CHAPTER A-4

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MECHANICAL

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CHAPTER A-4

MECHANICAL

4.1 GENERAL

This chapter provides the minimum requirements and guidance for preparation and development of the following design aspects: Heating, ventilating, air conditioning (including hydronic distribution systems), plumbing (including compressed air, fuel gas, and medical gas systems), central energy plants, and P.O.L. systems. Further guidance for these mechanical systems will be provided in the Specific Instructions, if required. Guidance for other mechanical systems will also be provided in the Specific Instructions.

4.2 APPLICABLE PUBLICATIONS

This list is a minimum requirement, and is not intended to be an all inclusive requirement. The most current editions of the publications listed below, as of the date of contract award, shall be used, unless directed otherwise.

4.2.1 International Code Council, Inc.

ICC IBC International Building Code

ICC IPC International Plumbing Code

ICC IMC International Mechanical Code

ICC IFGC International Fuel Gas Code

ICC IRC International Residential Code

4.2.2 Unified Facilities Criteria (UFC)

1-200-02 High Performance and Sustainable Building Requirements

1-300-07A Design-Build Technical Requirements

3-400-02 Design: Engineering Weather Data

3-401-01 Mechanical Engineering

3-410-01 Heating, Ventilating, and Air Conditioning Systems

3-410-02 Direct Digital Control for HVAC and Other Building Systems

3-410-04 Industrial Ventilation

3-420-01 Plumbing Systems

3-420-02FA Compressed Air

3-430-01FA Heating and Cooling Distribution Systems

3-430-02FA Central Steam Boiler Plants

3-430-07 Operations and Maintenance: Inspection and Certification of Boilers and Unfired Pressure Vessels

3-430-08N Central Heating Plants

3-430-09 Exterior Mechanical Utility Distribution

3-430-11 Boiler Control Systems

3-440-01 Facility-Scale Renewable Energy Systems

3-450–01 Noise and Vibration Control

3-460-01 Design: Petroleum Fuel Facilities

3-460-03 O&M: Maintenance of Petroleum Systems

3-470-01 Utility Monitoring and Control System (UMCS) Front End and Integration

3-600-01 Fire Protection Engineering for Facilities

4-010-01 DoD Minimum Antiterrorism Standards for Buildings

4-010-06 Cybersecurity of Facility-Related Control Systems
4-826-10 Design: Refrigeration Systems for Cold Storage

4-832-01N Design: Industrial and Oily Wastewater Control

4.2.3 Department of the Army Technical Instructions (TI)

TI 800-01 Design Criteria

4.2.4 American Society of Mechanical Engineers (ASME)

ASME B31.1 Power Piping

ASME B31.3 Process Piping

ASME B31.5 Refrigeration Piping and Heat Transfer Components

ASME B31.8 Gas Transmission and Distribution Piping Systems

ASME B31.9 Building Services Piping

ASME BPVC Boiler and Pressure Vessels Code

4.2.5 Air Conditioning, Heating and Refrigeration Institute (AHRI).

ANSI/AHRI Std 210/240	Performance Rating of Unitary Air-Conditioning & Air-Source Heat Pump Equipment
ANSI/AHRI/CSA Std 310/380	Standard for Packaged Terminal Air-Conditioners and Heat Pumps
AHRI Std 410	Forced-Circulation Air-Cooling and Air-Heating Coils
AHRI Std 430	Performance Rating of Central Station Air-handling Unit Supply Fans
AHRI Std 440	Performance Rating of Room Fan-Coils
AHRI Std 550/590	Performance Rating of Water-Chilling and Heat Pump Water-Heating Packages Using the Vapor Compression Cycle
ANSI/AHRI Std 560	Absorption Water Chilling and Water Heating Packages
AHRI Std 840	Performance Rating of Unit Ventilators
AHRI Std 880	Performance Rating of Air Terminals
AHRI Std 1060	Performance Rating of Air-to-Air Heat Exchangers for Energy Recovery Ventilation Heat Equipment

4.2.6 American Conference of Governmental Industrial Hygienists (ACGIH)

ACGIH 2098	Industrial Ventilation: A Manual of Recommended Practice for Design
ACGIH 2092S	Industrial Ventilation: A Manual of Recommended Practice

4.2.7 American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE), Inc. Standards

ASHRAE HVAC Applications Handbook

ASHRAE HVAC Systems and Equipment Handbook

ASHRAE Fundamentals Handbook

ASHRAE Refrigeration Handbook

ANSI/ASHRAE Standard 15	Safety Standard for Refrigeration Systems
ASHRAE Standard 55	Thermal Environmental Conditions for Human Occupancy
ASHRAE Standard 62.1	Ventilation for Acceptable Indoor Air Quality

ASHRAE Standard 90.1	Energy Standard for Buildings Except Low-Rise Residential Buildings
ASHRAE Standard 90.2	Energy-Efficient Design of Low-Rise Residential Buildings
ASHRAE Standard 189.1	Standard for the Design of High-Performance Green Buildings Except Low-Rise Residential Buildings
ASHRAE Standard 202	Commissioning Process for Buildings and Systems
ASHRAE Guideline 0	The Commissioning Process

4.2.8 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), Inc.

ANSI/SMACNA 008	IAQ Guidelines for Occupied Buildings Under Construction
SMACNA 1378	Thermoplastic Duct (PVC) Construction Manual
SMACNA 1403	Accepted Industry Practice for Industrial Duct Construction
SMACNA 1429	HVAC Systems Commissioning Manual
SMACNA 1520	Round Industrial Duct Construction Standards
SMACNA 1767	Kitchen Ventilation Systems & Food Service Equipment Fabrication & Installation Guidelines
SMACNA 1780	HVAC Systems – Testing, Adjusting and Balancing
SMACNA 1793	Architectural Sheet Metal Maual
SMACNA 1819	Fire, Smoke and Radiation Damper Installation Guide for HVAC Systems
SMACNA 1858	HVAC Sound And Vibration Manual
SMACNA 1884	Fibrous Glass Duct Construction Standards
SMACNA 1922	Rectangular Industrial Duct Construction Standards
SMACNA 1966	HVAC Duct Construction Standards Metal and Flexible
SMACNA 1972 CD	HVAC Air Duct Leakage Test Manual
SMACNA 1981	Seismic Restraint Manual Guidelines for Mechanical Systems
SMACNA 1987	HVAC Duct Systems Inspection Guide

4.2.9 National Fire Protection Association (NFPA)

NFPA 30	Flammable and Combustible Liquids Code
NFPA 30A	Code for Motor Fuel Dispensing Facilities and Repair Garages
NFPA 31	Standard for the Installation of Oil-Burning Equipment
NFPA 37	Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines
NFPA 54	National Fuel Gas Code
NFPA 55	Compressed Gases and Cryogenic Fluids Codes
NFPA 58	Liquefied Petroleum Gas Code
NFPA 80	Standard for Fire Doors and Other Opening Protectives
NFPA 82	Standard on Incinerators and Waste and Linen Handling Systems and Equipment
NFPA 85	Boiler and Combustion Systems Hazards Code
NFPA 90A	Standard for the Installation of Air Conditioning and Ventilating Systems
NFPA 90B	Standard for the Installation of Warm Air Heating and Air Conditioning Systems
NFPA 91	Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists and Noncombustible Particulate Solids
NFPA 96	Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations
NFPA 99	Health Care Facilities Code
NFPA 101	Life Safety Code
NFPA 105	Standard for Smoke Door Assemblies and Other Opening Protectives
NFPA 211	Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances
NFPA 214	Standard on Water-Cooling Towers
NFPA 407	Standard for Aircraft Fuel Servicing

NFPA 409	Standard on Aircraft Hangars
NFPA 418	Standard for Heliports

4.2.10 Guide Specifications

See Chapter 11 of this manual.

