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NAVFAC PTS-D30 (June 2023)  
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Preparing Activity: NAVFAC SUPERSEDING PTS-D30 (September 2022)  
  
PERFORMANCE TECHNICAL SPECIFICATION  
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SECTION D30  
  
HVAC  
06/23

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NOTE: This section is intended to be used as a guide and contains requirements that are common to many different types of facilities; however, not all requirements and equipment items will be applicable to all projects. In addition, there may be special requirements for a particular project that are not addressed at all. The RFP preparer may have to incorporate additional information to address these special requirements in this PTS and corresponding Part 3 ESR. If the RFP preparer chooses to delete building elements that are not required for the project, do not change the remaining Uniformat paragraph designations (example - A102001). Uniformat designations are unique to the products they are assigned to. However, the subparagraph numerical extensions (example - 1.2 or a,b,c) of the Uniformat designations may change if subparagraphs are deleted.  
  
This guide specification is formatted utilizing Uniformat II, an industry recognized standard, ASTM E 1557. When the RFP preparer chooses to add a paragraph that does not apply to an existing building element already included in the specification, refer to the Uniformat/WBS located on the NAVFAC Design-Build Website for a listing of Uniformat II designations and definitions.  
  
NOTE: The RFP preparer may view or hide the criteria notes in this PTS section by modifying the WORD preferences for "Hidden text". To view the criteria notes, choose "File" then "Option". Click "Display" then check the "Hidden text" box under "Always show these formatting marks on the screen". In the same section, check the box for "Print hidden text" under "Printing options" to print the criteria notes.  
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**D30 GENERAL**

RFP Part 3 including the Engineering System Requirements (ESR) provide project specific requirements. The RFP Part 4, Performance Technical Specifications (PTS) provide generalized technical requirements that apply to multiple facility types and include more requirements than are applicable to any one project. Therefore, only the RFP Part 4 requirements that apply to the project and further define the RFP Part 3 project specific requirements are required.

**D30 1.1 NARRATIVE**

This section includes the construction of interior mechanical systems. This section covers installations inside the facility and out to the five foot line. See Section G30, *Site Civil/Mechanical Utilities*, for continuation of systems beyond the five-foot line.

**D30 1.2 MECHANICAL DESIGN GUIDANCE**

Provide the design and installation in accordance with the following references. This Performance Technical Specification (PTS) adds clarification to the fundamental requirements contained in the following Government Standards. The general requirements of this PTS section are located in PTS Section Z10, *General Performance Technical Specification*.

**D30 1.2.1 Government Standards**

Federal Energy Management Program (FEMP)

UNIFIED FACILITIES CRITERIA (UFC)

|  |  |
| --- | --- |
| UFC 1-200-01 | DoD Building Code (A reference in this PTS section to UFC 1-200-01 requires compliance with the Tri-Service Core UFCs that are listed therein, which includes the following significant UFC(s): UFC 3-401-01, Mechanical Engineering UFC 3-420-01, Plumbing Systems) |
| UFC 1-200-02 | High Performance and Sustainable Building Requirements |
| UFC 3-440-01 | Facility-Scale Renewable Energy Systems |

UNIFIED FACILITIES GUIDE SPECIFICATIONS (UFGS)

|  |  |
| --- | --- |
| UFGS 01 78 24.00 20 | Facility Data Workbook (FDW) |
| UFGS 23 05 93 | Testing, Adjusting, and Balancing for HVAC |
| UFGS 23 09 00 | Instrumentation and Control for HVAC |
| UFGS 23 09 23.02 | BACnet Direct Digital Control for HVAC and Other Building Control Systems |
| UFGS 23 09 13 | Instrumentation and Control Devices for HVAC |
| UFGS 23 81 23 | Computer Room Air Conditioning Units |

**D30 1.3 PERFORMANCE VERIFICATION AND ACCEPTANCE TESTING**

a. Verification of satisfactory HVAC system performance must be via Performance Verification Testing, as detailed in this section.

