SECTION 23 54 16

HEATING SYSTEM; GAS-FIRED HEATERS

This guide specification covers the requirements for gas-fired heaters, including unit heaters, wall furnaces, and infrared heaters.

PART 1 GENERAL

1.1 REFERENCES

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. Current editions of references at time of delivery order shall be used.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z21.86/CSA 2.32	Vented Gas-Fired Gravity Space Heating Appliances
ANSI Z83.19/CSA 2.35	Gas-Fired High-Intensity Infrared Heaters
ANSI Z83.4/CSA 3.7	Non-Recirculating Direct Gas-Fired Industrial Air Heaters
ANSI Z83.8/CSA 2.6	American National Standard/CSA Standard for Gas Unit Heater, Gas Packaged Heaters, Gas Utility Heaters and Gas-Fired Duct Furnaces

CSA STANDARDS (CSA)

CSA Directory	(updated continuously online) Product Index

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 1	Motors and Generators

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 211	Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances
NFPA 54	National Fuel Gas Code

UNDERWRITERS LABORATORIES (UL)

UL Gas&Oil Dir	Flammable and Combustible Liquids and Gases Equipment Directory

1.2 SUBMITTALS

Government approval is required for submittals. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Detail Drawings
Installation

SD-03 Product Data

Spare parts data shall be submitted for each different item of materials and equipment specified, after approval of the detail drawings, and not later than the date of beneficial occupancy. The data shall include a complete list of parts and supplies, with current unit prices and source of supply.

SD-06 Test Reports

Testing, Adjusting, and Balancing

Test reports shall be submitted in booklet form showing all field tests performed to adjust each component and all field tests performed to prove compliance with the specified performance criteria, upon completion and testing of the installed system. Each test report shall indicate the final position of controls.

SD-10 Operation and Maintenance Data

Operation and Maintenance Instructions

Four complete copies of operating instructions outlining the step-by-step procedures required for system startup, operation and shutdown. The instructions shall include the manufacturer's name, model number, service manual, parts list, and brief description of all equipment and basic operating features. Four complete copies of maintenance instructions listing routine maintenance, possible breakdowns, and repairs and troubleshooting guide. The instructions shall include simplified piping, wiring, and control diagrams for the system as installed.

1.3 QUALITY ASSURANCE

Submit detail drawings consisting of illustrations, schedules, performance charts, instructions, brochures, diagrams, and other information to illustrate the requirements and operation of the system. Detail drawings for space heating equipment, controls, associated equipment, and for piping and wiring. Drawings shall show proposed layout and anchorage of equipment and appurtenances, and equipment relationship to other parts of the work including clearances for maintenance and operation.

1.4 DELIVERY, STORAGE, AND HANDLING

Protect all equipment delivered and placed in storage from weather, humidity and temperature variations, dirt and dust, or other contaminants.

1.5 EXTRA MATERIALS

Submit spare parts data for each different item of material and equipment specified, after approval of the detail drawings, and not later than 2

months prior to the date of beneficial occupancy. Include in the data a complete list of parts and supplies, with current unit prices and source of supply.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

2.1.1 General

Provide materials and equipment which are standard products of a manufacturer regularly engaged in manufacturing of the products and that essentially duplicate equipment that has been in satisfactory use at least 2 years prior to bid opening.

2.1.2 Nameplates

Secure a plate to each major component of equipment containing the manufacturer's name, address, type or style, model or serial number, and catalog number. Also, affix an ENERGY STAR label as applicable.

2.1.3 Equipment Guards

Belts, pulleys, chains, gears, couplings, projecting setscrews, keys, and other rotating parts so located that any person may come in close proximity thereto shall be completely enclosed or guarded. High-temperature equipment and piping so located as to endanger personnel or create a fire hazard shall be guarded or covered with insulation of type specified for service.

2.2 ELECTRICAL WORK

Electrical motor driven equipment shall be provided complete with motors, motor starters, and controls. Motors shall conform to NEMA MG 1. Electrical equipment and wiring shall be in accordance with Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Electrical characteristics shall be as specified or indicated. Integral size motors shall be premium efficiency type in accordance with NEMA MG 1. Motor starters shall be provided complete with thermal overload protection and other appurtenances necessary for the motor control specified. Each motor shall be of sufficient size to drive the equipment at the specified capacity without exceeding the nameplate rating of the motor. Manual or automatic control and protective or signal devices required for the operation specified and any control wiring required for controls and devices specified, but not shown, shall be provided.

2.3 HEATERS

Heaters shall be equipped for and adjusted to burn natural gas. Each heater shall be provided with a gas pressure regulator that will satisfactorily limit the main gas burner supply pressure. Heaters shall have an intermittent or interrupted electrically ignited pilot or a direct electric ignition system. Safety controls shall conform to the ANSI standard specified for each heater. Mounting brackets and hardware shall be furnished by the heater manufacturer and shall be factory finished to match the supported equipment.

