4	(1987) Recessed Luminaires, Ceiling Compatibility
NEMA MG 1	(2003) Motors and Generators
NEMA MG 10	(1994) Energy Management Guide for Selection and Use of Polyphase Motors
NEMA OS 1	(1996) Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports
NEMA PB 1	(1995) Panelboards
NEMA PB 2	(1995) Deadfront Distribution Switchboards
NEMA RN 1	(1998) Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit
NEMA ST 20	(1992) Dry-Type Transformers for General Applications
NEMA WD 1	(1999) General Requirements for Wiring Devices
NEMA WD 6	(1997) Wiring Devices - Dimensional Requirements

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 101	(2003) Life Safety Code
NFPA 70	(2002) National Electrical Code

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

47 CFR 18	Industrial, Scientific, and Medical Equipment

UNDERWRITERS LABORATORIES (UL)

UL 1	(2000) Flexible Metal Conduit
UL 6	(2000) Rigid Metal Conduit
UL 20	(1995; Rev thru Oct 1998) General-Use Snap Switches
UL 50	(1995; Rev thru Nov 1999) Enclosures for Electrical Equipment

UL 67	(1993; Rev thru Oct 1999) Panelboards
UL 83	(1998; Rev thru Sep 1999) Thermoplastic-Insulated Wires and Cables
UL 98	(1994; Rev thru Jun 1998) Enclosed and Dead-Front Switches
UL 198B	(1995) Class H Fuses
UL 198C	(1986; Rev thru Feb 1998) High-Interrupting-Capacity Fuses, Current-Limiting Types
UL 198D	(1995) Class K Fuses
UL 198E	(1988; Rev Jul 1988) Class R Fuses
UL 198G	(1988; Rev May 1988) Fuses for Supplementary Overcurrent Protection
UL 198H	(1988; Rev thru Nov 1993) Class T Fuses
UL 360	(1996; Rev thru Oct 1997) Liquid-Tight Flexible Steel Conduit
UL 467	(1993; Rev thru Feb 2001) Grounding and Bonding Equipment
UL 486A	(1997; Rev thru May 2001) Wire Connectors and Soldering Lugs for Use with Copper Conductors
UL 486C	(1997; Rev thru Aug 1998) Splicing Wire Connectors
UL 486E	(1994; Rev thru Feb 1997) Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors
UL 489	(1996; Rev thru Dec 1998) Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures
UL 498	(1996; Rev thru Jan 1999) Attachment Plugs and Receptacles
UL 506	(1994; R Oct 1997) Specialty Transformers
UL 508	(1999; Rev thru Dec 2001) Industrial Control Equipment
UL 510	(1994; Rev thru Apr 1998) Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape
UL 512	(1993; Rev thru Mar 1999) Fuseholders

UL 514A	(1996; Rev Dec 1999) Metallic Outlet Boxes
UL 514B	(2004) Safety Conduit, Tubing, and Cable Fittings
UL 542	(1999) Lampholders, Starters, and Starter Holders for Fluorescent Lamps
UL 674	(1994; Rev thru Oct 1998) Electric Motors and Generators for Use in Division 1 Hazardous (Classified) Locations
UL 698	(1995; Rev thru May 1999) Industrial Control Equipment for Use in Hazardous (Classified) Locations
UL 797	(1993; Rev thru Mar 1997) Electrical Metallic Tubing
UL 844	(1995; Rev thru Mar 1999) Electric Lighting Fixtures for Use in Hazardous (Classified) Locations
UL 845	(1995; Rev thru Nov 1999) Motor Control Centers
UL 854	(1999; Rev thru Aug 2001) Service - Entrance Cables
UL 869A	(1998) Reference Standard for Service Equipment
UL 877	(1993; Rev thru Nov 1999) Circuit Breakers and Circuit-Breaker Enclosures for Use in Hazardous (Classified) Locations
UL 886	(1994; Rev thru Apr 1999) Outlet Boxes and Fittings for Use in Hazardous (Classified) Locations
UL 891	(1994; Rev thru Jan 1995) Dead-Front Switchboards
UL 924	(1995; Rev thru Oct 97) Emergency Lighting and Power Equipment
UL 935	(1995; Rev thru Oct 1998) Fluorescent-Lamp Ballasts
UL 943	(1993; Rev thru May 1998) Ground-Fault Circuit-Interrupters
UL 1004	(1994; Rev thru Nov 1999) Electric Motors
UL 1010	(1995; Rev thru Mar 1999) Receptacle-Plug Combinations for Use in Hazardous (Classified) Locations
UL 1029	(1994; Rev thru Dec 1997)

	High-Intensity-Discharge Lamp Ballasts
UL 1242	(1996; Rev Mar 1998) Intermediate Metal Conduit
UL 1449	(1996; Rev thru Dec 1999) Transient Voltage Surge Suppressors
UL 1570	(1995; Rev thru Nov 1999) Fluorescent Lighting Fixtures
UL 1571	(1995; Rev thru Nov 1999) Incandescent Lighting Fixtures
UL 1572	(1995; Rev thru Nov 1999) High Intensity Discharge Lighting Fixtures
UL 1660	(2000) Liquid-Tight Flexible Nonmetallic Conduit
UL Elec Const Dir	(2001) Electrical Construction Equipment Directory

1.2 GENERAL

1.2.1 Rules

The installation shall conform to the requirements of NFPA 70 and NFPA 101, unless more stringent requirements are indicated or shown.

1.2.2 Coordination

The drawings indicate the extent and the general location and arrangement of equipment, conduit, and wiring. The Contractor shall become familiar with all details of the work and verify all dimensions in the field so that the outlets and equipment shall be properly located and readily accessible. Lighting fixtures, outlets, and other equipment and materials shall be carefully coordinated with mechanical or structural features prior to installation and positioned according to architectural reflected ceiling plans; otherwise, lighting fixtures shall be symmetrically located according to the room arrangement when uniform illumination is required, or asymmetrically located to suit conditions fixed by design and shown. Raceways, junction and outlet boxes, and lighting fixtures shall not be supported from sheet metal roof decks. If any conflicts occur necessitating departures from the drawings, details of and reasons for departures shall be submitted and approved prior to implementing any change. The Contractor shall coordinate the electrical requirements of the mechanical work and provide all power related circuits, wiring, hardware and structural support, even if not shown on the drawings.

1.2.3 Special Environments

1.2.3.1 Weatherproof Locations

Wiring, Fixtures, and equipment in designated locations shall conform to NFPA 70 requirements for installation in damp or wet locations.

1.2.3.2 Hazardous Locations

Wiring and equipment in locations indicated shall be of the classes, groups, divisions, and suitable for the operating temperature; as indicated.

1.2.3.3 Ducts, Plenums and Other Air-Handling Spaces

Wiring and equipment in ducts, plenums and other air-handling spaces shall be installed using materials and methods in conformance with NFPA 70unless more stringent requirements are indicated in this specification or on the contract drawings.

1.2.4 Standard Products

Material and equipment shall be a standard product of a manufacturer regularly engaged in the manufacture of the product and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening.

1.2.5 Nameplates

1.2.5.1 Identification Nameplates

Major items of electrical equipment and major components shall be permanently marked with an identification name to identify the equipment by type or function and specific unit number as indicated. Designation of motors shall coincide with their designation in the motor control center or panel. Unless otherwise specified, identification nameplates shall be made of laminated plastic in accordance with ASTM D 709 with black outer layers and a white core. Edges shall be chamfered. Plates shall be fastened with black-finished round-head drive screws, except motors, or approved nonadhesive metal fasteners. When the nameplate is to be installed on an irregular-shaped object, the Contractor shall devise an approved support suitable for the application and ensure the proper installation of the supports and nameplates. In all instances, the nameplate shall be installed in a conspicuous location. At the option of the Contractor, the equipment manufacturer's standard embossed nameplate material with black paint-filled letters may be furnished in lieu of laminated plastic. The front of each panelboard, motor control center, switchgear, and switchboard shall have a nameplate to indicate the phase letter, corresponding color and arrangement of the phase conductors. The following equipment, as a minimum, shall be provided with identification nameplates:

Minimum 1/4 inch High Letters	Minimum 1/8 inch High Letters
Panelboards	Control Power Transformers
Starters	Control Devices
Safety Switches	Instrument Transformers
Motor Control Centers	
Transformers	
Equipment Enclosures	
Switchboards	
Motors	

Each panel, section, or unit in motor control centers, switchgear or similar assemblies shall be provided with a nameplate in addition to nameplates listed above, which shall be provided for individual compartments in the respective assembly, including nameplates which

identify "future," "spare," and "dedicated" or "equipped spaces."

1.2.6 As-Built Drawings

Following the project completion or turnover, within 30 days the Contractor shall furnish 2 sets of as-built drawings to the Contracting Officer.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with SECTION 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Interior Electrical Equipment; G-AE.

Detail drawings consisting of equipment drawings, illustrations, schedules, instructions, diagrams, and other information necessary to define the installation. Detail drawings shall show the rating of items and systems and how the components of an item and system are assembled, function together, and how they will be installed on the project. Data and drawings for component parts of an item or system shall be coordinated and submitted as a unit. Data and drawings shall be coordinated and included in a single submission. Multiple submissions for the same equipment or system are not acceptable except where prior approval has been obtained from the Contracting Officer. In such cases, a list of data to be submitted later shall be included with the first submission. Detail drawings shall show physical arrangement, construction details, connections, finishes, materials used in fabrication, provisions for conduit or busway entrance, access requirements for installation and maintenance, physical size, electrical characteristics, foundation and support details, and equipment weight. Drawings shall be drawn to scale and/or dimensioned. Optional items shall be clearly identified as included or excluded. Detail drawings shall as a minimum include:

a. Transformers.

b. Switchgear.

c. Motors and rotating machinery.

d. Motor control centers.

e. Single line electrical diagrams including primary, metering, sensing and relaying, control wiring, and control logic.

f. Sway bracing for suspended luminaires.

Structural drawings showing the structural or physical features of major equipment items, components, assemblies, and structures, including foundations or other types of supports for equipment and conductors. These drawings shall include accurately scaled or dimensioned outline and arrangement or layout drawings to show the physical size of equipment and components and the relative arrangement and physical connection of related components. Weights of equipment, components and assemblies shall be provided when required to verify the adequacy of design and proposed

construction of foundations or other types of supports. Dynamic forces shall be stated for switching devices when such forces must be considered in the design of support structures. The appropriate detail drawings shall show the provisions for leveling, anchoring, and connecting all items during installation, and shall include any recommendations made by the manufacturer.

Electrical drawings including single-line and three-line diagrams, and schematics or elementary diagrams of each electrical system; internal wiring and field connection diagrams of each electrical device when published by the manufacturer; wiring diagrams of cabinets, panels, units, or separate mountings; interconnection diagrams that show the wiring between separate components of assemblies; field connection diagrams that show the termination of wiring routed between separate items of equipment; internal wiring diagrams of equipment showing wiring as actually provided for this project. Field wiring connections shall be clearly identified.

If departures from the contract drawings are deemed necessary by the Contractor, complete details of such departures, including changes in related portions of the project and the reasons why, shall be submitted with the detail drawings. Approved departures shall be made at no additional cost to the Government.

SD-03 Product Data

Fault Current and Protective Device Coordination Study; G-AE.

The study shall be submitted along with protective device equipment submittals. No time extensions or similar contract modifications will be granted for work arising out of the requirements for this study. Approval of protective devices proposed shall be based on recommendations of this study, The Government shall not be held responsible for any changes to equipment, device ratings, settings, or additional labor for installation of equipment or devices ordered and/or procured prior to approval of the study.

Manufacturer's Catalog; G-AE.

Data composed of catalog cuts, brochures, circulars, specifications, product data, and printed information in sufficient detail and scope to verify compliance with the requirements of the contract documents.

Material, Equipment, and Fixture Lists; G-AO.

A complete itemized listing of equipment and materials proposed for incorporation into the work. Each entry shall include an item number, the quantity of items proposed, and the name of the manufacturer of each item.

Installation Procedures; G-AO.

Installation procedures for rotating equipment, transformers, switchgear, battery systems, voltage regulators, and grounding resistors. Procedures shall include diagrams, instructions, and precautions required to install, adjust, calibrate, and test devices and equipment.

As-Built Drawings; G-AO.

The as-built drawings shall be a record of the construction as installed. The drawings shall include all the information shown on the contract

drawings, deviations, modifications, and changes from the contract drawings, however minor. The as-built drawings shall be kept at the job site and updated daily. The as-built drawings shall be a full-sized set of prints marked to reflect all deviations, changes, and modifications. The as-built drawings shall be complete and show the location, size, dimensions, part identification, and other information. Additional sheets may be added. The as-built drawings shall be jointly inspected for accuracy and completeness by the Contractor's quality control representative and by the Contracting Officer prior to the submission of each monthly pay estimate. Upon completion of the work, the Contractor shall submit three full sized sets of the marked prints to the Contracting Officer for approval. If upon review, the as-built drawings are found to contain errors and/or omissions, they will be returned to the Contractor for correction. The Contractor shall correct and return the as-built drawings to the Contracting Officer for approval within ten calendar days from the time the drawings are returned to the Contractor.

Onsite Tests; G-AO.

A detailed description of the Contractor's proposed procedures for on-site tests.

SD-06 Test Reports

Factory Test Reports; G-AO.

Six copies of the information described below in 8 1/2 x 11 inch binders having a minimum of 5 rings from which material may readily be removed and replaced, including a separate section for each test. Sections shall be separated by heavy plastic dividers with tabs.

a. A list of equipment used, with calibration certifications.

b. A copy of measurements taken.

c. The dates of testing.

d. The equipment and values to be verified.

e. The conditions specified for the test.

f. The test results, signed and dated.

g. A description of adjustments made.

Field Test Plan; G-AO.

A detailed description of the Contractor's proposed procedures for onsite test submitted 30 days prior to testing the installed system. No field test will be performed until the test plan is approved. The test plan shall consist of complete field test procedures including tests to be performed, test equipment required, and tolerance limits.

Field Test Reports; G-AO.

Six copies of the information described below in 8 1/2 x 11 inch binders having a minimum of 5 rings from which material may readily be removed and replaced, including a separate section for each test. Sections shall be separated by heavy plastic dividers with tabs.

a. A list of equipment used, with calibration certifications.

b. A copy of measurements taken.

c. The dates of testing.

d. The equipment and values to be verified.

e. The conditions specified for the test.

f. The test results, signed and dated.

g. A description of adjustments made.

h. Final position of controls and device settings.

SD-07 Certificates

Materials and Equipment; G-AO.

The label or listing of the Underwriters Laboratories, Inc., will be accepted as evidence that the materials or equipment conform to the applicable standards of that agency. In lieu of this label or listing, a statement from a nationally recognized, adequately equipped testing agency indicating that the items have been tested in accordance with required procedures and that the materials and equipment comply with all contract requirements will be accepted. However, materials and equipment installed in hazardous locations must bear the UL label unless the data submitted from other testing agency is specifically approved in writing by the Contracting Officer. Items which are required to be listed and labeled in accordance with Underwriters Laboratories must be affixed with a UL label that states that it is UL listed. No exceptions or waivers will be granted to this requirement. Materials and equipment will be approved based on the manufacturer's published data.

For other than equipment and materials specified to conform to UL publications, a manufacturer's statement indicating complete compliance with the applicable standard of the American Society for Testing and Materials, National Electrical Manufacturers Association, or other commercial standard, is acceptable.

1.4 WORKMANSHIP

Materials and equipment shall be installed in accordance with NFPA 70, recommendations of the manufacturer, and as shown.

1.5 SEISMIC REQUIREMENTS

Seismic details shall conform to Sections 13080 SEISMIC PROTECTION FOR MISCELLANEOUS EQUIPMENT and 16070 SEISMIC PROTECTION FOR ELECTRICAL EQUIPMENT

PART 2 PRODUCTS

Products shall conform to the respective publications and other requirements specified below. Materials and equipment not listed below shall be as specified elsewhere in this section. Items of the same classification shall be identical including equipment, assemblies, parts,

and components.

2.1 CABLES AND WIRES

Conductors No. 8 AWG and larger diameter shall be stranded. Conductors No. 10 AWG and smaller diameter shall be solid, except that conductors for remote control, alarm, and signal circuits, classes 1, 2, and 3, shall be stranded unless specifically indicated otherwise. Conductor sizes and ampacities shown are based on copper, unless indicated otherwise. All conductors shall be copper.

2.1.1 Equipment Manufacturer Requirements

When manufacturer's equipment requires copper conductors at the terminations or requires copper conductors to be provided between components of equipment, provide copper conductors or splices, splice boxes, and other work required to meet manufacturer's requirements.

2.1.2 Aluminum Conductors

Aluminum conductors shall not be used.

2.1.3 Insulation

Unless indicated otherwise, or required by NFPA 70, power and lighting wires shall be 600-volt, Type THWN, THHN, or THW conforming to UL 83 , except that grounding wire may be type TW conforming to UL 83; remote-control and signal circuits shall be Type TW, THW or TF, conforming to UL 83. Where lighting fixtures require 90-degree Centigrade (C) conductors, provide only conductors with 90-degree C insulation or better.

2.1.4 Bonding Conductors

ASTM B 1, solid bare copper wire for sizes No. 8 AWG and smaller diameter; ASTM B 8, Class B, stranded bare copper wire for sizes No. 6 AWG and larger diameter.

2.1.5 Service Entrance Cables

Service entrance (SE) and underground service entrance (USE) cables, UL 854.

2.2 TRANSIENT VOLTAGE SURGE PROTECTION

Transient voltage surge suppressors (TVSS) or surge protective devices (SPD) shall be designed to protect all AC electrical circuits and connected equipment from the damaging effects of external and internal transients. Surge suppressors shall be tested to the guidelines found in IEEE C62.41 and IEEE C62.45, and suppressors shall be UL 1449 2nd edition listed and labeled. SPD shall be rated for the same service voltage as the panel being protected and the surge suppressors shall be a permanently connected TVSS as defined in UL 1449 2nd edition.

Surge suppressors shall be tested to Category C3 as defined in IEEE C62.41 and be UL rated for Service Entrance application. Surge suppressor ratings shall be for use at 120/208 volts rms, operating voltage; 60 Hz; 3-phase; 4 wire with ground; transient suppression voltage. Fuses shall not be used as surge suppression.

2.2.1 Product Features

a. NEMA 12 steel enclosure for interior unless unit is part of panelboard, switchboard or motor control center.

b. LED circuit status indicators to indicate module failure.

c. Bidirectional and bipolar protection.

d. Constructed of solid state components, no lights or relays shall be used that will require maintenance or replacement.

e. Response time: no greater than 0.5 nanoseconds for any of the individual protection modes.

f. Operating frequency: 60 Hz.

g. Designed for parallel connection.

h Audible Noise shall be a 35 dB maximum @ 3 ft from unit.

i Provide dry contacts for remote monitoring.

j. Warranty: 5 years minimum.

k. Safety Thermal Cutouts shall be used to clear a sustained low current overvoltage fault.

l. 200kAIC surge rated fuses shall be used to clear sustained high current overvoltage fault.

m. TVSS shall have a minimum EMI/RFI filtering of -50dB at 100k Hz with an insertion ratio of 50:1 using MIL STD 220A methodology.

n. Line-to-neutral and neutral-to-ground suppression paths for WYE configured circuits and line-to-line, line-to-ground, for Delta configured circuits.

o. The unit shall be connected to a dedicated circuit breaker in the panelboard, motor control center. switchboard or shall have an integral circuit breaker. Size of breaker shall be per manufacturer.

p. Designed for parallel operation.

q. The minimum low exposure surge current capacity shall be 40kA L-N, 40kA L-G and 30kA N-G.

2.2.1.1 Suppressed Voltage Rating (SVR)

The Suppressed Voltage Rating (SVR) shall be tested in accordance with the measured voltage limiting test and duty cycle test from the latest edition of UL 1449 with 6" leads. The SVR shall not exceed the following:

Nominal Voltage	L-L	L-N	N-G	L-G	MCOV
480Y/277	1200	600	600	600	320
208Y/120	700	400	400	400	150
240 DELTA	700	NA	NA	700	275
480 DELTA	1500	NA	NA	1500	575
120/240	700	400	400	400	150

*MCOV = maximum continuous operating voltage

2.3 CIRCUIT BREAKERS

2.3.1 MOLDED-CASE CIRCUIT BREAKERS

Molded-case circuit breakers shall conform to NEMA AB 1 and UL 489and UL 877 for circuit breakers and circuit breaker enclosures located in hazardous (classified) locations. Circuit breakers may be installed in panelboards, switchboards, enclosures, motor control centers, or combination motor controllers.

2.3.1.1 Construction

Circuit breakers shall be suitable for mounting and operating in any position. Lug shall be listed for copper conductors only in accordance with UL 486E. Single-pole circuit breakers shall be full module size with not more than one pole per module. Multi-pole circuit breakers shall be of the common-trip type having a single operating handle such that an overload or short circuit on any one pole will result in all poles opening simultaneously. Sizes of 100 amperes or less may consist of single-pole breakers permanently factory assembled into a multi-pole unit having an internal, mechanical, nontamperable common-trip mechanism and external handle ties. All circuit breakers shall have a quick-make, quick-break overcenter toggle-type mechanism, and the handle mechanism shall be trip-free to prevent holding the contacts closed against a short-circuit or sustained overload. All circuit breaker handles shall assume a position between "ON" and "OFF" when tripped automatically. All ratings shall be clearly visible.

2.3.1.2 Ratings

Voltage ratings shall be not less than the applicable circuit voltage. The interrupting rating of the circuit breakers shall be at least equal to the available short-circuit current at the line terminals of the circuit breaker and correspond to the UL listed integrated short-circuit current rating specified for the panelboards and switchboards. Molded-case circuit breakers shall have nominal voltage ratings, maximum continuous-current ratings, and maximum short-circuit interrupting ratings in accordance with NEMA AB 1. Ratings shall be coordinated with system X/R ratio.

2.3.1.3 Thermal-Magnetic Trip Elements

Thermal magnetic circuit breakers shall be provided as shown. Automatic operation shall be obtained by means of thermal-magnetic tripping devices located in each pole providing inverse time delay and instantaneous circuit protection. The instantaneous magnetic trip shall be adjustable and accessible from the front of all circuit breakers on frame sizes above 150 amperes.

2.3.2 Solid-State Trip Elements

Solid-state circuit breakers (Insulated Case Systems Type) shall be provided as shown. All electronics shall be self-contained and require no external relaying, power supply, or accessories. Printed circuit cards shall be treated to resist moisture absorption, fungus growth, and signal leakage. All electronics shall be housed in an enclosure which provides protection against arcs, magnetic interference, dust, and other

contaminants. Solid-state sensing shall measure true RMS current with error less than one percent on systems with distortions through the 13th harmonic. Peak or average actuating devices are not acceptable. Current sensors shall be torodial construction, encased in a plastic housing filled with epoxy to protect against damage and moisture and shall be integrally mounted on the breaker. Where indicated on the drawings, circuit breaker frames shall be rated for 100 percent continuous duty. Circuit breakers shall have tripping features as shown on the drawings and as described below:

a. Long-time current pick-up, adjustable from 50 percent to 100 percent of continuous current rating.

b. Adjustable long-time delay.

c. Short-time current pick-up, adjustable from 1.5 to 9 times long-time current setting.

d. Adjustable short-time delay.

e. Short-time I square times t switch.

f. Instantaneous current pick-up, adjustable from 1.5 to 9 times long-time current setting.

g. Adjustable ground-fault delay.

h. Overload and short-time and ground-fault trip indicators shall be provided.

2.3.3 HACR Circuit Breakers

Circuit breakers 60 amperes or below, 240 volts, 1-pole or 2-pole, intended to protect multi-motor and combination-load installations involved in heating, air conditioning, and refrigerating equipment shall be marked "Listed HACR Type."

2.4 MOTOR SHORT-CIRCUIT PROTECTOR (MSCP)

Motor short-circuit protectors shall conform to UL 508 and shall be provided as shown. Protectors shall be used only as part of a combination motor controller which provides coordinated motor branch-circuit overload and short-circuit protection, and shall be rated in accordance with the requirements of NFPA 70.

2.4.1 Construction

Motor short-circuit protector bodies shall be constructed of high temperature, dimensionally stable, long life, nonhygroscopic materials. Protectors shall fit special MSCP mounting clips and shall not be interchangeable with any commercially available fuses. Protectors shall have 100 percent one-way interchangeability within the A-Y letter designations. All ratings shall be clearly visible.