b. The Government reserves the right to witness all Acceptance Tests and Inspections, review data, and request other such additional inspections and repeat tests as necessary to ensure that the system and provided services conform to the stated requirements.

c. The Qualified Testing Organization must provide the Acceptance Tests and Inspections test plan and perform the acceptance tests and inspections. Perform and evaluate test methods, procedures, and test values in accordance with appropriate standards, and the manufacturer's recommendations. Place equipment in service only after completion of required tests and evaluation of the test results have been completed. Supply to the testing organization complete sets of shop drawings, settings of adjustable devices, and other information necessary for an accurate test and inspection of the system prior to the performance of any final testing. Perform acceptance tests and inspections on Computer Room Air Conditioning Units, Direct Digital Control System, and HVAC Testing/Adjusting/Balancing.

**D30 1.4 HVAC COMMISSIONING**

Commission the HVAC systems per the Commissioning Plan as required by Part 2 Section 01 91 00.15, *Building Commissioning*. HVAC system commissioning must coordinate with and incorporate the testing, reporting, training & O&M documentation requirements of UFGS 23 05 93, *Testing, Adjusting, and Balancing for HVAC;* UFGS 23 09 00, *Instrumentation and Control for HVAC*; UFGS 23 09 23.02, *BACnet Direct Digital Control for HVAC and Other Building Control System s*and UFGS 23 09 13, *Instrumentation and Control Devices for HVAC*.

**D30 1.5 DESIGN SUBMITTALS**

Submit design Submittals in accordance with Z10, *General Performance Technical Specifications*, Part 2 Section 01 33 10.05 20, *Design Submittal Procedures*, FC 1-300-09N, *Navy and Marine Corps Design Procedures*, and UFC 3-401-01, *Mechanical Engineering*.

In addition, UFGS sections listed below or in the body of the PTS text are to be used by the Designer of Record (DOR) as a part of the design submittal. If the UFGS products or systems are applicable to the project, the DOR must edit these referenced UFGS sections and submit them as a part of the design submittal specification. Edit the specification sections in accordance with the limitations stated in PTS section Z10, *General Performance Technical Specifications*.

UFGS 01 78 24.00 20, *Facility Data Workbook (FDW)*

UFGS 23 09 00, *Instrumentation and Control for HVAC*

UFGS 23 09 23.02, *BACnet Direct Digital Control for HVAC and Other Building Control Systems*

UFGS 23 09 13, *Instrumentation and Control Devices for HVAC*

UFGS 23 05 93, *Testing, Adjusting, and Balancing for HVAC*

UFGS 48 14 13.00 20, *Solar Liquid Flat Plate and Evacuated Tube Collectors*

**D30 1.6 CONSTRUCTION SUBMITTALS**

Submit construction submittals in accordance with PTS section Z10, *General Performance Technical Specifications*. In addition to the Z10 requirements, the Designer of Record (DOR) must approve the following construction submittals as a minimum:

Solar hot water heating system fixtures and equipment, and OMSI information for all equipment and fixtures.

**D30 1.7 MOTORS**

High efficiency single-phase fractional-horsepower alternating-current motors, corresponding to the applications listed in NEMA MG 11. Select polyphase motors based on high efficiency characteristics relative to the applications as listed in NEMA MG 10. Additionally, all polyphase squirrel-cage medium induction motors with continuous ratings must meet or exceed energy efficient ratings in accordance with Table 12-10 of NEMA MG 1. Provide controllers for 3-phase motors rated 1 hp (0.75 kW) and above with phase voltage monitors designed to protect motors from phase loss and over/under-voltage. Provide means to prevent automatic restart by a time adjustable restart relay. For packaged equipment, provide controllers including the required monitors and timed restart. Provide reduced voltage starters for all motors 25 hp and larger.

