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USACE / NAVFAC / AFCEA / NASA UFGS-23 82 23 (November 2008)  
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Preparing Activity: NASA Superseding  
UFGS-23 82 23 (August 2008)

## UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated April 2010

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#### SECTION 23 82 23

#### UNIT VENTILATORS

11/08

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### SECTION 23 82 23

#### UNIT VENTILATORS 11/08

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NOTE: This guide specification covers the requirements for unit heaters and ventilators.

Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable items(s) or insert appropriate information.

Remove information and requirements not required in respective project, whether or not brackets are present.

Comments and suggestions on this guide specification are welcome and should be directed to the technical proponent of the specification. A listing of technical proponents, including their organization designation and telephone number, is on the Internet.

Submit recommended changes to a UFGS as a Criteria Change Request (CCR).

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## PART 1 GENERAL

### 1.1 REFERENCES

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NOTE: This paragraph is used to list the publications cited in the text of the guide specification. The publications are referred to in the text by basic designation only and listed in this paragraph by organization, designation, date, and title.

Use the Reference Wizard's Check Reference feature when you add a RID outside of the Section's Reference Article to automatically place the reference in the Reference Article. Also use the Reference Wizard's Check Reference feature to update the issue dates.

References not used in the text are automatically  
deleted from this section of the project  
specification when you choose to reconcile  
references in the publish print process.

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The publications listed below form a part of this specification to the  
extent referenced. The publications are referred to within the text by the  
basic designation only.

ACOUSTICAL SOCIETY OF AMERICA (ASA)

- ASA S12.11/Part 1 (2003; R 2008) Acoustics-Measurement of  
Noise and Vibration of Small Air-Moving  
Devices, Part 1: Airborne Noise Emission
- ASA S12.11/Part 2 (2003; R 2008) Acoustics-Measurement of  
Noise and Vibration of Small Air-Moving  
Devices, Part 2: Structure-borne Vibration
- ASA S12.30 (1990; R 2002) Standard Guidelines for the  
Use of Sound Power Standards and for the  
Preparation of Noise Test Codes
- ASA S12.53/1 (1999; R 2004) Acoustics- Determination of  
Sound Power Levels of Noise Sources -  
Engineering Methods for Small, Movable  
Sources in Reverberant Fields - Part1:  
Comparison Method for Hard-Walled Test  
Rooms
- ASA S12.53/2 (1999; R 2004) Acoustics- Determination of  
Sound Power Levels of Noise Sources Using  
Sound Pressure - Engineering Methods for  
Small, Movable Sources in Reverberant  
Fields - Part2: Methods for Special  
Reverberation Test Rooms

ALUMINUM ASSOCIATION (AA)

- AA DAF-45 (2003) Designation System for Aluminum  
Finishes

ASTM INTERNATIONAL (ASTM)

- ASTM A 568/A 568M (2009a) Standard Specifications for Steel,  
Sheet, Carbon, and High-Strength,  
Low-Alloy, Hot-Rolled and Cold-Rolled,  
General Requirements for
- ASTM A 653/A 653M (2009a) Standard Specification for Steel  
Sheet, Zinc-Coated (Galvanized) or  
Zinc-Iron Alloy-Coated (Galvannealed) by  
the Hot-Dip Process
- ASTM F 1040 (1987; R 2007) Standard Specification for  
Filter Units, Air Conditioning, Viscous -  
Impingement and Dry Types, Replaceable

CANADIAN STANDARDS ASSOCIATION (CSA)

ANSI Z83.8/CSA 2.6 (2006; Addenda 1 2009) Gas Unit Heater and Gas-Fired Duct Furnaces

INTERNATIONAL CODE COUNCIL (ICC)

ICC IFGC (2009) International Fuel Gas Code

ICC IMC (2009) International Mechanical Code

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 1 (2007; Errata 2008) Standard for Motors and Generators

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 54 (2009) National Fuel Gas Code

NFPA 70 (2008; AMD 1 2008) National Electrical Code

NFPA 90A (2009; Errata 09-1) Standard for the Installation of Air Conditioning and Ventilating Systems

U.S. DEPARTMENT OF DEFENSE (DOD)

DOD-G-24508 (1998; Rev A; Am 4) Military Specification Grease, High Performance, Multipurpose (Metric)

1.2 SUBMITTALS

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NOTE: Review Submittal Description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list to reflect only the submittals required for the project. Keep submittals to the minimum required for adequate quality control.