2.4.2 Ratings

Voltage ratings shall be not less than the applicable circuit voltage. Letter designations shall be A through Y for motor controller Sizes 0, 1, 2, 3, 4, and 5, with 100,000 amperes interrupting capacity rating. Letter

designations shall correspond to controller sizes as follows:

CONTROLLER SIZE	MSCP DESIGNATION
NEMA O	A-N
NEMA 1	A-P
NEMA 2	A-S
NEMA 3	A-U
NEMA 4	A-W
NEMA 5	A-Y

2.5 CONDUIT AND TUBING

2.5.1 Electrical, Zinc-Coated Steel Metallic Tubing (EMT)

UL 797

2.5.2 Flexible Conduit, Steel and Plastic

General-purpose type, UL 1; liquid tight, UL 360, and UL 1660.

2.5.3 Intermediate Metal Conduit

UL 1242.

2.5.4 PVC Coated Rigid Steel Conduit

NEMA RN 1.

2.5.5 Rigid Metal Conduit

UL 6.

2.6 CONDUIT AND DEVICE BOXES AND FITTINGS

2.6.1 Boxes, Metallic Outlet

NEMA OS 1 and UL 514A.

2.6.2 Boxes, Outlet for Use in Hazardous (Classified) Locations

UL 886.

2.6.3 Boxes, Switch (Enclosed), Surface-Mounted

UL 98.

2.6.4 Fittings for Conduit and Outlet Boxes

UL 514B.

2.6.5 Fittings For Use in Hazardous (Classified) Locations

UL 886.

2.7 CONDUIT COATINGS PLASTIC RESIN SYSTEM

NEMA RN 1, Type A-40.

2.8 CONNECTORS, WIRE PRESSURE

2.8.1 For Use With Copper Conductors

UL 486A.

2.9 ELECTRICAL GROUNDING AND BONDING EQUIPMENT

UL 467.

2.9.1 Ground Rods

Ground rods shall be of copper-clad steel conforming to UL 467 not less than 3/4 inch in diameter by 8 feet in length of the sectional type driven full length into the earth.

2.9.2 Ground Bus

The ground bus shall be bare conductor or flat copper in one piece, if practicable.

2.10 ENCLOSURES

NEMA ICS 6 or NEMA 250 or UL 698 for use in hazardous (classified) locations, unless otherwise specified.

2.10.1 Cabinets and Boxes

Cabinets and boxes with volume greater than 100 cubic inches shall be in accordance with UL 50, hot-dip, zinc-coated, if sheet steel.

2.10.2 Circuit Breaker Enclosures

UL 489.

2.11 LIGHTING FIXTURES, LAMPS, BALLASTS, EMERGENCY EQUIPMENT, CONTROLS AND ACCESSORIES

The following specifications are supported and supplemented by information and details on the drawings. Additional fixtures, if shown, shall conform to this specification. Lighting equipment installed in classified hazardous locations shall conform to UL 844. Lamps, lampholders, ballasts, transformers, electronic circuitry and other lighting system components shall be constructed according to industry standards. Equipment shall be tested and listed by a recognized independent testing laboratory for the expected installation conditions. Equipment shall conform to the standards listed below.

2.11.1 Lamps

Lamps shall be constructed to operate in the specified fixture, and shall function without derating life or output as listed in published data. Lamps shall meet the requirements of the Energy Policy Act of 1992.

a. Incandescent and tungsten halogen lamps shall be designed for 125 volt operation (except for low voltage lamps), shall be rated for minimum life of 2,000 hours, and shall have color temperature between 2,800 and 3,200 degrees Kelvin. Tungsten halogen lamps shall incorporate quartz capsule construction. Lamps shall comply with ANSI C78.20 and sections 238 and 270 of ANSI C78.21.

b. Fluorescent lamps shall have color temperature 3,500 degrees Kelvin. They shall be designed to operate with the ballasts and circuitry of the fixtures in which they will be used. Fluorescent lamps, including spares, shall be manufactured by one manufacturer to provide for color and performance consistency. Fluorescent lamps shall comply with ANSI C78.1. Fluorescent tube lamp efficiencies shall meet or exceed the following requirements.

T8, 32 watts	(4' lamp)	2800 lumens
T12,34 watts	(4' lamp)	2800 lumens
T8,59 watts	(8' lamp)	5700 lumens
T12,60 watts	(8' lamp)	5600 lumens

1. Linear fluorescent lamps, unless otherwise indicated, shall be 4 feet long 32 watt T8, 265 mA, with minimum CRI of 75. Lamps of other lengths or types shall be used only where specified or shown. Lamps shall deliver rated life when operated on instant start ballasts .

2. Small compact fluorescent lamps shall be twin, double, or triple tube configuration as shown with bi-pin or four-pin snap-in base and shall have minimum CRI of 85. They shall deliver rated life when operated on ballasts as shown. 9 and 13 watt double tube lamps shall comply with ANSI C78.2B. 18 and 26 watt double tube lamps shall comply with ANSI C78.2A. Minimum starting temperature shall be 32 degrees F for twin tube lamps and for double and triple twin tube lamps without internal starter; and 15 degrees F for double and triple twin tube lamps with internal starter.

3. Long compact fluorescent lamps shall be 18, 27, 39, 40, 50, or 55 watt bi-axial type as shown with four-pin snap-in base; shall have minimum CRI of 85; and shall have a minimum starting temperature of 50 degrees F. They shall deliver rated life when operated on instant start ballasts .

c. High intensity discharge lamps, including spares, shall be manufactured by one manufacturer in order to provide color and performance consistency. High intensity discharge lamps shall be designed to operate with the ballasts and circuitry of the fixtures in which they will be used and shall have wattage, shape and base as shown. High intensity discharge lamps, unless otherwise shown, shall have medium or mogul screw base and minimum starting temperature of -20 degrees F. Metal halide lamps, unless otherwise shown, shall have minimum CRI of 65; color temperature of 4,300 degrees Kelvin; shall be -BU configuration if used in base-up position; and shall be -H or high output configuration if used in horizontal position. Lamps shall comply with all applicable ANSI C78.1350, ANSI C78.1351, ANSI C78.1352, ANSI C78.1355,ANSI C78.1375, and ANSI C78.1376.

2.11.2 Ballasts and Transformers

Ballasts or transformers shall be designed to operate the designated lamps within their optimum specifications, without derating the lamps. Lamp and ballast combinations shall be certified as acceptable by the lamp manufacturer.

a. Low voltage incandescent transformers shall be Class II UL listed 120/12 volt or 120/24 volt step-down transformers as required for the lamps shown. Transformers shall be high power factor type and shall be rated for continuous operation under the specified load. Transformers shall be encased or encased and potted, and mounted integrally within the lighting fixture unless otherwise shown.

b. Fluorescent ballasts shall comply with ANSI C82.1 and shall be mounted integrally within fluorescent fixture housing unless otherwise shown. Ballasts shall have maximum current crest factor of 1.7; high power factor; Class A sound rating; maximum operating case temperature of 77 degrees F above ambient; and shall be rated Class P. Unless otherwise indicated, the minimum number of ballasts shall be used to serve each individual fixture. A single ballast may be used to serve multiple fixtures if they are continuously mounted, identically controlled and factory manufactured for that installation with an integral wireway.

1. Compact fluorescent ballasts shall comply with IEEE C62.41 Category A transient voltage variation requirements and shall be mounted integrally within compact fluorescent fixture housing unless otherwise shown. Ballasts shall have minimum ballast factor of 0.95; maximum current crest factor of 1.6; high power factor; maximum operating case temperature of 77 degrees F above ambient; shall be rated Class P; and shall have a sound rating of Class A. Ballasts shall meet FCC Class A specifications for EMI/RFI emissions. Ballasts shall operate from nominal line voltage of 120 volts at 60 Hz and maintain constant light output over a line voltage variation of ± 10%. Ballasts shall have an end-of-lamp-life detection and shut-down circuit. Ballasts shall be UL listed and shall contain no PCBs. Ballasts shall contain potting to secure PC board, provide lead strain relief, and provide a moisture barrier.

2. Electronic fluorescent ballasts shall comply with 47 CFR 18 for electromagnetic interference. Ballasts shall withstand line transients per IEEE C62.41, Category A. Ballasts shall have total harmonic distortion between 10 and 20%; minimum frequency of 20,000Hz; filament voltage between 2.5 and 4.5 volts; maximum starting inrush current of 20 amperes; and shall comply with the minimum Ballast Efficacy Factors shown in the table below. Minimum starting temperature shall be 50 degrees F. Ballasts shall carry a manufacturer's full warranty of three years, including a minimum $10 labor allowance per ballast.

ELECTRONIC FLUORESCENT BALLAST EFFICACY FACTORS

LAMP TYPE	TYPE OF STARTER & LAMP	NOMINAL OPERATIONAL VOLTAGE	NUMBER OF LAMPS	MINIMUM BALLAST EFFICACY

ELECTRONIC FLUORESCENT BALLAST EFFICACY FACTORS

				FACTOR
32W T8	rapid start linear & U-tubes	120 or 277 V	1	2.54
			2	1.44
			3	0.93
			4	0.73
34W T12	rapid start linear & U-tubes	120 or 277 V	1	2.64
			2	1.41
			3	0.93
59W T8	rapid start linear	120 or 277 V	2	0.80
60W T12	rapid start linear	120 or 277 V	2	0.80

3. Magnetic fluorescent ballasts shall be energy-saving, automatic resetting type, approved for the application by the Certified Ballast Manufacturers and complying with ANSI C82.1 and UL 935. Minimum ballast starting temperature shall be 40 degrees F for normal service and 0 degrees F where cold temperature service is required. Magnetic fluorescent ballasts shall have a ballast factor not less than shown in the following table:

MAGNETIC FLUORESCENT BALLAST FACTORS*

Design starting temperature above 40 degrees F with 60 Hz input frequency

LAMP TYPE	NUMBER OF LAMPS	NOMINAL OPERATIONAL INPUT VOLTAGE	TYPE OF STARTER & LAMP	MIN. BALLAST FACTOR
25W F25T8	1	120v	rapid start	.96
	1	277v		.96
	2	120v		.95
	2	277v		.94
32W F32T8	1	120v	rapid start	.96
	1	277v		.95
	2	120v		.85
	2	277v		.96
96W F96T8	1	120 or 277v	instant start	1.10
	2			.85

* For ballasts not specifically designed for use with dimming controls.

c. High intensity discharge ballasts shall comply with UL 1029 and, if multiple supply types, with ANSI C82.4. Ballasts shall have minimum ballast factor of 0.9; high power factor; Class A sound rating; and maximum operating case temperature of 77 degrees F

above ambient.

1. Electronic high intensity discharge ballasts shall be constant wattage autotransformer type; shall have less than 10% ballast loss; shall have total harmonic distortion between 10 and 20%; and shall have a minimum starting temperature of 0 degrees F.

2. Magnetic high intensity discharge ballasts shall have a minimum starting temperature of -20 degrees F.

2.11.3 Fixtures

Fixtures shall be in accordance with the size, shape, appearance, finish, and performance shown. Unless otherwise indicated, lighting fixtures shall be provided with housings, junction boxes, wiring, lampholders, mounting supports, trim, hardware and accessories for a complete and operable installation. Recessed housings shall be minimum 20 gauge cold rolled or galvanized steel as shown. Extruded aluminum fixtures shall have minimum wall thickness of 0.125 inches. Plastic lenses shall be 100% virgin acrylic or as shown. Glass lenses shall be tempered. Heat resistant glass shall be borosilicate type. Conoid recessed reflector cones shall be Alzak with clear specular low iridescent finish.

a. Incandescent fixtures shall comply with UL 1571. Incandescent fixture specular reflector cone trims shall be integral to the cone and shall be finished to match. Painted trim finishes shall be white with minimum reflectance of 88%. Low voltage incandescent fixtures shall have integral step-down transformers.

b. Fluorescent fixtures shall comply with UL 1570. Recessed ceiling fixtures shall comply with NEMA LE 4. Fixtures shall be plainly marked for proper lamp and ballast type to identify lamp diameter, wattage, color and start type. Marking shall be readily visible to service personnel, but not visible from normal viewing angles. Fluorescent fixture lens frames on recessed and surface mounted troffers shall be one assembly with mitered corners. Parabolic louvers shall have a low iridescent finish and 45 degree cut-off. Louver intersection joints shall be hairline type and shall conceal mounting tabs or other assembly methods. Louvers shall be free from blemishes, lines or defects which distort the visual surface. Integral ballast and wireway compartments shall be easily accessible without the use of special tools. Housings shall be constructed to include grounding necessary to start the lamps. Open fixtures shall be equipped with a sleeve, wire guard, or other positive means to prevent lamps from falling. Medium bi-pin lampholders shall be twist-in type with positive locking position. Long compact fluorescent fixtures and fixtures utilizing U-bend lamps shall have clamps or secondary lampholders to support the free ends of the lamps.

c. High intensity discharge fixture shall comply with UL 1572. Recessed ceiling fixtures shall comply with NEMA LE 4. Reflectors shall be anodized aluminum. Fixtures for horizontal lamps shall have position oriented lampholders. Lampholders shall be pulse-rated to 5,000 volts. Fixtures indicated as classified or rated for hazardous locations or special service shall be designed and independently tested for the environment in which they are installed. Recessed lens fixtures shall have extruded aluminum lens frames. Ballasts shall be integral to fixtures and shall be accessible without the use of special tools. Remote ballasts shall be encased and potted. Lamps shall be

shielded from direct view with a UV absorbing material such as tempered glass, and shall be circuited through a cut-off switch which will shut off the lamp circuit if the lens is not in place.

d. Emergency lighting fixtures and accessories shall be constructed and independently tested to meet the requirements of applicable codes. Batteries shall be Nicad or equal with no required maintenance, and shall have a minimum life expectancy of five years and warranty period of three years.

e. Exit Signs

Exit signs shall be ENERGY STAR compliant, thereby meeting the following requirements. Input power shall be less than 5 watts per face. Letter size and spacing shall adhere to NFPA 101. Luminance contrast shall be greater than 0.8. Average luminance shall be greater than 15 cd/m^2 measured at normal (0 degree) and 45 degree viewing angles. Minimum luminance shall be greater than 8.6 cd/m^2 measured at normal and 45 degree viewing angles. Maximum to minimum luminance shall be less than 20:1 measured at normal and 45 degree viewing angles. The manufacturer warranty for defective parts shall be at least 5 years.

2.11.4 Lampholders, Starters, and Starter Holders

UL 542

2.12 LOW-VOLTAGE FUSES AND FUSEHOLDERS

2.12.1 Fuses, Low Voltage Cartridge Type

NEMA FU 1.

2.12.2 Fuses, High-Interrupting-Capacity, Current-Limiting Type

Fuses, Class G, J, L and CC shall be in accordance with UL 198C.

2.12.3 Fuses, Class K, High-Interrupting-Capacity Type

UL 198D.

2.12.4 Fuses, Class H

UL 198B.

2.12.5 Fuses, Class R

UL 198E.

2.12.6 Fuses, Class T

UL 198H.

2.12.7 Fuses for Supplementary Overcurrent Protection

UL 198G.

2.12.8 Fuseholders

UL 512.

2.13 INSTRUMENTS, ELECTRICAL INDICATING

ANSI C39.1.

2.14 MOTORS, AC, FRACTIONAL AND INTEGRAL

Motors, ac, fractional and integral horsepower, 500 hp and smaller shall conform to NEMA MG 1 and UL 1004for motors; NEMA MG 10 for energy management selection of polyphase motors; and UL 674 for use of motors in hazardous (classified) locations. In addition to the standards listed above, motors shall be provided with efficiencies as specified in the table "MINIMUM NOMINAL EFFICIENCIES" below.

2.14.1 Rating

The horsepower rating of motors should be limited to no more than 125 percent of the maximum load being served unless a NEMA standard size does not fall within this range. In this case, the next larger NEMA standard motor size should be used.

2.14.2 Motor Efficiencies

All permanently wired polyphase motors of 1 hp or more shall meet the minimum full-load efficiencies as indicated in the following table, and as specified in this specification. Motors of 1 hp or more with open, drip proof or totally enclosed fan cooled enclosures shall be high efficiency type, unless otherwise indicated. Motor efficiencies indicated in the tables apply to general-purpose, single-speed, polyphase induction motors. Applications which require definite purpose, special purpose, special frame, or special mounted polyphase induction motors are excluded from these efficiency requirements. Motors provided as an integral part of motor driven equipment are excluded from this requirement if a minimum seasonal or overall efficiency requirement is indicated for that equipment by the provisions of another section.

MINIMUM NOMINAL MOTOR EFFICIENCIES
OPEN DRIP PROOF MOTORS

HP	1200 RPM	1800 RPM	3600 RPM
1	82.5	85.5	80.0
1.5	86.5	86.5	85.5
2	87.5	86.5	86.5
3	89.5	89.5	86.5
5	89.5	89.5	89.5
7.5	91.7	91.0	89.5
10	91.7	91.7	90.2
15	92.4	93.0	91.0
20	92.4	93.0	92.4
25	93.0	93.6	93.0
30	93.6	93.6	93.0
40	94.1	94.1	93.6
50	94.1	94.5	93.6
60	95.0	95.0	94.1
75	95.0	95.0	94.5
100	95.0	95.4	94.5
125	95.4	95.4	95.0
150	95.8	95.8	95.4

200	95.4	95.8	95.4
250	95.4	96.2	95.8
300	95.4	95.0	95.4
350	94.5	95.4	95.0
400	94.1	95.8	95.0
450	94.5	95.4	95.4
500	94.5	94.5	94.5

TOTALLY ENCLOSED FAN-COOLED MOTORS

HP	1200 RPM	1800 RPM	3600 RPM
1	82.5	85.5	78.5
1.5	87.5	86.5	85.5
2	88.5	86.5	86.5
3	89.5	89.5	88.5
5	89.5	89.5	89.5
7.5	91.7	91.7	91.0
10	91.7	91.7	91.7
15	92.4	92.4	91.7
20	92.4	93.0	92.4
25	93.0	93.6	93.0
30	93.6	93.6	93.0
40	94.1	94.1	93.6
50	94.1	94.5	94.1
60	94.5	95.0	94.1
75	95.0	95.4	94.5
100	95.4	95.4	95.0
125	95.4	95.4	95.4
150	95.8	95.8	95.4
200	95.8	96.2	95.8
250	95.6	96.2	95.9
300	95.4	96.1	95.8
350	94.5	96.2	94.8
400	94.5	95.8	94.5
450	94.5	94.5	94.5
500	94.5	94.5	94.5

2.15 MOTOR CONTROLS AND MOTOR CONTROL CENTERS

2.15.1 General

NEMA ICS 1, NEMA ICS 2, NEMA ICS 3 and NEMA ICS 6, and UL 508 and UL 845. Panelboards supplying non-linear loads shall have neutrals sized for 200 percent of rated current.

2.15.2 Motor Starters

Combination starters shall be provided with circuit breakers, .

2.15.2.1 Reduced-Voltage Starters

Reduced-voltage starters shall be provided for polyphase motors 50 hp or larger. Reduced-voltage starters shall be of the single-step autotransformer type having an adjustable time interval between application of reduced and full voltages to the motors.

2.15.3 Thermal-Overload Protection

Each motor of 1/8 hp or larger shall be provided with thermal-overload protection. Polyphase motors shall have overload protection in each ungrounded conductor. The overload-protection device shall be provided either integral with the motor or controller, or shall be mounted in a separate enclosure. Unless otherwise specified, the protective device shall be of the manually reset type. Single or double pole tumbler switches specifically designed for alternating-current operation only may be used as manual controllers for single-phase motors having a current rating not in excess of 80 percent of the switch rating.

2.15.4 Low-Voltage Motor Overload Relays

2.15.4.1 General

Thermal overload relays shall conform to NEMA ICS 2 and UL 508. Overload protection shall be provided either integral with the motor or motor controller, and shall be rated in accordance with the requirements of NFPA 70. Standard units shall be used for motor starting times up to 7 seconds. Slow units shall be used for motor starting times from 8 to 12 seconds. Quick trip units shall be used on hermetically sealed, submersible pumps, and similar motors.

2.15.4.2 Construction

Manual reset type thermal relay shall be bimetallic construction. Automatic reset type thermal relays shall be bimetallic construction. Magnetic current relays shall consist of a contact mechanism and a dash pot mounted on a common frame.

2.15.4.3 Ratings

Voltage ratings shall be not less than the applicable circuit voltage. Trip current ratings shall be established by selection of the replaceable overload device and shall not be adjustable. Where the controller is remotely-located or difficult to reach, an automatic reset, non-compensated overload relay shall be provided. Manual reset overload relays shall be provided otherwise, and at all locations where automatic starting is provided. Where the motor is located in a constant ambient temperature, and the thermal device is located in an ambient temperature that regularly varies by more than minus 18 degrees F, an ambient temperature-compensated overload relay shall be provided.

2.15.5 Automatic Control Devices

2.15.5.1 Direct Control

Automatic control devices (such as thermostats, float or pressure switches) which control the starting and stopping of motors directly shall be designed for that purpose and have an adequate horsepower rating.

2.15.5.2 Pilot-Relay Control

Where the automatic-control device does not have such a rating, a magnetic starter shall be used, with the automatic-control device actuating the pilot-control circuit.

2.15.5.3 Manual/Automatic Selection

a. Where combination manual and automatic control is specified and the automatic-control device operates the motor directly, a double-throw, three-position tumbler or rotary switch (marked MANUAL-OFF-AUTOMATIC) shall be provided for the manual control.

b. Where combination manual and automatic control is specified and the automatic-control device actuates the pilot control circuit of a magnetic starter, the magnetic starter shall be provided with a three-position selector switch marked MANUAL-OFF-AUTOMATIC.

c. Connections to the selector switch shall be such that; only the normal automatic regulatory control devices will be bypassed when the switch is in the Manual position; all safety control devices, such as low-or high-pressure cutouts, high-temperature cutouts, and motor-overload protective devices, shall be connected in the motor-control circuit in both the Manual and the Automatic positions of the selector switch. Control circuit connections to any MANUAL-OFF-AUTOMATIC switch or to more than one automatic regulatory control device shall be made in accordance with wiring diagram approved by the Contracting Officer unless such diagram is included on the drawings. All controls shall be 120 volts or less unless otherwise indicated.

2.15.6 Motor Control Centers

Control centers shall conform to the requirements of NEMA ICS 1, NEMA ICS 2, NEMA ICS 3 and NEMA ICS 6, and UL 508 and UL 845. Control centers shall be indoor type and shall contain combination starters and other equipment as indicated. Control centers shall be NEMA ICS 2, Class 1, Type B. Each control center shall be mounted on floor sills or mounting channels. Each circuit shall have a suitable metal or laminated plastic nameplate with white cut letters. Motor control centers shall be provided with a full-length ground bus bar.

2.16 PANELBOARDS

Dead-front construction, NEMA PB 1 and UL 67.

2.17 RECEPTACLES

2.17.1 Heavy Duty Grade

NEMA WD 1. Devices shall conform to all requirements for heavy duty receptacles.

2.17.2 Standard Grade

UL 498.

2.17.3 Ground Fault Interrupters

UL 943, Class A or B.

2.17.4 Hazardous (Classified) Locations

UL 1010.

2.17.5 NEMA Standard Receptacle Configurations

NEMA WD 6.

Single and Duplex, 15-Ampere and 20-Ampere, 125 Volt

15-ampere, non-locking: NEMA type 5-15R, locking: NEMA type L5-15R,
20-ampere, non-locking: NEMA type 5-20R, locking: NEMA type L5-20R.

2.18 Service Entrance Equipment

UL 869A.

2.19 SPLICE, CONDUCTOR

UL 486C.

2.20 POWER-SWITCHGEAR ASSEMBLIES INCLUDING SWITCHBOARDS

Assemblies shall be metal-enclosed, freestanding general-purpose ventilated type in accordance with NEMA PB 2, UL 891, and IEEE C37.20.1 and shall be installed to provide front access. Busses shall be copper. Assembly shall be approximately 90 inches high; arrangement of circuit breakers and other items specified shall be as indicated. The withstand rating and interrupting capacity of the switchboards and circuit breakers shall be based on the maximum fault current available.

2.20.1 Circuit Breakers

Circuit breakers shall be stationary insulated-case, systems type circuit breakers .

