

2. AMENDMENT/MODIFICATION NO. R0012	3. EFFECTIVE DATE 12/20/02	4. REQUISITION/PURCHASE REQ. NO.	5. PROJECT NO. (If applicable)
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6. ISSUED BY US ARMY ENGINEER DISTRICT, AK CEPOA-CT (DACA85) PO BOX 6898 ELMENDORF AFB, AK 99506-6898 SUSAN COYNER (907)753-2838	CODE J4P0000	7. ADMINISTERED BY (If other than Item 6) US ARMY ENGINEER DISTRICT, AK CEPOA-CO-SAO PO BOX 6898 ELMENDORF AFB, ALASKA 99703-6898	CODE DACA85
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8. NAME AND ADDRESS OF CONTRACTOR (No., street, county, State and ZIP Code)	(X)	9A. AMENDMENT OF SOLICITATION NO. DACA85-02-R-0009
	X	9B. DATED (SEE ITEM 11) 03/15/02
		10A. MODIFICATION OF CONTRACT/ORDER NO.
		10B. DATED (SEE ITEM 13)

CODE 089C4	FACILITY CODE
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11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS

The above numbered solicitation is amended as set forth in Item 14. The hour and date specified for receipt of Offers is extended, is not extended.

Offer must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended, by one of the following methods:

(a) By completing Items 8 and 15, and returning 0 copies of the amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGEMENT TO BE RECEIVED AT THE PLACE DESIGNATED FOR THE RECEIPT OF OFFERS PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If by virtue of this amendment you desire to change an offer already submitted, such change may be made by telegram or letter, provided each telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.

12. Accounting and Appropriation Data (If required)

PROJECT TITLE AND LOCATION: New Fuel Systems Maintenance Dock, Elmendorf AFB, Alaska

13. THIS ITEM APPLIES ONLY TO MODIFICATIONS OF CONTRACTS/ORDERS, IT MODIFIES THE CONTRACT/ORDER NO. AS DESCRIBED IN ITEM 14.

(X)	A. THIS CHANGE ORDER IS ISSUED PURSUANT TO: (Specify authority) THE CHANGES SET FORTH IN ITEM 14 ARE MADE IN THE CONTRACT ORDER NO. IN ITEM 10A.
	B. THE ABOVE NUMBERED CONTRACT/ORDER IS MODIFIED TO REFLECT THE ADMINISTRATIVE CHANGES (such as changes in paying office, appropriation date, etc). SET FORTH IN ITEM 14, PURSUANT TO THE AUTHORITY OF FAR 43.103(b).
	C. THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF:
	D. OTHER (Specify type of modification and authority)

E. IMPORTANT: Contractor is not, is required to sign this document and return _____ copies to the issuing office.

14. DESCRIPTION OF AMENDMENT/MODIFICATION (Organized by UCF section headings, including solicitation/contract subject matter where feasible.)

PROPOSAL DUE DATE IS EXTENDED TO 27 JAN 2003, by AM#12... 4:00 pm - local time - at the US Army Corps of Engineers, 2204 Third Street, Rm 29, Elmendorf AFB, Alaska. BY 11:00 am, LOCAL TIME -- SEE SECTION 00100, PARA 2.3 ...AM#12

NOTICE TO OFFERORS: PLEASE MARK OUTSIDE OF ENVELOPE IN WHICH BID IS SUBMITTED TO SHOW AMENDMENTS RECEIVED. YOU ARE REQUIRED TO ACKNOWLEDGE RECEIPT OF THIS AMENDMENT ON THE REVERSE SIDE OF STANDARD FORM 1442.

IMPORTANT NOTE: Keep in mind that the base is still under tight security measures and access to non-DOD personnel is limited or restricted and requires extra time to process through the Boniface Gate.

Except as provided herein, all terms and conditions of the document referenced in Item 9A or 10A, as heretofore changed, remains unchanged and in full force and effect.

15A. NAME AND TITLE OF SIGNER (Type or print)	16A. NAME AND TITLE OF SIGNER (Type or print)		
15B. CONTRACTOR/OFFEROR	15C. DATE SIGNED	16B. UNITED STATES OF AMERICA BY _____ (Signature of Contracting Officer)	16C. DATE SIGNED
(Signature of person authorized to sign)			

AMENDMENT TO SOLICITATION

CONTINUATION SHEET

Amendment No. R0012

Page: 2

a. The following drawings are replaced in their entirety for the superseded drawings. And are listed in SCR-5.

NONE

b. The following documents are reissued in their entirety.

SECTION 01010:

- PART 1: Scope Summary
- PART 2: Minimum Design Criteria
- PART 3: Room Criteria Sheets

c. The following sections (including submittal registers) are deleted.

NONE

d. The following sections (including submittal registers) are added.

NONE

e. The following attachments are added.

Appendix 1	Appendix 17 - 2
Appendix 1-1	Appendix 17 - 3
Appendix 2	Appendix 17 - 4
Appendix 3	Appendix 17 - 5
Appendix 4	Appendix 17 - 6
Appendix 5	Appendix 17 - 7
Appendix 6	Appendix 17 - 8
Appendix 7	Appendix 18
Appendix 8	Appendix 19 - 1
Appendix 9	Appendix 19 - 2
Appendix 10	Appendix 19 - 3
Appendix 11	Appendix 20
Appendix 12	Appendix 21 - 1
Appendix 13	Appendix 21 - 2
Appendix 14	Appendix 21 - 3
Appendix 15	Appendix 21a
Appendix 16	Appendix 21b
Appendix 17	Appendix 21c
Appendix 17 - 1	Appendix 21d

f. NOTICE TO OFFERORS: Please mark outside of envelope in which offer is submitted to show amendments received. You are required to acknowledge receipt of this amendment on the reverse side of Standard Form 1442.

DACA85-02-R-0009
AMENDMENT 0012
20 DECEMBER 2002

The date specified for receipt of Offers is extended to 27 January 2003.

Page 3 of the Proposal Schedule is corrected, replaced and attached.

SOLICITATION OFFER, AND AWARD <i>(Construction, Alteration, or Repair)</i>	1. SOLICITATION NUMBER DACA85-02-R-0009	2. TYPE OF SOLICITATION <input type="checkbox"/> SEALED BID (B/FB) <input checked="" type="checkbox"/> NEGOTIATED (B/FPI)	3. DATE ISSUED 03/15/02	PAGE OF PAGES
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IMPORTANT - The "offer" section on the reverse must be fully completed by the offeror.

4. CONTRACT NUMBER	5. REQUISITION/PURCHASE REQUEST NUMBER DACW85	6. PROJECT NUMBER
7. ISSUED BY US ARMY ENGINEER DISTRICT, AK CEPOA-CT (DACA85) PO BOX 898 ANCHORAGE, AK 99506	8. ADDRESS OFFER TO US ARMY ENGINEER DISTRICT, ALASKA PO BOX 898 (2204 3RD ST-ELMENDORF AFB) ANCHORAGE, AK 99506-0898	

9. FOR INFORMATION CALL	A. NAME SUSAN COYNER	B. TELEPHONE NUMBER (include area code) (NO COLLECT CALLS) 907-753-2838
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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 CODE: 233310
PROJECT TITLE AND LOCATION: NEW FUEL SYSTEMS MAINTENANCE DOCK, ELMENDORF AFB, AK
OPEN TO LARGE AND SMALL BUSINESS
DESCRIPTION OF WORK: Design, permitting, site preparation and construction of an approximately 4,000 square meter (SM) Aircraft Fuel Systems Maintenance Hangar on Hangarstand 11 located on Airlifter Drive. Demolition of the existing Fuel Systems Maintenance Hangar (Hangar 10) including ACM Disposal and Elimination of Interior Columns in the new hangar. The estimated design and construction cost for this project is between \$10,000,000 and \$15,000,000. **THIS SOLICITATION WILL BE ISSUED USING ELECTRONIC BID SETS (EBS) AND PROVIDED ON COMPACT DISKS-READ ONLY (CD-ROM) AT NO CHARGE.**
<http://ebs.poa.usacc.army.mil>

11. The Contractor shall begin performance within 10 calendar days and complete it within 1,066 calendar days after receiving AM10... **SEE SCR 1

award, notices to proceed. This performance period is mandatory, negotiable. (See SCR-1)

12A. THE CONTRACTOR MUST FURNISH ANY REQUIRED PERFORMANCE PAYMENT BOND?
 (If "YES," indicate within how many calendar days after award in item 12B.)
 YES NO

12B. CALENDAR DAYS
 10

13. ADDITIONAL SOLICITATION REQUIREMENTS:

A. Sealed offers in original and AM#5...3...AM#5 copies to perform the work required are due at the place specified in item 8 by 1600 (hour) local time AM#2...08/14/02 ~~SUSPEND~~. 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. AM#3...10 JULY 2002...AM#3 AM#4...14 JUN 2002...AM#4 AM#5...28 JUN 2002...AM#5 AM#7...17 JUL 2002...AM#7 AM#8...03 Jan 2003...AM#8 AM#9...27 Jan 2003...AM#9 AM#10...03 Jan 2003...AM#10 AM#12...27 Jan 2003...AM#12

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.

GOVERNMENT BETTERMENTS CONT'D.

<u>Item No.</u>	<u>Description</u>	<u>Quantity</u>	<u>Unit</u>	<u>Unit Price</u>	<u>Amount</u>
0010.	Acoustic deck at hangar roof, complete.	1	Lump Sum	\$ _____	\$ _____
0011.	Epoxy paint for hangar floor, complete.	1	Lump Sum	\$ _____	\$ _____

AM#12Total of ~~Contractor~~ ***AM#12***Government Betterments (0009 thru 0011) \$ _____

TOTAL of Base Items (0001 thru 0003), Optional Items (0004 A & B thru 0008, and Government Betterments Items 0009 thru 0011) \$ _____

EVALUATION OF OFFERS.

1. **AWARD:** Award will be made in accordance with SECTION 00120 - EVALUATION FACTORS FOR AWARD.
2. **INCOMPLETE OFFERS:** Failure to submit an offer on all items in the schedule will result in an incomplete offer and the proposal will be rejected. Lump sum or unit prices must be shown for each item within the schedule.
3. **SPECIAL CONDITION:** If a modification to an offer based on unit prices is submitted which provides for a lump sum adjustment to the total estimated cost, the application of the lump sum adjustment to each unit price in the proposal schedule must be stated. If it is not stated, the offeror agrees that the lump sum adjustment shall be applied on a pro rata basis to every unit price in the proposal schedule.
4. **SUB-DIVIDED ITEMS.** The Government will not award sub-divided items separately; however under Option 2, Items 0005 A & B or Items 0005 C & D may be awarded.

-- End of Proposal Schedule --

PART 1 SCOPE SUMMARY

1.1 PROJECT LOCATION

1.1.1 Project Location – Elmendorf Air Force Base is located on the northern edge of Anchorage Alaska and is accessible from the Glenn Highway at Boniface Parkway. Anchorage, Alaska is located at 61 degrees north latitude.

A. Arctic conditions exist at the project site; however, permafrost is unlikely to be encountered. Winter temperatures in the range of -10 degrees C to -20 degrees C are common for extended periods; -30 degrees C temperatures can last for several days in a row. Snow begins accumulating in early October and does not begin to melt until April; .5 meters (18") snow cover is common through mid-May.

1. Climate – see SECTION 00800 page 20 for Climatological Summary for Elmendorf AFB.

B. Proposed Site –The new construction site is located north of Arctic Warrior Drive, west of Vandenburg Road, and east of Talley Avenue and Alaska Railroad tracks, both of which have been closed. A new modified tow-way will extend east from the north/south runway to the new facility.

1. Option 5 - Demolition of the Horse Stable Complex will occur at this site.

2. Under separate contract for 2003, new security fencing will be erected on Arctic Warrior Drive cutting across Talley Road; a 30' swing gate will be installed by the Government on Truemper Loop.

1.2 STATEMENT OF WORK SUMMARY

1.2.1 Project Schedule

A. The following dates are approximate project milestones; actual dates for 65%, 95%, and 100% Design Submittals and review conferences shall be proposed by the D/B Contractor and must be confirmed with the Government.

1. Design/Build Notice to Proceed 1/15/03

2. Final Contract Documents 7/28/03

3. Beneficial Occupancy of New Hangar 11/4/04

1.2.2 Technical Requirements - refer to SECTION 01010, Part 2 – Minimum Design Criteria for Demolition, Hazards Abatement, Civil, Architectural, Structural, Mechanical, Electrical, and Fire Protection for detailed technical requirements.

1.2.3 GENERAL - New Fuel Systems Maintenance Hangar with associated site improvements will serve the 3^d CRS – Component Repair Squadron - of the 3^d Wing Command at Elmendorf AFB, Alaska. The new facility will replace the Fuel Systems Maintenance functions of existing Hangar 10 and will accommodate (3) F-15 or F-22 aircraft simultaneously for the purpose of in-tank fuel maintenance operations.

A. Contractor shall ensure no permanent obstructions encroach within the Runway Lateral Clear Zone Width of 305 meters (1000 feet) from the runway centerline. Air space restrictions prohibit obstructions within a 1V:7H Transition Surface beyond the 305-m the Runway Lateral Clear Zone. These and all site constraints are defined or enforced by the flightline command.

B. This facility is the first building and southernmost structure of the east-side masterplan development. Building limits are driven by future work to the north. See C-1 Site Survey (Appendix 1) for northwest building coordinate limits. The coordinate shown shall apply to the future 4th Bay expansion (Option 1) if expansion is planned for the west side of the new facility.

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- C. Both F-15 and F-22 aircraft will be serviced at this facility. Where criteria differ for the two aircraft types, the more stringent shall apply so that both aircraft are accommodated.
- 1.2.4 SITE DEVELOPMENT – Aircraft maneuvering and parking, utilities connections and extensions, storm drainage, fire hydrants and fire pump, GOV service vehicle access and unpaved POV parking, paving, landscaping, site lighting and other amenities are outlined in Part 2 of this Section.
- A. Paved fire lane access – 6.1 meters (20'-0") wide, minimum per UFC and MIL HDBK 1008C, will be provided on all sides of the building.
- B. Concrete apron – 3.05 meters (10 feet) wide extending the full width of Maintenance Bay doors. See structural technical requirements in SECTION 01010 part 2.5.4.G.
- C. New "Modified Tow-way" - shall align with the southernmost aircraft crossover of the north-south runway and is approximately 457 meters (1500 feet) long, 22.9 meters (75 feet) wide overall. The new asphaltic concrete taxiway extends from the runway to the new Hangar's northwest corner, then transitions to a concrete apron in front of the Maintenance Bay doors. See civil technical requirements for "Modified Tow-way" paving criteria, SECTION 01010 part 2.3.14.A.2(a).
1. Centerline and edge markings per ETL 97-18, ETL 94-01, and AFI-32-1076 are required by Elmendorf AFB flightline command.
- D. POV parking – gravel pad surface for 25 vehicles inside the fence gate access at Truemper Loop and Arctic Warrior Drive. Parking area shall be located southeast of the new facility at a 25-m anti-terrorism standoff distance.
- 1.2.5 NEW FUEL SYSTEMS MAINTENANCE HANGAR – constructed as a complete and stand alone structure with its own mechanical, electrical, and fire suppression systems for the building functions and 3 baseline, (4th bay future expansion per Option 1) aircraft bays for fuel cell maintenance operations.
- A. The structural design of the building may place columns within the maintenance bays provided aircraft access and maneuvering is not impacted. Columns may not encroach on aircraft clearances within the Bays or at the walls.
- B. The design shall show and accommodate a fourth Maintenance Bay future expansion. All building systems (structural, mechanical, electrical, fire suppression, etc.) shall be sized for the fourth bay expansion.
1. The fourth Maintenance Bay shall be designed to allow re-fueling within the building, requiring a 1-hour fire rated blast proof separation to the adjacent Maintenance Bay(s). The concrete masonry unit wall must extend to the underside of the roof structure.
 2. Seismic bracing between the future expansion Maintenance Bay and adjacent Maintenance Bay shall allow future access consisting of (2) openings each 1830 mm (6') wide x 2135 mm (7') high.
 3. The design shall allow visual supervision to all bays either at the main level or mezzanine level.
- 1.2.6 DEMOLITION - Building 8675 located in the project site area shall include removal of foundations, supply wells, septic tanks, utility connections, fencing, etc. Building 8661 located adjacent to the project area shall be relocated by the government under separate contract, the foundation, supply well, septic tank, and utility connections shall be removed by the contractor.
- 1.2.7 PROJECT OPTIONS

- A. Project Options are additions to the Baseline scope of work that shall be priced separately by the D/B Contractor per SECTION 00100 and evaluated by the Government per SECTION 00120.
1. OPTION 1 – Fourth Maintenance Bay: shown in the Baseline design as future expansion, completed within the project schedule.
 2. OPTION 2 – Aircraft Concrete Hardstand: each 19.8m wide x 25.3m long (65 feet x 83 feet), located on the north side of the Modified Tow-way in front of the Maintenance Bay doors. Include grounding points on 3 meter grid and aircraft tie-downs. See appendix 8 and 9 for aircraft tie-down diagrams.:
 - a) OPTION 2A – Concrete Hardstand for 1 aircraft
 - b) OPTION 2B – Concrete Hardstand for 2 aircraft
 3. OPTION 3 – Paved POV Parking: paved surface for the 25-vehicle lot described in paragraph 1.2.3.D.
 4. OPTION 4 – Relocate Building 8661 to Hillberg Area: includes relocating the superstructure onto suitable new foundation, utility hook-ups, and utility disconnects at the demolition site; see Appendix 16 for local map.
 5. OPTION 5 – Demolition of Horse Stable Complex: includes buildings 8659, 8663, 8657, 8661 (foundation only), 8665 (3 buildings under one number), foundations, supply wells, septic tanks, utility connections, fencing, etc.

1.2.8 GOVERNMENT BETTERMENTS

- A. Betterments are listed in order of priority as determined by the Government, and are more fully defined in the respective discipline minimum design requirements in Part II of this Section. Proposals shall include as many or all of the following Betterments as the overall budget and gross building area allow.
1. GOVERNMENT BETTERMENT 1 - Paint All Exposed Structural Steel in the Maintenance Bays and Tank Area.
 2. GOVERNMENT BETTERMENT 2 - Acoustical Roof Deck in Maintenance Bays and Tank Area.
 3. GOVERNMENT BETTERMENT 3 - Epoxy Floor Paint at Maintenance Bays and Tank Area.

1.2.9 CONTRACTOR-PROPOSED BETTERMENTS

- A. Contractor-Proposed Betterments shall meet and/or exceed minimum requirements within allowable funds.
- B. The design criteria stated in this RFP are the minimum quality acceptable. Innovation and creativity are encouraged in deliver the optimum facility serving the 3rd CRS and the 3rd Wing Command and the best value to the Government within allowable funds.
1. Civil, mechanical, electrical, and fire protection minimum design requirements described in Section 2.3, 2.5, 2.6, and 2.7 are prescriptive where indicated.
- C. Refer to SECTION 00100 for Proposal submission requirements and SECTION 00120 for Proposal Evaluation Factors.
1. With the exception of Prohibited Items, all Contractor-proposed Betterments that benefit the facility will be considered, and will be evaluated based on durability, function, conformance to Base standards, maintenance, and aesthetics.

1.2.10 PROHIBITED ITEMS

- A. Proposals shall not present a design inclusive of any prohibited item described by each discipline in Section II Minimum Design Criteria narratives.

1.3 STATEMENT OF WORK - GENERAL PROJECT REQUIREMENTS

1.3.1 Hazardous Materials

- A. Extent of soil or ground water contamination within the project boundaries is reflected in Appendix 18 - ST534 Removal Action Report (removal of the UST by the Scouts Building). Refer to SECTION 01010 2.3 civil technical requirements for contaminated soils removal, hauling, and stockpiling.
- B. Preliminary indication of asbestos and other hazardous materials related to BSA building and horse stable facilities is provided in Appendix 19 - Hazardous Materials Survey, Boy Scouts of America and Horse Stable Facilities Demolition, Elmendorf AFB, AK, August 2002.

1.3.2 Q/D (Quantity Distance) Arc and Anti-Terrorism Standoff Distances

- A. Q/D Arc at Hardstands – 45.72 meters (150 feet) to any permanent structure.
- B. Q/D Arc from Future Development to the North – 410 meters (1,250 feet) for aircraft carrying explosive munitions: window glazing on the north elevation of the new Hangar shall be kept to the minimum required for building functionality.
 - 1. Any glazing facing north shall comply with AFMAN 91-201 paragraphs 4.17.8 and 4.31.
- C. Anti-Terrorism - the project facility is categorized as a "Controlled Area Inside a Restricted Area"; the threat level at project location is "Low" per Department of Defense standard #2016. Security measures include shatter protective window lamination at interior glazed panes.
 - 1. No exterior perimeter lighting criteria apply for anti-terrorism purposes.
 - 2. POV parking and Dumpsters require 24.4 meters (80 feet) minimum standoff distance from the new facility.
 - 3. Reference Appendix 15, "Unified Facilities Criteria (UFC) 4-010-01" dated July 31, 2002.

1.3.3 Americans With Disabilities Act (ADA)

- A. Accessibility standards for this facility shall apply to staffed office areas on the lower level, Training/Conference Room, handicap accessible toilet room, building entrance and circulation to the staff areas. It is presumed that the aircraft maintenance crew working in this specialized military facility is able-bodied; therefore the second floor office spaces (if applicable), maintenance bays, and toilet/shower areas are not required to be handicap accessible.

1.3.4 Intent

- A. The Government seeks a complete and usable Fuel Systems Maintenance Hangar, free of defects and compatible with the surrounding built and natural environment.
- B. This Project shall be designed and constructed with quality materials and workmanship throughout and in accordance with all applicable codes and standards and the requirements of this RFP. It is the intent of this RFP to establish minimum design and construction requirements for the proposed buildings that meet or exceed the standards referenced in this Section. Choice of materials and methods of construction shall not compromise the safety of building occupants and shall optimize quality, function, aesthetics, economy, maintainability, and life cycle cost.

1.3.5 Site Diagram / Building Layout

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- A. No suggested site layout or building space plan is included in this RFP; the D/B contractor is given information on site constraints and spatial relationships needed to develop the most effective Project design the budget allows. See appendix 1 for site information.

1.3.6 Metric Design Requirement

- A. This project shall be designed, drawn, and constructed with materials of SI Units (metric) as outlined in Appendix 21 and SECTION 01451. Drawings shall be set up and dimensioned in hard metric (100mm module) SI units only. English (IP inch/pound) shall not be used.

1.3.7 Designer of Record

- A. Final design submittals and each drawing included therein shall be signed by and affixed with the seal of an architect or professional engineer registered in the State of Alaska who shall be termed the "Designer of Record" for the respective disciplines.
 - 1. See SECTION 01010 part 2.8 for differing qualifications for Fire Protection engineering.
- B. Where construction and testing standards and criteria are contained within SECTION 01010, the Designer of Record shall place them in the construction documents and require them of the Contractor during construction.

1.4 REFERENCES

1.4.1 Appendices

- A. The drawings and documents listed below delineate project-specific design criteria in support of the codes and references.
 - 1. G-01 Location/Vicinity Map;
C-1 Site Survey with Building Limits, Required Clearances, Utilities;
Hillberg Area Map for Relocation of Building 8661 (see OPTION 4)
G-Tabs – Revised March 31, 2000; Water, Sewer, Storm Drain, Natural Gas, Liquid Fuel,
Central Heating & Cooling, Communication, Electrical, Street Lighting
 - 2. Unified Facilities Criteria (UFC) 1-200-01; Design: General Building Requirements, dated July 31, 2002.
 - 3. Elmendorf AFB Architectural Compatibility Study, dated November 4-9, 2001.
 - 4. Geotechnical Findings Report, dated October 2002.
 - 5. Site Photographs
 - 6. Manual 113, Section III – Aircraft Fuel Systems Maintenance Facilities and Areas
 - 7. AFH 32-1084 (includes Table 7.2 – Aircraft Separation Dimensions Inside Hangars)
7a AFH 32-1084 Chapter 2, Section D – Hardstand Criteria
 - 8. F-22 Raptor and F-15E aircraft dimension diagram;
F-15 hold-down diagram
 - 9. F-22 Facilities Requirements Plan (FRP), Revision N, dated 11/10/2000 (excerpted)
 - 10. Air Force Environmental Requirements – Pollution Prevention Measure of Merit
 - 11. Engineering Technical Letter (ETL) 1110-3-491 – Sustainable Design for Military Facilities
 - 12. Engineering Technical Letter (ETL) 01-2 – Fire Protection Engineering Criteria for New Aircraft Facilities
 - 13. Chemical Data Report – Soils at New Hangar Construction Site, dated 08-2002.
 - 14. Elmendorf AFB SOP - Standard Operating Procedure for Utilities Outages and Electrical Service Hook-up
 - 15. Unified Facilities Criteria (UFC) 4-010-01, dated July 31, 2002.
 - 16. Standard Telecommunications Infrastructure Requirements for New or Renovated Facilities, dated December 26, 2001.
 - 17. As-Built Drawings for Existing Buildings at New Construction Site
 - 18. ST534 Removal Action Report (removal of the UST by the Boy Scouts Building)

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19. Boy Scouts Building and Horse Stables Hazardous Material Demolition Survey Report.
20. Guide Specifications SECTIONS: 02065 Contaminated Soils Removal, Hauling, and Stockpiling; and 02111 Excavation and Handling of Contaminated Material.
21. Metric Design Guide; General Services Administration Office of Design and Construction, April 1992.

1.4.2 Codes and References

- A. Codes and Industry standard references are not attached with this RFP. Each offeror shall be responsible for obtaining any documents not attached as part of this RFP but is referenced as criteria for this project. Requirements contained in this RFP may revise, add to, or substitute for criteria contained in the referenced documents. This RFP shall be deemed the controlling authority wherever such differences exist.
1. The Engineering Improvement Recommendations System can be found at www.usace.army.mil/inet/usace-docs/.
 2. Engineering Technical Letters (ETL's) can be found at www.afcesa.af.mil/Publications/ETLs/default.html.
- B. Publications: construction shall be in accordance with the following codes, standards, and regulations. If dates are not given for reference standards or criteria, the latest edition is to be used. The most stringent shall govern where discrepancies occur. See the subsequent discipline narratives in this Section for additional regulatory standards, codes, and references.
1. U.S. Department of Defense
 - a) Interim Department of Defense Antiterrorism/Force Protection Construction Standards, December 1999
 - b) Department of Defense Antiterrorism/Force Protection Minimum Construction Standards, October 2000
 - c) DOD 6055.9, DOD Ammunition and Explosive Safety Standard, 1999
 2. U.S. Department of the Air Force
 - a) Air Force Handbooks (AFH)
 - AFH 32-1084, Facility Requirements, 1996
 - AFH 32-1163, Engineering Weather Data, 2000
 - b) Air Force Instruction (AFI)
 - AFI 32-1065, Grounding Systems, 1998
 - AFI 32-1063, Electric Power Systems, 1994
 - c) Air Force Joint Manual (AFJMAN)
 - AFJMAN 32-1082, Facilities Engineering – Electrical Exterior Facilities, 1996
 - AFJMAN 32-1083, Electrical Interior Facilities, 1995
 - AFJMAN 32-1090, Noise and Vibration Control, 1995
 - d) Air Force Manuals (AFM)
 - AFM 88-5, Chapter 4, Drainage for Areas Other Than Airfields, 1983
 - AFM 88-7, Chapter 1, Pavement Design for Roads, Streets, Walks, and Open Storage Areas, 1992
 - AFM 88-7, Chapter 5, General Provisions and Geometric Design for Roads, Streets, Walks, and Open Storage Areas, 1987
 - AFM 88-9, Electrical Design Lightning and Static Electricity Protection, 1985
 - AFM 88-10, Volume 1, Water Supply Sources and General Considerations
 - AFM 88-10, Volume 5, Water Supply, Water Distribution, 1986
 - AFM 88-11, Volume 2, Sanitary and Industrial Waste, Sewers, 1985
 - Manual 113 for Permanent Fuel Maintenance Structures
 - e) Air Force Manuals (AFMAN)
 - AFMAN 32-1070, Plumbing, 1993
 - AFMAN 32-1071, Vol. 1, Security Engineering Project Development, 1994
 - AFMAN 32-1071, Vol. 2, Security Engineering Concept Design, 1994
 - AFMAN 32-1071, Vol. 3, Security Engineering Final Design, 1994
 - AFMAN 32-1076, Design Standards for Visual Air Navigation Facilities
 - AFMAN 32-1093, Energy Monitoring and Control Systems (EMCS), 1991

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- AFMAN 91-31, Occupational Safety and Health Standard, 1997
- AFMAN 91-201, Explosives Safety Standards, 2000
- f) Air Force Occupational Safety and Health (AFOSH)
AFOSH 91-32, Fire Protection and Prevention, 1998
- g) Air Force Pamphlets (AFPAM)
AFPAM 32-1097, Sign Standards Pamphlet, 1997
- h) Air Force Regulations (AFR)
AFR 88-19, Volume 9, Arctic and Subarctic Construction Buildings, 1988
- i) Air Force Center for Environmental Excellence (AFCEE), Interior Design
Presentation Format, Air Force Interior Design Guides, Chapter 12 SID/CED
Presentation Format
- j) Facility Design Guide for Enlisted Dormitories, 1997
- k) Metal Buildings for Air Force Facilities in Alaska, A Report Compiled by the U.S.
Army Corps of Engineers, North Pacific Division, 1989
- l) Installation Force Protection Guide, 1996
- m) Base Security Standards – AFJMAN 32-1071, Vol. 3, Ch. 2
- 3. U.S. Department of the Army
 - a) Engineering Circulars (EC)
EC 1110-1-92, Classification of Type of Construction, 21 June 2000
 - b) Engineering Manuals (EM)
EM 385-1-1, Safety and Health Requirements Manual, 1996
 - c) Engineering Regulations (ER)
ER 1110-345-700, Design Analysis, Drawings, and Specifications, 1997
 - d) Engineering and Design Interior Design (ER) 1110-345-122 (available online at
TechInfo – <http://www.poa.usace.army.mil/idg/splash.htm>)
 - e) Engineering Technical Letters (ETL)
ETL 1110-3-393, Design of Surfaced Areas, 1988
ETL 97-18, Guide Specification for Airfield and Roadway Marking, December
1997
ETL 94-01, Standard Airfield Pavement Marking Schemes, April, 1991
ETL 1110-3-491, Sustainable Design for Military Facilities, 2001
 - f) Technical Instructions (TI)
TI-800-01, Design Criteria, Chapter 11 Energy Conservation Criteria, 1998
TI-809-04, Seismic Design for Buildings, 1998
TI-809-07, Design of Cold-Formed Load Bearing Steel Systems and Masonry Veneer/Steel Stud Walls,
1998
TI-809-29, Structural Considerations for Metal Roofing, 1998
TI-809-30, Metal Building Systems, 1998
TI-809-52, commentary on Snow Loads, 1998
TI-809-53, Commentary on Roofing Systems, 1999
- 4. Military Handbooks
MIL-HDBK-1008C, Fire Protection for Facilities Engineering, Design, and Construction, 1997
MIL-HDBK-1190, Facility Planning and Design Guide, 1987
- 5. ACI International (ACI)
ACI 318, Building Code Requirements for Structural Concrete and Commentary
ACI 315, Manual of Standard Practice for Detailing Reinforced Concrete Structures
- 6. American National Standards Institute (ANSI) Codes and Standards
ANSI 250.8, Steel Doors and Frames, 1998
ANSI C2, National Electrical Safety Code (Latest Edition)
ANSI MH 27.1, Underhung Cranes and Monorail Systems, 1981
- 7. Electronic Industries Association (EIA)
568-A-1995, Commercial Building Telecommunications Cabling Standard, 1995
569-A, Commercial Building Standard for Telecommunications Pathways and Spaces, 1998
606-1993, Administration Standard for the Telecommunication Infrastructure of Commercial Buildings,
1993
607-1994, Commercial Building Grounding and Bonding Requirements for Telecommunications, 1994

8. American Society of Civil Engineers (ASCE)
ASCE 7, Minimum Design Loads for Buildings and Other Structures, 1998
9. American Society for Testing and Materials (ASTM)
ASTM C 578, Rigid, Cellular Polystyrene Thermal Insulation, 1995
10. American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
Codes and Standards
Handbook of Fundamentals, Latest Edition
11. ASME Codes and Standards
12. 49-CFR 101-19.6 Uniform Federal Accessibility Standards
13. 18 AAC 75, Oil and Hazardous Substances Pollution Control Regulations, ADEC
14. 18 AAC 70, Water Quality Standards, ADEC
15. Factory Mutual Engineering and Research (FM) - Approval Guide Fire Protection, 1998
16. Gypsum Association, (GA) - GA 600, Fire Resistance Design Manual, 1997
17. Illuminating Engineering Society (IES) - Lighting Handbook, 2001
18. International Conference of Building Officials (ICBO) Codes
19. National Electrical Code (NEC)
20. International Building Code (IBC), 2000
21. Uniform Fire Code (UFC)
22. Uniform Mechanical Code (UMC)
23. Uniform Plumbing Code (UPC)
24. SMACNA Standards
25. ASHRAE Standards
26. Material Handling Institute (MHI)
MHI CMAA 74, Top Running and Under Running Single Girder Electric Overhead
Traveling Cranes Utilizing under Running Trolley Hoist
27. Metal Building Manufacturers Association (MBMA)
MBMA Low Rise Building Systems Manual, 1996
28. National Fire Protection Association (NFPA) Standards
NFPA 11, Low Expansion Foam and Combined Agent Systems
NFPA 13, Installation of Sprinkler Systems
NFPA 16A, Installation of Closed-Head Foam-Water Sprinkler Systems
NFPA 10, Portable Fire Extinguishers, 1998
NFPA 13, Installation of Sprinkler Systems, 1999
NFPA 20, Centrifugal Fire Pump
NFPA 30, Flammable and Combustible Liquids Code, 2000
NFPA 30A, Motor Fuel Dispensing Facilities and Repair Garages, 2000
NFPA 37, Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines,
1998 Edition
NFPA 54, National Fuel Gas Code, 1999
NFPA 70, National Electrical Code, 1999
NFPA 72, National Fire Alarm Code, 1999
NFPA 80, Fire Doors and Fire Windows, 1999
NFPA 88B, Repair Garages, 1997
NFPA 96, Ventilation Control and Fire Protection of Commercial Cooking Operations, 1998
NFPA 101, Life Safety Code, 2000
NFPA 211, Standard for Chimneys, Fire Places, Vents, and Solid Fuel Burning Appliances
NFPA 409, Standard on Aircraft Hangars
NFPA 780, Installation of Lightning Protection Systems, 1997
NFPA 2001, Clean Agent Fire Extinguishing Systems, 2000
29. National Wood Window and Door Association (NWWDA)
NWWDA Industry Standard I.S. 1-A-97, Architectural Wood Flush Doors, 1997
NWWDA Industry Standard I.S. 2-97, Voluntary Specifications for Aluminum,
Vinyl (PVC) and Wood Windows and Glass Doors
30. NSF International (NSF)
NSF-01, Listings of Food Equipment and Related Products, Components, and Materials, 1994
NSF Std 2, Food Equipment, 1996

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31. State of Alaska Administrative Code (AAC)
 - 18 AAC 72, Wastewater Disposal Regulations, 1997
 - 18 AAC 75, Oil and Hazardous Substances Pollution Control Regulations, 1999
 - 18 AAC 80, Drinking Water Regulations, Latest Edition
32. Steel Deck Institute (SDI)
 - Standard Specifications Load Tables and Weight Tables for Steel Joists and Joist Girders
 - Design Manual for Composite Decks, Form Decks, Roof Decks and Cellular Metal Floor Deck with Electrical Distribution; No. 29
 - Diaphragm Design Manual (Second Edition); No. DDM02
33. Underwriters Laboratories (UL)
 - UL 580, Tests for Uplift Resistance of Roof Assemblies, 1994
 - UL 790, Tests for Fire Resistance of Roof Covering Materials, 1997
 - UL 1256, Fire Test of Roof Deck Constructions, 1998
 - UL Fire Resistance Directory Volumes 1 and 2, 2000

PART 2 MINIMUM DESIGN CRITERIA

2.1 DEMOLITION DESIGN CRITERIA

2.1.1 Scope and Objectives

- A. The Design-Build Contractor's Architect or Engineer(s) of Record shall be responsible for the design associated with demolition work. Complete design shall generally include that required to define and describe execution of the demolition work including hazardous material abatement, removal, handling, and disposal; shoring and safety measures; and interface with existing utilities and surface features that remain. The demolition design drawings and calculations shall be sealed by the architect or engineer(s) in responsible charge. The architect or engineer(s) shall be licensed in the State of Alaska.
- B. Demolition work shall consist of the complete design of removal of existing buildings, footings and foundations (where indicated), slabs, site improvements, and utilities as indicated and as required to accomplish the new construction. It shall be the Contractor's responsibility to protect existing features, including roads, utilities, paving, existing monitoring wells, remediation systems, and similar items not in the contract work limits, which if damaged by the Contractor shall be replaced in kind at no cost to the Government.
 - 1. OPTION 5 – Horse Stable Complex demolition includes complete removal of footings and foundations.
- C. Salvageable Material
 - 1. There are no salvageable items to turn over to the Government.
- D. All excavations from demolition activities shall be backfilled with classified material in 300-mm lifts and compacted to 95% of optimum density.

2.1.2 References

- A. The publications listed below form a part of this specification. The publications are referred to in the text by basic designation only. If dates are not given for reference standards or criteria, the latest edition is to be used.
- B. Demolition shall be in accordance with the following codes, standards, regulations, and references. The most stringent shall govern when discrepancies occur.
 - 1. EM 385-1-1, U.S. Army Corps of Engineers Safety and Health Requirements Manual
 - 2. Contractor Guidance for Preparing and Executing Storm Water Pollution Prevention Plans, Corps of Engineers Guide Specification SECTION 01356
 - 3. Hazardous Material Survey (see Appendix 13)
 - 4. Geotechnical Findings Report (see Appendix 4)
 - 5. Pollution Prevention Measure of Merit (see Appendix 10)
 - 6. Refer to Hazardous Materials Removal Design Criteria, paragraph 2.2, for specific codes, standards, and regulations applicable to hazardous material removal work.

2.1.3 Work Description – Baseline Demolition

- A. Building 8675 is a single-story wood frame structure over a crawlspace foundation, asphalt shingle roofing and wood siding; it is the only structure in the baseline scope of work. The contractor shall remove the building, foundation, supply well, septic tank, and utility connections completely.

- B. Building 8661 is a single-story wood frame structure with a slab on grade foundation, wood siding, metal roofing. This building will be relocated by the government under separate contract. The contractor shall remove the foundation, supply well, septic tank, and utility connections completely.
 - C. Portions of asphalt pavement along Talley Avenue, Frontage Road, and Truemper Loop will be demolished where it interferes with the excavation and construction of the new facilities.
 - D. Overhead Electrical – The overhead power cables, service drops, poles, and transformers shall be removed from within the limits of the new construction. Cables that remain shall be terminated appropriately at the poles and the poles shall be guyed as required.
 - E. Miscellaneous utilities including water, gas, telephone, and fiber optic will require removal and/or relocation as required for the new construction.
- 2.1.4 Work Description: OPTION 5 – HORSE STABLE COMPLEX DEMOLITION**
- A. Includes Buildings 8659, 8663, 8657, 8665 (3 buildings under one number), foundations, supply wells, septic tanks, utility connections, fencing, etc.
- 2.1.5 Demolition procedures, methods, sequence of operations, and equipment shall be in accordance with EM 385-1-1 and Elmendorf AFB FOD requirements.**
- A. Rubbish and debris shall be removed from work site daily, unless otherwise directed, to avoid accumulation at the demolition site. All rubbish and debris shall be removed from the Base; no on-Base disposal site is available for this project.
 - B. The Contractor shall take necessary precautions to avoid damaging Government property, and if damage occurs, shall repair or replace the damage as directed by the Contracting Officer at no cost to the government.
 - C. 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.
 - D. Demolition of all features or items found on the site (paved parking areas, fence, utilities, poles, etc.) shall be considered incidental to the Contract. Title to material and equipment to be demolished is vested in the Contractor upon receipt of notice to proceed and the Government will not be responsible for the condition, loss, or damage to such property. There are no known items of historical significance on the site.
 - 1. Disposal of Solid Wastes: The Contractor shall be responsible for disposal of all demolition debris, construction debris, and all solid waste at an approved off-base location. Solid waste shall be placed in containers and disposed of on a regular schedule. All handling, transport, and disposal shall be conducted in such a way as to prevent spillage and contamination in compliance with Federal, State, and Local requirements. Clean soil materials shall be disposed of on-Base in accordance with Elmendorf AFB borrow pit procedures and plan. Disposal of any hazardous waste shall be made through the Elmendorf AFB Hazardous Waste Facility in accordance with Elmendorf AFB procedure and plan for hazardous material.
 - 2. Existing utility services shall be protected from damage. Coordinate and obtain locates for all buried utilities prior to beginning work.
 - 3. All asphalt paving and concrete shall be sawcut at the limits of removal. As applicable, replacement or repair asphalt paving, concrete, base material, and subbase material shall match existing thickness.