**D3010 ENERGY SUPPLY**

**D301002 GAS SUPPLY SYSTEM**

**D301002 1.1 NATURAL GAS PIPING**

Conform to requirements of the local natural gas utility and ASME B31.8, *Gas Transmission and Distribution Piping Systems*, for exterior piping. Conform to requirements of NFPA 54, *National Fuel Gas Code*, for interior gas piping. Provide meter and pressure regulator in accordance with the requirements of the local utility. Provide earthquake valve where required by code. Provide the complete natural gas system to the facility, including any applications and permits.

**D301002 1.2 MATERIALS AND EQUIPMENT**

**D301002 1.2.1 Aboveground Within Buildings**

Black steel meeting requirements of ASTM A 53/A 53M, Schedule 40, and associated ASME fittings threaded ends for sizes 2 inches (50 mm) and smaller; otherwise, plain end beveled for butt welding.

**D301002 1.3 PRESSURE TESTS**

Pressure test in accordance with NFPA 54 at 1.5 times maximum working pressure, but in no case less than 50 PSI (350 kPa).

**D301002 1.4 PROPANE PIPING**

If required, provide the same as specified for natural gas and comply with NFPA 58.

**D301002 1.4.1 Underground**

Polyethylene (PE) pipe conforming to ASTM D 2513 for 100 PSI (690 kPa) (gage) working pressure. Standard Dimension Ratio must be 11.5 maximum. Provide detectable aluminum plastic backed tape or detectable magnetic plastic tape manufactured specifically for warning and identification of direct buried piping. Tape must be detectable by an electronic detection instrument. Warning tape to be color coded with warning and identification of utility type imprinted in bold black letters continuously over the entire tape length. Warning and identification to read, "CAUTION, BURIED (utility type) LINE BELOW" or similar wording. Color to be yellow for gas lines. Polyethylene fittings must be ASTM D 2683 socket fittings or ASTM D 2513 molded butt-fusion fittings.

**D301002 1.5 PROPANE TANKS**

If not provided by the propane provider, the tank material and installation must comply with NFPA 58.

**D301005 SOLAR ENERGY SUPPLY SYSTEM**

Design and build each solar domestic hot water heating system meeting the requirements of UFC 3-440-01 *Facility-Scale Renewable Energy Systems*. Each system must be fully integrated with the building DDC controls system.

Provide complete solar domestic hot water system designed and built by a single contractor who specializes in solar heated water systems. System must be designed, built, and tested by this contractor who is responsible for the provided system to operate as proposed. This design-build contractor must be endorsed in writing, prior to system design, by the manufacturer of the solar plate collectors provided for this solicitation.

The solar domestic hot water system designer must work with the building designers to optimize the roof area, slope and orientation available for solar domestic hot water. Coordinate with other solar systems utilizing the roof area such as photovoltaic systems.

Provide solar liquid flat plate collector systems to comply with the requirements specified in UFGS Section 48 14 13.00 20, *Solar Liquid Flat Plate and Evacuated Tube Collectors.*

**D3020 HEAT GENERATING SYSTEMS**

**D302003 FUEL-FIRED UNIT HEATERS**

**D302003 1.1 GAS-FIRED UNIT HEATERS**

ANSI Z83.8 and AGA label. Equip each heater with individually adjustable package discharge louver. Provide with thermostat.

**D302003 1.2 INFRARED HEATERS**

ANSI Z83.8 and AGA label.

**D3030 COOLING GENERATING SYSTEMS**

If coatings are indicated in ESR Section D30, provide with copper tube/copper fin construction or immersion applied, baked phenolic or other approved coating that passes the 3000 hour salt spray resistance test using the ASTM B117 procedure. Field applied coatings are not acceptable.

**D303002 DIRECT EXPANSION SYSTEMS**

If coatings are indicated in ESR Section D30, provide with copper tube/copper fin construction or immersion applied, baked phenolic or other approved coating that passes the 3000 hour salt spray resistance test using the ASTM B117 procedure. Field applied coatings are not acceptable.