4.2.11 Engineering Regulations (ER)

ER 1110-1-12	Engineering and Design – Quality Management
ER 1110-1-8173	Energy Modeling and Life Cycle Cost Analysis
ER 1110-345-723	Total Building Commissioning Procedures

4.2.12 American National Standards Institute (ANSI)

ANSI Z21.10.1/CSA 4.1	Gas Water Heaters Vol. I, Storage Water Heaters with Input Ratings of 75,000 Btu Per Hour or Less
ANSI Z21.10.3/CSA 4.3	Gas-Fired Water Heaters Vol. III, Storage Water Heaters With Input Ratings Above 75,000 Btu Per Hour, Circulating and Instantaneous
ANSI Z21.13/CSA 4.9	Gas-Fired Low Pressure Steam and Hot Water Boilers
ANSI Z21.15/CSA 9.1	Manually Operated Gas Valves for Appliances, Appliance Connector Valves and Hose End Valves
ANSI Z21.18/CSA 6.3	Gas Appliance Pressure Regulators
ANSI Z21.21/CSA 6.5	Automatic Valves for Gas Appliances
ANSI Z21.22/CSA 4.4	Relief Valves for Hot Water Supply Systems
ANSI Z21.24/CSA 6.10	Connectors for Gas Appliances
ANSI Z21.41/CSA 6.9	Quick-Disconnect Devices for Use with Gas Fuel Appliances
ANSI Z21.45	Flexible Connectors of Other Than All-Metal Construction for Gas Appliances
ANSI Z21.47/CSA 2.3	Gas-Fired Central Furnaces
ANSI Z21.66/CGA 6.14	Automatic Vent Damper Devices for Use with Gas-Fired Appliances
ANSI Z21.69/CSA 6.16	Connectors for Movable Gas Appliances
ANSI Z21.78/CSA 6.20	Standard Specification for Combination Gas Controls for Gas

	Appliances
ANSI Z21.80/CSA 6.22	Line Pressure Regulators
ANSI Z21.86/CSA 2.32	Vented Gas-Fired Space Heating Appliances
ANSI Z358.1	Emergency Eyewash and Shower Equipment
ANSI Z83.4/CSA 3.7	Non-Recirculating Direct Gas-Fired Heating and Forced Ventilation Appliances for Commercial and Industrial Application
ANSI Z83.8/CSA 2.6	Gas Unit Heaters, Gas Packaged Heaters, Gas Utility Heaters, and Gas-Fired Duct Furnaces
ANSI Z83.19/CSA 2.35	Gas-Fired High-Intensity Infrared Heaters

4.2.13 Energy Criteria

See Chapter A-7 of this manual.

4.3 **PRECONCEPT (PROGRAMMING) SUBMITTAL REQUIREMENTS**

No requirements for this section.

4.4 **CODE 3 DESIGN SUBMITTAL REQUIREMENTS**

4.4.1 Any Base of project specific requirements will be provided with specific instructions to contract or delivery order.

4.5 **CONCEPT (35%) DESIGN SUBMITTAL REQUIREMENTS**

4.5.1 Concept Design Analysis. The analysis will form the basis of the future Preliminary and Final Design Analyses, as required for Preliminary (60 Percent) Design Submittal and Final (100 Percent) Design Submittal of this chapter, depending on submittal requirements, and will contain the following in narrative form:

a. Heating, Ventilating, and Air Conditioning.

(1) Criteria listings - manuals, pamphlets, technical books, etc.

(2) Design conditions used in calculations - inside and outside temperatures, personnel load, equipment heat release (if any), outside air or ventilation requirements, U-factors, and other special conditions.

(3) Block loads for heating and cooling shall be calculated using ASHRAE-based computer-generated load calculations. Block load program inputs and outputs shall be provided. Where passive solar applications prove feasible and cost effective (see CHAPTER A-7, ENERGY ANALYSES, ECONOMIC ANALYSES, CONTROL SYSTEMS, UMCS), the Designer shall employ a load calculation method that can incorporate all applicable passive solar factors. All load calculation software must be approved in advance by the Savannah District. For all

calculations (cooling load, heating load, pipe sizing, duct sizing, etc.), the design analysis shall contain layout sketches that show how the building or system was segmented for computer input.

(4) Type of systems considered and full description including justification for selection, description of air distribution, zoning and control description, and description and justification for any connections to existing systems. Provide justification for chosen systems based on life cycle cost analysis. See Chapter A-7 of this manual for additional life cycle cost analysis requirements.

(5) Brief description of various items of equipment. Indicate operating temperatures and capacities.

(6) Description of piping systems including type of pipe, insulation requirements, and whether concealed or exposed.

(7) Description of any demolition or asbestos removal required. See CHAPTER A-12, ASBESTOS AND OTHER HAZARDOUS MATERIALS (IDENTIFICATION, HANDLING AND REMOVAL) if asbestos is encountered.

(8) A list of items for which any additional criteria, clarification, or guidance is required.

(9) Documentation of compliance with ASHRAE 90.1 and ASHRAE 62.1.

b. Plumbing.

(1) Criteria listing - manuals, codes, etc.

(2) Plumbing calculations as necessary to determine number of fixture units, cold and hot water capacity requirements, and equipment or capacities of miscellaneous and special systems.

(3) Fixture determination listing quantity and type of fixtures for both men's and women's toilets, and other fixtures such as drinking water fountains, service sinks, etc. Indicate male and female building population, if available.

(4) Description of domestic water heating and storage equipment, including capacity, type (gas, electric, boiler, water), materials, and insulation. (Life cycle cost justification will be provided with concept design analysis for justification of selection, if appropriate, in accordance with Chapter A-7 of this manual.)

(5) Piping types and location (concealed or exposed), together with material proposed and insulation requirements.

(6) Brief description of miscellaneous systems such as compressed air (capacity, pressure, piping, location of air outlets, etc.), roof drainage, natural gas (pressure, quantity, and equipment to be served), and other special systems.