4. Provide site-clearing operations necessary for construction of the facility and related improvements. Miscellaneous demolition shall include clearing and grubbing of organic overburden as required to construct the new improvements at the site location.
 5. Contractor shall demolish building service utilities and cap off all existing utility connections at manholes or where the service line connects to the mainline. Dead end service lines shall not be allowed. Closure of utilities shall be with welded cap or flange or other industry standard termination. Patch penetrations in manhole walls where old utility lines are removed.
 6. The Contractor shall conduct demolition and removal operations to ensure minimum interference with streets, walks, or other adjacent facilities being used.
 7. The Contractor shall ensure safe passage of persons around area of demolition and conduct operations to prevent injury to adjacent buildings, structures, and persons. The Contractor shall promptly repair damages caused to adjacent structures by demolition operations at no cost to the Government.
 8. Contractor shall review and comply with Elmendorf AFB requirements for borrow pit operation with regard to hauling and disposal regulations, in exchange for use of Elmendorf AFB borrow facilities, and before starting any demolition work. Burning is not permitted on site. Blasting is not permitted.
 9. Use water mist, temporary enclosures and other suitable methodology to limit the spread of dust and debris. Contractor shall maintain rigorous dust control on all construction sites, haul roads, and at the landfill site. Elmendorf AFB requirements for dust and Foreign Object Debris (FOD) control is that no visible dust or debris may come off active construction sites at any time of the day or night, and no visible dust or debris from Contractor use of haul roads or landfill. Construction sites shall be monitored after hours and weekends for dust control. Construction sites and haul routes shall be continually monitored during use to clean up mud, control dust and other debris, and repair damage caused by construction activities.
 10. Use Best Management Practices (BMP's) as necessary to mitigate storm water erosion and sediment pollution runoff from the site. Comply with governing state and federal environmental protection regulations.
 11. Contractor shall provide a temporary 6-foot high chain link fence to provide separation of the site and pedestrians and vehicle traffic. Coordinate security and barrier requirements with the Contracting Officer and Elmendorf AFB. Fencing will be required around the entire construction site.
- 2.1.6** Subsurface Conditions: see the Geotechnical Findings Report in Appendix 4.
- A. Field screening shall be used to determine if soils are contaminated during all excavation work.
 - B. If contamination is detected, see SECTION 01010-2.3.11 for procedures.
- 2.1.7** Hazardous Materials: Refer to Hazardous Materials Report in Appendix and Hazardous Material Abatement Design Criteria, SECTION 01010 Part 2.2, for specific requirements for hazardous material removal.
- 2.1.8** Backfilling of Demolished Sites: All excavations from demolition activities shall be backfilled in 300-mm lifts and compacted to 95% of optimum density. Backfill shall be classified material and shall not contain organic material, trash, rubble, stones in excess of 150 mm or other deleterious materials.
- 2.1.9** Environmental Issues
- A. Environmental issues must be considered in both the design and construction of this project. In general, the Contractor is responsible for preparing the necessary documentation, including

- work plans, sampling and testing reports, and other documents required to accomplish the work.
1. The Contractor shall comply with existing permit and work plan requirements in place between Elmendorf AFB and regulatory agencies. The Contractor shall communicate environmental issues through the Contracting Officer.
 2. Direct communication with regulatory agencies shall be approved in advance by the Contracting Officer. The Contractor shall pay for regulatory review fees necessary for obtaining permits. Contractor shall follow current State of Alaska Department of Environmental Conservation (ADEC) regulation 18 AAC 75, Articles 3 and 9.
- B. This project may include handling and disposal of hazardous materials. See SECTION 01010 Part 2.3 – Civil Design Criteria, for specific requirements for contaminated soil and storm water runoff.
1. See SECTION 01010.2.2 - Hazardous Abatement Design Criteria, for specific requirements for hazardous materials.
 2. Surface runoff that enters excavations may become contaminated if soils are contaminated. Dewatering of surface runoff from excavation shall include sampling and testing and treatment as required. Any dewatering required during construction shall be coordinated with the Contracting Officer.
 3. If any garbage, debris, drums, free liquids, or other potentially hazardous materials not addressed in the Hazardous Materials Report are encountered during construction, notify the Contracting Officer before proceeding with removal.
 4. The Contractor shall submit a description of hazardous materials, including Material Safety Data Sheets (MSDS) and projected quantity of each, anticipated to be brought to the site for use during construction. Contractor shall submit description within 21 days of NTP.
 5. The Contractor shall be responsible for impacts caused by the Contractor, including spills; dust control during construction; excavation and sediment control; prevention of pollution caused by spillage of bitumen, fuels, grease and oils; erosion; concrete spillage; aggregate washing; and sanitary and other waste disposal.

PART 2 MINIMUM DESIGN CRITERIA

2.2 HAZARDOUS MATERIALS CRITERIA

2.2.1 Scope Summary: This Section includes the minimum requirements for the proper identification, removal and disposal of hazardous materials from Boy Scouts of America building (8675) and the Horse Stable Complex prior to demolition.

A. A hazardous materials survey was performed by the US Army Corps of Engineers for this project. The hazardous material survey report furnished is to be considered a starting point for identification of hazardous materials in the facility. Additional investigation and sampling may be required by the contractor. The contractor is ultimately responsible for identifying, removing and disposing of all hazardous materials necessary to complete the project safely and in compliance with current local, state and federal regulations.

1. The chemical data report for the site is attached as Appendix 13.
2. The removal action report for building 8675 (BSA) Underground Storage Tank is attached as Appendix 18.
3. The hazardous materials survey report for the BSA and Horse Stables Complex is attached as Appendix 19.

2.2.2 Scope of Work: The Contractor shall identify all hazardous materials in the project to be removed, create a work plan for the safe removal of these materials, remove the materials and transport and dispose of them in accordance with all applicable federal, state and local regulations, the specifications and the approved work plan. Coordinate all project abatement activity with the work of other trades at the job site to ensure that unprotected workers are not exposed to hazardous materials. Provide documentation that hazardous materials have been removed, properly disposed of and the work area is safe for unprotected workers.

2.2.3 Asbestos Abatement: Asbestos abatement work shall be performed in accordance with referenced standards and regulations, the specifications, and the approved Contractor's hazardous materials work plan. A preliminary hazardous materials survey of BSA and the Horse Stable complex has been performed and results indicate that asbestos-containing material exists in or on these buildings. Asbestos may also exist in buried pipe, pipe insulation or pipe coating where tie-ins or capping is required. The Contractor is responsible for identifying, removing and disposing of all asbestos containing materials, dust or debris that may be disturbed to complete the project work

2.2.4 Lead Abatement: Lead-containing paints have been detected on items to be demolished or removed as part of the project scope of work. Settled and concealed dust containing lead may also be present in the building on all architectural, structural, mechanical and electrical components. Lead contaminated soils identified shall be removed and properly disposed of. It is the contractors' responsibility to identify all lead hazards and take appropriate actions for removal, disposal and worker protection. Lead abatement work shall be performed in accordance with referenced standards and all current applicable regulations, the specifications, and the approved Contractor's hazardous materials work plan. Regulated work areas shall be established for all lead abatement work. Metal items shall be recycled to the extent practical. All loose and flaking paint chips shall be collected and disposed of as hazardous waste unless proven non-hazardous by the EPA Toxicity Characteristics Leaching Procedure.

2.2.5 Chemical Hazards Abatement: Chemical hazards abatement work shall be performed in accordance with referenced standards and regulations, the specifications, and the approved Contractor's Hazardous Materials Work Plan. Regulated work areas shall be established for all chemical hazards abatement work.

2.2.6 References: Hazardous materials abatement shall be performed in accordance with the following applicable codes, standards and regulations.

ANSI Z9.2 Fundamentals Governing the Design and Operation of Local Exhaust Systems.
ANSI Z87.1 Occupational and Educational Eye and Face Protection.
ANSI Z88.2 Respiratory Protection
ASTM D 1331-00 Surface and Interfacial Tension of Solutions of Surface-Active Agents
ASTM D 4397 -00 Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications
ASTM E 119-00a Fire Tests of Building Construction and Materials
ASTM E 1368 -00 Visual Inspection of Asbestos Abatement Projects
ASTM E 1553(1993) Practice for Collection of Airborne Particulate Lead During Abatement and Construction Activities
ASTM E 1613-99 Standard Method for Determination of Lead by Inductively Coupled Plasma Atomic Emission Spectrometry (ICP-AES), Flame Atomic Absorption Spectrometry (FAAS), or Graphite Furnace, Atomic Absorption Spectrometry
ASTM E 1644-98 Practice for Hot Plate Digestion of Dust Wipe Samples for the Determination of Lead
ASTM E 1726-01 Preparation of Soil Samples by Hot Plate Digestion for Subsequent Lead Analysis
ASTM E 1727-99 Field Collection of Soil Samples for Lead Determination by Atomic Spectrometry Techniques
ASTM E 1728-02 Field Collection of Settled Dust Samples Using Wipe Sampling Methods for Subsequent Lead Determination
ASTM E 1729-99 Field Collection of Dried Paint Samples for Lead Determination by Atomic Spectrometry Techniques
ASTM E 1741-00 Preparation of Airborne Particulate Lead Samples Collected during Abatement and Construction Activities for Subsequent Analysis by Atomic Spectrometry
ASTM E 1792-01e1 Wipe Sampling Materials for Lead in Surface Dust
29 CFR 1910 Occupational Safety and Health Standards
29 CFR 1926 Safety and Health Regulations for Construction
40 CFR 61 National Emissions Standards for Hazardous Air Pollutants
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 263 Standards Applicable to Transporters of Hazardous Waste
40 CFR 268 Land Disposal Restrictions
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 Procedures
49 CFR 173 Shippers - General Requirements for Shipments and Packaging
AR 200-1 Hazardous Materials and Regulated Waste Management USA Army, Alaska, Pamphlet 200-1 Haz
CGA G-7 Compressed Air for Human Respiration
CGA G7.1 Commodity Specification for Air
Elmendorf AFB, OPLAN 19-3, Hazardous Waste, Used Oil, and Hazardous Material Management Plan
EM 385-1-1 (1996) US ARMY Corps of Engineers Safety and Health Requirements Manual
EPA 340/1-90-018 (1990) Asbestos/NESHAP Regulated Asbestos Containing Materials Guidance
EPA 340/1-90-019 (1990) Asbestos/NESHAP Adequately Wet Guidance
EPA 560/5-85-024 (1985) Guidance for Controlling Asbestos-Containing Materials in Buildings
NFPA 701 Methods of Fire Tests for Flame Resistant Textiles and Films
NIOSH Pub No. 84-100 NIOSH Manual of Analytical Methods
8 AAC 61 Occupational, Health and Environmental Control, Toxic and Hazardous Substances
18 AAC 60 Environmental Conservation-Solid Waste Management
UL 586 High-Efficiency, Particulate, Air Filter Units

2.2.7 Qualifications

- A. Designated Competent Person: The Contractor shall use properly qualified and trained personnel to perform duties as the competent person. The person selected shall have prior experience in the administration and supervision of abatement projects, including exposure assessment and monitoring, work practices, abatement methods, disposal procedures and site safety and health requirements.
- B. Supervisors and Workers: The Contractor shall use only properly qualified and trained supervisors and workers for all abatement work. All workers and supervisors shall have current certificates of training for the level of hazardous materials work being performed.
- C. Designated Industrial Hygienist: The Contractor shall select an industrial hygienist to prepare the Contractor's Hazardous Materials 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.
- D. Independent Testing Laboratory: An independent testing laboratory shall be used to perform all testing and analysis required during hazardous materials abatement. The lab shall meet the requirements as set forth in the U.S. Army Corps of Engineers, Unified Facilities Guide Specifications, SECTION 13280, Asbestos Abatement and SECTION 13281, Lead Hazard Control Activities.
- E. Citations on Previous Projects: The Contractor and all subcontractors shall provide a record of any citations and penalties received from federal, state or local regulatory agencies relating to asbestos or hazardous materials abatement activities performed by the Contractor or subcontractor.

2.2.8 Personnel Program Requirements

- A. Medical Requirements: Medical requirements shall conform to 29 CFR 1926.1101 for asbestos abatement work, to 29 CFR 1926.62 for lead abatement work and to other pertinent federal, state or local requirements.
- B. Training: Supervisor and worker training shall be in accordance with all federal state and local regulations. In addition, each worker shall be instructed by the Contractors' industrial hygienist on the specific health and safety hazards associated with the project, hazard communication program, specific work practices and engineering controls required, security procedures and the air monitoring program.
- C. Respiratory Protection Program: The Contractor shall establish in writing and implement a respiratory protection program in accordance with 29 CFR 1926.62 and .1101, 29 CFR 1910.134, ANSI Z88.2, CGA G-7, CGA G-7.1 and the specifications.
- D. Hazard Communication Program: A hazard communication program shall be established and implemented in accordance with 29 CFR 1926.59.
- E. Confined Space Compliance Program: If entry into utilidor or other confined spaces is required a written confined space compliance program shall be established and implemented in accordance with 29 CFR 1910.146 and with the COE Safety and Health Requirements Manual, EM 385-1-1, dated 3 September 1996. Figure 6-1 of the COE publication is a flowchart which will be valuable in helping the Contractor in the decision making process.
- F. Personal Protective Equipment: The Contractor shall provide respirators, protective clothing and eye protection at no cost to the workers. All personal protective equipment shall meet federal, state and local requirements for the type work performed.

- G. **Hygiene Facilities and Practices:** The Contractor shall establish a decontamination and shower area for the decontamination of employees, materials and equipment as required by 29 CFR 1926.62 and 1926.1101. The Contractor shall ensure that employees enter and exit established regulated areas through a decontamination area.
- 2.2.9 Hazardous Materials Work Plan:** The Contractor shall develop and submit a written comprehensive site specific Hazardous Materials Work Plan covering all abatement work to be performed by the Contractor and subcontractors. The Plan shall describe the personal protective equipment to be used, location and description of regulated areas, abatement methods, storage and disposal procedures, sampling and testing procedures, environmental controls, emergency response procedures, schedule and work coordination plans and security procedures.
- A. **Licenses, Permits and Notifications:** Necessary licenses, permits and notifications shall be obtained in conjunction with the project's hazardous materials abatement, transportation and disposal actions. Timely notifications of such actions shall be furnished as required by federal, state and local regulations. The Contractor is responsible for any fees or costs associated with licenses, permits or notifications.
- B. **Air Monitoring Equipment:** The Contractor's industrial hygienist shall approve air monitoring equipment to be used to collect samples. Pumps and sampling cassettes shall be suitable for the contaminate being sampled.
- C. **Expendable Supplies:** Glove bags, disposal containers, sheet plastic and other expendable materials shall conform to the requirements of U.S. Army Corps of Engineers, Unified Facilities Guide Specifications, SECTION 13280 and SECTION 13281.
- D. **Encapsulants:** Encapsulants shall meet the requirements identified in Corps of Engineers, Unified Facilities Guide Specifications SECTION 13280 "Asbestos Abatement" and SECTION 13281 "Lead Hazard Control Activities".
- E. **Materials Safety Data Sheets:** Submit Materials Safety Data Sheets (MSDS) and projected quantities of hazardous materials to be used on the job in accordance with Elmendorf OPLAN 19-3, Hazardous Waste, Used Oil, and Hazardous Material Management Plan.
- 2.2.10 Methods Of Compliance:** The Contractor shall employ proper control and handling procedures in accordance with all applicable OSHA, EPA, DOT and Elmendorf AFB regulations, U.S. Army Corps of Engineers, Unified Facilities Guide Specifications, SECTION 13280, Asbestos Abatement and SECTION 13281 (previously 02090), Lead-based Paint Removal. These procedures must be clearly described in the Contractor's Hazardous Materials Work Plan.
- A. **Critical Barriers:** Critical barriers shall be installed as necessary to prevent the spread of contamination to adjacent work areas or to the public. Critical barriers shall be installed as described in Corps of Engineers, Unified Facilities Guide Specifications, SECTION 13280.
- B. **Regulated Areas:** All Class I, II, and III asbestos work shall be conducted within a regulated area. 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 hazardous materials.
- C. **Signs and Labels:** Danger signs and tape shall be used to demarcate areas where hazardous materials work is being performed and shall be posted at work area entrances, exits, decontamination areas, emergency exits, and waste disposal areas. Warning labels shall be affixed to all components or containers containing asbestos or other hazardous waste in accordance with all federal, state and local regulations.

- D. **Local Exhaust Ventilation:** Local exhaust ventilation equipment shall conform to ANSI Z9.2, 29 CFR 1926.62, and 29 CFR 1926.1101. Filters on local exhaust system equipment shall conform to ANSI Z9.2 and UL 586.
 - E. **Tools:** Vacuums shall be equipped with HEPA filters and have sufficient capacity to efficiently collect, transport and retain asbestos or other hazardous waste. Power tools shall not be used to remove asbestos unless the tool is equipped with an integral HEPA vacuum collection system. Reusable tools shall be thoroughly decontaminated prior to being removed from regulated areas.
- 2.2.11 Final Cleaning and Inspection:** Upon completion of abatement, the regulated areas shall be cleaned by collecting, packing and storing all gross contamination. A final cleaning shall be performed using HEPA filtered vacuums and wet cleaning of all exposed surfaces and objects in the regulated area. Upon completion of the final cleaning, the Contractor and Contracting Officers' Representative shall conduct a final visual inspection of the cleaned area in accordance with ASTM E 1368.
- A. **Lockdown:** Prior to removal of plastic barriers and after completing the final visual inspection requirements, a lockdown encapsulant shall be spray applied to ceilings, walls, floors and other surfaces in the regulated area if unprotected workers will be required to re-enter the buildings after abatement is complete.
 - B. **Clearance Certification:** When hazardous materials abatement and final clean up is completed the Contractor will certify in writing that the area is safe before unrestricted entry is permitted.
- 2.2.12 Exposure Assessment and Air Monitoring:** Exposure assessment, air monitoring and analysis of airborne contaminants shall be performed in accordance with 29 CFR 1926.62, 29 CFR 1926.1101 and U.S. Army Corps of Engineers, Unified Facilities Guide Specifications, SECTION 13280 and SECTION 13281. Exposure assessment and air monitoring shall be performed by the Contractor's independent industrial hygienist. Samples shall be analyzed by the Contractor's independent testing lab.
- 2.2.13 Cleanup and Disposal:** All hazardous waste including contaminated filters, scrap, containers, equipment and clothing shall be placed in proper disposal containers for disposal. All asbestos waste shall be disposed of in an EPA/DEC permitted landfill in accordance with 40 CFR 61, state, and local procedures. Lead contaminated waste and other hazardous waste must be handled, stored and transported in accordance with 40 CFR 260, 40 CFR 261, 40 CFR 262, 40 CFR 263, and Elmendorf AFB OPLAN 19-3. All hazardous waste generated on Elmendorf AFB shall be turned over to the Elmendorf Defense Reutilization and Marketing Office (DRMO), Hazardous Waste TSD facility located at Building 11735, Vandenberg Ave., Elmendorf AFB. Coordinate with the Elmendorf Environmental Flight (552-1742) for storing, marking, labeling, packaging and disposal of all hazardous waste generated on Elmendorf AFB.
- 2.2.14 Government Betterments:** Not applicable.
- 2.2.15 Prohibited Items:** Not applicable.
- 2.2.16 D/B Contractor Betterments:** Not applicable.

PART 2 MINIMUM DESIGN CRITERIA

2.3 CIVIL DESIGN CRITERIA

2.3.1 References

- A. 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. If dates are not given for reference standards or criteria, the latest edition is to be used.
- B. Construction shall be in accordance with the following codes, standards, and regulations. The most stringent shall govern when discrepancies occur.
1. EM 385-1-1, U.S. Army Corps of Engineers Safety and Health Requirements Manual
 2. ETL 94-01, Standard Airfield Pavement Marking Schemes
 3. ETL 97-18, Guide Specification for Airfield and Roadway Marking
 4. MIL-HDBK-1008C, Fire Protection for Facilities Engineering, Design, and Construction
 5. MIL-HDBK-1190, Sept 1987, Facility Planning and Design Guideline
 6. National Fire Protection Association Fire Codes (NFPA)
 7. Cold Climate Utilities Manual, Canadian Society for Civil Engineering, 2050 Mansfield Street, Montreal, Quebec H3A 1Z2.
 8. ADOT&PF Standard Specifications for Highway Construction State of Alaska, Department of Transportation and Public Facilities
 9. AGA Manual, American Gas Association, Plastic Pipe Manual for Gas Service
 10. ASME B31.8, Gas Transmission and Distribution Piping System
 11. 49 CFR 192, Transportation of Natural and Other Gas by Pipeline
 12. AFH 32-1084, Facility Requirements
 13. AFP 32-1097, Sign Standards Pamphlet
 14. TI 814-03, Aug 1998, Water Distribution
 15. TI 814-10, Aug 1998, Wastewater Collection
 16. AFM 88-10 Vol.-1/TM 5-813-1, June 1987, Water Supply, Sources and General Considerations
 17. AFM 88-10 Vol.-5/TM 5-813-5, Nov 1986, Water Supply, Water Distribution
 18. AFM 88-11 Vol.-1/TM 5-814-1, Mar 1985, Sanitary and Industrial Wastewater Collection, Gravity Sewer & Appurtenances
 19. AFM 88-3 Chp.-7/TM 5-818-1, Oct 1983, Soils and Geology Procedures for Foundation Design of Buildings and Other Structures (other than Hydraulic Structures).
 20. AFM 88-5 Chp.-1/TM 5-820-1, Aug 1987, Surface Drainage for Airfields
 21. AFM 88-5 Chp.-4/TM 5-820-4, Oct 1983, Drainage Areas for Other than Airfields
 22. AFM 88-7 Chp.-5/TM 5-822-2, July 1987, General Provisions and Geometric Design for Roads, Streets, Walks, and Open Storage Areas
 23. AFM 88-7 Chp.-1/TM 5-822-5, June 1992, Pavement Design for Roads, Streets, Walks, and Open Storage Areas
 24. AFM 88-6 Chp.-8/TM 5-822-7, Aug, 1987, Standard Practice for Concrete Pavements
 25. AFM 88-6 Chp.-7/TM 5-822-11, June, 1993, Standard Practice for Sealing Joints and Cracks, Rigid and Flexible Pavements
 26. AFMAN 32-8008 Vol.-1/TM 5-825-1, Mar 1994, General Provisions for Airfield Pavements Design
 27. TM 5-853-1,2,3, May 1994, Security Engineering Design, Volumes 1, 2, & 3
 28. UFC 3-250-03, Standard Practice Manual for Flexible Pavement
 29. UFC 3-260-01, Airfield and Heliport Planning and Design
 30. UFC 3-260-02, Pavement Design for Airfields
 31. UFC 4-010-01, DOD Minimum Antiterrorism Standards for Buildings
 32. Uniform Federal Accessibility Standards, (UFAS); Federal Register. (FED-STD-795)

33. 18 AAC 72, State of Alaska, Department of Environmental Conservation (ADEC), Wastewater Disposal
34. 18 AAC 78, State of Alaska, Department of Environmental Conservation (ADEC), Underground Storage Tank Regulations
35. 18 AAC 80, State of Alaska, Department of Environmental Conservation (ADEC), Drinking Water Regulations
36. EAFB Standard Operation Procedures (SOP) for Waste Disposal and Borrow Pit Operations
37. Hazardous Materials and Waste Management Plan (HMWMP) for EAFB.
38. Contractor Guidance For Preparing and Executing Storm water Pollution Prevention Plans, ADOT&PF 2nd Edition 1993.
39. Geotechnical Findings Report for New Fuel Systems Maintenance Dock, Site 3 (ELM 179), Alaska, dated October, 2002 (see Appendices)
40. EAFB Utility Maps (see Appendices)

2.3.2 Minimum Requirements

- A. The Design-Build contractor's Civil Engineer(s) of Record shall be responsible for the civil design. Complete civil design shall generally include site work, earthwork, grading and drainage, roads and parking, airfield pavements, utilities, hazardous material, and coordination of any architectural, mechanical, and electrical site features although they may be shown on other disciplines' drawings. The civil design drawings and calculations shall be sealed by the engineer in responsible charge. The engineer shall be licensed as a civil engineer in the State of Alaska.

2.3.3 Scope and Objectives

- A. Site work shall consist of the complete design and construction of building site earthwork and grading, access roadways, parking areas, asphalt and concrete pavement sections for airfields, aircraft maneuvering areas, curbs and gutters, pedestrian walks, site utilities, fire protection requirements, security/lighting provisions, site drainage, and landscaping. The facility shall be completely usable with utility connections and other amenities as described in this document.
- B. Design shall take into consideration topography and natural characteristics of the area, including climatic conditions, prevailing winds, areas of snow accumulation, etc. It shall be the Contractor's responsibility to protect existing features, which include roads, utilities, sidewalks, paving, curbs, and similar items not in the contract work limits, which if damaged by the Contractor shall be replaced, in kind at no cost to the Government. Site work and utility designs shall provide a functional development requiring only routine maintenance through its design life. Emphasis shall be placed on positive drainage, separation of dissimilar soil materials, and minimizing heave and subsidence. Site planning, development and the Contractor's operations shall at all times take into consideration that other facilities bordering the site must remain fully operational during the performance of the work.

2.3.4 Sub-Arctic Climate

- A. Sub-arctic conditions exist at the Project Site. Winter temperatures in the range of -5 degrees C to -25 degrees C are common for extended periods every winter, and temperatures of -30 degrees C are periodically experienced for periods of several days.
- B. Snow begins accumulating in late September/October and does not begin to melt until March/April. It is common to have one meter of snow cover through mid March. The design analysis shall include written descriptions, accompanied by calculations as necessary, to show that all elements of the Civil Design are designed according to the principles and procedures of the Cold Climate Utilities Manual.

2.3.5 Topographic Survey

- A. The Project Site survey data of the proposed site location shows the topography, streets, utilities, and other surface features. The Contractor shall review and field verify the topographic survey information and be responsible for all additional survey(s) required to complete requirements of these documents.
 - 1. Project Survey Control. Survey monuments listed on the survey shall be used as the horizontal and vertical reference control points for work performed by the Contractor.
 - 2. Protection of Monuments. Existing survey monuments shall be protected during construction from movement and damage. Damaged monuments shall be replaced, to the original order of survey accuracy, at no cost to the Government.
 - 3. Not all underground utilities may be shown on the topographic survey provided. Contractor shall obtain utility locates prior to starting any earthwork.

2.3.6 Fire Protection

- A. New fire hydrants will be required at the project site. For the exterior fire protection system, Contractor shall install a looped water line around the new hangar building. Minimum water line size for the fire protection system shall be 200mm. Contractor shall determine number of hydrants required for this facility but shall install a minimum of four (4), one at each corner of the new facility. Locate hydrants so as not to interfere with aircraft maneuvering operations.
- B. Provide fire hydrants at each corner of the building. In addition, a fire hydrant shall be located within 45.7-m of the fire department building connection. Consideration shall be given to hydrant placement and the planned Fourth Maintenance Bay (Option 1). Fire hydrants shall be located so that they will not need to be relocated or additional hydrants needed when the Fourth Maintenance Bay is constructed and are accessible by fire fighting equipment.
- C. Fire hydrants shall be UL listed dry barrel type with breakaway flange and shall match in appearance and threading of those presently in use on the installation, Mueller or Amercian Darling. Hydrant laterals shall be 150-mm minimum size, and shall have an underground shutoff valve with an adjustable valve box in each lateral within 3 meters of the hydrant. Hydrants shall have their pumper outlet facing the street. Hydrants shall be located a minimum of 1 meter and a maximum of 2 meters from pavement with 610-mm from finished ground to top nut of hydrant and 460-mm to center of pumper connection. Break-away flange of hydrant barrel shall be located 100-mm maximum above finish grade adjacent to hydrant. Hydrants shall be painted Sorrel Brown. Provide bollards to protect hydrants that are located in traffic areas.
- D. Pressure and flow capacity of the existing water line is not available. Flow calculated from the Base hydraulic model indicates the 200mm line near building 8665 should flow about 101 l/sec @ 310 kPa residual pressure and 164 l/sec @ 138 kPa residual. Contractor shall perform a flow test after the new hydrants are installed to confirm the design.
- E. For the buildings internal fire suppression system, if water pressure from the mainline is inadequate, a booster pump will be required. See Part 2.8 - Fire Protection Design Criteria, for further fire protection requirements.

2.3.7 Force Protection / Antiterrorism

- A. The site requires force protection / antiterrorism as described herein and per UFC 4-010-01 requirements:
 - 1. Eliminate locations of concealment. Any recessed areas, concealed spaces, and landscape features on the exterior of the building shall be designed with security in mind. This includes well-lit alcoves, and avoidance of large objects in the landscape, etc.

- Creativity and common sense are required to provide interesting visual features while still providing a safe, accessible and secure environment.
2. Trash receptacles and dumpsters shall be located at least 25 meters from any building element.
 3. Windows shall be protected per Force Protection requirements, see architectural requirements Part 2.4.
 4. Site circulation and parking shall be designed to deter a vehicle from driving or parking closer than 25 meters to the building.
- B. A new perimeter fence will be installed in Spring 2003 by others. New fence will connect to the existing fence near intersection of Talley Avenue and Arctic Warrior Drive and continue along north side of Arctic Warrior Drive to Vandenberg Avenue, then north along Vandenberg Avenue to Davis Highway. A new vehicle gate will be installed at Truemper Loop that can be used to access the project site. A new gate will also be installed on the north end of Talley Avenue new the Davis Highway. Both gates may be used by the contractor to access the new Hangar site. No other permanent security fencing is anticipated for this project.

2.3.8 Site Layout and Design

- A. Requirements described herein and further defined in MIL-HDBK-1190, TM 5-822-2, TM 5-822-5, TM 5-820-1, TM 5-820-4, UFC 3-250-03, UFC 3-260-01, UFC 3-260-02, and Uniform Federal Accessibility Standards, shall be incorporated into the design. The site layout and design shall meet the minimum provisions of all applicable references outlined in Part 2.3.1 above.
- B. The Contractor shall confine proposed development to the project area as designated in these RFP documents.
- C. The limits of the project site and construction fencing are shown on the Site Survey, C-1, in Appendix 1.
 1. Site improvement locations and configurations shall conform to the general requirements as described herein these RFP documents. Provide handicap parking and accessible access to the building in accordance with Uniform Federal Accessibility Standards. See Architectural Part 2.4 for additional accessibility requirements.
 2. Protect existing utility lines when new pavements are constructed above them. When the depth of cover over utilities, structural load, or thermal regime is changed, the utilities shall be redesigned for the altered conditions. New underground utility lines (including utilidors, manholes, vaults, etc.) shall not be located under roads, streets, parking areas or drainage ditches, unless there is no practical alternative, and the Contracting Officer provides written approval.
 3. Sleeve all utilities including water, sewer, electrical, communication and natural gas utilities, new and existing, that cross under the new "Modified Tow-way".
- D. Provide paved transition of Frontage Road across new "Modified Tow-way". Maximum longitudinal gradient of the transition shall be 2 percent. Frontage Road is used for emergency and tow vehicles that operate along the runway.

2.3.9 Geotechnical

- A. The Design-Build contractor's Geotechnical Engineer of Record shall be responsible for preparing design recommendations. The foundation recommendation report shall be sealed by the engineer in responsible charge and shall be licensed as a civil engineer in the State of Alaska.

- B. A geotechnical findings report for this project has been provided by the Government, see appendix 5. It shall be the Contractor's responsibility to provide any additional fieldwork deemed necessary. The Contractor shall verify all government-furnished information. It is the Contractor's responsibility to investigate the subsurface soil conditions, ground water table and soil resistivity, etc. and obtain adequate geotechnical data to determine utility installation, trench sections and transition requirements, soil bearing capacity, foundation design, consolidation/settlement criteria, roadway or parking structural sections, trench dewatering, waterproofing design, footing design, caisson design and all other necessary site work geotechnical criteria to provide project requirements.
- C. Surface runoff that enters excavations may become contaminated if soils are contaminated. Dewatering of surface runoff from excavation shall include sampling and testing and treatment as required.
- D. Design and Analysis. The Contractor shall prepare a geotechnical design analysis for all work performed for this project. The geotechnical design analysis shall be submitted for review with the 35% design submittal. The analysis shall include evaluation of soils and liquefaction, bearing capacity analyses, settlement calculations, lateral earth pressures, temporary and permanent dewatering designs, foundation design, analysis of the effects of arctic climate including frost transition recommendations. Design shall be in accordance with TM 5-818-1, TM 5-822-5, and the Cold Climate Utilities Manual, followed by other references of choice. Organize the design analysis into Sections:
1. Site: Overall geotechnical analyses of the project sites.
 2. Buildings: Analysis and design of each foundation type for each building.
 3. Utilities: Analysis and design for each utility and buried utility system.
 4. Traffic systems: Analysis and design for each type of traffic system, i.e., street, parking area, aircraft parking and maneuvering, etc.
- E. Final Geotechnical Report. The Contractor shall submit five (5) copies of the final report, in booklet form, to the Contracting Officer within 30 days of the final earthwork activity. The final report shall be stamped and sealed by the Contractors Geotechnical Engineer. The report shall include:
1. The Contractors Geotechnical Design Analysis.
 2. Field Screen Information. Include the SAP, an explanatory narrative of the work performed, observations, typical photos, map showing the location and type of test(s), and a table of field screening and other test results that is updated as work proceeds.
 3. Compaction Test Plan and Data.
 4. Calibration of Equipment. List of equipment, copies of calibration curves and results of calibration tests for each, and observations on the correlation between field and laboratory tests results.
- F. Earthwork. Clean soil material from excavation that is in-excess-of project needs shall be transported and disposed of on-Base in accordance with the EAFB requirements for waste disposal and borrow pit operation. Coordinate with Base Civil Engineering, John Mahaffey (907) 552-7415, the point of contact for the on base landfill. All other debris shall be disposed of according to Paragraph 2.1.3C1, Disposal of Solid Wastes. All liability of any nature resulting from the disposal of the materials shall be the responsibility of the Contractor.
1. Borrow Source: Contractor shall comply with all aspects of EAFB requirements for borrow pit operations.
 2. Materials: Shall be classified in accordance with the Unified Soil Classification System and compaction efforts shall be specified by ASTM standards.
 3. Classified Fill and Backfill: Soil material used as classified fill and backfill shall be well-graded non-frost susceptible materials consisting of sand, gravel, broken stone, or similar material and containing not more than 60 percent by weight passing the No. 4 sieve. All material shall be free of frozen lumps. Material shall not exceed a size

- equaling 2/3 of the specified maximum lift thickness. Material within 600-mm of the surface shall not exceed 50-mm in diameter.
4. Non-frost Susceptible Soils: 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 C 117, ASTM C 136, ASTM D 75, and ASTM D 422.
 5. Subbase: Subbase, greater than 900-mm below finish grade, shall consist of non-frost susceptible (NFS) pit run gravel, sand, combination of these, or other approved NFS materials. Subbase within 900-mm of the finish grade shall consist of classified fill or backfill material, spread, processed, and compacted on the prepared subgrade or subbase.
 6. Base Course: Gradation shall conform to ADOT&PF Standard Specification for Highway Construction, Table 703-2, Grading D-1, except the percentage of particles by weight having diameters less than 0.02-mm shall be from 0 to 3 percent.

2.3.10 Operation of the On-Base Gravel Extraction Site

- A. General: The government will provide an on-base gravel extraction site for the Contractor to use. The Contractor is under no obligation to use the on-base gravel extraction site. The on-base borrow pit, which is under the jurisdiction of the base civil engineer and his/her technical representative, will be inspected on a regular basis for compliance with these specifications. Non-compliance with these specifications can result in the Contractor no longer being permitted to use the on-base borrow pit and the Contractor shall then be required to utilize an off-base borrow pit at no additional cost to the government.
- B. Gravel Extraction Site: The on-base borrow source shown on the drawings is available for the Contractor's use. The Contractor is responsible for performing the necessary testing to determine the usability and reject level of the aggregate mined from the gravel extraction site. The government makes no claims that the gravel extraction site will meet the specifications. If this source is used, aggregate shall be mined from the area designated by the Contracting Officer.
- C. Use of Off-Base Aggregate Sources: The use of off-base aggregate sources and off-base asphalt plants shall not constitute a change in contract price.
- D. Method of Operating the Gravel Extraction Site: The method of operating the gravel extraction site will be subject to approval in order to obtain materials conforming to the specified requirements, to insure utilization of available materials to the best advantage, and to avoid opening numerous small pits, or shallow pits over large areas. The pit shall be opened in such a manner as to expose the vertical faces of the deposit for suitable working depths. All strata and pockets of unsuitable materials overlaying or occurring in the deposit shall be stockpiled for reclamation as directed.
- E. Preliminary Approval: Preliminary approval of the gravel extraction site shall not mean that all materials found in the deposit will be acceptable and the right is reserved by the Contracting Officer to reject certain areas, strata, or channels within the areas and zones of the gravel extraction area, when in the opinion of the Contracting Officer, the material is unsatisfactory.
- F. On-Base Gravel Extraction Site: The contractor shall provide all of the required work for the development of the on-base gravel extraction site, which includes but is not limited to: clearing and grubbing, stripping and stockpiling of the overburden, field surveying to locate boundaries, stockpiling of the reject materials in the designated areas, and satisfactory drainage of the gravel extraction site. These items shall be considered as incidental operations to the gravel extraction process and will result in no additional cost to the Government.

- G. **Government Guarantee:** The Government does not guarantee that all the materials needed to meet the aggregate specifications will be available at the on-base gravel extraction site. Blend-sand which is required for the asphalt pavement is not available on-base. The Contractor shall immediately notify the Contracting Officer in writing of problems meeting the gradation requirements for aggregate.
- H. **Access Road:** The access road to the Gravel Extraction Site is a 3.6-meter wide earthen road. The Contractor shall provide dust control on this road. The Contractor may widen or otherwise upgrade this road using gravel from Gravel Extraction Site.
- I. **Use of the Gravel Extraction Site:** The Gravel Extraction Site shown on the drawings is the only authorized on-base source for this contract. The Contracting Officer will provide the specific location within the limits of the new gravel extraction area for the Contractor to set-up operation.
- J. **Stockpiling of Processed or Unprocessed Materials:** Due to the lack of cleared space in the borrow pit, the Contractor shall clear and grub and strip overburden for the additional cleared space required to stockpile material. Submit stockpile plan to the Contracting Officer for approval.
- K. **Stockpile of Processed and Unprocessed Materials:** All stockpile of processed and unprocessed materials shall be marked in the field with metal signage on metal posts with concrete base indicating type of material and project name. Keep separate piles for each type of material. All processed and unprocessed materials that are excess to this contract shall remain the property of the Air Force and shall be stockpiled neatly at the gravel extraction site.
- L. **Stockpiling of Clearing and Grubbing Material:** The clearing and grubbing material generated from the gravel extraction operation shall be neatly placed into the new boundary berms. The new boundary berms shall be 6 meters high with the sides sloped at 2 meters horizontal by 1 meter vertical and shall be placed along the boundary edges of the Gravel Extraction Site in the areas designed by the Contracting Officer. This material typically consists of brush-hogged trees, brush, grass, peat, organics, and the like. No unprocessed trees shall be used for the berms. All larger trees (greater than 100-mm diameter) shall be cut into 3-meter long sections and neatly piled at locations as directed by the Contracting Officer.
- M. **Stockpiling of the Overburden Material:** The overburden material generated from the gravel extraction operation shall be neatly placed into the new boundary berms. The new boundary berms shall be 6 meters high with the sides sloped 2 meters horizontal by 1 meter vertical and shall be placed along the boundary edges of the Gravel Extraction Site in the areas designated by the Contracting Officer. This material typically consists of sandy gravels with high levels of clays and silts.
- N. **Stockpiling of the Reject Material:** The reject material generated from the crushing or screening shall be stockpiled at locations as directed by the Contracting Officer.
- O. **Reject Material:** Reject material is defined as the uncrushed material generated by the crushing operation which is scalped off prior to being crushed and has no further use on this contract. When this material complies with the material specifications for classified soil, unclassified soil, subbase, pipe bedding soil, or the like, the Contractor may use this material for those items in this contract.
- P. **Excess Reject Material:** The excess reject material shall remain the property of the Air Force. Provide an access point to the reject.
- Q. **Gravel Extraction Plan:** Submit a Gravel Extraction Plan at 1:1000 scale to the Contracting Officer for approval, which includes the following: mining procedures, asphalt plant and

crushing plant layouts, other equipment layouts, stockpile locations and quantities, stripping locations, clearing and grubbing areas, 30 meter vegetation buffer, 6 meter high berm location, etc. At the completion of the mining, the Contractor shall submit to the Contracting Officer the following: the actual layout of the area mined with actual quantities of all materials extracted and the actual layout of the submitted Gravel Extraction Plan as indicated above.

- R. Gravel Extraction Site Work Hours: The gravel extraction site operation shall be limited to Monday through Sunday inclusive, between 0700 - 1800 hours, excluding federal holidays, unless approved otherwise in writing by the Contracting Officer. Provide proposed work hours and work schedule for the operation to the Contracting Officer for approval at least 10 days prior to starting work.
- S. Other Extraction Hours: Should the Contractor desire to work other than these hours, the Contractor must request approval of the deviation in writing at least 72 hours prior to the period of the intended deviation. The Contractor shall not accomplish the deviation in work hours unless permitted in writing or verbally by the Contracting Officer.
- T. Fuel Spills: On a weekly basis, the Contractor shall remove all fuel spill stains and all other POL spill stains generated by his operation from the gravel extraction floor and properly dispose of them as fuel contaminated soil at the Contractor's expense.
- U. Mining Operations
 - 1. Safe Mining Procedures: Contractor shall follow safe mining procedures IAW applicable State and Federal regulations, namely MSHA (Mining Safety and Health Administration).
 - 2. Signs: Contractor shall place metal signs (0.6 meter square, minimum) at all entrances to the gravel extraction site that say "DO NOT ENTER UNLESS AUTHORIZED BY THE BASE CIVIL ENGINEER".
 - 3. Extraction Site Maintenance: During the mining operation and upon completion of the mining operation, the Contractor shall make sure that the remaining vertical walls of the gravel extraction area that are mined do not exceed a height of 6 meters from the gravel extraction floor to the first bench level, from the first bench level to the second bench level, etc. The remaining vertical walls will be stepped upward and into the vertical face with a rise of 6 meters (maximum) and a run of 12 meters (minimum) for each 6-meter bench level up to the top of the vertical face. Submit benching plan to the Contracting Officer for approval. Limit excavation depth to approximately 3 meters above the groundwater table.
 - 4. Clear Zone, Scaling, Demobilization Requirements
 - a) Borrow Pit Operation: No portion of the borrow pit operation (including stockpiles and the boundary berms) shall extend into the Clear Zone of the airfield.
 - b) Scale of Material: The Contractor shall scale all loads of material leaving on-Base Gravel Extraction Site. The Contractor shall submit monthly running totals for each type of material (in metric tons) removed from the on-base gravel extraction site to the Contracting Officer and the base borrow pit engineer.
 - c) Demobilization: The Contractor shall demobilize from the "Gravel Extraction Site" not later than 30 days after completion of the work requiring use of the site.
 - 5. Final Clean-Up: Upon completion of the work covered by this contract, the Contractor shall leave the borrow areas and adjacent premises in a satisfactory condition, with free drainage to adjacent drainage area. Contractor shall level out the gravel extraction floor, filling in all holes, and leveling out all piles except for those stockpiled for future use. All spills shall be cleaned up.

2.3.11 Contaminated Soils

- A. The Contractor shall provide field screen soil sampling throughout the duration of excavation activities to determine if contamination is present in the soils. The site is not expected to be

contaminated. The Sampling and Analysis Plan (SAP) shall include the Field Sampling Plan (FSP) and the Quality Assurance Program Plan (QAPP). The Contractor shall immediately notify, by writing and phone, the CO if contamination is discovered. The Base Environmental Office shall be responsible for providing notification to ADEC. Contaminated soils procedures do not apply to the gravel extraction site operation. Contractor not required to provide field screen soil sampling at the gravel extraction site operation.

