
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.

UNDERWRITERS LABORATORIES (UL)

UL 1096 (1986; 4th Ed; Rev thru Jan 30, 1988)
Electric Central Air Heating Equipment

1.2 GENERAL REQUIREMENTS

NOTE: If Section 16003S GENERAL ELECTRICAL PROVISIONS is not included in the project specification, applicable requirements therefrom should be inserted and the following paragraph deleted.

Section 16003S GENERAL ELECTRICAL PROVISIONS applies to work specified in this section.

Fabrication Drawings shall be submitted for duct heaters consisting of fabrication and assembly details to be performed in the factory.

Equipment and Performance Data shall be submitted for duct heaters including use life, system functional flows, safety features, and mechanical automated details.

Manufacturer's Instructions shall be submitted for duct heaters including special provisions required to install equipment components and system packages. Special notices shall detail impedances, hazards and safety precautions.

1.3 SUBMITTALS

NOTE: Review Submittal Description (SD) definitions in Section 01330 SUBMITTAL PROCEDURES and edit the following list to reflect only the submittals required for the project. Submittals should be kept 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, a code of up to three characters within the submittal tags may be used 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.

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 will review the submittal for the Government.] Submit the following in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Fabrication Drawings shall be submitted for duct heaters in accordance with paragraph entitled, "General Requirements," of this section.

Installation drawings shall be submitted for duct heaters in accordance with the paragraph entitled, "Installation," of this section.

SD-03 Product Data

Equipment and Performance Data shall be submitted for duct heaters in accordance with paragraph entitled, "General Requirements," of this section.

Manufacturer's catalog data shall be submitted for the following items:

- Duct Heaters
- Heating Elements
- Enclosures
- Controls

SD-08 Manufacturer's Instructions

Manufacturer's Instructions shall be submitted for duct heaters in accordance with paragraph entitled, "General Requirements," of this section.

PART 2 PRODUCTS

2.1 PRODUCT STANDARDS

Duct heaters shall conform to the requirements of UL 1096.

2.2 DESCRIPTION

Duct heaters shall have the capacity indicated, plus or minus 5 percent.

Duct heaters shall be factory prewired, ready for field terminal connections.

[Capacity shall be based on [_____] [16] degrees C [60] degrees F entering air and [_____] [30] degrees C [85]-degree F discharge air at [_____] [8.5] cubic meter [300] cubic feet per minute.]

2.3 HEATING ELEMENTS AND ENCLOSURES

Heating elements shall be installed with a framework complete with terminal, and junction boxes shall be constructed of mill-aluminized or galvanized carbon steel. A magnetic contactor shall be provided in a separate enclosure insulated from the duct at duct heater location or at a separate, remote location.

Gasketing shall be 1.6 millimeter 1/16-inch thick non-asbestos woven-cloth tape.

Flange depth shall be suitable for duct insulation provided. Terminal junction box shall be insulated to prevent elevated temperatures.

[Sheathed heating-element construction shall consist of a resistance wire insulated by highly compacted refractory insulation protected by a sealed metallic-finned sheath. Component materials shall be as follows:

Resistance wire shall be a helix-wound alloy approximately 80 percent nickel and 20 percent chromium.

Refractory insulation shall be magnesium oxide. Element shall be subjected to a dielectric test of twice the element rated voltage plus 1,000 volts applied between terminal and sheath for a period of 1 minute.

Sheathing shall consist of aluminum fins cast around an internal steel sheath containing refractory insulation and resistance wire or carbon-steel fins permanently attached to a tubular carbon-steel or corrosion-resistant steel sheath containing refractory insulation and resistance wire and with all external surfaces porcelainized.

Wattage density shall not exceed 90 watts per 25 linear millimeter linear inch of heated element length or not greater than 22 watts per 645 square millimeter square inch.]

**NOTE: Do not specify an open heating element when
it will be exposed to salt air.**

[Open heating-element construction shall consist of a helix-wound resistance wire alloy approximately 80 percent nickel and 20 percent chromium. Wattage density shall not exceed 50 watts per 25 linear millimeter linear inch of heated element. Element support shall minimize abrasion and sagging. Safety screens shall be provided on both upstream and downstream sides of heater elements.

Dummy elements shall be provided or other provisions similar to open area perforated screens shall be included if required to uniformly distribute airflow across heater face.]

2.4 CONTROLS

Units shall be furnished with integral overheat cutouts for primary and secondary protection. Automatic-reset primary cutout shall be the disk type and shall be suitable for 277-volt, 60-hertz service.

[Disk type manual-reset secondary cutouts shall be provided and shall be wired in series with each circuit.]

[Bulb type manual-reset secondary cutouts shall be provided and shall actuate integral magnetic backup contactors.]

[Bulb type manual-reset secondary cutouts shall be provided and shall deenergize each circuit directly.]

Indicating light(s) shall be provided to indicate:

Heater on

Each circuit on

[Pilot switch shall be locally provided to cut off heater through integral magnetic contactors.]

Heater assemblies rated at 45 amperes and larger shall have the heater assembly subdivided and fused. Each subdivided 45-ampere heater load section shall be fused. In circuits of less than 45 amperes, appropriate sections shall be fused.

Magnetic contactors other than integral overheat-cutout associated units shall be remotely located as indicated and shall be UL-approved.

[Step controllers for sequencing heater loads shall be constructed of UL-approved components and shall include the following:

Delay to prevent line surge when energizing loads

Individual fusing of each step

Intercomponent wiring to terminals for field connection

Cabinet]

[Wall-mounted thermostats shall be [single-] [two-] [three-] stage type.]

[Thermostats shall be complete with thermometer, mechanical high-limit stop, calibrated operator, and an adjustable heater to effect anticipation and to prevent override of space temperature. Range shall be between 13 and 40 degrees C 55 and 105 degrees F. Differential shall not exceed 1 degrees C 1.5 degrees F. Thermostat shall be rated for operation at 24 volts, 60 hertz. Any necessary transformers, wiring, and devices to meet this requirement shall be provided. Cases shall be finished in brushed or satin chrome.]

NOTE: Supplement the following paragraph if
solid-state step controller is selected.

[Power to unit shall be controlled by a UL-listed solid-state silicon-controlled rectifier (SCR) system such that voltage is continuously impressed and varied in minute increments over a range of zero to rated voltage or to 105 percent of rated voltage maximum.]

PART 3 EXECUTION

3.1 INSTALLATION

Duct heaters shall be installed in accordance with the manufacturer's instructions and shall be located to permit access to the heater after installation.

3.2 FIELD TESTING

Duct heaters shall be demonstrated to operate satisfactorily in the presence of the Contracting Officer.

An operational test shall be conducted for a minimum of 6 hours.

Duct heaters shall be cycled five times, from start to operating thermal conditions to off, to verify adequacy of construction, system controls, and component performance.

-- End of Section --