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Preparing Activity: NASA Superseding
UFGS-23 82 23 (February 2011)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated January 2017

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DIVISION 23 - HEATING, VENTILATING, AND AIR CONDITIONING (HVAC)

SECTION 23 82 23.00 40

UNIT VENTILATORS

05/14

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SECTION 23 82 23.00 40

UNIT VENTILATORS 05/14

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

Adhere to UFC 1-300-02 Unified Facilities Guide Specifications (UFGS) Format Standard when editing this guide specification or preparing new project specification sections. 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, suggestions and recommended changes for this guide specification are welcome and should be submitted as a Criteria Change Request (CCR).

PART 1 GENERAL

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 48.00 40 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.

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

]1.1 REFERENCES

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 Reference Identifier (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.

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	(2013) Acoustics-Measurement of Noise and Vibration of Small Air-Moving Devices, Part 1: Airborne Noise Emission
ASA S12.11/Part 2	(2013) 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	(2011; R 2016) 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 2015) 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 DAF45	(2003; Reaffirmed 2009) Designation System for Aluminum Finishes
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AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z83.8/CSA 2.6 (2016) American National Standard/CSA
Standard for Gas Unit Heater, Gas Packaged
Heaters, Gas Utility Heaters and Gas-Fired
Duct Furnaces

ASTM INTERNATIONAL (ASTM)

ASTM A568/A568M (2014) Standard Specifications for Steel,
Sheet, Carbon, Structural, and
High-Strength, Low-Alloy, Hot-Rolled and
Cold-Rolled, General Requirements for

ASTM A653/A653M (2015; E 2016) Standard Specification for
Steel Sheet, Zinc-Coated (Galvanized) or
Zinc-Iron Alloy-Coated (Galvannealed) by
the Hot-Dip Process

ASTM F1040 (1987; R 2007) Standard Specification for
Filter Units, Air Conditioning, Viscous -
Impingement and Dry Types, Replaceable

INTERNATIONAL CODE COUNCIL (ICC)

ICC IFGC (2015) International Fuel Gas Code

ICC IMC (2015) International Mechanical Code

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 1 (2016) Motors and Generators

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 54 (2015) National Fuel Gas Code

NFPA 70 (2017) National Electrical Code

NFPA 90A (2015) Standard for the Installation of
Air Conditioning and Ventilating Systems

U.S. DEPARTMENT OF DEFENSE (DOD)

DOD-G-24508 (1977; Rev A; Am 4 1998) Grease, High
Performance, Multipurpose (Metric)

1.2 SUBMITTALS

**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.**

**The Guide Specification technical editors have
designated those items that require Government
approval, due to their complexity or criticality,
with a "G." Generally, other submittal items can be**

reviewed by the Contractor's Quality Control System. Only add a "G" to an item, 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.

Use the "S" Classification only in SD-11 Closeout Submittals. An "S" following a submittal item indicates that the submittal is required for the Sustainability Notebook to fulfill federally mandated sustainable requirements in accordance with Section 01 33 29 SUSTAINABILITY REPORTING.

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

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.] Submittals with an "S" are for inclusion in the Sustainability Notebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Material, Equipment, and Fixture List[; G[, [____]]]

Listing of Product Installations[; G[, [____]]]

SD-02 Shop Drawings

Heat Exchangers[; G[, [____]]]

Burners[; G[, [____]]]

Fans[; G[, [____]]]

Motors[; G[, [____]]]

Controls[; G[, [____]]]

Vertical Discharge Units[; G[, [____]]]

Horizontal Discharge Units[; G[, [____]]]
 Heating Element[; G[, [____]]]
 Propellers[; G[, [____]]]
 Fresh Air Intakes[; G[, [____]]]
 Gas Unit Heaters[; G[, [____]]]
 Propeller Unit Heaters[; G[, [____]]]
 Cabinet Unit Heaters[; G[, [____]]]
 Unit Ventilators[; G[, [____]]]
 SD-03 Product Data[; G[, [____]]]
 Gas Unit Heaters[; G[, [____]]]
 Propeller Unit Heaters[; G[, [____]]]
 Cabinet Unit Heaters[; G[, [____]]]
 Unit Ventilators[; G[, [____]]]
 Casing[; G[, [____]]]
 Heat Exchangers[; G[, [____]]]
 Burners[; G[, [____]]]
 Fans[; G[, [____]]]
 Motors[; G[, [____]]]
 Controls[; G[, [____]]]
 Vertical Discharge Units[; G[, [____]]]
 Horizontal Discharge Units[; G[, [____]]]
 Heating Element[; G[, [____]]]
 Propellers[; G[, [____]]]
 Filters[; G[, [____]]]
 Enclosures[; G[, [____]]]
 Wall Sleeve[; G[, [____]]]
 Fresh Air Intakes[; G[, [____]]]
 Insulation[; G[, [____]]]
 Spare Parts[; G[, [____]]]
 Vibration Isolation[; G[, [____]]]

SD-04 Samples

Color Chart[; G[, [____]]]