- B. Sampling and Analysis Plan (SAP). The Contractor shall prepare and submit a Sampling and Analysis Plan (SAP) to the Contracting Officer for approval. The SAP shall reflect the degree of complexity of the project and shall be composed of a Field Sampling Plan (FSP) and a Quality Assurance Program Plan (QAPP). The plans shall include method to be used for field screening and frequency of sampling. Field screening shall be utilized according to prudent, professional judgment. The Contractor shall exercise a high degree of control over field screening in conjunction with construction in order to adequately screen for POL contaminated soil.
- C. Equipment. The Contractor's shall use a Hydrocarbon Vapor (HV) test or other appropriate field test to qualitatively check for the presence or absence of soil contamination where visible stains are not apparent. The Contractor shall include in the SAP a description of the type of instruments selected, limits, action levels, procedures for testing, and training to use the instruments and interpret the data.
- D. Excavation and Handling of Contaminated Material. Screening of excavated soil shall be conducted during all excavating activities. Field screening shall be performed in accordance with the approved Sampling and Analysis Plan (SAP). If field-screening results indicate contaminated soils exists in the excavated material or is remaining in the excavation, additional field screening tests shall be used to delineate the boundary between clean soils and contaminated materials.
- E. Contaminated Soil Identification and Removal. When visual inspection, field screening, or commercial laboratory testing identifies contaminated soils, confirmation shall be accomplished through Contractor quality control (QC) samples and government quality assurance (QA) samples. QA and QC duplicate samples shall be collected at a rate of at least one per every ten non-duplicate samples collected. QC samples will be submitted as blind duplicates to the Contractor's laboratory. QA samples will be submitted to an independent laboratory selected by the Government.
- F. If contaminated soils are identified, the requirements and procedures of Appendix 20 (specification SECTION 02065 and 02111) shall be strictly followed.

2.3.12 Geotechnical Testing

- A. Compaction tests 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 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 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.
- B. Calibration of Equipment. Provide the manufacturer's recommended calibration procedures for each piece of test equipment.

- C. **Compaction Test Plan and Data.** The Contractor shall submit the initial compaction test plan to the Contracting Officer prior to beginning earthwork activities on the work item. Plan and Data shall include:
1. **Compaction Test Plan.** Shall show the exact location of each test. This plan shall be keyed to the test results.
 2. **Test Record.** The record of each test shall reflect the type of test procedure(s), the firm or person that performed the test, the project title and contract number.
 3. **Test Results and other Data.** Log and compile the results of each test and any observation made, and for compaction tests, the volume or unit weight of the standard, and the volume or unit weight of the compacted soil.
- D. **Type and Frequency of Tests.** 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. The area referred to hereinafter which determines the minimum number of tests required shall be an area that is compacted in one continuous operation.
- E. **Structural (Type 1) Compaction Tests.** The following density tests are required beneath structures with on-grade concrete floor slabs and footings and slabs. The number of tests shall apply to each layer of material placed.
1. **Compacted Area: 50-square meters or less.** A minimum of two tests or one test for each 12-square meters of area, whichever will provide the greatest number of tests.
 2. **Compacted Area: Between 50-square meters and 360-square meters.** A minimum of four tests.
 3. **Compacted Area: 360-square meters or greater.** One test for each 90-square meters of area.
- F. **Structural (Type 2) Compaction Tests.** The following density tests are required beneath footings for structures where the compaction requirements beneath footings and floor slabs vary. The number of tests shall apply to each layer of material placed.
1. **Continuous Footings:** One test for each 15-meters of continuous footing for walls over 30-meters long or a minimum of two tests per wall, whichever provides the greatest number of tests.
 2. **Column Footings:** One test per footing.
- G. **Utility Systems Compaction Tests.** The number of density tests required for backfill in utility trenches shall conform to the following:
1. **Bedding Layers under Utilities:** One test per 60-meters 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 90-meters 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 30-meters of trench, whichever provides the greatest number of tests.
- H. **Roadway, driveway, parking area, and aircraft apron, "Modified Tow-way", and maneuvering area (Size 1) Compaction Tests.** The number of density tests required for roadways and driveways up to 90-meters in length, and parking areas and aircraft apron and maneuvering area up to 550-square meters, shall conform to the following requirements for each layer of material placed:
1. **Subbase and Base Course:** A minimum of two tests or one test for each 20 meters of length or each 140-square meters of area, whichever provides the greatest number of tests.
 2. **Subgrade:** A minimum of two tests or one test for each 30-meters of length or each 200-square meters of area, whichever provides the greatest number of tests.

- I. Roadway, driveway, parking area, and aircraft apron, "Modified Tow-way", and maneuvering area (Size 2) Compaction Tests. The number of density tests required for roadways over 90-meters in length and parking areas and aircraft apron and maneuvering area over 550-square meters, shall conform to the following requirements for each layer of material placed:
 1. Subbase and Base Course: A minimum of four tests or one test for each 45-meters of length or 280-square meters of area, whichever provides the greatest number of tests.
 2. Subgrade: A minimum of four tests or one test for each 60-meters of length or 370-square meters of area, whichever provides the greatest number of tests.

- J. Gradation and Non-frost Susceptibility Tests. Tests shall be conducted on structural soil materials for structures, utility systems, and roadways, driveways, and aircraft maneuvering and parking areas. In-place structural soil materials shall be sampled and tested for gradation and non-frost susceptibility requirements at least once for every 750-compacted-cubic meters or portion thereof and for every change in borrow source. 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 materials.

2.3.13 Site Grading and Storm Drainage

- A. Requirements described herein and further defined in TM 5-822-2 and TM 5820-4 shall be incorporated into the design:
 1. Building Finish Floor Elevation. The Contractor shall establish the finish floor elevation of buildings to provide positive drainage away from the building. The Hangar bay entrance and approach shall be sloped a minimum of 2% away from the building for a distance of 6m and provide positive drainage around the building.
 2. Site Grading. Finish grade adjacent to the building shall be 150-mm below the finish floor elevation, except at doors. Site grading, parking and taxi areas, etc., shall be sloped to drain to the existing ditches. Non-paved drainage slopes away from the building shall be a minimum of 5.0-percent for a horizontal distance of 3-meters, and be graded 2.0-percent slope thereafter to existing and/or new (as necessary) drainage outfall collection point(s). Open areas, away from the building, shall also be graded 2.0-percent sloped to the existing drainage outfall system. Banks of earthwork cuts or embankments, ditches, etc, shall not be steeper than one (1) meter vertical in three (3) meters horizontal. The preferred slope for permanent banks and ditches is one (1) meter vertical in four (4) meters horizontal. Optimum desired slope for site grading is 2-percent. Minimum slope is 1.0-percent.
 3. Storm Drainage Design. New site drainage shall maintain predominant existing drainage patterns. Building site is not located within the 100-year floodplain. Storm drainage calculations, including runoff from adjacent properties, and discharge volume shall be based on a 10-year storm event. Additional ditches and culverts shall be provided on the site as necessary for positive drainage. Areas experiencing consolidated flow, roof drain outlets, roof drip lines, parking lots, drainage swales, etc. shall be designed with features to prevent erosion. Use of culverts should be minimized to avoid stoppage of flow due to ice damming and glaciation. If culverts are used, they should be oversized and/or means of thawing shall be provided.
 - a) Existing Drainage System. The Base storm drainage system is comprised of open grass lined ditches and culverts. Percolation ponds or infiltration trenches may be considered on the south side of the new facility for control of surface runoff.
 - b) Special care shall be taken to prevent ponding near Arctic Warrior Drive due to drainage and runoff changes caused by this project.
 - c) Contaminated Water. The design shall provide for collection and treatment of runoff from snow storage areas and from paved areas. The major concern is

- vehicular oils and sediment load. The design shall include calculations and references' showing the method of treatment provided is adequate.
- d) Construction Period. Runoff from within the project boundaries, during construction of the project, shall be the responsibility of the Contractor, including all NPDES permits (as necessary) or requirements. Silt laden or other environmental degrading waters shall be collected and treated prior to discharge from the project site to existing drainage system.
 - e) Preferred Methods. The preferred method of handling rain and snowmelt is overland gravity flow to grassy swales and collection ditches for filtering. The preferred method of treating runoff from parking lots and snow storage areas is allowing flow through grassy areas (land treatment). Runoff from roof drains and gutter collections systems must be directed away from buildings without causing winter glaciating or erosion. Insulated and heat traced drain lines may be required to direct runoff away from the building.
 - f) Storm water Pollution Prevention Plan. Contractor shall prepare and submit to ADEC and the Contracting Officer for review a SWPPP and conduct all construction activities in accordance with the approved plan. The plan shall, as a minimum, include the following items: methods for clearing/grubbing, temporary erosion and sediment control measures, Best Management Practices (BMP's) on-site, excavation/embankment construction, temporary and permanent drainage features, haul roads/material stockpile sites, construction in and around water bodies/existing drainage features, containment control, cleanup and disposal methods of petroleum products or other hazardous substances generated by construction equipment or activities. The plan shall also address BMP's for post-construction activities and operation of the facility. Contractor is responsible for all fees associated with the NPDES, SWPPP, and ADEC review and permits.

2.3.14 Vehicular and Aircraft Traffic Systems

- A. General Design. Includes access roadways, parking areas, "Modified Tow-way", and aircraft apron, taxi ways, and maneuvering areas. The Contractor shall layout traffic improvements to be functional to the users, with strong emphasis on safety. Traffic systems shall be designed and constructed to the provisions of MIL HDBK-1190, and to provide accessibility for the handicapped in accordance with Uniform Federal Accessibility Standards. The geometric layout and pavement section of each type pavement or traffic system shall be designed in accordance with AFH 32-1084, UFC 3-260-01, UFC 3-260-02, UFC 3-250-01, UFC 3-250-02, UFC 3-250-03, UFC 3-260-2, TM 5-822-2, TM 5-822-5, TM 5-825-1.
 - 1. All paving areas shall be cleared and stripped to clean material that is free of organic materials and other debris. The pavement section for access roads shall be designed in accordance with TM 5-822-5.
 - 2. Asphalt Surfacing. All roadways, circulation areas, "Modified Tow-way", and aircraft maneuvering areas shall be asphalt surfaced. Pavement structural section for aircraft shall be designed for Medium Load, Type A airfield pavements per AFH 32-1084. All materials used in AC Pavement, PCC Pavement, and PCC sidewalk shall conform to the requirements of applicable AFM, TM, and UFC requirements. Layer thickness shall be according to the geotechnical design, however, the thickness of the base course layer shall be no less than 150-mm and the thickness of asphalt layer shall be no less than 50-mm in non-aircraft traffic areas. In aircraft traffic areas, minimum base thickness shall be 150-mm and the minimum thickness of asphalt layer shall be 100-mm. Base course material shall have less than 3% fines smaller than 0.02-mm. Asphalt concrete mix design shall comply with EAFB standards for gradation, SBS asphalt content and aggregate fracture count.
 - a) New aircraft "Modified Tow-way" from south end of north-south runway shall align with southern most cross over to the south ramp, identified on the site plan as

T/W 'D3'. New "Modified Tow-way" shall be designed and constructed to the geometric requirements for a "Tow Way" per UFC 3-260-01 EXCEPT minimum paved width shall be 23-m. Full structural pavement section shall be provided for the 23-m paved width.

- b) The intent of the design and construction of the "Modified Tow-way" for this project is to be able to add paved shoulders in the future and have a usable taxiway without having to modify the pavement, base, subbase or subgrade of the "Modified Tow-way".
3. Concrete Surfacing. All aircraft apron and parking areas, including hangar floor, shall be reinforced or plain concrete. Pavement structural section for aircraft shall be designed for Medium Load, Type A airfield pavements per AFH 32-1084. All materials used in reinforced concrete pavements shall conform to the requirements of applicable AFM, TM, and UFC requirements. Layer thickness shall be according to the geotechnical design, however, the thickness of concrete section shall be no less than 225-mm in aircraft apron and parking areas. Base course material shall have less than 3% fines smaller than 0.02-mm.
4. Emergency vehicle and fire truck access shall be provided on all sides of the facility. Access surface shall be paved with asphalt concrete, minimum 6.1-m wide and shall accommodate a fire truck with a 12.2-m turning radius.
5. Transverse Gradients. Roads and parking areas shall have gradients in accordance with TM 5-822-2 and TM 5-822-5. Gradients shall not exceed a maximum 3.0-percent slope due to winter ice conditions and in no case be less than 0.5-percent, to avoid ponding. Grades for aprons, taxiways, and modified tow ways shall be in accordance with applicable Air Force design manuals.
6. Pavement Markings. Pavement shall be marked according to ETL 94-01 and ETL 97-18 for aircraft maneuvering. Minimum markings shall be provided for pavement edges, hold short line and centerline maneuvering for F-15 and F-22 aircraft. Pavement marking material shall conform to Corps of Engineering standards.
7. Snow Removal and Storage. Snow removal and convenient storage shall be considered in the design and layout of all roadways, parking and sidewalks. Snow removed from access roadways, parking lots, airfield pavements, and sidewalks shall be stored on site. Grader and front-end loaders are used to remove snow. Snow storage shall be convenient to the removal area without excessive haul distances. Provide adequate storage for a heavy snow year assuming a maximum seasonal snow depth of 2-meters on all streets, driveways, walks, and parking lots.

2.3.15 Pedestrian Traffic Systems

- A. Design and geometric layout shall be in accordance with TM 5-822-2. Facility shall provide accessibility for the handicapped in accordance with Uniform Federal Accessibility Standards. Provide concrete sidewalks for access to the buildings. Consider both vehicular and pedestrian circulation in design of pedestrian traffic systems.
 1. Sidewalks. Concrete sidewalks shall extend from all building entrances nearest vehicle access area. Sidewalks shall be a minimum of 1525-mm wide except where handicapped access requirements dictate greater width. Transverse slope of sidewalks shall be 2.0-percent minimums and 3.0-percent maximum, except where requirements for handicapped access govern.
 2. Handicap Access. See architectural Part 2.4 for accessibility requirements.

2.3.16 Utility System

- A. Before beginning work, the Contractor shall become familiar with all existing utility systems, to verify the location of existing utilities and other information shown on Appendix drawings. The Contractor is responsible for supplementing government provided information as necessary to design and construct new work.

- B. All utilities shall be designed and constructed in accordance with EAFB standards and the criteria contained herein. Electric power lines and communication cables shall be installed according to the Electrical Design Criteria. The materials and equipment to be furnished under this specification shall be the standard product of the manufacturer. Where two or more units of the same item, type, or class of equipment are supplied, these units shall be from a single manufacturer.
- C. The Contractor shall notify the Contracting Officer before a utility tie-in is required. See Appendix 14 for EAFB REQUIREMENTS for utility outages. The notification shall be made a minimum of 10-days before tapping the line. Utility system shutdown(s) for tapping/tie-in(s) shall be made within a four (4) hour planned utility outage. The Contractor shall submit a work plan for utility tie-in/tap work prior to beginning the specified utility work. Connections between new work and existing utility mains shall be made with standard fittings, specials, using methods for on-site conditions and Manufacturers recommendations. The Contracting Officer shall approve the method of constructing connections under pressure before work begins. Contractor shall make provisions to provide temporary utilities to all facilities affected by outages longer than four (4) hours in duration.
- D. The Contractor shall design the piping system with pipe anchors, thrust restraint, and provisions for expansion/contraction.. The Contractor shall fully design these items, determining the number needed and the location of each.
- E. It is the Contractor's responsibility to design and construct all new mainline extensions and utility services for the new buildings.
- F. In addition to NPDES/Temporary Erosion and Pollution Control requirements, as specified herein, various elements of Post utility work may require ADEC review(s) and/or approval(s) in accordance with 18 AAC 80 and 18 AAC 72. If required, per the scope of the project improvements, Contractor shall confirm ADEC approval/permit requirements; submit and obtain all necessary ADEC approvals prior to beginning any work. As a minimum, ADEC permits may be required for the water and sewer utility installation.

2.3.17 Utilities (Sewer, Water and Gas)

- A. General: The Contractor shall notify the Contracting Officer before a utility tie-in is required. The notification shall be a minimum of 10 days prior to tapping the line. All utility connections shall be coordinated through the Contracting Officer.
- B. Contractor's Responsibility: It is the Contractor's responsibility to confirm the specific locations of the existing utilities and to design and construct new utility services to provide water supply, including the fire protection requirements, sanitary sewage and natural gas for the new building. The water and sewage systems shall be designed and constructed in accordance with the criteria contained herein and shall also conform to Alaska Department of Environmental Conservation (ADEC) requirements, as applicable.
- C. Utility Lines: All utility lines installed shall have a plastic marker tape (minimum 150-mm wide by 0.1-mm installed 200-250-mm below grade). The plastic marker tape shall include a metallic wire for detection purposes and shall bear a continuous printed inscription describing the type of utility line buried below.
- D. Sanitary Sewer:
 - 1. Sanitary Sewer design, construction and leakage testing shall conform to the National Standard Plumbing Code. Pipe materials and joints shall conform to the applicable ASTM, ANSI or other Standard as appropriate.

2. The Contractor shall provide a new sewer line from the building to an existing sewer main. The nearest sewer line is located on the east side of Vandenberg Avenue.
3. The Contractor shall verify inverts and capacities. The existing lift station in Vandenberg Avenue is assumed to have the capacity to handle the increased flow from this facility.
4. Routing of the new line and locations of required appurtenances shall be designed by the Contractor and approved by Alaska Department of Environmental Conservation (ADEC) and the Contracting Officer (CO).
5. The gravity sewer laterals shall be minimum 150-mm with a minimum slope of 0.6 percent. Manholes shall be placed at all angles and intersections. Manholes shall not be located in the roadways or parking lots, but in areas that are readily accessible for operation and maintenance purposes. All sanitary sewers shall be straight alignment between manholes.
6. If a pressure force-main sewer line is required, minimum 100-mm line shall be used. Clean-outs shall be installed on the pressure line at 90-m spacing. Coordinate with mechanical section 2.6.8.
7. The Contractor shall coordinate all work on existing sanitary sewer lines with the Contracting Officer (CO).
8. Maintain minimum flow velocity of 610-mm per second for average flow.
9. All sewer pipe shall be High Density Polyethylene (HDPE) and protected from freezing. All sewer lines less than 2.7 meters deep shall receive adequate pipe insulation to prevent freezing. Pressure force-mains shall be buried 3.05-m.

E. Water Distribution

1. Water distribution shall be designed and constructed in accordance with local standards and codes. The mains shall be designed and installed in accordance with NFPA 24 and applicable AWWA Standards. The service lines shall be designed in accordance with the National Plumbing Code and applicable AWWA Standards. A tee and gate valve shall be installed at the point of connection to the main. Mains and piping shall be disinfected in accordance with AWWA Manual C-651.
2. Replace approximately 85-m of existing 300-mm cast iron water line where the existing line crosses under the new "Modified Tow-way" alignment with new 300-mm ductile iron water line. Center new water line section on center of "Modified Tow-way". Existing cast iron pipe uses lead joints.
3. Water distribution shall be of adequate size to provide adequate quantity at sufficient pressure of potable water to satisfy both facility domestic and fire flow requirements. Water demand shall be in accordance with MIL-HDBK-1008C and local standards and codes.
4. Facility pressure shall be a minimum of 1.4 kPa. System design shall provide a minimum residual pressure of 1.4 kPa at each fire hydrant. Water main shall be of appropriate capacity to provide the required fire flow and duration. Contractor to verify availability of water pressure and flow before designing water distribution system.
5. All plugs, caps, tees, bends, and hydrants on water mains and hydrant laterals shall be provided with reaction backing or movement prevented by attaching metal tie rods or clamps.
6. Water mains and services shall be separate from parallel sanitary sewers by 3 meters, center to center. If water line and sanitary sewer cross, sewer pipe shall be concrete-encased 3 meters on each side of crossing.
7. Water lines shall have a minimum cover of 3 meters. Service lines shall be protected from freezing. All water lines, service and fire protection, shall enter the building from below the foundation and slab. No entry from outside of the building above grade is allowed. Water lines under the building must be ductile iron with restrained joints. "Megalug" joints are not allowed. Transition from HDPE to ductile iron shall be made at the 1.5m line from the building.
8. All water lines shall be HDPE (except for the replacement line under the new "Modified Tow-way") and protected from freezing.

9. Provide an indicator post with lockable handle for the valve on the supply line to the building. The valve with the designation "PIV" shall be equipped with indicator post conforming to the requirements of NFPA 24. Operation shall be by a wrench, which will be attached to each post. The post indicator valve shall be no closer than 12 meters to the building. Protect PIV with bollards.
10. Conductive Tracer Wire: Where polyethylene pipe is installed, a copper tracer wire (No. 8 stranded copper wire with insulation) shall be installed on the new pipe to later permit use of locating devices. The conductive wire shall be looped around the pipe every 3 meters, and securely taped to pipe every 3 meters. Where the tracer wire exits the ground next to a valve box or fire hydrant, the tracer wire shall be attached to the valve box or the hydrant using a 316 stainless steel band. Tracer wire shall be tested for continuity and approved before acceptance.

F. Natural Gas Distribution:

1. Underground natural gas piping shall be HDPE Drisco 8000 only, to be compatible with existing Base piping. Connect to the existing HDPE 150-mm line along Vandenberg Avenue with a hot tap and install an isolation valve. Mainline pressure is 410 kPa.
2. All gas piping and equipment shall be installed in conformance with manufacturer's recommendations and applicable sections of ASME B31.8, AGA Manual and 49 CFR 192
3. Steel pipe riser shall be used to transition from underground piping to above ground. All steel pipe shall have a thermoplastic resin protective coating.
4. Gas pipe shall be sleeved under all roads, railroads, taxiways and paved areas. Sand bedding or suitable pipe support shall be provided for gas pipe through the sleeve.
5. Conductive Tracer Wire: Where polyethylene pipe is installed, a copper tracer wire (No. 8 stranded copper wire with insulation) shall be installed on the new pipe to later permit use of locating devices. The conductive wire shall be looped around the pipe every 3 meters, and securely taped to pipe every 3 meters. Where the tracer wire exits the ground next to a valve box or fire hydrant, the tracer wire shall be attached to the valve box or the hydrant using a 316 stainless steel band. Tracer wire shall be tested for continuity and approved before acceptance.
6. Valves shall only be located in valve boxes or inside buildings.
7. Provide all fittings, valves, meters, regulators and other required equipment for a complete and usable system.

2.3.18 Miscellaneous

- A. Dumpster Storage Area. Provide a screened, concrete, central dumpster storage pad with adequate room for truck access. Dumpster pad shall be reinforced concrete sized for one (1) standard size dumpster of the type used at the Base and adequate room for access of the dumpster loading truck. At a minimum, screening shall be chain link fencing with privacy slats. Privacy slats shall be Sorrel Brown in color. Vehicle access to the pad shall be designed for a standard garbage truck and shall be asphalt surfaced as described for roads and parking lots. Dumpster storage area shall be located a minimum of 25m from any building.
- B. Electrical Transformer Pad. The electrical service pad mounted transformer is to be screened with an architectural screen that blends aesthetically with the facility. A chain link gate with vertical slats for visual screening shall provide maintenance access. Transformer and privacy slats shall be painted Sorrel Brown. The transformer shall be located a minimum of 10-m from the building per force protection requirements.
- C. Signs. Provide street and building signs in accordance with AFP 32-1097 and Base standards. Provide building and parking area identification signs at all buildings.

2.3.19 Government Betterments

- A. The Government-Proposed Betterments listed in 01010 Part 1.5 shall conform to the criteria outlined above.

2.3.20 D/B Contractor-Proposed Betterments

- A. All D/B Contractor-Proposed Betterments shall conform to the performance criteria outlined above.

2.3.21 Prohibited Items

- A. Prohibited items shall be those that do not meet the minimum requirements already listed.

PART 2 MINIMUM DESIGN CRITERIA

2.4 ARCHITECTURAL DESIGN CRITERIA

2.4.1 Building Design and Building Systems – General

- A. Construction Summary – the D/B contractor is responsible for preparing a building code study that supports the design criteria and the proposed building design in full compliance with the codes and standards referenced in this RFP. In case of conflicting requirements, ETL-01-2 supercedes MIL HDBK 1008C; MIL HDBK 1008C supercedes the 2000 International Building Code (IBC).
1. Construction Type – IBC Type II-B Sprinklered, minimum
 2. Occupancy – H-3 (Hangar Space), B (Offices)
 - a) 2-hour occupancy separation per IBC Table 302.3.3 and note “a”.
 3. Table 503 – Allowable Building Heights and Areas: maximum height - 3-stories, 16.76 meters (55’); maximum area - 1300 square meters (14,000 square feet).
 - a) Height modification per exception in paragraph 504.1 - Unlimited height for sprinklered single-story aircraft hangar buildings.
 - b) Area modifications per Sections 506 and 507.
 4. Table 601 – Types of Construction and Fire Resistive Requirements: exterior bearing walls, interior bearing walls, non-bearing exterior walls, structural frame, permanent partitions, floors and floor ceilings, roofs and roof ceilings – no requirement.
 5. Mezzanines per Section 505.
 6. Design wind load – 45 meters/second, exposure “C”.
 7. Roof system shall meet Factory Mutual I-90 Wind Uplift Standards for wind speeds up to 160 kph (100 mph).
 8. NFPA 101 Section 40.6.2 – maximum travel distance to nearest exit is 30.5 meters (100’). Section 40.6.3 – maximum distance to means of egress from mezzanine floor is 75 feet. Section 40.6.4 – prohibits dead-end corridors in hazardous use spaces.
 9. ETL 01-2 – Blast Protection Wall – between Maintenance Bay and support areas, one-hour fire rated construction and 45-minute fire rated door and window openings.
- B. Anti-Terrorism Standards Summary - see paragraph 1.3.2.C for requirements.
- C. Summary of Clearance Requirements and Quantity Distances (QD) for Permanent Structures; see Appendix documents for detailed requirements:
1. Q/D Arc at Hardstands – 45.72 meters (150 feet) to any permanent structure.
 2. Q/D Arc from Future Development to the North – 410 meters (1,250 feet) for aircraft carrying explosive munitions: window glazing on the north elevation of the new Hangar shall be kept to the minimum required for building functionality.
 - a) Any glazing facing north shall comply with AFMAN 91-201 paragraphs 4.17.8 and 4.31.
 3. Fire Lane Access – 6.1 meters (20’-0”) wide all sides of building
 4. Modified Tow-Way Centerline Clearance to Building – 19.05 meters (62.5 feet); Hangar may be positioned at the edge of the 38.1 meters (125 feet) wide modified tow-way.
 5. Maintenance Bay operation, structural clearances, and required door clearances shall accommodate F-22 and F-15 aircraft inside the Maintenance Bay. Structural elements and building mounted equipment shall not encroach on required clearances.
 - a) See clearance diagram attached to Maintenance Bay room criteria sheet.
 - b) Hangar aircraft doors shall allow 3050 mm (10’) wing-tip clearance, and 1525mm (5’) vertical clearance: F-22/F-15 aircraft door clear opening shall be 7.92 meters (26’-0”) high, 19.66 meters (64.5’ feet) wide.
- 2.4.2 Summary of Functional Building Requirements – see Technical Requirements, Appendices, and Room Criteria Sheets for more detailed information.

- A. Offerors are not constrained in the physical arrangement of the (3) Maintenance Bays plus the future expansion 4th Maintenance Bay. Room Criteria Sheets in SECTION 01010 Part 3 detail the specific requirements for all areas.
 - 1. The 3rd CRS has no preference on how aircraft are towed into the building, i.e., "nose-in" versus "tail-in". The "nose-in" configuration requires an exit for the tug vehicle at the rear of the Maintenance Bay.
 - 2. Up to two Maintenance Bays may be served by one aircraft door; building design shall address excessive heat loss caused by oversize doors.
 - 3. The Option 2 Hardstands shall not be positioned directly in front of the Maintenance Bay doors, allowing emergency aircraft evacuation without obstruction. The hardstands might best be located across the Tow-way from the Hangar.
 - 4. Spaces not used by the 3rd CRS crew such as: Fire Pump/Foam Storage, Boiler Room, Generator Room, Electrical Room may be co-located and positioned away from the office spaces with separate access.
 - 5. The Office/Dispatch functions must have good visibility to all Maintenance Bays, 2nd floor location is acceptable.
- B. Provide paved area under building eave or with a canopy to shelter service vehicles such as: servicing carts, snow plows, bobcat. Overall size shall be 65 square meters (700 square feet) and 3350 mm high (11'-0") clearance. See picture of current exterior storage at Hangar 10 in Appendix 5 which illustrates an acceptable solution.
- C. The Main Entrance to the facility must comply with the Elmendorf AFB Architectural Compatibility Study, dated November, 2001; see Appendix 3.
- D. Mezzanine space in Maintenance Bays above utility spaces and office spaces may be utilized for storage, equipment access, or staffed supervision areas:
 - 1. Floor/Ceiling assembly creates a lid on the B-occupancy support spaces, and shall be part of the 1-hour rated occupancy separation between B and H-3 occupancies. Assembly shall include steel deck with concrete fill to achieve blast resistance.
 - 2. Ceiling framing shall be sized for storage use and surfaced for foot traffic. Design floor/ceiling for future upper level office space. When constructed for occupancy, future office space will be separated from the Maintenance Bay by a 1-hour rated blast protection masonry wall extending to the roof deck.
 - 3. Provide steel Mezzanine access stair with slip resistant treads.
- E. Acoustical design of building walls and partitions will meet or exceed the minimum criteria defined in the Room Criteria Sheets area for all program areas. FIIC 57 (Field Impact Isolation Class), and FSTC 52 (Field Sound Transmission Class). Telephone, cable, outlets, ducts, and any other penetrations must not compromise acoustical integrity of wall assemblies. Offerors are encouraged to use acoustical and space planning to minimize intrusive exterior noise, equipment vibration, and noise transfer to office functions where possible.
- F. Natural lighting shall be designed to enhance occupied interior spaces. The Hangar functions will benefit from additional visibility that daylight delivers. Space planning shall address delivery of daylight to circulation and staff areas. Operable windows in staffed areas are preferred over fixed pane units.
- G. Concrete-filled pipe bollards are required to protect building corners, openings, exterior equipment, and doors from vehicle traffic.

2.4.3 References and Standards:

- A. The publications listed below form the standards of material and workmanship in construction. Refer to each discipline for additional references. The most stringent shall govern when discrepancies occur.
1. AAMA American Architectural Manufacturer's Association Guide Specifications Manual
 - a) 608-1977 Methods for Electrolytically Deposited Color Anodic Finishes
 - b) 1503 Method for Thermal Transmittance and Condensation Resistance of Windows, Doors, and Glazed Wall Sections
 2. AATCC American Association of Textile Chemists and Colorists
 - a) 134-1996 Electrostatic Propensity of Carpets
 3. ADAAG American Disabilities Act Accessibility Guidelines
 4. AISC American Institute of Steel Construction
 - a) Specifications for Structural Steel Buildings
 - b) S334L-1993 Metric Load and Resistance Factor Design
 - c) S335-1989 Specification for Structural Steel Buildings
 - d) Allowable Stress Design, Plastic Design
 5. AISI American Iron and Steel Institute
 - a) 1996 – Cold-Formed Specification and Commentary for the Design of Cold-Formed Steel Structural Members
 - b) 1996 – Cold-Formed Steel Design Manual
 6. ANSI American National Standards Institute
 - a) A 151.1 Test Procedure and Acceptance Criteria for Physical Endurance
 - b) A 208.1 1999 Particleboard Material Formed Woods
 - c) A 224.1 Test Procedure and Acceptance Criteria for Prime Painted Steel Surface for Steel Doors and Frames
 - d) A 250.8 – 1998 Recommended Specifications for Standard Steel Doors and Frames
 - e) Z 97.1 – 1984 (1994) Safety Performance Specifications and Methods of Test for Safety Glazing Material Used in Buildings
 7. ANSI/AWS D 1.4 – 1992 Welding Reinforcing Steel, Metal Inserts and Connections in Reinforced Concrete Construction; Structural Welding Code – Reinforcing Steel
 8. ASTM American Society for Testing and Materials
 - a) A 36M – 2000 Standard Specification for Structural Carbon Steel
 - b) A 53M – 1996 Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
 - c) A 123M – 2000 Standard Specification for Zinc (Hot Dipped Galvanized) Coatings on Iron and Steel Products
 - d) A 153M – 1982 (R 1987) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
 - e) A 167 – 1999 Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
 - f) A 307 – 1988 Steel Bolts and Studs, 60,000psi Tensile Strength
 - g) A 325 – 2000 Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 KSI Minimum Tensile Strength
 - h) A 463/A 463M Standard Specification for Steel Sheet, Aluminum Coated, by the Hot-Dip Process
 - i) A 500 – 1999 Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
 - j) A 570M – 1998 Standard Specification for Steel, Sheet and Strip, Carbon, Hot-Rolled, Structural Quality
 - k) A 653M – 2000 Zinc-Iron Alloy (galvannealed) by the Hot-Dip Process
 - l) A 792M Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process, General Requirements for
 - m) A 924M Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
 - n) B 117 Standard Practice for Operating Salt Spray (Fog) Apparatus

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- o) B 221 Standard Specification for Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric)
- p) C 33 Concrete Aggregate
- q) C 36M – 1999 Gypsum Wallboard
- r) C 79M – 2000 Treated Core and Nontreated Core Gypsum Sheathing Board
- s) C 109M – 1999 Compressive Strength of Hydraulic Cement Mortars
- t) C 144 – 1999 Standard Specification for Aggregate for Masonry Mortar
- u) C 150 – Standard for Portland Cement
- v) C 215 Standard Test Method for Fundamental Transverse, Longitudinal, and Torsional Frequencies of Concrete Specimens
- w) C 236 Steady-State Thermal Performance of Building Assemblies by Means of a Guarded Hot Box
- x) C 272 Standard Test Method for Water Absorption of Core Materials for Structural Sandwich Construction
- y) C 348 Test Method for Flexural Strength of Hydraulic Cement Mortars
- z) C 474 – 1997 Joint Treatment Materials for Gypsum Board Construction
- aa) C 475 – 1994 Gypsum Wallboard Joint Compound and Joint Tape for Finishing Gypsum Board
- bb) C 494M Chemical Admixtures for Concrete
- cc) C 518 Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
- dd) C 531 Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, and Monolithic Surfacing and Polymer Concretes
- ee) C 578 Specification for Rigid, Cellular Polystyrene Thermal Insulation
- ff) C 630 – 2000 Water-resistant Gypsum Backing Board
- gg) C 635 - 2000 Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and for Lay-in Panel Ceilings
- hh) C 636-96 Standard Installation of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings
- ii) C 834 – 2000 Specification for Latex Sealants
- jj) C 840 Standard Specification for Application and Finishing of Gypsum Board
- kk) C 882 Standard Test Method for Bond Strength of Epoxy-Resin Systems Used with Concrete by Slant Shear
- ll) C 920 – 1998 Standard Specification for Elastomeric Joint Sealants
- mm) C 1028 Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method
- nn) C 1036 – 1992 (1997) Standard Specification for Flat Glass
- oo) C 1047 Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base
- pp) C 1107 - 1999 Specification for Non-shrink Grout
- qq) C 1172 Standard Specification for Laminated Architectural Flat Glass
- rr) D 226 – 1997a Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
- ss) D 522 Mandrel Bend Test of Attached Organic Coatings
- tt) D 822 Conducting Tests on Paint and Related Coatings and Materials Using Filtered open-Flame Carbon-Arc Exposure Apparatus
- uu) D 968 Abrasion Resistance of Organic Coatings by Falling Abrasive
- vv) D 1211 Standard Test Method for Temperature-Change Resistance of Clear Nitrocellulose Lacquer Films Applied to Wood
- ww) D 1308 Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes
- xx) D 2247 Practice for testing Water Resistance of Coatings in 100% Relative Humidity
- yy) D 2794 Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)

- zz) D 2842 Standard Test Method for Water Absorption of Rigid Cellular Plastics
- aaa) D 2843 – 1999 Standard Test Method for Measuring the Density of Smoke from the Burning or Decomposition of Plastic
- bbb) D 3273 Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environment Chamber
- ccc) D 3363 Test Method for Film Hardness by Pencil Test
- ddd) D 4397 Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications
- eee) D 4637 EPDM Sheet Used in Single-Ply Roof Membrane
- fff) E 84 – 2000a Standard Test Method for Surface-Burning Characteristics of Building Materials
- ggg) E 90 – 1999 Laboratory Measurement of Airborne Sound Transmission Class (STC) Loss of Building Partitions
- hhh) E 108 Standard Tests Method for Fire Tests of Roof Coverings
- iii) E 119 – 2000 Standard methods for Fire Tests of Building Construction and Material
- jjj) E 283 Test Method for Determining the Rate of Air Leakage through Exterior Window, Curtain Walls, and Doors under Specified Pressure Differences Across the Specimen
- kkk) E 330 Standard Test Method for Structural Performance of Exterior Window, Curtain Walls, and Doors by Uniform Static Air Pressure Difference
- lll) E 331 Standard Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference
- mmm) E 336 – 1997 Method for Measurement of Airborne Sound Insulation in Buildings
- nnn) E 413 – 1987 (1999) Rating Sound Insulation
- ooo) E 648 Standard Test Method for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source
- ppp) E 662 Test Method for Specific Optical Density of Smoke Generated by Solid Materials
- qqq) E 773 Standard Test Method for Accelerated Weathering of Sealed Insulating Glass Units
- rrr) E 774 Standard Specification for the Classification of the Durability of Sealed Insulating Glass Units
- sss) E 814 – 2000 Method for Fire Tests of Through-Penetration Fire Stops
- ttt) E 1264 Standard Classification for Acoustical Ceiling Products
- uuu) F 476 – 1984 Test Methods for Security of Swinging Door Assemblies
- vvv) F 1303 Standard Specification for Sheet Vinyl Floor Covering with Backing
- www) F 1861 – 1998 Standard Specification for Resilient Wall Base
- xxx) G 23 Practice for Operating Light-Exposure Apparatus (Carbon-Arc Type) with and without Water for Exposure of Non-metallic Materials
- 9. AWI Architectural Woodwork Institute - Architectural Woodwork Quality Standards
- 10. AWS American Welding Society
 - a) A5.1 – 1991 Specification for Carbon Steel Electrodes for Shielded Metal Arc Welding
 - b) D1.1 – 1988 Structural Welding Code Steel
 - c) WHB-01 – 1987 Welding Handbook, Volumes 1 thru 5 (8th Edition)
- 11. BHMA Builders Hardware Manufacturers Association
 - a) A 156.4 Door Controls and Closers
 - b) A 156.6 Architectural Door Trim
- 12. CFR Code of Federal Regulations
 - a) 29 Part 1926 Safety and Health Regulations for Construction
 - b) 29 Part 1926 Subpart C – General Safety and Health Provisions
 - c) 29 Part 1926 Subpart T – Demolition
 - d) 16 CFR Part 1201 Safety Glazing Safety Standard for Architectural Glazing Materials

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- e) 49 CFR 101-19.6 Uniform Federal Accessibility Standards
- 13. CISCA Ceiling and Interior Systems Construction Association - Acoustical Ceilings Use and Practice
- 14. COE Corps of Engineers
- 15. CRI Carpet and Rug Institute
 - a) Carpet Specifiers Handbook
 - b) Standard for Installation of Textile Floor Covering Materials
- 16. DOD - Department of Defense Specifications
 - a) DOD-P-21035 (Rev. B) Paint, High Zinc Dust Content, Galvanizing Repair (Metric)
- 17. GANA Glass Association of America Energy Standards Manual
 - a) Glazing Manual
 - b) Sealing Manual
- 18. GA Gypsum Association
 - a) GA 201 – 1985 Gypsum Board for Walls and Ceilings
 - b) GA 216 – 2000 Application and Finishing of Gypsum Board
 - c) GA 600 – 1997 Fire-Resistance Design Manual
- 19. GSA General Services Administration
 - a) CID A A 50542 Coating System: Reflective Slip-Resistant Chemical-Resistant Urethane for Maintenance Facility Floors
- 20. MIL Military Specifications (require waiver)
 - a) C-18480 (Rev. B, Notice 1) Coating Compound, Bituminous, Solvent, Coal-Tar Base
 - b) D-3134 (Rev. J) Deck Covering Materials
- 21. NAAMM National Association of Architectural Metal Manufacturers
 - a) NAAMM 500 Metal Finishes Manual for Architectural and Metal Products
- 22. NEMA National Electrical Manufacturers Association
 - a) LD3 – 1995 High Pressure Decorative Laminates
 - b) LD3.1 – 1995 Performance, Application, Fabrication, and Installation of High Pressure Decorative Laminates
- 23. NFPA National Fire Protection Association
 - a) NFPA 80 – 1999 Fire Doors and fire Windows
 - b) NFPA 101 2000 Life Safety Code
- 24. NRCA National Roofing Contractors Association
 - a) Low Slope Roofing Materials Guide
- 25. SIGMA Sealed Insulating Glass Manufacturers Association Recommended Practices
- 26. SJI Steel Joist Institute Specifications, Load Tables, and Weight Tables for Steel Joist Girders
- 27. SMACNA Sheet Metal and Air Conditioning Contractors' National Assoc. Architectural Sheet Metal Manual
- 28. SPC The Society for Protective Coatings
 - a) SP5 – 1994 White Metal Blast Cleaning
 - b) SP6 – 1994 Commercial Blast Cleaning
- 29. TCA Tile Council of America – Standards
- 30. TM Technical Manual – Army Publication Distribution Center
- 31. IBC International Building Code
- 32. UFC 2-600-1
- 33. UL Underwriters Laboratories
 - a) 10B – 1997 Fire Tests of Door Assemblies
 - b) 305 – 1995 Panic Hardware
 - c) 723 – 1996 (rev thru Dec. 1998) Test for Surface Burning Characteristics of Building Materials
 - d) 790 – 1997 (rev thru July 1998) Tests for Fire Resistance of Roof Covering Materials
 - e) Outline Test Method for Measuring the Surface Flame Propagation Characteristics of Flooring and Floor Covering Materials
- 34. WWPA Western Wood Products Association

35. Western Lumber Grading Rules (1999)

- 2.4.4** Modified Tow-Way shall be asphalt concrete per 2.3.14.A.2. Apron, Building Foundation and Floor Construction shall be reinforced cast in place concrete (see structural requirements section 2.5). Concrete slab in composition determined by structural criteria.
- A. Hardstand(s) (Option 2) shall be concrete per structural loading requirements outlined in section 01010 paragraph 2.5.4.G, Appendix 8 and 9. Provide grounding points on 3 meter grid per electrical requirements and aircraft tie-downs per Appendix 8 and 9 diagrams.
 - B. Maintenance Bay floor – concrete slab able to meet structural loading of towed and parked F-15/F-22 aircraft. Required thickness shall be determined by structural calculations. Finish in broom texture acceptable to the 3rd CRS, with finish described in paragraph 2.4.16.B.
 - 1. Concrete apron shall extend 10' in front of Hangar doors and along their full width with hydronic heat trace system at the hangar door threshold.
 - 2. Provide grounding points (see electrical requirements, SECTION 01010, 2.7), on 3 meter grid.
 - C. Tank Area floor - requires 1000 gallon capacity floor recess for spilled jet fuel (see section 2.6 for Mechanical Requirements); ramp transition from Maintenance Bay to Tank Area shall facilitate fork-lift access. Broom finish in a texture acceptable to the 3rd CRS.
 - D. Provide equipment pads for floor-mounted equipment, vibration isolation pads at compressor and generator equipment.
 - E. Construction joints in office and support area concrete slabs shall either formed or saw cut or cut with a jointing tool to the indicated depth after the surface has been finished. Sawed joints shall be completed within 4 to 12 hours after concrete placement. Protect joints from intrusion of foreign matter.
 - F. Moisture Barriers
 - 1. Vapor Retarder - Capillary Water Barriers such as sand, gravel, or crushed stone shall be provided beneath membranes at slabs-on-grade with dampproofing. At walls, drainage matting may be used instead.
 - 2. Waterproof Paper – ASTM C 171 consisting of (2) sheets of Kraft paper cemented together with reinforced bituminous material.
 - G. Expansion/Contraction Joint Filler – ASTM D 1751 or ASTM D 1752, ½" thick unless otherwise indicated.
- 2.4.5** Roof Construction: Main roof may be flat or sloped design. Roof run-off must be directed away from building apron, fire lanes and vehicle circulation, building entrances, and other paved areas.
- A. The complete roof system shall have a UL 1256, UL 790, Class A classification, be listed as "fire classified" in UL Building Materials Directory and bear the UL label. Roofing system over steel deck shall be rated Class I-90.
 - 1. Roof insulation above the vapor retarder shall have a minimum R-value of R-30 as measured at 75 degrees F in accordance with ASTM C518.
 - B. Provide a .76 meter (2'-6") deep overhang to shelter the F-22/F-15 hangar door openings.

