SECTION 23 55 00

##### FUEL-Fired Heaters

### BASED ON DFD MASTER SPECIFICATION DATED 10/1/2012

***This section has been written to cover most (but not all) situations that you will encounter. Depending on the requirements of your specific project, you may have to add material, delete items, or modify what is currently written. The Division of Facilities Development expects changes and comments from you.***

**PART 1 ‑ GENERAL**

**SCOPE**

This section includes specifications for fuel-fired heaters. Included are the following topics:

PART 1 - GENERAL

Scope

Related Work

Reference

Reference Standards

Quality Assurance

Submittals

Operation and Maintenance Data

Warranty

PART 2 - PRODUCTS

Gas Fired Unit Heaters

Infrared Heating Devices

Direct Fired Make-up Air Units

Indirect Fired Make-up Air Units

PART 3 - EXECUTION

Installation

Gas Fired Unit Heaters

Infrared Heating Devices

Make-up Air Units

Construction Verification Items

Functional Performance Testing

Agency Training

**RELATED WORK**

Section 01 91 01 or 01 91 02 – Commissioning Process

Section 23 08 00 – Commissioning of HVAC

Section 23 11 00 - Facility Fuel PipingSection 23 05 23 - General-Duty Valves for HVAC Piping

Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment

Section 23 05 13 - Common Motor Requirements for HVAC Equipment

Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment

Section 23 51 00 - Breechings, Chimneys, and Stacks.

**REFERENCE**

Applicable provisions of Division 1 govern work under this section.

**Reference Standards**

AGA American Gas Association

ANSI Z83.4 Direct Gas Fired Makeup Air Heaters

ANSI Z83.6 Gas Fired Infrared Heaters

GAMA Gas Appliance Manufacturers Association

NEC National Electrical Code

# QUALITY ASSURANCE

Refer to division 1, General Conditions, Equals and Substitutions.

**SUBMITTALS**

Refer to division 1, General Conditions, Submittals.

Include specific manufacturer and model numbers, equipment identification corresponding to project drawings and schedules, dimensions, capacities, materials of construction, ratings, weights, power requirements and wiring diagrams, filter information and information for all accessories.

# OPERATION AND MAINTENANCE DATA

All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

***Delete the following if there are no additional requirements.***

In addition to the general content specified under GENERAL REQUIREMENTS supply the following additional documentation:

1. ***[A/E and commissioning provider to define detailed operation and maintenance data requirements for equipment specifications added to this section.]***

# WARRANTY

Gas fired unit heaters heat exchangers warranted for five years. Remainder of unit heater components warrated for 1 year from startup.

Radiant heat tubes warranted against internal corrosion for 10 years. Remainder of infrared radiant heater components warranted for 1 year from date of startup.

Direct fired make-up air units warranted for 12 months from date of startup.

Indirect fired make-up air units warranted for 12 months from date of startup.

**PART 2 ‑ PRODUCTS**

**GAS FIRED UNIT HEATERS**

Manufacturers: Modine, Reznor, Sterling or Trane

####  This specification is for direct vent, sealed combustion, propeller type unit heaters.

Horizontal discharge, direct vent sealed combustion type. AGA certified for use with [natural][propane] gas. Minimum combustion efficiency (Ec) of 80%. All wiring shall comply with the National Electrical Code.

Construct casing of cold rolled steel with baked enamel finish. Direct drive propeller type fan statically and dynamically balanced and including fan safety guard and adjustable vertical and horizontal louvers for control of air diffusion on discharge of unit. Aluminized steel burners, electronic spark ignition with electronic flame supervision and timed lockout control. Heavy gauge [aluminized][stainless] steel heat exchanger and factory installed induced draft blower for heat exchanger prepurge and combustion gas venting. Provide a hinged access panel on the bottom of the unit to access the burner or provide side access (pull out drawer) to burner assembly. Single point power connection. Unit must be approved for vertical or side wall venting

Specify a stainless steel heat exchanger if the unit is located in a corrosive environment.

Provide spark ignited intermittent pilot system with electronic flame supervision

AGA gas controls, including manual main shut‑off valve, 24 volt redundant combination gas control valve with 100 percent safety shut‑off valve and main gas pressure regulator.