2.20.2 Auxiliary Equipment

2.20.2.1 Instruments

Instruments shall be long scale, 6.8 inches minimum, semiflush rectangular, indicating or digital switchboard type, mounted at eye level.

a. Ammeter, range 0 to 1000 amperes, complete with selector switch having off position and positions to read each phase current.

b. Voltmeter, range 0 to 600 volts, complete with selector switch having off position and positions to read each phase to phase voltage.

2.20.2.2 Control Switch

A control switch with indicating lights shall be provided for each electrically operated breaker.

2.21 SNAP SWITCHES

UL 20.

2.22 TAPES

2.22.1 Plastic Tape

UL 510.

2.22.2 Rubber Tape

UL 510.

2.23 TRANSFORMERS

Single- and three-phase transformers shall have two windings per phase. Full-capacity standard NEMA taps shall be provided in the primary windings of transformers unless otherwise indicated. Three-phase transformers shall be configured with delta-wye windings, except as indicated. "T" connections may be used for transformers rated 15 kVA or below. Transformers supplying non-linear loads shall be UL listed as suitable for supplying such loads with a total K-factor not to exceed K- 13 and have neutrals sized for 200 percent of rated current.

2.23.1 Transformers, Dry-Type

Transformers shall have 220 degrees C insulation system for transformers 15 kVA and greater, and shall have 180 degrees C insulation system for transformers rated 10 kVA and less, with temperature rise not exceeding 150 degrees C under full-rated load in maximum ambient temperature of 40 degrees C. Transformer of 150 degrees C temperature rise shall be capable of carrying continuously 100 percent of nameplate kVA without exceeding insulation rating.

600 Volt or Less Primary.

NEMA ST 20, UL 506, general purpose, dry-type, self-cooled, ventilated . Transformers shall be provided in NEMA 1 enclosure. Transformers shall be quiet type with maximum sound level at least 3 decibels less than NEMA standard level for transformer ratings indicated.

2.23.2 Average Sound Level

The average sound level in decibels (dB) of transformers shall not exceed the following dB level at 12 inches for the applicable kVA rating range listed unless otherwise indicated:

kVA Range	dB Sound Level
1-50	50
51-150	55
151-300	58

2.24 WATTHOUR/DEMAND METERS, CHECK

ANSI C12.10 for self-contained watthour-demand meter with pulse-initiators for remote monitoring of watt-hour usage and instantaneous demand. Meter shall be drawout switchboard type. Meter shall be Class 100 .

2.25 INSTRUMENT TRANSFORMERS

2.25.1 General

Instrument transformers shall comply with ANSI C12.11 and IEEE C57.13. Instrument transformers shall be configured for mounting in/on the device to which they are applied. Polarity marks on instrument transformers shall be visually evident and shown on drawings.

2.25.2 Current Transformers

Unless otherwise indicated, bar, wound, or window-type transformers are acceptable; and except for window-type units installed over insulated buses, transformers shall have a BIL rating consistent with the rated BIL of the associated switchgear or electric power apparatus bushings, buses or conductors. Current transformers shall have the indicated ratios. The continuous thermal-current rating factor shall be not less than 2.0 . Other thermal and mechanical ratings of current transformer and their primary leads shall be coordinated with the design of the circuit breaker and shall be not less than the momentary rating of the associated circuit breaker. Circuit protectors shall be provided across secondary leads of the current transformers to prevent the accidental open-circuiting of the transformers while energized. Each terminal of each current transformer shall be connected to a short-circuiting terminal block in the circuit interrupting mechanism cabinet, power transformer terminal cabinet, and in the associated instrument and relay cabinets.

2.25.2.1 Current Transformers for kWH and Demand Metering (Low Voltage)

Current transformers shall conform to IEEE C57.13. Provide current transformers with a metering accuracy Class of 0.3 through B-0.5, with a minimum RF of 1.5 at 30 degrees C, with 600-volt insulation, and 10 kV BIL. Provide butyl-molded, window-type current transformers mounted in the current transformer cabinet.

2.25.2.2 Voltage Transformers

Voltage transformers shall have indicated ratios. Units shall have an accuracy class rating of 3. Voltage transformers shall be of the drawout type having current-limiting fuses in both primary and secondary circuits. Mechanical interlocks shall prevent removal of fuses, unless the associated voltage transformer is in a drawout position. Voltage transformer compartments shall have hinged doors.

2.26 WIRING DEVICES

NEMA WD 1 for wiring devices, and NEMA WD 6 for dimensional requirements of wiring devices.

2.27 COORDINATED POWER SYSTEM PROTECTION

Analyses shall be prepared to demonstrate that the equipment and system constructed meet the specified requirements for equipment ratings, coordination, and protection. They shall include a load flow analysis, a fault current analysis, and protective device coordination study. The studies shall be performed by a registered professional engineer with demonstrated experience in power system coordination in the last three years. The Contractor shall provide a list of references complete with points of contact, addresses and telephone numbers. The selection of the engineer is subject to the approval of the Contracting Officer.

2.27.1 Scope of Analyses

The fault current analysis, and protective device coordination study shall begin at: the source bus and extend down to system buses where fault availability is 10,000 amperes (symmetrical) for building/facility 600 volt level distribution buses

2.27.2 Determination of Facts

The time-current characteristics, features, and nameplate data for each existing protective device shall be determined and documented. The Contractor shall coordinate with the BASE for fault current availability at the site.

2.27.3 Single Line Diagram

A single line diagram shall be prepared to show the electrical system buses, devices, transformation points, and all sources of fault current (including generator and motor contributions). A fault-impedance diagram or a computer analysis diagram may be provided. Each bus, device or transformation point shall have a unique identifier. If a fault-impedance diagram is provide, impedance data shall be shown. Locations of switches, breakers, and circuit interrupting devices shall be shown on the diagram together with available fault data, and the device interrupting rating.

2.27.4 Fault Current Analysis

2.27.4.1 Method

The fault current analysis shall be performed in accordance with methods described in IEEE Std 242, and IEEE Std 399.

2.27.4.2 Data

Actual data shall be utilized in fault calculations. Bus characteristics and transformer impedances shall be those proposed. Data shall be documented in the report.

2.27.4.3 Fault Current Availability

Balanced three-phase fault, bolted line-to-line fault, and line-to-ground fault current values shall be provided at each voltage transformation point and at each power distribution bus. The maximum and minimum values of fault available at each location shall be shown in tabular form on the diagram or in the report.

2.27.5 Coordination Study

The study shall demonstrate that the maximum possible degree of selectivity has been obtained between devices specified, consistent with protection of equipment and conductors from damage from overloads and fault conditions. The study shall include a description of the coordination of the protective devices in this project. Provide a written narrative that describes: which devices may operate in the event of a fault at each bus; the logic used to arrive at device ratings and settings; situation where system coordination is not achievable due to device limitations (an analysis of any device curves which order overlap); coordination between upstream and downstream devices; and relay settings. Recommendations to improve or enhance system reliability, and detail where such changes would involve additions or modifications to the contract and cost changes (addition or reduction) shall be provided. Composite coordination plots shall be provided on log-log graph paper.

2.27.6 Study Report

a. The report shall include a narrative: the analyses performed; the bases and methods used; and the desired method of coordinated protection of the power system.

b. The study shall include descriptive and technical data for existing devices and new protective devices proposed. The data shall include manufacturers published data, nameplate data, and definition of the fixed or adjustable features of the existing or new protective devices.

c. The report shall document utility company data including system voltages, fault MVA, system X/R ratio, time-current characteristic curves, current transformer ratios, and relay device curves and protective device ratings and settings.

d. The report shall contain fully coordinated composite time-current characteristic curves for each bus in the system, as required to ensure coordinated power system protection between protective devices or equipment. The report shall include recommended ratings and settings of all protective devices in tabulated form.

e. The report shall provide the calculations performed for the analyses, including computer analysis programs utilized. The name of the software package, developer, and version number shall be provided.

PART 3 EXECUTION

3.1 GROUNDING

Grounding shall be in conformance with NFPA 70, the contract drawings, and the following specifications.

3.1.1 Ground Rods

The resistance to ground shall be measured using the fall-of-potential method described in IEEE Std 81. The maximum resistance of a driven ground shall not exceed 25 ohms under normally dry conditions. If this resistance cannot be obtained with a single rod, 3 additional rods not less than 6 feet on centers, or if sectional type rods are used, 3 additional sections may be coupled and driven with the first rod. In high-ground-resistance, UL listed chemically charged ground rods may be used. If the resultant resistance exceeds 25 ohms measured not less than 48 hours after rainfall, the Contracting Officer shall be notified immediately. Connections below grade shall be fusion welded. Connections above grade shall be fusion welded or shall use UL 467 approved connectors.

3.1.2 Grounding Conductors

A green equipment grounding conductor, sized in accordance with NFPA 70 shall be provided, regardless of the type of conduit. Equipment grounding bars shall be provided in all panelboards. The equipment grounding conductor shall be carried back to the service entrance grounding connection or separately derived grounding connection. All equipment grounding conductors, including metallic raceway systems used as such, shall be bonded or joined together in each wiring box or equipment enclosure. Metallic raceways and grounding conductors shall be checked to assure that they are wired or bonded into a common junction. Metallic boxes and enclosures, if used, shall also be bonded to these grounding

conductors by an approved means per NFPA 70. When switches, or other utilization devices are installed, any designated grounding terminal on these devices shall also be bonded to the equipment grounding conductor junction with a short jumper.

3.2 WIRING METHODS

Wiring shall conform to NFPA 70, the contract drawings, and the following specifications. Unless otherwise indicated, wiring shall consist of insulated conductors installed in rigid zinc-coated steel conduit electrical metallic tubing intermediate metal conduit. Where cables and wires are installed in cable trays, they shall be of the type permitted by NFPA 70 for use in such applications. Wire fill in conduits shall be based on NFPA 70 for the type of conduit and wire insulations specified. Wire fill in conduits located in Class I or II hazardous areas shall be limited to 25 percent of the cross sectional area of the conduit.

3.2.1 Conduit and Tubing Systems

Conduit and tubing systems shall be installed as indicated. Conduit sizes shown are based on use of copper conductors with insulation types as described in paragraph WIRING METHODS. Minimum size of raceways shall be 1/2 inch. Only metal conduits will be permitted when conduits are required for shielding or other special purposes indicated, or when required by conformance to NFPA 70. Electrical metallic tubing (EMT) may be installed only within buildings. EMT may be installed in concrete and grout in dry locations. EMT installed in concrete or grout shall be provided with concrete tight fittings. EMT shall not be installed in damp or wet locations, or the air space of exterior masonry cavity walls. Bushings, manufactured fittings or boxes providing equivalent means of protection shall be installed on the ends of all conduits and shall be of the insulating type, where required by NFPA 70. Only UL listed adapters shall be used to connect EMT to rigid metal conduit, cast boxes, and conduit bodies. Penetrations of above grade floor slabs, time-rated partitions and fire walls shall be firestopped in accordance with SECTION 07840 FIRESTOPPING. Except as otherwise specified, IMC may be used as an option for rigid steel conduit in areas as permitted by NFPA 70. Raceways shall not be installed under the firepits of boilers and furnaces and shall be kept 6 inches away from parallel runs of flues, steam pipes and hot-water pipes. Raceways shall be concealed within finished walls, ceilings, and floors unless otherwise shown. Raceways crossing structural expansion joints or seismic joints shall be provided with suitable expansion fittings or other suitable means to compensate for the building expansion and contraction and to provide for continuity of grounding. Wiring installed in underfloor raceway system shall be suitable for installation in wet locations.

3.2.1.1 Pull Wires

A pull wire shall be inserted in each empty raceway in which wiring is to be installed if the raceway is more than 50 feet in length and contains more than the equivalent of two 90-degree bends, or where the raceway is more than 150 feet in length. The pull wire shall be of No. 14 AWG zinc-coated steel, or of plastic having not less than 200 pounds per square inch tensile strength. Not less than 10 inches of slack shall be left at each end of the pull wire.

3.2.1.2 Conduit Stub-Ups

Where conduits are to be stubbed up through concrete floors, a short elbow shall be installed below grade to transition from the horizontal run of conduit to a vertical run. A conduit coupling fitting, threaded on the inside shall be installed, to allow terminating the conduit flush with the finished floor. Wiring shall be extended in rigid threaded conduit to equipment, except that where required, flexible conduit may be used 6 inches above the floor. Empty or spare conduit stub-ups shall be plugged flush with the finished floor with a threaded, recessed plug.

3.2.1.3 Below Slab-on-Grade or in the Ground

Electrical wiring below slab-on-grade shall be protected by a conduit system. Conduit passing vertically through slabs-on-grade shall be rigid steel or IMC. Rigid steel or IMC conduits installed below slab-on-grade or in the earth shall be field wrapped with 0.010 inch thick pipe-wrapping plastic tape applied with a 50 percent overlay, or shall have a factory-applied polyvinyl chloride, plastic resin, or epoxy coating system.

3.2.1.4 Changes in Direction of Runs

Changes in direction of runs shall be made with symmetrical bends or cast-metal fittings. Field-made bends and offsets shall be made with an approved hickey or conduit-bending machine. Crushed or deformed raceways shall not be installed. Trapped raceways in damp and wet locations shall be avoided where possible. Lodgment of plaster, dirt, or trash in raceways, boxes, fittings and equipment shall be prevented during the course of construction. Clogged raceways shall be cleared of obstructions or shall be replaced.

3.2.1.5 Supports

Metallic conduits and tubing,and the support system to which they are attached, shall be securely and rigidly fastened in place to prevent vertical and horizontal movement at intervals of not more than 10 feet and within 3 feet of boxes, cabinets, and fittings, with approved pipe straps, wall brackets, conduit clamps, conduit hangers, threaded C-clamps, beam clamps, or ceiling trapeze. Loads and supports shall be coordinated with supporting structure to prevent damage or deformation to the structure. Loads shall not be applied to joist bridging. Attachment shall be by wood screws or screw-type nails to wood; by toggle bolts on hollow masonry units; by expansion bolts on concrete or brick; by machine screws, welded threaded studs, heat-treated or spring-steel-tension clamps on steel work. Nail-type nylon anchors or threaded studs driven in by a powder charge and provided with lock washers and nuts may be used in lieu of expansion bolts or machine screws. Raceways or pipe straps shall not be welded to steel structures. Cutting the main reinforcing bars in reinforced concrete beams or joists shall be avoided when drilling holes for support anchors. Holes drilled for support anchors, but not used, shall be filled. In partitions of light steel construction, sheet-metal screws may be used. Raceways shall not be supported using wire or nylon ties. Raceways shall be independently supported from the structure. Upper raceways shall not be used as a means of support for lower raceways. Supporting means shall not be shared between electrical raceways and mechanical piping or ducts. Cables and raceways shall not be supported by ceiling grids. Except where permitted by NFPA 70, wiring shall not be supported by ceiling support systems. Conduits shall be fastened to sheet-metal boxes and cabinets with two locknuts where required by NFPA 70, where insulating bushings are used,

and where bushings cannot be brought into firm contact with the box; otherwise, a single locknut and bushing may be used. Threadless fittings for electrical metallic tubing shall be of a type approved for the conditions encountered. Additional support for horizontal runs is not required when EMT rests on steel stud cutouts.

3.2.1.6 Exposed Raceways

Exposed raceways shall be installed parallel or perpendicular to walls, structural members, or intersections of vertical planes and ceilings. Raceways under raised floors and above accessible ceilings shall be considered as exposed installations in accordance with NFPA 70 definitions.

3.2.1.7 Communications Raceways

Communications raceways indicated shall be installed in accordance with the previous requirements for conduit and tubing and with the additional requirement that no length of run shall exceed 50 feet for 1/2 inch and 3/4 inch sizes, and 100 feet for 1 inch or larger sizes, and shall not contain more than two 90-degree bends or the equivalent. Additional pull or junction boxes shall be installed to comply with these limitations whether or not indicated. Inside radii of bends in conduits of 1 inch size or larger shall not be less than ten times the nominal diameter.

3.2.2 Cables and Conductors

Installation shall conform to the requirements of NFPA 70. Covered, bare or insulated conductors of circuits rated over 600 volts shall not occupy the same equipment wiring enclosure, cable, or raceway with conductors of circuits rated 600 volts or less.

3.2.2.1 Sizing

Unless otherwise noted, all sizes are based on copper conductors and the insulation types indicated. Sizes shall be not less than indicated. Branch-circuit conductors shall be not smaller than No. 12 AWG. Conductors for branch circuits of 120 volts more than 100 feet long and of 277 volts more than 230 feet long, from panel to load center, shall be no smaller than No. 10 AWG. Class 1 remote control and signal circuit conductors shall be not less than No. 14 AWG. Class 2 remote control and signal circuit conductors shall be not less than No. 16 AWG. Class 3 low-energy, remote-control and signal circuits shall be not less than No. 22 AWG.

3.2.2.2 Use of Aluminum Conductors in Lieu of Copper

Aluminum conductors shall not be used.

3.2.2.3 Cable Splicing

Splices shall be made in an accessible location. Crimping tools and dies shall be approved by the connector manufacturer for use with the type of connector and conductor.

Copper Conductors, 600 Volt and Under: Splices in conductors No. 10 AWG and smaller diameter shall be made with an insulated, pressure-type connector. Splices in conductors No. 8 AWG and larger diameter shall be made with a solderless connector and insulated with tape or heat-shrink type insulating material equivalent to the conductor insulation.

3.2.2.4 Conductor Identification and Tagging

Power, control, and signal circuit conductor identification shall be provided within each enclosure where a tap, splice, or termination is made. Where several feeders pass through a common pull box, the feeders shall be tagged to indicate clearly the electrical characteristics, circuit number, and panel designation. Phase conductors of low voltage power circuits shall be identified by color coding. Phase identification by a particular color shall be maintained continuously for the length of a circuit, including junctions.

a. Color coding shall be provided for service, feeder, branch, and ground conductors. Color shall be green for grounding conductors and white for neutrals; except where neutrals of more than one system are installed in the same raceway or box, other neutral shall be white with colored (not green) stripe. The color coding for 3-phase and single-phase low voltage systems shall be as follows:

120/208-volt, 3-phase: Black(A), red(B), and blue(C).

277/480-volt, 3-phase: Brown(A), orange(B), and yellow(C).

120/240-volt, 1-phase: Black and red.

b. Conductor phase and voltage identification shall be made by color-coded insulation for all conductors smaller than No. 6 AWG. For conductors No. 6 AWG and larger, identification shall be made by color-coded insulation, or conductors with black insulation may be furnished and identified by the use of half-lapped bands of colored electrical tape wrapped around the insulation for a minimum of 3 inches of length near the end, or other method as submitted by the Contractor and approved by the Contracting Officer.

c. Control and signal circuit conductor identification shall be made by color-coded insulated conductors, plastic-coated self-sticking printed markers, permanently attached stamped metal foil markers, or equivalent means as approved. Control circuit terminals of equipment shall be properly identified. Terminal and conductor identification shall match that shown on approved detail drawings. Hand lettering or marking is not acceptable.

3.3 BOXES AND SUPPORTS

Boxes shall be provided in the wiring or raceway systems where required by NFPA 70 for pulling of wires, making connections, and mounting of devices or fixtures. Pull boxes shall be furnished with screw-fastened covers. Indicated elevations are approximate, except where minimum mounting heights for hazardous areas are required by NFPA 70. Unless otherwise indicated, boxes for wall switches shall be mounted 48 inches above finished floors. Switch and outlet boxes located on opposite sides of fire rated walls shall be separated by a minimum horizontal distance of 24 inches. The total combined area of all box openings in fire rated walls shall not exceed 100 square inches per 100 square feet. Maximum box areas for individual boxes in fire rated walls vary with the manufacturer and shall not exceed the maximum specified for that box in UL Elec Const Dir. Only boxes listed in UL Elec Const Dir shall be used in fire rated walls.

3.3.1 Box Applications

Each box shall have not less than the volume required by NFPA 70 for number of conductors enclosed in box. Boxes for metallic raceways shall be listed for the intended use when located in normally wet locations, when flush or surface mounted on outside of exterior surfaces, or when located in hazardous areas. Boxes installed in wet locations and boxes installed flush with the outside of exterior surfaces shall be gasketed. Boxes for mounting lighting fixtures shall be not less than 4 inches square, or octagonal, except smaller boxes may be installed as required by fixture configuration, as approved. Cast-metal boxes with 3/32 inch wall thickness are acceptable. Large size boxes shall be NEMA 1 or as shown. Boxes in other locations shall be sheet steel. Boxes for use in masonry-block or tile walls shall be square-cornered, tile-type, or standard boxes having square-cornered, tile-type covers.

3.3.2 Brackets and Fasteners

Boxes and supports shall be fastened to wood with wood screws or screw-type nails of equal holding strength, with bolts and metal expansion shields on concrete or brick, with toggle bolts on hollow masonry units, and with machine screw or welded studs on steel work. Threaded studs driven in by powder charge and provided with lockwashers and nuts, or nail-type nylon anchors may be used in lieu of expansion shields, or machine screws. Penetration of more than 1-1/2 inches into reinforced-concrete beams or more than 3/4 inch into reinforced-concrete joists shall avoid cutting any main reinforcing steel. The use of brackets which depend on gypsum wallboard or plasterboard for primary support will not be permitted. In partitions of light steel construction, bar hangers with 1 inch long studs, mounted between metal wall studs or metal box mounting brackets shall be used to secure boxes to the building structure. When metal box mounting brackets are used, additional box support shall be provided on the side of the box opposite the brackets. This additional box support shall consist of a minimum 12 inch long section of wall stud, bracketed to the opposite side of the box and secured by two screws through the wallboard on each side of the stud. Metal screws may be used in lieu of the metal box mounting brackets.

3.3.3 Mounting in Walls, Ceilings, or Recessed Locations

In walls or ceilings of concrete, tile, or other non-combustible material, boxes shall be installed so that the edge of the box is not recessed more than 1/4 inch from the finished surface. Boxes mounted in combustible walls or ceiling material shall be mounted flush with the finished surface. The use of gypsum or plasterboard as a means of supporting boxes will not be permitted. Boxes installed for concealed wiring shall be provided with suitable extension rings or plaster covers, as required. The bottom of boxes installed in masonry-block walls for concealed wiring shall be mounted flush with the top of a block to minimize cutting of the blocks, and boxes shall be located horizontally to avoid cutting webs of block. Separate boxes shall be provided for flush or recessed fixtures when required by the fixture terminal operating temperature, and fixtures shall be readily removable for access to the boxes unless ceiling access panels are provided.

3.3.4 Installation in Overhead Spaces

In open overhead spaces, cast-metal boxes threaded to raceways need not be separately supported except where used for fixture support; cast-metal

boxes having threadless connectors and sheet metal boxes shall be supported directly from the building structure or by bar hangers. Hangers shall not be fastened to or supported from joist bridging. Where bar hangers are used, the bar shall be attached to raceways on opposite sides of the box and the raceway shall be supported with an approved type fastener not more than 24 inches from the box.

3.4 DEVICE PLATES

One-piece type device plates shall be provided for all outlets and fittings. Plates on unfinished walls and on fittings shall be of zinc-coated sheet steel, cast-metal, or impact resistant plastic having rounded or beveled edges. Plates on finished walls shall be of steel with baked enamel finish or impact-resistant plastic and shall be ivory . Screws shall be of metal with countersunk heads, in a color to match the finish of the plate. Plates shall be installed with all four edges in continuous contact with finished wall surfaces without the use of mats or similar devices. Plaster fillings will not be permitted. Plates shall be installed with an alignment tolerance of 1/16 inch. The use of sectional-type device plates will not be permitted. Plates installed in wet locations shall be gasketed and provided with a hinged, gasketed cover, unless otherwise specified.

3.5 RECEPTACLES

3.5.1 Single and Duplex, 15 or 20-ampere, 125 volt

Single and duplex receptacles shall be rated 15 amperes, 125 volts, two-pole, three-wire, grounding type with polarized parallel slots. Bodies shall be of ivory to match color of switch handles in the same room or to harmonize with the color of the respective wall, and supported by mounting strap having plaster ears. Contact arrangement shall be such that contact is made on two sides of an inserted blade. Receptacle shall be side- or back-wired with two screws per terminal. The third grounding pole shall be connected to the metal mounting yoke. Switched receptacles shall be the same as other receptacles specified except that the ungrounded pole of each suitable receptacle shall be provided with a separate terminal. Only the top receptacle of a duplex receptacle shall be wired for switching application. Receptacles with ground fault circuit interrupters shall have the current rating as indicated, and shall be UL Class A type unless otherwise shown. Ground fault circuit protection shall be provided as required by NFPA 70 and as indicated on the drawings.

