Preparing Activity: USACE Superseding without Revision
UFGS-23 54 16.00 10 (April 2008)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated July 2023
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05/20

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GAS-FIRED HEATING EQUIPMENT
05/20

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

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 item(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

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 will automatically be 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.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z21.66/CGA 6.14	(2015; R 2020) Automatic Vent Damper Devices for Use with Gas-Fired Appliances
ANSI Z21.86/CSA 2.32	(2016) Vented Gas-Fired Space Heating Appliances
ANSI Z83.4/CSA 3.7	(2017; R 2022) Non-Recirculating Direct Gas-Fired Heating and Forced Ventilation Appliances for Commercial and Industrial Application
ANSI Z83.8/CSA 2.6	(2016; R 2021) Gas Unit Heaters, Gas Packaged Heaters, Gas Utility Heaters, and Gas-Fired Duct Furnaces
ANSI Z83.19/CSA 2.35	(2017; R 2022) Gas-Fired High-Intensity Infrared Heaters

CSA GROUP (CSA)

CSA Directory	(updated continuously online) Product Index

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 1	(2021) Motors and Generators

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 54	(2021) National Fuel Gas Code
NFPA 211	(2019) Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 3-301-01	(2023) Structural Engineering

UNDERWRITERS LABORATORIES (UL)

UL FLAMMABLE & COMBUSTIBLE	(2012) Flammable and Combustible Liquids and Gases Equipment Directory

1.2 SUBMITTALS

****

NOTE: Review submittal description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list, and corresponding submittal items in the text, to reflect only the submittals required for the project. The Guide Specification technical editors have classified 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 Army projects, fill in the empty brackets following the "G" classification, with a code of up to three characters 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.

The "S" classification indicates submittals required as proof of compliance for sustainability Guiding Principles Validation or Third Party Certification and as described in Section 01 33 00 SUBMITTAL PROCEDURES.

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" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Detail Drawings
Installation

SD-03 Product Data

Spare Parts

SD-06 Test Reports

Testing, Adjusting, and Balancing

SD-10 Operation and Maintenance Data

Operation and Maintenance Instructions

1.3 QUALITY ASSURANCE

****

NOTE: All Federal buildings must comply with Executive Order 13423 and Public Law 109-58 (Energy Policy Act of 2005); whether new construction, replacement construction, or, to the greatest extent practical, refurbishment and system replacement. In order to comply with E.O. 13423 and the Energy Policy Act of 2005, building designs must achieve energy consumption levels that are at least 30 percent below the level required by the 2004 publication of ASHRAE 90.1.

In accordance with P.L. 109-58 (Energy Policy Act of 2005), Executive Order 13423, and Federal Acquisition Regulation (FAR) 23.203 Energy-efficient Products must meet or exceed the performance criteria for ENERGY STAR®-qualified or FEMP-designated products as long as these requirements are nonproprietary. The FEMP and ENERGY STAR product requirements are available on the web at www.eere.energy.gov/femp/procurement and www.energystar.gov/products. Where ENERGY STAR or FEMP products are not applicable, energy consuming products and systems must meet or exceed the requirements of ASHRAE 90.1.

****

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. 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 [_____] 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. All gas fired appliances must meet the requirements of NFPA 54.

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

Completely enclose or guard belts, pulleys, chains, gears, couplings, projecting setscrews, keys, and other rotating parts so located that any person may come in close proximity thereto. Guard or cover high-temperature equipment and piping so located as to endanger personnel or create a fire hazard with insulation of type specified for service.

2.2 ELECTRICAL WORK

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NOTE: Indicate motor type, class, and enclosure type on the drawings.

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Provide electrical motor driven equipment complete with motors, motor starters, and controls. Provide motors conforming to NEMA MG 1. Provide electrical equipment and wiring accordance with Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Provide electrical characteristics as specified or indicated. Provide premium efficiency integral size motors in accordance with NEMA MG 1. Provide motor starters complete with thermal overload protection and other appurtenances necessary for the motor control specified. Each motor must 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, must be provided.