A "G" following a submittal item indicates that the submittal requires Government approval. Some submittals are already marked with a "G". Only delete an existing "G" if the submittal item is not complex and can be reviewed through the Contractor's Quality Control system. Only add a "G" if the submittal is sufficiently important or complex in context of the project.

For submittals requiring Government approval on Army projects, use a code of up to three characters within the submittal tags following the "G" designation to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for

Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy, Air Force, and NASA projects.

Choose the first bracketed item for Navy, Air Force and NASA projects, or choose the second bracketed item for Army projects.

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Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are [for Contractor Quality Control approval.][for information only. When used, a designation following the "G" designation identifies the office that reviews the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

#### SD-01 Preconstruction Submittals

Submit [Material, Equipment, and Fixture List](#) in accordance with paragraph entitled, "General Requirements," of this section.

#### [Listing of Product Installations](#)

#### SD-02 Shop Drawings

Submit connection diagrams indicating the relations and connections of the following items. Indicate the general physical layout of all controls, and internal tubing and wiring details on the drawings.

[Heat Exchangers](#)  
[Burners](#)  
[Fans](#)  
[Motors](#)  
[Controls](#)  
[Vertical Discharge Units](#)  
[Horizontal Discharge Units](#)  
[Heating Element](#)  
[Propellers](#)  
[Fresh Air Intakes](#)

Submit [Control Diagrams](#) in accordance with paragraph entitled, "General Requirements," of this section.

Submit installation drawings for the following items in accordance with the paragraph entitled, "Installation," of this section.

Submit Record Drawings for the following items providing current factual information including deviations from, and amendments, to the drawings and concealed and visible changes in the work.

[Gas Unit Heaters](#)  
[Propeller Unit Heaters](#)  
[Cabinet Unit Heaters](#)  
[Unit Ventilators](#)

#### SD-03 Product Data

Submit Equipment and performance data for the following items

consisting of use life, system functional flows, safety features, and mechanical automated details. Submit curves indicating tested and certified equipment responses and performance characteristics.

Gas Unit Heaters  
Propeller Unit Heaters  
Cabinet Unit Heaters  
Unit Ventilators

Submit Manufacturer's catalog data for the following items:

Casing  
Heat Exchangers  
Burners  
Fans  
Motors  
Controls  
Vertical Discharge Units  
Horizontal Discharge Units  
Heating Element  
Propellers  
Filters  
Enclosures  
Wall Sleeve  
Fresh Air Intakes  
Insulation  
Spare Parts  
Vibration Isolation

#### SD-04 Samples

Submit Manufacturer's standard color chart for the following items showing manufacturer's standard color selections and finishes.

Gas Unit Heaters  
Propeller Unit Heaters  
Cabinet Unit Heaters  
Unit Ventilators

#### SD-07 Certificates

Submit [Records of Existing Conditions](#) in accordance with paragraph entitled, "General Requirements," of this section.

Submit [Listing of Product Installations](#) in accordance with paragraph entitled, "Installation," of this section.

Submit Certificates for following items showing conformance with the referenced standards contained in this section.

Heat Exchangers  
Burners  
Fans  
Motors  
Controls  
Vertical Discharge Units  
Horizontal Discharge Units  
Heating Element  
Propellers

Fresh Air Intakes

SD-10 Operation and Maintenance Data

Submit [6] [\_\_\_\_\_] copies of the Operation and Maintenance Manuals  
30 calendar days prior to testing the following systems:

Gas Unit Heaters  
Propeller Unit Heaters  
Cabinet Unit Heaters  
Unit Ventilators

Update and resubmit data for final approval no later than 30  
calendar days prior to contract completion.

1.3 MECHANICAL PROVISIONS

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NOTE: If Section 23 00 00 AIR SUPPLY, DISTRIBUTION,  
VENTILATION, AND EXHAUST SYSTEMS is not included in  
the project specification, insert applicable  
requirements therefrom and delete the following  
paragraph. If Section 23 05 48 VIBRATION AND  
SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT is  
not included in the project specification, insert  
applicable requirements therefrom and delete the  
second paragraph.

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[Section 23 00 00 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST  
SYSTEMS applies to work specified in this section.]

Submit vibration isolation components

1.4 GENERAL REQUIREMENTS

Provide Control Diagrams that show physical and functional relationships of  
equipment. Provide electrical diagrams that show size, type, and capacity  
of the systems. Submit pneumatic diagrams for air and gas systems.