3.5.2 Weatherproof Applications

Weatherproof receptacles shall be suitable for the environment, damp or wet as applicable, and the housings shall be labeled to identify the allowable use. Receptacles shall be marked in accordance with UL 514A for the type of use indicated; "Damp locations", "Wet Locations", "Wet Location Only When Cover Closed". Assemblies shall be installed in accordance with the manufacturer's recommendations.

3.5.2.1 Damp Locations

Receptacles in damp locations shall be mounted in an outlet box with a gasketed, weatherproof, cast-metal cover plate (device plate, box cover) and a gasketed cap (hood, receptacle cover) over each receptacle opening. The cap shall be either a screw-on type permanently attached to the cover plate by a short length of bead chain or shall be a flap type attached to

the cover with a spring loaded hinge.

3.5.2.2 Wet Locations

Receptacles in wet locations shall be installed in an assembly rated for such use whether the plug is inserted or withdrawn, unless otherwise indicated. In a duplex installation, the receptacle cover shall be configured to shield the connections whether one or both receptacles are in use.

3.6 WALL SWITCHES

Wall switches shall be of the totally enclosed tumbler type. The wall switch handle and switch plate color shall be ivory . Wiring terminals shall be of the screw type or of the solderless pressure type having suitable conductor-release arrangement. Not more than one switch shall be installed in a single-gang position. Switches shall be rated 15-ampere 120 -volt for use on alternating current only. Pilot lights indicated shall consist of yoke-mounted candelabra-base sockets rated at 75 watts, 125 volts, and fitted with glass or plastic jewels. A clear 6-watt lamp shall be furnished and installed in each pilot switch. Jewels for use with switches controlling motors shall be green, and jewels for other purposes shall be red. Dimming switches shall be solid-state flush mounted, sized for the loads.

3.7 SERVICE EQUIPMENT

Service-disconnecting means shall be of the enclosed molded-case circuit breaker type with an external handle for manual operation. When service disconnecting means is a part of an assembly, the assembly shall be listed as suitable for service entrance equipment. Enclosures shall be sheet metal with hinged cover for surface mounting unless otherwise indicated.

3.8 PANELBOARDS AND LOADCENTERS

Circuit breakers and switches used as a motor disconnecting means shall be capable of being locked in the open position. Door locks shall be keyed alike. Nameplates shall be as approved. Directories shall be typed to indicate loads served by each circuit and mounted in a holder behind a clear protective covering. Busses shall be copper .

3.8.1 Panelboards

Panelboards shall be circuit breaker or fusible switch equipped as indicated on the drawings.

3.9 FUSES

Equipment provided under this contract shall be provided with a complete set of properly rated fuses when the equipment manufacturer utilize fuses in the manufacture of the equipment, or if current-limiting fuses are required to be installed to limit the ampere-interrupting capacity of circuit breakers or equipment to less than the maximum available fault current at the location of the equipment to be installed. Fuses shall have a voltage rating of not less than the phase-to-phase circuit voltage, and shall have the time-current characteristics required for effective power system coordination. Time-delay and non-time-delay options shall be as specified.

3.9.1 Cartridge Fuses; Noncurrent-Limiting Type

Cartridge fuses of the noncurrent-limiting type shall be Class H, nonrenewable, dual element, time lag type and shall have interrupting capacity of 10,000 amperes. At 500 percent current, cartridge fuses shall not blow in less than 10 seconds.

3.9.2 Cartridge Fuses; Current-Limiting Type

Cartridge fuses, current-limiting type, Class RK1 or RK5 shall have tested interrupting capacity not less than 100,000 amperes. Fuse holders shall be the type that will reject all Class H fuses.

3.9.3 Continuous Current Ratings (600 Amperes and Smaller)

Service entrance and feeder circuit fuses (600 amperes and smaller) shall be Class RK1 , current-limiting, time-delay with 200,000 amperes interrupting capacity.

3.9.4 Motor and Transformer Circuit Fuses

Motor, motor controller, transformer, and inductive circuit fuses shall be Class RK1 or RK5, current-limiting, time-delay with 200,000 amperes interrupting capacity.

3.10 UNDERGROUND SERVICE

Unless otherwise indicated, interior conduit systems shall be stubbed out 5 feet beyond the building wall and 2 feet below finished grade, for interface with the exterior service lateral conduits and exterior communications conduits. Outside conduit ends shall be bushed when used for direct burial service lateral conductors. Outside conduit ends shall be capped or plugged until connected to exterior conduit systems. Underground service lateral conductors will be extended to building service entrance and terminated in accordance with the requirements of SECTION 16375 ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND and NFPA 70.

3.11 MOTORS

Each motor shall conform to the hp and voltage ratings indicated, and shall have a service factor and other characteristics that are essential to the proper application and performance of the motors under conditions shown or specified. Three-phase motors for use on 3-phase 208-volt systems shall have a nameplate rating of 200 volts. Unless otherwise specified, all motors shall have open frames, and continuous-duty classification based on a 40 degree C ambient temperature reference. Polyphase motors shall be squirrel-cage type, having normal-starting-torque and low-starting-current characteristics, unless other characteristics are specified in other sections of these specifications or shown on contract drawings. The Contractor shall be responsible for selecting the actual horsepower ratings and other motor requirements necessary for the applications indicated. When electrically driven equipment furnished under other sections of these specifications materially differs from the design, the Contractor shall make the necessary adjustments to the wiring, disconnect devices and branch-circuit protection to accommodate the equipment actually installed.

3.12 MOTOR CONTROL

Each motor or group of motors requiring a single control and not controlled

from a motor-control center shall be provided under other sections of these specifications with a suitable controller and devices that will perform the functions as specified for the respective motors. Each motor of 1/8 hp or larger shall be provided with thermal-overload protection. Polyphase motors shall have overload protection in each ungrounded conductor. The overload-protection device shall be provided either integral with the motor or controller, or shall be mounted in a separate enclosure. Unless otherwise specified, the protective device shall be of the manually reset type. Single or double pole tumbler switches specifically designed for alternating-current operation only may be used as manual controllers for single-phase motors having a current rating not in excess of 80 percent of the switch rating. Automatic control devices such as thermostats, float or pressure switches may control the starting and stopping of motors directly, provided the devices used are designed for that purpose and have an adequate horsepower rating. When the automatic-control device does not have such a rating, a magnetic starter shall be used, with the automatic-control device actuating the pilot-control circuit. When combination manual and automatic control is specified and the automatic-control device operates the motor directly, a double-throw, three-position tumbler or rotary switch shall be provided for the manual control; when the automatic-control device actuates the pilot control circuit of a magnetic starter, the latter shall be provided with a three-position selector switch marked MANUAL-OFF-AUTOMATIC. Connections to the selector switch shall be such that only the normal automatic regulatory control devices will be bypassed when the switch is in the Manual position; all safety control devices, such as low- or high-pressure cutouts, high-temperature cutouts, and motor-overload protective devices, shall be connected in the motor-control circuit in both the Manual and the Automatic positions of the selector switch. Control circuit connections to any MANUAL-OFF-AUTOMATIC switch or to more than one automatic regulatory control device shall be made in accordance with wiring diagram approved by the Contracting Officer unless such diagram is included on the drawings. All controls shall be 120 volts or less unless otherwise indicated.

3.12.1 Reduced-Voltage Controllers

Reduced-voltage controllers shall be provided for polyphase motors 50 hp or larger. Reduced-voltage starters shall be of the single-step autotransformer type having an adjustable time interval between application of reduced and full voltages to the motors.

3.12.2 Motor Control Centers

Control centers shall be indoor type and shall contain combination starters and other equipment as indicated. Control centers shall be NEMA ICS 2, Class 1, Type B. Each control center shall be mounted on floor sills or mounting channels. Each circuit shall have a suitable metal or laminated plastic nameplate with white cut letters. Combination starters shall be provided with circuit breakers. Motor control centers shall be provided with a full-length ground bus bar.

3.12.3 Contacts

Unless otherwise indicated, contacts in miscellaneous control devices such as float switches, pressure switches, and auxiliary relays shall have current and voltage ratings in accordance with NEMA ICS 2 for rating designation B300.

3.12.4 Safety Controls

Safety controls for boilers shall be connected to a 2-wire, 120 volt grounded circuit supplied from the associated boiler-equipment circuit. Where the boiler circuit is more than 120 volts to ground, safety controls shall be energized through a two-winding transformer having its 120 volt secondary winding grounded. Overcurrent protection shall be provided in the ungrounded secondary conductor and shall be sized for the load encountered.

3.13 MOTOR-DISCONNECT MEANS

Each motor shall be provided with a disconnecting means when required by NFPA 70 even though not indicated. For single-phase motors, a single or double pole toggle switch, rated only for alternating current, will be acceptable for capacities less than 30 amperes, provided the ampere rating of the switch is at least 125 percent of the motor rating. Switches shall disconnect all ungrounded conductors.

3.14 TRANSFORMER INSTALLATION

Three-phase transformers shall be connected only in a delta-wye or wye-delta configuration as indicated except isolation transformers having a one-to-one turns ratio. "T" connections may be used for transformers rated at 15 kVA or below. Dry-type transformers shown located within 5 feet of the exterior wall shall be provided in a weatherproof enclosure. Transformers to be located within the building may be provided in the manufacturer's standard, ventilated indoor enclosure designed for use in 40 degrees C ambient temperature, unless otherwise indicated.

3.15 LIGHTING FIXTURES, LAMPS AND BALLASTS

This paragraph shall cover the installation of lamps, lighting fixtures and ballasts in interior or building mounted applications.

3.15.1 Lamps

Lamps of the type, wattage, and voltage rating indicated shall be delivered to the project in the original cartons and installed just prior to project completion. Lamps installed and used for working light during construction shall be replaced prior to turnover to the Government if more than 15% of their rated life has been used. Lamps shall be tested for proper operation prior to turn-over and shall be replaced if necessary with new lamps from the original manufacturer. 10% spare lamps of each type, from the original manufacturer, shall be provided.

3.15.2 Lighting Fixtures

Fixtures shall be as shown and shall conform to the following specifications and shall be as detailed on the drawings. Illustrations shown on the drawings are indicative of the general type desired and are not intended to restrict selection to fixtures of any particular manufacturer. Fixtures of similar designs and equivalent energy efficiency, light distribution and brightness characteristics, and of equal finish and quality will be acceptable if approved. In suspended acoustical ceilings with fluorescent fixtures, the fluorescent emergency light fixtures shall be furnished with self-contained battery packs.

3.15.2.1 Accessories

Accessories such as straps, mounting plates, nipples, or brackets shall be provided for proper installation.

3.15.2.2 Ceiling Fixtures

Ceiling fixtures shall be coordinated with and suitable for installation in, on or from the ceiling as shown. Installation and support of fixtures shall be in accordance with NFPA 70 and manufacturer's recommendations. Where seismic requirements are specified herein, fixtures shall be supported as shown or specified. Recessed fixtures shall have adjustable fittings to permit alignment with ceiling panels. Recessed fixtures installed in fire-resistive ceiling construction shall have the same fire rating as the ceiling or shall be provided with fireproofing boxes having materials of the same fire rating as the ceiling, in conformance withUL Elec Const Dir. Surface-mounted fixtures shall be suitable for fastening to the ceiling panel structural supports.

3.15.2.3 Fixtures for Installation in Grid Type Ceilings

Fixtures for installation in grid type ceilings which are smaller than a full tile shall be centered in the tile. 1 by 4 foot fixtures shall be mounted along the grid rail as shown. Work above the ceiling shall be coordinated among the trades to provide the lighting layout shown. Fixtures mounted to the grid shall have trim exactly compatible with the grid. Contractor shall coordinate trims with ceiling trades prior to ordering fixtures. Metric fixtures shall be designed to fit the metric grid specified. Fixtures in continuous rows shall be coordinated between trades prior to ordering. Fixtures shall be mounted using independent supports capable of supporting the entire weight of the fixture. No fixture shall rest solely on the ceiling grid. Recessed fixtures installed in seismic areas should be installed utilizing specially designed seismic clips. Junction boxes shall be supported at four points.

3.15.2.4 Suspended Fixtures

Suspended fixtures shall be provided with swivel hangers or hand-straights so that they hang plumb. Pendants, rods, or chains 4 feet or longer excluding fixture shall be braced to prevent swaying using three cables at 120 degrees of separation. Suspended fixtures in continuous rows shall have internal wireway systems for end to end wiring and shall be properly aligned to provide a straight and continuous row without bends, gaps, light leaks or filler pieces. Aligning splines shall be used on extruded aluminum fixtures to assure hairline joints. Steel fixtures shall be supported to prevent "oil-canning" effects. Fixture finishes shall be free of scratches, nicks, dents, and warps, and shall match the color and gloss specified. Pendants shall be finished to match fixtures. Aircraft cable shall be stainless steel. Canopies shall be finished to match the ceiling and shall be low profile unless otherwise shown. Maximum distance between suspension points shall be 10 feet or as recommended by the manufacturer, whichever is less.

Suspended fixtures installed in seismic areas shall have 45% swivel hangers and shall be located with no obstructions within the 45% range in all directions. The stem, canopy and fixture shall be capable of 45% swing.

3.15.3 Ballasts

Remote type ballasts or transformers, where indicated, shall be mounted in a well ventilated, easily accessible location, within the maximum operating distance from the lamp as designated by the manufacturer.

3.15.4 Emergency Light Sets

Emergency light sets shall conform to UL 924 with the number of heads as indicated. Sets shall be permanently connected to the wiring system by conductors installed in short lengths of flexible conduit.

3.16 EQUIPMENT CONNECTIONS

Wiring not furnished and installed under other sections of the specifications for the connection of electrical equipment as indicated on the drawings shall be furnished and installed under this section of the specifications. Connections shall comply with the applicable requirements of paragraph WIRING METHODS. Flexible conduits 6 feet or less in length shall be provided to all electrical equipment subject to periodic removal, vibration, or movement and for all motors. All motors shall be provided with separate grounding conductors. Liquid-tight conduits shall be used in damp or wet locations.

3.16.1 Motors and Motor Control

Motors, motor controls, and motor control centers shall be installed in accordance with NFPA 70, the manufacturer's recommendations, and as indicated. Wiring shall be extended to motors, motor controls, and motor control centers and terminated.

3.17 CIRCUIT PROTECTIVE DEVICES

The Contractor shall calibrate, adjust, set and test each new adjustable circuit protective device to ensure that they will function properly prior to the initial energization of the new power system under actual operating conditions.

3.18 PAINTING AND FINISHING

Field-applied paint on exposed surfaces shall be provided under SECTION 09900 PAINTS AND COATINGS.

3.19 REPAIR OF EXISTING WORK

The work shall be carefully laid out in advance, and where cutting, channeling, chasing, or drilling of floors, walls, partitions, ceiling, or other surfaces is necessary for the proper installation, support, or anchorage of the conduit, raceways, or other electrical work, this work shall be carefully done, and any damage to building, piping, or equipment shall be repaired by skilled mechanics of the trades involved at no additional cost to the Government.

3.20 FIELD TESTING

Field testing shall be performed in the presence of the Contracting Officer. The Contractor shall notify the Contracting Officer 10 days prior to conducting tests. The Contractor shall furnish all materials, labor, and equipment necessary to conduct field tests. The Contractor shall

perform all tests and inspection recommended by the manufacturer unless specifically waived by the Contracting Officer. The Contractor shall maintain a written record of all tests which includes date, test performed, personnel involved, devices tested, serial number and name of test equipment, and test results. All field test reports will be signed and dated by the Contractor.

3.20.1 Safety

The Contractor shall provide and use safety devices such as rubber gloves, protective barriers, and danger signs to protect and warn personnel in the test vicinity. The Contractor shall replace any devices or equipment which are damaged due to improper test procedures or handling.

3.20.2 Ground-Resistance Tests

The resistance of each grounding electrode system shall be measured using the fall-of-potential method defined in IEEE Std 81. Soil resistivity in the area of the grid shall be measured concurrently with the grid measurements. Ground resistance measurements shall be made before the electrical distribution system is energized and shall be made in normally dry conditions not less than 48 hours after the last rainfall. Resistance measurements of separate grounding electrode systems shall be made before the systems are bonded together below grade. The combined resistance of separate systems may be used to meet the required resistance, but the specified number of electrodes must still be provided.

a. Single rod electrode - 25 ohms .

b. Grid electrode - 25 ohms.

3.20.3 Ground-Grid Connection Inspection

All below-grade ground-grid connections will be visually inspected by the Contracting Officer before backfilling. The Contractor shall notify the Contracting Officer 24 hours before the site is ready for inspection.

3.20.4 Cable Tests

The Contractor shall be responsible for identifying all equipment and devices that could be damaged by application of the test voltage and ensuring that they have been properly disconnected prior to performing insulation resistance testing. An insulation resistance test shall be performed on all low and medium voltage cables after the cables are installed in their final configuration and prior to energization. The test voltage shall be 500 volts DC applied for one minute between each conductor and ground and between all possible combinations of conductors. The minimum value of resistance shall be:

R in megohms = (rated voltage in kV + 1) x 1000/(length of cable in feet)

Each cable failing this test shall be repaired or replaced. The repaired cable system shall then be retested until failures have been eliminated.

3.20.4.1 Low Voltage Cable Tests

a. Continuity test.

b. Insulation resistance test.

3.20.5 Motor Tests

a. Phase rotation test to ensure proper directions.

b. Operation and sequence of reduced voltage starters.

3.20.6 Dry-Type Transformer Tests

The following field tests shall be performed on all dry-type transformers 50 kVA and above.

a. Insulation resistance test phase-to-ground, each phase.

b. Turns ratio test.

3.20.7 Circuit Breaker Tests

The following field tests shall be performed on circuit breakers.

3.20.7.1 Circuit Breakers, Low Voltage

a. Insulation resistance test phase-to-phase, all combinations.

b. Insulation resistance test phase-to-ground, each phase.

c. Closed breaker contact resistance test.

d. Manual and electrical operation of the breaker.

3.20.7.2 Circuit Breakers, Molded Case

a. Insulation resistance test phase-to-phase, all combinations.

b. Insulation resistance test phase-to-ground, each phase.

c. Closed breaker contact resistance test.

d. Manual operation of the breaker.

3.20.8 Motor Control Centers

a. Insulation resistance test phase-to-phase, all combinations.

b. Insulation resistance test phase-to-ground, each phase.

c. Manual and electrical operational tests.

3.21 OPERATING TESTS

After the installation is completed, and at such time as the Contracting Officer may direct, the Contractor shall conduct operating tests for approval. The equipment shall be demonstrated to operate in accordance with the specified requirements. An operating test report shall be submitted in accordance with paragraph FIELD TEST REPORTS.

3.22 FIELD SERVICE

3.22.1 Onsite Training

The Contractor shall conduct a training course for the operating staff as designated by the Contracting Officer. The training period shall consist of a total of 8 hours of normal working time and shall start after the system is functionally completed but prior to final acceptance tests. The course instruction shall cover pertinent points involved in operating, starting, stopping, servicing the equipment, as well as all major elements of the operation and maintenance manuals. Additionally, the course instructions shall demonstrate all routine maintenance operations. A VHS format video tape of the entire training shall be submitted.

3.22.2 Installation Engineer

After delivery of the equipment, the Contractor shall furnish one or more field engineers, regularly employed by the equipment manufacturer to supervise the installation of equipment, assist in the performance of the onsite tests, oversee initial operations, and instruct personnel as to the operational and maintenance features of the equipment.

3.23 ACCEPTANCE

Final acceptance of the facility will not be given until the Contractor has successfully completed all tests and after all defects in installation, material or operation have been corrected.

-- End of Section --

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SECTION 16526

AIRFIELD LIGHTING AND VISUAL NAVIGATION AIDS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C119.1	(1986; R 1997) Sealed Insulated Underground Connector Systems Rated 600 Volts

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 123/A 123M	(2002) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 153/A 153M	(2001a) Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A 780	(2001) Repair of Damaged and Uncoated Areas of Hot-Dipped Galvanized Coatings
ASTM B 117	(1997) Operating Salt Spray (Fog) Apparatus
ASTM D 709	(2000) Laminated Thermosetting Materials
ASTM D 1654	(1992; R 2000) Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments

FACTORY MUTUAL ENGINEERING AND RESEARCH (FM)

FM P7825a	(1998) Approval Guide Fire Protection
FM P7825b	(1998) Approval Guide Electrical Equipment

U.S. FEDERAL AVIATION ADMINISTRATION (FAA)

FAA AC 70/7460-1	(Rev J) Obstruction Marking and Lighting
FAA AC 150/5345-7	(Rev D; Change 1) L-824 Underground Electrical Cable for Airport Lighting Circuits
FAA AC 150/5345-26	(Rev B; Changes 1 & 2) L-823 Plug and Receptacle, Cable Connectors

FAA AC 150/5345-42	(Rev C; Change 1) Airport Light Bases, Transformer Houses, Junction Boxes and Accessories
FAA AC 150/5345-43	(Rev E) Obstruction Lighting Equipment
FAA AC 150/5345-44	(Rev F) Taxiway and Runway Signs
FAA AC 150/5345-46	(Rev B) Runway and Taxiway Light Fixtures
FAA AC 150/5345-47	(Rev A) Isolation Transformers for Airport Lighting Systems
FAA C-6046	(1978) Frangible Coupling Type I and Type 1A, Details

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2	(2002) National Electrical Safety Code
IEEE C62.11	(1999) Metal-Oxide Surge Arresters for AC Power Circuits
IEEE C62.41	(1991; R 1995) Surge Voltages in Low-Voltage AC Power Circuits
IEEE Std 48	(1998) Standard Test Procedures and Requirements for Alternating-Current Cable Terminations 2.5 kV through 765 kV

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA LA 1	(1992; R 1999) Surge Arresters
NEMA RN 1	(1998) Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit
NEMA TC 6	(1990) PVC and ABS Plastic Utilities Duct for Underground Installation
NEMA WC 7	(1988; Rev 3 1996) Cross-Linked-Thermosetting-Polyethylene-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy
NEMA WC 8	(1988; Rev 3 1996) Ethylene-Propylene-Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2002) National Electrical Code

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC Paint 20	(1991) Zinc-Rich Primers (Type I - "Inorganic" and Type II - "Organic")

UNDERWRITERS LABORATORIES (UL)

UL 1	(2000) Flexible Metal Conduit
UL 6	(2000) Rigid Metal Conduit
UL 44	(1999) Thermoset-Insulated Wires and Cables
UL 360	(1996; Rev thru Oct 1997) Liquid-Tight Flexible Steel Conduit
UL 486A	(1997; Rev thru May 2001) Wire Connectors and Soldering Lugs for Use with Copper Conductors
UL 486B	(1997; Rev thru May 2001) Wire Connectors for Use with Aluminum Conductors
UL 510	(1994; Rev thru Apr 1998) Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape
UL 514A	(1996; Rev Dec 1999) Metallic Outlet Boxes
UL 854	(1999; Rev thru Aug 2001) Service - Entrance Cables
UL 1242	(1996; Rev Mar 1998) Intermediate Metal Conduit
UL Elec Const Dir	(2001) Electrical Construction Equipment Directory

1.2 GENERAL REQUIREMENTS

Items of the same classification shall be identical including equipment, assemblies, parts, and components.

1.2.1 Existing Airfield Lighting

Existing airfield lighting systems shall remain in operating condition except for minimum interruptions, as approved in writing by the Contracting Officer. Prior to each interruption, all necessary materials and a sufficient labor force shall be assembled to permit completing the work within the scheduled time interval. Under no circumstances shall any of the existing airfield lighting circuits be left inoperative without making provisions for suitable temporary connections in the affected area or areas. All airfield lighting circuits covered under this contract shall be restored in such a manner that they will be operational at dusk each day. The Contractor shall submit a plan for outages and maintaining lighting and lighting control. A minimum of 72 hours notice shall be provided in writing to the Contracting Officer prior to the interruption of existing systems.

1.2.2 Code Compliance

The installation shall comply with the requirements and recommendations of NFPA 70 and IEEE C2 and local codes where required.

1.2.3 Standard Product

Material and equipment shall be a standard product of a manufacturer regularly engaged in the manufacture of the product and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening.

1.2.4 Prevention of Corrosion

1.2.4.1 Metallic Materials

Metallic materials shall be protected against corrosion as specified. Aluminum shall not be used in contact with earth or concrete. Where aluminum conductors are connected to dissimilar metal, fittings conforming to UL 486B shall be used.