SD-05 Design Data

Connection Diagrams[; G[, [____]]]

Control Diagrams[; G[, [____]]]

SD-07 Certificates

Records of Existing Conditions[; G[, [____]]]

Listing of Product Installations[; G[, [____]]]

Heat Exchangers[; G[, [____]]]

Burners[; G[, [____]]]

Fans[; G[, [____]]]

Motors[; G[, [____]]]

Controls[; G[, [____]]]

Vertical Discharge Units[; G[, [____]]]

Horizontal Discharge Units[; G[, [____]]]

Heating Element[; G[, [____]]]

Propellers[; G[, [____]]]

Fresh Air Intakes[; G[, [____]]]

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals[; G[, [____]]]

SD-11 Closeout Submittals

Record Drawings[; G[, [____]]]

1.3 QUALITY ASSURANCE

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

NOTE: When possible the use of sealed bearings is encouraged. One of the major causes of bearing failures is over lubrication and lubrication contamination. Using sealed bearings helps to eliminate this failure mode.

NOTE: Provide fan and motor balance that conforms to ISO Std. 1940/1 - (2003) Balance Quality Requirements for Rotors in a Constant(Rigid) State. Provide motor vibration levels that conform to NEMA Specification MG-1, Motors and Generators, Part 7 unless otherwise noted.

2.1 SYSTEM DESIGN

Submit product data for vibration isolation components.

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.

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

Submit equipment and performance data for [Gas Unit Heaters][Propeller Unit Heaters][Cabinet Unit Heaters][Unit Ventilators] consisting of use life, system functional flows, safety features, and mechanical automated details. Submit curves indicating tested and certified equipment responses and performance characteristics.

2.2 MANUFACTURED UNITS

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 manufacturer's standard color chart for [Gas Unit Heaters][Propeller Unit Heaters][Cabinet Unit Heaters][Unit Ventilators] showing manufacturer's standard color selections and finishes.

Submit spare parts list and information meeting referenced standards within this section.

2.2.1 Gas Unit Heaters (GUH)

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

2.2.1.1 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.

2.2.1.2 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.

]2.2.1.3 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.

2.2.1.4 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.

2.2.1.5 Fans

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

2.2.1.6 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.

2.2.1.7 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.]

2.2.2 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.**

[2.2.2.1 Type

Provide suspended type unit heaters, arranged for discharge of air as

indicated.

]2.2.2.2 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.]

]2.2.2.3 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:

Volume (cms)	Velocity (cms)
Up to 0.47	4.1
0.48 to 1.42	4.6
1.43 and over	5.1

Volume (cfm)	Velocity (fpm)
Up to 1,000	800
1,001 to 3,000	900
3,001 and over	1,000

Provide adjustable double deflection louvers.

]2.2.2.4 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).

2.2.2.5 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.

2.2.2.6 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.

][2.2.2.7 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.

][2.2.2.8 Control

Control unit heaters [by line-voltage thermostats] [_____].

]2.2.3 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.**

2.2.3.1 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.

2.2.3.2 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.

2.2.3.3 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 48.00 40 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.

2.2.3.4 Filters

Provide 25 millimeter 1-inch minimum thickness, replaceable, throwaway type filters conforming to ASTM F1040.

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.

2.2.3.5 Enclosures

NOTE: Show architectural and mechanical details not covered herein on the drawings or supplement the following.

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

][Provide enclosure construction consisting of a minimum 16-gage, cold-rolled carbon steel of stretcher-leveled quality conforming to ASTM A568/A568M. 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.

]2.2.3.6 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.

]2.2.3.7 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.

]2.2.4 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.

2.2.4.1 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.

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

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

]2.2.4.2 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 stain free and noiseless element movement.

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

2.2.4.3 Fan and Drive Assembly

Provide a centrifugal, forward-curved, double-width, double-inlet type fan. Ensure fan 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.

2.2.4.4 Filters

Provide 25 millimeter 1-inch minimum thickness, replaceable, throwaway type filters conforming to ASTM F1040.

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.

2.2.4.5 Dampers

Provide opposed-blade type dampers constructed to resist salt air. Provide galvanized steel blades, [mechanically attached] [with secure sealing provisions] and 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.

]2.2.4.6 Enclosures

NOTE: Show architectural and mechanical details not covered herein on the drawings or supplement the following.

[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 A568/A568M. 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] [non-corroding 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.

]2.2.4.7 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 A653/A653M. 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.

2.2.4.8 Thermal and Acoustic Insulation

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

2.2.4.9 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.

] 2.2.4.10 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 DAF45. 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, Section 23 11 25 FACILITY GAS PIPING and Section 33 51 15 NATURAL-GAS / LIQUID PETROLEUM GAS 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.

3.3 CLOSEOUT ACTIVITIES

Submit record drawings providing current factual information including deviations from, and amendments, to the drawings and concealed and visible changes in the work.

Submit [6] [_____] copies of the operation and maintenance manuals 30 calendar days prior to testing the system.

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

-- End of Section --