(7) Description of any demolition or asbestos removal required. See CHAPTER A-12, ASBESTOS AND OTHER HAZARDOUS MATERIALS (IDENTIFICATION, HANDLING AND REMOVAL) if asbestos is encountered.

(8) A list of items for which additional criteria, clarification, or guidance is required.

c. Outside Utilities.

(1) Criteria listings - manuals, pamphlets, codes, etc.

(2) Pipe size calculations in tabular form. Where project utilities are extensions of existing systems, it must be shown that these are adequate for the additional load requirements.

(3) Description of the utility systems chosen. Provide justification for chosen systems based on life cycle cost analysis.

(4) Topographic Survey requirements for utility distribution routing shall be in accordance with CHAPTER A-1, SITE DEVELOPMENT, INCLUDING WATER AND SEWER.

(5) A list of items for which additional criteria, clarification, or guidance is required.

d. Renovation Recommendations. The A-E shall make all recommendations for renovation requirements in existing buildings and/or recommendations for the use of existing mechanical systems. Recommendations shall include all supporting rationale, assumptions, calculations, condition of existing equipment, etc.

4.5.2 Concept Drawings. Provide plan view showing the following:

a. Heating, Ventilating, and Air Conditioning. Heating, ventilating, and air conditioning equipment layout - chillers or refrigeration compressors, boilers, pumps, condensers or cooling tower, air handling units, fans, air distribution duct layout (may be single line), hoods, and other items of major equipment required for the facility.

b. Plumbing. Plumbing fixture layout, floor and area drains, and plumbing equipment layout (hot water generator, storage tank, air compressors, etc.).

c. Outside Utilities. Indicate locations and sizes of outside utilities, heating hot water, steam, chilled water, and natural gas lines where required to support the project. Show same scale as other sitework drawings.

d. Mechanical Room(s). Provide a 1:50 scale plan(s) in metric design (or 1/4 inch = 1 foot) of the mechanical room(s) indicating all equipment to be located therein with at least 1 meter (3 feet) of clearance between each item and the nearest adjacent wall/ceiling or electrical/control panel. Space required for placement of all such items as coils, filters, motors, and belts shall be shown on the plan. If electrical panels are located within the mechanical room, indicate the space around the panel where piping is prohibited by code.

4.5.3 Concept Specifications. Provide outline specifications to be used for the project in accordance with CHAPTER A-11, SPECIFICATIONS. Where Savannah District or Unified Facilities Guide Specifications are to be used without change, a listing of the appropriate UFGS numbers will suffice. Where a departure or addition to a guide specification is required, include in listing a brief description of the equipment or procedure constituting the departure or addition.

Where no guide specification is available, prepare an outline specification from available criteria and instructions, giving all pertinent equipment and material characteristics.

4.5.4 Standard Drawings or Site Adaptations. Indicate all utility requirements as above and provide narrative and calculations for any other changes required for site adaptation or conformance to latest criteria. Design analysis, drawings, and specifications shall be updated to reflect the latest Sustainable Design and Energy Use Reduction requirements.

4.5.5 Field Investigation. The A-E shall make a complete and thorough field investigation prior to performing any design work on this project. This shall be done to verify conditions existing at the time of design compared to those shown on as-built drawings provided by the Project Manager. Any conflicts shall be reported to the Project Manager, Savannah District. The field investigation shall also determine the extent of mechanical renovation required in any existing building to accommodate the scope of this new project.

4.5.6 Boiler Permits. See paragraph 4.11.8 for boiler permitting requirements.

4.6 **PRELIMINARY (OVER THE SHOULDER) SUBMITTAL REQUIREMENTS**

If project specific instructions require this section, rather than section 4.7, the requirements identified in section 4.7 shall be submitted for this section, otherwise, there are no requirements for this section.

4.7 **PRELIMINARY (60%) DESIGN SUBMITTAL REQUIREMENTS**.

4.7.1 General. When only Concept and Final Design submittals are required, the Final Design submittals shall contain all information developed in the Concept (35 Percent) Design Submittal Requirements, as well as that identified in this section (Preliminary (60 Percent) Design Submittal Requirements), and the Final (100 Percent) Design Submittal Requirements.

4.7.2 Preliminary Design Analysis.

4.7.2.1 The Preliminary Design Analysis will be a refinement of the Concept Design Analysis. All comments from this office relating to Concept design shall be incorporated in the Preliminary Design Analysis.

4.7.2.2 Base all new designs on the most economical plan consistent with the applicable publications listed in this manual. Cite the criteria references for all major design decisions.

4.7.2.3 Identify all references to standard texts, etc., for all major design decisions or assumptions not covered by criteria references.

4.7.2.4 All design analyses shall clearly show calculated capacities of all major items of mechanical equipment such as air handling units and coils, condensing units, water chillers, boilers, pumps, humidifiers, cooling towers, fans, hot water heaters and tanks. Pump heads will be estimated for preliminary design. Analyses shall show manufacturer's make and model number of equipment used for layout purposes, and shall show weights of major items of equipment. Include summaries of heating and cooling loads and, where applicable, show determination of water quantities and temperature rise or drop for hot water, chilled water, and condenser water. Show calculations for air on and off coils and develop air conditioning and/or

heating process cycles on a standard psychrometric chart, showing each air conditioning, heating, ventilation, humidification, and dehumidification system.

4.7.2.5 For Preliminary design, all piping inside the building and ductwork need not be sized based on detailed calculations, but should show estimated sizes sufficiently accurate to prepare the Preliminary Cost Estimate.

4.7.2.6 The Preliminary Design Analysis shall also include the following specific items, when applicable:

a. Heating, Ventilating, and Air Conditioning.

(1) Calculations for heating and cooling loads will be made in accordance with UFC and ASHRAE requirements. Computer-generated load calculations shall be used. Load calculation software must be ASHRAE-based and must be approved in advance by the Savannah District.

(2) Boiler sizes will be based on calculated heat load, safety factors, piping losses, and pickup requirements. Selection of boilers will be based on "gross" rating. List in design analysis allowances made for safety factors, piping losses, etc.

(3) Mechanical Ventilation. When calculating fan capacities for ventilation purposes, show in the analysis the volume of the space to be ventilated and the number of the air changes per hour used. If fan capacity is based on heat liberated in the space, show all assumptions made along with computations. All calculations required by ASHRAE Standard 62.1 shall be shown. This includes ventilation effectiveness and multiple space analysis if the ventilation rate procedure is used.

b. Outside Utilities.

(1) Exterior heating hot water, steam, chilled water, and natural gas distribution piping shall be sized for preliminary design. The analysis shall show flow quantities, pipe sizes, pressure drops per meter (or per 100 feet), total pressure drop, and initial and final pressures.