1.2.4.2 Ferrous Metal Hardware

Ferrous metal hardware shall be hot-dip galvanized in accordance with ASTM A 123/A 123M and ASTM A 153/A 153M.

1.2.4.3 Luminaires Fabricated from Ferrous Metals

Luminaires fabricated from ferrous metals, unless hot-dip galvanized or of porcelain enamel finish shall be factory finished with a weather-resistant finish in accordance with paragraphs FACTORY COATING and FINISHING, except exposure shall be 200 hours. Finish color shall be the manufacturer's standard, unless otherwise indicated.

1.2.5 Unusual Service Conditions

Items furnished under this section shall be specifically suitable for the following unusual service conditions:

Temperature: -60 degrees F to 100 degrees F

1.2.5.1 Other

Material or equipment to be installed underground; in handholes, manholes, or underground vaults; or in light bases, shall be suitable for submerged operation.

1.2.6 Verification of Dimensions

The Contractor shall become familiar with details of the work, verify dimensions in the field, and advise the Contracting Officer of any discrepancy before performing any work.

1.3 SYSTEM DESCRIPTION

The airfield lighting and visual navigation aids shall consist of obstruction lighting and marking, taxiway lights, apron lights and the lighting power supply and control.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When

used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with SECTION 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Materials and Equipment; G, ED.

A complete itemized listing of equipment and materials proposed for incorporation into the work. Each itemization shall include an item number, the quantity of items proposed, and the name of the manufacturer. Data composed of catalog cuts, brochures, circulars, specifications and product data, and printed information in sufficient detail and scope to verify compliance with requirements of the contract documents.

Parts.

A list of parts and components for the system by manufacturer's name, part number, nomenclature, and stock level required for maintenance and repair necessary to ensure continued operation with minimal delays.

SD-06 Test Reports

Field Quality Control; G, RE.

Upon completion and testing of the installed system, performance test reports are required in booklet form showing all field tests performed to adjust each component and all field tests performed to provide compliance with the specified performance criteria. Each test shall indicate the final position of controls.

Field test reports shall be written, signed and provided as each circuit or installation item is completed. Field tests shall include resistance-to-ground and resistance between conductors, and continuity measurements for each circuit. For each series circuit the input voltage and output current of the constant current regulator at each intensity shall be measured. For multiple circuits the input and output voltage of the transformer for each intensity setting shall be measured. A visual inspection of the lights operation, or of the markings appearance, or of the installation of fixtures or units installed shall be reported.

Inspection.

Inspection reports shall be prepared and provided as each stage of installation is completed. These reports shall identify the activity by contract number, location, quantity of material placed, and compliance with requirements.

SD-07 Certificates

Cables, General Requirements.

Certifications, when specified or required, including Certification of the Qualifications of Medium-Voltage Cable Installers, Certified Factory and Field Test Reports, and Certificates of Compliance submitted in lieu of other proofs of compliance with these contract provisions. A certification that contains the names and the qualifications of persons recommended to perform the splicing and termination of medium-voltage cables approved for installation under this contract shall be included. The certification

shall indicate that any person recommended to perform actual splicing and termination has been adequately trained in the proper techniques and has had at least 3 recent years of experience in splicing and terminating the same or similar types of cables approved for installation. Any person recommended by the Contractor may be required to perform a dummy or practice splice and termination, in the presence of the Contracting Officer, before being approved as a qualified installer of medium-voltage cables. If that additional requirement is imposed, the Contractor shall provide short sections of the approved types of cables with the approved type of splice and termination kits, and detailed manufacturer's instruction for the proper splicing and termination of the approved cable types. The certification shall be prepared in conformance with paragraph CERTIFICATES OF COMPLIANCE in the SPECIAL CONTRACT REQUIREMENTS, and shall be accompanied by satisfactory proof of the training and experience of persons recommended by the Contractor as cable installers. The SF sub 6 gas pressurized cable and conduit system installer must be trained and certified in installation of this type of system and must be approved by the manufacturer of the system.

Materials and Equipment

When equipment or materials are specified to conform to the standards or publications and requirements of AASHTO, ANSI, ASTM, AEIC, FM, IEEE, IES, NEMA, NFPA, or UL, or to an FAA, FS, or MS, proof that the items furnished under this section of the specifications conform to the specified requirements shall be included. The label or listing in UL Elec Const Dir or in FM P7825a, FM P7825b or the manufacturer's certification or published catalog specification data statement that the items comply with applicable specifications, standards, or publications and with the manufacturer's standards will be acceptable evidence of such compliance. Certificates shall be prepared by the manufacturer when the manufacturer's published data or drawings do not indicate conformance with other requirements of these specifications.

SD-10 Operation and Maintenance Data

Equipment; G, RE.

Six copies of operation and six copies of maintenance manuals for the equipment furnished. One complete set shall be furnished prior to performance testing and the remainder shall be furnished upon acceptance. Operating manuals shall detail the step-by-step procedures required for system startup, operation, and shutdown. Operating manuals shall include the manufacturer's name, model number, parts list, and brief description of all equipment and their basic operating features. Maintenance manuals shall list routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guides. Maintenance manuals shall include conduit and equipment layout and simplified wiring and control diagrams of the system as installed.

PART 2 PRODUCTS

2.1 MATERIALS

Equipment and materials shall be new unless indicated or specified otherwise. Materials and equipment shall be labelled when approved by Underwriters Laboratories (UL) or Factory Mutual (FM) System. Askarel and insulating liquids containing polychlorinated biphenyls (PCB's) will not be allowed in any equipment. Equipment installed below grade in vaults,

manholes, and handholes shall be the submersible type.

2.1.1 Electrical Tape

Electrical tape shall be UL 510 plastic insulating tape.

2.1.2 Nameplates

Each major component of equipment shall have as a minimum the manufacturer's name, address, and catalog or style number on a nameplate securely attached to the item of equipment. Laminated plastic nameplates shall be provided for equipment, controls, and devices to identify function, and where applicable, position. Nameplates shall be 1/8 inch thick laminated cellulose paper base phenolic resin plastic conforming to ASTM D 709 sheet type, grade ES-3, white with black center core. Surface shall be a matte finish with square corners. Lettering shall be engraved into the black core. Size of nameplates shall be 1 by 2-1/2 inches minimum with minimum 1/4 inch high normal block lettering. Nameplates provided as indicated. Nameplates shall be fastened to the device with a minimum of two sheet metal screws or two rivets.

2.1.3 Conduit, Conduit Fittings, and Boxes

2.1.3.1 Rigid Steel Conduit and Fittings

The metal conduit and fittings shall be UL 6 and UL 1242, respectively, coated with a polyvinylchloride (PVC) sheath bonded to the galvanized exterior surface, nominal 40 mils thick, conforming to NEMA RN 1.

2.1.3.2 Flexible Metal Conduit

Flexible metal conduit shall be UL 1, zinc-coated steel. UL 360 liquid-tight flexible metal conduit shall be used in wet locations.

2.1.3.3 Outlet Boxes for Use with Steel Conduit, Rigid or Flexible

These outlet boxes shall be UL 514A, cast metal with gasket closures.

2.1.3.4 Plastic Duct for Concrete Encased Burial

These ducts shall be PVC conforming to NEMA TC 6, Type EB.

2.1.3.5 Frangible Couplings and Adapters

These frangible couplings shall be in accordance with FAA C-6046. Upper section of frangible coupling shall be provided with one of the following:

a. Unthreaded for slip-fitter connections.

b. 2 inch 11-1/2-N.P.T. (tapered) with 7/32 inch nominal wall thickness to accept rigid conduit coupling.

c. Frangible Couplings for specialized applications as approved.

2.1.4 Wire and Cable

Conductors shall be copper except as otherwise indicated.

2.1.4.1 Conductor Sizes

Conductor size shall conform to American Wire Gage (AWG). Conductor sizes larger than No. 8 AWG shall be stranded. No. 8 AWG and smaller may be solid or stranded unless otherwise indicated.

2.1.4.2 Low Voltage Wire and Cable

UL 854, Type USE, 600 volts shall be used for underground low voltage power cables. UL 44, Type XHHW shall be used for secondary series lighting circuits to be installed in pavement.

2.1.4.3 Power Cables for Use in Airfield Lighting

Power cables shall be rated 5 kV, 133 percent insulation level, with shield and jacket conforming to NEMA WC 7 for crosslinked polyethylene or NEMA WC 8 for ethylene-propylene rubber insulated cables.

2.1.4.4 Wire and Cable for Airfield and Heliport Lighting Systems

a. Airfield lighting cable shall be FAA AC 150/5345-7, #8 AWG, Type L-824 for crosslinked polyethylene Type C 5000-volt cable. Series airfield lighting cable shall be unshielded.

b. Counterpoise Wire. No. 2 AWG bare stranded copper, annealed or soft drawn.

c. Fused Cable Connectors. Connector shall consist of a line-side receptacle and a load-side plug, each in a molded rubber form and including crimp-on fittings for the cable ends to accommodate a 250-volt cartridge-type fuse with fuse rating as indicated. Connectors in kit form shall be properly sized for the specific cable diameter involved. Completed connection shall be watertight.

2.1.4.5 Cable Tags

Cable tags for each cable or wire shall be installed at duct entrances entering or leaving manholes, handholes, and at each terminal within the lighting vault. Cable tags shall be stainless steel, bronze, lead strap, or copper strip, approximately 1/16 inch thick or hard plastic 1/8 inch thick suitable for immersion in salt water and impervious to petroleum products and shall be of sufficient length for imprinting the legend on one line using raised letters. Cable tags shall be permanently marked or stamped with letters not less than 1/4 inch in height as indicated. Two-color laminated plastic is acceptable. Plastic tags shall be dark colored with markings of light color to provide contrast so that identification can be easily read. Fastening material shall be of a type that will not deteriorate when exposed to water with a high saline content and to petroleum products.

2.1.5 Ground Rods

Ground rods shall be sectional copper-clad steel with diameter adequate to permit driving to full length of the rod, but not less than 3/4 inch in diameter and not more than 10 feet long, unless indicated otherwise.

2.1.6 Lightning Arresters

These lightning arresters shall be in accordance with IEEE C62.11 and IEEE

C62.41 as applicable with ratings as indicated.

2.1.7 Surge Protection

Surge protection shall be metal oxide varistors (MOV) in accordance with NEMA LA 1 for power and signal circuits with ratings as recommended by the system manufacturer.

2.1.8 Cable Connectors and Splices

Cable connectors in accordance with FAA AC 150/5345-26, Item L-823 shall be used for connections and splices appropriate for the type of cable. Other types of cable connectors and splices shall be of copper alloys for copper conductors, aluminum alloys for aluminum-composition conductors and a type designed to minimize galvanic corrosion for copper to aluminum-composition conductors. For FAA Type L-824 lighting cable, connectors shall be FAA AC 150/5345-26, Type L-823.

2.1.9 Transformers

2.1.9.1 Encapsulated Isolation Transformers

These transformers shall be FAA AC 150/5345-47, Type L-830. Each transformer shall be provided with rating as shown on the contract drawings.

2.1.10 Light Bases

Light bases shall be FAA AC 150/5345-42 Type L-867.

2.1.10.1 Accessories

Base plates, cover plates, and adapter plates shall be provided to accommodate various sizes of fixtures. Bolts shall be stainless steel.

2.1.11 Lamps and Filters

Lamps shall be of size and type indicated, or as required by fixture manufacturer for each lighting fixture required under this contract. Filters shall be of colors as indicated and conforming to the specification for the light concerned or to the standard referenced.

2.1.12 Lighting Fixtures

The lighting fixtures for the airfield lighting shall be as shown in the contract drawings. If high mast assemblies other than what is shown on the drawings are provided, the contractor shall submit the following additional information for Government approval:

2.1.12.1 Light Calculations

A point-to-point analysis of the entire parking apron shall be provided. Each point shall not exceed 50-foot on center. Average illumination of the parking apron shall be 2.0 foot-candles at the ground, with a 0.7 loss factor.

2.1.12.2 Fixture Aiming Plan

A drawing identifying a definitive means for aiming the individual light fixtures shall be provided to achieve the minimum illumination levels

identified above.

2.2 OBSTRUCTION LIGHTING AND MARKING

Obstructions on or near the airfield shall be marked and/or lighted as shown on the contract drawings. Obstruction marker lights shall emit aviation red steady burning light. The light fixtures, shall be multiple-socket assembly FAA AC 150/5345-43, Type L-810. Obstruction marker lights shall be double-unit type as shown in the contract drawings.

2.3 TAXIWAY LIGHTING SYSTEMS

Taxiway lighting systems shall include edge lights. This system shall also include the associated equipment, power supplies and controls, mounting devices, and interconnecting wiring to provide complete systems as specified.

2.3.1 Taxiway Edge Lights

Taxiway edge light shall emit aviation blue light. The edge lights shall meet the requirements of FAA AC 150/5345-46, Type L-861, Light Emitting Diode (LED) elevated lights.

2.3.2 Taxiway Guidance Signs

The taxiway guidance signs shall meet the requirements of FAA AC 150/5345-44, Type L-858Y for information. The size and information on the signs shall be as shown on contract drawings. The power supply to connect to series circuits shall be as indicated on the contract drawings. However, all work shall be as required by the manufacturer.

2.4 FACTORY COATINGS

Equipment and component items, including but not limited to transformer stations and ferrous metal luminaries not hot-dip galvanized or porcelain enamel finish shall be provided with corrosion-resistant finishes which shall withstand 200 hours of exposure to the salt spray test specified in ASTM B 117 without loss of paint or release of adhesion of the paint primer coat to the metal surface in excess of 1/16 inch from the test mark. The scribed test mark and test evaluation shall be in accordance with ASTM D 1654 with a rating of not less than 7 in accordance with TABLE 1, (Procedure A). Cut edges or otherwise damaged surfaces of hot-dip galvanized sheet steel or mill galvanized sheet steel shall be coated with zinc rich paint conforming to SSPC Paint 20 in accordance with ASTM A 780.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

Circuits installed underground shall conform to the requirements of SECTION 16375 ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND, except as required herein. Steel conduits installed underground shall be installed and protected from corrosion in conformance with the requirements of SECTION 16415 ELECTRICAL WORK, INTERIOR. Except as covered herein, excavation, trenching, and backfilling shall conform to the requirements of SECTION 02314 EARTHWORK FOR UTILITIES. Concrete work shall conform to the requirements of SECTION 03300 CAST-IN-PLACE STRUCTURAL CONCRETE.

3.2 CABLES, GENERAL REQUIREMENTS

The type of installation, size and number of cables shall be as indicated. Conductors larger than No. 8 AWG shall be stranded. Loads shall be divided as evenly as practicable on the various phases of the system. Manufacturer's written recommendations shall be furnished for each type of splice and medium-voltage cable joint and termination, and for fireproofing application methods, and shall be approved before any work is done. Medium-voltage cable joints and terminations shall be the standard product of a manufacturer and shall be either of the factory preformed type or of the kit type containing tapes and other required parts. Medium-voltage cable joints shall be made by qualified cable splicers. Compounds and tapes shall be electrical grade suitable for the cable insulation provided and shall use design materials and techniques recommended by the manufacturer. Maximum length of cable pull and cable pulling tensions shall not exceed the cable manufacturer's recommendations.

3.3 MEDIUM-VOLTAGE CABLES

Medium-voltage cables shall be suitable for a rated circuit voltage of 5 kV. Other parts of the cable system such as joints and terminations shall have ratings not less than the rating of the cables on which they are installed. Separable insulated connectors shall have nominal voltage ratings coordinated to associated apparatus ratings rather than cable ratings when used to connect cable to apparatus. Cables shall be provided with 133 percent insulation level.

3.3.1 Cable Joints

Shields shall be applied as required to continue the shielding system through each entire cable joint. Shields may be integrally molded parts of preformed joints. Shields shall be grounded at each joint.

3.3.1.1 Types

Separable insulated connectors of suitable construction or standard splice kits shall be used for single-conductor and two-conductor cables. The connectors shall be of FAA AC 150/5345-26.

3.3.1.2 Requirements

Cable joints shall provide insulation and jacket equivalent to that of the associated cable. Lead sleeves shall be provided for lead-covered cables. Armored cable joints shall be enclosed in compound-filled, cast-iron or alloy, splice boxes equipped with stuffing boxes and armor clamps of a suitable type and size for the cable being installed.

3.3.2 Terminations

Terminations shall be IEEE Std 48, Class 1 or Class 2, of the molded elastomer, wet-process porcelain, prestretched elastomer or heat-shrinkable elastomer type. Acceptable elastomers are track-resistant silicone rubber or track-resistant ethylene propylene compounds, such as ethylene propylene rubber or ethylene propylene diene monomer. Separable insulated connectors may be used for apparatus terminations, when such apparatus is provided with suitable bushings. Terminations shall be of the outdoor type, except that where installed inside outdoor equipment housings which are sealed against normal infiltration of moisture and outside air, indoor, Class 2 terminations are acceptable. Class 3 terminations are not acceptable.

Terminations, where required, shall be provided with mounting brackets suitable for the intended installation and with grounding provisions for the cable shielding, metallic sheath, and armor.

3.3.2.1 Factory Preformed Type

Molded elastomer, wet-process porcelain, prestretched, and heat-shrinkable terminations shall utilize factory preformed components to the maximum extent practicable rather than tape build-up. Terminations shall have basic impulse levels as required for the system voltage level. Leakage distances shall pass the wet withstand voltage test required by IEEE Std 48 for the next higher BIL level.

3.4 LOW-VOLTAGE CABLES

Cable shall be rated 600 volts, except that secondaries of isolation transformer to in-pavement lights installed in pavement saw kerf and 48 volt DC control cables may be 300 volts. Other parts of cable systems such as splices and terminations shall be rated at not less than 600 volts. Splices in wires No. 10 AWG and smaller shall be made with an insulated, solderless, pressure type connector, conforming to the applicable requirements of UL 486A. Splices in wires No. 8 AWG single conductor cable shall be made with FAA AC 150/5345-26 Type L-823 connectors. Splices below grade or in wet locations shall be sealed type conforming to ANSI C119.1 or shall be waterproofed by a sealant-filled, thick wall, heat shrinkable, thermosetting tubing or by pouring a thermosetting resin into a mold that surrounds the joined conductors.

3.5 DUCT LINES

Duct lines shall be concrete-encased, thin-wall type.

3.5.1 Requirements

Numbers and sizes of ducts shall be as indicated. Duct lines shall be laid with a minimum slope of 4 inches per 100 feet. Depending on the contour of the finished grade, the high point may be at a terminal, a manhole, a handhold, or between manholes or handholes. Manufactured 90 degree duct bends may be used only for pole or equipment risers, unless specifically indicated as acceptable. The minimum manufactured bend radius shall be 18 inches for ducts of less than 3 inches diameter, and 36 inches for ducts 3 inches or greater in diameter. Otherwise, long sweep bends having a minimum radius of 25 feet shall be used for a change of direction of more than 5 degrees, either horizontally or vertically. Both curved and straight sections may be used to form long sweep bends as required, but the maximum curve shall be 30 degrees and manufactured bends shall be used. Ducts shall be provided with end bells when duct lines terminate in manholes or handholes. Duct line markers shall be provided as indicated at the ends of long duct line stubouts or for other ducts whose locations are indeterminate because of duct curvature or terminations at completely below-grade structures. In lieu of markers, a 5 mil brightly colored plastic tape not less than 3 inches in width and suitably inscribed at not more than 10 feet on centers with a continuous metallic backing and a corrosion-resistant 1 mil metallic foil core to permit easy location of the duct line, shall be placed approximately 12 inches below finished grade levels of such lines.

3.5.2 Treatment

Ducts shall be kept clean of concrete, dirt, or foreign substances during construction. Field cuts requiring tapers shall be made with proper tools and match factory tapers. After a duct line is completed, a standard flexible mandrel shall be used for cleaning followed by a brush with stiff bristles. Mandrels shall be at least 12 inches long and shall have diameters 1/4 inch less than the inside diameter of the duct being cleaned. Pneumatic rodding may be used to draw in lead wires. A coupling recommended by the duct manufacturer shall be used when an existing duct is connected to a duct of different material or shape. Ducts shall be stored to avoid warping and deterioration with ends sufficiently plugged to prevent entry of water or solid substances. Ducts shall be thoroughly cleaned before being laid. Plastic ducts shall be stored on a flat surface and protected from the direct rays of the sun.

3.5.3 Concrete Encasement

Each single duct shall be completely encased in concrete with a minimum of 3 inches of concrete around each duct, except that only 2 inchesof concrete are required between adjacent electric power or adjacent communication ducts, and 4 inches of concrete shall be provided between adjacent electric power and communication ducts. Duct line encasements shall be monolithic construction. Where a connection is made to a previously poured encasement, the new encasement shall be well bonded or doweled to the existing encasement. At any point, except railroad crossings, tops of concrete encasements shall be not less than 18 inches below finished grade or paving. At railroad crossings, duct lines shall be encased with concrete, reinforced as indicated. Tops of concrete encasements shall be not less than 5 feet below tops of rails, unless otherwise indicated. Separators or spacing blocks shall be made of steel, concrete, plastic, or a combination of these materials placed not further apart than 4 feet on centers. Ducts shall be securely anchored to prevent movement during the placement of concrete and joints shall be staggered at least 6 inches vertically.

3.5.4 Installation of Couplings

Joints in each type of duct shall be made up in accordance with the manufacturer's recommendations for the particular type of duct and coupling selected and as approved. In the absence of specific recommendations, various types of duct joint couplings shall be made watertight as specified.

3.5.4.1 Plastic Duct

Duct joints shall be made by brushing a plastic solvent cement on insides of plastic coupling fittings and on outsides of duct ends. Each duct and fitting shall then be slipped together with a quick one-quarter-turn twist to set the joint tightly.

3.6 MANHOLES AND HANDHOLES

The manholes and handholes shall be as specified in SECTION 16375 ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND.

3.7 CABLE MARKERS

Cable markers or tags shall be provided for each cable at duct entrances entering or leaving manholes or handholes and at each termination within

the lighting vault. Cables in each manhole or handhole shall have not less than two tags per cable, one near each duct entrance hole. Immediately after cable installation, tags shall be permanently attached to cables and wires so that they cannot be accidentally detached.

3.8 ELEVATED AIRFIELD LIGHTS

Elevated lights shall be frangible mounted, not to exceed 14 inches in height except where higher mounting is permitted in snow accumulation areas. Equipment exceeding 14 inches in height shall be frangible mounted as indicated.

3.9 SPLICES FOR AIRFIELD LIGHTING CABLE

3.9.1 Connectors

Kit type connectors shall be used to splice 5 kV single-conductor series lighting cables. During installation and prior to covering with earth, mating surfaces of connectors shall be covered until connected and clean when plugged together. At joint where connectors come together, heat shrinkable tubing shall be installed with waterproof sealant with two half-lapped layers of tape over the entire joint. Joint shall prevent entrapment of air which might subsequently loosen the joint.

3.10 GROUNDING SYSTEMS

3.10.1 Counterpoise Installation

Counterpoise wire shall be laid for entire length of circuits supplying airfield lighting. Wire shall be in one piece, except where distance exceeds the length usually supplied. Counterpoise shall be installed on top of the envelope of concrete-encased duct and approximately 6 inches above direct burial cables and duct lines. Where trenches or duct lines intersect, counterpoise wires shall be electrically interconnected by exothermic welding or brazing. Counterpoise to earth ground shall be connected at every 2,000 feet of cable run, at lighting vault, and at feeder connection to light circuit by means of ground rods as specified. Counterpoise shall be installed in a separate duct under roads, railroads, and paved areas above the highest duct containing electrical or communications circuits.

3.10.2 Fixture Grounding

Each fixture or group of adjacent fixtures shall be grounded by a grounding circuit separate from the counterpoise system unless required otherwise or by driven ground rods if permitted. Fixtures, steel light bases or grounding bushings on steel conduits shall be connected to an independent ground rod by a No. 6 AWG bare stranded copper wire. Semiflush fixtures for direct mounting in pavement need not be grounded. Copper wire shall be connected to ground rods by exothermic weld or brazing.

3.11 MARKING AND LIGHTING OF AIRWAY OBSTRUCTIONS

High mast light poles shall be marked and lighted in accordance with FAA AC 70/7460-1 and as indicated in or required otherwise.