Provide Material, Equipment, and Fixture List that includes manufacturer's  
style or catalog numbers, specification and drawing reference numbers,  
warranty information, and fabrication site information.

Submit Records of Existing Conditions consisting of the results of survey  
of work area conditions and features of existing structures and facilities  
within and adjacent to the jobsite. Commencement of work constitutes  
acceptance of existing conditions.

Provide Listing of Product Installations that includes identification of at  
least 5 installed units, similar to those proposed for work, that have been  
in successful service for a minimum period of 5 years. Provide list that  
includes purchaser, address of installation, service organization, and date  
of installation.

PART 2 PRODUCTS

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NOTE: When possible the use of sealed bearings is



encouraged. One of the major causes of bearing failures is overlubrication and lubrication contamination. Using sealed bearings helps to eliminate this failure mode.

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NOTE: Provide fan and motor balance that conforms to ISO Std. 1940/1 - (1986) Balance Quality Requirements of Rigid Rotors - Determination of Permissible Residual Unbalance unless otherwise noted. Provide motor vibration levels that conform to NEMA Specification MG-1, Motors and Generators, Part 7 unless otherwise noted.

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## 2.1 MANUFACTURED UNITS

Submit [Spare parts](#) list and information meeting referenced standards within this section.

### 2.1.1 [Gas Unit Heaters](#) (GUH)

Provide drawings or schedule that include capacity, gas data and mounting height.

#### 2.1.1.1 Type

Provide suspended type unit heaters, arranged for discharge of air as indicated. Provide unit that complies with [ANSI Z83.8/CSA 2.6](#) and [NEMA MG 1](#).

#### 2.1.1.2 [Casing](#)

Provide casing that is manufactured of not less than [1.0 millimeter 20-gage](#) steel. Provide casing with a phosphate pretreatment, primer, and baked enamel finish inside and outside. Provide horizontal [adjustable] [non-adjustable] louvers, completely recessed inside the casing frame.

[Provide [Four-way] [\_\_\_\_] deflection vanes.]

#### 2.1.1.3 [Heat Exchangers](#)

Provide welded construction, heavy aluminized steel heat exchangers. Provide exchangers that are formed in a clam-shell design to completely surround the burner. Provide individual combustion chambers for each burner.

#### 2.1.1.4 [Burners](#)

Provide die-formed, aluminum-painted, heavy mild steel burners with long slot ports for even supply of gas. Provide unitized construction burner assembly with integral crossover for positive burner ignition. Provide a draft diverter as an integral part of each heat exchanger section to allow backdrafts to bypass burner assembly without affecting normal operation.

#### 2.1.1.5 [Fans](#)

Provide propeller type fans, designed and manufactured for unit heater application. Provide fans with a minimum of three aluminum blades.

#### 2.1.1.6 Motors

Provide motors that are totally enclosed, with built-in overload protection. Mount motors to back panel by a fan guard motor mount constructed of spring steel wire.

#### 2.1.1.7 Controls

Provide controls that include high limit switch, fan controls [including fan timer, lockout timer [\_\_\_\_]], a 24-volt automatic gas valve with 100 percent safety pilot shutoff, a pressure regulator with leak limiting device, and manual main and pilot valves. Provide an integral junction box for all power and control connections.

[Provide a low voltage transformer.] [Provide a spark ignition controller.]

#### 2.1.2 Propeller Unit Heaters-Hot Water and Steam (PUH)

Provide drawings or schedule that include capacity, heating media data and mounting height.

\*\*\*\*\*  
NOTE: This specification is applicable to both hot  
water and steam heating medium.  
\*\*\*\*\*

##### 2.1.2.1 Type

[Provide suspended type unit heaters, arranged for discharge of air as indicated.]

##### 2.1.2.2 Vertical Discharge Units

[Provide vertical discharge units that operate at speeds not in excess of 1,200 revolutions per minute (rpm), except that units with 14.6 kilowatt 50,000 British thermal units per hour output and less operate at speeds up to 1,800 rpm. Cover discharge opening with a fan guard.]

\*\*\*\*\*  
NOTE: When one of the following paragraphs is  
selected, the mounting height is affected.  
\*\*\*\*\*

[Provide louver cone diffusers.] [Provide adjustable vane diffuser.]

