





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.

UNDERWRITERS LABORATORIES (UL)

UL 1996

(2009; Reprint Dec 2009) Electric Duct Heaters

## 1.2 GENERAL REQUIREMENTS

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NOTE: If Section 26 00 00.00 20 BASIC ELECTRICAL MATERIALS AND METHODS is not included in the project specification, applicable requirements therefrom should be inserted and the following paragraph deleted.

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Section 26 00 00.00 20 BASIC ELECTRICAL MATERIALS AND METHODS applies to work specified in this section.

Submit [fabrication drawings](#) for duct heaters consisting of fabrication and assembly details to be performed in the factory.

Submit [equipment and performance data](#) for duct heaters including use life, system functional flows, safety features, and mechanical automated details.

Submit [manufacturer's instructions](#) for duct heaters including [installation drawings](#) showing any special provisions required to install equipment components and system packages. Clearly note impedances, hazards and safety precautions.

## 1.3 SUBMITTALS

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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. 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.

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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 01 33 00 SUBMITTAL PROCEDURES:

#### SD-02 Shop Drawings

Fabrication Drawings

Installation Drawings

#### SD-03 Product Data

Equipment and Performance Data

Duct Heaters

Heating Elements

Enclosures

Controls

#### SD-08 Manufacturer's Instructions

Manufacturer's Instructions

### PART 2 PRODUCTS

#### 2.1 PRODUCT STANDARDS

Provide duct heaters conforming to the requirements of UL 1996.

#### 2.2 DESCRIPTION

Provide duct heaters with the capacity indicated, plus or minus 5 percent. Ensure duct heaters are factory prewired, ready for field terminal connections.

[ Base capacity 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

Install heating elements with a framework complete with terminal, and construct junction boxes of mill-aluminized or galvanized carbon steel. Provide with a magnetic contactor in a separate enclosure insulated from the duct at duct heater location or at a separate, remote location.

Ensure all gasketing is 1.6 millimeter 1/16-inch thick non-asbestos woven-cloth tape, with flange depth suitable for duct insulation provided. Insulate terminal junction box to prevent elevated temperatures.

[ Provide sheathed heating-element consisting of a resistance wire insulated by highly compacted refractory insulation protected by a sealed metallic-finned sheath. Provide component materials as follows:

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

Refractory insulation - magnesium oxide. Subject element 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 - 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 is not to 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.

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NOTE: Do not specify an open heating element when  
it will be exposed to salt air.  
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[ Provide open heating-element consisting of a helix-wound resistance wire alloy approximately 80 percent nickel and 20 percent chromium. Wattage density is not to exceed 50 watts per 25 linear millimeter linear inch of heated element. Ensure element support minimizes abrasion and sagging. Provide safety screens on both upstream and downstream sides of heater elements.

Provide dummy elements or include other provisions similar to open area perforated screens if required to uniformly distribute airflow across heater face.

### ] 2.4 CONTROLS

Provide units with integral overheat cutouts for primary and secondary protection, with automatic-reset primary cutout of the disk type and suitable for 277-volt, 60-hertz service.

[ Provide disk type manual-reset secondary cutouts wired in series with each circuit.

] [Provide bulb type manual-reset secondary cutouts which actuate integral magnetic backup contactors.

] [Provide bulb type manual-reset secondary cutouts which deenergize each circuit directly.

] Provide indicating light(s) to show:

a. Heater on

b. Each circuit on

[ Locally provide pilot switch to cut off heater through integral magnetic contactors.

] For heater assemblies rated at 45 amperes and larger, provide the heater assembly subdivided and fused. Fuse each subdivided 45-ampere heater load section. In circuits of less than 45 amperes, fuse appropriate sections.

Provide UL-approved magnetic contactors, (other than integral overheat-cutout associated units), remotely located as indicated.

[ Provide step controllers for sequencing heater loads of UL-approved components and include the following:

a. Delay to prevent line surge when energizing loads

b. Individual fusing of each step

c. Intercomponent wiring to terminals for field connection cabinet

] [Provide [single-] [two-] [three-] stage type wall mounted thermostats.

] [Provide thermostats complete with thermometer, mechanical high-limit stop, calibrated operator, and an adjustable heater to effect anticipation and to prevent override of space temperature. Ensure range is between 13 and 40 degrees C 55 and 105 degrees F, with differential not to exceed 1 degrees C 1.5 degrees F, rated for operation at 24 volts, 60 hertz. Provide any necessary transformers, wiring, and devices to meet this requirement. Finish cases in brushed or satin chrome.

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

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[ Provide control of power to unit 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

Install duct heaters in accordance with the manufacturer's instructions and

locate duct heaters to permit access to the heater after installation.

### 3.2 FIELD TESTING

Demonstrate that duct heaters operate satisfactorily in the presence of the Contracting Officer.

Conduct an operational test for a minimum of [6] [\_\_\_\_\_] hours.

Cycle duct heaters five times, from start to operating thermal conditions to off, to verify adequacy of construction, system controls, and component performance.

-- End of Section --