**D303002 1.1 HEAT PUMPS**

**D303002 1.1.1 Air to Air**

Air-cooled, split system heat pumps with ducted air distribution. Provide units factory assembled, designed, tested, and rated in accordance with AHRI 210/240 or AHRI 340/360. Equipment to be Energy Star Qualified, and heat pumps must include the Energy Star label affixed to the equipment. For small (less than 65,000 Btuh) air-cooled heat pumps, Energy Star requires a minimum 14 SEER, 11 EER, and 8.0 HSPF. For medium (65,000 to 135,000 Btuh) air-cooled heat pumps, Energy Star requires a minimum 11.3 EER, 11.4 IEER, and 3.35 COP. For large (136,000 to 240,000 Btuh) air-cooled heat pumps, Energy Star requires a minimum 10.9 EER, 11 IEER, and 3.35 COP. Provide manufacturer's minimum recommended clearance around condensing units. Size refrigerant piping in accordance with the manufacturer's recommendations. Insulate refrigerant piping suction lines and condensate drain.

**D303002 1.2 CONDENSING UNITS**

Air-cooled, split system air conditioner with ducted air distribution. Provide units factory assembled, designed, tested, and rated in accordance with AHRI 210/240 or AHRI 340/360. Condensing units with capacities greater than or equal to 135,000 Btuh to meet the minimum efficiency requirements specified by ASHRAE 90.1-2013 Table 6.8.1-1 "Electrically Operated Unitary Air Conditioners and Condensing Units". Provide manufacturer's minimum recommended clearance around condensing units. Size refrigerant piping in accordance with the manufacturer's recommendations.

**D303002 1.3 DUCTLESS SPLIT SYSTEM**

Air-cooled, ductless split system. Provide units factory assembled, designed, tested, and rated in accordance with ARI 210/240. Provide manufacturer's minimum recommended clearance around heat pump or condensing units. Size refrigerant piping in accordance with the manufacturer's recommendations. Insulate refrigerant piping suction lines and condensate drain.

**D303002 1.4.1 Light Commercial Air Conditioner, Three-Phase, Ductless Split Systems**

In order to meet Energy Star requirements, ductless split system air conditioners smaller than 65,000 Btuh require a minimum SEER of 14 and EER of 12; ductless split system air conditioners that have an electric resistance heating section (or no heating) and are sized from 65,000 Btuh up to 240,000 Btuh to have an EER of 11.7 and an IEER of 11.8; all other air conditioners sized from 65,000 Btuh up to 240,000 Btuh to have an EER of 11.5 and IEER of 11.6.

**D303002 1.4.2 Light Commercial Heat Pump, Three-Phase, Ductless Split Systems**

In order to meet Energy Star requirements, ductless split system heat pumps smaller than 65,000 Btuh require a minimum SEER of 14, EER of 11, and HSPF of 8.2; ductless split system heat pumps that have an electric resistance heating section (or none) and are sized from 65,000 Btuh up to 135,000 Btuh to have an EER of 11.3, an IEER of 11.4, and a COP of 3.35 (rated at 47 deg F); ductless split system heat pumps that have an electric resistance heating section (or none) and are sized from 135,000 Btuh up to 240,000 Btuh to have an EER of 10.9, an IEER of 11, and a COP of 3.25 (rated at 47 deg F).

**D303002 1.4 VARIABLE REFRIGERANT FLOW SYSTEMS**

Provide a complete system consisting of VRF heat pump units, branch circuit controllers, VRF fan coil units, and associated controls. Provide inverter driven heat pump units that utilize R410A refrigerant. In order to meet Energy Star requirements, heat pumps smaller than 65,000 Btuh require a minimum SEER of 14, EER of 11, and HSPF of 8.2; heat pumps that have an electric resistance heating section (or none) and are sized from 65,000 Btuh up to 135,000 Btuh to have an EER of 11.3, an IEER of 11.4, and a COP of 3.35 (rated at 47 deg F); heat pumps that have an electric resistance heating section (or none) and are sized from 135,000 Btuh up to 240,000 Btuh to have an EER of 10.9, an IEER of 11, and a COP of 3.25 (rated at 47 deg F). On the branch circuit controllers, include multiple branch connections allowing for simultaneous heating and cooling utilizing hot gas refrigerant or sub-cooled liquid. The total capacity of the branch controllers must be between 50 and 150 percent of the rated capacity.