##### 2.1.2.3 Horizontal Discharge Units

[Provide maximum volume in cubic meter per second (cms) feet per minute (cfm) and face velocity in meter second (m/s) feet per minute (fpm) for horizontal discharge units as follows:

<u>Volume</u> <u>(cms)</u>	<u>Velocity</u> <u>(m/s)</u>
Up to 0.47	4.1
0.48 to 1.42	4.6

<u>Volume (cms)</u>	<u>Velocity (m/s)</u>
1.43 and over	5.1]
<u>Volume (cfm)</u>	<u>Velocity (fpm)</u>
Up to 1,000	800
1,001 to 3,000	900
3,001 and over	1,000

[Provide adjustable double deflection louvers.]

#### 2.1.2.4 Heating Element

Provide manufacturer's standard construction heating elements, rated for [standard] [low output temperature] service of not less than 149 degrees C at 517 kilopascal 300 degrees F at 75 pounds per square inch (psi).

#### 2.1.2.5 Casings

Provide casings with smoothly contoured propeller orifice rings constructed of 1.0 millimeter 20-gage or thicker cold-rolled carbon steel. Provide casing surface finish that includes phosphate pretreatment, prime coating, and baked enamel finish.

#### 2.1.2.6 Propellers and Motors

Provide propellers that have not less than four aluminum blades and are dynamically balanced.

[Provide horizontal-discharge units with fan inlet safety guard.]

[Mount motors on elastomer vibration isolators.]

#### 2.1.2.7 Sound Rating

\*\*\*\*\*  
**NOTE: Select the title and the following paragraph  
only if supplemented on the drawings or herein by a  
sound rating in decibels.**  
\*\*\*\*\*

[Test and sound rate unit heater in accordance with ASA S12.11/Part 1, ASA S12.11/Part 2, ASA S12.30, and ASA S12.53/1 and ASA S12.53/2.]

#### 2.1.2.8 Control

[Control unit heaters [by line-voltage thermostats] [\_\_\_\_\_].]

#### 2.1.3 Cabinet Unit Heaters (CUH)

Provide drawings or schedule that include capacity, power rating, heating media, filter, pressure drop, size, and other pertinent data.

\*\*\*\*\*  
NOTE: This specification is applicable to both hot  
water and steam heating medium.  
\*\*\*\*\*

#### 2.1.3.1 Type

Provide quiet-operating type cabinet unit heaters, complete with heating elements, fans and drives, filters, baffles and division walls, control provisions, and enclosures with access panels.

Provide cabinets that do not exceed drawing dimensions.

Rate unit pressure components for service at not less than 1050 kilopascal 150 psi at system working temperature.

#### 2.1.3.2 Heating Element

Provide [manufacturer's standard aluminum fin] [serpentine copper-type tube] heating element that is drainable and ventable.

Provide heating element with constant and permanent cataloged capacity.

Provide seamless deoxidized copper tube material.

Provide fins that are mechanically connected to the tubes. Regard loose fins at operating temperatures as causing a reduction in capacity, requiring replacement of all such material at no additional cost to the Government. Elements with bent or damaged fins are not acceptable.

Make expansion provisions and supports such that element movement is strainfree and noiseless.

[Make face area of the coil not less than that specified on the drawings.]

#### 2.1.3.3 Fan and Drive Assembly

[Provide centrifugal, forward-curved, double-width, double-inlet type fan, that has been statically and dynamically balanced at the factory.]

[Provide direct fan drives.]

[Provide direct fan drives, except where belt drives are indicated. Provide belt-drive motors that are fitted with adjustable rails and an adjustable sheave to permit 20 percent adjustment to fan speed. Elastomer mount independent fan shafts in self-aligning [antifriction] [sleeve-type] bearings, with essentially lifetime lubrication.]

[Provide [two] [three] [four]-speed drives. Provide switch positions that include an off position.]

[Provide rotating elements that are statically and dynamically balanced. Vibration isolate the fan and drive assembly.] Refer to Section 23 05 48 VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT for vibration isolation considerations.

The maximum allowable direct-drive motor rotational speed is 1,200 rpm.

#### 2.1.3.4 Filters

Provide 25 millimeter 1-inch minimum thickness, replaceable, throwaway type filters conforming to ASTM F 1040.

Install filters in a bypass-proof frame to ensure filtering of all moving air before entry into heating element. Ensure filters are removable without tools.