3.11.1 Obstruction Marker Lights

Obstruction marker lights shall be installed where indicated with 1 inch

zinc-coated rigid steel conduit stems using standard tees and elbows, except that lowering devices, when required, shall be installed in accordance with equipment manufacturer's recommendations.

3.12 ISOLATION TRANSFORMERS

Transformer lead connections shall conform to FAA AC 150/5345-26. Transformer secondary connectors shall plug directly into a mating connector on the transformer secondary leads. During installation, mating surfaces of connectors shall be covered until connected and clean when plugged together. At joint where connectors come together, heat shrinkable tubing shall be installed with waterproof sealant or with two half-lapped layers of tape over the entire joint. Joint shall prevent entrapment of air which might subsequently loosen the joint.

3.13 TAXIWAY LIGHTING SYSTEMS

3.13.1 Taxiway Edge Lights

Edge lights shall be elevated type lights. Elevated lights shall be frangible mounted and each light supplied power through an isolation transformer. The taxiway lights shall be omnidirectional and only require leveling.

3.14 FIELD QUALITY CONTROL

The Contracting Officer shall be notified 5 working days prior to each test. Deficiencies found shall be corrected and tests repeated.

3.14.1 Operating Test

Each completed circuit installation shall be tested for operation. Equipment shall be demonstrated to operate in accordance with the requirements of this Section.

3.14.2 Distribution Conductors, 600-Volt Class

Test shall verify that no short circuits or accidental grounds exist using an instrument which applies a voltage of approximately 500 volts providing a direct reading in resistance.

3.14.3 Counterpoise System Test and Inspection

Continuity of counterpoise system shall be visually inspected at accessible locations. Continuity of counterpoise system to the vault grounding system shall be tested in manhole closest to the vault.

3.14.4 Progress Testing for Series Lighting Circuits

A megger test shall be conducted on each section of circuit or progressive combinations of sections as they are installed. Each section or progressive combination of sections shall be tested with a megohmmeter providing a voltage of approximately 1000 volts, a direct reading in resistance. Results shall be documented. Faults indicated by these tests shall be eliminated before proceeding with the circuit installation.

3.14.5 Electrical Acceptance Tests

Acceptance tests shall be performed for series and multiple airfield

lighting circuits only on complete lighting circuits. Each series and multiple lighting circuit shall receive a high voltage insulation test.

3.14.5.1 Low-Voltage Continuity Tests

Each series circuit shall be tested for electrical continuity. Faults indicated by this test shall be eliminated before proceeding with the high-voltage insulation resistance test.

3.14.5.2 High-Voltage Insulation Resistance Tests

Each series lighting circuit shall be subjected to a high-voltage insulation resistance test by measurement of the insulation leakage current with a suitable high-voltage test instrument which has a steady, filtered direct current output voltage and limited current. High-voltage tester shall include an accurate voltmeter and microammeter for reading voltage applied to the circuit and resultant insulation leakage current. Voltages shall not exceed test values specified below.

a. Test Procedure: Both leads shall be disconnected from regulator output terminals and support so that air gaps of several inches exist between bare conductors and ground. Cable sheaths shall be cleaned and dried for a distance of 1 foot from ends of cables and exposed insulation at ends of cables. Ends of both conductors of the circuit shall be connected together and to high-voltage terminals of test equipment, and test voltage applied as specified in the following tabulation between conductors and ground for a period of 5 minutes.

	Test Voltage, dc	
Series Lighting Circuits	First Test on New Circuits	Test on Existing Circuits
Medium Intensity Series Lighting Circuits (5,000 volt leads, 30/45 watt transformers)	6000	3000
600-Volt Circuits	1800	600

When additions are made to existing circuits, only new sections shall be tested in accordance with "First Test on New Circuits" in table above. To ensure reliable operation, complete circuit shall be tested at reduced voltages indicated above.

b. Leakage Current: Insulation leakage current shall be measured and recorded for each circuit after a 1 minute application of the test voltage. If leakage current exceeds values specified below, the circuit shall be sectionalized and retested and the defective parts shall be repaired or replaced. Leakage current limits include allowances for the normal number of connectors and splices for each circuit as follows:

1. Three microamperes for each 1000 feet of cable.

2. Two microamperes for each 5,000 volt series transformer.

If measured value of insulation leakage current exceeds calculated value, the circuit shall be sectionalized and tested as specified for each section. Defective components shall be repaired or replaced until repeated tests indicate an acceptable value of leakage current for the entire circuit.

3.14.6 Final Operating Tests

After completion of installations and the above tests, circuits, control equipment, and lights covered by the contract shall be demonstrated to be in acceptable operating condition. Each switch in the control tower lighting panels shall be operated so that each switch position is engaged at least twice. During this process, lights and associated equipment shall be observed to determine that each switch properly controls the corresponding circuit. Telephone or radio communication shall be provided between the operator and the observer. Tests shall be repeated from the alternate control station, from the remote control points, and again from the local control switches on the regulators. Each lighting circuit shall be tested by operating the lamps at maximum brightness for not less than 30 minutes. At the beginning and at the end of this test the correct number of lights shall be observed to be burning at full brightness. One day and one night operating test shall be conducted for the Contracting Officer.

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SECTION 16528

EXTERIOR LIGHTING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C78.1350	(1990) Electric Lamps - 400-Watt, 100-Volt, S51 Single-Ended High-Pressure Sodium Lamps
ANSI C80.1	(1995) Rigid Steel Conduit - Zinc Coated
ANSI C82.4	(1992) Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps (Multiple-Supply Type)
ANSI C119.1	(1986; R 1997) Sealed Insulated Underground Connector Systems Rated 600 Volts
ANSI C135.1	(1979) Galvanized Steel Bolts and Nuts for Overhead Line Construction
ANSI C135.14	(1979) Staples with Rolled or Slash Points for Overhead Line Construction
ANSI C135.30	(1988) Zinc-Coated Ferrous Ground Rods for Overhead or Underground Line Construction
ANSI C136.2	(1996) Luminaries, Voltage Classification of Roadway Lighting Equipment
ANSI C136.3	(1995) Roadway Lighting Equipment-Luminaries Attachments
ANSI C136.6	(1997) Roadway Lighting Equipment - Metal Heads and Reflector Assemblies - Mechanical and Optical Interchangeability
ANSI C136.9	(1990) Roadway Lighting - Socket Support Assemblies for Use in Metal Heads - Mechanical Interchangeability
ANSI C136.10	(1996) Roadway Lighting- Locking-Type Photocontrol Devices and Mating Receptacles - Physical and Electrical

	Interchangeability and Testing
ANSI C136.11	(1995) Multiple Sockets for Roadway Lighting Equipment
ANSI C136.15	(1997) Roadway Lighting, High Intensity Discharge and Low Pressure Sodium Lamps in Luminaries -

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 123/A 123M	(2002) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 153/A 153M	(2001a) Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A 575	(1996; R 2002) Steel Bars, Carbon, Merchant Quality, M-Grades
ASTM A 576	(1990b; R 2000) Steel Bars, Carbon, Hot-Wrought, Special Quality
ASTM B 2	(2000) Medium-Hard-Drawn Copper Wire
ASTM B 8	(1999) Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
ASTM B 117	(1997) Operating Salt Spray (Fog) Apparatus
ASTM D 1654	(1992; R 2000) Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments

ILLUMINATING ENGINEERING SOCIETY OF NORTH AMERICA (IESNA)

IESNA RP-8	(1983; R 1993) Roadway Lighting

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2	(2002) National Electrical Safety Code
IEEE C136.13	(1999) Metal Brackets for Wood Poles
IEEE Std 81	(1983) Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System (Part 1)

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA OS 2	(1998) Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports
NEMA RN 1	(1998) Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit
NEMA TC 6	(1990) PVC and ABS Plastic Utilities Duct

	for Underground Installation
NEMA TC 9	(1990) Fittings for ABS and PVC Plastic Utilities Duct for Underground Installation

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2002) National Electrical Code

UNDERWRITERS LABORATORIES (UL)

UL 6	(2000) Rigid Metal Conduit
UL 44	(1999) Thermoset-Insulated Wires and Cables
UL 98	(1994; Rev thru Jun 1998) Enclosed and Dead-Front Switches
UL 467	(1993; Rev thru Feb 2001) Grounding and Bonding Equipment
UL 486A	(1997; Rev thru May 2001) Wire Connectors and Soldering Lugs for Use with Copper Conductors
UL 514B	(2004) Safety Conduit, Tubing, and Cable Fittings
UL 514C	(1996; Rev thru Jun 2001) Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers
UL 651	(1995; Rev thru Oct 1998) Schedule 40 and 80 Rigid PVC Conduit
UL 651A	(1995; Rev thru Apr 1998) Type EB and A Rigid PVC Conduit and HDPE Conduit
UL 854	(1999; Rev thru Aug 2001) Service - Entrance Cables
UL 1029	(1994; Rev thru Dec 1997) High-Intensity-Discharge Lamp Ballasts
UL 1572	(1995; Rev thru Nov 1999) High Intensity Discharge Lighting Fixtures

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with SECTION 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Lighting System; G-AO.

Detail Drawings; G-AO.

Detail drawings for the complete system and for poles, lighting fixtures.

As-Built Drawings; G-AO.

Final as-built drawings shall be finished drawings on mylar or vellum and shall be delivered with the final test report.

SD-03 Product Data

Equipment and Materials; G-AO.

Data published by the manufacturer of each item on the list of equipment and material, to permit verification that the item proposed is of the correct size, properly rated or applied, or is otherwise suitable for the application and fully conforms to the requirements specified.

Spare Parts; G-AO.

Spare parts data for each item of material and equipment specified, after approval of detail drawings for materials and equipment, and not later than 4 months before the date of beneficial occupancy. The data shall include a complete list of parts, special tools, and supplies, with current unit prices and sources of supply.

SD-06 Test Reports

Operating Test; G-AO.

Test procedures and reports for the Operating Test. After receipt by the Contractor of written approval of the test procedures, the Contractor shall schedule the tests. The final test procedures report shall be delivered after completion of the tests.

Ground Resistance Measurements; G-AO.

The measured resistance to ground of each separate grounding installation, indicating the location of the rods, the resistance of the soil in ohms per millimeter and the soil conditions at the time the measurements were made. The information shall be in writing.

SD-10 Operation and Maintenance Data

Lighting System; G-AO.

A draft copy of the operation and maintenance manuals, prior to beginning the tests for use during site testing. Final copies of the manuals as specified bound in hardback, loose-leaf binders, within 30 days after completing the field test. The draft copy used during site testing shall be updated with any changes required, prior to final delivery of the manuals. Each manual's contents shall be identified on the cover. The manual shall include names, addresses, and telephone numbers of each subcontractor installing equipment and systems, and nearest service representatives for each item of equipment for each system. The manuals shall have a table of contents and tab sheets. Tab sheets shall be placed at the beginning of each chapter or section and at the beginning of each appendix. The final copies delivered after completion of the field test shall include modifications made during installation checkout and

acceptance.

1.3 SYSTEM DESCRIPTION

1.3.1 Lighting System

The lighting system shall be configured as specified and shown. The system shall include all fixtures, hardware, poles, cables, connectors, adapters and appurtenances needed to provide a fully functional lighting system.

1.3.2 Electrical Requirements

The equipment shall operate from a voltage source as shown, plus or minus 10 percent, and 60 Hz, plus or minus 2 percent.

1.3.3 Interface Between Lighting System and Power Distribution

Conductors shall be as indicated.

1.3.4 Nameplates

Each major component of equipment shall have a nonferrous metal or engraved plastic nameplate which shall show, as a minimum, the manufacturer's name and address, the catalog or style number, the electrical rating in volts, and the capacity in amperes or watts.

1.3.5 Standard Products

Materials and equipment shall be standard products of manufacturer regularly engaged in the manufacture of such products. Items of equipment shall essentially duplicate equipment that has been in satisfactory use at least 2 years prior to bid opening.

1.4 CORROSION PROTECTION

1.4.1 Aluminum Materials

Aluminum shall not be used.

1.4.2 Ferrous Metal Materials

1.4.2.1 Hardware

Ferrous metal hardware shall be hot-dip galvanized in accordance with ASTM A 153/A 153M and ASTM A 123/A 123M.

1.4.2.2 Equipment

Equipment and component items, including but not limited to metal poles and ferrous metal luminaries not hot-dip galvanized or porcelain enamel finished, shall be provided with corrosion-resistant finishes which shall withstand 480 hours of exposure to the salt spray test specified in ASTM B 117 without loss of paint or release of adhesion of the paint primer coat to the metal surface in excess of 1/16 inch from the test mark. The scribed test mark and test evaluation shall have a rating of not less than 7 in accordance with TABLE 1, (procedure A) of ASTM D 1654. Cut edges or otherwise damaged surfaces of hot-dip galvanized sheet steel or mill galvanized sheet steel shall be coated with a zinc rich paint conforming to the manufacturer's standard.

1.4.3 Finishing

Painting required for surfaces not otherwise specified and finish painting of items only primed at the factory, shall be as specified in SECTION 09900 PAINTS AND COATINGS.

PART 2 PRODUCTS

2.1 STANDARD PRODUCT

Material and equipment shall be the standard product of a manufacturer regularly engaged in the manufacture of the product and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Items of the same classification shall be identical including equipment, assemblies, parts, and components.

2.2 BRACKET ARMS

2.2.1 On Steel Poles

Poles shall be provided with bracket arms of the support arm style and of the length indicated on drawings. Bracket arms shall conform to the design of the pole provided. The bracket arms shall be capable of supporting the equipment to be mounted on it with the maximum wind and ice loading encountered at the site. Strength of bracket arms shall be in accordance with IEEE C136.13. Steel brackets shall be galvanized. Wood bracket arms shall not be used.

2.3 CABLE

The Contractor shall provide all wire and cable not indicated as government furnished equipment. Wire and cable components shall be able to withstand the jobsite environment for a minimum of 20 years.

2.3.1 Insulated Cable

Cable shall be type USE conforming to UL 854, with copper conductors and type RHW or XHHW insulation conforming to UL 44, and shall include green ground conductor. Parts of the cable system such as splices and terminations shall be rated not less than 600 volts. The size and number of conductors and the number of cables shall be as indicated. Conductors larger than No. 8 AWG shall be stranded.

2.3.2 Bare Copper Conductors

Medium-hard-drawn copper conductors shall conform to ASTM B 2 and ASTM B 8.

2.4 CABLE SPLICES AND CONNECTORS

Cable splices and connectors shall conform to UL 486A. Underground splices and connectors shall also conform to the requirements of ANSI C119.1.

2.5 HANDHOLES

Handholes shall be as indicated. Strength of handholes and their frames and covers shall conform to the requirements of IEEE C2. Handholes for low voltage cables installed in parking lots, sidewalks, and turfed areas shall be from an aggregate consisting of sand and with continuous woven glass

strands having an overall compressive strength of at least 10,000 psi and a flexural strength of at least 5,000 psi. Handhole covers in parking lots, sidewalks, and turfed areas shall be of the same material as the box.

2.6 CONDUIT, DUCTS AND FITTINGS

2.6.1 Conduit, Rigid Steel

Rigid steel conduit shall conform to ANSI C80.1 and UL 6.

2.6.2 Conduit Coatings

Underground metallic conduit and fittings shall be coated with a plastic resin system conforming to NEMA RN 1, Type 40. Epoxy systems may also be used.

2.6.3 Conduit Fittings and Outlets

2.6.3.1 Boxes, Nonmetallic, Outlet and Flush-Device Boxes and Covers

NEMA OS 2 and UL 514C.

2.6.3.2 Boxes, Switch (Enclosed), Surface Mounted

UL 98.

2.6.3.3 Fittings for Conduit and Outlet Boxes

UL 514B.

2.6.3.4 Fittings, PVC, for Use with Rigid PVC Conduit and Tubing

UL 514B.

2.6.4 Non-Metallic Duct

Non-metallic duct lines and fittings utilized for underground installation shall be suitable for the application. Duct shall be thick-wall, single, round-bore type. Material of one type shall be used. Acrylonitrile-butadiene-styrene (ABS) duct shall conform to NEMA TC 6and NEMA TC 9. High-density conduit shall conform to UL 651A. Schedule 40 polyvinyl chloride (PVC) shall conform to UL 651. Plastic utility duct and fittings manufactured without a UL label or listing shall be provided with a certification as follows: "The materials are suitable for use with 167 degree F wiring. No reduction of properties in excess of that specified for materials with a UL label or listing will be experienced if samples of the finished product are operated continuously under the normal conditions that produce the highest temperature in the duct."

2.7 GROUND RODS

Ground rods shall be of zinc coated steel conforming to ANSI C135.30 not less than 3/4 inch in diameter by 10 feet in length of the sectional type driven full length into earth.

2.8 POLES

Metal poles shall be the pole manufacturer's standard design for supporting the number of fixtures indicated. The effective projected area of

luminaries and other pole-mounted devices shall be taken into account in pole design. Poles shall have grounding provisions. The type of pole shaft material provided shall not be mixed on any project. Grounding connection shall be provided near the bottom of each metal pole and at each concrete pole anchor base. Scratched, stained, chipped, or dented poles shall not be installed.

2.8.1 Steel Poles

Steel poles shall be hot-dip galvanized in accordance with ASTM A 123/A 123M and shall not be painted. Poles shall have tapered tubular members, either round in cross-section or polygonal. Pole shafts shall be one piece. Poles shall be welded construction with no bolts, rivets, or other means of fastening except as specifically approved. Pole markings shall be approximately 3 to 4 feet above grade and shall include manufacturer, year of manufacture, top and bottom diameters, length, and a loading tree. Attachment requirements shall be provided as indicated, including grounding provisions. Climbing facilities are not required. Bases shall be of the anchor bolt-mounted type.

2.8.2 Anchor Bolts

Anchor bolts shall be the pole manufacturer's standard, but not less than necessary to meet the pole wind and ice loading, herein and other specified design requirements.

2.9 POLE LINE HARDWARE

Zinc coated hardware shall conform to ANSI C135.1 and ANSI C135.14, and steel hardware material shall conform to ASTM A 575 and ASTM A 576. Hardware shall be hot-dip galvanized in accordance with ASTM A 153/A 153M.

2.10 ILLUMINATION

2.10.1 General Lighting

Luminaries, ballasts, lamps, and control devices required for general area lighting shall be in accordance with the drawings.

2.10.2 Roadway Lighting

Luminaries, ballasts, lamps, and control devices required for roadway lighting shall be in accordance with the drawings.

2.11 LAMPS AND BALLASTS, HIGH INTENSITY DISCHARGE (HID) SOURCES

2.11.1 High-Pressure Sodium

Lamps shall conform to ANSI C78.1350 . Ballasts shall conform to ANSI C82.4, or UL 1029. High-pressure sodium lamps shall be clear.

2.12 LUMINARY COMPONENTS

Luminary components shall conform to the following: attachments, ANSI C136.3; voltage classification, ANSI C136.2; field identification marking, ANSI C136.15; interchangeability, ANSI C136.6 and ANSI C136.9; and sockets, ANSI C136.11.

2.13 LIGHTING CONTROL EQUIPMENT

2.13.1 Photo-Control Devices

Photo-control devices shall conform to ANSI C136.10. Each photo-control element shall be a replaceable, weatherproof, plug-in or twist-lock assembly adjustable operation range of approximately 0.5 to 5.0 foot-candles. Luminaries shall be equipped with weatherproof plug-in or twist-lock receptacle to receive the photo-control element.

2.14 PHOTOMETRIC DISTRIBUTION CLASSIFICATION

Photometrics shall conform to IESNA RP-8.

2.15 LUMINARIES, FLOODLIGHTING

2.15.1 HID and Incandescent

HID lighting fixtures shall conform to UL 1572.

2.16 FIXTURES

Standard fixtures shall be as detailed on the drawings. Illustrations shown on these sheets or on the drawings are indicative of the general type desired and are not intended to restrict selection to fixtures of any particular manufacturer. Fixtures of similar design, equivalent light distribution and brightness characteristics, equal finish and quality will be acceptable as approved.

2.16.1 Accessories

Accessories such as straps, mounting plates, nipples, or brackets shall be provided for proper installation.

2.16.2 In-Line Fuse

An in-line fuse shall be provided for each fixture, and shall consist of a fuse and a UL approved waterproof fuse holder rated at 30 amperes, 600 volts , with insulated boots. Fuse rating shall be 600 volts .

PART 3 EXECUTION

3.1 GENERAL

The Contractor shall install all system components and appurtenances in accordance with the manufacturer's instructions, IEEE C2, and contract documents, and shall furnish necessary hardware, fixtures, cables, wire, connectors, interconnections, services, and adjustments required for a complete and operable system.

3.1.1 Current Site Conditions

The Contractor shall verify that site conditions are in agreement with the design package. The Contractor shall report all changes to the site or conditions that will affect performance of the system to the Government. The Contractor shall not take any corrective action without written permission from the Government.

3.2 ENCLOSURE PENETRATIONS

Enclosure penetrations shall be from the bottom unless the system design requires penetrations from other directions. Penetrations of interior enclosures involving transitions of conduit from interior to exterior, and penetrations on exterior enclosures shall be sealed with rubber silicone sealant to preclude the entry of water. The conduit riser shall terminate in a hot-dipped galvanized metal cable terminator. The terminator shall be filled with an approved sealant as recommended by the cable manufacturer, and in such a manner that the cable is not damaged.

3.3 PREVENTION OF CORROSION

3.3.1 Aluminum

Aluminum shall not be used in contact with earth or concrete, and where connected to dissimilar metal, shall be protected by approved fittings and treatment.

3.3.2 Steel Conduits

Steel conduits shall not be installed within concrete slabs-on-grade. Steel conduits installed underground or under slabs-on-grade, or penetrating slabs-on-grade, shall be field wrapped with 0.010 inch thick pipe-wrapping plastic tape applied with a 50 percent overlap, or shall have a factory-applied plastic resin, epoxy coating. Zinc coating may be omitted from steel conduit which has a factory-applied epoxy coating.

3.3.3 Cold Galvanizing

Field welds and/or brazing on factory galvanized boxes, enclosures, conduits, etc. shall be coated with a cold galvanized paint containing at least 95 percent zinc by weight.

3.4 CABLE INSTALLATION

Cable and all parts of the cable system such as splices and terminations shall be rated not less than 600 volts. The size and number of conductors and the number of cables shall be as indicated. Conductors larger than No. 8 AWG shall be stranded. Each circuit shall be identified by means of fiber or nonferrous metal tags, or approved equal, in each junction box, and at each terminal.

3.4.1 Splices

Splices below grade shall be made with nonpressure-filled resin systems using transparent, interlocking, self-venting, longitudinally split plastic molds. Splices above grade shall be made with sealed insulated pressure connectors and shall provide insulation and jacket equal to that of the cable. In order to prevent moisture from entering the splice, jackets shall be cut back to expose the required length of insulation between the jacket and the tapered end of the insulation.

3.4.2 Installation in Duct Lines

Ground and neutral conductors shall be installed in duct with the associated phase conductors. Cable splices shall be made in handholes only.

3.5 CONNECTIONS TO BUILDINGS

Cables shall be extended into the various buildings as indicated and shall be properly connected to the indicated equipment. Empty conduits to the indicated equipment from a point 5 feet outside the building wall and 2 feet below finished grade are specified in SECTION 16415 ELECTRICAL WORK, INTERIOR . After installation of cables, conduits shall be sealed to prevent moisture or gases from entering the building.

3.6 DUCT LINES

3.6.1 Requirements

Numbers and size of ducts shall be as indicated. Duct lines shall be laid with a minimum slope of 4 inches per 100 feet. Depending on the contour of the finished grade, the high point may be at a terminal, a manhole, a handhole, or between manholes or handholes. Short radius manufactured 90 degree duct bends may be used only for pole or equipment risers, unless specifically indicated as acceptable. The minimum manufactured bend radius shall be 18 inches for ducts of less than 3 inches in diameter, and 36 inches for duct 3 inches or greater in diameter. Otherwise, long sweep bends having a minimum radius of 25 feet shall be used for a change of direction of more than 5 degrees, either horizontally or vertically. Both curved and straight sections may be used to form long sweep bends, but the maximum curve used shall be 30 degrees and manufactured bends shall be used. Ducts shall be provided with end bells when duct lines terminate in manholes or handholes.