Size and install refrigerant piping in strict compliance with the manufacturer's requirements. Refrigerant piping must be clean, dry, and leak free. Prior to installation all refrigerant pipes must remain sealed. During installation and prior to filling, use nitrogen to maintain cleanliness and prevent oxidation and scaling while brazing. Install each system to provide proper oil return. Refrigerant piping must be copper, ACR type, ASTM B280. All joints must be sil-brazed. All thicknesses of piping must remain the same throughout the system. Individually pressure test and commission each refrigerant circuit. Perform pressure testing using nitrogen at 1-1/2 times the system operating pressure. Design each system to meet Refrigerant Piping and Heat Transfer Components ASME B31.9, Building Services Piping Code and design to allow for expansion and contraction.

**D3040 DISTRIBUTION SYSTEMS**

**D304001 AIR DISTRIBUTION, HEATING & COOLING**

**D304001 1.1 DUCTWORK**

Except as specified herein, provide ductwork constructed, braced, reinforced, installed, supported, and sealed in accordance with SMACNA standards.

**D304001 1.1.1 Flexible Ducts**

Use insulated flexible duct only for connections to air distribution devices to adapt to minor offsets. Flexible duct must be UL 181 listed and in conformance with SMACNA 1966 duct construction standards with a minimum R value of 4. Limit flexible ductwork to maximum of 5 feet (1.5 meters) in length.

**D304001 1.1.2 Flexible Connections**

Provide flexible connectors between fans and ducts.

**D304001 1.1.3 Volume Dampers**

Provide manual volume dampers in each branch take-off from the main duct to control air quantity except for primary supply ductwork on VAV systems. Dampers must conform to SMACNA 1966 duct construction standards and must be seal class "A" construction.

**D304001 1.1.4 Fire Dampers**

Fire dampers must be rated in accordance with UL 555. Fire dampers must be dynamic type rated for closure against a moving airstream. Provide fire dampers that do not intrude into the air stream when in the open position.

**D304001 1.1.5 Smoke Dampers**

Smoke dampers must be rated in accordance with UL 555S.

**D304001 1.1.6 Sound Attenuators**

Fabricated attenuators that will reduce the rated sound pressure level of the fan down to at least 65 decibels in the 250 Hz (third octave band) center frequency by using a reference sound source calibrated in decibels of sound power at 10 to 12 watts. Maximum permissible pressure drop must not exceed 0.63 inch of water (157 Pa).

**D304001 1.2 LOUVERS & HOODS**

**D304001 1.2.1 Louvers**

Louvers must bear AMCA ratings seal for air performance and water penetration in accordance with AMCA 500L and AMCA 511. Louvers must be constructed of anodized aluminum alloy or stainless steel. Provide birdscreens.

**D304001 1.2.2 Hoods**

Hoods must be constructed of anodized aluminum alloy or stainless steel. Provide with birdscreens.

**D304001 1.3 GRILLES, REGISTERS, & DIFFUSERS**

Factory-finished grilles, registers, and diffusers. Exterior and exposed edges must be rolled, or otherwise stiffened and rounded.

**D304001 1.4 INSULATION**

Provide external thermal insulation for all ductwork. Insulate ductwork in concealed spaces with blanket flexible mineral fiber. Insulate ductwork in Mechanical Rooms and exposed locations with rigid mineral fiber insulation.

Provide insulation with factory applied all-purpose jacket with integral vapor retarder. In exposed locations, provide a jacket with white surface suitable for painting. Flame spread/smoke developed rating for all insulation must not exceed 25/50. Minimum insulation thickness must be the minimum thickness required by ASHRAE 90.1. Insulate the backs of all supply air diffusers with blanket flexible mineral fiber insulation.