2.3.1 Direct Fired Make-Up Air Heaters

Heaters shall be in accordance with ANSI Z83.4/CSA 3.7. Direct fired make-up air heaters use outside air directly ducted to the heater. The products of combustion generated by the heater are released into the outside air stream being heated. Heaters shall be equipped with motorized inlet and outlet back draft dampers, discharge air diffuser, duct collar, air filters, and bird screen. Gas control valve shall be modulating type. Maximum air temperature rise during minimum burner fire shall be 7 degrees F. Fan shall be single-speed, two speed with low speed approximately two-thirds of high speed, or variable speed as applicable. Outdoor heaters shall be weatherized and shall have manufacturer's standard exterior finish for outdoor units. Motorized inlet and outlet dampers shall be closed when the unit is shut down. Dampers shall be interlocked to prevent burner operation when dampers are closed. Heaters shall be provided with a space thermostat, a low limit air stream thermostat, and an ambient air thermostat. The space thermostat shall control the gas control valve. The low limit air stream thermostat shall shut down the entire unit if the discharge air temperature drops below the space thermostat setting. The ambient air thermostat shall shut down the burner if the outside air exceeds the space thermostat setting.

2.3.2 Indirect Fired Make-Up Heaters

Heaters shall be in accordance with ANSI and CSA Standards. Heaters shall be equipped with motorized inlet dampers, duct collar, and air filters. Gas control valve shall be modulating type. Maximum air temperature rise during minimum burner fire shall be 7 degrees F. Fan shall be two speed, with low speed approximately two-thirds of high speed. Motorized inlet dampers shall be closed when the unit is shut down. Dampers shall be interlocked to prevent burner operation when dampers are closed. Heaters shall be provided with a space thermostat, a low limit air stream thermostat, and an ambient air thermostat. The space thermostat shall control the modulating gas control valve. The low limit air stream thermostat shall shut down the entire unit if the discharge air temperature drops below the space thermostat setting. The ambient air thermostat shall shut down the burner if the outside air exceeds the space thermostat setting.

2.3.3 Unit Heaters

Heaters shall conform to requirements of ANSI Z83.8/CSA 2.6. Heat exchangers shall be aluminized steel or stainless steel. Aluminized steel heat exchangers will be satisfactory in most applications. Omit the aluminized if there is a corrosive condition. Air discharge section shall be equipped with adjustable horizontal louvers and vertical louvers or fins. Products of combustion shall be vented to the outside atmosphere. Heater fan motors shall operate at a speed not in excess of 1,550 rpm for units with output capacities up to and including 60,000 Btuh. Fan shafts shall be either directly connected to the driving motor, or indirectly connected by multiple V-belt drive. Fans in one unit shall be of the same size. Heaters shall be power-vented type, suitable for sidewall vent discharge and single-wall-thickness vent piping. Heaters shall have automatic ignition. Heaters shall employ metered combustion air with enclosed draft diverter (no open flue collar). Heaters shall be provided with a space thermostat which controls both unit's fan and burner. Heaters shall have minimum steady

state efficiencies of 78 percent at maximum rated capacity and 75 percent at minimum rated capacity that is provided and allowed by the controls.

2.3.4 Wall Furnace

Wall furnace shall be the [gravity][fan] type in accordance with ANSI Z21.86/CSA 2.32 and as indicated. Furnace shall be provided with a space thermostat which controls both the unit's fan and burner.

2.3.5 Duct Furnace

Duct furnace shall be in accordance with ANSI Z83.8/CSA 2.6. Furnace shall be power-vented type, suitable for sidewall vent discharge and single wall thickness vent piping. Furnace shall have automatic ignition. Furnace shall employ metered combustion air with enclosed draft diverter (no open flue collar). Furnace heat exchangers shall be aluminized steel or stainless steel. Aluminized steel heat exchangers will be satisfactory in most applications. Contractor shall omit the aluminized steel if there is a corrosive condition. Furnace shall have minimum steady state thermal efficiency of 80 percent at maximum rated capacity and 75 percent at minimum rated capacity that is provided and allowed by the controls. Furnace shall be provided with a space thermostat which controls the unit's burner.

2.3.6 Infrared Heaters

Heaters shall conform to the requirements of ANSI Z83.19/CSA 2.35 and shall be vented or unvented type as indicated.

Unvented infrared heaters may be employed only in buildings with high ceilings such as shop buildings, industrial buildings, etc.