***Coordinate inlet pressure requirements with available gas pressure. Indicate on drawings or equipment schedule inlet gas pressure requirements.***

Provide fan controls and limit safety controls including but not limited to:

-Pressure switch to verify combustion/exhaust gas airflow

-high limit controls

-Fan time delay to delay the fan start until the heat exchanger reaches a predetermined temperature and to allow the fan to operate, after burner shut down, to remove heat exchanger residual heat.

 [Refer to Sections [23 09 24][23 09 23][23 09 14 OR 23 09 15] for temperature control work.]

***If temperature controls are not included elsewhere in the documents specify all control work under this section by deleting the above sentence and editing the following. If temperature controls are included in other sections then delete the following.***

[This Contractor shall provide all temperature control and interlocking necessary to perform the specified control sequence. All relays, transformers and controls are to be in enclosures. Provide factory installed 24 volt control transformer along with 24 v wall mounted thermostat. All wiring shall be in conduit in accordance with Division 26 00 00 - Electrical and comply with the NEC.]

***If temperature control sequences are not indicated elsewhere, then insert control sequences here.***

Provide an air inlet/vent termination assembly and threaded hanger connections.

**INFRA‑RED HEATING DEVICES**

Manufacturers: Ambi-Rad, Roberts-Gordon (Co-Ray-Vac) or Combustion Research Corp(Reflect-O-Ray).

***This specification is for non-condensing powered exhaust type systems.***

The entire system shall be AGA certified “Gas Infrared Heaters” conforming to ANSI standard Z83.6. All wiring shall comply with the National Electrical Code.

System configuration and performance as indicated on the drawings and/or equipment schedules.

***Include minimum steady state efficiency, burner capacity and heat output per linear ft in the equipment schedule***

Overall system and sub-systems certified for use with [natural][propane] gas, as indicated on the drawings. Each comprised of burner unit, outside air inlet, combustion pipe, radiant pipe, reflectors, support brackets, vacuum fan(s) (separate from burner unit), exhaust pipe, thermostats and safety controls. Provide gas regulator, automatic gas valves and safety interlocks on gas train.

Unit is to be non-condensing type.

Burner and associated controls shall include, direct spark ignition, electronic flame monitoring, “power on” and “burner on” indicator lights, 100% gas safety shutoff in case of ignition failure, pre purge and post purge of system and air flow switch to prove combustion air flow prior to firing burner.

The combustion pipe shall be constructed of [16 gauge aluminized steel] [16 gauge stainless steel] for a minimum of 10’. The radiant pipe shall be constructed of [spiral wound 22 gauge aluminized steel][16gauge stainless steel]. Construct flexible connector between vacuum fan and pipe of stainless steel.

Direct drive 115 volt vacuum fan [with stainless steel fan wheel] to exhaust all combustion gases to the outdoors.

**Specify stainless steel piping and fan wheel if the heater is located in a corrosive environment.**

Provide polished aluminum or polished stainless steel reflectors over all heat exchanger piping including elbows, u-bends and fittings.

Provide single point 115v power connection at burner unit. Vacuum fan power to be field wired to burner. (Power wiring by Division 26 00 00 - Electrical contractor. Thermostat and control wiring by this contractor)

Furnish a low voltage or 115 volt wall mounted thermostat. If low voltage is used then proved factory installed control transformer.

Coordinate the power wiring requirements between the burner and the fan with the electrical consultant.

**DIRECT FIRED MAKE‑UP AIR UNITS**

Manufacturers: Greenheck, Hastings, Reznor, Rupp, Sterling, Trane or Weather-Rite.

AGA certified for use with [natural][propane] gas.

[Outdoor units cabinet constructed of 16 gauge aluminized steel with enamel finish or 16 gauge galvanized steel. Gasketed access panels and doors for access to all components including blower, burner and electrical components. All seams to be foam taped or caulked to prevent moisture from entering the unit. Provide a weatherhood constructed of 16 gauge galvanized steel with galvanized bird screen. ]

[Indoor units cabinet constructed of 16 gauge aluminized steel with enamel finish or 18 gauge galvanized steel, gasketed access panels and doors for access to all components including blower, burner and electrical components.]

Insulate cabinet with [1” thick mat-faced fiberglass][1” thick foil faced fiberglass or 1” thick dual wall construction]. Insulation facing erosion resistance as indicated in TIMA standard AHC 101-75, section D-4-10.