**D304007 EXHAUST SYSTEMS**

**D304007 1.1 FANS**

AMCA 210 certified, with AMCA seal. Fan bearings must have a minimum average life of 200,000 hours at design operating conditions. Provide bird screens for outdoor inlets and outlets. Provide direct-drive type fans with means for verifying operation via the building DDC system or with speed controllers

**D304007 1.2 IN-LINE FANS**

UL-Listed centrifugal fans.

**D304007 1.3 WALL FANS**

Propeller fans with fan guards. Provide centrifugal fans with backdraft dampers and wall bracket.

**D304007 1.4 ROOFTOP FANS**

UL-Listed centrifugal fans with roof curb.

**D304007 1.5 UTILITY SETS**

AMCA 210 with AMCA seal.

**D304007 1.6 BATHROOM FANS**

UL 507 and UL-listed, Home Ventilating Institute (HVI) certified and with AMCA seal for ceiling installation.

**D304008 AIR HANDLING UNITS**

AMCA 210 certified fans with AMCA seal. Fan bearings must have a minimum average life of 200,000 hours at design operating conditions. Provide bird screens for outdoor inlets and outlets.

**D304090 OTHER DISTRIBUTION SYSTEMS**

**D304090 1.1 VARIABLE FREQUENCY DRIVES (VFD)**

Factory-assembled variable frequency drive control systems for variable speed control. Provide all air handling unit and pump VFD's from the same manufacturer. Each VFD must include motor starter, motor disconnects and controls as required for a complete system. Units must be UL-listed and comply with the National Electric Code.

Provide the following accessories:

Disconnect switch

Control circuit transformer, with primary and secondary fuses

Manual bypass

System hand-off-auto switch with provisions for remote start/stop of the system.

System initialized light

Run light

Failure alarm

LCD digital display with numeric keypad

Provide a control interface for remote monitoring of VFD functions and alarms from the DDC control system computer.

**D304090 1.2 CONDENSATE DRAIN PIPING**

ASTM B 88, Type M or L, hard drawn copper.

**D304090 1.3 CONDENSATE DRAIN INSULATION**

Insulate condensate drain piping with flexible cellular insulation.

**D304090 1.4 PIPING IDENTIFICATION**

Provide piping identification labels or Stencil names or code letters for piping systems in clearly visible letters and symbols. Provide arrow-shaped markings to indicate direction of flow.

**D304090 1.5 PIPE SLEEVES**

Provide pipe sleeves at each wall and floor penetration. The sleeve must be of a material suitable to protect the carrier pipe (two pipe sizes larger) and sealed with an appropriate flexible material. Provide fire stopping in fire rated walls in accordance with IBC.

**D304090 1.6 HEAT TAPE**

UL-Listed, self-regulating, heat tape on piping subject to freezing.

**D3050 TERMINAL & PACKAGE UNITS**

**D305002 UNIT HEATERS**

See D302003 for gas-fired unit heaters.

**D305005 ELECTRIC HEATING**

**D305005 1.1 UNIT HEATERS**

Factory assembled, UL-1025, unit heaters.

**D305005 1.2 BASEBOARD HEATERS**

Factory assembled, UL-1042, heaters.

**D305005 1.3 WALL HEATERS**

Factory assembled, UL-1025, cabinet heaters.

**D305005 1.4 INFRARED HEATERS**

Factory assembled, UL-Listed and labeled heaters.

**D305006 PACKAGE UNITS**

**D305006 1.1 ROOFTOP AIR HANDLERS**

Factory packaged units in accordance with AHRI 430 and suitable for outdoor installation. Provide with manufacturer's roof curb.

**D305006 1.2 DUCT HEATER**

Factory assembled, UL-listed heaters. Provide control cabinet and heating coil.