(2) Expansion Loop Calculations. Expansion loop sizes shall be calculated for heating hot water distribution systems. The entire distribution system shall be analyzed using a three-dimensional, finite element analysis program. Input, output and diagrams, indicating node locations shall be submitted. Loops shall provide adequate expansion on the straight runs of the system within the stress limits of ASME B31.1. Distance between guides on loops shall be equal to twice the width of the loop. Anchor distances shall not exceed 75 m (250 feet). Loops shall generally be formed of equal leg segments.

4.7.3 Preliminary Drawings. The Preliminary Drawings will be a refinement of the Concept Drawings. All comments from this office relating to Concept design shall be incorporated in the Preliminary Drawings. In addition, the Preliminary Drawings shall contain the following:

a. Floor plan layouts showing location and capacities of all items of mechanical equipment, piping, ductwork, and fixtures.

b. Enlarged plan of Mechanical Equipment Rooms. Equipment room layouts shall be sufficiently complete to show piping and duct layouts and access for maintenance. A minimum

of 900 mm (36 inches) working clearance shall be provided around all major equipment items when depicting the largest of three manufacturer's standard unit dimensions.

c. Layout (may be single line) of ductwork and piping inside of building including all items of mechanical equipment and fixtures. Detailed piping riser diagrams, sections, and elevations are not required for preliminary design unless required to show intent of design. Details and detailed piping schematic diagrams are required for preliminary design.

d. Equipment capacities shall be listed in the schedules. Minimum efficiency shall be included in the schedule for pumps. All major equipment shall have maximum kilowatts (horsepower) listed in the schedule. Coordinate electrical requirements with the electrical designer. Do not specify equipment by trade name.

e. Plumbing fixture schedule shall list individual fixtures and pipe size connections (cold water, hot water, waste, and vent).

f. Heating Hot water distribution plan showing location and sizes of lines and pits, pit equipment with capacities, anticipated grading of lines, and location and sizes of expansion loops and anchors.

g. Chilled water, domestic water, gas, and liquid fuel distribution plan showing location and size of distribution lines.

h. Any information other than the requirements listed above which the designer considers necessary to show the intent of design.

4.7.4 Preliminary Specifications. The concept submitted Unified Facilities Guide Specifications (UFGS) list shall be updated to include any new specifications based on the refined preliminary design. All specifications from the list shall be tentatively marked up, with major edits, and submitted as part of the preliminary (60 percent) submittal. Specifications shall comply with the requirements of Chapter A-11, SPECIFICATIONS. Specifications shall be submitted with red-line edits indicating all deleted/modified text.

4.7.4.1 Specifications will not be restrictive. Generally, the description will be such that at least three manufacturers can meet the specified requirements. Do not use trade names in the specifications.

4.7.5 Boiler Permits. See paragraph 4.11.8 for boiler permitting requirements.

4.8 **FINAL (100%) DESIGN SUBMITTAL REQUIREMENTS**

4.8.1 General. When only Concept and Final Design submittals are required, the Final Design Submittals shall contain all information developed in the Concept (35 Percent) Design Submittal Requirements, as well as that identified in the Preliminary (60 Percent) Design Submittal Requirements, and the Final (100 Percent) Design Submittal Requirements.

4.8.2 Final Design Analysis.

4.8.2.1 The Final Design Analysis will be a refinement and completion of the Concept and/or Preliminary Design Analyses and shall contain all the information called for in paragraphs 4.5

and 4.7 of this chapter, even when preliminary submittal is not required. All comments from this office relating to Concept and Preliminary design shall be incorporated in the Final Design Analysis.

4.8.2.2 The design analysis will show applicable references for design assumptions not found in common reference manuals which were not listed during the Preliminary design stage.

4.8.2.3 All pipe sizing computations will be included in the analysis. Piping analyses will show design flow, pipe size, friction factors, slopes, lengths, and elevations where applicable, conducted quantity, and velocity in the various mains and branches. Where necessary, flow diagrams will be included in the analysis.

4.8.2.4 The determination of pump heads will be based on complete take off of friction losses and static heads.

4.8.2.5 The plumbing piping analysis will clearly show the main and branch loads in terms of "fixture units" as well as flow quantities L/min (gpm), supply pressure, and pressure available at all fixtures based on full flow conditions.

4.8.2.6 All duct sizing computations will be included in the analysis. Ductwork analyses will show friction loss and will clearly indicate the air velocities encountered in the main ducts. Where necessary, flow diagrams will be included in the analysis.

4.8.2.7 The determination of static pressure on fans and air handling units will be based on complete take off of static losses. The value should be calculated such that an allowance will be made for dirty filters. This value shall be included in the external pressure drop on the air handling unit schedule.

4.8.2.8 Heating, air conditioning, and ventilating analyses will include a summary sheet to show the final capacity of each piece of equipment including the manufacturer's make and model used for layout. The weight of each of the items of equipment will be included in this summary.

4.8.2.9 P.O.L. systems will be fully developed in accordance with project specific instructions when required.

4.8.3 Final Drawings.

4.8.3.1 The Final Drawings will be a refinement and completion of Concept and/or Preliminary Drawings and shall contain all the information called for in paragraphs 4.5 and 4.7 of this chapter, even when preliminary submittal is not required. All comments from this office relating to Concept and Preliminary design shall be incorporated in the Final Drawings.

4.8.3.2 Where crowded conditions exist due to close proximity of other phases of the work, sufficient sections and elevations will be shown to indicate clearly the exact location of the particular item in relation to other items. As a minimum, one section will be taken through the most congested area of each mechanical room.

4.8.3.3 The number of elevations and details will be sufficient to allow construction and installation of the work without additional design work by the Contractor.

4.8.3.4 Where equipment connection details are shown, indicate all required valves, gauges, and fittings required. Coordinate with specification requirements and make sure that valves, fittings, etc., that are specified to be furnished with each piece of equipment are included in the detail.

4.8.3.5 Equipment room plans will clearly indicate by dotted lines, the space required for "tube pulling" on such items as boilers, chillers, condensers, etc. Sufficient room will be allowed for maintenance, coil removal, filter removal, etc., on other items of equipment. Space reserved by code at electrical panels shall also be shown.

4.8.3.6 Final plans shall show all pipe and duct sizes. Ductwork will be drawn to scale on plans. Catwalks, ladders, platforms, access panels, and doors required for operation and maintenance of equipment, valves, and accessories will be indicated on the drawings.

4.8.3.7 Performance characteristics for all items of mechanical equipment will be placed in carefully prepared equipment schedules. Equipment characteristics specified in "Note" fashion, or in random locations on the drawings are not acceptable. Equipment characteristics selected shall not be restrictive to any one manufacturer but must be competitive among at least three major manufacturers. No manufacturers' trade names shall be shown on the drawings.