Exhaust vents will not be located directly above infrared heaters. The location of the heaters should be coordinated with light fixtures, sprinkler systems, structural members, and any other items that may be sensitive to the heat that will be generated.

Where the units are used in metal buildings, the roof will be insulated and an adequate noncombustible vapor barrier will be provided. Unvented infrared heaters will not be used in hazardous areas.

Select type of heater required and delete the inapplicable type of ventilation. Capacity of the exhaust system must be a minimum of 4 cfm per 1,000 Btu per hour input to properly dilute the carbon dioxide produced.

Provision will be made to provide air to the space in an amount equal to the exhaust.

Vented heaters shall be vented to the outside atmosphere. Heater style shall be surface combustion or tubular type as indicated. Reflector shape shall be parabolic, horizontal, or standard as indicated. Heaters shall be provided with space thermostats which control the unit's burner.

Thermostats located in the direct radiation pattern shall be covered with a metal shield.

2.4 THERMOSTATS

Space thermostats shall be single stage with 3-degree F differential and set point range of 40 to 75 degrees F. Thermostats shall control the fan and burner.

If necessary, space thermostats shall be two-stage with 2-degree F differential within each stage, 3-degree F differential between each stage, and set point range of 40 to 75 degrees F. The thermostats shall control the burner and stage multiple furnaces and shall have a set point range of 40 to 75 degrees F. The high temperature stage shall control the unit fan motor. Low temperature stage shall control the burner.

The thermostats shall control the burner and fan. If necessary, space thermostats shall be two stages with 2-degree F differential within each stage, 3-degree F differential between each stage, and set point range of 40 to 75 degrees F. The thermostats shall control the burner and stage multiple furnaces.

2.5 VENT PIPING

Vent piping shall conform to the requirements of NFPA 54. Plastic material polyetherimide (PEI) and polyethersulfone (PES) are forbidden to be used for vent piping of combustion gases.

2.6 ELECTRIC AUTOMATIC VENT DAMPERS

Electric automatic vent dampers shall conform to the requirements of ANSI Z21.66/CGA 6.14 and shall be provided in the vents of heaters except unvented infrared heaters using indoor air for combustion air.

2.7 INSULATION

Insulation for piping and equipment and application shall be in accordance with Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

2.8 FACTORY FINISHES

Equipment and component items, when fabricated from ferrous metal, shall be factory finished with the manufacturer's standard finish.

PART 3 EXECUTION

3.1 EXAMINATION

After becoming thoroughly familiar with all details of the work, verify all dimensions in the field, and advise the Contracting Officer of any discrepancy before performing any work.

3.2 INSTALLATION

Install equipment as indicated and in accordance with the recommendations of the equipment manufacturer and the listing agency, except as otherwise specified.

3.2.1 Heating Equipment

Install heaters with clearance to combustibles, complying with minimum distances as determined by CSA Directory, UL Gas&Oil Dir and as indicated on each heater approval and listing plate. Support heaters independently from the building structure, as indicated, but not relying on suspended ceiling systems for support.

3.2.2 Vents

Locate vent dampers, piping and structural penetrations as indicated. Vent damper installation shall conform to ANSI Z21.66/CGA 6.14. Vent pipes, where not connected to a masonry chimney conforming to NFPA 211, shall extend through the roof or an outside wall and shall terminate, in compliance with NFPA 54. Vents passing through waterproof membranes shall be provided with the necessary flashings to obtain waterproof installations.

3.2.3 Gas Piping

Connect gas piping as indicated, complying with the applicable requirements at Section 23 11 25 FACILITY GAS PIPING.

3.3 TRAINING

Conduct a training course for the maintenance and operating staff. The training period of typically 2 hours normal working time shall start after the system is functionally complete but before the final acceptance tests. Consult equipment manufacturer for recommended training time.

Give the Contracting Officer at least two weeks advance notice of such training. The training shall include all of the items contained in the approved operation and maintenance instructions as well as demonstrations of routine maintenance operations.

Submit 6 complete copies of operating instructions outlining the step-by-step procedures required for system startup, operation and shutdown. The instructions shall include the manufacturer's name, model number, service manual, parts list, and brief description of all equipment and basic operating features.

Submit 6 complete copies of maintenance instructions listing routine maintenance, possible breakdowns, repairs and troubleshooting guide. The instructions shall include simplified piping, wiring, and control diagrams for the system as installed.

3.4 TESTING, ADJUSTING, AND BALANCING

Perform testing, adjusting, and balancing as specified in Section 23 05 93 TESTING, ADJUSTING, AND BALANCING OF HVAC SYSTEMS. Submit test reports in booklet form showing all field tests performed to adjust each component and all field tests performed to prove compliance with the specified performance criteria, upon completion and testing of the installed system. Each test report shall indicate the final position of controls.

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