#### 2.1.3.5 Enclosures

\*\*\*\*\*  
NOTE: Architectural and mechanical details not covered herein must be shown on the drawings or the following must be supplemented.  
\*\*\*\*\*

[Provide enclosure configuration that does not deviate from drawing specifications.]

[Provide enclosure construction consisting of a minimum 1.6 millimeter 16-gage, cold-rolled carbon steel of stretcher-leveled quality conforming to ASTM A 568/A 568M. Provide construction that has smooth, blemish-free surfaces, without sharp edges, and with flush joints. Wrinkled-metal and notched-corner construction is not acceptable. Provide enclosure that has space for all riser pipes and controls. Provide access doors that have tamperproof latches. Hinge doors and panels to protect surface finishes and personnel.]

[Provide enclosure surface finish that includes manufacturer's standard phosphate pretreatment, prime coat, and baked enamel finish in color selected by the Contracting Officer.]

#### 2.1.3.6 Insulation

[Insulate backs of recessed units with not less than 13 millimeter 1/2 inch of 48 kilogram per cubic meter 3-pound per cubic foot density fibrous-glass insulation conforming to NFPA 90A.]

#### 2.1.3.7 Control Cycle

[Sequence operation [as per manufacturer's recommendations] [\_\_\_\_].]

[Provide control components that conform to requirements specified under Section 23 09 33.00 40 ELECTRIC AND ELECTRONIC CONTROL SYSTEM FOR HVAC.]

#### 2.1.4 Unit Ventilators (UV)

Provide drawings or schedule that include capacity, power rating, heating duty and method, and other pertinent data.

\*\*\*\*\*  
NOTE: This specification is applicable to both hot water and steam heating equipment.

Where large numbers of units are required, a standard size cabinet is allowed.

Where only one or two units are involved, deletion

of polarized plug-in module requirement is allowed.

\*\*\*\*\*

#### 2.1.4.1 Type

[Provide quiet-operating modular type unit ventilators, complete with heating elements, fans and drives, filters, baffles and division walls, dampers, control provisions, and enclosures with access panels.]

[Provide unit pressure components that are rated for service at not less than 1050 kilopascal 150 psi at system working temperature.]

[Provide intercomponent wiring that conforms to NFPA 70. Provide components of unit assembly that are UL listed and approved.]

[Provide heating, fan, and control modules that have polarized, color-coded, plug-in connections.]

#### 2.1.4.2 Heating Element

[Provide [the manufacturer's standard aluminum fin,] [serpentine copper-tube type,] drainable and ventable heating element.]

[Provide heating element with constant and permanent cataloged capacity.]

[Provide seamless deoxidized copper tube material.]

[Mechanically connect fins to the tubes. Regard loose fins at operating temperatures as causing a reduction in capacity, and replace all such material at no additional cost to the Government. Elements with bent or damaged fins are not acceptable.]

[Provide expansion provisions and supports that have stainfree and noiseless element movement.]

[Provide coil with face area that is not less than specified drawing dimensions.]

#### 2.1.4.3 Fan and Drive Assembly

Provide centrifugal, forward-curved, double-width, double-inlet type fan, and that is statically and dynamically balanced.

\*\*\*\*\*

**NOTE: Select, rewrite, or delete the following paragraph only after checking direct drive units.**

\*\*\*\*\*

[Provide belt driven fans, mounted on a common shaft. Support shaft by independent, elastomer-mounted, self-aligning, antifriction or sleeve-type bearings with lifetime lubrication. Provide adjustable motor sheave with not less than 20 percent speed variation either way from capacity point. Provide adjustable belt tension.]

[Provide motor that is manually controlled by two-position on/off switch.]

\*\*\*\*\*

**NOTE: Select the following paragraph for direct drive units in lieu of preceding paragraph.**

\*\*\*\*\*

[Provide motor that is manually controlled by [three] [four]-position switch.]

\*\*\*\*\*

**NOTE: For very small units, only shaded-pole-type motors are available from some manufacturers.**

\*\*\*\*\*

Provide elastomer vibration-isolation mounted, permanent split-capacitor type motors with adjustable rail mounting.

#### 2.1.4.4 Filters

Provide 25 millimeter 1-inch minimum thickness, replaceable, throwaway type filters conforming to ASTM F 1040.

Install filters in a bypass-proof frame to ensure filtering of all moving air before entry into heating element. Ensure filters are removable without tools.