- C. Building main entrance and all door openings shall be protected from rain, snow and roof runoff using smaller roof areas. Building mounted lighting and equipment, roof-mounted antennae and other equipment shall be protected from snow and ice roof runoff damage.
- D. Warranty: 15-year full roofing system manufacturer's labor and material warranty that the roof system will be free from leaks caused by defects in materials supplied and leaks caused by workmanship involved in the installation of such materials.
- E. Details and Penetrations shall comply with NRCA Construction Details. Modified bituminous roofing shall comply with ARMA Recommended Performance Criteria for Roofing Membranes Using Polymer Modified Bituminous Products. Comply with ARMA Guide to Preparing Built-up Roofing Specifications, NRCA Roofing and Waterproofing Manual, and NRCA Handbook of Accepted Roofing Knowledge.
- F. GOVERNMENT BETTERMENT #2 – Acoustical Roof Deck in Maintenance Bays and Tank Area: Epic Metals Corporation "ER2RA" Acoustic Ceiling Roof Deck with NRC value .95 or alternate product of equal performance and required structural properties.
- G. Roofing Components, Low Slope Roof: structural metal deck (see Betterment #2 paragraph F), 16 mm (5/8") Dens-deck, 2-ply hot-mopped vapor retarder, R38 rigid insulation, protection board, 3-ply built up roofing system; metal flashings, 2-ply built up roof base flashing, gutters, downspouts; including the following accessories:
 - 1. 4-Ply Modified Built-up Roof
 - a) Base Sheet: ASTM D 4601; 30.7 lbs/square, 60 mils thickness, fiberglass mat, SBS-modified asphalt, lightly surfaced with mineral release material; extending a minimum 8" up the surface of parapet and other vertical surfaces.
 - b) (2 layers) Interply Sheet: ASTM D 4601; 47.5 lbs/square, 60 mils thickness, fiberglass mat felt, SBS-modified asphalt equivalent of Type G-2 base sheet, with fire retardant stabilizers and lightly surfaced with mineral release material.
 - c) Cap Sheet: ASTM D 5147 and ASTM D 3909; 102 lbs/square, 150 mils thickness, 0.5 gram loss Granule Adhesion; Breaking Strength at 0 degrees F – MD=125 lbs degrees F / inch, XM=100 lbs degrees F / inch; Breaking Strength at 77 degrees F – MD=80 lbs degrees F/inch, SM=40 obs degrees F/inch; Elongation at Break – MD 4 percent, XM 4 percent; Ultimate Elongation at Sample Break – MD 25 percent, XM 40 percent; Tear Resistance – MD 100 lbs degrees/inch, XM 90 lbs degrees/inch; polyester/fiberglass mat with random pattern on wet laid polyester fibers with resin and latex.
 - d) Polyglass mat impregnated and coated with SBS modified asphalt filled with fire retardant stabilizers and surfaced with ceramic granules for ultraviolet protection and weatherability.
 - 2. Cant Strips – pressure preservative treated softwood, 45-degree cant with 3-1/2" legs.
 - 3. EPS Insulation – ASTM C 578, Type II expanded polystyrene; (2) 4" board thickness layers, (1) 2" board thickness layer with the following characteristics and tapered to provide a minimum slope of 1/4" per foot:
 - a) Water Absorption Rate: Maximum 4 percent per ASTM C 272
 - b) Board Density: Minimum 1.3 pcf, minimum
 - c) Compressive Strength: Minimum 10 psi at 10 percent deformation
 - d) Thermal Conductivity K Factor: 0.28 at 75 degrees F per ASTM C 518, minimum R39 insulation value as tested at 75 degrees F.
 - e) Board edges: Square
 - 4. Bituminous Vapor Retarder – two plies of glass roofing felt mopped in asphalt, installed on top of insulation underlayment.
 - 5. Insulation Underlayment – 16mm (5/8") thick glass mat gypsum roof board conforming to ASTM C 1177/C 1177M or as otherwise required by code, UL requirement, and

- membrane manufacturer. Mechanically fasten to structural roof deck per uplift resistance standards.
6. Joint Tape – asphalt treated glass fiber reinforced, 6 inches wide, self-adhering
 7. Fasteners – types and sizes best suited for the purpose and shall comply with listing and roofing manufacturers approved instructions. Mechanically fasten the first layer of insulation to the roof deck per FM I-90 standards.
 8. SEBS – Rubber Modified Roofing Asphalt - ANSI/ASTM D 312; asphalt primer per ANSI/ASTM D 41; plastic cement ASTM D 2822, Type II, cutback asphalt type.
- H. Metal Flashings – prefinished and preformed galvanized sheet stock; ASTM A 924M, Grade C minimum, 24 ga; coating designation Z275 in conformance with A 525, or 1.9 mil Zincoaluminum coating compound of 45 percent zinc and 55 percent aluminum alloy by weight per ASTM A 792. Form sections true to shape, accurate in size, square, and free from distortion or defects. Form pieces in longest practicable lengths. Minimum bend radius 3.5 x metal thickness. Form bends at room temperature. Hem exposed edges on underside ½ inch; miter and rivet lap seam corners. Provide double beads of sealant in laps. Form material with backup plate seams of same material. Fabricate formed vertical faces with bottom edge formed outward and hemmed to form drip and hook for concealed cleats and back-up plate seams. Provide 24 ga flashings with 22 ga continuous concealed cleats on exterior face, minimum 2" wide, interlockable with flashing.
1. Exposed Finish – shop applied baked-on epoxy primer and baked on PVF2, finish coat. Prefinishing system equal to PPG's Duranar, DeSoto's Fluoropon, or Glidden's Nubelar; 70 percent "Kynar 500" coating in total dry film thickness of 1 mil.
 2. Concealed Finish – shop applied baked on .15 mil epoxy primer and baked-on .35 mil off-white backer.
- I. Flexible Flashings – self-adhering rubber modified membrane with laminated polyethylene film and release paper backing; maximum permeance rating of 0.1 perm (6ng/Pa x s x sq.m.). Provide primer when recommended by vapor-retarder manufacturer.
- J. Roof Drains shall comply as a minimum with SMACNA Architectural Sheet Metal Manual. Roof drainage details shall comply with NRCA Construction Details. Overflow roof drains shall be routed to the main roof drain. The weight of retained water below the level of the overflow roof drains shall be included as a load in structural calculations. Drains shall have strainers, and shall be no less than 4" diameter.
1. Only interior roof drains and overflow drains shall be used in a flat roof area. Roof drain spacing shall not exceed 23 meters (75 feet) in any direction; no single roof drain shall serve a roof area greater than 558 square meters (6,000 square feet).
- K. Metal Roofing – sloped (2:12 minimum pitch) metal roofing is an acceptable alternative to flat roof design solution and shall be used at the main building entrance. Uninsulated metal roof shelters shall be used at personnel doors and coiling door openings.
1. IMSA Klip-Rib factory formed standing seam roof panel assembly or equal product designed for concealed mechanical attachment to roof deck are acceptable.
 - a) 22 gauge minimum panel thickness.
 - b) Comply with manufacturer requirements for span limitations.
 - c) Clips shall be 21 gauge designed to meet negative load requirements.
 - d) Zincoaluminum Aluminum zinc alloy coated steel sheet per ASTM A-792, Class AZ-55.
 2. Provide flashing and trim as recommended by panel manufacturer to match wall or roof panels.
 3. Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs and other suitable fasteners designed to withstand design loads.
 - a) Use stainless steel fasteners.

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- b) Use metal-backed neoprene washers under heads of fasteners exposed to weather.
 - 4. Accessories for a complete installation shall be provided, including: trim, copings, fascia, ridge closures, seam covers, battens, flashings, sealants, gaskets, fillers, and closure strips – per industry best practices.
- 2.4.6 Exterior Wall System – see structural section 2.5 for concrete footing, foundations, concrete stem wall and structural steel frame of wall. All products shall be fire and safety rated for the use and locations intended. Structural elements shall be fire protected per IBC requirements. Exterior color scheme shall conform to standard Base colors.**
- A. Reinforced concrete wainscot to 1225mm (4'-0) above Maintenance Bay floor level; includes Tank Area.
 - B. Prefinished Corrugated Metal Siding, 60 mm (0.023-inch) thick minimum, with factory colored finish on the exposed side; and with the following characteristics
 - 1. Zinc coated steel conforming to ASTM A 446, G 90 coating designation; or
 - 2. Aluminum-zinc alloy coated steel conforming to ASTM A 792, AZ 50 or AZ 55 coating; or
 - 3. Aluminum-coated steel conforming to ASTM A 463, Type 2, coating designation T2 65
 - 4. Design allowances shall be made for expansion and contraction at top and bottom of panels consistent with the manufacturer's recommendations
 - 5. Color selected from manufacturer's standard selections; dry film coating bonded by adhesive to a cleaned metal substrate, dry film thickness of 0.5 mil.
 - 6. Finish shall be baked on epoxy primer and baked-on PVF finish coat. Prefinishing system equal to PPG's Duranar, DeSoto's Fluorpon, or Glidden's Nubelar; 70 percent "Kynar" coating.
 - 7. Exposed Fasteners are zinc-coated steel, corrosion resisting steel, or nylon capped steel.
 - 8. Accessories compatible with the panel system and substrate. Flashing, trim, molded closure strips, caps, and similar metal accessories shall be not less than the minimum thicknesses specified for covering with factory color finish to match panels. Molded closure strips shall be closed cell or solid cell synthetic rubber or neoprene. Thermal spacer blocks and other thermal barriers at concealed clip fasteners per manufacturer recommendations.
 - 9. Manufacturer's Warranty shall be a period of no less than 20 years covering panel finish from fade, chalk, and deterioration.
 - C. Insulated Translucent Panel System – 70mm (2-3/4") thick factory prefabricated sandwich panels and aluminum installation system.
 - 1. Panel and system must be listed by International Conference of Building Officials (ICBO). Quality control standards for fire, structural, and water infiltration testing in conformance with "Acceptance Criteria for Sandwich Panels".
 - 2. Translucent facing – manufactured from glass fiber reinforced thermoset resins specifically for architectural use. Thermoplastic (e.g. polycarbonate, acrylic) faces are NOT acceptable.
 - 3. Flammability – interior face sheet shall be UL listed and have a flamespread rating no greater than 50 (20) and smoke developed no greater than 250 (200) when tested per UL 723. Burn extent by ASTM D-635 shall be no greater than 1". Faces shall not deform, deflect or drip when subjected to fire or flame or delaminate when exposed to 300 degrees F for 25 minutes per UBC; or faces shall conform to FM 4411.
 - 4. Weatherability – The full thickness of the exterior face shall not change color more than 3.0 Hunter or CIE Units DELTA E by ASTM D-2244. Color stability shall be unaffected by abrasion or scratching. Exterior face shall have a permanent glass erosion barrier embedded beneath the surface to provide maximum long-term resistance to reinforcing fiber exposure. Sacrificial surface films or coatings are NOT acceptable erosion barriers.
 - 5. Exterior face sheet – 1.78mm (0.070") thick, light in color.

6. Interior face sheet – 1.14mm (0.45”) thick, light in color.
 7. Strength – impact resistance per UL 972.
 8. Grid – thermally broken aluminum I-beam grid core of 6063-T⁶ or 6005-T5 with provisions for mechanical interlocking of members; width of I-beam no less than 11mm (7/16”). Thermal break shall be minimum 1”. Panels shall withstand 1200 degrees F fire for minimum one hour without collapse or exterior flaming. Thermally broken panels shall have minimum Condensation Resistance Factor of 80 by AAMA 1503.1 measured on the grid line.
 9. Panels shall have a U-factor certified by NFRC laboratory and as recommended by manufacturer for the project conditions.
- D. Metal stud wall furring and framing shall comply with ASTM C754 for conditions indicated. Steel sheet components shall comply with ASTM C645 and with manufacturer standard corrosion resistant zinc coating.
1. Steel studs and runners shall be 20 gauge, or .83 mm (0.0329 inches) base metal thickness.
 2. Accessories for complete framing system for fire rated and non-fire rated assemblies include: firestop track, 79mm flat strap and backing plate, cold rolled channel bridging (1.37mm bare steel thickness), hot shaped rigid furring channels (.45mm thick per ASTM C645), resilient furring channels (12.7mm deep), corrosion resistant fasteners of type/material/size/properties required to fasten steel members to substrates.
 3. 16mm Gypsum Wall Board (type “X” where required) up to 3050 mm (10’) gypsum interior wall face complying with ASTM C 36, and installed in compliance with ASTM C 840 and GA 216.
- E. Wainscot to 2500mm (8’) above Maintenance Bay and Tank Area floors – 22 gauge galvanized corrugated metal panel by IMSA “NuWave” or equal, with 880mm (34-2/3”) net coverage and 23mm (7/8”) rib depth at 68mm (2-2/3”) on center.
1. Conform to ASTM A-924/ASTM A-792 zinalume, minimum yield 40,000 psi.
 2. Protective coating in conformance with ASTM A-924/A-792 and A-250.
 - a) “Zinalume Plus” finish, or equal.
- F. Weather Resistive Barrier: asphalt saturated organic felt complying with ASTM D 226, Type I (No. 15 asphalt felt), and overlapped 100 mm (4 inches).
- G. Fiberglass Batt Insulation, minimum 3.3 M²-K/W (R19), unfaced, sized to fit snugly between framing members without gaps or voids.
- H. Vapor retarder, continuous 8-mil film per ASTM D4397 requirements, at the warm side of the insulation.
- I. Dampproofing – conforming to ACI Guide to the Use of Waterproofing, Dampproofing, Protective and Decorative Barrier Systems for Concrete shall be used at foundation walls and other building elements that are subject to high humidity, dampness, or frequent direct water contact; but are not subject to hydrostatic pressure or immersed in water.
1. Waterproofing shall be used at shower room walls (if masonry), water wash-down areas, and other areas subject to hydrostatic pressure
 2. Dampproofing shall be used at concrete stem walls, transition areas where membrane waterproofing (if any) terminate, and other areas susceptible to dampness. At through-the-wall flashings dampproofing shall form a bond between the concrete and flashing.
 - a) Dampproofing at and below grade shall be chemically compatible with ground water and soils
- J. Exterior Perimeter Insulation – conforming to ASTM C 578 Type VI, expanded or extruded cellular type, with the following characteristics:

1. Thermal Resistivity: R of 5.0 at 75 degrees F.
2. Thickness: as indicated.
3. Board Size: 600mm x 1200mm (24 x 48 inches), square edges.
4. Compressive Strength: 30 psi, minimum
5. Water Absorption: per ASTM D 2842, 0.3 percent by volume, maximum.
6. Adhesive: gun grade, mastic type, compatible with insulation and substrate.
7. Protective Coating: acrylic copolymer based adhesive and waterproof coating mixed with Portland cement, suitable for protecting insulation from ultraviolet and physical damage and extending 150 mm (6") below grade.

2.4.7 F-15/F-22 Aircraft Doors

- A. Hard panel horizontal-acting or vertical-acting hangar doors may be proposed. Doors must have a record demonstrating success in aircraft hangars in arctic and sub-arctic military installations. Doors shall be complete with wheels, top guide rollers, motor operators, brakes, electrical controls, operating hardware, weathering, trolley ducts, top guides, and bottom rails, EPDM weatherstripping, controls, push buttons, limit switches, disconnects, etc.
1. Door operation is horizontal sliding of unidirectional, biparting, or individually motor operated type which, when fully closed, forms a weathertight enclosure.
 2. All Door Operators shall be powered with high-cycle use motors and on emergency back-up power (see electrical requirements 2.7).
 3. Doors and components shall be engineered to withstand design wind loads. The wind load deflection shall not exceed the door height in inches divided by 120. Fiber stresses in the door members due to combined dead and wind loads shall not exceed 29,300 psi.
 4. Door Leaf shall be of bolted and/or welded construction with non-spliced vertical members, assembled to square tolerances up to 3 mm to 6100 mm (1/8" to 20"). Door covering shall be preformed metal insulated panels with maximum U-value of .067.
 5. Weathering material:
 - a) Vertical edges shall be weathered with 3mm thick 2-ply cloth inserted EPDM flap, located as to engage a matching 13 gauge bent metal rub plate on the adjacent door or jamb. Flaps shall be retained continuously for their full length by keeper clamp-type retainer bars bolted at 305 mm (12") centers with 6 mm (1/4") plated hex head fasteners. Clearances between metal parts on vertical edges of leaves and between leaves and jambs shall not be less than 127 mm (5").
 - b) Sill weathering shall be provided on the exterior sides of the leaves; each shall consist of a single flap of 1/8" 2-ply cloth inserted EPDM material retained by continuous clamp-type retainer bars bolted at 305 mm (12") centers with 6 mm (1/4") plated hex head fasteners.
 - c) Head weathering shall consist of 2 parts. The floating head wind curtain consists of support angles which moves up and down with the telescoping type top roller and a 16 gauge sheet curtain attached to the angles. The flexible weathering part attached to the top of the door leaves shall be 1/8" 2-ply cloth inserted EPDM material retained by continuous clamp-type retainer bars bolted at 305 mm (12") centers with 6 mm (1/4") plated hex head fasteners.
 - d) The use of white nitrile rubber is prohibited.
- B. Hardware includes components manufactured expressly for use on aircraft hangar doors: telescoping top guide roller assemblies, bottom wheels, bumpers, tractor pulls, track cleaners for a complete installation
- C. Metal surfaces shall be given a priming coat of rust inhibitive paint.
1. Tnemec 1099.
- D. Door Operation:

1. Operation of each door shall be by traction type power drives with one in each drive leaf, designed to move in either direction at a maximum speed of 13.7 meters (45') per minute at zero wind load conditions, and shall be operable up to and including a wind load of 5 pounds per square foot. Necessary roller chains, sprockets, jack-shafts, bearings, and take-up devices shall be included for a complete operating system.
 - a) Each system shall be on emergency back-up power and provided with an acceptable means of emergency conversion to tractor towing.
 - b) Variable speed motors are not acceptable.
 - c) Motors shall be rated for door operation duty and shall be normal starting torque type and rated for service at 460 volts, 3 phase, 60 Hertz.
 - d) Gear reduction units shall be of the highest quality helical worm gear double reduction of commercial manufacture and shall have internal continuous lubrication. The units shall be of a type which allows a reversal of effort through the gears without damage to the gears. The gears shall be non selflocking and be rated AGMA Standard with a safety factor of 1.
 - e) The high-speed shaft brakes shall be integral with the motors and shall be of the spring set solenoid release self-adjusting disc type with an auxiliary manual release.

E. Applicable Standards:

1. Federal Specification
 - a) HH-P-151E Packing, Ribber-Sheet, Cloth Insert
 - b) QQ-I-652C Iron Castings, Gray
 - c) QQ-I-666D Iron, Malleable, Ferritic for Castings
 - d) QQ-S-681F Steel Castings
2. ASTM
 - a) A36-81 Structural Steel
 - b) A366-72 Steel, Carbon, Cold-Rolled Sheet Commercial Quality
3. NEMA
 - a) IC-1 Industrial Control Standards
 - b) ST-1 Standards for Specialty Transformers
 - c) IC-5 Industrial Controls and Systems
4. AWS
 - a) Code for Arc and Gas Welding

F. Some Manufacturers that provide doors meeting the above requirements above salient features

- G. Warranty: one year after date of substantial completion for hangar doors, top guides, and electrical system against all defects in material and workmanship.

2.4.8 Doors and Windows

- A. Exterior Aluminum Windows, with the following performance requirements
1. Force Protection Glazing: all exterior glazing shall meet the minimum resistance standards in the Force Protection Guidelines.
 - a) All exterior glazing shall be insulating glass with a laminated inner pane. Inner panes of insulated glass units shall be 6millimeter laminated annealed glass or 6-millimeter laminated thermally tempered glass. Laminated glass shall consist of two layers of Type I transparent float glass, Class 1 – clear Quality q3 – glazing select, conforming to ASTM C1036.
 - b) Glass shall be bonded together with 1.52-mm thick PVB interlayer under pressure, or alternatives such as resin laminates, conforming to requirements of 16 CFR 1201 and ASTM C1172. Color shall be clear.
 - c) Window Film shall be "Protekt" by Madico, or equal, and shall pass impact requirements of ANSI Z97.1 Safety Glazing Standard and Category II

- requirements of the Consumer Product Safety Commission, Safety Standard for Architectural Glazing Materials, CPSC 16 CFR 1201.
2. Operating mechanisms, parts, and equipment in operable windows shall have a history of reliability and readily available replacement parts.
 3. Air Infiltration: ASTM E 283, shall not exceed 0.06 cfm per square foot of fixed area at test pressure of 12.0 psf.
 4. Water Infiltration: ASTM E 331, no water penetration at a test pressure of 15 psf.
 5. Structural Performance: full recovery of glazing materials at 100 mph wind velocity. Windows shall be designed for wind loads in accordance with IBC.
 6. Security: windows shall offer substantial resistance to unauthorized entry, equal in resistance to the adjoining wall.
 7. Fire Protection: where required by code, fire windows, frames, and hardware shall be either tested and listed by UL or similar nationally accredited testing laboratories or approved authorities. Such fire windows shall be installed with label attached in accordance with NFPA 80.
 8. Thermal Performance: ASTM C 236, minimum u-value of 0.65 and a minimum crf of 61. Thermal break fixed or casement frames, meeting a design STC of 50 per ASTM E 90 and a field test STC of 45 per ASTM E 336. Insulating glass units per ASTM E 774 and E 773:
 - a) Transmittance: 42 percent
 - b) U-value: 0.29 winter; 0.30 summer
 - c) Shading coefficient: 0.30
 - d) Reflective Heat Gain: 64
 - e) Light Reflectance: 10 percent.
 9. Safety Glass where required by UBC and AFMAN 91-201, Section 4.31. Operable outside windows shall have guards conforming to NFPA 101, Chapter 5, ANSI C 97.1, and ASTM C 1172
 10. Float glass: ASTM C 1036
 11. Expansion/Contraction: system components must comply with cycling temperature range of 170 degrees F over a 12 hour period without causing detrimental effects to system components, anchorages, and other building elements.
 12. Maintain air barrier and vapor seal throughout the window assembly; 40 percent rh without seal failure at interior atmospheric pressure of 1 inch sp 72 degrees F.
 - a) Glazing compound: Sealant per ASTM C 920, Grade NS, Class 25, Use G, A and O.
- B. Exterior Coiling Door: capable of withstanding the effects of design loads without permanent deformation; Wind Load 960 Pa (20 lbs/sq.ft.) acting inward and outward; Operation Cycle requirements if 100,000 for components and motor.
1. Steel Door Curtain Slats – structural quality, cold-rolled galvanized steel sheets complying with ASTM A 653 with G90 (ASTM A 653M, with Z275) zinc coating. Galvanized steel sheet thickness not less than 0.7mm (0.028 inch).
 2. Fill slats with manufacturer's standard rigid cellular polystyrene or polyurethane foam type thermal insulation complying with maximum flame-spread and smoke developed indices of 75 and 450 respectively, per ASTM E 84.
 3. Endlocks – malleable iron castings galvanized after fabrications or high strength nylon. Provide locks on not less than alternate curtain slats for alignment and resistance against lateral movement.
 4. Windlocks – malleable iron castings secured to curtain slats with galvanized rivets or high strength fasteners as required to comply with wind load.
 5. Bottom Bar – consisting of (2) angles, each not less than 38 mm x 38 mm x 3 mm (1-1/2"x1-1/2"x1/8") either galvanized or stainless steel to suit slat type.
 6. Motor operator with combination bottom astragal and sensor edge complying with NFPA 70; high-starting torque, reversible, continuous-duty, Class A insulated complying with

NEMA MG 1 with overload protections and operating at not less than 0.2 meters/second (2/3 fps).

7. Obstruction Detection Device – able to protect the full door opening width.
8. Flush bolts at frame on inside face; or preferred security measure determined by the users.
9. Curtain jamb guides – angles or channels and angles of material and finish to match curtain slats, sized to retain curtain; provide integral wear strips to prevent metal-to-metal contact; removable stops on guides to prevent overtravel of curtain.
10. Hood – formed to entirely enclose and weatherseal coiled curtains and operating mechanism at opening head; edges, top, and bottom rolled and reinforced for stiffness; fabricate with sealant joint bead profile for exterior applications.
 - a) Finish complying with NAAMM's Metal Finishes Manual for Architectural and Metal Products – powder coated applied finish per manufacturer's written instructions.

C. Exterior Man-Doors

1. ANSI A 151.1 and ANSI 224.1; maximum deflection with 450 pounds pressure shall not exceed 9/16 inch. Doors shall be SDI Grade II, Model 2, thermally insulated to an overall R value of 10, measure in accordance with ASTM C 236. Insulated steel door systems shall comply with ISDSI 102, meeting the following characteristics:
 - a) Exterior doors and frames shall be galvanized and factory primed to receive field finish
 - b) Install doors and frames per SD01 guidelines and manufacturer's written instructions.
 - c) Steel meets ANSI A 250.8 standards
 - d) Minimum 6-millimeter glazing where applicable.

D. Interior Counter Coiling Door

1. Fire rated counter – high pressure laminate finish, UL tested assembly and labeled for 1-1/2 hour fire rating for approved use with fire-door assembly.
2. Fire rated door assembly – complying with NFPA 80, labeled and listed for fire ratings indicated by UL, FM or another testing and inspecting agency acceptable to authorities having jurisdiction.
 - a) Smoke seals – UL listed and tested smoke seal at perimeter gaskets
 - b) Steel door curtain slats – structural quality, cold-rolled galvanized steel sheets complying with ASTM A 653.
 - c) Motor operator and heat or fire alarm actuated automatic-closing device.
 - d) Obstruction Detection Device – able to protect the full door opening width
 - e) Padlock locking mechanism
 - f) Counterbalancing mechanism – counterbalance barrel, spring balance, torsion rod, brackets
 - g) Finish complying with NAAMM's Metal Finishes Manual for Architectural and Metal Products – powder coated applied finish per manufacturer's written instructions.

E. Interior Doors

1. Unless otherwise indicated, frequently used doors shall have a vision panel except where privacy, security, or fire safety requirements preclude inclusion.
2. Doors shall offer equal resistance to unauthorized entry to adjacent wall construction. Standard of quality per HMMA 861 Guide Specifications for Commercial Hollow Metal Doors and Frames.
3. Fire Protection of entire door/frame/hardware assembly shall be either tested and/or listed by UL or similar accredited testing laboratory approved by FM. Label shall be attached in accordance with NFPA 80.

4. Hot-Rolled Steel Sheets: ASTM A 569/A 569M, CS (commercial steel), Type B, free of scale, pitting, or surface defects. Flush design doors, 44 mm (1-3/4") thick, of seamless hollow construction. SD01 100 standard, heavy duty, prepared to receive hardware.
5. Hardware shall conform to ANSI/BHMA. Hardware shall be provided for each door and as required per NFPA 101 and referenced accessibility standards.
6. Hollow Metal Relite Frames shall have a load carrying capacity of 950 pounds, galvanized where exposed to corrosive elements, and factory primed to receive field finish. Removable glazing beads shall be screw-on or snap-on type. Frame assembly shall carry UL rating where required.
7. Glazing: safety glass shall meet ASTM C 1172 and ANSI Z 97.1. Setting blocks, glazing tape, spacers and shims in accordance with manufacturer's installation instructions.
8. Door silencers shall be used at all doors except those in gasketed frames.
9. Weather-stripping for head and jamb protection shall be elastomeric type of synthetic rubber, vinyl, or neoprene per door frame manufacturer. Use bottom sweep weather-stripping, 1/8" thick neoprene or spring
10. Install removable stops on secure side of wall where possible.

F. Access Doors

1. Placement of panels and orientation of fixtures shall be coordinated so as to minimize visual impact while providing adequate access to equipment being serviced.
2. Fabricate frames and flanges of 16 gauge steel and door panels of 14 ga. steel, galvanized where exposed to corrosive environment; UL listed products in rated ceilings and partitions in accordance with NFPA 80-99, NFPA 252-99, and UL 10B-97.
3. Size access panels so that two-handed work can be easily accomplished. See Mechanical, Section 2.6 for access requirements.

2.4.9 Interior Partitions

- A. Blast Protection Wall – concrete masonry construction between Maintenance Bay and support areas; one-hour fire rated construction with 45-minute fire rated door and window openings.
- B. Area separation walls, occupancy separations, mechanical rooms, and corridors shall be designed and constructed to fire ratings defined by code, and to acoustical requirements defined by area in the Room Criteria Sheets. Industry standards for fire ratings, application, and finishing shall be in accordance with Gypsum Association and Underwriters Laboratory. Minimum requirements for interior walls are as follows:
 1. Non-Bearing Partitions – 40mm x 90mm studs @ 400 mm o.c. with 1 layer 16mm type 'x' gypsum wall board each side.
 2. Moisture resistant gypsum wall board shall be used in damp area walls.
 3. Cementitious tile backer board at shower areas
 4. Light orange peel texture for painted gypsum wallboard finish
 5. Studs and screws shall be spaced to meet UL requirements for the required fire resistance and structural requirements. Allowable deflection is L/240.
- C. Hollow Metal Relights
 1. Frames shall have a load carrying capacity of 950 pounds. Frames exposed to corrosive environment shall be galvanized. Factory primed to receive field finish.
 2. Removable glazing beads shall be screw on or snap-on type. Frame assembly shall display required UL ratings.
 3. Safety glass shall meet MSTM C 1172 and ANSI Z 97.1.
 4. Setting blocks, glazing tape, spacers and shims in accordance with manufacturer's installation requirements.
- D. Hardware - conform to ANSI/BHMA, and integrate project into existing base security system. Hardware shall be compliant with NFPA 101 and referenced accessibility standards. Heavy

duty builders hardware with features inaccessible to tampering, hinges at exterior side of doors shall be pinned, set screw, or welded so they cannot be removed.

1. Automatic Door Closers – doors part of fire rated assembly and exterior swinging doors shall have closers.
2. Door locksets shall be "Best" brand, or shall meet or exceed "Best" performance requirements with cast levers and escutcheons. Cylinders are 7-pin tumbler type constructed from brass or bronze, stainless steel or nickel silver; mortise type threaded cylinders with rings and straight or clover type cam.
3. Cores are required to be "Best" brand, no substitutions. Interchangeable cores shall match finish of lockset.
4. Emergency exit-only doors shall have no exterior hardware, deadlocking panic hardware only on interior side, except doors from Maintenance Bay to exterior near exterior accesses to building utility spaces (i.e. Compressor, Boiler Room, Generator).
5. Kickplates are 1.3 mm stainless steel, beveled at top and two sides.
6. Wall stops or overhead stops are required throughout, floor stops should be avoided.
7. Door silencers shall be used at all doors except those in gasketed frames.
8. Weather-stripping for head and jamb protection shall be elastomeric type of synthetic rubber, vinyl, or neoprene per door frame manufacturer. Use bottom sweep weather-stripping, 1/8" thick neoprene or spring tension type of bronze or corrosion resisting steel on an extruded aluminum or bronze bar.
9. X-08 Lock – cypher locks, card key system-card reader system compatible with Base. Indenti-Card to be compatible with current system, requiring proximity card reader and 5 digit pin number to gain access. Locate at individual work areas. Install BMS per user requirements.

2.4.10 Exterior Signage

- A. Signage shall be integrated into the building and site design in an attractive manner. The Air Force sign standard is located at: <http://afpubs.hq.af.mil> and typing "32-1097" in the "short title" search block.

2.4.11 Sealants

- A. At exterior windows and doors, wall louvers, roof vents and other miscellaneous penetrations through the exterior envelope, flashings, backer rods, sealants, and caulks shall be provided which properly contain irregular forms, recesses, and grooves weather tight. Sealants shall be either concealed from UV exposure or of the type not susceptible to UV degradation.
- B. All sealants shall be chemically formulated for the material substrate, joint movement, and environmental exposure. Color shall be properly coordinated with the adjacent materials.

2.4.12 Exterior Paint – reference Sherwin Williams products and application recommendations, or equal product of another manufacturer.

- A. Vertical Masonry Surfaces – CMU
 1. Coating Vehicle – latex
 2. Coating Finish – filler
 3. Surface Preparation - S-W3
 4. Primer - 1 coat block PrepRite Block Filler (B25W25)
 5. Coating Vehicle – acrylic latex
 6. Coating Finish – satin
 7. Topcoat – 2 coats A-100 Exterior Latex Satin (A82)
- B. Metal Surfaces – Steel
 1. Coating Vehicle – acrylic latex

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2. Coating Finish – primer
3. Surface Preparation – SSPC-SP2
4. Primer - 1 coat All Surface Enamel Latex Primer (A41)
5. Coating Vehicle - acrylic latex
6. Coating Finish – satin
7. Topcoat - 2 coats A-100 Exterior Latex Satin (A82)

C. Galvanized Surfaces

1. Coating Vehicle – acrylic latex
2. Coating Finish – primer
3. Surface Preparation – S-W10
4. Primer - 1 coat All Surface Enamel Latex Primer (A41)
5. Coating Vehicle – acrylic latex
6. Coating Finish – satin
7. Topcoat - 2 coats A-100 Exterior Latex Satin (A82)

2.4.13 Mail boxes are not provided in this contract.

2.4.14 Interior Construction

A. Toilet & Shower Partitions: Provide solid plastic polymer resin toilet partitions capable of supporting superimposed load for occupant safety. Partitions shall provide for privacy and blend aesthetically with surroundings.

1. Toilet Partition Doors and Panels: 25.4mm (1") thick x 610mm (24") minimum width x 1470mm (58") high; 864mm (34") wide door.
2. Shower Partition: 25.4mm (1") thick x 1930mm (76") high
 - a) Mount to pilasters and panels with continuous shower corners. Shower corners and headrail shall be made of heavy extruded aluminum with bright dip anodized finish. All fastenings/brackets shall be of stainless steel and secured with tamper resistant torx screws.
 - b) Shower curtain and heavy duty stainless steel rod and brackets.
3. Shower Pan: Provide one-piece terrazzo base, partitions shall be 25mm (1") thick solid polymer resin.
4. Materials:
 - a) Solid Plastic Polymer Resin – high density polyethylene (HDPE) with homogenous color throughout, eased edges which is waterproof, nonabsorbent and mark resistant.
 - b) Pilaster shoes and caps (sleeves) per ASTM A666, type 302 or 304 stainless steel not less than 0.8 mm thick and 75 mm high; finish to match hardware.
 - c) Head Rails: Hollow aluminum tube, 1x1-5/8 in. size, with anti-grip strips and cast socket wall brackets.
 - d) Attachments, Screws, and Bolts: Stainless steel; tamper proof type; heavy duty extruded aluminum brackets.
 - e) Hardware: Chrome plated non-ferrous cast pivot hinges, gravity type, adjustable for door close positioning; nylon bearings; thumb turn door latch; door strike and keeper with rubber bumper; cast alloy chrome plated coat hook and bumper.
 - f) Pilaster Shoes: ASTM A 167 Type 304 stainless steel with No. 4 finish.
 - g) Installation: install partitions secure, plumb, and level in accordance with manufacturers' instructions.

B. Lockers: recessed wall type, per the following criteria:

1. Single tier, 400mm (15") wide x 400mm (15") deep x 1830mm (72") high; all seams and joints welded, 14 gauge door, 16 gauge frame, 16 gauge body parts with 18 gauge backs; one piece door w/ louvers and full loop type hinges, all metal locking system,

recessed handle, baked on enamel finish and number plate. Provide one hat shelf and 3 single prong hooks.

- C. Toilet Accessories: all products used in the accessible toilet rooms shall meet all referenced accessibility standards.
1. Grab Bar – installed to be capable of withstanding a 1200 kg (500 lb) vertical load without coming loose from the fastenings and without obvious permanent deformation; FS WW-P-541/GEN and FS WW-P-541/8.
 2. Toilet Tissue Dispenser – FS WW-D-1908, FS WW-H-1911, Type II, roller mounted on single continuous bracket; coordinate type of toilet tissue with facility standard.
 3. Sanitary and Napkin and Tampon Receptacle – disposable liner type conforming to FS WW-P-541/GEN and FS WW-P-541/8, Type I, Class 1. Provide stock of 50 disposable liners with receptacle.
 4. Sanitary Napkin and Tampon Dispenser – conforming to FS WW-P-541/GEN and FS WW-p-541/8, Type I, Class 5, recessed. Stainless steel construction, dispensing mechanism for complementary vending.
 5. Paper Towel Dispenser – conforming to CED A-A-2380, constructed of not less than 0.0269 inch stainless steel, recessed mounted. Coordinate type of paper towel type with facility standard.
 6. Waste Receptacle – conforming to FS WW-P-541/GEN and FS WW-P-541/8, Type II, stainless steel, recessed mounted. May be incorporated into paper towel dispenser unit.
 7. Soap Dispenser – liquid type with vertical stainless steel tank with holding capacity of 40 fluid ounces.
 8. Mirror – tilt mirror in handicap accessible toilet room conforming to FS DD-M-00411, Class 2 Style C.
- D. Horizontal Louver Blinds - shall comply with AWCMA Document 1029 as selfleveling, consisting of louver slats, rails, ladders, tapes, lifting/tilting mechanisms, cord/cord-lock, tilt control, and installation hardware.
- E. Interior Signage - shall meet Elmendorf Air Force Base Installation Design Guide. Signage shall be integrated into the building design in an attractive manner. Interior signage shall identify all spaces and life safety elements in the building. Conform to ADA guidelines in first floor public spaces.
- F. Utility Stair: 1100mm (44") minimum width steel stair with open risers and treads of open grate material. All railings, guards and treads to be welded. Stairs shall be designed and fabricated to carry a uniform live load of 100 pounds per square foot or a concentrated load of 300 pounds at the center of any tread. Handrails shall not be less than 864mm (34") or more than 965mm (38") when measured vertically from the tread nose to the top surface of the rail. When used as guardrails, the top surface shall not be less than 1067mm (42"). Structural steel construction to meet or exceed the requirements of AISC. ASTM A36 and A500 structural steel.
- G. Fire extinguishers: Provide extinguishers and cabinets in size, quantity, and type to match occupancy.
- H. Countertops, Cabinets, and Shelving - constructed of high-density plastic laminate with sturdy hardware and built according to "Premium grade" standards of the "Architectural Woodwork Quality Standards 7th Edition Version 1.2 1999".
1. Extend wall cabinets to finish ceiling, without enclosed soffits, for additional storage capacity.
 2. Miscellaneous shelving to be constructed of 19 mm (3/4") A/B grade birch plywood with clear or painted finish, and shall be supported by adjustable double slot heavy duty steel brackets on wall standards. Use matching wood edge banding on all edges. Brackets are mounted 30" on center, maximum.

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3. Casework joints, connections, hardware and finish shall be constructed to withstand high abuse.
4. Countertops shall be scribed to fit opening and constructed of high-pressure decorative laminate. Backsplashes, countertops, and edges shall be one-piece construction. Waterfall or bullnose countertop edges are preferred.