3.6.2 Treatment

Ducts shall be kept clean of concrete, dirt, or foreign substances during construction. Field cuts requiring tapers shall be made with proper tools and shall match factory tapers. A coupling recommended by the duct manufacturer shall be used when an existing duct is connected to a duct of different material or shape. Ducts shall be stored to avoid warping and deterioration with ends sufficiently plugged to prevent entry of any water or solid substances. Ducts shall be thoroughly cleaned before being laid. Plastic ducts shall be stored on a flat surface and protected from the direct rays of the sun.

3.6.3 Nonencased Direct-Burial

Top of duct lines shall be not less than 24 inches below finished grade and shall be installed with a minimum of 3 inches of earth around each duct, except that between adjacent electric power and communication ducts, 12 inches of earth is required. Bottom of trenches shall be graded toward manholes or handholes and shall be smooth and free of stones, soft spots, and sharp objects. Where bottoms of trenches comprise materials other than sand, a 3 inch layer of sand shall be laid first and compacted to approximate densities of surrounding firm soil before installing ducts. Joints in adjacent tiers of duct shall be vertically staggered at least 6 inches. The first 6 inch layer of backfill cover shall be sand compacted as previously specified. The rest of the excavation shall be backfilled and compacted in 3 to 6 inch layers. Duct banks may be held in alignment with earth. However, high tiered banks shall use a wooden frame or equivalent form to hold ducts in alignment prior to backfilling.

3.6.4 Installation of Couplings

Joints in each type of duct shall be made up in accordance with the manufacturer's recommendation for the particular type of duct and coupling selected and as approved.

3.6.4.1 Plastic Duct

Duct joints shall be made by brushing a plastic solvent on insides of plastic coupling fittings and on outsides of duct ends. Each duct and fitting shall then be slipped together with a quick 1/4 turn to set the joint tightly.

3.6.5 Concrete

Concrete work shall be as specified in SECTION 03300 CAST-IN-PLACE STRUCTURAL CONCRETE. Concrete shall be plain, 2500 psi at 28 days, except that reinforced concrete shall be 3000 psiat 28 days.

3.6.6 Duct Line Markers

Duct line markers shall be provided at the ends of long duct line stubouts or for other duct locations that are indeterminate because of duct curvature or terminations at completely below-grade structures. In addition to markers, a 5 mil brightly colored plastic tape, not less than 3 inches in width and suitably inscribed at not more than 10 feet on centers with a continuous metallic backing and a corrosion-resistant 1 mil metallic foil core to permit easy location of the duct line, shall be placed approximately 12 inches below finished grade levels of such lines.

3.7 HANDHOLES

The exact locations shall be determined after carefully considering the locations of other utilities, grading, and paving. Exact locations shall be approved before construction is started.

3.7.1 Construction

Handholes shall be constructed as indicated on drawings, including appurtenances. Top, walls, and bottom shall consist of reinforced concrete. Walls and bottom shall be of monolithic construction. Concrete shall be 3000 psi at 28 days. Precast concrete handholes having the same strength and inside dimensions as cast-in-place concrete handholes may be used. In paved areas, the top of entrance covers shall be flush with the finished surface of the paving. In unpaved areas, the top of entrance covers shall be approximately 1/2 inch above the finished grade. Where finished grades are in cut areas, unmortared brick shall be installed between the top of handhole and entrance frame to temporarily elevate the entrance cover to existing grade level. Where duct lines enter walls, the sections of duct may be cast in the concrete or may enter the wall through a suitable opening. The openings around entering duct lines shall be caulked tight with lead wool or other approved material.

3.7.2 Appurtenances

The following appurtenances shall be provided for each handhole.

3.7.3 Ground Rods

In each handhole, at a convenient point close to the wall, a ground rod conforming to paragraph GROUNDING shall be driven into the earth before the floor is poured; approximately 4 inches of the ground rod shall extend above the floor after pouring. When precast concrete units are used, the top of the ground rod may be below the floor; a No. 1/0 AWG copper ground conductor shall be brought inside through a watertight sleeve in the wall.

3.8 POLE INSTALLATION

Pole lengths shall provide a luminary mounting height of 30 feet. Electrical cabling shall be provided to the light pole as specified in SECTION 16528 EXTERIOR LIGHTING. The mount interfaces shall have ac power connected, and the pole wiring harness shall be connected to the luminary. Pole installation shall conform to the manufacturer's recommendations, NFPA 70, and IEEE C2. Poles shall be set straight and plumb.

3.8.1 Pole Brackets

Brackets shall be installed as specified by the manufacturer and as shown on drawings. Mounting hardware shall be sized appropriately to secure the mount, luminary, and housing with wind and ice loading normally encountered at the site. Pole brackets for floodlights shall have the number of tenons indicated, arranged to provide the indicated spread between each tenon. Where indicated on drawings, adjustable heads shall be installed on the brackets to position the luminaries. Identical brackets shall be used with one type of luminary.

3.8.2 Concrete Foundations

Concrete foundations shall have anchor bolts accurately set in the foundation using a template supplied by the pole manufacturer. Once the concrete has cured, the pole shall be set on the foundation, leveled on the foundation bolts, and secured with the holding nuts. The space between the foundation and the pole base shall be grouted. Concrete and grout work shall conform to SECTION 03300 CAST-IN-PLACE STRUCTURAL CONCRETE. Concrete shall be 3000 psi at 28 days.

3.8.3 Rigid Steel Conduit Ells

Rigid steel conduit ells shall be provided where specified or indicated on drawings.

3.8.4 Steel Pole Installation

Poles shall be mounted on cast-in-place foundations. Conduit elbows shall be provided for cable entrances into pole interiors.

3.8.4.1 Cast-In-Place Foundations

Concrete foundations, sized as indicated, shall have anchor bolts accurately set in foundations using templates supplied by the pole manufacturer. Concrete work and grouting is specified in SECTION 03300 CAST-IN-PLACE STRUCTURAL CONCRETE. After the concrete has cured, pole anchor bases shall be set on foundations and leveled by shimming between anchor bases and foundations or by setting anchor bases on leveling nuts and grouting. Poles shall be set plumb. Anchor bolts shall be the manufactures standard, and not less than necessary to meet the pole wind

loading and other specified design requirements.

3.9 LIGHTING

3.9.1 Lamps

Lamps of the proper type, wattage, and voltage rating shall be delivered to the project in the original containers and installed in the fixtures just before completion of the project.

3.9.2 Fixture Installation

Standard fixtures shall be installed as detailed on the drawings Illustrations shown on these sheets or on the drawings are indicative of the general type desired and are not intended to restrict selection of fixtures to any particular manufacturer. Fixtures of similar design, equivalent light-distribution and brightness characteristics, and equal finish and quality will be acceptable as approved.

3.9.2.1 Accessories

Accessories such as straps, mounting plates, nipples, or brackets shall be installed as required for proper installation.

3.9.2.2 In-Line Fuses

An in-line fuse shall be provided for each fixture.

3.10 LIGHTING CONTROL SYSTEM

3.10.1 Photo-Control

Lighting luminaries shall be individually controlled by photo-control elements mounted on the heads of the luminaries.

3.11 GROUNDING

Grounding shall be in conformance with NFPA 70, the contract drawings, and the following. Grounding conductors shall be soft-drawn, stranded copper. Ground rods shall be driven into the earth so that after the installation is complete, the top of the ground rod will be approximately 1 foot below finished grade, except in handholes. Butt grounds shall not be used.

3.11.1 Ground Rods

The resistance to ground shall be measured using the fall-of-potential method described in IEEE Std 81. The maximum resistance of a driven ground rod shall not exceed 25 ohms under normally dry conditions. Whenever the required ground resistance is not met, additional electrodes shall be provided interconnected with grounding conductors , to achieve the specified ground resistance. The additional electrodes shall be up to three, 10 feet long rods spaced a minimum of 10 feet apart in diameter, up to 30 feet long, coupled and driven with the first rod. In high ground resistance, UL listed chemically charged ground rods may be used. If the resultant resistance exceeds 25 ohms measured not less than 48 hours after rainfall, the Contracting Officer shall be notified immediately. Connections below grade shall be fusion welded. Connections above grade shall be fusion welded or shall use UL 467 approved connectors.

3.11.2 Items to be Grounded

Ground conductors, metallic conduits, junction boxes, and noncurrent-carrying metallic parts of equipment shall be grounded. Connections above grade shall be made with solderless connectors, and those below grade shall be made by a fusion-welding process.

3.11.3 Lighting Pole

One ground rod shall be provided at each pole. Bases of metal lighting poles shall be connected to ground rods by means of No. 8 AWG bare copper wire.

3.11.4 Handhole

In each handhole, at a convenient point close to the wall, a ground rod shall be driven into the earth before the floor is poured, and approximately 4 inches of the ground rod shall extend above the floor after pouring. When precast concrete units are used, the top of the ground rod may be below the floor, and a No. 1/0 AWG copper ground conductor shall be brought inside through a watertight sleeve in the wall. Connection to ground rods shall be by means of bolted-clamp terminals or by an approved fusion-welding process. Ground wires shall be neatly and firmly attached to handhole walls, and the amount of exposed bare wire shall be held to a minimum.

3.12 TESTS

3.12.1 Operating Test

After the installation is completed and at such time as the Contracting Officer may direct, the Contractor shall conduct an operating test for approval. The equipment shall be demonstrated to operate in accordance with the requirements specified. The test shall be performed in the presence of the Contracting Officer. The Contractor shall furnish instruments and personnel required for the test, and the Government will furnish the necessary electric power.

3.12.2 Ground Resistance Measurements

The resistance to ground shall be measured by the fall-of-potential method described in IEEE Std 81.

The contractor shall maintain a separate set of drawings, elementary diagrams and wiring diagrams of the lighting to be used for "as-built" drawings. This set shall be accurately kept up to date by the Contractor with all changes and additions to the lighting system. In addition to being complete and accurate, this set of drawings shall be kept neat and shall not be used for installation purposes. Upon completion of the as-built drawings, a representative of the Government will review the as-built work with the Contractor. If the as-built work is not complete, the Contractor will be so advised and shall complete the work as required.

-- End of Section --

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SECTION 16710

PREMISES DISTRIBUTION SYSTEM

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ELECTRONIC INDUSTRIES ALLIANCE (EIA)

EIA ANSI/TIA/EIA-568-B	(2001) Commercial Building Telecommunications Cabling Standard
EIA ANSI/TIA/EIA-568-B.2-1	(2002) Transmission Performance Specifications for 4-pair 100 ohm Category 6 Cabling
EIA ANSI/TIA/EIA-569-A	(2001) Commercial Building Standard for Telecommunications Pathways and Spaces
EIA ANSI/TIA/EIA-606A	(1993) Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
EIA ANSI/TIA/EIA-607A	(1994) Commercial Building Grounding/Bonding Requirement Standard
EIA TIA/EIA-TSB-67	(1995) Transmission Performance Specifications for Field Testing of Unshielded Twisted-Pair Cabling Systems

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2002) National Electrical Code

1.2 SYSTEM DESCRIPTION

The premises distribution system shall consist of inside-plant horizontal and riser cables and connecting hardware to transport telephone signals between equipment items in a building.

1.3 ENVIRONMENTAL REQUIREMENTS

Connecting hardware shall be rated for operation under ambient conditions of 32 to 140 degrees F and in the range of 0 to 95 percent relative humidity, noncondensing.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation;

submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with SECTION 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Premises Distribution System; G-AO.

Detail drawings including a complete list of equipment and material. Detail drawings shall contain complete wiring and schematic diagrams and other details required to demonstrate that the system has been coordinated and will function properly as a system. Drawings shall include vertical riser diagrams, outlet face plate details for all outlet configurations, sizes and types of all cables, conduits, and cable trays. Drawings shall show proposed layout and anchorage of equipment and appurtenances, and equipment relationship to other parts of the work including clearance for maintenance and operation.

Installation; G-AO.

Record drawings for the installed wiring system infrastructure per EIA ANSI/TIA/EIA-606A. The drawings shall show the location of all cable terminations and location and routing of all backbone and horizontal cables. The identifier for each termination and cable shall appear on the drawings.

SD-03 Product Data

Record Keeping and Documentation; G-AO.

Documentation on cables and termination hardware in accordance with EIA ANSI/TIA/EIA-606A.

Spare Parts; G-AO.

Lists of spare parts, tools, and test equipment for each different item of material and equipment specified, after approval of detail drawings, not later than 2 months prior to the date of beneficial occupancy. The data shall include a complete list of parts and supplies, with current unit prices and source of supply, and a list of spare parts recommended for stocking.

Manufacturer's Recommendations; G-AO.

Where installation procedures, or any part thereof, are required to be in accordance with the recommendations of the manufacturer of the material being installed, printed copies of these recommendations, prior to installation shall be provided. Installation of the item will not be allowed to proceed until the recommendations are received and approved.

Test Plan; G-AO.

Test plan defining the tests required to ensure that the system meets technical, operational and performance specifications, 60 days prior to the proposed test date. The test plan must be approved before the start of any testing. The test plan shall identify the capabilities and functions to be tested, and include detailed instructions for the setup and execution of

each test and procedures for evaluation and documentation of the results.

Qualifications; G-AO.

The qualifications of the Manufacturer, Contractor, and the Installer to perform the work specified herein. This shall include proof of the minimum qualifications specified herein.

SD-06 Test Reports

Test Reports.

Test reports in booklet form with witness signatures verifying execution of tests. Test results will also be provided on 3-1/2 inch diskettes in WINDOWS 98/NT format. Reports shall show the field tests performed to verify compliance with the specified performance criteria. Test reports shall include record of the physical parameters verified during testing. Test reports shall be submitted within 14 days after completion of testing.

SD-07 Certificates

Premises Distribution System.

Written certification that the premises distribution system complies with the EIA ANSI/TIA/EIA-568-B.2-1, EIA ANSI/TIA/EIA-569-A, and EIA ANSI/TIA/EIA-606A standards.

Materials and Equipment.

Where materials or equipment are specified to conform, be constructed or tested to meet specific requirements, certification that the items provided conform to such requirements. Certification by a nationally recognized testing laboratory that a representative sample has been tested to meet the requirements, or a published catalog specification statement to the effect that the item meets the referenced standard, will be acceptable as evidence that the item conforms. Compliance with these requirements does not relieve the Contractor from compliance with other requirements of the specifications.

Installers; G-AO.

The Contractor shall submit certification that all the installers are factory certified to install and test the provided products.

1.5 QUALIFICATIONS

1.5.1 Minimum Contractor Qualifications

All work under this section shall be performed by and all equipment shall be furnished and installed by a certified Telecommunications Contractor, hereafter referred to as the Contractor. The Contractor shall have the following qualifications in Telecommunications Systems installation:

a. Contractor shall have a minimum of 3 years experience in the application, installation and testing of the specified systems and equipment.

b. All supervisors and installers assigned to the installation of this system or any of its components shall have factory certification from

each equipment manufacturer that they are qualified to install and test the provided products.

c. All installers assigned to the installation of this system or any of its components shall have a minimum of 3 years experience in the installation of the specified copper and fiber optic cable and components.

1.5.2 Minimum Manufacturer Qualifications

The equipment and hardware provided under this contract will be from manufacturers that have a minimum of 3 years experience in producing the types of systems and equipment specified.

1.6 DELIVERY AND STORAGE

Equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variation, dirt and dust or other contaminants.

1.7 OPERATION AND MAINTENANCE MANUALS

Commercial off the shelf manuals shall be furnished for operation, installation, configuration, and maintenance for all products provided as a part of the premises distribution system. Specification sheets for all cable, connectors, and other equipment shall be provided.

1.8 RECORD KEEPING AND DOCUMENTATION

1.8.1 Cables

A record of all installed cable shall be provided on electronic media using Windows based computer cable management software per EIA ANSI/TIA/EIA-606A. A licensed copy of the cable management software including documentation, shall be provided. The cable records shall include the required data fields for each cable and complete end-to-end circuit report for each complete circuit from the assigned outlet to the entry facility per EIA ANSI/TIA/EIA-606A.

1.8.2 Termination Hardware

A record of all installed patch panels and outlets shall be provided in hard copy format and on electronic media using Windows based computer cable management software per EIA ANSI/TIA/EIA-606A. A licensed copy of the cable management software including documentation, shall be provided. The hardware records shall include only the required data fields per EIA ANSI/TIA/EIA-606A.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products and shall be the manufacturer's latest standard design that has been in satisfactory use for at least 1 year prior to installation. Materials and equipment shall conform to the respective publications and other requirements specified below and to the applicable requirements of NFPA 70.

2.2 UNSHIELDED TWISTED PAIR CABLE SYSTEM

2.2.1 Horizontal Cable

Horizontal cable shall meet the requirements of EIA ANSI/TIA/EIA-568-B.2-1 for Category 6. Cable shall be label-verified. Cable jacket shall be factory marked at regular intervals indicating verifying organization and performance level. Cable shall be rated CMP per NFPA 70.

2.2.2 Connecting Hardware

Connecting and cross-connecting hardware shall be the same category as the cable it serves. Hardware shall be in accordance with EIA ANSI/TIA/EIA-568-B.

2.2.2.1 Telecommunications Outlets

Outlet assemblies used in the premises distribution system shall consist of modular jacks assembled into both simplex and duplex outlet assemblies in single or double gang covers as indicated on the drawings. Wall and desk outlet plates shall come equipped with two modular jacks, with the top or left jack labeled "voice" and the bottom or right jack labeled "data". Modular jacks shall be the same category as the cable they terminate and shall meet the requirements of EIA ANSI/TIA/EIA-568-B and shall meet the Link Test parameters as listed in EIA TIA/EIA-TSB-67 and supplemented by EIA ANSI/TIA/EIA-568-B.2-1. Modular jack pin/pair configuration shall be T568B per EIA ANSI/TIA/EIA-568-B. Modular jacks shall be unkeyed. Faceplates shall be provided and shall be ivory in color, impact resistant plastic. Mounting plates shall be provided for system furniture and shall match the system furniture in color.

2.2.2.2 Patch Panels

Patch panels shall consist of eight-position modular jacks, with rear mounted type 110 insulation displacement connectors, arranged in rows or columns on 19 inch rack mounted panels. Jack pin/pair configuration shall be T568A per EIA ANSI/TIA/EIA-568-B. Jacks shall be unkeyed. Panels shall be provided with labeling space. The modular jacks shall conform to the requirements of EIA ANSI/TIA/EIA-568-B, and shall be rated for use with Category 6 cable in accordance with EIA ANSI/TIA/EIA-568-B.2-1 and shall meet the Link Test parameters as listed in EIA TIA/EIA-TSB-67 and supplemented by EIA ANSI/TIA/EIA-568-B.2-1.

2.2.2.3 Terminal Blocks

Terminal blocks shall be wall mounted wire termination units consisting of insulation displacement connectors mounted in plastic blocks, frames or housings. Blocks shall be type 110 which meet the requirements of EIA ANSI/TIA/EIA-568-B, and shall be rated for use with Category 6 cable in accordance with EIA ANSI/TIA/EIA-568-B.2-1 and shall meet the Link Test parameters as listed in EIA TIA/EIA-TSB-67 and supplemented by EIA ANSI/TIA/EIA-568-B.2-1. Blocks shall be mounted on standoffs and shall include cable management hardware. Insulation displacement connectors shall terminate 22 or 24 gauge solid copper wire as a minimum, and shall be connected in pairs so that horizontal cable and connected jumper wires are on separate connected terminals.

2.3 FIBER OPTIC CABLE SYSTEM

2.3.1 Connecting Hardware

2.3.1.1 Patch Panels

Patch panels shall be a complete system of components by a single manufacturer, and shall provide termination, splice storage, routing, radius limiting, cable fastening, storage, and cross-connection. Patch panels shall be 19 inch rack mounted panels. Patch panels shall provide strain relief for cables. Panels shall be provided with labeling space. Patch panel connectors and couplers shall be the same type and configuration as used elsewhere in the system. Patch panels shall consist of eight-position modular jacks, with rear mounted type 110 insulation displacement connectors, arranged in rows or columns on 19 inch rack mounted panels. Jacks shall be unkeyed. Patch panel shall convert from fiber optic to category 6.

2.4 EQUIPMENT RACKS

2.4.1 Wall Mounted Enclosed Swingout Rack

Wall mounted equipment racks shall be steel relay racks to mount equipment 19 inches wide with standoff brackets for wall mounting. Uprights shall be drilled and tapped 12-24 in a 1/2 inch pattern. Standoff brackets shall be of sufficient length for a 6 inch clearance between rack and wall. Wall mounted racks shall be hinged, lockable, and ventilated. AC outlets shall be provided as shown.

2.4.2 Cable Guides

Cable guides shall be specifically manufactured for the purpose of routing cables, wires and patch cords horizontally and vertically on 19 inch equipment racks. Cable guides shall consist of ring or bracket-like devices mounted on rack panels for horizontal use or individually mounted for vertical use. Cable guides shall mount to racks by screws and/or nuts and lockwashers.

2.5 EQUIPMENT MOUNTING BACKBOARD

Plywood backboards shall be provided, sized as shown, painted with two coats of white or light colored paint.

2.6 TELECOMMUNICATIONS OUTLET BOXES

Electrical boxes for telecommunication outlets shall be 4-11/16 inch square by 2-1/8 inches deep with minimum 3/8 inch deep single or two gang plaster ring as shown. Provide a minimum 1 inch conduit.

PART 3 EXECUTION

3.1 INSTALLATION

System components and appurtenances shall be installed in accordance with NFPA 70, manufacturer's instructions and as shown. Necessary interconnections, services, and adjustments required for a complete and operable signal distribution system shall be provided. Components shall be labeled in accordance with EIA ANSI/TIA/EIA-606A. Penetrations in fire-rated construction shall be firestopped in accordance with SECTION

07840 FIRESTOPPING. Conduits, outlets and raceways shall be installed in accordance with SECTION 16415 ELECTRICAL WORK, INTERIOR. Wiring shall be installed in accordance with EIA ANSI/TIA/EIA-568-B and as specified in SECTION 16415 ELECTRICAL WORK, INTERIOR. Wiring, and terminal blocks and outlets shall be marked in accordance with EIA ANSI/TIA/EIA-606A. Cables shall not be installed in the same cable tray, utility pole compartment, or floor trench compartment with ac power cables. Cables not installed in conduit or wireways shall be properly secured and neat in appearance and, if installed in plenums or other spaces used for environmental air, shall comply with NFPA 70 requirements for this type of installation.

3.1.1 Horizontal Distribution Cable

The rated cable pulling tension shall not be exceeded. Cable shall not be stressed such that twisting, stretching or kinking occurs. Cable shall not be spliced. Copper cable not in a wireway shall be suspended a minimum of 8 inches above ceilings by cable supports no greater than 60 inches apart. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items. Placement of cable parallel to power conductors shall be avoided, if possible; a minimum separation of 12 inches shall be maintained when such placement cannot be avoided. Cables shall be terminated; no cable shall contain unterminated elements. Minimum bending radius shall not be exceeded during installation or once installed. Cable ties shall not be excessively tightened such that the transmission characteristics of the cable are altered. In raised floor areas, cable shall be installed after the flooring system has been installed. Cable 6 feet long shall be neatly coiled not less than 12 inches in diameter below each feed point in raised floor areas.

3.1.2 Telecommunications Outlets

3.1.2.1 Faceplates

As a minimum each jack shall be labeled as to its function and a unique number to identify cable link.

3.1.2.2 Cables

Unshielded twisted pair cables shall have a minimum of 6 inches of slack cable loosely coiled into the telecommunications outlet boxes. Minimum manufacturers bend radius for each type of cable shall not be exceeded.

3.1.3 Terminal Blocks

Terminal blocks shall be mounted in orderly rows and columns. Adequate vertical and horizontal wire routing areas shall be provided between groups of blocks. Industry standard wire routing guides shall be utilized.

3.1.4 Unshielded Twisted Pair Patch Panels

Patch panels shall be mounted in equipment racks with sufficient modular jacks to accommodate the installed cable plant plus 10 percent spares. Cable guides shall be provided above, below and between each panel.

3.1.5 Fiber Optic Patch Panels

Patch panels shall be mounted in equipment racks with sufficient ports to accommodate the installed cable plant plus 10 percent spares. A slack loop of fiber shall be provided within each panel. Loop shall be 3 feet in

length. The outer jacket of each cable entering a patch panel shall be secured to the panel to prevent movement of the fibers within the panel, using clamps or brackets specifically manufactured for that purpose.

3.1.6 Equipment Racks

Cable guides shall be bolted or screwed to racks. Racks shall be installed level. Ganged racks shall be bolted together. Wall mounted racks shall be secured to the mounting surface to prevent fully loaded racks from separating from the mounting surface.