#### 2.1.4.5 Dampers

Provide opposed-blade type dampers constructed to resist salt air. Provide galvanized steel blades with [mechanically attached] [secure sealing provisions] not dependent upon adhesives. Provide high-grade commercial quality flanged-type bearings with extended race and corrosion-resistant steel balls and [plated races] [heat-treated carbon steel] construction with factory-applied grease conforming to DOD-G-24508, suitable for salt air exposure. Provide sleeve-type oil-impregnated bronze bearings.

[Provide face and bypass damper with external bypass duct if required by unit.]

[Provide mixing dampers as an assembly within a mixing box. Provide dampers that are capable of varying the mixed air in any proportion from 100 percent room air to 100 percent outside air.]

#### 2.1.4.6 Enclosures

\*\*\*\*\*

**NOTE: Architectural and mechanical details not covered herein must be shown on the drawings or the following must be supplemented.**

\*\*\*\*\*

[Provide enclosure configuration per manufacturer's recommendations.]

[Provide enclosure that is not less than 1.6 millimeter 16-gage cold-rolled carbon steel of stretcher-leveled quality conforming to ASTM A 568/A 568M. Provide smooth construction with blemish-free surfaces, without sharp edges, and with flush joints. Form and brace enclosure to ensure plane surfaces with no oilcan effect. Wrinkled metal and notched corner construction is not acceptable. Provide pencilproof venetian type louvers. Provide louvers that are constructed of metal and, in their normal position, sustain a distributed load of 890 newton 200 pounds, maximum. Provide enclosure that has space for all riser pipes and controls. Provide access doors that have tamperproof latches.]

[Specially protect enclosure internal surfaces, exposed to condensation and to salt airstream, with [heavy coatings] [noncorroding materials]. Flash chrome- and cadmium-plating is not acceptable.]

[Provide enclosure surface finish that includes manufacturer's standard phosphate pretreatment, prime coat, and baked enamel finish. Provide the color selected by the Contracting Officer.]

#### 2.1.4.7 Wall Sleeve

Provide wall sleeve that is constructed of not less than 1.3 millimeter 18-gage galvanized carbon steel, with commercial zinc weight conforming to ASTM A 653/A 653M. Provide finish that consists of manufacturer's standard galvanized surface preparation and not less than [two finish coats of baked enamel] [one finish coat of high-build epoxy]. Provide color selected by the Contracting Officer.

#### 2.1.4.8 Thermal and Acoustic Insulation

Provide insulation to prevent heat loss, heat gain, condensation, and to provide acoustic treatment of surfaces.

#### 2.1.4.9 Control Cycle

\*\*\*\*\*  
NOTE: Select or delete the title and the following  
two paragraphs or rewrite and supplement by  
including the control cycle for this equipment to  
suit the project conditions.  
\*\*\*\*\*

[Sequence operation per manufacturer's recommendation's.]

[Provide control components that conform to requirements specified under Section 23 09 33.00 40 ELECTRIC AND ELECTRONIC CONTROL SYSTEM FOR HVAC.]

#### 2.1.4.10 Fresh Air Intakes

Provide extruded-aluminum intake louvers with 1.6 millimeter 16-gage, 13 by 13 millimeter 1/2-by 1/2-inch mesh aluminum wire birdscreens for all fresh air intakes. Provide extruded aluminum that is subjected to caustic etch and 0.5 micrometer anodize treatment in accordance with AA DAF-45. Protect aluminum from dissimilar metals and causticity of concrete or mortar by elastomeric seals. Provide intake that is particularly suited to indicated building-construction penetration.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

##### 3.1.1 Equipment

Install equipment in accordance with manufacturer's recommendations.

##### 3.1.2 Gas Piping

Install gas piping in compliance with ICC IFGC, NFPA 54 and Section 23 11 25 FACILITY GAS PIPING and Section 33 51 15 NATURAL-GAS / LIQUID PETROLEUM



DISTRIBUTION.

#### 3.1.3 Combustion Air

Provide Combustion Air in compliance with ICC IMC.

#### 3.1.4 Location

Install heaters in compliance with clearance and mounting height requirements of ICC IFGC and NFPA 70.

#### 3.1.5 Venting

Provide heaters that are vented in compliance with NFPA 54, ICC IMC and ICC IFGC.

### 3.2 FIELD QUALITY CONTROL

Conduct operational tests per manufacturer's instructions.

-- End of Section --