4.8.3.8 Electrical characteristics will not be included in equipment schedules. Minimum efficiency shall be included in the schedule for pumps only. All other major equipment (1.1 kw or more) shall have maximum kilowatts (horsepower) listed in the schedule. See CHAPTER A-7, ENERGY ANALYSES, ECONOMIC ANALYSES, CONTROL SYSTEMS, UMCS.

4.8.3.9 Location of equipment, piping, and ductwork shall be completely coordinated with other features of the project - architectural, structural, electrical, etc.

4.8.3.10 Riser diagrams of soil, waste, drain, and vent stacks, and water risers will be shown on the drawings for all buildings two stories and higher.

4.8.3.11 Where critical, the air suction and discharge directions of such items as fans, air-cooled condensers, and cooling towers will be indicated on the drawings. Make sure that building fresh air intakes are located at a sufficient distance away from the air discharge of air-cooled condensing units, cooling towers, etc., as to preclude pick up of this air into the fresh air intake.

4.8.3.12 Heat distribution, liquid fuel distribution, and chilled water distribution drawings will have complete profiles for the entire length of run. These profiles will indicate elevations, depth of bury, and all interfering utilities which may be encountered. Details of pits, drip points, etc., will be shown. Where required to clearly define the requirements, profiles as specified above will be provided for natural gas distribution systems.

4.8.3.13 HVAC Controls. The Designer shall refer to CHAPTER A-7, ENERGY ANALYSES, ECONOMIC ANALYSES, CONTROL SYSTEMS, UMCS for HVAC Controls Final Design requirements. HVAC control system design shall be in accordance with the guidance presented in UFC 3-410-02. Coordinate with the appropriate Base Energy personnel for Base specific Controls requirements. Controls for boilers, chillers, and their auxiliaries located in central energy plants shall also be coordinated with the appropriate Base Energy personnel.

4.8.4 Final Specifications.

4.8.4.1 Typed, fully edited project specifications shall be submitted in accordance with CHAPTER A-11, SPECIFICATIONS.

4.8.4.2 Specifications will not be restrictive. Generally, the description will be such that at least three manufacturers can meet the specified requirements. Do not use trade names in the specifications.

4.8.4.3 The subparagraphs on "Electrical Work" shall be carefully coordinated with the electrical section of the specifications. There shall be no conflicts as to which section covers starters, controls, or wiring, and no conflicts as to the type of starters required for the individual items of equipment.

4.8.4.4 The Designer shall refer to CHAPTER A-7, ENERGY ANALYSES, ECONOMIC ANALYSES, CONTROL SYSTEMS, UMCS, for specification requirements for HVAC Control Systems.

4.8.4.5 Particular care will be given to the compatibility of components, for example, the burner should suit the boiler; the combustion controls should suit the oil type and burner type selected.

4.9 **CORRECTED FINAL DESIGN SUBMITTAL REQUIREMENTS**

4.9.1 Notice. In the Corrected Final Design Submittal, the designer of record finalizes the construction documents. This includes the incorporation of approved comments from the previous design submittal reviews. The Corrected Final Design Submittal requirements shall be the same as the Final Design Submittal requirements. Unless indicated otherwise in the project Specific Instructions, this submittal will not be another review in ProjNet and is only for final backcheck of all comments.

4.9.2 Compliance. The comments generated during the Final Design review shall be incorporated in the Corrected Final submittal.

4.10 **REQUIREMENTS FOR PREPARATION OF DESIGN/BUILD RFP PACKAGES**

4.10.1 General. Unless indicated otherwise, RFP shall comply with the requirements of UFC 1-300-07A. Unless indicated otherwise, A-E shall be furnished an electronic format sample or template for the written technical requirements portion of the RFP to be edited for the specific project. The RFP shall describe the minimum proposal requirements.

4.10.1.1 Plumbing: RFP shall indicate that the plumbing systems shall be designed and installed in accordance with the International Plumbing Code.

4.10.1.2 Supply Air Plenums: RFP shall indicate that supply air plenums shall not be used unless approved by Savannah District.

4.10.1.3 Mechanical Systems Maintainability and Accessibility: RFP shall indicate that special attention shall be given to the maintainability and accessibility of all HVAC systems. Accessibility features (i.e. access panels, etc.) shall be designed and included as required to allow complete access to all mechanical systems and system components, which are

concealed, or require adjustment, inspection, maintenance, and replacement. Provide adequate clearance around all pieces of equipment for periodic maintenance, inspection, and cleaning. Service of one piece of equipment shall not require disturbance of adjacent equipment.

4.10.1.4 Commissioning: RFP shall indicate that Total Building Commissioning shall be required. The Savannah District will not serve as the Commissioning Authority, required under sustainable design.

4.10.1.5 Evaluation Factors: RFP shall address “evaluation factors” and indicate the order of relative importance of all factors evaluated. The A-E shall coordinate discussion of evaluation factors with the Savannah District Project Manager for guidance.

4.10.1.6 Proposer Submittal Requirements: As a minimum, RFP shall require the proposers to submit the following as part of their proposal:

a. Design Narrative: RFP shall require a design narrative describing the mechanical and plumbing system types proposed to be installed and description of air distribution, zoning, and control systems. The design narrative shall address all RFP issues and contain all explanatory material giving the design decisions that would not be obvious to an engineer reviewing the final drawings and specifications. The design narrative should also contain an outline of the specifications, sustainability checklists, and the indoor and outdoor design conditions.

b. Catalog Cuts: RFP shall address requirements for manufacturers catalog cuts for major pieces of equipment (air handlers, boilers, chillers, pumps over 5 hp) to be provided with submittal, that shall represent actual equipment proposed to be installed. RFP shall indicate that deviations and installation of equipment other than proposed will not be allowed or accepted unless approved by the Contracting Officer. RFP shall also indicate that proposed equipment shall be approved conditionally, pending its compliance with the specifications for the specific project.

4.10.1.7 Successful Proposer Submittal Requirements: As a minimum, for the remainder of the submittals for the successful proposer, the RFP shall require the successful proposer to submit Design Analysis, Drawings, Specifications, and any additional requirements in accordance with the Savannah District Design Manual for Military Construction, Chapter A-4.

4.10.2 Draft RFP Submittal. Submit the following:

a. The A-E shall provide design criteria, drawings, and an initial list of specifications for the RFP.

b. The A-E shall provide a narrative describing the mechanical and plumbing system types and description of air distribution, zoning, and control systems.

c. The A-E shall perform LCCAs (Life Cycle Cost Analysis) for HVAC system selection and for 30% solar thermal domestic hot water heating. HVAC system alternatives (air side) shall be submitted to Savannah District for approval. The system that wins out in the LCCA shall be documented in the RFP as the system to be designed around. Any other systems that come within 10% of the winning system in the LCCA shall also be documented in the RFP as potential systems to be designed around, pending the systems approval from the Savannah District.