2.4.15 Interior Design and Finishes

- A. Wall Base: 100 mm-rubber cove conforming to ASTM F 1861, Tpe TS, Group 1, Styles A and R; top set straight and coved, 4 inches high. Vinyl base is prohibited. Color match rubber base to transition strips. Do not install rubber resilient base in conjunction with ceramic, quarry or other similar hard tile surfaces.
- B. Vinyl Composition Tile – installed on prepared substrates per industry best practices, in conformance to the following:
 1. Static Load Limit – 125 psi
 2. ASTM F 1303; Type II, Grade I, Class A
 3. Critical Radiant Flux: ASTM E 648 – Pass
 4. NBS Smoke: ASTM E 662, 450 or less
 5. Meet ADA for static coefficient of friction
 6. Installation per RFCI Recommended Work Procedures for Resilient Floor Covering
- C. Resilient Sheet Flooring – Linoleum Flooring
 1. Nominal overall thickness 2.5mm (.100in)
 2. Static Load Limit 17.6 kg/cm2 (250 lbs./sq.in.)
 3. Fire Safety: ASTM F 970
 4. Critical Radiant Flux: ASTM E 648 - 0.45 watts/cm2, class 1
 5. Smoke: ASTM E 662 – 450 or less
 6. Installation per RFCI Recommended Work Procedures for Resilient Floor Covering
- D. Resilient Sheet Flooring – Vinyl Sheet Flooring
 1. Nominal overall thickness 2.5mm (.100in)
 2. Meet static load requirements of ASTM F 1303
 3. Fire Safety: ASTM E 648; Class 1
 4. Meet ADA for static coefficient of friction
 5. Installation per RFCI Recommended Work Procedures for Resilient Floor Covering
- E. Carpet – shall be stain resistant and provide for easy cleanability, of sufficient weight and density to resist high traffic commercial use.
 1. CRI Carpet Specifiers Handbook and CRI Standard for Installation of Textile Floor Covering Materials.
 2. Flame spread no greater than 75 when tested in accordance with ASTM E 84.
 3. Flame propagation index less than 4.0 when tested in accordance with UL 992.
 4. Critical Radiant Flux shall be 0.45 watt per square centimeter when tested in accordance with ASTM E 648.
 5. Flooring Radiant Panel – ASTM E 648, direct glue down, Class 1.
 6. Static Propensity: AATCC 134, 3.0 kv or less.
 7. Install using sound industry practices for seam placement, surface preparation, pile direction, seam treatment, scribing, etc.
- F. Walk-off Mat – heavy duty extruded aluminum strips with fusion bonded carpet, insert strips, surface mounted application with heavy gage vinyl support cushions interlocked with aluminum strips. Utility entrances shall have extruded steel grating in front of doors.

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- G. Wainscots may be used in public areas to provide lower wall protection and aesthetic value. Offerors may propose creative solutions, and designs will be evaluated based on appearance and durability. Room Criteria Sheets do not indicate areas requiring wainscots it is the Offeror's option to design to the project's benefit.

2.4.16 Interior Paint – reference Sherwin Williams products and application recommendations, or equal product of another manufacturer.

A. GOVERNMENT BETTERMENT #1 – Paint All Exposed Structural Steel in Maintenance Bays and Tank Area.

1. Baseline Requirement: Factory prime coat at underside of floor or roof deck and at structural steel or provide the following finish.
 - a) Coating Vehicle – alkyd
 - b) Coating Finish – primer
 - c) Surface Preparation – SSPC-SP2
 - d) 1 Coat Kem Kromik Universal Metal Primer
2. Betterment:
 - a) Coating Vehicle – acrylic
 - b) Coating Finish – primer/finish
 - c) Surface Preparation – SSPC-SP2
 - d) 1 Coat Kem Kromik Universal Metal Primer
 - e) 2 Coats Industrial Enamel

B. GOVERNMENT BETTERMENT #3 – Epoxy Floor Paint at Maintenance Bays and Tank Area.

1. Baseline Requirement: includes all support areas not receiving finish flooring:
 - a) Coating Vehicle – moisture cured urethane
 - b) Coating Finish – gloss
 - c) Surface Preparation – SSPC-SP13 NACE 6
 - d) Topcoat - 2 coats ArmorSeal Rextthane I Floor Coating with slip-resistant additive.
2. Betterment: pigmented, two-component, aliphatic polyester-urethane performance topcoat over two-part epoxy coating based on a Duraflex system for hangar floors; equal-performing substitutes will be considered.
 - a) Slab preparation – mechanically profiled, shot-blasted.
 - b) Primer – “Duraglaze Tie-Coat”
 - c) Base Coating – “Dur-a-Gard”, 2 coats
 - d) Top Coating – “Poly-Thane 3”, 2 coats; in light color with slip-resistant additive.

C. Gypsum Wall Board Surfaces

1. Coating Vehicle – latex
2. Coating Finish – primer
3. Surface Preparation – S-W8
4. Primer - 1 coat PrepRite 200 Interior Latex Primer (B28W200)
5. Coating Vehicle – latex
6. Coating Finish – satin
7. Topcoat - 2 coats ProClassic Waterborne Acrylic Satin, (B20)

D. Masonry Surfaces - CMU, Concrete

1. Coating Vehicle – latex
2. Coating Finish – primer
3. Surface Preparation – S-W3,5
4. Primer - 1 coat PrepRite Masonry Primer (B28W300)
5. Coating Vehicle – latex
6. Coating Finish – satin
7. Topcoat - 2 coats ProClassic Waterborne Acrylic Satin (B70)

E. Steel – Galvanized

1. Coating Vehicle – acrylic
2. Coating Finish – primer
3. Surface Preparation – SSPC-SP2, SP3
4. Topcoat - 1 coat DTM Acrylic Primer/Finish (B66W1)
5. Coating Vehicle – acrylic
6. Coating Finish – semi-gloss
7. Topcoat - 2 coats DTM Acrylic Coating

2.4.17 Suspended Acoustical Panel Ceiling – Materials

A. Grid:

1. 610mm x 1220mm (2'x4') and 610mm x 610mm (2'x2')15/16" exposed tee.
2. Classification: Heavy-Duty
 - a) Main Beam Load: 1220mm (4') hangar spacing, minimum 16.0 pounds per linear foot.
 - b) Cross Tee Load: 1220mm (48")length, minimum 13.85 pounds per linear foot.
3. Seismic Performance: Classified for zone 4.
4. Fire Resistance: Install per UL fire resistive design where required to meet hourly rating.

B. Acoustic Panels:

1. Classification: ASTM E 1264; Type 111, Form 2, Pattern CDK
2. Light Reflectance: Minimum 0.81
3. Size 610mm x 1220mm (2'x4')and 610mm x 610mm x 19mm (2'x2'x 3/4")
4. NRC: minimum 0.50.
5. CAC: minimum 35.
6. Surface Burning Characteristics: ASTM E 1264; Class A, Flame Spread 25 or under.
7. Acoustical ceilings shall comply with CISCA - Acoustical Ceilings Use and Practice.
8. Installation: Install grid and panel per manufacturer's written Instructions and best industry practices.
9. Warranty: Provide one-year warranty against sagging and warping of panels.

2.4.18 D/B Contractor-Proposed Betterments: All D/B contractor-proposed betterments shall conform to the performance criteria outlined in this section.

2.4.19 Prohibited Items: The following items are prohibited from inclusion in proposals:

- A. Vinyl wall base
- B. PVC Roofing
- C. Roof gutters

PART 2 MINIMUM DESIGN CRITERIA

2.5 STRUCTURAL DESIGN CRITERIA

2.5.1 References

- A. Structural design and design documents shall be in accordance with the following codes and regulations, and shall conform to the standards recognized by the codes and regulations. If dates are not given for reference standards or criteria, the latest edition is to be used. Where reference is specifically made from this narrative to other sections of the overall "Request for Proposal" document or from other sections to this section, the criteria stated here in this section shall govern. Specific design loads, the materials, the strength and quality of the materials indicated here in shall be considered minimums. If design loads, material(s) or materials(s) as components of a system are not specifically prohibited from the project and they meet the requirements of the specified codes, they may be included in the project. Structural design shall be provided for elements that are not part of the structural system, but provide support for other facility system(s).
1. American Association of State Highway and Transportation Officials (AASHTO)
 2. American Concrete Institute (ACI):
 - a) ACI 318 Building Code Requirements for Structural Concrete and Commentary
 - b) ACI 315 Manual of Standard Practice for Detailing Reinforced Concrete Structures
 - c) ACI Manual of Concrete Practice, Part 1 through Part 5
 - d) ACI 530 Building Code Requirements for Masonry Structures
 3. American Institute of Steel Construction (AISC)
 - a) AISC ASD 9th Ed., Allowable Stress Design, Manual of Steel Construction
 - b) AISC LRFD 2nd Ed., Load & Resistance Factor Design Specification for Structural Steel Buildings
 - c) AISC Pub No. S341 (1997) Seismic Provisions for Structural Steel Buildings
 - d) AISC Pub No. S341s (2001) Seismic Provisions for Structural Steel Buildings, Supplement No.
 4. American Iron and Steel Institute (AISI)
 - a) AISI Cold Formed Steel Design Manual
 5. American Welding Society (AWS)
 - a) AWS D1.1, Structural Welding Code – Steel
 6. American National Standards Institute/American Society of Civil Engineers (ANSI/ASCE)
 - a) ASCE 7 Minimum Design Loads for Buildings and Other Structures
 7. Federal Emergency Management Agency, National Earthquake Hazards Reduction Program (FEMA)
 - a) FEMA 302 (1997 edition) NEHRP Recommended Provisions for Seismic Regulations for New Buildings
 - b) FEMA 303 (1997 edition) NEHRP Recommended Provisions for Seismic Regulations for New Bridges
 8. International Building Code (IBC), 2000 edition
 9. National Concrete Masonry Association Publications
 10. Masonry Institute of America Publications
 11. Steel Deck Institute (SDI): SDI Design Manual and Diaphragm Design Manual
 12. Steel Joist Institute (SJI): SJI Standard Specifications, Load Tables and Weight Tables for Steel Joists
 13. Unified Facilities Criteria (UFC)
 - a) UFC 1-200-01 Design: General Building Requirements
 14. Military Design Manuals (DM), Technical Instructions (TI), Engineering Instructions (EI), Technical Letters (TL) and Technical Manuals (TM)
 - a) TI 800-01 Design Criteria
 - b) TI 809-01 Load Assumptions for Building
 - c) TI 809-02 Structural Design Criteria for Buildings
 - d) TI 809-04 Seismic Design for Buildings
 - e) TI 809-06 Masonry Design for Buildings
 - f) TI 809-26 Welding Guidance for Buildings
 - g) TI 809-27 Concrete Floor Slabs on Grade Subject to Heavy Loads

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|----|----------------|---|
| h) | TI 809-29 | Structural Considerations for Metal Roofing |
| i) | TI 809-30 | Metal Building systems |
| j) | TI 809-52 | Commentary on Snow Loads |
| k) | TM 5-853-1,2,3 | Security Engineering, Vol. 1, 2, & 3, |

2.5.2 General Information

- A. The Design-Build contractor's Structural Engineer of Record shall be responsible for the design of the complete structural system for the buildings. Complete structural system for the buildings shall include foundations, walls, roof framing, floor and roof diaphragms, lateral load stability, framing and connection of any architectural features, and support and bracing of mechanical and electrical related structures, although they may be shown on other disciplines' drawings. The structural engineer is also responsible for the design of all lesser structures. Related structural design shall be compatible with the architectural design. The structural design drawings and calculations shall be sealed by the engineer in responsible charge. The engineer shall be licensed as a civil engineer in the State of Alaska.

2.5.3 Minimum requirements

- A. All buildings must have complete gravity and lateral force resisting structural systems. Any system or method of construction to be used shall be based on a rational analysis in accordance with well-established principles of mechanics. Such analysis shall result in a system that provides a complete load path capable of transferring all loads and forces from their point of origin to the load-resisting elements.
- B. The building systems shall be capable of withstanding design forces from wind and earthquake loading. The total lateral force shall be distributed to the various vertical elements of the lateral force resisting system in proportion to their rigidities considering the rigidity of the horizontal bracing system or diaphragm. Rigid elements that are assumed not to be part of the lateral force resisting system may be incorporated in buildings, provided that their effect on the action of the system is considered and provided for in the design. Provisions shall be made for the increased forces induced on resisting elements of the structural system resulting from torsion due to eccentricity between the center of application of the lateral forces and the center of rigidity of the lateral force resisting system.
- C. Buildings and other structures shall be designed to sustain local damage with the structural system as a whole remaining stable and not being damaged to an extent disproportionate to the original local damage. This shall be achieved through an arrangement of the structural elements that provides stability to the entire structural system. This shall be accomplished by providing sufficient continuity, redundancy, or ductility, or a combination thereof, in the members of the structure.
- D. Where specific design codes, standards, and regulations are not noted, structural design shall be in accordance with US Army Corps of Engineers Technical Instructions and Technical Manuals. Material designs may be completed using other industry standard references in conjunction with the referenced organizations within. In case of conflicting requirements, the more stringent design criteria shall govern.
- E. The environmental conditions of the project location, including temperatures, shall be considered in the design of all structures.

2.5.4 Design Loads

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- A. **Building Category:** The new hangar is classified as a special occupancy facility (ASCE 7 Category III). Importance factor for this classification is 1.15 for wind and 1.10 for snow.
- B. **Dead Loads:** Dead loads will be according to the actual weight of materials. Weights of various building materials will be taken from applicable tables of ASCE 7. Actual weight of equipment, mechanical, electrical and piping shall be used in design of the supporting structure.
- C. **Live Loads:** Live loads will be according to requirements of ASCE 7. The following live loads are anticipated for this facility:
1. Office Areas
 2. Corridors and Stairs
 3. Ceilings structure over ancillary areas 6.00 kPa
- D. **Snow Loads:**
1. Snow loads will be in accordance with ASCE 7 and CEPOA-EN-TE-ST criteria.
 2. Ground snow load shall be 3.10 kPa.
 3. Minimum roof snow load shall be 1.90 kPa times I_s .
 4. Drift loading and unbalanced loading will be in accordance with ASCE 7 requirements.
- E. **Wind Loads:** Wind loads per ASCE 7. Design wind speed (3 second gust) is 45 meters per second, exposure "C". Consideration shall be given to wind uplift pressure for the roof system and shall be shown on the drawings.
- F. **Seismic Loads:**
1. Seismic loads shall be per IBC 2000 and UFC 1-200-01. Controlling lateral accelerations are as follows:
 - a) Seismic Use Group = "II", Special Occupancy Facilities (High Value Equipment)
 - b) $S_s = 1.50g$, 0.2 Sec. Period Spectral Acceleration
 - c) $S_1 = 0.55g$, 1.0 Sec. Period Spectral Acceleration
 - d) Importance factor, $I_e = 1.25$
 2. The dead load for seismic mass shall include 20% of the roof snow load.
- G. **Special Loads:**
1. Floors, aprons, grates, utilidor lids and other items in traffic areas shall be designed to support F-15 and F-22 aircraft wheel loads. Maximum design wheel loads:
 - a) F-15E: 2100 kPa main gear tire pressure, 0.0745 square meter contact area. Maximum weight, fully fueled, no weapons – 33,566 kG
 - b) F-22: 2010 kPa main gear tire pressure, 0.066 square meter contact area. Maximum weight, full internal fuel, no weapons – 28,123 kG
 2. Ceiling structure over interior office, tool room, restrooms, mechanical rooms, etc. shall be designed for 6.00 kPa live load for future storage areas.
- H. **Non-Structural Components:** Non-structural components (mechanical and electrical equipment, piping, ductwork, lights, suspended ceilings, etc) shall be restrained against seismic loads. Industry standards may be utilized where allowed by code. For other elements, restraint shall be designed.

2.5.5 Concrete

- A. Structural concrete shall be in accordance with ACI 318, minimum 28-day compressive strength = 28 MPa. The reinforcing of concrete walls, continuous footings, ties and bond beams shall be continuous and typical details showing the arrangement of reinforcing at corners and intersections of these members shall be shown on the drawings.

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- B. Concrete mix design shall be approved by the Structural Engineer of Record and shall be suitable for the site weather conditions. At a minimum, air entrainment will be 4 to 6 percent and water to cement ratio a maximum of 0.45.
- C. Reinforcing shall be bars. Welded wire fabric is prohibited in slabs on grade construction.

2.5.6 Reinforced Masonry

- A. Normal weight concrete masonry units, grade N-1, type S mortar, $f'm = 10$ Mpa.
- B. Concrete grout fill $f_c = 14$ MPa, pea gravel aggregate, maximum W/C ratio = 0.56, 200-mm to 250-mm maximum slump. Grout all cells above and below grade.
- C. Reinforcing steel per ASTM A615, Grade 60 and ASTM A706 for welded reinforcing steel.

2.5.7 Structural Steel

- A. Structural steel design and construction shall be in accordance with the American Institute of Steel Construction. All structural steel shall be shop primed. 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.
- B. Structural steel shall conform to ASTM A36, A572 or A992, rolled sections and plates; ASTM A500, Grade B for tube sections.
- C. Shop connections for structural steel shall be welded and, in general, field connections will be made with high strength bolts, ASTM A325 or A490 type connections. Load indicating washers or "twist-off" type bolts shall be used to indicate correct pre-tensioning of bolts. All connections shall be detailed on the final plans.
- D. Steel Joists shall be designed, fabricated and erected in accordance with Steel Joist Institute Standard Specifications and Load Tables.
- E. Steel stud wall systems may be used for interior non-bearing walls. Steel studs shall conform to the AISI specifications with galvanized finish.

2.5.8 Metal Deck

- A. Design and construction shall be in accordance with Steel Deck Institute design manuals and load tables. Required section modulus and moment of inertia shall be shown on the drawings.
- B. Minimum deck thickness shall be 0.75-mm (20 gauge) and shall have a minimum G60 galvanized coating. Button punching of roof deck diaphragm is not allowed.

2.5.9 Pre-Engineered Metal Building System

- A. Pre-engineered metal building system shall be fully designed, detailed and stamped by a registered civil or structural engineer. Design drawings and design analysis must be submitted with each submittal package as described in SECTION 01012. A pre-engineered metal building system shall not be treated as a shop drawing type of submittal but must be part of the normal design review process.
- B. Lateral wall bracing shall be comprised of members capable of resisting both tensile and compressive forces. Tension-only "rod" bracing is not allowed.

2.5.10 Submittals

- A. Submittals shall be prepared by suppliers and submitted to the contractor and engineer of record for review and approval. Provide copies of final approved submittals bearing the contractor's and engineer of record's review stamps to the Corps of Engineers for information only in accordance with SECTION 01015.
- B. Shop drawings for fabrication, bending and placement of concrete reinforcement. Indicate grade of steel on shop drawings. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures" showing bar schedules, diagrams of bent bars, and arrangement of concrete reinforcement.
- C. Mix design for concrete, mortar, and grout. Testing for mix designs, using materials proposed for work in this project, shall have been performed not more than six months prior to placement of the mix in this project.
- D. Shop drawings for structural steel, steel joists, and steel decking showing layout, including complete details and schedules. Show assembly for structural steel, joist types, and metal decking types.
- E. Calculations and drawings for steel joists shall be stamped by a registered engineer.

2.5.11 Inspections and Tests

- A. Provide inspection and testing of structural materials and construction through independent test agencies and laboratories.
- B. Testing and inspection shall be specified by the structural engineer of record based on the design methods and materials used. At a minimum, regular inspection and Special Inspection requirements shall conform to the requirements in IBC 2000, TI 809-02 and FEMA 302.
- C. At a minimum, field quality assurance shall include sampling and testing of concrete during placement for temperature, air content, and slump. Strength test cylinders shall also be obtained.

2.5.12 Force Protection

- A. Force protection is required for buildings with respect to standoff distances and window protection; see Civil and Architectural Design Requirements.

2.5.13 Geotechnical

- A. The Design-Build contractor's Geotechnical Engineer of Record shall be responsible for preparing design recommendations for the foundation system for the buildings and site features. The foundation recommendation report shall be sealed by the engineer in responsible charge. The engineer shall be licensed as a civil engineer in the State of Alaska. A report, titled "Geotechnical Findings Report New Fuel Systems Maintenance Dock, Site 3, (ELM 179)" dated October, 2002 has been prepared for this project by the Government (see appendix 4). However, it is the Contractor's responsibility to provide any additional fieldwork deemed necessary.

2.5.14 Acceptable Building Systems

- A. The following building systems are acceptable for this project, however other building systems meeting the requirements listed above and not specifically prohibited may be used.
 - 1. Cast in place concrete foundations.
 - 2. Concrete slabs on grade.
 - 3. Structural steel post and beams.
 - 4. Engineered metal trusses.

2.5.15 Options and Government Betterments

- A. Fourth Maintenance Bay is identified as Option 1 in the Proposal Schedule. See SECTION 01010 paragraph 1.3 Options.

2.5.16 D/B Contractor-Proposed Betterments

- A. All D/B Contractor-Proposed Betterments shall conform to the criteria outlined above.

2.5.17 Prohibited Items

- A. Items that do not meet the minimum requirements listed are not allowed for the structures of this project. Specific systems prohibited include:
 - 1. Light gauge cold-formed stud bearing walls.
 - 2. Tension-only rod lateral bracing system. Lateral force resisting system braces must be designed to resist both tensile and compressive forces.
 - 3. Metal strap lateral bracing system.
 - 4. Slab on grade reinforcement shall be re-bar only. Welded wire fabric is not allowed.

PART 2 MINIMUM DESIGN CRITERIA

2.6 MECHANICAL DESIGN CRITERIA

2.6.1 Summary

- A. These specifications and the Room Criteria Sheets constitute the basis for the building mechanical design and construction of the New Fuel Systems Maintenance Dock replacement. The contractor may use alternative design solutions and materials to meet the technical performance criteria. The alternative design solutions must provide methods, materials, workmanship, and quality of installation equal to, or better than, the minimal requirements of this specification section. Use metric units for design and construction.
- B. Specific requirements listed herein take precedence over conflicting requirements in the referenced documents.

2.6.2 Scope

- A. Design and furnish all construction documents, labor, materials, equipment, supervision of labor, and performance of all operations required to completely install satisfactorily operating mechanical and plumbing systems. Major items of work include, but are not limited to, the installation of the following systems:
- B. General Mechanical Materials and Methods.
 - 1. Plumbing
 - 2. Oil Water Separators
 - 3. Natural Gas Piping
 - 4. Gas Fired Ceiling Radiant Heating
 - 5. Hanger Door Snowmelt system
 - 6. Hydronic (Glycol) Heating
 - 7. Ventilation Systems
 - 8. Controls and Instrumentation
 - 9. Mechanical Rooms
 - 10. Shop Air
 - 11. Breathing Air
- C. Code Reference and Industry Standards Criteria: The design and construction shall comply with the latest editions of the following guides and standards and local codes and ordinances. Military publications can be obtained at the website: www.usace.army.mil.
 - 1. International Building Code (IBC)
 - 2. Air Moving and Conditioning Association (AMCA)
 - 3. American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
 - 4. American Gas Association (AGA)
 - 5. American Society of Mechanical Engineers (ASME)
 - 6. National Fire Protection Association (NFPA)
 - 7. International Plumbing Code (IPC)
 - 8. American Society for Testing Materials (ASTM)
 - 9. American Water Works Association (AWWA)
 - 10. American Welding Society (AWS)
 - 11. Hydraulic Institute (HI)
 - 12. National Bureau of Standards (NBS)
 - 13. National Electrical Code (NEC)
 - 14. National Electrical Manufacturers Association (NEMA)

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15. Underwriters' Laboratories, Inc. (UL): All equipment shall bear the UL label or equivalent from a nationally recognized testing agency acceptable to the authority having jurisdiction.
16. American National Standards Institute (ANSI)
17. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
18. International Mechanical Code (IMC)
19. Air-Conditioning and Refrigeration Institute (ARI)
20. International Fire Code (IFC)
21. All base materials shall comply with standards of ASTM and ANSI.
22. Occupational Safety and Health Administration (OSHA).
23. Environmental Protection Agency (EPA)
24. National Environmental Balancing Bureau (NEBB)
25. MIL-HDBK-1008C Fire Protection for Facilities Engineering, Design and Construction
26. MIL-HDBK-1028/1C Aircraft Maintenance Facilities
27. Corps of Engineers Guide Specifications
28. State of Alaska, Department of Environmental Conservation Requirements
29. COE TI 809-04 Seismic Design for Buildings
30. COE T.O. 1-1-3 Inspection and Repair of Aircraft Integral Tank and Fuel Cells
31. ETL 1110-3-466, Selection and design of oil/water separators at Army Facilities

- D. General Design Conditions: the mechanical systems for this facility shall be designed in accordance with the references listed above and for the design conditions listed below.

Project Location:	Elmendorf AFB, Alaska
Elevation:	58.5 m
Heating Degree Days: (Base 18° C)	6,041 °C-Day
Outside Design Air Temperatures:	
	Winter: -27° C. DB
	Summer: 22° C. DB
	16° C. WB
Inside Design Air Temperatures:	
Maintenance Bay	Winter: 18° C. DB
Other Occupied Areas	Winter: 22° C. DB
Mech/Elec/Storage Rooms	Winter: 13° C. DB

- E. General Mechanical Materials and Methods:

1. Design decisions will be based on life cycle cost determinations and the impact on productivity and operating efficiency of the functions of the facility. Studies of other analysis will be made to consider the life cycle cost of the facility to arrive at an economical cost that takes into consideration not only the initial construction costs, but also the operating and maintenance costs of the building and its associated impact on the mission performance over the anticipated life of the facility.
2. Full access for maintenance of mechanical equipment shall be provided. The area or structure where HVAC equipment is located and the equipment itself shall allow sufficient clearance for removing coils and filters without having to remove piping, structure, doors or other surrounding items. Access to all mechanical equipment shall be unhindered and a minimum of 1 m wide by 2 m high. Access shall not require crawling over or under structure, pipes or other items. Stairs with handrails shall be provided when equipment is located in a basement, on a roof or on a mezzanine greater than 460 mm above finished floor. Catwalks, operating platforms, ladders, and guardrails shall be provided where

needed to provide reasonable access for maintenance of equipment located in any attics or suspended in high bay areas.

3. Framed instructions laminated in plastic, including wiring, sequence of operations and control diagrams showing the complete layout of the entire system, shall be posted. 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.

F. Operating and Maintenance Data:

1. Provide six (6) sets of each type of instructions, bound together in D-ring metal ringed hardcover binders with removable pages, with a typewritten index indicating location of items in the work. Any information not pertinent to this work shall be deleted or neatly and completely lined out. Binders shall be of capacity to allow a minimum of 20 percent expansion. Contractor shall provide 20 hours of training on controls including start up/shutdown and maintenance/calibration. O & M DDC controls training sessions shall be video recorded, and the tape shall be included with the final O&M documentation.
2. O & M training shall be provided by the contractor. A 95% submittal of corrected contract drawings indicating as-built conditions shall be submitted 15 calendar days prior to scheduled O & M training. Deficiencies found during O & M training shall be corrected by the contractor, and updated drawings shall be submitted no more than 15 days after completion of training.
3. The Contractor shall prepare operating and maintenance instructions containing information to operate, prolong service life or replace parts of the work. Operating and maintenance data shall specifically include:
 - a) List of all contractors and subcontractors names, addresses and telephone numbers.
 - b) List of all equipment and material manufacturers' local representatives and suppliers and their addresses and telephone numbers.
 - c) Pipe and duct identification schedules.
 - d) Nameplate directory with a list of all equipment indicating designation, location of equipment, manufacturers' name, model number, serial number, electrical characteristics, primary control switch location and normal position of switch.
 - e) Valve directory indicating valve number, size, location, function, service, type and normal position.
 - f) Air and hydronic test and balance report.
4. Equipment Literature: Literature shall be grouped together by system, i.e., plumbing, heat generation, etc. For all equipment, fixtures, devices, valves and specialties, provide the following:
 - a) Manufacturer's data sheets and cut sheets.
 - b) Model and serial numbers.
 - c) Capacity curves, charts and calculations.
 - d) Electrical characteristics.
 - e) Replacement parts list.
 - f) As-built equipment piping diagrams.
 - g) As-built equipment wiring diagrams.
 - h) Manufacturer's instructions for operation and maintenance. Completely mark out on all literature sheets all non-applicable items. Where piping and wiring diagrams are not available from the manufacturer, they shall be produced by the Contractor.
 - i) Control Drawings with terminals wire numbers and sequence of operations.
 - j) A copy of the as-built DDC block programming print.
5. System Description: For each system section, the Contractor shall produce and include a basic system narrative description. Each narrative shall be comprised of the following:

- a) Brief system description, including sequence of operation.
 - b) Basic system function discussion, including any interaction with other systems or components.
 - c) Primary system preventive maintenance procedures.
 - d) How to isolate all major components.
 - e) How to drain, fill and vent liquid system.
 - f) How to drain, clean and refill all tanks, pumps and tube bundles.
 - g) How to clean coils and change air filters for air systems.
 - h) Emergency shutdown procedures.
6. Master Maintenance Schedule: List each item of equipment requiring inspection and maintenance, showing required component maintenance and the intervals when such inspection and maintenance shall be performed (daily, weekly, monthly, semi-annually, etc.). For each item, reference the page within the maintenance manual, where detailed manufacturer's maintenance instructions can be found.
 7. All equipment shall be protected from corrosion. For products with protective coatings, specifications shall be written to require the products' corrosion protection bond to pass one of the industry standard adhesion tests.
 8. All mechanical systems, equipment, and controls installed outside heated spaces shall be designed and rated for the ambient condition in which they are installed.
- G. Testing, Adjusting and Balancing
1. The facility heating, ventilation and air conditioning systems shall be tested, adjusted and balanced in accordance with the standards established by the National Environmental Balancing Bureau (NEBB) or American Air Balance Council (AABC). Standard forms shall be used. All work shall be performed in accordance with UFGS 15990A, Testing, Adjusting, and Balancing of HVAC Systems.
 2. The final balance point setting of all HVAC adjustment devices including valves, splitters and dampers shall be permanently marked so that adjustment can be restored if disturbed at any time.
 3. The TAB Specialist shall review all design documents prior to construction, submit all recommendations to Contractor, and include this information in TAB report.
 4. The TAB Specialist shall witness all ductwork leakage tests.
 5. The Test and Balance Report must be submitted for review a minimum of 30 days prior to proposed date for Final Inspection.
 6. 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 the duties required for the project. If for any reason the specialist loses subject certification the Contractor shall immediately notify the Contracting Officer and submit another TAB Specialist for approval. All work performed by the TAB Specialist shall be considered invalid if the TAB Specialist loses its certification prior to contract completion, and the work must be performed by the approved successor.
- H. HVAC System Commissioning
1. Perform HVAC commissioning. Procedures for documenting and verifying the performance of all mechanical systems shall be in conformance with UFGS 15995A, Commissioning of HVAC Systems.
 2. The contractor shall designate team members to participate in the pre-commissioning checks and the functional performance testing specified in UFGS 15995A. 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
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- Q Contractor's Chief Quality Control Representative
- M Contractor's Mechanical Representative
- E Contractor's Electrical Representative
- T Contractor's TAB Representative
- C Contractor's Control Representative
- D Design Agent's Representative
- O Contracting Officer's Representative
- U Using Agency's Representative

3. Each checklist shown in UFGS 15995A 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 the individual is not required.

I. General Piping Minimum Requirements:

1. The following items are typical for all piping installations.
 - a) Close all openings in pipes with appropriate caps, plugs or covers during progress of the work to preclude introduction of undesirable materials or contaminants.
 - b) Slope all pipelines and provide low point drains, using hose end gate valves and high point vents, using specified automatic air vents.
 - c) Provide valves and unions adjacent to all tanks and equipment for isolation and removal purposes. All valves shall be installed with stems vertical wherever possible, and in no case shall stems be oriented below horizontal.
 - d) Ream ends of all pipes to full diameter free of burrs, nicks and sharp edges.
 - e) Cut pipe accurately from measurements taken on the site. Springing or bending to fit on make up pipe will not be permitted.
 - f) Bushings will not be permitted except on tanks and similar equipment. Close nipples will not be permitted.
 - g) Reduction of pipe sizes shall be made with reducing tees or reducing fittings.
 - h) All pipelines except piping under slab on grade shall be installed parallel with building lines and as high as possible. Piping shall clear all doors, windows and other openings. Avoid all ducts, light fixtures and similar equipment and conceal in finished areas wherever possible.
 - i) Piping shall be supported in a manner to prevent binding, undue swing and vibration transmission to the structure.
 - j) Where multiple pipes are clustered and routed in parallel, use trapeze hangers.
 - k) Piping within finished rooms shall be concealed above suspended ceilings or within new walls and pipe chases.
 - l) Coordinate the placement of concealed items requiring future maintenance, adjustment or replacement in such a manner that provides full access from an access panel, door, or suspended ceiling. Where needed, provide the access panel or door to these items.
 - m) Threaded Joints: Apply Teflon tape to male equipment threads.
 - n) Soldered Joints: Use Type 95/5 Tin-Antimony or an IAPMO approved, lead-free solder, for copper tubing.
 - o) Ring gaskets, spiral wound with centering ring, shall be used with all flanges.
 - p) Arrange piping along walls in horizontal groups, each group to be in one plane.
 - q) All non-factory finished piping, insulated and non-insulated, and pipe/equipment supports shall be painted.
 - r) Locate thermometers and gauges to permit observation by personnel standing on floor.
 - s) Provide instrument cocks at pressure gauges.
 - t) Provide insulating couplings, dielectric nipples or flanges to prevent electrolysis at dissimilar metal piping connections.
 - u) Unions for copper piping shall be brass.

- v) Field check all valves for packing and lubricant. Replace leaking packing.
 - w) Install valves to be accessible from floor level. Do not install valves with stem pointing downward.
 - x) Provide isolation valves near all mechanical equipment requiring service. Provide isolation valves at each toilet group, for hot and cold water supply.
 - y) Provide valves same size as line size. All ball valves shall be full port.
 - z) Install swing checks and gravity closing lift checks in horizontal position.
 - aa) Provide gate blowdown valves and hose adapters at strainers, valves shall be the same size as strainer blowoff connection. Provide end caps at all hose adapters and drain down valves.
 - bb) Provide nickel or chrome-plated escutcheons on all pipes passing through walls, floors and ceilings in finished areas, and where piping is in corridors, closets or cabinets and subject to view when doors are open. Escutcheons shall cover the pipe sleeve and shall be set with screws or springs for holding plate in position.
2. Design and install piping with provisions for expansion and contraction using expansion loops, swing or expansion joints where required. Provide for expansion and contraction in mains, risers, and runouts. Do not spring or force piping during installation.
 3. Flush all piping systems with clear water. Operate valves and other system components; drain and sterilize domestic water systems in accordance with requirements of AWWA C601 entitled: "Disinfection of Mains".
 4. Test all piping systems before concealing piping. Before testing, isolate or remove all equipment from system that would be damaged by test pressure. Purge or bleed air from piping systems before performing hydrostatic testing. Perform hydrostatic or pneumatic tests on piping in accordance with the following schedule. Maintain pressure for at least 24 hours.

System

Heating Water
 Domestic Water
 Soil and Waste
 Rain Water Leaders
 Natural Gas (low pressure)

Air
 Wat

2.6.3 Pipe Sleeves:

- A. Provide sleeves where pipes pass through walls, floors or ceilings. Sleeves in bearing walls, foundations, masonry or concrete walls and slabs shall be black steel pipe. All sleeves through frame or similar construction shall be 20 gauge galvanized sheet metal with edges turned 15 mm, installed flush with both sides of wall partition. All sleeves shall be flush with surfaces except mechanical rooms, basement floor and any wet floor area where seepage may occur. In such areas the sleeves shall project a minimum of 25 mm above floor.
- B. Size sleeves to allow 15 mm annular space between pipe insulation, or the bare pipe, and the pipe sleeve. The space between pipe and sleeve shall be filled with mineral wool or other non-combustible material to prevent passage of fire and smoke. The non-combustible material shall be caulked between pipe and sleeve at wall surface. The caulking shall have suitable smoke and flame retarding capabilities for the application as evidenced by U. L. testing and labeling.
- C. Where sleeves are installed in walls with high sound transmission loss or sleeve serves vibration-isolated pipe, sufficient space shall be provided between pipe and sleeve and packed with multiple layers of high-density sponge neoprene to reduce transmission of sound. Allow space on each side of opening and cover neoprene with non-combustible material and

caulking, as required to seal opening in accordance with above requirements. Provide sound dampening sleeves at all mechanical room, fan room and conference room penetrations.

- D. For piping passing through sleeves in areas containing floor drains and in waterproof construction, caulk annular space between pipe or pipe insulation and the enclosing sleeve to attain a watertight installation. Caulk and finish with sealing compound.

2.6.4 Piping Hangers and Supports

- A. All piping within the confines of the building walls shall be rigidly supported from the building structure by means of hangers or supports.
- B. Support piping to maintain required grading and pitching of lines, to prevent and/or dampen excessive vibration, to secure piping in place and prevent any undue stain on the connected equipment. Lateral support against earthquake-induced forces shall be accomplished by positive attachments without consideration of friction.
- C. Arrange supports to provide for expansion and contraction. No drilling of structural members will be permitted. Hanger and supports shall have a minimum safety factor of 5, based upon ultimate tensile or compressive strength, as applicable of material used.
- D. Provide bracing to prevent lateral motion.
- E. Provide plastic coated hangers and supports for copper pipe.
- F. Provide galvanized hangers and supports for hot-dipped galvanized sprinkler piping.
- G. Do not support weight of piping from mechanical equipment, ductwork, pump flanges, coil connects, or piping of other trades and related items.
- H. Provide insulation shields between hanger or support and piping for insulated piping.
- I. Provide retaining clamp on all C-clamps and beam clamps.
- J. Chain or straphangers "plumbers tape" will not be permitted.
- K. Support vertical lines at bases with riser clamps.
- L. Provide trapeze type hangers for multiple parallel horizontal pipes.
- M. Do not bend pipe hanger rods to provide alignment of piping offset from overhead supports.
- N. Provide additional support for heavy valves, specialties, and sway bracing where required.
- O. Provide pipe guides, anchors and expansion joints for all heating pipes, with one guide on each side of every expansion joint.
- P. Remove rust from ferrous hanger equipment and rods, and apply one coat of rust inhibiting paint before, or immediately after, erection.
- Q. Pipe Hanger Schedule: refer to UFGS 15070A, Seismic Protection of Mechanical Equipment for pipe hanger spacing and rod sizes.

2.6.5 Component Identification

A. Piping Identification

1. Contractor shall provide pipe markers that identify all piping, including domestic hot and cold water piping, with approved color coded adhesive bands that show fluid type, piping system identification and directional flow arrows.
2. Piping identification label to be black letters not less than 50 mm high. Directional arrows shall be black, not less than 50 mm long, on yellow background. Piping identification and directional arrows shall meet ANSI A13.1-81.
3. Identify piping at 5 m centers in all rooms, as well as in all the other spaces (such as shafts) in which piping may be viewed. There shall be at least one set of identifying bands per pipe in each space requiring identifying bands. In addition, the origination of each pipe main shall be further identified indicating the zone served.

B. Valve Identification

1. Identify valves in all areas with 50 mm x 100 mm identification tags installed on handwheels or stem with brass bead chain. Identification tags shall be engraved, indicating the service abbreviation, stating whether normally open (engraved on green) or normally closed (engraved on red). Install tags with brass jack chain on handwheel or stem.
2. Service abbreviation shall match piping service identification label. In addition, each valve tag shall include a unique sequential identification number. Where valves are located above suspended ceilings, provide colored pin markers in ceiling tiles to allow location of valves.

C. Equipment Identification

1. Manufacturer's nameplates shall be provided on all equipment identifying manufacturer's name, model number, size, capacity, and electrical characteristics. Leave manufacturer's nameplates clean and legible.
2. Identify all equipment with engraved identification tags showing symbol number and service as shown on the concept drawings. Securely fasten identification tags to equipment.

D. Identification Charts

1. Provide charts framed with glass or plastic front. Pipe identification chart shall list piping systems with symbol and color-coding where applicable. Valve identification chart shall list valve model numbers and symbol for service corresponding to piping symbol. Mount identification charts in Boiler room and AFFF Equipment Room.

E. Duct Identification

1. Identify all primary outside, return, exhaust and supply air ducts with black-stenciled letters applied directly to duct or insulation, if applicable. Supply air duct identification shall include zone or space served.

2.6.6 Insulation

A. General:

1. All insulation materials, including linings, jackets, facings, wet or dry adhesives, and vapor barriers, shall meet requirements of NFPA 90A. Flame spread rating shall not exceed 25 and smoke developed rating shall not exceed 50, as defined in ASTM E84.
2. Provide insulation on all hydronic heating and domestic water piping systems. Insulation shall be fiberglass. Provide complete with vapor barrier permeability rating of 1.149ng/s-m²-Pa, and with a thermal conductivity of k=.036 W/m-K at 38 degrees C mean temperature.
3. Provide PVC pipe fitting covers and seal ends of fiberglass insulation with mastic.
4. Provide cold and refrigeration piping systems with a continuous vapor seal. No staples or pins are permitted on cold water piping system insulation.

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5. All non-factory finished fiberglass insulation shall be finished with glass cloth and two coats of mastic.
6. Piping insulation shall be continuous at all hangers and supports with rigid inserts and sheet metal shields.
7. Rigid Insulation Inserts for Pipe: Calcium silicate, or approved substitute, for installation between pipe and hanger. Provide cellular foam glass inserts for all cold piping systems. Insulation inserts shall be not less than 150 mm long for 40 mm to 65 mm pipe, and 225 mm long for 80 mm to 150 mm pipe; thickness equal to adjoining insulation.
8. Galvanized Metal Shields: 16 gauge for 90 mm and smaller pipe, and 14 gauge for 100 mm and larger; formed to fit the diameter of the insulation, extending up to the centerline of the pipe. Length equal to insulation hanger inserts.

B. Metal Jackets

1. Aluminum jackets shall be 0.63 mm thick, have an embossed finish, and meet ASTM B209. Jacket sections shall be joined using longitudinal slip joints with a minimum 2 inches lap, caulk, and seal between all metal seams. Jacket shall be secured with 12 mm wide by 0.8 mm thick annealed stainless steel bands.
2. Provide aluminum jackets on all insulated piping exposed in finished areas up to 3 m above finished floor.

C. Piping Insulation

1. Hydronic Heating Piping: 40 mm pipe and smaller, 25 mm thick; 50 mm to 150 mm pipe, 40 mm thick.
2. Domestic Hot, Cold, and Recirculating Piping: All pipe sizes, 25 mm thick.
3. Piping Subject to Outside Ambient Temperatures: All pipe sizes, 40 mm thick.
4. Roof Drainage: 25 mm thick.
5. Plumbing vents: 1200 mm below roof insulation to termination above roof line, 25 mm thick.

D. Ductwork Insulation:

1. Provide exterior insulation on all outside air ductwork, outside air intake plenums, relief air discharge and 1200 mm upstream of exhaust ductwork. Insulation shall be fiberglass with a $k=0.035$ W/m-K at 24 degrees C or better. All insulated ducts shall be covered with 50 mm of insulation with a factory applied vapor barrier and multipurpose FSK facing. All non-factory finished fiberglass insulation shall be finished with glass cloth embedded with 2 coats of mastic.