3.1.7 Rack Mounted Equipment

Equipment to be rack mounted shall be securely fastened to racks by means of the manufacturer's recommended fasteners.

3.1.8 Spare Parts

The Contractor shall provide spare parts data for each different item of material and equipment specified, after approval of the related submittals and not later than the start of the field tests.

3.2 TERMINATION

Cables and conductors shall sweep into termination areas; cables and conductors shall not bend at right angles. Manufacturer's minimum bending radius shall not be exceeded. When there are multiple system type drops to individual workstations, relative position for each system shall be maintained on each system termination block or patch panel.

3.2.1 Unshielded Twisted Pair Cable

Each pair shall be terminated on appropriate outlets, terminal blocks or patch panels. No cable shall be unterminated or contain unterminated elements. Pairs shall remain twisted together to within the proper distance from the termination as specified in EIA ANSI/TIA/EIA-568-B. Conductors shall not be damaged when removing insulation. Wire insulation shall not be damaged when removing outer jacket.

3.3 GROUNDING

Signal distribution system ground shall be installed in the telecommunications entrance facility and in each telecommunications closet in accordance with EIA ANSI/TIA/EIA-607A and SECTION 16415 ELECTRICAL WORK, INTERIOR. Equipment racks shall be connected to the electrical safety ground.

3.4 ADDITIONAL MATERIALS

The Contractor shall provide the following additional materials required for facility startup.

a. 2 of each type outlet.

b. 2 of each type cover plate.

c. 1 of each type terminal block for each telecommunications closet.

d. 1 Set of any and all special tools required to establish a cross

connect and to change and/or maintain a terminal block.

3.5 ADMINISTRATION AND LABELING

3.5.1 Labeling

All labels shall be in accordance with EIA ANSI/TIA/EIA-606A.

3.5.2 Cable

All cables will be labeled using color labels on both ends with unencoded identifiers per EIA ANSI/TIA/EIA-606A.

3.5.3 Termination Hardware

All workstation outlets and patch panel connections will be labeled using color coded labels with unencoded identifiers per EIA ANSI/TIA/EIA-606A.

3.6 TESTING

Materials and documentation to be furnished under this specification are subject to inspections and tests. All components shall be terminated prior to testing. Equipment and systems will not be accepted until the required inspections and tests have been made in accordance with the approved Test Plan submitted by the Contractor, demonstrating that the signal distribution system conforms to the specified requirements, and that the required equipment, systems, and documentation have been provided. The Contractor shall submit Test Reports as they are completed.

3.6.1 Unshielded Twisted Pair Tests

All metallic cable pairs shall be tested for proper identification and continuity. All opens, shorts, crosses, grounds, and reversals shall be corrected. Correct color coding and termination of each pair shall be verified in the communications closet and at the outlet. Horizontal wiring shall be tested from and including the termination device in the communications closet to and including the modular jack in each room. Backbone wiring shall be tested end-to-end, including termination devices, from terminal block to terminal block, in the respective communications closets. These test shall be completed and all errors corrected before any other tests are started.

3.6.2 Category 6 Circuits

All category 6 circuits shall be tested using a test set that meets the Class II accuracy requirements of EIA TIA/EIA-TSB-67 standard, including the additional tests and test set accuracy requirements of EIA ANSI/TIA/EIA-568-B.2-1. Testing shall use the Basic Link Test procedure of EIA TIA/EIA-TSB-67, as supplemented by EIA ANSI/TIA/EIA-568-B.2-1. Cables and connecting hardware which contain failed circuits shall be replaced and retested to verify the standard is met.

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SECTION 16711

TELEPHONE SYSTEM, OUTSIDE PLANT

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C62.61	(1993) Gas Tube Surge Arresters on Wire Line Telephone Circuits

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 2239	(1999) Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter

ELECTRONIC INDUSTRIES ALLIANCE (EIA)

EIA ANSI/EIA-455-81A-91	(1992) FOTP-81 Compound Flow (Drip) Test for Filled Fiber Optic Cable
EIA ANSI/EIA/TIA-455-30B	(1991) FOTP-30 Frequency Domain Measurement of Multimode Optical Fiber Information Transmission Capacity
EIA ANSI/EIA/TIA-455-53A	(1990) FOTP-53 Attenuation by Substitution Measurement for Multimode Graded-Index Optical Fibers or Fiber Assemblies Used in Long Length Communications Systems
EIA ANSI/TIA/EIA-568-A	(1995; Addendum 3 1998) Commercial Building Telecommunications Cabling Standard - 3 Parts
EIA ANSI/TIA/EIA-607	(1994) Commercial Building Grounding and Bonding Requirements for Telecommunications

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2	(2002) National Electrical Safety Code

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2002) National Electrical Code

U.S. DEPARTMENT OF AGRICULTURE (USDA)

RUS REA Bull 1753F-601 (PE-90)	(1994) Filled Fiber Optic Cables, PE-90
RUS REA Bull 345-50 PE-60	(1979) Trunk Carrier Systems
RUS REA Bull 345-65 PE-33	(1985) Shield Bonding Connectors
RUS REA Bull 345-72 PE-74	(1995) Field Splice Closures
RUS Bull 1751F-643	(1998) Underground Plant Design
RUS Bull 1753F-401 (PC-2)	(1995) RUS Standard for Splicing Copper and Fiber Optic Cables,)C-2
RUS IP 344-2	(1999) List of Materials Acceptable for Use on Telecommunications Systems of RUS Borrowers
RUS REA Bull 1751F-641	(1995) Construction of Buried Plant
RUS REA Bull 1753F-201 PC-4	(1976) Acceptance Tests and Measurements of Telephone Plant
RUS REA Bull 1753F-205 (PE-39)	(1993) REA Specification for Filled Telephone Cables
RUS REA Bull 1753F-207 PE-87	(1994) Terminating (TIP) Cable
RUS REA Bull 1753F-208 PE-89	(1993) Filled Telephone Cables with Expanded Insulation

UNDERWRITERS LABORATORIES (UL)

UL 497	(1995; Rev Oct 1999) Protectors for Paired Conductor Communication Circuits

1.2 SYSTEM DESCRIPTION

The outside plant system shall consist of all cable, conduit, manholes, poles, etc. required to provide signal paths from the closest point of presence to the new facility, including free standing frames or backboards, terminating cables, lightning and surge protection modules at the entry facility. The work consists of furnishing, installing, testing and making operational a complete outside plant system for continuous use.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with SECTION 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Telephone System; G-AO

Installation; G-AO

Detail drawings, consisting of a complete list of equipment and material, including manufacturer's descriptive and technical literature, performance charts and curves, and catalog cuts. Detail drawings shall also contain complete configuration information, wiring diagrams and any other details required to demonstrate that the cable system has been coordinated to support the transmission systems identified in the specifications and drawings. Drawings shall show proposed layout and anchorage of equipment and appurtenances, and equipment relationship to other parts of the work including clearance for maintenance and operations.

Record Drawings; G-AO

Record drawings for the installed wiring system showing the actual location of all cable terminations, splices, routing, and size and type of all cables. The identifier for each termination and cable shall appear on the drawings. The drawings shall include gauge and pair or fiber count for each cable, duct and innerduct arrangement, or conductor assignment of outside plant, and protector and connector block layout at the termination points after installation.

SD-03 Product Data

Spare Parts; G-AO

Equipment

A data list of recommended spare parts, tools, and test equipment for each different item of material and equipment specified prior to beneficial occupancy. The data shall include a complete list of parts and supplies, with current unit prices and source of supply.

Installation; G-AO

Printed copies of the manufacturer's recommendations for the material being installed, prior to installation. Installation of the item will not be allowed to proceed where installation procedures, or any part thereof, are required to be in accordance with those recommendations until the recommendations are received and approved.

Acceptance Tests; G-AO

Test plans defining all tests required to ensure that the system meets specified requirements. The test plans shall define milestones for the tests, equipment, personnel, facilities, and supplies required. The test plans shall identify the capabilities and functions to be tested.

Cutover and Records; G-AO

The cutover plan shall provide procedures and schedules for relocation of facility station numbers without interrupting service to any active location.

SD-06 Test Reports

Acceptance Tests; G-AO

Test reports in booklet form showing all field tests performed, upon completion and testing of the installed system. Measurements shall be

tabulated on a pair by pair or strand by strand basis.

SD-07 Certificates

Telephone System; G-AO

Proof that the items furnished under this section conform to the specified requirements in FCC, ICEA, REA, RUS, ANSI, ASTM, NFPA, EIA, or UL, where materials and equipment are so specified.

Qualifications; G-AO

The qualifications of the manufacturer, splicer, and installation supervisor as specified.

1.4 QUALIFICATIONS

1.4.1 Cable Installers

Installation shall be under the direct supervision of an individual with a minimum of 3 years experience in the installation of the specified copper and fiber optic cable and components.

1.4.2 Cable Splicing and Termination

All cable splicers shall have training in the proper techniques and have a minimum of 3 years experience in splicing and terminating the specified cables. Modular splices shall be performed by factory certified personnel or under direct supervision of factory trained personnel for products used.

1.4.3 Manufacturers

The cable, equipment, and hardware provided shall be from manufacturers that have a minimum of 3 years experience in producing the types of cable, equipment, and hardware specified.

1.5 DELIVERY AND STORAGE

1.5.1 Cable Requirements-

All cable shall be shipped on reels. The diameter of the drum shall be large enough to prevent damage to the cable during reeling and unreeling. The reels shall be constructed to prevent damage during shipment and handling. The outer end of the cable shall be securely fastened to the reel head to prevent the cable from becoming loose in transit. The inner end of the cable shall project into a slot in the side of the reel, or into a housing on the inner slot of the drum, with sufficient length to make it available for testing. The inner end shall be fastened to prevent the cable from becoming loose during installation. End seals shall be applied to each of the cables to prevent moisture from entering the cable. The reels with cable shall be suitable for outside storage conditions when the temperature ranges from minus 40 to plus 148 degrees F,with relative humidity from 0 to 100 percent.

1.5.2 Equipment

All equipment shall be stored with protection from the weather, humidity and temperature variations, dirt and dust, or other contaminants, in accordance with the manufacturer's requirements.

PART 2 PRODUCTS

2.1 STANDARD PRODUCTS

Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of such products and shall be the manufacturer's latest standard design that has been in satisfactory use for at least 2 years prior to bid opening. Each major component of equipment shall have the manufacturer's name and type identified on the equipment. All products supplied shall be specifically designed and manufactured for use with outside plant communications systems. All items of the same class of equipment shall be the products of a single manufacturer.

2.2 CABLE

2.2.1 Copper Conductor Cable

Copper conductor cable shall conform to the following:

2.2.1.1 Underground

Cable shall be manufactured per RUS REA Bull 1753F-205 (PE-39) or RUS REA Bull 1753F-208 PE-89. A5 mil copper clad alloy steel or 5 milcopper clad stainless steel metallic shield shall be provided.

2.2.1.2 Screened

Screened cable shall comply with RUS REA Bull 1753F-205 (PE-39) or RUS REA Bull 1753F-208 PE-89.

2.2.2 Fiber Optic Cable

Fiber optic cable shall be specifically designed for outside use with tight or loose buffer construction. The tight buffer optical fiber cable shall consist of a central glass optical fiber surrounded by a soft intermediate buffer to allow for thermal expansions and proper fitting of the secondary buffer. The loose buffer optical fiber cable shall have the glass optical fiber within a filled loose tube. All fiber optic cables used shall conform to the requirements of RUS REA Bull 1753F-601 (PE-90) including any special requirements made necessary by a specialized design.

2.2.2.1 Cable Cores

A central, nonmetallic core member shall be included to serve as a cable core foundation to reduce strain on the fibers, but not to serve as a pulling strength member.

2.2.2.2 Optical Fiber

Single-mode optical fibers shall be Class IV.

2.2.2.3 Performance Requirements

The fiber optic cable shall comply with the specified mechanical performance requirements while used in buried and underground duct applications where the temperature varies from minus 5 to plus 140 degrees F. Optical performance degradation shall be less than 5 percent of the optical performance requirements in the temperature range of minus 5 to

plus 140 degrees F. The fiber optic cable shall not be damaged in storage where the temperature may vary from minus 40 to plus 148 degrees F.

2.3 CLOSURES

2.3.1 Copper Conductor Closures

2.3.1.1 Buried Closure

Buried closure shall conform to RUS REA Bull 345-72 PE-74.

2.3.1.2 Underground Closure

Underground closures shall conform to RUS REA Bull 345-72 PE-74. The closure shall be of thermoplastic, thermoset, or stainless steel material and be suitable for use in a vault or manhole.

2.3.2 Fiber Optic Closures

2.3.2.1 Fiber Optic Underground

The underground closure shall be suitable to house a splice organizer in a protective housing. An encapsulating compound shall be poured into this enclosure. The closure shall be of thermo-plastic, thermoset-plastic, or stainless steel material and suitable for use in a vault or manhole. The encapsulating compound shall be re-enterable and shall not alter the chemical stability of the closure.

2.4 CABLE SPLICES AND ORGANIZERS

2.4.1 Copper Cable Splices

All cables greater than 25 pairs shall be spliced using modular splicing connectors, which accommodate 25 pairs of conductors at a time. The correct connector size shall be used to accommodate the wire gauge of the cable to be spliced. The connectors used shall be listed in RUS IP 344-2.

2.4.2 Fiber Optic Cable Splices

Each fiber optic splice shall be physically protected by a splice kit. The kit shall be specially designed for the splice.

2.5 HANDHOLE AND DUCT

All handhole and duct products shall conform to RUS Bull 1751F-643.

2.5.1 New handholes

New handholes shall be as shown on the drawings. Handholes may be pre-cast or cast in place.

2.5.2 Duct/Conduit

Conduit shall be furnished as specified in SECTIONS 16415 ELECTRICAL WORK, INTERIOR and 16375 ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND and as shown on project drawings.

2.5.3 Innerduct

Innerduct shall be SIDR 11.5 polyethylene plastic pipe conforming to ASTM D 2239.

2.6 CONNECTOR BLOCKS

Connector blocks consisting of flame-retardant molded plastic fastened to a metal mounting bar shall be provided to terminate the outside plant cable as shown. The connector blocks shall be of 100-pair block size and equipped with protection modules. The connector blocks shall be 24 gauge stub type. The cable stubs shall be 100 pair and conform to RUS REA Bull 1753F-207 PE-87.

2.7 PROTECTOR MODULES

The protector modules shall be of the two-element gas tube type. Protection modules shall be heavy duty, A>10 kA, B>400, C>65A where A is the maximum single impulse discharge current, B is the impulse life and C is the AC discharge current per ANSI C62.61. The gas modules shall shunt high voltage to ground, fail short, be equipped with an external spark gap and heat coils, and shall comply with UL 497.

2.8 FIBER-OPTIC TERMINATIONS

2.8.1 Fiber Optic Connectors

All outside plant fiber strands shall be terminated in a SC type fiber optic connector, with ceramic ferrule material and a maximum insertion loss of 0.5 dB. Connectors shall meet performance standards of EIA ANSI/TIA/EIA-568-A. If pre-connectorized cable assemblies or pigtails are used, the connectors shall be terminated on a 10 footlength of single-fiber cable. The single-fiber cable shall contain a buffered optical fiber of the same type and specification as that used in the multi-fiber cable.

2.9 MISCELLANEOUS ITEMS

2.9.1 Shield Connectors

Shield connectors shall make a stable, low-impedance electrical connection between the shield of the communications cable and a conductor such as a strap, bar, or wire. The connector shall be made of tin-plated tempered brass. Shield bond connectors shall comply with RUS REA Bull 345-65 PE-33.

2.9.2 Grounding Braid

Grounding braid shall provide low electrical impedance connections for dependable shield bonding. The braid shall be made from flat tin-plated copper.

2.9.3 Warning Tape

Marking and locating tape shall be acid and alkali resistant polyethylene film, 6 incheswide with a minimum strength of 1750 psi lengthwise and 1500 psicrosswise. The tape shall be manufactured with integral wires, foil backing, or other means to enable detection by a metal detector when the tape is buried up to 3 feet deep. The metallic core shall be encased in a protective jacket or provided with other means to protect it from corrosion and shall be specifically manufactured for marking and locating underground

utilities. The warning tape shall be orange in color and continuously imprinted with the words "WARNING - COMMUNICATIONS CABLE BELOW" at not more than 48 inch intervals.

2.9.4 Cable Warning Signs

Cable warning signs, which identify the route of buried cable, shall be stake mounted. The stake shall be driven into undisturbed soil and the sign shall be mounted to the stake in accordance with the manufacturer's instructions. Warning signs shall be placed at intervals of no more than 500 feetand at each change of direction in the cable route. Warning signs shall also be placed on each side of every crossing of surface obstacles such as roads, railroads, stream crossings, or any similar crossing where excavation is likely to occur.

PART 3 EXECUTION

3.1 INSTALLATION

All system components and appurtenances shall be installed in accordance with the manufacturer's instructions and as shown. All installation work shall be done in accordance with the safety requirements set forth in the general requirements of IEEE C2 and NFPA 70.

3.1.1 Cable Inspection and Repair

All cable and wire used in the construction of the project shall be handled with care. Each reel shall be inspected for cuts, nicks or other damage. All damage shall be repaired to the satisfaction of the Contracting Officer. The reel wrap shall remain intact on the reel until the cable or wire is ready to be placed.

3.1.2 Underground Cable

Underground cable installation shall be accomplished in accordance with the requirements set forth in RUS REA Bull 1751F-641.

3.1.2.1 Cable Pulling

For cable installed in ducts and conduit, a cable feeder guide shall be used, between the cable reel and the face of the duct and conduit, to protect the cable and guide it into the duct and conduit as it is paid off the reel. As the cable is paid off the reel, it shall be inspected for jacket defects. Precautions shall be taken during installation to prevent the cable from being kinked or crushed. A pulling eye shall be attached to the cable and used to pull the cable through the duct and conduit system. Cable shall be hand fed and guided through each handhole. As the cable is paid off the reel into the cable feeder guide, it shall be sufficiently lubricated with a type of lubricant recommended by the cable manufacturer. Where the cable is pulled through a handhole, additional lubricant shall be applied at all intermediate handholes. Dynamometers or load-tension instruments shall be used to ensure that the pulling line tension does not exceed the installation tension value specified by the cable manufacturer. The mechanical stress placed upon a cable during installation shall not cause the cable to be twisted or stretched.

3.1.2.2 Penetrations for Cable Access

Penetrations in walls, ceilings or other parts of the building, made to

provide for cable access, shall be caulked and sealed. Where conduits and ducts pass through fire walls, fire partitions, above grade floors, and fire rated chase walls, the penetration shall be sealed with fire stopping materials as specified in SECTION 07840 FIRE STOPPING. Fire stopped penetrations shall not compromise the fire rating of the walls or floors. All underground building entries shall be through waterproof facilities.

3.1.2.3 Cable Bends

Telephone cable bends shall have a radius of not less than 10 times the cable diameter. Only large radius sweeps shall be used in conduit runs and shall not exceed a cumulative 90 degrees between manholes.

3.1.3 Handhole and Ducts

Handhole and duct systems shall be installed in accordance with SECTION 16375 ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND. Handholes shall be placed in line with the main duct. Splice cases shall be mounted in the center on the long sides. Lateral conduits shall exit the long sides near the corners.

3.1.3.1 Innerduct Installation

Splices, joints, couplings, or connections of any type will not be allowed between handholes. Innerduct shall be plugged at both ends with polyurethane foam duct seal; this material shall also be inserted between the innerduct and the duct if cables are placed in the innerducts. Only one cable shall be installed in a given innerduct. New unoccupied innerducts shall be trimmed leaving 2 inches exposed.

3.1.3.2 Pull Cord

Pull cords of 3/8 inchpolypropylene shall be installed in all unused ducts and inner-ducts with a minimum of 2 feet spare cord protruding from each end.

3.1.4 Surge Protection

All cables and conductors, which serve as communication lines, shall have surge protection meeting the requirements of RUS REA Bull 345-50 PE-60 installed at the entry facility.

3.2 SPLICING

3.2.1 Copper Conductor Splices

Copper conductor cable splicing shall be accomplished in accordance with RUS Bull 1753F-401 (PC-2). Modular splicing shall be used on all cables larger than 25 pairs.

3.2.2 Fiber Optic Splices

Fiber optic splicing shall be in accordance with the manufacturer's recommendation; each splice shall have a loss of less than 0.1 dB.

3.3 GROUNDING

Except where specifically indicated otherwise, all exposed non-current carrying metallic parts of telephone equipment, cable sheaths, cable

splices, and terminals shall be grounded. Grounding shall be in accordance with requirements of NFPA 70, Articles 800-33 and 800-40.

3.3.1 Ground Bars

3.3.1.1 Telecommunications Master Ground Bar (TMGB)

A copper TMGB shall be provided, in accordance with EIA ANSI/TIA/EIA-607, to be the hub of the basic grounding system by providing a common point of connection for ground from outside cable, MDF, and equipment. The TMGB shall have a ground resistance, including ground, of 10 ohms or less.

3.3.2 Incoming Outside Plant Cables

All incoming outside plant cable shields shall be bonded directly to the TMGB or the closest TGB.

3.3.3 Cable Stubs

All shields of cable stubs shall be bonded to a TGB located on the frame.

3.3.4 Shields

The shields of all incoming cables shall not be bonded across the splice to the cable stubs.

3.3.5 Protection Assemblies

The protector assemblies shall be mounted directly on the vertical frame ironwork. The assemblies mounted on each vertical frame shall be connected with a No. 6 AWG copper conductor to provide a low resistance path to the TGB.

3.3.6 Handholes

The shields of all cables in each handhole shall be bonded together by a bonding wire or ribbon. At intermediate handholes, where the cable is pulled through without a sheath opening, bonds are not required. If the handhole has a lacerating bonding ribbon, the shields of spliced cables shall be attached to it.

3.4 CUTOVER AND RECORDS

All necessary transfers and cutovers, shall be accomplished by the Contractor.

3.5 ACCEPTANCE TESTS

The Contractor shall provide all personnel, equipment, instrumentation, and supplies necessary to perform all required testing. Notification of any planned testing shall be given to the Contracting Officer at least 14 days prior to any test; testing shall not proceed until after the Contractor has received written Contracting Officer's approval of the test plans as specified. The test plans shall define all the tests required to ensure that the system meets technical, operational, and performance specifications. The test plans shall define milestones for the tests, equipment, personnel, facilities, and supplies required. The test plans shall identify the capabilities and functions to be tested.

3.5.1 Copper Conductor Cable

The following acceptance tests shall be performed in accordance with RUS REA Bull 1753F-201 PC-4:

a. Shield continuity.

b. Conductor continuity.

c. Conductor insulation resistance.

d. Structural return loss.

e. Cable insertion loss and loss margin at carrier frequencies.

f. Shield ground for single jacketed cables.

g. DC loop resistance.

3.5.2 Fiber Optic Cable

Two optical tests shall be performed on all optical fibers: Optical Time Domain Reflectometry (OTDR) Test, and Attenuation Test. These tests shall be performed on the completed end-to-end spans which include the near-end pre-connectorized single fiber cable assembly, outside plant as specified, and the far-end pre-connectorized single fiber cable assembly.

3.5.2.1 OTDR Test

The OTDR test shall be used to determine the adequacy of the cable installations by showing any irregularities, such as discontinuities, micro-bendings, improper splices, for the cable span under test. Hard copy fiber signature records shall be obtained from the OTDR for each fiber in each span and shall be included in the test results. The OTDR test shall be measured in both directions. A reference length of fiber, 3280 feet minimum, used as the delay line shall be placed before the new end connector and after the far end patch panel connectors for inspection of connector signature. The OTDR test shall be conducted in accordance with EIA ANSI/EIA-455-81A-91 for single-mode fiber. Splice losses shall not exceed 0.1db. Attenuation losses shall not exceed 0.5 db/km at 1310 nm and 1550 nm for single-mode fiber.

3.5.2.2 Attenuation Test

End-to-end attenuation measurements shall be made on all fibers, in both directions, using a 850 nanometer light source at one end and the optical power meter on the other end to verify that the cable system attenuation requirements are met. The measurement method shall be in accordance with EIA ANSI/EIA/TIA-455-53A.

3.5.2.3 Bandwidth Test

The bandwidth shall be measured in both directions on all fibers. The bandwidth measurements shall be in accordance with EIA ANSI/EIA/TIA-455-30B.

-- End of Section --