2.3 HEATERS

****

NOTE: Heater mounting brackets and related hardware should be specified to be furnished by the equipment manufacturer with factory finish if project does not warrant separate specification sections for miscellaneous metals and field painting. The designer should consult UFC 3-31-04 and Sections 13 48 73 and 23 05 48.19 to determine if seismic details are required. If required, refer to specification sections 13 48 73 and 23 05 48.19 or include the necessary details on the drawings. Delete the reference to seismic details, if they are not required. Indicate all applicable vent pipe routing on drawing.

Unless stated otherwise, heaters must have a minimum combustion efficiency of 80 percent at maximum capacity. Show heater combustion efficiencies on the drawings.

****

Equip heaters for and adjust to burn [natural][liquified petroleum][dual fuel natural/liquified petroleum] gas. Provide each heater with a gas pressure regulator that will satisfactorily limit the main gas burner supply pressure. Heaters must have an intermittent or interrupted electrically ignited pilot or a direct electric ignition system. Provide safety controls that conform to the ANSI standard specified for each heater. Furnish mounting brackets and hardware by the heater manufacturer and factory finish to match the supported equipment. Seismic details must be [in accordance with UFC 3-301-01 and Sections 13 48 73 SEISMIC CONTROL FOR MISCELLANEOUS EQUIPMENT and 23 05 48.19 [SEISMIC] BRACING FOR HVAC][as indicated].

2.3.1 Direct Fired Make-Up Air Heaters

****

NOTE: Designer should choose inlet or discharge damper according to climate zone. Generally, locations which experience more than 2220 heating degree C days 4,000 heating degree F days should use discharge dampers on units located outdoors, and inlet dampers on units located indoors. Applications in moderate climates can be specified at the designer's option.

****

Furnish heaters 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. Equip heaters with [motorized [inlet][and][outlet]] [backdraft] dampers,[discharge air diffuser,][duct collar,][air filters,][and][bird screen]. Provide [single-stage][two stage][modulating] gas control valve. Maximum air temperature rise during minimum burner fire must be 4 degrees C 7 degrees F. Fan must be [single-speed][two speed, with low speed approximately two-thirds of high speed][variable speed]. Provide weatherized outdoor heaters with manufacturer's standard exterior finish for outdoor units. Provide motorized [inlet][and][outlet] dampers that close when the unit is shut down. Dampers must be interlocked to prevent burner operation when dampers are closed. Provide heaters with a [space][discharge air] thermostat, a low limit air stream thermostat, and an ambient air thermostat. The [space][discharge air] thermostat must control the gas control valve. Provide low limit air stream thermostat to shut down the entire unit if the discharge air temperature drops below the [space][discharge] thermostat setting. Provide ambient air thermostat to shut down the burner if the outside air exceeds the [discharge][space] thermostat setting.

2.3.2 Indirect Fired Make-Up Heaters

Provide heaters in accordance with ANSI and CSA Standards. Equip heaters with motorized inlet dampers, duct collar, and air filters. Provide modulating gas control valve. Maximum air temperature rise during minimum burner fire must be 4 degrees C 7 degrees F. Fan must be two speed, with low speed approximately two-thirds of high speed. Provide motorized inlet dampers that close when the unit is shut down. Dampers must be interlocked to prevent burner operation when dampers are closed. Provide heaters with a space thermostat, a low limit air stream thermostat, and an

ambient air thermostat. The space thermostat must control the modulating gas control valve. Provide low limit air stream thermostat to shut down the entire unit if the discharge air temperature drops below the space thermostat setting. Provide ambient air thermostat to shut down the burner if the outside air exceeds the space thermostat setting.

2.3.3 Unit Heaters

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NOTE: Aluminized steel heat exchangers will be satisfactory in most applications. Omit the aluminized if there is a corrosive condition.