4.10.3 Final RFP Submittal.

4.10.3.1 Implement review submittal comments.

4.10.3.2 Verify consistency between plans, specifications, and corrections.

4.11 **TECHNICAL REQUIREMENTS**

4.11.1 Statement of Work. Mechanical work includes, but is not limited to, the design of the following systems:

a. Air Conditioning.
b. Compressed Air.
c. Emergency Engine-Generator Units.
d. Natural Gas Distribution and Natural Gas Fittings.
e. Heating.
f. Hoists and Lifts.
g. Incinerators.
h. Ventilation for Equipment Rooms.
i. Mechanical Equipment Spaces.
j. Plumbing.
k. Refrigeration.
l. Chilled Water Distribution.
m. Heating Hot Water and Steam Distribution.
n. Liquid Fuel Storage, Distribution, and Dispensing.
o. Seismic Protection.

4.11.2 Basic Technical Requirements. TI 800-01, ERs, and UFCs.

4.11.3 Coordination of Work.

4.11.3.1 Coordinate space requirements, foundations, supports, duct and pipe routing, electrical service, and the like for mechanical items with architectural, structural, and electrical design elements.

4.11.3.2 Coordinate exterior mechanical distribution systems with design elements handling other exterior utility designs and sitework.

4.11.3.3 All piping and ductwork will be concealed in habitable areas of all Army buildings, except storage or service facilities, as well as utility and medical storage spaces in hospitals.

4.11.4 Supplementary Technical Publications. Additional technical publications will be requested by the Designer for each project. These publications will supplement those cited in paragraph Basic Technical Requirements. In case of conflict between publications, the publications cited in paragraph Basic Technical Requirements will govern. See paragraph APPLICABLE PUBLICATIONS for a list of applicable Technical Publications.

4.11.5 Guide Specifications. The appropriate sections of guide specifications will be requested by the Designer initially and again at the Preliminary design stage for each project. The Designer shall read each before design is started and pay special attention to the TECHNICAL

NOTES included with each section of guide specifications. The specifications and notes reflect criteria that must be incorporated in the design.

4.11.6 System Selection.

4.11.6.1 Full engineering considerations shall be given to achieve greater operating economics by the use of one or more of the several proven energy conservation systems. Several considerations to achieve energy conservation are described in Architectural and Engineering Instructions. See CHAPTER A-7, ENERGY ANALYSES, ECONOMIC ANALYSES, CONTROL SYSTEMS, UMCS.

4.11.6.2 The A-E shall evaluate the following design alternatives on a life cycle cost basis.

a. Alternative domestic hot water heating systems.

b. Extension of existing heating hot water, steam, or chilled water distribution systems to serve this facility versus self-contained systems.

c. Building HVAC Systems Selection: The A-E shall carefully evaluate all of the project criteria and use good engineering judgement to select HVAC system alternatives which are compatible with the facility. A minimum of 3 viable alternatives shall be selected. The A-E shall contact Mechanical Section, Design Branch, for approval of alternatives to receive life cycle costing prior to computerized energy analysis as required by CHAPTER A-7, ENERGY ANALYSES, ECONOMIC ANALYSES, CONTROL SYSTEMS, UMCS.

d. Providing the building with 30% solar thermal domestic hot water heating, or percent life cycle cost effective.

4.11.7 Standard Systems Criteria.

4.11.7.1 Air Conditioning.

4.11.7.1.1 Outside Design Conditions. Unless stated otherwise in Specific Instructions, outside design conditions shall be as required by UFC 3-410-01.

4.11.7.1.2 Inside Design Conditions. Unless stated otherwise in Specific Instructions, inside design conditions shall be as required by UFC 3-410-01.

4.11.7.1.3 Year-Round Cooling Requirements. If an air conditioning system serves areas having high internal heat gains (such as electronic equipment areas), considerations must be given to possible year-round cooling requirements and the system designed accordingly; this will include provisions for low ambient operation of air-cooled condensers; or if permitted, the use of an outside air economizer cycle. Provisions for reheating of supply air should be provided where justified.

4.11.7.1.4 Reliability, redundancy, and other requirements for air conditioning of Communications/Electronic installations shall be in accordance with I3A, TI 800-01, and UFCs..

4.11.7.1.5 Additional criteria required for proper design of special facilities will be given in specific instructions.

4.11.7.1.6 Air conditioned existing buildings, having attic spaces with insulation on the ceiling, shall be provided with mechanical ventilation to maintain a maximum of 5.56 degrees C (10 degrees F) above ambient in the attic space. No existing facility with attic space will be air-conditioned unless insulation is added to the ceiling to bring the roof/ceiling assembly thermal resistance factor into conformance with current criteria.

4.11.7.1.7 Automatic Heating and Cooling Changeover Controls. Outdoor sensing unit and controls shall be located where they will not sense heat generated by mechanical or electrical equipment. They shall not be located in the outside air intakes and exhaust air streams of mechanical equipment rooms where they can be affected. Automatic changeover is permitted where there is a building central heating and air conditioning system, provided the changeover control is based on sensing outside air temperatures. When automatic changeover controls are used the building piping system shall contain a control loop. When changeover takes place, the control loop will allow the water in the piping system to continue circulating in order for it to become a neutral temperature before it enters the equipment (boiler or chiller). Having the water at a neutral temperature before it enters the equipment (boiler or chiller) will prevent thermal shock of the equipment (boiler or chiller).

4.11.7.1.8 Fire Protection. The current requirements of NFPA 90A and 90B will be incorporated in all heating and air conditioning systems designs except that corridors shall not be used as a supply, return, or exhaust air plenum in any type of occupancy.

4.11.7.1.9 Noise and Vibration Control. All noise control design work shall be in accordance with UFC 3-450-01 and ASHRAE requirements.

4.11.7.1.10 Ductwork Design. Ductwork shall be designed in accordance with ASHRAE recommendations and applicable SMACNA standards. Variable air volume systems shall have ducts sized by the Static Regain Method.

4.11.7.1.11 For Air Force projects, a "kJ" ("Btu") meter shall be provided at the point of entry for any new building or major building renovation that is to be served from a central chilled water plant. The meter shall be commercially available and sense chilled waterflow and temperature differential from which it shall automatically calculate and record Btu's.

4.11.7.1.12 Humid Areas. Reference UFC 3-410-01, for additional requirements for humid areas.

4.11.7.1.13 Filtration. For all air handling units serving occupied spaces, filter the combined supply air, including return and outside air, using a combination of 30 percent efficient prefilter(s) and 80 to 85 percent efficient final filter(s). Where practical, provide separate filtration or other means to clean the outdoor air, typically equivalent to that used for the combined air stream, prior to mixing it with the return air. Separate filtration for the outdoor air will reduce the contaminants in the outdoors from entering the primary air stream. Even in areas where the outdoor air is seemingly clean, low levels of auto emissions, pollen, dust, etc., can accumulate on the interior of ductwork and plenums and later cause inadequate air quality problems. Due to the decrease in system airflow as the pressure drop across the filter increases, size fans for the “dirty” filter condition. This will ensure that each fan has adequate capacity to deliver the design airflow as the filter becomes loaded.