Mat-face liner is acceptable for units serving spaces such as garages, shops, etc. Specify foil facing for units serving spaces such as kitchens, laundries, etc.

Provide centrifugal DWDI forward curved fan with statically and dynamically balanced wheels and one piece through shaft and heavy duty sealed ball bearings with extended grease fittings. Fan shall be isolated from unit with vibration isolators and flexible connectors to prevent vibration from transmitting to the building. As an option to internal vibration isolation provide isolators for [floor mounting][suspending] unit along with pipe flex connectors and duct flex connectors as indicated in section 23 05 48.

Motors shall be open drip proof with adjustable belt drives.

***If the unit is not a modulating type then modify the following paragraph accordingly.***

Modulating type direct fired burner shall be constructed of cast iron gas manifold connected to stainless steel mixing plates, turndown ratio of 25:1, suitable for heating air from –20 deg. F.

AGA certified gas controls, [meeting FM requirements] and [meeting IRI requirements] including flame safeguard relay with flame sensor, high & low gas pressure switches, intermittent spark or hot surface ignition system, manual main shut‑off valve, electronic modulating gas valve, pilot controls, electric safety shut‑off valve, main and pilot gas regulators suitable for inlet pressure indicated on the drawings.

***Verify inlet pressure requirement and available inlet pressure.***

Provide complete with the following electric controls: Factory installed motor starter with auxiliary contacts, control transformer, high temperature limit switch, low outlet temperature shut‑off, high and low flow proving switches, automatic mild weather burner lockout. Contain all electrical in a [NEMA 2][NEMA 1] control box with fused disconnect,

[Refer to Sections [23 09 24][23 09 23][23 09 14 OR 23 09 15] for temperature control work.]

***If temperature controls are not included elsewhere in the documents specify all control work under this section by deleting the above sentence and editing the following. If temperature controls are included in other sections then delete the following.***

[This Contractor shall provide all temperature control and interlocking necessary to perform the specified control sequence. All relays, transformers and controls are to be in enclosures. Provide factory installed 24 volt control transformer along with a remote control panel including summer/off/winter switch, blower on, burner on, and safety lockout indicator lights and temperature selector with [discharge][space] temperature sensor. All wiring shall be in conduit in accordance with Division 26 00 00 - Electrical and comply with the NEC.]

***If temperature control sequences are not indicated elsewhere, then insert control sequences here.***

Provide filter section with 2" thick 30% efficient throwaway filters. Provide dirty filter switch with indicating light. Filter section to be low velocity V‑bank type.

Provide units complete with the following accessories:

[Intake][Discharge] shut‑off damper with motor and end switch.

 [Outside air inlet hood with screened inlet]

**INDIRECT FIRED MAKE‑UP UNITS**

Manufacturers: Greenheck, Hastings, Reznor, Modine or Trane.

AGA certified for use with [natural][propane] gas. Minimum combustion efficiency (Ec) of 80%.

[Outdoor units to use gravity vent type combustion.

Outdoor unit’s cabinet constructed of 16 gauge aluminized steel or 16 gauge galvanized steel. Gasketed access panels and doors for access to all components including blower, burner and electrical components. All seams to be foam taped or caulked to prevent moisture from entering the unit. Provide a weatherhood constructed of 16 gauge galvanized steel with galvanized bird screen. ]

[Indoor units to use separated combustion type heating with combustion air ducted directly from outside to prevent space pressure effects on the furnace. Provide terminal assembly for combustion air/exhaust air termination.

Indoor unit’s cabinet constructed of 16 gauge aluminized steel or 18 gauge galvanized steel, gasketed access panels and doors for access to all components including blower, burner and electrical components.]

Provide centrifugal DWDI forward curved fan with statically and dynamically balanced wheels and one piece through shaft and heavy duty sealed ball bearings with extended grease fittings. Fan shall be isolated from unit with vibration isolators and flexible connectors to prevent vibration from transmitting to the building. As an option to internal vibration isolation provide isolators for [floor mounting][suspending] unit along with pipe flex connectors and duct flex connectors as indicated in section 23 05 48.

The heater shall be constructed of E-3 (409) stainless steel heat exchanger with removable E-3 (409) stainless steel burner(s) suitable for heating air from –20 deg F.

