YORK®	**ELECTRIC HEATERS FOR AIR HANDLING UNITS**	
APPLICATION GUIDE	Supersedes: Nothing	Form 100.00-AG4 (604)

ELECTRIC HEATERS

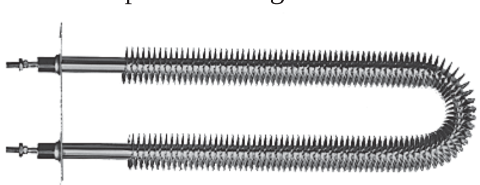
Electric heaters are used in air handling units as either a primary or secondary source of heating. The heating elements are in contact with the airstream.

There are two types of electric heaters used in air handling equipment, open element and finned tubular.

Open element electric heaters utilize high resistance Nichrome wire (80% nickel, 20% chromium) to provide heat to the airstream. Nichrome wire has a high maximum operating temperature, long life and a high resistance to corrosion. When an electrical current is applied to the wire, it gives off heat. The wire is connected to the control panel which regulates the amount of heat provided by the electric heater and fills the tunnel of the air handling unit. Open element heaters have several advantages over finned tube heaters. Open element heaters can produce a higher amount of heat in a frame size than a similarly sized finned tubular heater. Finned tubular heaters fill more of the tunnel; therefore, creating a higher pressure drop than an open element heater. Another advantage of the open element heater is that the heat generated enters the airstream directly. The heat generated by the finned tubular heater has to travel through the fins before entering the airstream.

Open element

Finned tubular heaters also have Nichrome elements, but the elements are precisely centered in a stainless steel tube. The tube is then filled with magnesium oxide. To promote heat transfer, stainless steel fins are helically wound to the stainless steel tube. The fins are wound in a continuous manner to pull heat away from possible “hot spots” on the element in stratified airflow. Finned tubular heaters provide added safety by eliminating the possibility of electrical shock in case of an accidental contact with an exposed heating element.



Finned tubular

While there are advantages to each type of heating element, the higher cost to provide the finned tubular elements may restrict its use.

APPLYING ELECTRIC HEATERS

Engineers must consider several points when selecting an electric heater in air handling units. The face velocity of the air passing over the heating elements must not be less than a minimum specified value when the heater is energized. There are three (3) factors that are considered when an appropriate face velocity is calculated. Those three (3) factors are kW, frame size and heater element type. Sufficient airflow for the required kW in a given frame prevents an overheating condition. Heat must be dissipated away from the heating elements. Finned tubular element heaters require more airflow due to a tendency for the finned tubes to dissipate heat more slowly.

The following calculation is used for determining face velocity:

Face velocity = CFM/Face Area

Another consideration is the amount of current draw the electric heater will place on the incoming power source. The National Electric Code (NEC) requires that electric heaters be divided into individual circuits drawing 48 amps or less. The amp draw can be calculated using the kW and voltage of the heater.

Amps = (kW x 1000)/(Vac x 1.732)

Attention must also be paid to the geographical area in which the AHU will be located. Certain parts of the country or world may have electricity costs that would either support the use of an electric heater or discourage the use. Local power companies should be consulted if the information is not presented at the time of providing a bid to a customer.

ELECTRIC HEAT CONTROLS

As is the case with most AHU applications, controls are critical. Electric heaters provide constant heat when power is applied to the elements; therefore, a control panel is always supplied. Electric heaters in AHUs can be provided with three different types of control interfaces. Individual stages, a step controller, or a silicone controlled rectifier (SCR) controller integrated into the control panel. The type of control selected depends upon the application and the amount of control required.

Individual staging is the most common and inexpensive. It requires multiple contact closures from a thermostat or temperature controller. This control interface is the least precise of the three.

A step controller gradually increases or decreases the amount of heat in specific increments or steps. The entire face of the electric heater is energized when powered up. A step controller operates contactors that control the heating elements. A step energizes a holding coil of a contactor and turns on a step of heat. While a step controller works in “stages”, a proportional input signal operates the heater. A proportional signal that may range from 0 to 10 Vdc will utilize a microprocessor that steps on 10% of the heating load at 1 Vdc and the corresponding amount of contactors. As the signal is increased or decreased, contactors are turned on or off depending on the proportional input signal.

SCRs provide very precise heat control without the use of individual steps. The entire face of the electric heater is energized in much smaller, more precise, increments than a step controller. The heater can be controlled from 0 to 100% output. Precise control is achieved over the entire range of the electric heater. The precise control is an asset at low heating requirements when a step controller would cycle creating undesirable swings in temperature.

Another advantage of using an SCR is its silent operation. This becomes very important when the heater is contained in an AHU that will supply air to sound sensitive spaces. SCRs will also maintain a required leaving air temperature that a step controller could not hold exactly.

Step controllers and SCRs modulate the heaters using analog signals, such as 0-10 Vdc, 4-20 mA, 135 ohm and 2200 ohm from a temperature controller. The job specification for the electric heater will state which signal is required.

CONTACTORS

Just as there are different types of controls and control signals, there is also a variety of types of contactors. The two main types of contactors are magnetic and mercury.

Magnetic contactors are standard in the AHU industry. This type of contactor is noisy since the switching contacts are mechanical. A “clicking” noise can be heard during operation. The “clicking” noise is typically acceptable as the other components in an air handling unit create more noise than the magnetic contactors.

Mercury contactors use mercury, displaced by a magnetically operated solenoid to make a contact closure. Since a liquid is providing the switching, the contactors are extremely quiet. Due to fewer moving mechanical parts, this type of contactor lasts longer than a mechanical contactor. The downside of the mercury contactor is a much higher price when compared to the magnetic contactor.

Within both magnetic and mercury contactors are two-pole (de-energizing) and three-pole (disconnecting) contactors. De-energizing contactors are the standard in the AHU industry and disconnecting contactors are an upgrade.

CODES

As with most aspects of air handling equipment, electric heaters must adhere to industry standards. Organizations such as ETL and UL have labels that are placed on electric heaters to indicate that the heater meets specific code criteria. All electric heaters are UL recognized for zero clearance to combustible surfaces. The UL zero clearance requirement states that the electric heater can be as close as required to combustible materials without creating a fire hazard.

UL also has a requirement that a fan interlock device, for airflow verification, must be used for electric heaters in AHUs. The UL airflow interlock requirement states that an electric heater must have a method to shut down the electric heater in the event the AHU fan stops or the airflow is greatly reduced to prevent an overheat condition. There are several ways to shut down the electric heater. Electric heaters may either have a built-in differential pressure switch or a fan motor starter interlock to confirm adequate airflow across the heating elements.

APPLICATION AND ADVANTAGES OF ELECTRIC HEAT

Electric heat is applied most often in AHUs that are in northern, colder climates; where a back-up heater is needed or where other types of heat have a high first cost. While electric heat can consume large amounts of energy, the increasing cost of natural gas and oil is making electric heat a more viable primary heat source.

Electric heaters are easier to install than other types of heat sources. Only electrical connections are required, eliminating the need for field installation of piping, which can be both costly and time consuming.

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