4.11.7.2 Compressed Air. Unless requirements are stated in Specific Instructions, compressed air system and compressor sizes will be determined by the Designer from analysis of equipment layout and/or coordination with using service requirements.

4.11.7.3 Emergency Engine-Generator Units.

4.11.7.3.1 General. This feature must be coordinated with the electrical design element. A single set of specifications will be prepared to specify the unit and auxiliary equipment. The Mechanical Designer shall be responsible for plans and specifications covering the engine, fuel system, exhaust, and cooling system. The electrical designer will be responsible for the design and specification of the generator and other electrical appurtenances and controls. If a gasoline engine is used, the design shall conform to applicable NFPA codes; i.e., fueling systems, hazardous area classification, etc.

4.11.7.3.2 Ventilation for Emergency Engine-Generator Rooms. The ventilating air quantity shall be sufficient to hold the room temperature at approximately 48.9 degrees C (120 degrees F.) with a maximum of 51.67 degrees C (125 degrees F). The following heat dissipation rates will be used in calculating ventilation rate:

a. Heat given off by generator and exciter - 188 W/kW (8 Btu per minute per HP).

b. Heat given off by engine surfaces (either dry or water-cooled manifold) - 235 W/kW (10 Btu per minute per HP).

c. Heat given off by exhaust system - Initial surface temperatures of 415 C - 510 C (780 degrees F. to 950 degrees F.) for engines with water-cooled manifolds.

4.11.7.4 Natural Gas Distribution and Natural Gas Fittings. Natural Gas distribution system will extend from point of connection with existing main to a point 1.5 m (5 feet) from the building. Natural Gas fitting connects at the 1.5 m (5-foot) mark and covers all interior gas piping. The system will be designed such that there will be no exposed gas lines or meters in the front of the facility, and coordinated with the User.

4.11.7.5 Heating.

4.11.7.5.1 Outside Design Conditions. Unless stated otherwise in Specific Instructions, outside design conditions shall be as required by UFC 3-410-01.

4.11.7.5.2 Inside Design Conditions. Unless stated otherwise in Specific Instructions, inside design conditions shall be as required by UFC 3-410-01.

4.11.7.5.3 Energy Source Selection. Energy Source selection shall be based on criteria contained in Chapters A-5 and A-7 of this manual.

4.11.7.6 Hoists and Lifts.

4.11.7.6.1 Hoists. The mechanical designer shall determine lifting and travel speeds for motor operated hoists, trolleys, and cranes. The determinations shall be based on job requirements and will be in conformance with standard catalog products of at least three reputable manufacturers. Electrical requirements will be coordinated with electrical drawings. Monorail supports will be designed by the structural engineer and shown on structural drawings.

4.11.7.6.2 Lifts. Automotive lifts shall conform to the latest issue of ANSI/ALI ALCTV Standard for Automotive Lifts - Safety Requirements for the Construction, Testing, and Validation. The lift will be detailed on the drawings. Show on the drawings the necessary control dimensions such as lift center line and location of front of lift with respect to building wall. Also, show drainage piping which will connect pit drainage to building.

4.11.7.8 Ventilation for Equipment Rooms.

4.11.7.8.1 Refrigerant Compressor Rooms for Walk-in and Reach-in Refrigerators. Air-cooled condensing units with integral condensers will be provided with not less than 500 L/s of air per kW (800 CFM of air per horsepower) (nameplate rating). Water-cooled condensers and remote air-cooled condensers will be provided with not less than 50 L/s of air per kW (80 CFM of air per horsepower) (nameplate rating). Compressor rooms will be provided with outside air intake louvers and thermostatically controlled exhaust fans.

4.11.7.8.2 Mechanical equipment rooms will usually be ventilated using outside air intake louvers and a thermostatically controlled exhaust fan. Use a supply fan in lieu of an exhaust fan in rooms where atmospheric burners are located. The ventilation fan will have a two-speed motor, that is sized, at the high speed, to have adequate capacity to limit the room dry bulb temperature to a maximum of 6 degrees C (10 degrees F) above the outdoor dry bulb temperature when both equipment and ambient loads are at their maximum peaks. The high speed will be activated 6 degrees C (10 degrees F) below the maximum temperature at which the most sensitive item of equipment in the room can operate. The low speed will operate at 11 degrees C (20 degrees F) below that of the high speed.

4.11.7.8.3 Gas-fired Furnaces. The following NFPA 54 guidance will be used:

a. Provide combustion air as required by two permanent openings to the outside. Openings will communicate directly, or by duct, to the outside. One opening will be within 300 mm (12 inches) of the top of the Furnace Room and one opening will be within 300 mm (12 inches) of the bottom of the Furnace Room. Openings directly to the outside or ducted vertically to the outside will give a minimum free area of 11 mm^2 per 20 W (1 square inch per 4,000 BTUH) input rating for all equipment. Openings ducted horizontally to the outside will have a minimum free area of 11 mm^2 per 10 W (1 square inch per 2,000 BTUH) input rating.

b. All return air will be ducted to the furnace. The furnace room will not be used as a return.

4.11.7.9 Mechanical Equipment Spaces. Mechanical equipment (sized from three manufacturers), piping, and accessories in boiler and equipment rooms will be drawn to scale on the drawings in both plan and elevations. Adequate space will be provided for maintenance, operation, and replacement of equipment, piping, and accessories. Catwalks, ladders, platforms, access panels, and doors required for operation and maintenance of equipment, valves, and accessories will also be indicated and detailed on the drawings.

4.11.7.10 Plumbing.

4.11.7.10.1 Wall Hydrants and Lawn Faucets. The maximum spacing between wall hydrants or between lawn faucets around the perimeter of a building is 60 m (200 feet). Add 18 L/min (5 gpm) for each hydrant or faucet to building load for sizing water main. No diversity will be assumed.

4.11.7.10.2 Roof Drainage. Gutters and exterior downspouts will be sized by architectural design element, shown on the architectural drawings, and specified in architectural sections of the specifications. Roof drains and interior downspouts, including collection system, shall be sized by mechanical designer, shown on the mechanical drawings, and specified in the plumbing section of the mechanical specifications.

4.11.7.10.3 Wash Rack Drainage Facility. All wash racks shall be provided with suitable grease and sediment traps. The effluent from wash racks shall be provided with grit chambers and oil separators. The wash rack effluent will be discharged into storm drains or sanitary sewers as required by E.P.A. regulations.

4.11.7.10.4 Design for the Physically Handicapped. Appropriate modifications to plumbing fixtures, as required by Uniform Federal Accessibility Standard (UFAS), shall be included in all projects designated to be suitable for access by the physically handicapped.