AGA certified gas controls, [meeting FM requirements] and [IRI requirements] including flame safeguard relay with flame sensor, high & low gas pressure switches, intermittent spark or hot surface ignition system, manual main shut‑off valve, electronic modulating gas valve, pilot controls, electric safety shut‑off valve, main and pilot gas regulators suitable for inlet pressure indicated on the drawings.

***Verify inlet pressure requirement and available inlet pressure.***

Provide complete with the following electric controls: Motor starter with auxiliary contacts, control transformer, high temperature limit switch, low outlet temperature shut‑off, high and low flow proving switches, automatic mild weather burner lockout. Contain all electrical in a [NEMA 2][NEMA 1] control box with fused disconnect,

Coordinate the electrical items with the electrical consultant. Modify the above paragraph accordingly.

Provide electronic modulation between 50% and 100% capacity to control [discharge][space] temperature with a remote temperature sensor.

[Refer to Sections [23 09 24][23 09 23][23 09 14 OR 23 09 15] for temperature control work.]

***If temperature controls are not included elsewhere in the documents specify all control work under this section by deleting the above sentence and editing the following. If temperature controls are included in other sections then delete the following.***

[This Contractor shall provide all temperature control and interlocking necessary to perform the specified control sequence. All relays, transformers and controls are to be in enclosures. Provide factory installed 24 volt control transformer along with a remote control panel including summer/off/winter switch, blower on, burner on and safety lockout indicator lights and temperature selector with [discharge][space] temperature sensor. All wiring shall be in conduit in accordance with Division 26 00 00 - Electrical and comply with the NEC.]

***If temperature control sequences are not indicated elsewhere, then insert control sequences here.***

Provide filter section with 2" thick 30% efficient throwaway filters. Provide dirty filter switch with indicating light. Filter section to be designed for low velocity V‑bank type.

Provide units complete with the following accessories:

[Intake and supply air plenums.]

[Return and outside air mixing dampers with motors and linkage. Dampers to be low leakage type.]

**PART 3 ‑ EXECUTION**

**INSTALLATION**

Install units as shown on plans, as detailed and according to the manufacturer’s installation instructions.

Pipe vents from gas regulator to outside (where regulators are provided).

[Install remote panels and thermostats where indicated on the drawings. Provide all wiring between remote panels/thermostats and the gas fired item.]

Coordinate all power wiring with the electrical consultant. Coordinate all temperature controls with the temperature controls specifications. Clearly identify and coordinate which trade is providing the various wiring.

***Show routing, sizing and termination of all gas ,gas vent , combustion air and vent piping on the drawings.***

 ***Coordinate exterior wall/roof penetrations with the building wall/roof type and configuration.***

# GAS FIRED UNIT HEATERS

Install units and connect gas, combustion air and vent piping as instructed by the manufacture and in compliance with applicable code requirements. Suspend from building structure to maintain headroom beneath units as indicated in section 23 05 29. Connect combustion air and venting to outside of building as indicated on the drawings and terminate per the manufacturer's instructions.

## INFRA-RED HEATING DEVICES

Suspend units from structure as indicated on the drawings, as instructed by the manufacturer and in compliance with applicable codes. Gas connections to burner shall be made with a flexible connector. Route combustion air and vent piping to outside as indicated on the drawings and terminate per the manufacturer’s instructions.

## MAKE -UP AIR UNITS

[Suspend from structure][Install on concrete housekeeping pad][Install on steel stand][Mount on roof] as indicated on the drawings and in section 23 05 29. Install per the manufacturer’s written instructions and in compliance with applicable codes.

**CONSTRUCTION VERIFICATION**

Contractor is responsible for utilizing the construction verification checklists supplied under specification Section 23 08 00 in accordance with the procedures defined for construction verification in Section 01 91 01 or 01 91 02.

**FUNCTIONAL PERFORMANCE TESTING**

Contractor is responsible for utilizing the functional performance test forms supplied under specification Section 23 08 00 in accordance with the procedures defined for functional performance testing in Section 01 91 01 or 01 91 02.

# AGENCY TRAINING

All training provided for agency shall comply with the format, general content requirements and submission guidelines specified under Section 01 91 01 or 01 91 02.

Contractor to provide factory authorized representative and/or field personnel knowledgeable with the operations, maintenance and troubleshooting of the system and/or components defined within this section for a minimum period of [XX] hours.

END OF SECTION