****

Provide heaters conforming to requirements of ANSI Z83.8/CSA 2.6. Provide [aluminized steel][or][stainless steel] heat exchangers. Equip air discharge section with adjustable [horizontal louvers][and][vertical louvers or fins]. Fan shafts must be either directly connected to the driving motor, or indirectly connected by multiple V-belt drive. Fans in one unit must be of the same size. Furnish power-vented heaters, suitable for sidewall vent discharge and single-wall-thickness vent piping. Provide heaters that have automatic ignition. Heaters must employ metered combustion air with enclosed draft diverter (no open flue collar). Provide heaters with a space thermostat which controls both unit's fan and burner.

2.3.4 Wall Furnace

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NOTE: ANSI Z21.49 defines the gravity type units which are designed to draw combustion air from within the space. Indicate on the drawings the type of air discharge; top or front.

Wall furnace must have a minimum combustion efficiency of 77 percent and a minimum AFUE of 73 percent. Indicate wall furnace efficiencies on the drawings.

****

Provide [gravity][fan] wall furnace in accordance with ANSI Z21.86/CSA 2.32 and as indicated. Provide a space thermostat which controls both the unit's fan and burner.

2.3.5 Duct Furnace

****

NOTE: Aluminized steel heat exchangers will be satisfactory in most applications. Omit the aluminized steel if there is a corrosive condition.

****

Provide duct furnace in accordance with ANSI Z83.8/CSA 2.6. Provide power-vented furnace, suitable for sidewall vent discharge and single wall thickness vent piping. Provide furnace with automatic ignition. Furnace must employ metered combustion air with enclosed draft diverter (no open flue collar). Provide [aluminized steel][or][stainless steel] furnace heat exchangers. Provide furnace with 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. Provide furnace with a [space][discharge air] thermostat which controls the unit's burner.

2.3.6 Infrared Heaters

****

NOTE: 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 6.4 liters per second per 1000 Watt hour 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.

****

Furnish heaters conforming to the requirements of ANSI Z83.19/CSA 2.35 and [vented][or][unvented] type[as indicated].[Vented heaters must be vented to the outside atmosphere.] Heater style must be [surface combustion][tubular] type[as indicated]. Reflector shape must be[parabolic][horizontal][or][standard][as indicated]. Provide heaters with space thermostats which control the unit's burner. Cover thermostats located in the direct radiation pattern with a metal shield.

2.4 THERMOSTATS

****

NOTE: Single stage thermostats are used to control a unit at 100 percent capacity only. Two stage thermostats can be used to stage a unit's capacity to either 50 or 100 percent. Two stage thermostats are only applicable for unit heaters and duct furnaces.

****

Provide adjustable electric or electronic thermostats. Include control wiring required to complete the space temperature control system. Provide thermostats that have a 2 degree C 3 degree F differential and a set point range of [4 to 24 degree C 40 to 75 degrees F][minus 18 to plus 38 degrees C 0 to 100 degrees F][27 to 49 degrees C 80 to 120 degrees F]. Provide [single][two] stage thermostats.

2.5 VENT PIPING

Provide vent piping conforming 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

Provide electric automatic vent dampers conforming to the requirements of ANSI Z21.66/CGA 6.14 and provide in the vents of heaters [except unvented infrared heaters] using indoor air for combustion air.

2.7 INSULATION

Provide insulation for piping and equipment and application 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, must 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 FLAMMABLE & COMBUSTIBLE 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. Perform vent damper installation in conformance to ANSI Z21.66/CGA 6.14. Extend vent pipes, where not connected to a masonry chimney conforming to NFPA 211, through the roof or an outside wall and terminate, in compliance with NFPA 54. Provide vents passing through waterproof membranes 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 20 FACILITY GAS PIPING.

3.3 TRAINING

****

NOTE: Insert the number of hours to train personnel for equipment operations. Consult equipment manufacturer for recommended time.

****

Conduct a training course for the maintenance and operating staff. The training period of [_____] hours normal working time must start after the system is functionally complete but before the final acceptance tests. Give the Contracting Officer at least two weeks advance notice of such training. 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. 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. 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. Indicate the final position of controls.

-- End of Section --