2.6.7 Vibration Isolation:

- A. Furnish and install vibration isolating mountings and hangers for all equipment having reciprocating or rotating parts and for any other equipment, piping, or vessels that produce or transmit objectionable vibrations, pulsations, or noises.
- B. Furnish vibration isolators in the proper load range for the weight of the equipment supported. The natural frequency of the isolator shall be one-third to one-fifth of the lowest vibration frequency of the equipment or system where the isolator is used. When the equipment is mounted on a structure that is not rigid, the resilient mounts shall provide deflection that is at least four times the dead load deflection of the supporting structure. Isolators shall be selected so that deflection of each isolator on a piece of equipment is essentially identical.
- C. The following listed equipment shall be fitted with earthquake bracing and snubbers for seismic control in Zone 4. Analysis shall be performed by manufacturer supplying bracing and snubbers and data submitted for evaluation and approval. Such items shall be as manufactured by Mason Industries, Inc. or approved equal.
 1. Air-handling units

2. Boilers
 3. Heat Exchangers
 4. Expansion tanks
 5. Unit heaters, Radiant Heaters
 6. Hot water generators
 7. Utility fans
 8. Air Compressors
 9. All other central equipment, machinery, and tanks shall be fitted with bracing, anchors or snubbers for seismic control per COE TI 809-04. Lateral support against earthquake-induced forces shall be accomplished by positive attachments without consideration of friction. Analysis and restraint design shall be accomplished by the Contractor and submitted for evaluation and approval.
- D. Two nuts shall be provided on each bolt for equipment secured with cast in place, expansion or chemically bonded anchor bolts.
- E. All vibrating equipment and the interconnecting pipe and ductwork shall be isolated to eliminate the transmission of objectionable noise and vibration from the structure.
- F. Provide vibration hangars to support all piping and ductwork runs within the first 2 m nearest the connection to rotating equipment.
- G. Vibration mounting isolators sizes shall be determined by the isolator manufacturer and shall be installed in accordance with the manufacturer's instructions.

2.6.8 Plumbing System

- A. Provide a complete domestic water, waste and rainwater system designed and sized to serve all plumbing fixtures, and drains as described within this RFP and the room criteria sheets. Slope all slabs to drains.
- B. Provide automatic solenoid shut-off valve on inlet to oil/water separator(s) serving Maintenance Bays. Valves shall be full port ball valves to minimize restriction to flow. Provide controls to close valve upon activation of Maintenance Bay fire suppression system, with manual reset. Valve if in the Maintenance bay shall have rating of Class 1 division 1 rating if below the floor, class 1 Division 2 if above the floor.
- C. Design Criteria
1. The domestic water, waste and rainwater systems shall be designed, sized, constructed, tested, and inspected, in accordance with the most recent International Plumbing Code and all local code amendments. Do not connect storm drain to sewer piping service.
 2. All domestic water piping shall be sized for a maximum pressure drop of 11.3 kPa/10m of piping, and a maximum velocity of 2 m/s.
 3. All rainwater leader sizing shall be based on a design rainfall intensity of 40 mm/hr. Terminate drainage above grade. Provide heated exterior trench or heated buried pipe to swale, or other suitable drainage feature to prevent glaciations and pedestrian hazard. The minimum leader pipe size shall be 80 mm. Provide overflow roof drains, piping, and downspouts as per IPC. Provide heat tape for all piping subject to freezing, especially at downspouts, etc.
 4. Provide a gas fired hot water heater sized in accordance to the ASHRAE 1999 HVAC Applications Handbook, Service Water Heating. The domestic hot water supply temperature shall be set at 50 degrees C, adjustable.
 5. Only if a gravity sewer is unfeasible, the sewer service shall have a lift station with duplex pumps to discharge via a force main into the nearest utilidor main. Locate lift stations

inside Mechanical Rooms with high level alarm tied into the Building Automation System. Cover shall be gas tight.

6. Multiple sewer main connections are permissible, if deemed cost effective.
7. Install a domestic service water meter with strainer and a three-valve, by-pass line.
8. Floor drains shall be located at all low points of floors in rooms with plumbing; install trap primers, unless indicated otherwise.
9. Emergency eyewash and eyewash/showers shall be provided with the water of the volume and temperature indicated in ANSI Standard Z358.1-1998.

D. Materials

1. Roof drains shall be 350 mm diameter cast iron with bayonet type locking gravel guard, cast iron strainer/dome, and under-deck clamp. Zurn Z-100 series or approved equal.
2. Domestic water piping shall be type L copper tubing conforming to ASTM B88 with ANSI B16.22 fittings. Solder shall conform to ASTM B32, 95-5 tin antimony or IAPMO approved lead free. Above grade waste, drain, & vent piping shall be CISPI 301 cast iron no-hub with cast iron couplings. For forced discharge mains, use DWV copper, Type L, with soldered joints, the same as domestic water piping.
3. Below grade waste drain and vent piping shall be CISPI HSN cast iron hub and spigot with compression type neoprene gaskets.
4. Valves shall be all bronze ball or gate type with a minimum Class 200 pressure rating.
5. Provide plumbing fixtures as indicated in the Room Criteria Sheets. To the greatest extent possible, plumbing fixtures shall be from one manufacturer. All fixtures shall be institutional quality.
6. Water closets, urinals and lavatories shall be vitreous china; all counter top sinks shall be of stainless steel construction. Provide fixtures and faucets complete with all required specialties, trim, supports, and related items.
7. Water closets shall be flush valve type with elongated bowls and open-front seats without lids.
8. Provide low flow water conservation 0.14 L/s faucets, 6 L per flush water closets, and 0.16 L/s shower tempering valves.
9. Provide screwdriver-operated stops and escutcheons on all piping connections to fixtures.
10. Furnish chrome plated adjustable cast brass P-trap with tubing drain to wall. Size to match tailpiece with chrome plated escutcheon.
11. If required, provide duplex, heavy-duty sewage ejectors with epoxy coated steel sump, duplex wet pit non-clog vertical column grinder pumps, non-slam check valves, and factory control panels with all relays and contacts as required for the DDC system interface, including a hard-wired local alarm light and exterior-mounted rotating beacon.
12. Provide barrier-free refrigerated water cooler 8 mL/s of 10 degrees C water at 32 degrees C ambient air temperature and 27 degrees C entering water temperature. Provide unit with push bars, and satin finish stainless steel cooler top and backsplash.

E. Minimum Basic Requirements

1. Each domestic water branch pipe shall be controlled by a ball valve where it connects to the supply main or riser. Each toilet room, group of fixtures, or isolated fixture shall be separately controlled by valves in an accessible location and provided with access doors where necessary.
2. At all fixtures except water closets, install and connect hot water on left and cold water on right, as viewed when facing the fixture.
3. Install water hammer arresters at water connections to shock-producing fixtures and plumbing groups with flush valves or solenoid valves. Water hammer arresters to be sized and installed per Plumbing and Drainage Institute Standards.
4. All domestic hot water systems shall use a recirculating system, piped from each farthest fixture on a supply loop.

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5. Slope all domestic hot and cold water lines, and provide low point drains to facilitate the complete drain down of the building.
6. Pitch underground cast iron pipe within the building a minimum of 20 mm/m in the direction of flow. Make changes in direction of drainage lines with 45-degree wyes, long turn wyes, or sweep bends. Use long turn fittings wherever space conditions permit. Provide waterproofing around all lines penetrating through foundation walls and floor slabs.
7. Provide cleanouts at the base of each stack, each change in direction, and on a minimum of 15 m centers at horizontal runs. Cleaning screws, deck plates, and other plugs shall be made up with graphite and oil only; use no grease or cement.
8. Pitch plumbing vent lines to allow for drainage of condensation.
9. Encapsulate all exposed P-Traps, angle stops, and supply piping, located under handicap accessible lavatories and sinks, with fire resistant, molded foam, insulation per ADA requirements.
10. Traps, valves, water hammer arresters, and automatic devices in concealed piping shall be provided with access doors. The doors shall be stainless steel for toilets and prime-coated for painted areas. Provide U. L. rated access doors to match wall construction rating.
11. Floor trench drains shall be provided with sand and grit traps.
12. Install above ground oil-water separators on all hangar drainage. Unit shall be the wash-water recycling type with coalescing plates, subsurface sludge ports, ozone generator, stainless steel construction, and automatic operation. Landa Company style Alpha or equal. Do not install in explosive rated environment.
13. Insulate entire length of roof drain and overflow systems above grade.
14. Heat trace one meter downstream of rainwater and overflow leaders immediately after the roof drains and heat trace one meter upstream of rainwater overflow discharge to daylight downspouts.
15. Plumbing vents shall terminate minimum 250 mm inches above roof and shall be minimum 50 mm diameter for prevention of frost closure.

2.6.9 Hydronic (Glycol) Heating Systems

- A. Provide a complete hydronic heating system designed and sized to serve all hydronic heating terminal units as described within this RFP and the Room Criteria Sheets including the fourth Maintenance Bay. The system shall utilize duplex gas-fired boilers, a 50/50 propylene glycol hydronic heating solution and duplex primary/secondary hydronic heating pumps. Arctic entries shall be heated by cabinet unit heaters. The perimeter building spaces shall be heated by perimeter baseboard radiation terminal units. The hangar door floor area snowmelt system shall be served by the hydronic system. Separate heating fluids using a heat exchanger.
- B. Design Criteria
 1. The building heating system shall be designed to maintain an interior building temperature of 22 degrees C with a winter design temperature of -27 degrees C. DB. The building infiltration rate shall be based on the ASHRAE crack method with a 60-kph design wind speed. The minimum infiltration rate for entries shall be 2 air changes per hour (AC/HR) per Mil-Hdbk-1028/1c. The design heating load shall be calculated with a 1.2 safety factor for shell transmission losses and a 1.3 safety factor for infiltration losses.
 2. All terminal units, and reheat coils shall be sized with a 12 degrees C hydronic fluid temperature drop. All terminal units shall be de-rated and selected for a glycol heating solution.
 3. All head loss calculations shall be corrected for a glycol/water solution and all hydronic heating pumps shall have a 1.2 safety factor. All hydronic heating piping shall be sized for a maximum pressure drop of .35 kPa/m of piping.
 4. Each boiler shall be sized and selected for 50 percent maximum connected load, and sequenced together in a lead-lag configuration.

5. Boiler performance rating shall be in accordance with Hydraulic Institute Testing and Rating Standard for Cast Iron and Steel Heating Boilers. Boiler efficiency shall comply with ASHRAE 90.1-1989.

C. Materials

1. Hydronic heating piping 80 mm and under shall be type L copper tubing conforming to ASTM B88 with ANSI B16.22 fittings. Solder shall conform to ASTM B32, 95-5 tin antimony or IAPMO approved lead free. Piping over 80mm shall be ASTM A-53, grade B, carbon steel with welded or flanged type fittings equal and comparable to the piping.
2. Above ground natural gas piping shall be ASTM A53, Grade B, schedule 40 black steel with threaded or welded fittings equal and comparable to the piping. Provide gas service entrance with AGA certified gas valves, stops, automatic shut-off valve, gas pressure regulator, and gas meter. Provide connection of natural gas service in accordance with NFPA 54.
3. The glycol shall be Dowfrost HD propylene glycol inhibited fluid as manufactured by Dow Chemical Company or equal, factory premixed with de-ionized or distilled water. Silicon based inhibitors shall not be used (automotive glycol shall not be accepted as an alternative). The solution shall contain corrosion inhibitors and be compatible with all wetted parts of the system.
4. Heat exchangers shall be constructed according to ASME requirements for pressures and temperatures encountered and be compatible with fluids used.
5. Snowmelt tubing shall be cross-linked polyethylene tubing (ASTM F876).
6. Valves shall be all bronze ball or gate type with a minimum 150 pressure class rating.
7. Pumps shall be maintenance-free, in-line, single stage, cast iron volute with stainless steel impellers and motor shaft. Provide pumps with built-in multi-speed switches. The hydronic pumps shall be sized and the system designed for use at one speed below highest speed. Each primary glycol circulation pump shall be provided with an alternate backup pump. The pump motors shall be premium efficiency type motors. The primary and backup pumps shall be piped and valved so that one can be removed for maintenance and the other started, without a loss of service to the facility.
8. All pumps shall be system lubricated where possible. Otherwise use non-system lubricated in-line pumps.
9. Horizontal base mounted pumps shall be split case, if in-line pumps are not available.
10. Circulating pumps shall have piped in back-up pumps with manual switching for power to back-up pumps.
11. Isolate piping from pump vibration with flexible connectors. Connectors shall be corrugated stainless steel with double steel outer braid for piping under 50 mm. Provide twin sphere neoprene connectors with flanged ends for piping over 50 mm.
12. Isolation valves and pressure gauges shall be installed on suction/discharge sides of pumps. Balance valves shall not be used as isolation valves.
13. Pressure gauge ports shall be taken from piping, not pump flanges.
14. Balancing valves shall be installed on the discharge side of all pumps. Triple duty valves shall not be used.
15. Booster pumps shall not be isolated by control valves.
16. Booster pumps shall have readily accessible disconnect switches.
17. Remote booster pumps shall not be used.
18. Pressure gauges and isolation valves shall be installed at the fill point and at circulating pump suctions/discharge.
19. Flow measurement equipment shall be installed at all pumps.
20. For glycol make-up provide a factory packaged make-up system complete with 200 liter corrosion-proof tank, pump, pressure switch, and all necessary interconnecting pipe, wiring, and controls.
21. Baseboard finned tube radiation shall have architecturally styled enclosures with full back plates, ball bearing brackets and cradles, copper tubing/aluminum finned elements, extruded aluminum outlet grilles, and 16 gauge enclosure construction.

22. Heating coils shall be ARI 410 certified factory tested for 1400 kPa working pressure. Coils shall be aluminum finned copper tube construction. Air handling unit coils shall be minimum one row coils, drainable with factory vent and drain connections. De-rate coils for use with glycol solution.
23. Boilers shall be packaged heating units designed for use with flame retention type burners capable of burning natural gas. They shall be of a low pressure, cast iron, sectional type, capable of developing full HB-R gross output at full firing rate. The boilers shall have a pressurized firebox for forced draft venting and the burner shall be capable of delivering the necessary air for proper combustion and to pressurize the firebox. Boilers shall be constructed in accordance with ASME requirements, and bear the ASME symbol.
24. Hot water boilers shall have cast iron sections assembled with draw rods and sealed gas-tight with asbestos free sealing materials. They shall be provided with an insulated steel jacket with durable baked enamel finish. Breeching damper shall be of the lockable industrial type.
25. Boiler trim shall consist of:
 - a) ASME rated pressure relief valve, 200 kpa.
 - b) Combination water pressure and temperature gauge.
 - c) Drain valve, gate valve with plug.
 - d) Two each float type low water cut-offs with manual reset.
 - e) High limit temperature controller with manual reset.
26. Boiler controls:
 - a) Lead/lag operating controls shall be provided by DDC system, with compatible sensors installed in supply and return headers.
 - b) Flame safety controls shall be UL/FM approved, provided with burner package.
 - c) Provide 5-gauge package for mounting on boiler to include supply water temperature, return water temperature, boiler stack draft pressure, boiler firebox draft pressure and running time.
27. Boiler burners shall be forced draft type for natural gas, with adjustable combustion air supply, pressure regulator, gas valves, manual shut-off intermittent spark or glow coil ignition, flame sensing device, and automatic 100 percent shutoff.
28. Burner shall be provided with UL approved controls, including all required air flow switches and fuel shutoff valves. Controls shall be complete with ultraviolet combustion safety, electronic ignition, pre-purge, post-purge, and low-high-low firing controls.
29. Automatic control of low and high firing rates shall be by burner control on input from boiler discharge header aquastat. Manual override switch to be located at interface panel. DDC system shall monitor the position of this switch as well as the firing rate.
30. The burner control unit shall be furnished with a pre-wired microcomputer burner control system incorporating an LED display indicating boiler operating status. In addition, controller shall be capable of remote dial-out fault communication as well as local fault logging through the use of a shared DDC system communication line.
31. Factory pre-wired control cabinet shall be supplied with and mounted on burner. Cabinet shall house the flame safeguard control, burner motor starter, fuses, control switches, alarm bell, auxiliary alarm contact, control transformer, and burner status indicating lights.
32. Boiler mounted operating and safety controls, including operating thermostat, high temperature cutoff, and two low water cutoffs, shall interlock with burner controls.
33. Provide burner operating interlock for lead-lag sequencing control by DDC system.
34. All chimneys, breechings, and connectors shall be constructed of factory manufactured all fuel Chimney components, double wall construction with ventilated roof thimble and exit cone. Provide single chimney terminating above roof, braced and reinforced suitable for 100 mph winds.
35. The boiler water piping system shall include a chemical shot feeder and necessary valving to facilitate the addition of water treatment chemicals to the system.

D. Minimum Basic Requirements

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1. Provide automatic air vents at all high points and hydronic terminal units. Air vents shall be Hoffman 79 or equal. Provide 15 mm isolation ball valves.
2. Provide pressure gauges, and Pete's plugs across heat exchangers, coils, and pumps. Provide thermometers at all piping connections to heat exchangers.
3. The Contractor shall enlist the services of an established water treatment company to monitor the flushing, chemical cleaning and filling of all glycol and boiler water systems. The water treatment company representative shall sample and test glycol and water systems at initial start-up and provide necessary inhibitors and water treatment to insure conformance with boiler and glycol manufacturers recommendation. The water treatment company shall analyze samples of glycol solution and boiler water monthly for a 1-year period, beginning the month of Final Inspection. The water treatment company shall provide and install all necessary chemicals, glycol inhibitors, etc. as required to maintain system during this initial 1-year testing period. Each month during the 1-year test period the contractor shall submit copies of monthly tests performed, test results, and a description of all chemical additions and treatment to the Contracting Officer.
4. Provide optical hygrometer to government to test glycol concentrations.
5. After flushing and draining hydronic piping systems, circulate for a period of 6 hours a solution heated to 90 degrees C of 1 kg of tri-sodium phosphate for each 500 L of water in system. Upon completion, completely drain systems at all low points. Remove, clean, and replace strainer baskets. Refill system with a factory pre-mixed solution of corrosion inhibited propylene glycol and water.
6. Provide glycol make-up system with a glycol make-up storage tank, and automatic operated electric powered make-up pump. Supply pressure to the system shall be controlled with an adjustable pressure-regulating valve in the make-up supply line. Provide a manual by-pass for filling system.
7. Provide balancing valves to regulate water flow through each piping loop, coils, terminal units, and at other heating equipment and piping, for proportioning flow.
8. Pressure gauges shall be provided on each side of each pump, heating coil, heat exchanger and filter. Pressure gauges at each side of pumps shall be attached to the piping and not to the pump flanges. All pressure gauges shall be provided with isolation valves. Pressure gauges on glycol lines shall be provided with pin type pulsation snubbers. Temperature gauges shall be provided on each side of coils and heat exchangers.
9. Glycol loop temperature shall be reset linearly according to outside air temperature and shall not exceed 93 degrees C. The reset schedule shall be adjustable.
10. Hydronic piping systems shall be reverse-return systems.
11. Hydronic heating systems shall be capable of being isolated between individual floors and wings of the building.
12. Balancing valves shall be installed on all bypass and return lines serving a 3-way control valve. Furnish a hydronic balancing-meter for the project, compatible with the installed valves.
13. Balancing valves shall not serve as an isolation valve anywhere in the system. Combination balancing/isolation valves shall not be used.
14. Thermal expansion and contraction of the glycol solution shall be compensated through a diaphragm type expansion/contraction tank.
15. Boilers, expansion tanks, heat exchangers, glycol make-up tank, base mounted pumps and other large equipment shall be mounted on minimum 100 mm high reinforced concrete housekeeping pads. The equipment locations shall be coordinated and arranged for optimum upright access, with at least 1 m wide by 2.5 m high free area around equipment.

2.6.10 Gas Radiant Heaters – Maintenance Bay

- A. Heaters shall have sealed combustion chambers with ducted combustion air taken from the exterior. Comply with T.O. 1-1-3.

- B. Heater layout shall take into account minimum clearance requirements to aircraft and other fixed or moving obstructions. Install above top of all door openings.
- C. Heaters shall have minimum 16-gage tubing.

2.6.11 Hanger Door-Rail Snow Melt System

- A. The entire exterior apron and the Maintenance Bay door rails shall be served by a hydronic snowmelt system. Reference the structural design criteria for special concrete placement requirements. System equipment including circulation pump, a dedicated heat exchanger, air control devices and controls shall be located in the Boiler Room. Supply and return tubing manifolds shall be located in the Maintenance Bay near the doors. System size shall have capacity for fourth Maintenance Bay.
 - 1. The heating medium shall be a propylene glycol/water solution. Heat output shall be 377 w/m² of floor area minimum with a glycol supply temperature of 43° C. Snowmelt tubing shall be cross-linked polyethylene rated at 82° C maximum working temperature and 700 kpa working pressure. Manifolds shall be cast brass with integral circuit balancing valves.

2.6.12 Ventilation Systems

- A. Toilet rooms and janitor closets shall be equipped with exhaust fans ducted directly outdoors.
- B. Mechanical ventilation for cooling and combustion air shall be provided for the Boiler Room. The system shall utilize free cooling and mix outdoor air with room air to maintain the cooling set point via modulation of outside and return air control dampers. An engineered combustion air system, avoiding introduction of un-tempered outside air, shall be provided.
- C. Fire Protection Equipment Room shall be equipped with a cooling/ventilation system for space cooling and moisture control. Provide required engine cooling and combustion air for engine driven fire pumps.
- D. All oil/water separators and other below floor pits in the Hanger Bays shall have continuous mechanical exhaust to evacuate fumes. Airflow monitors shall alarm at the Building Automation System upon loss of airflow.
- E. The Hanger shall be provided with tank purge ventilation system(s) with flexible supply air and exhaust air duct drops located in the tank work areas as identified on the Room Criteria Sheets. Central or multiple supply/exhaust fan systems shall serve the drops. The drops shall be 305 mm diameter, and of length appropriate for the specific work intended. Air volume shall be 472 L/s per duct drop. Supply air shall be 100% outside air. Duct drop heights and lengths shall be coordinated with the user to serve the specific aircraft tank needs. The system(s) shall have capacity for all duct drops to operate at full capacity simultaneously.
- F. Drops shall be substantially supported with 3-way bracing to withstand horizontal and vertical forces caused by manual retracting and pulling on flexible drops.
- G. Provide heat recovery between supply and exhaust of the tank purge ventilation system(s) unless analysis shows it is not economically feasible. Refer to sub-paragraph N. below.
- H. Duct retraction shall consist of cables, pulleys, readily accessible wall brackets, and grounding leads at duct end fittings.
- I. Design Criteria

1. The general building ventilation system shall be sized, designed and installed in accordance with:
 - a) ASHRAE Standards and Handbooks.
 - b) 1995 SMACNA HVAC Duct Construction Standards.
 - c) 1996 NFPA 90A Installation of Air-Conditioning and Ventilation System.
 - d) 1997 International Mechanical Code.
 - e) 23rd Edition ACGIH Industrial Ventilation Handbook.
2. The office areas shall be maintained under a positive pressure with respect to the exterior and the Hanger. The general ventilation system shall provide minimum occupant fresh air ventilation in accordance to ASHRAE 62-1999. Outside air shall be used for cooling and shall be designed to maintain space temperatures at 25 degrees C, or less than 6.7 degrees C above the outside air temperature, whenever the outside air is 16 degrees C or warmer. The air handling unit shall be sized to deliver an average rate of 6.42 L/s-m2 minimum to office areas. This figure is an average and a computer-software cooling load calculation should be performed to derive space specific occupant, cooling, and exhaust airflow requirements.
3. Perform an energy budget of the facility in accordance with TI-800-1, Chapter 11.
4. The toilet rooms, locker rooms, and janitors closets shall be exhausted at a rate of 10.3 L/s-m2 or 10 AC/HR whichever is greatest.
5. The design room noise criteria (NC) inclusive of all mechanical equipment shall be:

a) Offices and general admin. space	NC-30
b) Hanger areas	NC-45
c) Common areas	NC-40
d) Conference Room	NC-25
e) Mechanical and Electrical rooms	per OSHA
6. Low velocity ductwork will be sized by the equal friction or equal velocity methods. Supply ducts will be sized at .65 Pa/m maximum. Return and relief ducts shall be sized at 2.5 m/s. Medium velocity ductwork, above pressure class of 500 Pa shall be sized using the static regain method with an industry recognized computer program.
7. Low velocity ductwork shall be constructed and conform to a minimum SMACNA pressure class of 750 Pa, Seal Class B, and applicable Leakage Class requirements. Material shall be galvanized steel. Medium velocity ductwork shall conform to SMACNA pressure class above 500 Pa, Seal Class B and the applicable Leakage Class requirements.
8. All outside air and relief air openings shall be sized for a maximum velocity of 2.5 m/s. Louvers shall be sized for a maximum velocity of 2.5 m/s through the free area.

J. Materials

1. Air-handling Units: Provide and install complete factory-assembled, piped, wired, and factory-tested air-handling units sized to serve the building as described within this RFP. The frames shall be constructed of 14-gauge galvanized steel. The casings shall be constructed of 16-gauge galvanized steel with double wall construction. Units shall be insulated with 50mm thick, 72 kg/m3 fiberglass insulation with full galvanized steel liner. Casing liner shall be perforated to reduce noise transmission with Mylar facing to facilitate full wash down. All exterior surfaces shall be phosphatized and factory finished with a baked enamel final coat. Provide units with an application-specific controller, furnished by the HVAC DDC system manufacturer. Provide the following standard factory sections:
 - a) Supply fan section
 - b) Preheat coil and filter
 - c) Glycol heating coil section
 - d) Filter box section with ASHRAE 52.1-92 30% efficient, UL Class 1, 50mm thick filters.
 - e) Mixing box section with positive shut-off low leakage dampers.

- f) Provide all sections with drain pans to facilitate full wash down.
 - g) Fans shall be tested in accordance with the procedures of AMCA 210 and shall bear the UL label and AMCA certified rating seal.
2. Diffusers, grilles and registers: Provide all diffusers, grilles and registers of steel construction with opposed blade volume dampers. Provide all ceiling supply diffusers with round inlet necks. Provide all linear slot supply diffusers with sound lined plenums.
 3. Flexible ducts shall be UL 181, Class 1, Air Duct material complying with NFPA 90A and 90B. Duct shall be of a factory fabricated assembly composed of a black CPE liner permanently bonded to a corrosion resistant helically wound spring steel wire; supporting a 25 mm thick fiberglass insulation blanket; 5.745 ng/s-m²-Pa fiberglass reinforced metalized film laminate vapor barrier with integral brass hanger grommets. Duct shall have a pressure rating of 1500 Pa positive, a 250 Pa negative and a maximum velocity rating of 20 m/s.
 4. All fire dampers shall be combination fire and smoke dampers in accordance to UL555/UL555S and bear the UL label. Units shall be sized to match the resistance rating of the wall, minimum 1-1/2 hr, and have a Class III smoke leakage rate. Provide power-open, fail-close actuators with automatic reset after test of nuisance alarms.
 5. Positive shut-off dampers shall be low leakage, thermally isolated, type with insulated airfoil blades (minimum U value of 2.6 W/m²-K). Seal shall be extruded silicone with a leakage rate of 25 L/s-m² at 1000 Pa differential static pressure.
- K. Minimum Basic Requirements
1. All ventilation equipment shall be installed on the warm side of the facility. No equipment shall be installed on the roof or require roof access for maintenance.
 2. All specified equipment shall be in mid-range of catalogued performance to allow for adjustment.
 3. All ductwork shall be hung, supported and installed in accordance with "Low Pressure Duct Construction Standards" or "High Pressure Duct Construction Standards" of SMACNA. Ductwork shall be supported to prevent and/or dampen excessive vibrations and with full seismic bracing.
 4. All fans shall be provided with inlet and outlet sound attenuators, sound lining, or acoustical enclosures as required to meet the maximum acceptable sound power levels in each room.
 5. Rectangular elbows shall have double thickness, extended edge, turning vanes.
 6. Straight duct sections of at least 7.5 duct diameters shall be shown from fan discharge, elbows and open duct ends.
 7. All flexible ductwork shall be secured to the sheet metal collars or diffuser necks with nylon "zip strips". Trim excess strip and covered with duct tape. All flexible ducts shall be limited to a 1600 mm maximum length.
 8. Provide flexible connections between all fans and ductwork. Flexible connection material shall be UL listed, fire-retardant, neoprene coated, woven glass fiber fabric, in accordance with NFPA 90A with a minimum weight of 9 kg/m² and crimped into 80 mm wide and 24 gauge thick galvanized steel collars.
 9. The flexible connections shall be suitable for 1-1/2 times the duct pressure at the connection. Flexible separation shall not be less than 150 mm between separated metals.
 10. All building exhaust air outlets shall have louvers; 25 mm mesh screens, and positive shut-off motorized control dampers. All building air intakes shall have protective hoods, 25 mm mesh screens and no louvers.
 11. Insulate all outside air ducts and plenums. Insulate all exhaust ducts from the building exterior penetration to 1200 mm downstream of ductwork.
 12. All mechanical penetrations through exterior building surfaces shall be sealed weather tight i.e. brazed seams and joints. All wall and roof penetrations shall be flashed, counter-flashed, and caulked. Roof penetrations shall be constructed in accordance with roof manufacturer's recommendations.

13. Seal all ductwork joints with SMACNA approved sealing system. Test all duct systems to prove air tightness. Duct leakage testing shall be witnessed by the TAB Specialist. Make tests prior to application of any external insulation before erection of enclosing construction. Duct leakage test procedures shall be in accordance to the SMACNA HVAC Air Duct Leakage Test Manual. All audible leaks must be corrected. Make corrections of minor leakage as approved. Maximum total system acceptable leakage shall correspond to SMACNA HVAC Air Duct Leakage Test Manual.
 14. Contractor shall provide a minimum of 14 days advance notice before performing an air balance so that Base HVAC Shop Personnel can be present to witness the procedure. Perform the air and hydronic balancing, testing and adjusting in conformance with American Air Balance Council (AABC) or National Environmental Balancing Bureau (NEBB) guidelines to achieve specified design values. Record the noise level of all rooms, inclusive of air and hydronic noise, at full flow. Correct the deficiencies required to comply with specified NC-values for each room. Submit a complete report listing all the initial and final readings.
 15. Branch ducts:
 - a) Branch ducts shall be offset from the main trunk duct (not opposite each other), to allow better balancing performance.
 - b) Each branch duct take-off shall have one of the following dampers: manually operated, opposed blade damper; manually operated, single blade damper; quadrant-type volume damper.
 - c) Manual volume dampers shall be installed at all branch duct connections upstream of registers/diffusers.
 - d) Branch ducts to registers/diffusers shall be a minimum length of two duct diameters.
 - e) Volume dampers shall be located two duct diameters from fittings and as far as possible from outlets
 16. All duct chases shall have lighting with exterior on/off switches readily accessible.
- L. Fans:
1. All fans shall be provided with inlet and outlet sound attenuators, sound lining, or acoustical enclosures as required to meet the maximum acceptable sound power levels.
 2. Fans shall be provided with access to fan through fan guard.
 3. Return fans shall not be used if return loss is less than 250 Pa. The building static pressure shall not exceed 25 Pa above ambient.
 4. Access doors/panels shall be provided to reach areas needing periodic cleaning (i.e. reheat coils, VAV boxes, etc.).
 5. Reheat coils shall only be used where absolutely necessary and the controls shall minimize wastage of energy.
 6. Fan motors shall be premium efficiency.
- M. Air Handling Units:
1. Air handling units shall have preheat and reheat coils installed.
 2. Air handling units shall be double-walled with the capability of being washed down internally.
 3. All air handling units shall be installed with sufficient space to remove coils and filters (access doors must be able to fully open).
 4. Air handlers located above a suspended ceiling shall have a servicing platform that extends 750 mm from the edge of the equipment and a clear workspace of at least 900 mm must be provided above the equipment on the controls side.
 5. Catwalks and ladders shall be provided to allow access to all elevated air handlers.
 6. Air handlers with a coil area greater than 2.3 m² shall be provided with inside lighting.
 7. Coils shall be equipped with the following items: drain pans with drain lines piped to indirect waste line or floor drain; sufficient space for cleaning; air bleed valves; 30 mm minimum condensate drains with piping sloped 20 mm/m (cooling coils).

8. Filter frames shall be of a standard size.
9. Grease (zerk) fittings shall be extended to a single, readily accessible point.
10. A thermometer shall be installed in all discharge air ductwork and all mixed air sections.
11. Control valves shall be installed outside of air handling units in a readily accessible location.
12. A minimum distance of 2-1/2 times the equivalent fan discharge duct diameter shall be provided between the return air fan and the return air and exhaust air dampers, 6 times if outlet velocities are greater than 30 m/s.
13. Exhaust fans shall be equipped with variable inlet vanes, variable pitch blades, variable discharge dampers, or motor speed control if system uses economizer controls (do not rely on relief vents).
14. Pre-heat coils shall be used with all ventilation/make-up air introduced into a heated space (sized for full flow/capacity in the event the HRV may be inoperable.)

N. Heat Recovery Units:

1. Heat recovery units shall be utilized unless economically unfeasible. Perform life cycle cost analysis using the NIST BLCC 5.0-01 software (www.eren.doe.gov/femp). Assume the tank purge ventilation system(s) operate 120 hours per week, and gas cost is \$.45/CCF.
2. Access shall be provided on both sides of coils for removal and cleaning.
3. Outside air and exhaust air shall be filtered before entering unit.
4. Coils shall have a fin density of no more than 8 fins per 25 mm.
5. Control valves shall be installed outside of the unit in a readily accessible location.
6. Plastic components shall not be exposed to outdoor air (i.e. damper brackets).
7. Drains shall be piped to an indirect waste line or floor drain.
8. Units shall be labeled using engraved metal or plastic nameplates.
9. Units shall be capable of being washed down.

O. Filter Gauges: Dwyer type differential pressure indicators shall be installed across all filters.

P. Louvers, Dampers and Mixing Boxes:

1. Pressure independent balancing dampers shall be installed downstream of VAV boxes.
2. Full quadrant balancing dampers shall be provided for all fresh air and return air ductwork to all air handling units.
3. Duct access doors shall be installed on both sides of all dampers.
4. High efficiency dampers shall be used on all fresh air dampers and mixing boxes.
5. Air intakes and exhausts shall be designed where the point of zero water penetration corresponds to the point on the air intake or exhaust curve where water penetration as defined by the Air Movement and Control Association (AMCA) Standard 500.

2.6.13 Direct Digital Controls

- A. A complete control system shall be installed to serve the entire building. New control components. The new HVAC controls for the facility shall be a DDC (direct digital control) microprocessor based system employing distributed processing. The system shall be designed and installed in accordance with the most recent version of Corps of Engineers Guide Specification SECTION 15951A, Direct Digital Control For HVAC. The controls shall be provided with a modem and dedicated analog telecommunication connection for remote communication to, and fully compatible with the existing Automated Logic EMCS Host system serving the Base.

B. Design Criteria

1. Manufacturer's Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

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2. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience.
 3. Operator System Access: Via software password with access levels at each control unit.
 4. Software shall have the capability of database creation, trend logging, report development, alarm processing, automatic time scheduling, night setback, event initiated programming and complete graphic programming software.
 5. The system shall be fully compatible with the existing Automated Logic Base Host EMCS System. Allow full remote monitoring and control functions from the Base Host Processing Unit via telephone modem, and provide all associated hardware/software necessary to accomplish this function. The DDC system shall be BACNET compatible at the building level.
 6. Provide a minimum of 20 hours of on-site operator training for each building to include, but not limited to, start-up, shutdown, maintenance, calibration and integration into the Base Host Processing Unit.
- C. Materials
1. HVAC controls shall include but not limited to the following:
 - a) Optimal run time.
 - b) Supply Air reset.
 - c) Dry Bulb Temperature sensor Switchover.
 - d) Economizer cycle.
 - e) Manual outside air over-ride potentiometer in each assembly area to vary the ventilation rate.
 2. Local control shall be accomplished by networked DDC panels using PID capabilities. Each controller shall be capable of stand-alone operations and shall be complete with battery back-up and manual operator override capability with a local hand-off-auto switch and 420 mA slider control of the output signal. Specifically, each valve shall have a manual lever that can be set to maintain temperature(s) locally. Local control shall include custom sequences of operation for each mechanical equipment, HVAC systems and terminal unit. System shall be expandable. For on-site use, provide all necessary hardware to connect a portable laptop computer; the computer shall be furnished by the government.
 3. Sensors shall be electronic, with remote set-point adjustment.
 4. Operators shall be electric.
- D. Minimum Basic Requirement:
1. Room zone valves shall have a manual bypass or override. Room sensors shall only be adjustable remotely from the DDC console. Each air handling unit shall be zoned to serve similar rooms; dissimilar spaces shall be on separate systems to allow proper ventilation rate and temperature control. In open areas, provide a thermostat for every 100 square meters.
 2. Control system shall not have any automatic reset low limit switches.
 3. Over current protection shall be provided for all input/output circuits of the DDC system.
 4. Steel channel structural supports shall be provided for any actuators installed on sheet metal smaller than 16 gauge.
 5. All mechanical equipment (including mechanical rooms, etc.) shall be a part of a Building Automation System or must be pre-wired to interface with an "inter-operable" Building Automation System. The control points and alarm input/outputs shall include, but are not limited to, all fan/pump motor above 1 kW, status monitoring via current transformers and failure alarms; low hydronic system pressure alarm; dirty filter alarms; freeze-stat trip alarm (no auto reset); high sewer sump alarm; general fault alarms from packaged computer cooling units; water meter totalizers; glycol make-up tank low level alarm.
 6. Provide complete building start up and commissioning in accordance with applicable portions of UFGS 15995A, Commissioning of HVAC Systems.

2.6.14 Mechanical Rooms

- A. Mechanical room entrances shall be large enough to facilitate movement of large equipment to and from mechanical room. Double doors with separate access outside of facility are preferred.
- B. All framed walls within mechanical rooms shall be constructed using cement board. (i.e. no gypsum board).
- C. Hot and cold hose bibb connections with back flow preventors shall be provided in mechanical rooms.
- D. Mechanical rooms shall have a minimum of one floor drain, with trap primer.
- E. Mechanical room floors shall slope to floor drains.
- F. 115 Volt power outlets shall be provided in mechanical rooms.
- G. Clearance shall be provided to remove, replace and maintain air filters, heat exchanger coils and hot water heating coils. All manufacturer recommended clearances shall also be provided.
- H. All access for maintenance shall be of an ergonomic design.
- I. All elevated units shall have catwalks and ladders to provide access.
- J. Combustion air systems shall be designed so the gravity combustion air inlet prevents cold air from "dumping" into the room and the outside air ventilation fan includes motorized mixing dampers arranged to mix outside air and return air to 13 degrees C.
- K. Inlet and exhaust openings for all facilities shall have hoods and louvers where they penetrate the exterior wall.
- L. Mechanical rooms shall be provided with ventilation allowing for a set temperature no higher than 27 degrees C.
- M. Mechanical room lighting shall be adequate for maintenance of all equipment.
- N. Mechanical rooms shall not be used a return plenums.
- O. Mechanical rooms shall have two pair of communication lines and a fiber optic line supplied for DDC controls.
- P. Copies of the following drawings shall be laminated in clear plastic and placed in the mechanical room:
 - 1. Duct work drawings
 - 2. Piping drawing
 - 3. Valve schedule
 - 4. Control schematics
 - 5. Description of Control Operations

2.6.15 Shop Air System

- A. Design Criteria:
 - 1. Provide shop air system for maintenance. The system shall be sized for the outlets indicated on the room criteria sheets including the fourth Maintenance bay, with a 60%

diversity using standard air tools and operating at 690 kPa. In addition, the system shall operate two "Bullard" Free-air pumps running simultaneously attached to the 1" shop air quick disconnects. The Bullard model ADP3CA pumps require 40 L/s at 655 kPa each. System shall deliver 700 kPa shop air to all outlets. Shop air piping shall be sized at a maximum pressure drop of .5kPa/m.

B. Components

1. Shop air compressor shall be a duplex rotary screw unit with integral receiver, receiver drain down valve, safety relief, moisture separator and drain, main pressure regulator, main filter, and heavy duty air inlet filter and silencer. Install unit on concrete housekeeping pad with vibration Isolation.
2. Shop air piping shall be schedule 40 ASTM A53 black steel with threaded malleable iron or forged welded fittings.
3. Provide isolation valve, regulator, filter with metal guard, gauge, duplex quick disconnects, and drip leg with blow down valve at each shop air outlet. Install shop air branch piping to each outlet from the top of the main.
4. Provide retractable hose reels at each location indicated. Hose reels shall be spring loaded retractable, with 30 m hoses, 10 mm diameter.
5. Provide shutoff valve, drip leg with valve, pressure regulator with gage, and triplex wall mounted shop outlet where indicated. Outlets shall include one 25 mm and two 10 mm quick disconnects.

2.6.16 Breathing Air System

A. Design Criteria

1. Provide Breathing air system for in-tank maintenance. The system shall comply with UFGS 15217N, Medical Gas and Vacuum Systems; and NFPA 99 for Medical Air. The system shall be sized for the outlets indicated on the room criteria sheets and drawings including the fourth maintenance Bay, with all outlets operating at once (3-users per outlet). All jets shall be serviceable from two sets of service drops, however one set may be shared with an adjacent jet in close proximity. If a partition wall is installed between jets, an additional set of service drops will be required to meet this requirement. System shall deliver 517 kPa air pressure. Air piping shall be sized at pressure drop of 5kPa/10m.

B. Materials

1. Air compressor shall be a duplex reciprocating unit with receiver and air filtration system; to provide air in compliance with CGA G-7.1, Grade D. Provide receiver drain down valve, safety relief, air dryer/cooler, moisture separator and drain, main pressure regulator, main filter, and heavy duty air inlet filter/silencer. Install unit on concrete housekeeping pad with vibration Isolation.
2. Piping shall be copper or stainless steel tubing complying with all requirements of Medical Air piping per the Corps of Engineers Guide Specifications.
3. Provide isolation valve and regulator with gage in cabinet for each 3-hose reel. Locate components 1.2 m above the floor in an accessible location. Size valving for a pressure reduction from 516 kPa to 205 kPa.
4. Provide retractable hose reels at each location indicated. Hoses shall be 30 m long and 15 mm diameter. Three hoses are required at each location. Either band the three hoses together on a single reel, or provide three hose reels at each position indicated. Hoses and fittings shall be manufactured by 3M to be compatible with the Users' 3M #7800S air supplied full face breathing masks (respirators).
5. Provide back-up medical Gas Cylinder Manifold system rated at 20,682 kPa with automatic switchover upon failure of main system. Back-up storage capacity shall be capable of serving 12 respirators for 30 minutes. Demonstrate tank capacity as part of building commissioning.