4.11.7.10.5 Domestic Hot Water Temperature.

a. Domestic hot water supply maximum temperatures at the point of use will be as required in UFC 3-420-01 unless higher temperatures are required for sanitizing and special processes.

b. Design guidance in UFC 3-420-01 and ASHRAE shall be followed.

4.11.7.10.6 Connection of Potable Water Supply with Utility Systems Having Chemical Treatment Facilities. When a potable water supply is connected with a utility system such as heating hot water system, chilled water system, or cooling tower, which is equipped with chemical treatment facilities, a reduced pressure principle backflow prevention device shall be provided. The positive break should occur between the potable water supply and the utility system. The drain line from the backflow assembly shall be run to a floor drain. The backflow assembly shall not be installed over 1500 mm (5 feet) above the floor for maintenance access.

4.11.7.11 Refrigeration.

4.11.7.11.1 Coordinate walk-in cooler and refrigerated space requirements with architectural drawings.

4.11.7.11.2 Provide defrost and drainage facilities for units.

4.11.7.11.3 Provide ample ventilation for compressor rooms as hereinbefore specified in paragraph 4.11.7.8.1.

4.11.7.12 Chilled Water Distribution. The chilled water distribution system will extend from connection to existing exterior mains to a point approximately 600 mm (2 feet) inside the mechanical equipment room where both the supply and return lines shall terminate with shutoff valves. The building chilled water system will connect to the distribution system at this point. A valved bypass will be installed on the distribution side of the shutoff valves. The amount of distribution piping between the equipment room wall or floor and the shutoff valves will be held to a minimum but will be of sufficient length to allow installation of the bypass.

4.11.7.12.1 Air-Cooled Chillers. All air-cooled chillers shall comply with the following requirement: Unless the condenser coil is completely protected through inherent design,

louvered panel coil guards shall be provided by the manufacturer to prevent physical damage to the coil.

4.11.7.13 Heating Hot Water and Steam Distribution. The Heating Hot Water and Steam distribution systems will extend from connection to existing exterior mains to a point approximately 600 mm (2 feet) inside the mechanical equipment room where both the supply and return lines shall terminate with shutoff valves. The building systems will connect to the distribution system at this point. For heating hot water systems, a valved bypass will be installed on the distribution side of the shutoff valves. The amount of distribution piping between the equipment room wall or floor and the shutoff valves will be held to a minimum but will be of sufficient length to allow installation of the bypass. High Temperature Heating Hot Water and Steam distribution systems shall enter the mechanical equipment room in close proximity to an exterior door to allow easy access to the shutoff valves from the door.

4.11.7.14 Liquid Fuel Storage, Distribution, and Dispensing.

4.11.7.14.1 In accordance with Air Pollution Abatement (Environmental) Policy, the following requirements will apply:

a. Fuel tanks of 151,416 L (40,000 gallon) capacity or more for storing gasoline or other organic liquids with a vapor pressure of 10.34 kPa (1.5 psi) absolute or greater under actual storage conditions shall either be of nonvented construction, designed for maximum pressure expected, or else equipped with floating roof or a vapor recovery system.

b. Stationary gasoline storage tanks of 900 L (240 gallons) or more shall be equipped with either submerged filling inlets or with vapor recovery systems such that loss of vapor to the atmosphere during filling operations shall be minimized.

c. Gasoline or petroleum distillate tank car or truck loading facilities handling 75,708 L (20,000 gallons) per day or more shall be equipped with submersible filling arms or other vapor emission control systems.

4.11.7.14.2 Aviation fuel tanks of steel construction will be interior lined with an epoxy coating system conforming to US DOD QPL-4556-28, Coating Kit, Epoxy, for Interior of Steel Fuel Tanks, minimum thickness of two coats, 0.15 mm (6 mils). Interior metal surfaces will be sandblasted to bright metal prior to coating, in accordance with the requirements of "Steel Structure Painting Council Surface Preparation Specification," SSPC-SP 5/NACE No. 1. Work must be accomplished by experienced lining applicators.

4.11.7.15 Seismic Protection. All projects will include appropriate provision for protection of mechanical piping, equipment, and underground utilities against damage from seismic events in accordance with UFC requirements. Generally, these requirements can be satisfied by the inclusion of the appropriate Unified Facilities Guide Specification section(s), in the contract specifications.

4.11.7.16 Other Systems. Other systems are required for special projects such as medical and industrial type facilities. These will be designed in accordance with the Specific Instructions issued for each project of this type.

4.11.8 Boiler Permits.

4.11.8.1 Pursuant to satisfying requirements under the Clean Air Act, at or before the 60 percent design stage, the A-E shall submit to the installation's environmental office 1) a listing of boilers and domestic hot water heaters that will be fired by natural gas, propane, and/or fuel oil, 2) the fuel or fuels (primary and backup, if applicable) that will be utilized for each piece of equipment, 3) the quantity of each particular size, and 4) the respective input firing rate. The document shall also provide a point of contact and an alternate point of contact, should the environmental office require additional information from the designer of record during the permitting process. Furthermore, two copies of the document shall also be sent to the Savannah District, one to the Project Manager for placement in Central Files, and another to the Mechanical Section.

4.11.8.2 This document shall not be sent prematurely, since any increase in boiler sizing subsequent to submission of the document will require revision to the permitting process. In any event, if there is a change in equipment sizing during refinement of the design process, an updated copy of said document shall be submitted per the guidance above.

4.11.8.3 Additionally, the A-E is responsible for incorporating into the design the equipment accessories required for compliance with the governing environmental laws. This includes, but is not limited to, determining the need for individual metering and the level of emissions monitoring required. The A-E's concept design narrative shall specifically address those features that will be incorporated into the boiler system design to assure compliance with the applicable environmental laws of the state.

4.11.8.4 Normally, for fast track design-build contracts, the construction permit will not have been obtained prior to award of the design-build contract. No construction associated with the building(s) housing the boiler(s) or other source(s) of contaminant can be done prior to obtaining the required permit. Generally, only the following things can be done prior to possession of the permit: clearing and grading, access roads, driveways, parking lots, underground utilities up to the five foot line of the buildings, and ancillary structures (structures not associated with housing the sources of contaminants). A-E developed requests for proposals (RFPs) for fast track construction shall contain the language necessary to convey this fact to proposers.

4.11.9 Sustainable Design. The design shall comply with the energy and water savings requirements provided in Chapter A-14 of the Savannah District Design Manual for Military Construction, Sustainable Design.

4.11.10 Energy Policy Act of 2005 (Public Law 109-58). The A-E shall provide documentation of compliance with the Energy Policy Act of 2005, as part of their design submittals.

4.11.11 Energy Independence and Security Act of 2007. The A-E shall provide documentation of compliance with the EISA 2007, as part of their design submittals.

4.11.12 ASHRAE 189.1. The A-E shall provide documentation of compliance with the applicable portions of ASHRAE 189.1, as part of their design submittals.

*** End of Section ***