**D3060 CONTROLS AND INSTRUMENTATION**

**D306001 HVAC CONTROLS**

**D306001 1.1 DIRECT DIGITAL CONTROLS**

Provide one of the following as directed in ESR Section D30.

a. Provide Direct Digital Controls (DDC) to comply with the requirements specified in UFGS Sections 23 09 00, *Instrumentation and Control for HVAC*, 23 09 23.02, *BACnet Direct Digital Control for HVAC and Other Building Control Systems*, and 23 09 13, *Instrumentation and Control Devices for HVAC*.

b. Provide a partial direct digital control (DDC) system that will communicate with the existing DDC system. If using BACnet protocol, comply with the requirements specified in UFGS Sections 23 09 00, *Instrumentation and Control for HVAC*, 23 09 23.02, *BACnet Direct Digital Control for HVAC and Other Building Control Systems*, and 23 09 13, *Instrumentation and Control Devices for HVAC*. Notwithstanding any other provisions of this Contract, no other product will be acceptable other than that indicated in ESR Section D30. Provide a distributed control system. Integrate all new DDC points on the existing server providing a seamless logical flow from the existing facilities to the new integrated facility.

c. Provide and integrate Direct Digital Controls (DDC) in accordance with Part 3 Chapter 6 D306001 1.1 DIRECT DIGITAL CONTROLS in compliance with requirements specified in UFGS Sections 23 09 00, *Instrumentation and Control for HVAC*, 23 09 23.02, *BACnet Direct Digital Control for HVAC and Other Building Control Systems*, 23 09 13, *Instrumentation and Control Devices for HVAC*, and UFGS 25 10 10, *Utility Monitoring and Control System (UMCS) Front End and Integration*.

The Designer of Record must use UFGS Sections 23 09 00, 23 09 23.02, and 23 09 13 if using BACnet protocol, and submit the edited specification sections as a part of the project design submittal.

Design requirements must be in accordance with all specification notes and the BAS Owner must be identified and designated early in the design documentation.

System must include stand alone digital controllers, a communication network, and a workstation computer with control software. Provide stand-alone control routines that operate without connection to the network during a loss of communication. Provide trending, scheduling and alarm tables (may be included with the sequence of operation). Provide reset routines (based on outdoor air temperature or zone demand) for hot water loop temperature setpoints and supply air static pressure control. Use alarming and trending services during performance testing or commissioning. Alarm every sequence routine when out-of-limits or control/response failure occurs. Display all graphic floor plans, equipment graphics, DDC ladder diagrams, and sequence of operations graphic pages.

All 120-volt wiring must comply with NFPA 70. All 24-volt wiring must comply with the IMC and terminal device manufacturer’s recommendations.

Provide training on the installed system according to the maximum training days in UFGS 23 09 00, UFGS 23 09 23.02, and UFGS 23 09 13. Demonstrate all operator workstation functions requiring BACnet services, i.e., navigating through the graphic displays, trending, alarming and monitoring of the new controls system from the existing operator workstation using only the existing application software and without the need to launch other applications or logon to other vendor applications.

**D306001 1.2 ELECTRONIC CONTROLS**

If required, provide programmable thermostats with built in keypads for scheduling of day and night temperatures with two setback periods per day. Provide independent summer and winter programs. Thermostats must have temporary and manual override of schedule and battery backup.

**D3070 SYSTEMS TESTING AND BALANCING**

**D3070 1.1 HVAC SYSTEM**

Provide HVAC systems testing and balancing that complies with the requirements specified in UFGS Specification Section 23 05 93, *Testing, Adjusting, and Balancing for HVAC*. The Designer of Record must prepare UFGS Specification Section 23 05 93, as a part of the project specification and include the prepared specification section in the design submittal for the project.

**D307002 AIR SIDE TESTING & BALANCING â€“ HEATING, COOLING & EXHAUST**

Refer to paragraph D3070.

**D3090 OTHER HVAC SYSTEMS AND EQUIPMENT**

**D309001 GENERAL CONSTRUCTION ITEMS**

**D309001 1.1 SEISMIC DESIGN**

Provide in accordance with UFC 3-401-01, *Mechanical Engineering*.

-- End of Section --