6. Provide alarms visible and audible in Maintenance Bay to notify of failures to the main air supply system and activation of the reserve cylinder system.
7. Compressor air intake shall be ducted to the exterior. Intake shall be 12 m away from building exhausts and vents, vehicle exhausts, and other sources of contamination.
8. Breathing air system pipe and hose fittings and quick disconnects shall be incompatible with shop air fittings.

2.6.17 Seismic Protection

- A. All mechanical piping, ductwork and equipment shall be seismically braced. Provide all necessary steel, hardware, devices and factory-manufactured components required for seismic protection of all mechanical equipment furnished under this contract.
- B. Design Criteria
 1. Design bracing and snubbers in accordance with Corps of Engineers Guide Specifications, SECTION 15070, "Seismic Protection For Mechanical Equipment." In particular, follow TI 809-04, "Seismic Design for Buildings," referenced in the stated document. The design shall also comply with AFM 88-3.
 2. Follow manufacturer's recommendations in selecting all factory-furnished devices.
 3. Submit an analysis of all required seismic control for evaluation and approval, as relating to mechanical equipment.
 4. Provide snubbers and flexible bracing as required for vibration isolation and earthquake protection. Use preferred factory-furnished equipment and devices to the extent feasible.

2.6.18 Required Items: Controls system shall be fully compatible with base host central processing system.

2.6.19 Prohibited Items:

- A. Items which do not meet the minimum requirements listed are not allowed for the mechanical systems for this project. The following specific systems are prohibited for this project:
 1. Roof Mounted Equipment and any ductwork outside the building envelope.
 2. Dielectric Unions.
 3. Mono-flo and single pipe systems.
 4. Reheat energy for HVAC temperature control.
 5. Gravity relief air dampers.
 6. Automotive glycol and/or silicone-based inhibitors.
 7. Ozone Depleting Substances.

PART 2 MINIMUM DESIGN CRITERIA

2.7 ELECTRICAL REQUIREMENTS

2.7.1 Scope:

- A. Furnish all labor, materials, equipment and supervision of labor for the complete and satisfactory design, construction and installation, but not limited to the following electrical systems:
1. Lighting
 2. Power
 3. Emergency Power Generation System
 4. Data/Communication System
 5. Special Systems
- B. Standards for Electrical Systems
1. Power system shall be completely designed in accordance with the latest edition of the NEC, NESC, and in accordance with the requirements herein.
 2. All plans shall be prepared and sealed by an engineer registered in the State of Alaska as an electrical engineer.
 3. USAF Engineering Technical Letters (ETL's) may be downloaded from the AFCESA website at <http://www.afcesa.af.mil/Publications/ETLs/default.html>.
- C. The design and construction shall comply with the latest editions of the following guides and standards and local codes and ordinances. Most Military publications can be obtained from the following web sites: 1) www.usace.army.mil, 2) <http://www.hnd.usace.army.mil/techinfo/index.asp>, 3) <http://www.afcesa.af.mil/>.
1. Military Handbook 1008C available at <http://w2.hnd.usace.army.mil/techinfo/milhbkm.htm>
 2. ADA Accessibility Guidelines for Building and Facilities. (see room criteria sheets for locations)
 3. Memorandum for Elmendorf Air Force Base Local Users - Elmendorf AFB Data Standards.
 4. Standard Telecommunications Infrastructure Requirements for New or Renovated Facilities; 3rd Communications Squadron Planning Section; Elmendorf AFB.
 5. Rural Utilities Service Criteria.
 6. International Building Code (IBC).
 7. National Electrical Manufacturers Association (NEMA).
 8. Underwriters' Laboratories, Inc. (U.L.). All equipment shall bear the UL label, or equivalent, from a nationally recognized testing agency, acceptable to the authority having jurisdiction.
 9. American National Standards Institute (ANSI).
 10. Illuminating Engineering Society of North America, I.E.S.N.A Lighting Handbook, ninth edition.
 11. Life Safety Code (NFPA Article 101).
 12. National Electrical Safety Code (NESC).
 13. EIA/TIA 568A Commercial Building Telecommunications Wiring Standard.
 14. EIA/TIA 569 Commercial Building Standard for Telecommunications Pathways and Spaces.
 15. EIA/TIA 606 Administration Standard for the Telecommunications Infrastructure of Commercial Buildings.
 16. EIA/TIA 607 Commercial Building Grounding and Bonding Requirements for Telecommunications.
 17. EIA/TIA TSB 67 Transmission Performance Specifications for Field Testing of Unshielded Twisted Pair Cabling Systems.
 18. IEEE C62.41 Surge Voltages in Low-Voltage AC Power Circuits.

19. IEEE STD 81 Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System (Part 1).
20. IEEE STD 242 Recommended Practice for Protection and coordination of Industrial and Commercial Power Systems.
21. IEEE STD 399 Recommended Practice for Industrial and Commercial Power Systems Analysis.
22. National Fire Protection Association (NFPA).
23. NFPA 70 National Electrical Code.
24. NFPA 72 National Fire Alarm Code.
25. NFPA 101 Safety to Life from Fire in Buildings and Structures.
26. USAF Engineering Technical Letter (ETL) 99-4, Fire Protection Engineering Criteria and Technical Guidance – Emergency Lighting and the Marking of Exits.
27. USAF Engineering Technical Letter (ETL) 01-2 Fire Protection Engineering Criteria – New Aircraft Facilities
28. USAF Engineering Technical Letter (ETL) 02-12, Communications and Information Systems Criteria for Air Force Facilities (replaces ETL-87-9, Prewiring).
29. USAF Technical Order (TO) 1-1-3, Inspection and Repair of Aircraft Integral Tank and Fuel Cells.
30. USAF Technical Instruction 811-16 Lighting Standards.
31. Air Force Occupational Safety and Health (AFOSH).
32. Air Force Joint Manual (AFJMAN) 32-1082, Facilities Engineering Electrical Exterior Facilities.
33. AFJMAN 32-1080 (TM 5-811-1), Electrical Power Supply and Distribution.
34. Air Force Instruction (AFI) 32-1065, Grounding Systems.
35. Airfield and Heliport Planning and Design Manual, (AFMAN 32-1123).
36. Corps of Engineers Guide Specifications (CEGS).
37. NETA, International Electrical Testing Specifications for Electric Power Distribution Equipment and Systems.
38. All base materials shall comply with standards of ASTM and ANSI.

2.7.2 Exterior Lighting

- A. Provide exterior lighting to illuminate adjacent tow-way, apron, and building perimeter.
- B. Illumination criteria in accordance with guides and standards listed in 2.7.1 above. Point-by-point calculations using a light loss factor of 0.62. Exterior lighting luminaires will be mounted on hangar exterior walls and tapered steel poles for area lighting of building exterior, aprons, and adjacent taxiways. All electroliers will be constructed to withstand 160 kph (100 mph) wind loading with a 1.3 gust factor.
- C. Feed branch circuits supplying exterior fixtures through electrically operated, mechanically held lighting contactors. The contactors shall be mounted indoors and controlled automatically. Site lighting luminaires shall be high-pressure sodium (HPS) type lamps and equipped with low-temperature ballasts. Luminaires shall incorporate cut-off type optics with no up-light component. The contractor shall submit point-to-point lighting calculations demonstrating the layout, fixture type, illumination levels and uniformity.
- D. All exterior building-mounted light fixtures are to be connected to the emergency generation system.
- E. No flood lights or wall packs are permitted.
- F. Mount exterior fixtures such that they are protected from damage from ice dams, or snow or ice shed from the roof.

2.7.3 Interior lighting

- A. Interior: Calculations shall be based on the actual finish material reflectances or a maximum of 80% for the ceiling, 50% for the wall and 20% for the floor, whichever is lower. The foot-candle levels shall be calculated using light loss factor of 0.7 and the ballast factor of the supplied equipment.
- B. General lighting schedules shall include lamp type, voltage, power consumption in VA, type of mounting, manufacturer and catalog number.
- C. Control switches for general room lighting shall be located at room entrances. Room with more than one door shall have three-or four-way switches.
- D. Emergency lighting shall be provided per IBC,NFPA 101 and ETL 99-4. Signage shall be green letters on white background.
- E. Exit signs shall be of the internally illuminated light emitting diode (LED) type. Interior lighting fixtures shall be as indicated in room criteria sheets.
- F. Provide energy-efficient fluorescent fixtures unless otherwise noted, with energy-saving ballasts.

2.7.4 Power – Special Locations

- A. In hazardous locations, provide materials and equipment listed for use in accordance with the hazardous location classification.
- B. References 27 and 28 in Section 2.7.1 c. contain extensive measures to be taken to protect against the hazards of maintenance in Fuel Cell Maintenance Hangars. Particular attention to these references by the design engineer is warranted.
- C. All classified locations within and adjacent to the hangar shall be identified by the design engineer and clearly delineated on the design documents.

2.7.5 Emergency Generator and Power arrangement

- A. Provide a four-stroke-cycle, diesel-fired, emergency generator unit inside the building, sized to provide emergency power to operate the exterior lights and hangar doors upon loss of normal power. Additional emergency or standby power loads may be added at the engineer's discretion. Transfer these loads automatically to the generator through a 4-pole automatic transfer switch upon power failure. Automatic transfer back to normal power, is required, when normal power is restored. Provide a permanent resistance load-bank sized to test the generator. Fuel supply and storage will be provided for 5 days of operation at full load. Use standby power rating of the generator as the basis of design to supply the loads. The generator shall use the best available technology to limit emissions, using JP-8 arctic fuel.

2.7.6 Service Entrance Equipment

- A. Provide electrical power service monitoring instrumentation on the service entrance main distribution panel. Provide service entrance equipment sized per the NEC for the building loads with an additional 25% spare capacity. Provide service voltage rated 277/480 Volts, 3-phase, 4-wire with a 3-pole main breaker.

2.7.7 Power Distribution

- A. Provide separate panels for each of the following types of loads:
 - 1. Lighting
 - 2. Office and staff area convenience receptacles and general power
 - 3. Mechanical Systems
 - 4. Computer equipment
- B. All outlets in office areas shall be served from branch circuit panel boards.
- C. Provide grounding type receptacles of current rating, voltage, phase and configuration as required to serve all equipment. Receptacles in the Maintenance Bay and Fuel Cell Maintenance rooms shall be rated for the Hazardous Location and shall electrically disconnect from the circuit before the plugs can be removed from the receptacles.
- D. Provide duplex receptacles to comply with the requirements of the Room Criteria sheets.
- E. No more than six duplex receptacles shall be connected to a single circuit.
- F. Provide double duplex receptacles with single device plate within 460mm (18 in.) of each data outlet.
- G. A minimum of one GFCI receptacle shall be provided in each restroom, electric room, mechanical room and janitor's closet.
- H. Two 20A quad receptacles on 2 dedicated circuits shall be provided behind the equipment rack, in the Communication Equipment Room. Refer to the 2.71, c. 4 reference for additional requirements.
- I. Provide weatherproof while in use (using metal covers) GFCI protected receptacles on the exterior of the building within 3m of each door. Provide additional receptacles such that no point on the exterior wall is more than 15m from a receptacle.
- J. Provide connections, services and equipment required for proper connection and operation of all equipment furnished or planned, presence denoted, or required in other portions of these specifications. Such equipment shall include, but not necessarily be limited to, mechanical systems equipment (fans, boilers, pumps, etc.), utilization equipment (drinking fountains, computers, copiers, etc.) and government-furnished-government-installed equipment.
- K. Maintain integrity of penetrations intended to be waterproof. Provide flashing at all penetrations of waterproof membranes.

2.7.8 Grounding

- A. Provide a grounding system in accordance with NEC Article 250.
- B. Provide insulated grounding conductors, sized per NEC requirements, in all secondary, distribution, feeder and branch circuit conduits.
- C. Provide a building grounding electrode system consisting of a ground ring, metal underground water pipe, building structural steel, concrete encased electrode, and copper clad steel rod electrodes. Make all grounding connections to building steel and below grade with exothermic connections. Bond the ground grid to the hangar static ground grid system as described below and in the room criteria sheets and to the electrical service as required by the NEC.

- D. Provide a 5m square, static grounding grid with connecting points consisting of ERICO Static Grounding Receptacles, model B165, or 19mm copper eyebolts recessed below the finished surface of the hangar floor and apron maintenance areas connected with minimum 4 AWG bare copper conductors. Bond the receptacles or eyebolts to the 4 AWG copper to form an electrically continuous ground. Bond each of the aircraft tie-downs to the ground grid. Bond static grounding "touch pads" to the grid and mount at hangar entrances and fuel cell maintenance locations.
- E. Provide a 1 AWG ground wire from the ground grid to the Telephone Backboard (TTB) ground bus.

2.7.9 Lightning Protection System

- A. No building lightning protection system is required. Protect the Fire Alarm remote transceiver from lightning and transient voltage surges.

2.7.10 Telecommunication

- A. Provide a telecommunication service entrance for an unclassified system. The service shall consist of a minimum 25 pair telephone service. Refer to section 2.7.1.c.4. for specific infrastructure requirements including telecom/data room sizes, equipment, cabling and preferred manufacturers.
 - 1. Telephone and Data Systems outlets, cabling and terminations shall be installed in all rooms as indicated in the room criteria sheets. All equipment, cabling and terminations shall meet Category 6 rating for Voice and Data. The system shall be in compliance with EIA/TIA criteria with all terminations labeled and identified. All installers must be manufacturer certified. The PBX, active LAN components (hubs, routers, bridges, modems, etc.) and computer systems will be procured and installed by the government.
 - 2. Voice and data cables shall be wired to comply with the requirements of the EIA/TIA 568A jack configuration. Cables shall have plenum rated insulation and jacket materials. No telecommunication or data conduit or cable may be routed below grade.
 - 3. Interior Raceways. Comply with the requirements of EIA/TIA 569. Minimum size 35 mm (1 1/4") for telephone/data conduits. Cable trays may be used for collecting and routing multiple cables to terminal closet(s). Use only long radius elbows. Conduit bodies are not permitted in telecom/data wiring. Provide home run from telephone and data outlets, through conduits to the cable tray to backboard or conduit directly to backboard. Provide plastic bushings on all conduit terminations. Minimum box size for outlets: 119 mm (4 11/16") square x 54 mm (2-1/8") deep.
 - 4. Grounding per ANSI/TIA/EIA-607, Commercial Building Grounding and Bonding Requirements for Telecommunications..

2.7.11 Lighting

- A. Fluorescent Ballast. ANSI C82.1, instant start, high power factor type electronic ballast with less than 10% harmonic distortion. Provide end-of-life sensing technology in ballasts for T5 and smaller lamps.
- B. High Intensity Discharge (HID) Ballast. ANSI C82.4, metal halide for interior areas and high-pressure sodium lamp ballast for exterior areas. Lighting fixtures installed exposed to exterior ambient conditions shall be capable of operation in minus 40 degrees C ambient temperatures.
- C. In rooms with suspended acoustical tile ceilings provide two or three lamp parabolic recessed fluorescent light fixtures. In rooms with gypsum wallboard ceilings provide wrap around surface mounted acrylic lens fluorescent fixtures. In exposed structures with no ceiling provide pendant

mounted fluorescent or metal halide fixtures. All three-lamp fixtures shall have 2 level switching

- D. Fluorescent lamps: Deluxe phosphor type with 3500K, 88+ CRI, T5, T8 or 4Pin Quad tube compact lamps. U-bent tubes are not permitted.

2.7.12 Exterior Electrical Distribution

- A. Provide electrical service by installing a new distribution transformer for the hangar. Extend underground service to the new pad mounted transformer located adjacent to the hangar from the overhead distribution line on the North side of Arctic Warrior Drive. Coordinate the pole to take distribution from with the Base Utility. Comply with RUS Standards for pole hardware and underground distribution.
- B. Underground primary cables shall consist of underground cable in conduit from fused cut-outs at the overhead distribution to the transformer. Cables shall conform to the requirements of NEMA WC 8 using ethylene-propylene-rubber (EPR), 15 kV, 133 percent insulation and a nonmetallic jacket with concentric neutral conductors. Cables shall have both conductor and insulation shielding for each phase.
- C. Provide Sorel Brown paint on all exterior electrical distribution equipment, including enclosures for switchgear, sectionalizers and transformers.
- D. Pad Mounted Transformer
- E. Building transformer shall be a pad-mounted, Y-Y, 12,470/7,200 primary volts. Transformer shall be oil filled, through feed, and dead front construction with separate high and low voltage compartments complying with ANSI C57.12.26.
- F. Transformer shall be equipped with primary fuse protection, surge arresters, connectors, bushings, parking bushings, load-break switches, adjustable, no-load tap changers, concrete pad and ground ring. Distance between transformer and other structures shall be in accordance with Military Handbook 1008C requirements.
- G. Concrete Pads - may be either pre-fabricated or cast-in-place and shall have minimum 20 MPa compressive strength. Tops of concrete pads shall be level and shall project 100 mm (4") above finished grade and sloped to drain. Edges of concrete pads shall have 20 mm (3/4") chamfer all around. 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 compartment.
- H. The Contractor is to remove the overhead distribution line through the building site as shown on drawing C1 in Appendix from the first pole west of Truemper Drive through the next seven poles. Dead-end the poles that remain at the ends of the line.
- I. Secondary Service - shall consist of underground wiring installed in conduit from the pad-mounted transformer to the main distribution panel. Provide type XHHW-2 cable in accordance with NEC for secondary feeder. The service entrance conductors shall not be larger than 500 kcmil. Provide parallel runs of conductors to achieve adequate conductor ampacity requirements.
- J. Coordinated Power System Protection

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1. Prepare and submit an analysis demonstrating that the equipment and system constructed meets the specific requirements for equipment ratings, coordination, and protection. The analysis shall include a fault current analysis and protective device coordination study. Protective devices shall be based on the recommendations of this study.
2. The fault current analysis, and protective device coordination study shall begin at the source bus and extend through the primary transformers, distribution equipment, low voltage (600 V and below) transformers, panelboards, loadcenters, feeder and branch circuit wiring.
3. The Contractor shall obtain from the base utility the fault current availability at the site or use an infinite bus as the calculation basis. Main power transformer ratings shall be coordinated with the requirements of the base utility as to impedance, impedance standard, insulation level, bushing configuration, fusing requirements, temperature rise and tap configuration.
4. A single line diagram shall be prepared to show the electrical system buses, devices, transformation points, and all sources of fault current (including motor contributions). Locations of switches, breakers, and circuit interrupting devices shall be shown on the diagram together with available fault data, and the device interrupting rating.
5. The fault current analysis shall be performed in accordance with methods described in IEEE Std 242, and IEEE Std 399. Actual data shall be used in fault calculations. Bus characteristics and transformer impedance shall be those proposed. Data shall be documented in the report. 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 values of fault available at each location shall be shown on the diagram or in the report.
6. Coordination 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 to describe how the devices may operate in the event of a fault at each bus; the logic used to arrive at the device ratings and settings; situations where system coordination is not achievable due to device limitation (an analysis of any device curves which overlap); the coordination between upstream and downstream devices.

2.7.13 Interior Distribution

- A. The electrical system shall consist of a Main Distribution Panel located in the electric room for distribution of power to branch circuit panelboards located around the facility to optimize conductor lengths and avoid power quality problems. Distribution equipment shall be deadfront construction and equipped with copper busses. A minimum of two 250 Amp, 3-pole circuit breaker spaces shall be provided for future use. Service entrance equipment shall be fully rated for available fault current.
- B. The service Main Distribution Panel (MDP) shall be equipped with Transient Voltage Surge Suppression.
- C. Provide MDP power monitoring equipment on the incoming feeder to provide the features and monitor the following parameters:
 1. Current, per phase
 2. Neutral current
 3. Voltage, line to line
 4. Voltage, line to neutral
 5. Real power, kW
 6. Reactive power, kVAR
 7. Apparent power, kVA

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8. Power factor
 9. Frequency
 10. Real power demand, kWd
 11. Reactive power demand, kVArd
 12. Apparent power demand, kVA_d
 13. Real energy, kWh
 14. Apparent energy, kVAh
 15. Energy accumulation modes
 16. KYZ output
 17. RS-485 and Modbus RTU connection
 18. THD, voltage and current
- D. Motor and Circuit Disconnects: These units will be sized for the specific circuit and application in which they are used. Each motor will be provided with a local, horsepower rated disconnect. Circuit disconnects will have ampere ratings equal to or greater than the ampere rating of the circuit supplying the equipment. All disconnects will be of the heavy-duty type.
- E. Motor Starters: Unless special considerations require selection of other types of starters, starters will be horsepower-rated and will consist of toggle-type manual starters for fractional horsepower motors and full NEMA size units sized for those motors greater than 0.37 kW (1/2 horsepower) in size or of 3-phase configuration. Starters will be equipped with red run pilot light, control transformer, start-stop push-buttons or H-O-A switches as required and connected so control will be shut down when the disconnect switch is opened for any reason.
- F. Where motors exceed 14.71 kW (20 HP) in rating and do not warrant VFD controllers provide auto-transformer reduced voltage starters or solid-state, soft-start controllers.
- G. Branch Circuit Panel boards shall be dead-front construction with copper buses and bolt-on circuit breakers, and shall have 15% minimum spare capacity above the NEC demand loads served. They shall be fully rated for the available fault current. Provide a minimum of 15% spare single pole breakers in each panel board.
- H. Transformers, Dry-Type: Single and three-phase transformers shall have shielded, copper windings. Provide insulation Class F Transformers with 185 degrees C insulation and a maximum 115 degrees C rise under full-rated load in a maximum ambient temperature of 40 degrees C.

2.7.14 Conduit and Raceway

- A. All wiring shall be installed in raceway. Raceways shall be specified of the type suited for the applications and locations. Raceway shall not be smaller than 16 mm (1/2") in diameter unless otherwise noted. Provide concealed conduit in all areas except utility spaces.
- B. Conduit Installation Schedule:
1. Underground Installations: Rigid Metal Conduit or Intermediate Metal Conduit.
 2. In or Under Slab on Grade: Rigid Metal Conduit or Intermediate Metal Conduit. Minimum Size: 27 mm diameter.
 3. Outdoor Locations, Above Grade: Rigid Metal Conduit or Intermediate Metal Conduit.
 4. In Slab Above Grade: Rigid Metal Conduit, Intermediate Metal Conduit, Electrical Metallic Tubing, Non-Metallic Conduit.
 5. Stub-ups from underground and in-slab locations: Rigid Metal Conduit or Intermediate Metal conduit to a height of 150mm (6 in.) above grade or finished slab.
 6. Wet and Damp Locations: Rigid Metal Conduit or Intermediate Metal Conduit.
 7. Dry Locations Concealed: Rigid Metal Conduit, Intermediate Metal Conduit, Electrical Metallic Tubing.

- C. Wire Markers: Each conductor at panel board, outlet and junction boxes, and each load connection. Legend:
 - 1. Power and Lighting Circuits: Panleboard and branch circuit or feeder number indicated on drawings.
 - 2. Control Circuits: Unique control wire number indicated on appropriate shop drawings.
- D. Conduit Markers: Furnish markers for each conduit longer than 3050 mm (10 ft), spaced 6100 mm (20 ft) on center. A consistent color and text label shall be established for the project.
- E. Underground Warning Tape. Provide detectable tape for all below grade installations.
- F. Label the service and generator room with signage indicating emergency power available under automatic start, with no warning.

2.7.18 Field Testing

- A. A proposed field test plan including the test safety plan shall be prepared based on the Acceptance Testing Specifications for Electric Power Distribution Equipment and Systems developed by the International Electrical Testing Association, Inc. (NETA). Submit the plan 30 days prior to testing the installed equipment or systems. The test plan shall consist of complete field test procedures including tests to be performed, test equipment required, and tolerance limits. Field testing shall be performed in the presence of the Contracting Officer. The Contractor shall notify the Contracting Officer 7 days prior to conducting tests. The Contractor shall perform all tests and inspections recommended by the manufacturers 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.
- B. Measure and record lighting levels after installation to insure that the lighting levels are within the recommended levels and meet the allowable ratio guidelines per I.E.S and USAF Technical Instruction 811-16. Provide tabulation comparing actual lighting levels with calculated (1.0 LLD) levels demonstrating that the end of service levels will remain within the above guidelines.
- C. Ground Resistance Tests shall be measured using the fall-of-potential method defined in IEEE Std. 81. Ground resistance measurements for electrical distribution and signal reference ground 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. Make resistance measurements of separate grounding electrodes before the systems are bonded together. If a made electrode (ground rod) does not have a minimum 25 ohms resistance to ground and additional ground rod shall be added in accordance with NEC section 250.56.
- D. Medium-Voltage Cable shall be field tested and inspected in accordance with NETA ATS. Perform field inspections and tests listed in NETA ATS, Section 7.3.3.
- E. Low-Voltage Cable Tests Low-voltage feeder 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 combination conductors in the same trench, duct, or cable, with all other conductors in the same trench, duct, or conduct. Perform megger tests prior to installing cable and immediately after pulling.
- F. Transformer Tests

1. The following field tests shall be performed on all transformers. Pass-fail criteria shall be in accordance with transformer manufacturer's specifications and in compliance with ANSI and NEMA standard:
 - a) Insulation resistance test phase-to-ground.
 - b) Turns ratio test.
 - c) Correct phase sequence.
 - d) Correct operation of tap changer.
2. Transformers shall be field tested and inspected in accordance with NETA ATS, except Section 4. Perform field inspections and tests listed in NETA ATS, Section 7.2.

G. Telephone/Data Wiring Tests

1. All circuits shall be tested using a test set that meets the Class II accuracy requirements of EIA/TIA TSB 67 and 95. Testing shall use the Basic Link Test procedure of EIA/TIA TSB 67 and 95.
2. Emergency Generator Test
 - a) Provide a load test on the generator for a minimum of 2 hours at 10% load, 4 hours at 50% load and 8 hours at 100% load. Provide full load test using the permanent test bank. Simulate power failure including operation of transfer switch, automatic starting cycle, and automatic shutdown and return to normal.
 - b) Record in 20 minute intervals during four hour test:
 - > Kilowatts
 - > Amperes
 - > Voltage
 - > Coolant temperature
 - > Room temperature
 - > Frequency
 - > Oil pressure
 - c) Test alarm and shutdown circuits by simulating conditions.

2.7.19 Land Mobile Radio Systems

- A. Provide three drops with coax cable in 50 mm conduit from roof mount, government furnished, Land Mobile Radio Antennas. Coordinate mounting locations and conduit/cable termination points with Base and Hangar personnel. Terminate conduits on roof with a NEMA 3R junction box for wiring by others. Provide GNC connectors at each coax cable-end.

2.7.20 Specialty Systems

- A. Provide a minimum of 4, 200A, 3 phase, 480V receptacles and 4, 20A, single phase 120V receptacles in the aircraft fuel cell maintenance locations within the hangar and at the exterior fuel cell maintenance location.

2.7.21 Seismic Protection

- A. All electrical fixtures, conduits and equipment shall be seismically braced. Provide all necessary steel, hardware, devices and factory-manufactured components required for seismic protection of all electrical equipment furnished under this contract, such as transformers, generators, supporting pads, light fixtures, etc.
- B. Provide snubbers and flexible bracing as required for vibration isolation and earthquake protection. Use preferred factory-furnished equipment and devices to the extent feasible.

2.7.22 Seismic Design Criteria

- A. Design bracing and snubbers in accordance with Corps of Engineers Guide Specifications, SECTION 16070, "Seismic Protection for Electrical Equipment." In particular, follow TI 809-4, "Seismic Design for Buildings," referenced in the stated document. The design shall also comply with AFM 88-3.
- B. Follow manufacturer's recommendations in selecting all factory-furnished devices.
- C. Submit an analysis of all required seismic control for evaluation and approval, as relating to electrical equipment.

2.7.23 Prohibited Items

- A. Type AC, MC, NM, NMS, NMC wire
- B. U-tube fluorescent lamps
- C. Exterior floodlights
- D. Exterior wall packs
- E. Plastic boxes

PART 2 MINIMUM DESIGN CRITERIA

2.8 FIRE PROTECTION DESIGN CRITERIA

2.8.1 Minimum Requirements: the following are minimum requirements for the Fuel Cell Maintenance Hangar, which must be included in a successful proposal.

2.8.2 References

- A. 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. Note: If dates are not given for reference standards or criteria, the latest edition is to be used.
- B. Design and Construction shall be in accordance with the following codes, standards, and regulations, latest adopted edition.
 1. UFC 1-200-01 (appendix 2) shall direct the various codes in effect for this discipline.
 2. ETL 01-2, Fire Protection Engineering Criteria – New Aircraft Facilities
 3. MIL-HDBK-1008C, Fire Protection for Facilities.
 4. ETL 1110-3-484, Engineering and Design, Aircraft Hangar Fire Protection Systems
 5. MIL-HDBK-1008C, Fire Protection for Facilities Engineering, Design, and Construction.
 6. TN 1423, National Institute of Standards and Technology (NIST), Analysis of High Bay Hangar Facilities for Fire Detector Sensitivity and Placement
 7. TI 809-04, Seismic Design for Buildings
 8. International Fire Code (IFC), 2000
 9. International Building Code (IBC), 2000
 10. NFPA 13, Installation of Sprinkler Systems
 11. NFPA 16A, Closed-Head Foam-Water Sprinkler Systems
 12. NFPA 20, Installation of Centrifugal Fire Pumps
 13. NFPA 24, Installation of Private Fire Service Mains and Their Appurtenances
 14. NFPA 70, National Electrical Code
 15. NFPA 72, National Fire Alarm Code
 16. NFPA 101, Life Safety Code
 17. NFPA 409, Standard on Aircraft Hangars
 18. NFPA 1963 Fire Hose Connections
 19. ANSI S3.41 Audible Emergency Evacuation Signals.

2.8.3 Fire Protection Sprinkler System

- A. Design Criteria
 1. The fire protection systems shall be a combination of wet, dry, and pre-action pipe sprinkler systems, and low level high expansion foam system designed in accordance with ETL 01-2, based on the hazard classification, occupancy, area, etc. Sprinkler systems shall be provided in all areas of the building. All areas subject to outside ambient temperature shall have a dry sprinkler system. The hanger area shall be provided with an overhead pre-action sprinkler system activated by a roof or ceiling level thermal detection system, and also be protected by a low-level high expansion foam system. Adjacent support spaces shall be provided with wet sprinkler system. The contractor shall comply with all the requirements listed in MIL-HDBK-1008C.
 2. The fire protection systems shall be hydraulically designed. Hydraulic calculations shall be in accordance with the Area/Density method of NFPA 13, and in accordance with minimum densities and areas indicated in ETL 01-2.
 3. The water service shall be based on the hydrant water test flow data contained in the Appendix and verified by a new field test performed by the contractor. Refer to section 2.3 Civil Design Criteria for available water source(s).

4. The fire protection systems shall be designed by a qualified fire protection engineer who is experienced in the design of Aircraft, and meets the requirements of ETL 01-2, section A1.6.1. The systems shall be installed by a firm that specializes and is experienced in the installation of these systems. The engineer's professional seal shall appear on all calculations and shop drawings.
5. The fire protection systems shall be designed to withstand earthquakes attributable to IBC Seismic acceleration, and shall include all hangers and earthquake bracing as required.
6. The contractor shall design a fire pump and/or sprinkler storage tank, if required due to inadequate fire flows. Comply with NFPA 20 requirements. Refer to the Civil section of the specifications for potential water supply sources.
7. Submit all calculations and layout drawings for review and approval, prior to construction.
8. All mechanical piping, ductwork and equipment shall be seismically braced. Provide all necessary steel, hardware, devices and factory-manufactured components required for seismic protection of all mechanical equipment furnished under this contract. Design bracing and snubbers in accordance with Corps of Engineers Guide Specifications, SECTION 15070, "Seismic Protection For Mechanical Equipment." In particular, follow TI 809-04, "Seismic Design for Buildings," referenced in the stated document. The design shall also comply with AFM 88-3. Follow manufacturer's recommendations in selecting all factory-furnished devices. Submit an analysis of all required seismic control for evaluation and approval, as relating to mechanical equipment.

2.8.4 Materials:

- A. Foam concentrate piping shall be stainless steel. Fittings shall be threaded, flanged, or grooved.
- B. Foam-water solution piping shall be steel conforming to ASTM A-795 or ASTM A53. Fittings shall be threaded, flanged, or grooved.
- C. Foam concentrate pumps shall be of stainless steel construction
- D. Piping and valves shall comply with NFPA 13. All equipment and components shall bear UL or FM label or marking.
- E. Piping: Schedule 40 black steel only, welded, threaded, or with grooved joint couplings. Dry-pipe system piping shall be the same except galvanized.
- F. Valves:
 1. Gate: OS&Y, iron body, bronze trim, flanged, 175 lb. WOG
 2. Check: Iron body, swing check, bronze disc and trim, flanged 175 lb. WOG.

2.8.5 Minimum Basic Requirements

- A. Locate fire department connection with sufficient clearance from walls, obstructions, or adjacent Siamese connectors to allow full swing of fire department wrench handle. Do not provide fire department connections on foam-water systems.
- B. Locate fire department connection to be fully accessible by a fire truck, from the building access road or parking lot.
- C. The sprinkler system components shall be accessible without damage or modification to the component. Components of the sprinkler system subject to maintenance, annual testing, and repair shall be maintainable, accessible and repairable by locally available service organization personnel.

- D. Fire sprinkler piping shall be routed, distributed and concealed above the suspended ceiling with recessed chrome plated heads and white escutcheons. Sprinkler piping in mechanical, electrical rooms and fan room mezzanines shall be exposed with upright sprinklers.
- E. Center heads in two directions in ceiling tile and provide piping offsets as required.
- F. Provide a: 65mm x 65mm x 100mm fire department connection, siamese cast brass body and trim, having two individual clapper valves. Flush mount. Lettering required, "AUTO SPRKR". Provide Knox-FDC Cap. Exposed parts polished chrome. Hose threads to match local standards.
- G. Protect base water supply at the fire sprinkler system riser with a double check valve, backflow prevention device per AFR 91-13.
- H. Sprinkler heads installed in finished spaces shall be concealed or semi-concealed type.
- I. Water motor alarms shall not be used. All sprinkler system alarms shall be electrically powered.
- J. The sprinkler system piping and sprinkler head locations shall be coordinated and be compatible with ceiling types, light fixtures, HVAC air diffusers, HVAC ducts and structural members. The location of all heads and the routing of all piping shall be subject to the approval of the Contracting Officer.
- K. Provide snubbers and flexible bracing as required for vibration isolation and earthquake protection. Use factory-furnished equipment and devices to the extent feasible.
- L. Provide draft curtains around each sprinkler system or up to 1400 square meters for hanger areas.
- M. Provide a dedicated fire protection room for foam-concentrate storage and proportioning systems, separated from aircraft servicing areas by 1-hour rated construction minimum.
- N. Provide fire pumps and pressure booster pumps where required, in compliance with ETL 01-2.

2.8.6 Preferred Items

- A. There are no preferred items.

2.8.7 Prohibited Items

- A. The following items are prohibited from use, and may adversely impact the proposal evaluation.
 - 1. Plastic pipe and fittings inside the building are not allowed.
 - 2. Schedule 20 pipe is not acceptable.

2.8.8 Fire Alarm System

- A. Compliance
 - 1. The fire detection and alarm system and the central reporting system shall be configured in accordance with ETL 1110-3-484, ETL 01-2, TN 1423, NFPA 72, UFC101 and MIL-HDBK-1008C. The equipment furnished shall be compatible and be UL listed, FM approved, or listed by a nationally recognized testing laboratory in accordance with the

applicable NFPA standards. The fire alarm system shall be able to communicate with Monaco D-700 fire reporting at the fire station by device/zone via radio transmitter. It is recommended that Monaco BT2-8 or equal is provided. Transmitting frequency shall be 148.425 MHz.

2. System Requirements

- a) Fire alarm system shall be fully addressable up to each individual device and designed to accommodate the entire building. The system shall include connections for at least 2 additional zones and provisions for the addition of future zones.
- b) Addressable initiation and notification devices, supervision and other functions shall be controlled, monitored and annunciated from the Fire Alarm Control Panel.
- c) The pull stations shall be non-glass break type and not require the use of a key to reset.
- d) Duct detectors located in concealed locations shall provide remote annunciation and test switch.
- e) The system shall also include a strobe alarm visual indicator located on the corner of the building pointing toward the tower.
- f) Device mounting heights will be in accordance with ADA Accessibility Guidelines for Building and Facilities requirements. Fire detection reporting system shall be via radio transceiver and be able to communicate with the central fire station by zone.

B. Operation

1. The fire alarm and detection system shall be a complete, supervised, Class A fire alarm 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. Textual, audible, and visual appliances and systems shall comply with NFPA 72.
2. Fire alarm system components requiring power, except for the control panel power supply, shall operate on 24 Vdc. 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 all functions 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 100 percent addressable expansion without hardware modifications to the panel.
3. 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 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) The fire alarm control panel shall provide the required monitoring and supervised control outputs needed to accomplish fire department over-rides, if required.
- k) The fire alarm control panel shall monitor the fire sprinkler system, or other fire protection extinguishing system.
- 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.

2.8.9 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 via a Monaco BT2-8 transmitting unit. The signal shall be different for each device. The transceiver shall send the following signals:
 - 1. General trouble.
 - 2. Transmitter trouble.
 - 3. Sprinkler trouble.
 - 4. AHU duct detector.
- 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.

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- 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.
- G. Shutdown of power to the data processing equipment in the alarmed area.

2.8.10 Installer qualification

- A. The installing Contractor shall provide the following: NICET Level 2 or higher Fire Alarm Technician shall install and terminate fire alarm devices, cabinets and panels. A licensed electrician or NICET Level 1 Fire Alarm Technician shall install conduit for the fire alarm system.

2.8.11 Design services

- A. 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:
 - 1. 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.
 - 2. A registered professional engineer (PE) in fire protection engineering.
 - 3. A registered PE in a related engineering discipline and member grade status in the National Society of Fire Protection Engineers.
 - 4. 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.

2.8.12 Technical Data and Software

- A. 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.
- B. 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.

2.8.13 Control Panel

- A. Control Panel shall comply with the applicable requirements of UL 864. 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 for a control panel, the units shall be installed in a single cabinet large enough to accommodate units.

2.8.14 Circuit Connections

- A. Circuit conductors entering or leaving the panel shall be connected to screw-type terminals with each conductor and terminal marked for identification.

2.8.15 System Expansion and Modification Capabilities

- A. 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.

2.8.16 Battery and Charger

- A. Storage batteries shall be provided and shall be 24 Vdc sealed, lead-calcium type requiring no additional water. The batteries shall have a capability, with primary power disconnected of operating the fire alarm system for a period of 24 hours.
- B. 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.

2.8.17 Initiating and Detecting Devices

- A. Fire indicating and detecting devices shall comply with the applicable requirements of NFPA 72, NFPA 90A, UL 38, UL 268, UL 968A, UL 521 and Military Handbook 1008C. Devices shall be individually addressable. Detectors located in concealed locations shall have a remote visible indicator LED/LCD. Devices shall be dynamically supervised and uniquely identified in the control panel. Manual pull stations shall be capable of being field programmed, shall latch upon operation and remain latched until manually reset.

2.8.18 Audible/Visual Notification Appliances

- A. Audible/visual notification appliances shall be provided to locations required by NFPA 72, NFPA 101, NFPA 13 and Military Handbook 1008C.

2.8.19 Electromagnetic Door Hold-Open Devices

- A. Devices shall comply with the appropriate requirements of UL 228. Compatible magnetic component shall be attached to the door. Devices shall be UL or FM approved. As a

minimum, allow for twelve (12) electrical door hold-open devices to be provided at locations to be determined during design.

2.8.20 Conduit

- A. All wiring shall be in conduit. Conduit and fittings shall comply with NFPA 70.

2.8.21 Wiring

- A. Wiring for 120 Volt power shall be No. 12 AWG minimum. Wiring for fire alarm dc circuits shall be No. 14 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.

2.8.22 Special Tools and Spare Parts

- A. Software, connecting cables and proprietary equipment, necessary for the maintenance, testing, and reprogramming of the equipment shall be furnished to the Contracting Officer. A computer shall be furnished to initially program and set-up the system; it does not have to be provided for future use. 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.

2.8.23 Framed Building Location Map

- A. Framed building location map under glass or in laminated plastic showing the complete layout of the building, including device addresses, device locations, and building room numbers, shall be posted next to fire alarm control panel.

2.8.24 Testing

A. Preliminary Tests:

1. 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 re-tested to assure that it is functional. After completing the preliminary testing, the Contractor shall complete and submit the NFPA 72, Certificate of Completion.

B. Acceptance Tests:

1. 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

2.8.25 Training

- A. 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.

2.8.26 Execution

- A. All work performed in association with DACA85-00-D-0006/0005 shall be performed in a professional and craftsman-like manner.

2.8.27 Preferred Items

- A. The following manufacturers are preferred for this project:
- B. Fire Alarm System by Pyrotronics.
- C. Radio Transmitter/Antenna by Monaco.

2.8.28 Warranty

- A. Industry standard warranties for products used in construction of for DACA85-00-D-0006/0005 shall apply. Deviation from manufacturer's required installation instructions or intended application, which will void a warranty, must be approved in writing by the government's contracting officer.

NEW FUEL SYSTEMS MAINTENANCE DOCK
DACA85-R-02-0009, AMENDMENT R0012

ELM179

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ROOM NAME
Function
Adjacencies
Area
Minimum Ceiling Height
BUILDING SYSTEMS
Electrical
Lighting
Telecommunication
Data
Plumbing
Heating
Ventilation
SPECIAL REQUIREMENTS
Storage
Casework
Security
Equipment
Furnishings
Acoustical
Life Safety
Door
Window
FINISHES
Floor
Base
Walls
Wainscot
Ceiling
Window Treatment
BUBBLE DIAGRAM

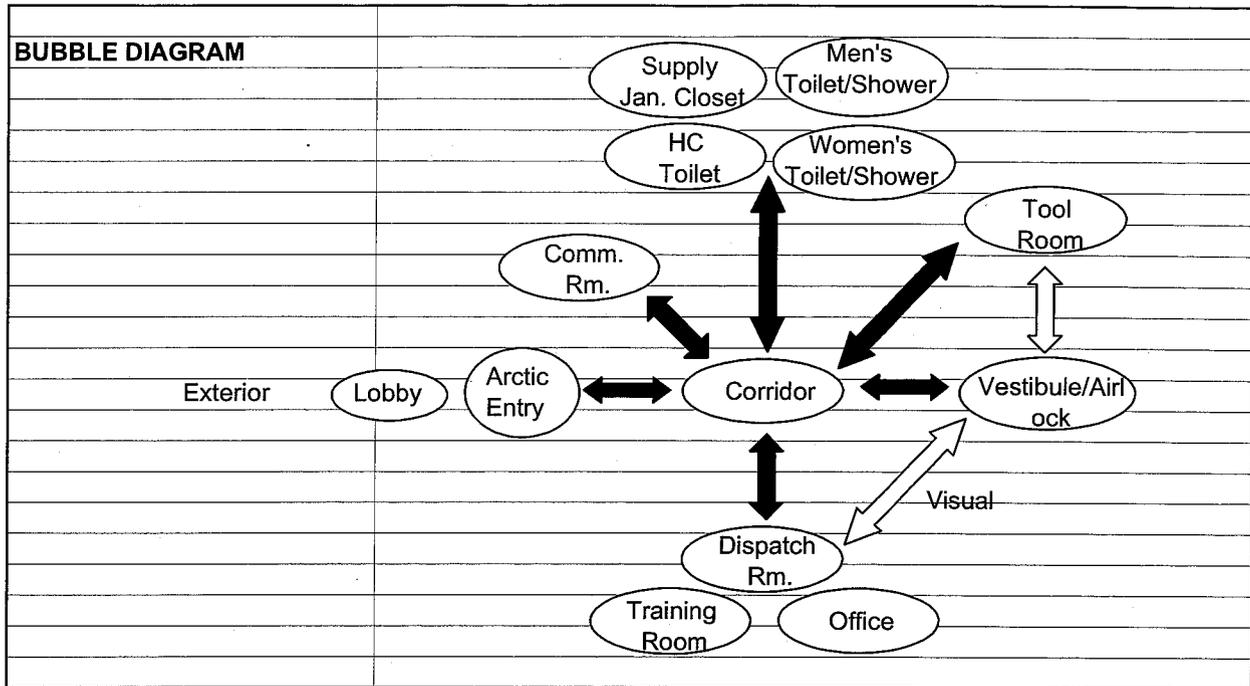
ROOM NAME	ARCTIC ENTRY
Function	Reduce heat loss, shed foot dirt and water
Adjacencies	Exterior / Service Corridor
Area	1200mm / 4'-0" min space between door swing
Minimum Ceiling Height	2590mm / 8'-6"
Width	2150mm (7'-0") minimum clear width
BUILDING SYSTEMS	
Electrical	(1) 120V convenience receptacles
Lighting	300 lux average, fluorescent or metal halide switched with exterior lighting control
Telecommunication	None
Data	None
Plumbing	None
Heating	Yes
Ventilation	None
SPECIAL REQUIREMENTS	
Storage	None
Casework	None
Security	None
Equipment	None
Furnishings	None
Acoustical	STC 50 to adjacent staff areas
Life Safety	Exit and emergency lighting if required
Door	double doors
Window	Maximum natural light to interior space
FINISHES	
Floor	Walk-off mat
Base	Rubber
Walls	Painted gwb
Wainscot	None
Ceiling	Suspended acoustical panel
Window Treatment	N/A
BUBBLE DIAGRAM	
<pre> graph TD Lobby((Lobby)) <--> ArcticEntry((Arctic Entry)) ArcticEntry <--> Exterior[Exterior] </pre>	

ROOM NAME	BOILER ROOM
Function	Boiler equipment, Plumbing equipment
Adjacencies	Service spaces (FirePump, Electrical, Generator)
Area	46.4 sq.m. / 500 sq.ft. approximately; size per equipment design requirements
Minimum Ceiling Height	2590 mm / 8'-6" to underside of structure
BUILDING SYSTEMS	
Electrical	(2) 120V Convenience receptacles, boiler disconnects, emergency boiler shutoff
Lighting	300 lux average, fluorescent, ceiling chain hung with up component, locally switched, emergency lighting
Telecommunication	Combination telecom and data jack
Data	Dedicated data jack for DDC
Plumbing	Floor drain(s), hose bibbs
Heating	Yes
Ventilation	Separate system sized for room cooling; Combustion air.
SPECIAL REQUIREMENTS	
Storage	None
Casework	None
Security	None
Equipment	None
Furnishings	None
Acoustical	STC 50 if adjacent to office functions
Life Safety	1-Hour Occupancy Separation
Door	Exterior access only - 1830mm x 2135mm (6'-0"w x 7'-0"h) double door
Window	None
FINISHES	
Floor	Concrete with sealant
Base	None
Walls	Paint
Wainscot	None
Ceiling	Exposed to structure
Window Treatment	N/A
BUBBLE DIAGRAM	

ROOM NAME	BREATHING AIR ROOM
Function	Breathing air equipment
Adjacencies	Clean air intake minimum 12 meters (40 feet) away from exhaust equipment or service vehicle parking; entrance access located near Hangar exit door; may share space with Shop Compressor equipment; locate away from Office use areas; Breathing Air compressor may NOT share space with Battery Charger equipment
Area	16.7 sq. m. / 180 sq. ft, minimum
Minimum Ceiling Height	2590 mm / 8'-6" to underside of structure
BUILDING SYSTEMS	
Electrical	(1) 120V convenience receptacle, disconnects for equipment
Lighting	300 lux average, locally switched, fluorescent fixtures, electronic ballasts
Telecommunication	None
Data	None
Plumbing	Floor Drain
Heating	Yes
Ventilation	Separate system sized for equipment cooling.
SPECIAL REQUIREMENTS	
Storage	None
Casework	None
Security	None
Equipment	CFCI back-up breathing air system and secondary back-up breathing air system; may share compressor with shop air equipment
Furnishings	GFGI Shelving for spare parts storage
Acoustical	Isolation pad for compressor; use space planning to attain acoustical separation; STC 48 to adjacent shop
Life Safety	None
Door	Exterior access, standard man-door; office function lockset
Window	None
FINISHES	
Floor	Concrete, sealed
Base	None
Walls	Painted gwb
Wainscot	None
Ceiling	Exposed to structure
Window Treatment	N/A
BUBBLE DIAGRAM	
<pre> graph TD BA[Breathing Air Rm] <--> E[Exterior] SA[Shop Air Comp] <--> E MB[Maintenance Bay] <--> TA[Tank Area] SA <--> BA MB <--> SA TA <--> SA </pre>	

ROOM NAME	COMMUNICATIONS
Function	Telephone and data equipment
Adjacencies	Adjacent to Office functions, accessed from Corridor; may not be combined with Electrical Room
Area	9.3 sq.m. / 100 sq.ft.
Minimum Ceiling Height	2590 mm / 8'-6" to underside of structure
BUILDING SYSTEMS	
Electrical	120V Quad receptacles, isolated grounding (TMGB), power strips on rack
Lighting	500 lux average, ceiling mounted, chain hung, up-component fluorescent, electronic ballasts
Telecommunication	2440mm x 1220mm plywood backboard for equipment, punch down blocks, combination telecom/data racks, patch panels for voice and data, local outlets
Data	Floor racks for rack mounted equipment, patch panels.
Plumbing	N/A
Heating	For exterior exposures only
Ventilation	Equipment cooling, positive pressure filtered ventilation
SPECIAL REQUIREMENTS	
Storage	None
Casework	None
Security	None
Equipment	CFCI Floor mounted communication equipment rack
Furnishings	None
Acoustical	Separate from electrical equipment to prevent hum in telephone lines
Life Safety	None
Door	Double man-door outward-swinging with storage function hardware
Window	None
FINISHES	
Floor	Concrete, sealed
Base	None
Walls	Painted gwb
Wainscot	None
Ceiling	Exposed to structure
Window Treatment	N/A
BUBBLE DIAGRAM	
<pre> graph TD CRm((Corridor Rm.)) <--> Up Arrow CommRm((Comm. Rm.)) CommRm <--> Double Arrow ElecRm((Electrical Rm.)) </pre>	

ROOM NAME	CORRIDOR
Function	Circulation, personnel lockers
Adjacencies	Direct access to Vestibule/Airlock, Dispatch, Tool Room, Offices, Training/Conference Room, Toilet Rooms, Electrical, Communications; personnel lockers can be located in alcove off the corridor for some privacy and improved flow
Area	As needed to support functions
Minimum Ceiling Height	2590mm / 8'-6"
Width	1825mm (6'-0") minimum clear width
BUILDING SYSTEMS	
Electrical	120V receptacles @ 10 meter (30') spacing
Lighting	300 lux average, fluorescent, electronic ballasts, exit lights, night lights, locally switched, emergency lights
Telecommunication	None
Data	None
Plumbing	Drinking fountain (2)
Heating	For exterior exposures only
Ventilation	Yes
SPECIAL REQUIREMENTS	
Storage	None
Casework	None
Security	None
Equipment	None
Furnishings	75 full height personnel lockers - 305mm wide x 305mm deep x 1825mm high (12"x12"x 72"), minimum
Acoustical	STC 50 to adjacent staff areas
Life Safety	Laminated film at inside pane of glass to exterior, if applicable
Door	1830mm x 2135mm (6'-0"w x 7'-0"h) double door to Hangar and Arctic Entry at building entrance 1830mm x 2135mm (6'-0"w x 7'-0"h) minimum
Window	Exterior daylight desired, not required
FINISHES	
Floor	Vinyl composition tile or resilient sheet flooring
Base	Rubber
Walls	Painted gwb
Wainscot	Optional
Ceiling	Suspended acoustical panel
Window Treatment	N/A



ROOM NAME	DISPATCH
Function	Office space for Supervisor, (1) Assistant, Training Monitor; plus (3) support personnel; supervision of Maintenance Bay operations
Adjacencies	Maintenance Bay visual access, Corridor; Mezzanine location desirable for supervision of Maintenance Bays
Area	27.9 sq.m. / 300 sq.ft., minimum; open office space for up to 5 persons at once
Minimum Ceiling Height	2590mm / 8'-6"
BUILDING SYSTEMS	
Electrical	120V quad receptacles at workstations; convenience receptacles @ 3 meter (10') spacing
Lighting	500 lux average, 2-level, local switching, electronic ballasts, night lights, emergency lights
Telecommunication	Combination telecom/data outlets for 5 workstations
Data	see Telecom.
Plumbing	None
Heating	Yes
Ventilation	Yes
SPECIAL REQUIREMENTS	
Storage	
Casework	1200mm (4'-0"h) wall or counter to separate Dispatch staff from Training Monitor; Dispatch status board is a slanted writing surface at desk height 2590 mm (8'-6") overall length 915 mm (3'-0") depth (see Appendix 5 for picture) open below work surface; 1525 (5'-0") countertop with drawers and storage cabinets below.
Security	
Equipment	GFGI (all) computers, printer, copy machine
Furnishings	
Acoustical	STC 50
Life Safety	Exterior window requires laminated film @ inside pane; 45-minute fire rated at Blast-resistant wall to Maintenance Bays
Door	Standard man-door to Corridor
Window	Window for visual supervision of Maintenance Bay; operable window to exterior
FINISHES	
Floor	Vinyl composition tile or resilient sheet flooring
Base	Rubber
Walls	Painted gwb
Wainscot	None
Ceiling	Suspended acoustical panel
Window Treatment	Mini-blind @ exterior window

ROOM NAME	ELECTRICAL ROOM
Function	Electrical equipment
Adjacencies	Adjacent to Mechanical spaces, exterior access
Area	24.6 sq.m. / 264 sq.ft. or as needed to support equipment
Minimum Ceiling Height	2590 mm / 8'-6" to underside of structure
BUILDING SYSTEMS	
Electrical	Main distribution panel, loadcenters, transformers as required, 120V convenience receptacles
Lighting	300 lux average, fluorescent, ceiling chain hung with upright component, locally switched, emergency lights
Telecommunication	combination telecom/data outlet
Data	see Telecom.
Plumbing	N/A
Heating	For exterior exposures only
Ventilation	Equipment cooling
SPECIAL REQUIREMENTS	
Storage	None
Casework	None
Security	None
Equipment	None
Furnishings	None
Acoustical	None
Life Safety	None
Door	Double man-door; exterior access
Window	None
FINISHES	
Floor	Concrete, sealed
Base	None
Walls	Painted gwb
Wainscot	Plywood to mount equipment
Ceiling	Exposed to structure
Window Treatment	N/A
BUBBLE DIAGRAM	
<pre> graph LR MB((Maintenance Bay)) <--> ER((Electrical Rm.)) ER <--> G((Generator Rm.)) ER <--> B((Boiler Rm.)) ER ==> Ext[Exterior] </pre>	

ROOM NAME	FAN ROOM
Function	Air-handling equipment
Adjacencies	Adjacent to Office functions; Mezzanine or exterior access
Area	9.3 sq.m. / 100 sq.ft., or as needed to accommodate equipment
Minimum Ceiling Height	2590 mm / 8'-6" to underside of structure
BUILDING SYSTEMS	
Electrical	(1) 120V convenience receptacle
Lighting	300 lux average, fluorescent, ceiling chain hung with upright component, locally switched, emergency lights
Telecommunication	Combination telecom/data outlet
Data	see Telecom.
Plumbing	N/A
Heating	For exterior exposures only
Ventilation	None
SPECIAL REQUIREMENTS	
Storage	None
Casework	None
Security	None
Equipment	None
Furnishings	None
Acoustical	None
Life Safety	None
Door	Double man-door
Window	None
FINISHES	
Floor	Concrete, sealed
Base	None
Walls	Painted gwb
Wainscot	Plywood to mount equipment
Ceiling	Exposed to structure
Window Treatment	N/A
BUBBLE DIAGRAM	
<pre> graph LR Offices([Offices]) <--> FanRoom([Fan Room]) FanRoom --> Exterior[Exterior] </pre>	

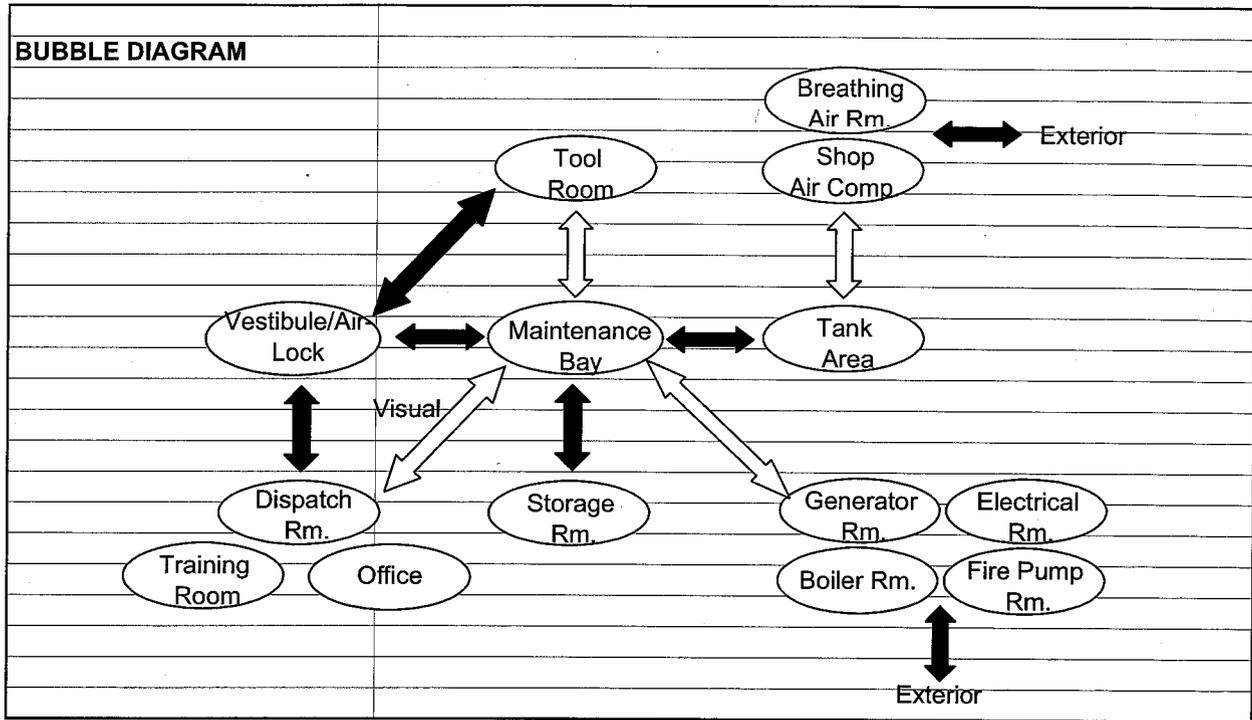
ROOM NAME	FIRE PUMP
Function	Fire pump equipment / Foam storage
Adjacencies	Maintenance Bay, exterior
Area	74.32 sq.m. / 800 sq.ft. approximately, or as needed to support equipment
Minimum Ceiling Height	2590 mm / 8'-6" to underside of structure
BUILDING SYSTEMS	
Electrical	(4) 120V convenience receptacles
Lighting	300 lux average, fluorescent, electronic ballasts, ceiling mount, chain-hung, up component, locally switched
Telecommunication	None
Data	Interconnect to fire alarm control panel (FACP)
Plumbing	Floor drain(s)
Heating	Yes
Ventilation	Equipment cooling, Combustion air
SPECIAL REQUIREMENTS	
Storage	None
Casework	None
Security	None
Equipment	None
Furnishings	None
Acoustical	None
Life Safety	None
Door	Double man-door; exterior access only
Window	None
FINISHES	
Floor	Concrete, sealed
Base	None
Walls	Painted gwb
Wainscot	None
Ceiling	Exposed to structure
Window Treatment	N/A
BUBBLE DIAGRAM	
<pre> graph LR MB([Maintenance Bay]) <--> TA([Tank Area]) MB --> FPR([Fire Pump Rm.]) FPR <--> EX[Exterior] </pre>	

ROOM NAME	GENERATOR
Function	Generator equipment
Adjacencies	Along outside wall, exterior access; self-contained unit apart from building is acceptable
Area	18.6 sq.m. / 200 sq.ft. - approximately 10'x20' shape
Minimum Ceiling Height	2590 mm / 8'-6" to underside of structure
BUILDING SYSTEMS	
Electrical	(2) 120V convenience receptacles, equipment disconnects, transfer switch
Lighting	300 lux average, fluorescent, ceiling mount, chain hung with up component, locally switched.
Telecommunication	None
Data	Outlet for connection to DDC
Plumbing	Floor drain
Heating	Yes
Ventilation	Engine cooling, combustion air
SPECIAL REQUIREMENTS	
Storage	None
Casework	None
Security	None
Equipment	None
Furnishings	None
Acoustical	Isolate equipment noise and vibration from occupied spaces
Life Safety	None
Door	Double man-door, storage lockset function
Window	None
FINISHES	
Floor	Concrete, sealed
Base	None
Walls	Painted gwb
Wainscot	None
Ceiling	Exposed to structure
Window Treatment	N/A
BUBBLE DIAGRAM	
<pre> graph LR ERm(Electrical Rm.) GRm(Generator Rm.) BRm(Boiler Rm.) Ext(Exterior) MB(Maintenance Bay) GRm <--> Ext Ext <--> MB </pre>	

ROOM NAME	HARDSTAND (EXTERIOR), SEE OPTION 2 - UP TO 2 REQUIRED
Function	Aircraft maneuvering and exterior maintenance
Adjacencies	Directly adjacent to Tow-way, near Maintenance Bay doors
Area	19.8 m (65') x 25.3 m (83') each
Minimum Ceiling Height	N/A
BUILDING SYSTEMS	
Electrical	Grounding points on 5 meter grid; 120V GFCI receptacles in accordance with exterior power requirements
Lighting	10 lux minimum
Telecommunication	None
Data	None
Plumbing	None
Heating	None
Ventilation	N/A
SPECIAL REQUIREMENTS	
Storage	None
Casework	None
Security	None
Equipment	Aircraft tie-downs required for both F15/F22 on each hardstand
Furnishings	None
Acoustical	None
Life Safety	None
Door	N/A
Window	N/A
FINISHES	
Floor	N/A
Base	N/A
Walls	N/A
Wainscot	N/A
Ceiling	N/A
Window Treatment	N/A
BUBBLE DIAGRAM	
<pre> graph TD HS([Hardstand]) <--> TW[Tow-way] TW <--> MB([Maintenance Bays]) </pre>	

ROOM NAME	LOBBY
Function	Circulation
Adjacencies	Arctic Entry, Corridor, Training-Conference
Area	23.2 sq. m. (250 sq. ft.), minimum; as needed to support functions and shift change personnel overflow
Minimum Ceiling Height	2590mm / 8'-6"
BUILDING SYSTEMS	
Electrical	(2) 120V convenience receptacles
Lighting	300 lux average, fluorescent, electronic ballasts, exit lights, night lights, locally switched
Telecommunication	None
Data	None
Plumbing	None
Heating	For exterior exposures only
Ventilation	Yes
SPECIAL REQUIREMENTS	
Storage	None
Casework	None
Security	None
Equipment	None
Furnishings	None
Acoustical	STC 50 to adjacent staff areas
Life Safety	Laminated film at inside pane of glass
Door	Per adjacent functions
Window	Exterior daylight desired, not required
FINISHES	
Floor	Vinyl composition tile or resilient sheet flooring
Base	Rubber
Walls	Painted gwb
Wainscot	Optional
Ceiling	Suspended acoustical panel
Window Treatment	N/A
BUBBLE DIAGRAM	
<pre> graph LR Exterior <--> Lobby[Lobby and Arctic Entry] Lobby <--> Corridor Corridor <--> Vestibule[Vestibule-Airlock] Vestibule <--> Maintenance[Maintenance Bay] </pre>	

ROOM NAME	MAINTENANCE BAY
Function	Fuel cell maintenance, up to (4) F-15or F-22 aircraft
Adjacencies	Tank area, Tow-way, Vestibule Airlock, Storage
Area	2,952 sq.m. / 31,776 sq.ft.; 3048 mm / 10 ft. minimum clearance around aircraft to nearest obstruction, 4570 mm / 15 ft. clearance to nearest wall
Minimum Ceiling Height	7,925 mm / 27'-0" to lowest obstruction
BUILDING SYSTEMS	
Electrical	Grounding points on 5 m (16'-4") grid; 400 Hz motor-generator set receptacles matching user's equipment at each jet location. Finished floor to top of hangar door to be explosion proof (Class 1, Div. II min.). Convenience receptacles at 15.2 meters (50') minimum spacing. SEE DIAGRAM FOR ELECTRIC REEL REQUIREMENTS.
Lighting	750 lux average, 3:1 avg/min uniformity, Hi-Bay metal halide or T5 HD fluorescent with up component, zoned bi-level switching by occupancy sensor and local switches, quartz re-strike on 10% of MH fixtures.
Telecommunication	Bat phone, paging
Data	None
Plumbing	Frost proof cold water hose bibbs (3 ea), floor/trench drains @ hangar doors to oil/water separators; (2) Eye-wash/shower stations; SEE DIAGRAM FOR BREATHING AIR AND SHOP AIR REQUIREMENTS
Heating	Overhead gas fired radiant heaters with ducted combustion air. Heated slab @ aprons and door tracks, 1200 mm (4') depth, full width of door openings
Ventilation	Central supply/exhaust purge system; SEE DIAGRAM FOR PURGE AIR REQUIREMENTS
SPECIAL REQUIREMENTS	
Storage	GFGI Racks 2-high for ducts and mats (8 total) - 56"x28"x42"h; GFGI (4) Mobile parts racks - 48"x72"x77"h
Casework	None
Security	None
Equipment	GFGI Rhine pump back-up air; GFGI Mobile fire extinguisher on cart; GFGI Spill kit
Furnishings	None
Acoustical	Government Betterment #2 - Acousti-Deck roof decking
Life Safety	1-hour blast-proof separation from adjacent occupied areas
Door	Man-doors 3'-0"x7'-0" x-heavy duty per exiting requirements, no exterior hardware except doors near exterior access support spaces; vertical-acting fabric hangar door or other insulated hangar door 19.66m wide x 8.24 m high (64'-6" x 27'-0-1/2"); see Government Betterment #4 - "Mega-Door" required; Tug doors (if using in a aircraft nose-in configuration) 1830 mm wide x 2450 mm high (6'-0" x 8'-0")
Window	Daylighting at upper walls
FINISHES	
Floor	Concrete with broom finish meeting user approval, hardener and sealant; Government Betterment #3 epoxy/acrylic floor finish, white or light color
Base	None
Walls	Epoxy paint at gwb and cmu surfaces
Wainscot	Corrugated galvanized steel panels up to 2500 mm (8'-0") above floor
Ceiling	Exposed to structure; Betterment #1 painted finish
Window Treatment	None



ROOM NAME	MOBILITY STORAGE
Function	Equipment and gear storage for mobilizations
Adjacencies	No immediate adjacency requirement, may be located on Mezzanine or 2nd Floor; may be accessed from the Maintenance Bays or office spaces
Area	23.22 sq.m. / 250 sq.ft., minimum
Minimum Ceiling Height	2590 mm / 8'-6" to underside of structure
BUILDING SYSTEMS	
Electrical	(2) 120 V convenience receptacles
Lighting	300 lux average, fluorescent fixtures, locally switched
Telecommunication	None
Data	None
Plumbing	N/A
Heating	For exterior exposures only
Ventilation	N/A
SPECIAL REQUIREMENTS	
Storage	None
Casework	None
Security	None
Equipment	None
Furnishings	None
Acoustical	None
Life Safety	None
Door	Double man-door 1830mm wide x 2130mm high (6'-0"x7'-0")
Window	None
FINISHES	
Floor	Concrete, sealed
Base	None
Walls	Painted gwb
Wainscot	None
Ceiling	Exposed to structure
Window Treatment	N/A
BUBBLE DIAGRAM	
	None

ROOM NAME	OFFICE
Function	Shop chief, assistant shop chief, base shift supervisor, shift superintendent
Adjacencies	Corridor, Vestibule-Airlock; Mezzanine level location desirable for Maintenance Bay supervision
Area	37.16 sq.m. / 400 sq.ft., minimum; arranged in 2 private offices plus open office area
Minimum Ceiling Height	2590 mm / 8'-6"
BUILDING SYSTEMS	
Electrical	120V quad receptacles at workstations, other convenience receptacles at 3 meter (10') spacing
Lighting	500 lux average, 2-level, local switching, electronic ballasts, night lights
Telecommunication	Combination telecom/data outlets for (4) workstations
Data	See Telecom.
Plumbing	N/A
Heating	Yes
Ventilation	Yes
SPECIAL REQUIREMENTS	
Storage	Office supply closet, 2.32 sq.m. / 25 sq.ft. minimum
Casework	None
Security	None
Equipment	GFGI office equipment: copier, printer, fax
Furnishings	GFGI (5) workstations
Acoustical	STC 50
Life Safety	Laminated film on inside pane of glass
Door	Standard man-door, office function lockset
Window	Window for supervision of Maintenance Bays; operable window to exterior
FINISHES	
Floor	Vinyl composition tile or resilient sheet flooring
Base	Rubber
Walls	Painted gwb
Wainscot	None
Ceiling	Suspended acoustical panel
Window Treatment	Mini-blinds
BUBBLE DIAGRAM	
<pre> graph TD Corridor --- Vestibule-Airlock Vestibule-Airlock --- Maintenance Bay Corridor --- Office Office --- DispatchRm[Dispatch Rm.] Office --- Training-Conference Office --- Maintenance Bay </pre>	

ROOM NAME	SHOP AIR COMPRESSOR
Function	Shop air compressor equipment; Fork-lift storage and battery charger can be co-located
Adjacencies	No immediate adjacency requirements; may combine space with Breathing Air compressor (NOTE: Breathing Air compressor may NOT share space with battery charger and fork-lift); entrance located near Maintenance Bay exit door
Area	51 sq.m. / 550 sq.ft., minimum, including fork-lift and battery charger area
Minimum Ceiling Height	2590 mm / 8'-6" to underside of structure
BUILDING SYSTEMS	
Electrical	(4) 120V convenience receptacles, disconnects for equipment
Lighting	300 lux average, locally switched, fluorescent fixtures, electronic ballasts
Telecommunication	none
Data	none
Plumbing	Floor drain, emergency eyewash/shower
Heating	For exterior exposures only
Ventilation	Separate ventilation system sized for equipment cooling; Battery ventilation.
SPECIAL REQUIREMENTS	
Storage	None
Casework	None
Security	None
Equipment	Battery charger, fork-lift (these may be located elsewhere)
Furnishings	None
Acoustical	Vibration isolation pad, STC 50 if adjacent to office space
Life Safety	None
Door	Exterior access only; insulated standard man-door and 1525mm x 2440mm (5'-0"w x 8'-0"h) insulated coiling door
Window	None
FINISHES	
Floor	Concrete, sealed
Base	None
Walls	Painted gwb
Wainscot	None
Ceiling	Exposed to structure
Window Treatment	N/A
BUBBLE DIAGRAM	

ROOM NAME	STORAGE ROOM
Function	Equipment storage for Maintenance Bay
Adjacencies	Directly adjacent to Maintenance Bay
Area	23 sq.m. / 250 sq.ft., minimum
Minimum Ceiling Height	2590 mm / 8'-6" to underside of structure
BUILDING SYSTEMS	
Electrical	(2) 120 V convenience receptacles
Lighting	300 lux average, fluorescent fixtures, locally switched
Telecommunication	None
Data	None
Plumbing	N/A
Heating	For exterior exposures only
Ventilation	N/A
SPECIAL REQUIREMENTS	
Storage	None
Casework	None
Security	None
Equipment	None
Furnishings	None
Acoustical	None
Life Safety	None
Door	Standard man-door and 1830mm wide x 2130mm high (6'-0"x7'-0") double door to Maintenance Bay
Window	None
FINISHES	
Floor	Concrete, sealed
Base	None
Walls	Painted gwb
Wainscot	Corrugated steel, galvanized
Ceiling	Exposed to structure
Window Treatment	N/A
BUBBLE DIAGRAM	
<pre> graph TD MB([Maintenance Bay]) <--> TA([Tank Area]) MB <--> SR([Storage Rm.]) </pre>	

ROOM NAME	SUPPLY-JANITOR CLOSET
Function	Office supplies, cleaning equipment
Adjacencies	Corridor, Office Spaces
Area	3.7 sq.m. / 40 sq.ft., minimum
Minimum Ceiling Height	2590mm / 8'-6"
BUILDING SYSTEMS	
Electrical	120V, GFCI convenience receptacles
Lighting	300 lux, fluorescent fixture, locally switched.
Telecommunication	None
Data	None
Plumbing	Janitor sink, faucet with wall brace and bucket hook
Heating	For exterior exposures only
Ventilation	Exhaust
SPECIAL REQUIREMENTS	
Storage	Heavy duty standards and brackets, 7600mm (25 l.f.) storage shelving, minimum
Casework	None
Security	None
Equipment	None
Furnishings	Mop holder
Acoustical	None
Life Safety	None
Door	Standard man-door
Window	None
FINISHES	
Floor	Vinyl composition tile or resilient flooring
Base	Rubber
Walls	Painted gwb
Wainscot	Fiberglass reinforced plastic at wet area
Ceiling	Suspended acoustical panel
Window Treatment	N/A
BUBBLE DIAGRAM	
<pre> graph TD HC[HC Toilet] --- SC((Supply Closet)) MW((Men's Washroom)) --- SC WW((Women's Washroom)) --- SC SC <--> CR((Corridor Rm.)) CR <--> EX[Exterior] </pre>	

ROOM NAME	TANK AREA
Function	External tank maintenance
Adjacencies	Open to Hangar
Area	141 sq.m. / 1,518 sq. ft.
Minimum Ceiling Height	7,925 mm / 26'-0"
BUILDING SYSTEMS	
Electrical	Class 1, Div. II min.; Devices from finished floor to 18" AFF to be explosion proof. (4) Convenience receptacles for drop lights. (2) electric reels.
Lighting	750 lux average, 3:1 avg/min uniformity, Hi-Bay metal halide or T% HD fluorescent with up component, zoned bi-level switching by occupancy sensor and local switches, quartz re-strike on 10% of MH fixtures.
Telecommunication	none
Data	none
Plumbing	Emergency eyewash/shower, hose bibb, (2) shop air reels, (1) breathing air reel, wall mounted; (2) wall-mounted triplex shop outlets, ceiling mounted; No floor drains.
Heating	Same as Maintenance Bay; access to eye-wash/shower station
Ventilation	One pair of Tank Purge duct drops from overhead
SPECIAL REQUIREMENTS	
Storage	Ramp into Tank Area for 3786 liters (1000 gallons) fuel spill containment; concrete curb all sides
Casework	None
Security	None
Equipment	None
Furnishings	None
Acoustical	Betterment #4 Acoustical Roof Deck
Life Safety	Same safety classification as Hangar
Door	OH door to exterior with forklift access- 3050mm wide x 2500mm high (10'-0"w x 8'-0"h); threshold above fuel containment level
Window	Daylighting at roof or walls
FINISHES	
Floor	Concrete with hardener and sealant; Betterment #2 "Lumiplate" ferrosilicon metallic aggregate dry shake surface hardener
Base	None
Walls	Painted CMU or corrugated steel panel to 2500 mm (8'-0"), galvanized
Wainscot	None
Ceiling	Exposed to structure; Betterment #3 painted finish
Window Treatment	None
BUBBLE DIAGRAM	
<pre> graph TD TR((Tool Room)) MB((Maintenance Bay)) TA((Tank Area)) MB <--> TA </pre>	

ROOM NAME	HC ACCESSIBLE TOILET ROOM
Function	Toilet Room - Unisex
Adjacencies	Access from Corridor, near Lobby, Training-Conference
Area	3.75 sq.m. / 40 sq.ft.
Minimum Ceiling Height	2590mm / 8'-6"
BUILDING SYSTEMS	
Electrical	(1) 120V GFCI receptacles
Lighting	Fluorescent fixtures for room and over-mirror lighting, switched by occupancy sensor.
Telecommunication	None
Data	None
Plumbing	(1 each) handicap accessible water closet, urinal, and lavatory
Heating	For exterior exposures only
Ventilation	Exhaust
SPECIAL REQUIREMENTS	
Storage	None
Casework	None
Security	None
Equipment	None
Furnishings	Grab bars, toilet tissue dispenser, soap dispenser, vanity mirror, coat hook, paper towel dispenser/receptacle
Acoustical	STC 50 adjacent spaces
Life Safety	None
Door	Standard man-door with privacy lockset
Window	None
FINISHES	
Floor	Resilient sheet flooring
Base	Self-cove resilient flooring - 100 mm (4")
Walls	Painted gwb
Wainscot	Ceramic wall tile to 1225 mm (48") above floor
Ceiling	Painted gwb
Window Treatment	N/A
BUBBLE DIAGRAM	
<pre> graph TD SC((Supply Closet)) <--> HT((HC Toilet)) MTS((Men's Toilet/Shower)) <--> HT WTS((Women's Toilet/Shower)) <--> HT HT <--> CR((Corridor Rm.)) CR <--> EX[Exterior] </pre>	

ROOM NAME	MEN'S TOILET & SHOWER ROOM
Function	Washroom, showers
Adjacencies	Access from Corridor; near supply closet
Area	26 sq.m. / 280 sq.ft., minimum
Minimum Ceiling Height	2590 / 8'-6"
BUILDING SYSTEMS	
Electrical	(2) 120V GFCI receptacles
Lighting	fluorescent fixtures for room and over-mirror lighting, switched by occupancy sensor.
Telecommunication	none
Data	none
Plumbing	2 standard water closets, 2 urinal, 2 standard lavatories; 3 standard showers - 36"x36" pan, floor drain
Heating	For exterior exposures only
Ventilation	Exhaust
SPECIAL REQUIREMENTS	
Storage	None
Casework	Vanity countertop - 2000 mm (6 linear feet), minimum
Security	None
Equipment	None
Furnishings	Toilet tissue dispensers, soap dispensers, vanity mirror(s), (10) coat hooks, paper towel dispenser/receptacle, shower curtains/rods, benches at dressing area; some personnel lockers may be located in this room (of the total required in the Corridor room criteria sheet)
Acoustical	STC 50
Life Safety	None
Door	Standard man-door
Window	None required, daylight preferred
FINISHES	
Floor	Resilient sheet flooring
Base	Self-cove resilient flooring - 100 mm (4")
Walls	Painted gwb
Wainscot	Ceramic wall tile to 1225 mm (48") above floor
Ceiling	Painted gwb
Window Treatment	N/A
BUBBLE DIAGRAM	
<pre> graph TD SC((Supply Closet)) --- MW((Men's Washroom)) HT((HC Toilet)) --- MW WW((Women's Washroom)) --- MW MW <--> C((Corridor)) C <--> Ext[Exterior] </pre>	

ROOM NAME	WOMEN'S TOILET ROOM
Function	Washroom, showers
Adjacencies	Access from Corridor; near supply closet
Area	13 sq.m. (140 sq.ft.) minimum
Minimum Ceiling Height	2590 / 8'-6"
BUILDING SYSTEMS	
Electrical	(1) 120V GFCI receptacles
Lighting	Fluorescent fixtures for room and over-mirror lighting, switched by occupancy sensor.
Telecommunication	None
Data	None
Plumbing	1 water closet, 1 lavatory, 2 standard shower - 915 mm x 915 mm (36"x36") pan, floor drain
Heating	For exterior exposures only
Ventilation	Exhaust Air
SPECIAL REQUIREMENTS	
Storage	None
Casework	Vanity countertop - 1225 mm (4'-0") long, minimum
Security	None
Equipment	None
Furnishings	Toilet tissue dispenser, feminine napkin receptacle, soap dispenser, vanity mirror(s), (6) coat hooks, paper towel dispenser/receptacle, shower curtain/rod, bench at dressing area; some personnel lockers may be located in this room (of the total required in the Corridor room criteria sheet)
Acoustical	STC 50
Life Safety	None
Door	Standard man-door
Window	None required, daylight desired
FINISHES	
Floor	Resilient sheet flooring
Base	Self-cove resilient flooring - 100 mm (4")
Walls	Painted gwb
Wainscot	Ceramic wall tile to 1225 mm (48") above floor
Ceiling	Painted gwb
Window Treatment	N/A
BUBBLE DIAGRAM	

ROOM NAME	TOOL ROOM
Function	Tool storage dispensary; staff of 5
Adjacencies	Immediately adjacent to Hangar and Dispatch
Area	52.4 sq.m./ 564 sq.ft., minimum
Minimum Ceiling Height	2590mm / 8'-6"
BUILDING SYSTEMS	
Electrical	120V convenience receptacles at 3 meter (10') spacing, minimum
Lighting	500 lux average, fluorescent fixtures, locally switched
Telecommunication	combination telecom/data outlet
Data	see Telecom.
Plumbing	(1) Shop air reel, (1) triplex shop air outlet, wall mounted
Heating	Yes
Ventilation	Yes. Positive pressure non-Hanger ventilation system.
SPECIAL REQUIREMENTS	
Storage	GFGI: Rolling tool carts, reference shelving, file cabinets, utility shelving
Casework	None
Security	None
Equipment	None
Furnishings	GFGI: Staff office furniture
Acoustical	None
Life Safety	Laminated film on inside pane of window
Door	Double door to Corridor - 1830mm wide x 2130mm high (6'-0"x7'-0"); Coiling counter door to Corridor - 1525mm wide; Exterior coiling door 1830mm wide x 2130mm high (6'-0"x 7'-0")
Window	Daylight preferred, operable window
FINISHES	
Floor	Vinyl composition tile
Base	Rubber
Walls	Painted gwb
Wainscot	None
Ceiling	Suspended acoustical panel
Window Treatment	None
BUBBLE DIAGRAM	<pre> graph TD DRm([Dispatch Rm.]) <--> TR([Tool Room]) C([Corridor]) <--> MB([Maintenance Bay]) C ==> TR C <--> DRm </pre>

ROOM NAME	TRAINING / CONFERENCE
Function	Group training, conference, office, break area
Adjacencies	Adjacent to staff support areas
Area	35.7 sq.m. / 384 sq.ft, minimum
Minimum Ceiling Height	2590 mm / 8'-6"
BUILDING SYSTEMS	
Electrical	(6) 120V convenience receptacles
Lighting	500 lux, local, bi-level switching fluorescent fixtures, setup switching for overhead/TV/film presentations
Telecommunication	combination telecom/data jacks
Data	See Telecom
Plumbing	Counter mounted two compartment sink, water to refrigerator and future ice machine.
Heating	Yes
Ventilation	Yes
SPECIAL REQUIREMENTS	
Storage	None
Casework	2125mm (7'-0") countertop, base cabinets, upper cabinets
Security	None
Equipment	(GFGI all) Microwave, ice machine, refrigerator (GFGI all) Training tables & seating for 25, projection screen, magnetic white board
Furnishings	
Acoustical	STC 50
Life Safety	Laminated film @ inside pane of window
Door	Standard man-door
Window	Exterior daylight, operable window
FINISHES	
Floor	Carpet
Base	Rubber
Walls	Painted gwb
Wainscot	None
Ceiling	Suspended acoustical panel
Window Treatment	Mini-blinds
BUBBLE DIAGRAM	
<pre> graph TD Exterior --> Corridor Corridor --> MaintenanceBay[Maintenance Bay] Corridor --> TrainingRoom[Training Room] TrainingRoom --> Office TrainingRoom --> DispatchRm[Dispatch Rm.] </pre>	

ROOM NAME	VESTIBULE / AIRLOCK
Function	Airlock between hazardous Maintenance Bay classification and non-hazardous classification of Corridor and Office functions
Adjacencies	Service Corridor, Maintenance Bay
Area	2.5 square meters, minimum
Minimum Ceiling Height	2590mm / 8'-6"
Width	1525mm (5'-0") minimum clear width
BUILDING SYSTEMS	
Electrical	(1) 120V convenience receptacle
Lighting	300 lux average fluorescent fixtures, electronic ballasts, locally switched
Telecommunication	None
Data	None
Plumbing	None
Heating	None
Ventilation	Yes - maintain pressure and air exchange required for airlock; size system at 15 air changes, exhaust from floor level directly to the outdoors. Monitor airflow and alarm at loss of exhaust air.
SPECIAL REQUIREMENTS	
Storage	None
Casework	None
Security	None
Equipment	None
Furnishings	None
Acoustical	STC 50 to adjacent staff areas
Life Safety	
Door	1225mm x 2135mm (4'-0"w x 7'-0"h) door each to Maintenance Bay and Corridor Rm. 1830mm x 2135mm (6'-0"w x 7'-0"h) minimum; gasketed with vision panel
Window	None
FINISHES	
Floor	Vinyl composition tile or resilient sheet flooring
Base	Rubber
Walls	Painted gwb
Wainscot	None
Ceiling	Suspended acoustical panel
Window Treatment	N/A
BUBBLE DIAGRAM	
<pre> graph LR A([Corridor Rm.]) <--> B([Vestibule /Airlock]) B <--> C([Maintenance Bay]) </pre>	