



# Warren Technology

2050 West 73 Street, Hialeah, Florida 33016 • Telephone (305) 556-6933 • Fax (305) 557-6157  
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## PRIMARY INTEGRAL COMPONENTS - ACCESSORY OPTIONS UL LISTED ELECTRIC DUCT HEATERS

Pictures shown are representative only and may vary with requirements and availability.

### MAGNETIC CONTACTOR

Magnetic contactor (Option B0) are UL rated for 100,000 cycle operation and, as standard, are used to de-energize only the circuit. This opens the minimum number of power lines to interrupt the flow of current to the stage of the heater being controlled by that contactor. The number and amperage of the contactors will vary depending upon the KW and voltage. The oil ratings may be 24, 120, 208, 240, or 277 volts

Disconnecting magnetic contactors (Option B6) are so arranged as to break all ungrounded lines. These are standard on 120 volt and 277 volt. This option is necessary when local codes require that contactors break all ungrounded lines. This type of contactor must be used where a Remote Panel (RP) heater is specified.



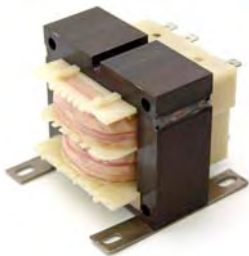
### MERCURY CONTACTOR

Mercury contactors (Option B3) are usually used where silent operation and/or frequent cycling is desired. The design of the contractor virtually eliminates contact noise and provides for long expectant life under heavy use. Mercury contactors can only be installed in the vertical position.

Disconnecting mercury contactors (Option B3/ B6) are also available and must be used when mercury contactors are specified with a Remote Panel (RP) heater.

### AIRFLOW SWITCH

The airflow (pressure) switch (Option C1) is a diaphragm type device that senses the air pressure across the heater surface closing the electrical switch and allowing the heater to be activated. This device assures airflow is present before allowing the heater to energize. The airflow switch is available for either positive or negative air pressure. The pressure differential is  $.05" \pm .02"$ . This device is position-sensitive and cannot be mounted in a flat horizontal position.



### TRANSFORMER

Control transformers are available mounted in the control panel for primary voltages of 120, 208, 240, 277 and 480 with secondary voltages of 24, 208, 24. A Class II transformer (Option D1) may be used only for 24-volt secondary voltage and only up to 3 steps. All transformers are priced based on a maximum of 30 AMPS per step. This transformer includes internal primary over-current protection. All other transformer requirements (Option D2) include external primary over-current protection. Secondary fusing for use in conjunction with D1 or D2 transformers is available (Option D3).

### POWER FUSING

UL and NEC require that heaters in excess of 48 AMPS be subdivided into branch circuits of 48 AMPS or less and be protected by fuses (Option F1). These are supplied by Warren Manufacturing. If circuit fusing on heaters of 48 AMPS or less is desired, price option F3. For fusing per step (less than 48 AMPS per step) price Option F2. The fewest number of fuse blocks required for the particular KW, AMPS, and Steps will be furnished. The over-current protection (fuses) must be sized for 125% of the circuit load.



### BACK-UP (SAFETY) CONTACTOR

Back-Up contactor (Option B5) is supplied as an addition to the primary controlling contactor or other device and is controlled only by the manual reset cutout. On an over-temperature condition, the back up is to be de-energized.



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## ACCESSORY OPTIONS



### FAN CONNECTION

A set of terminal connections (Option A1) is provided for external connection to the fan circuit. This option is available for line voltage control only. Internal connection can vary and must be specified as to desired method.

### THERMAL SAFETY DEVICES



A disc type automatic reset thermal safety cutout that de-energizes the heater element on overheating, and re-energizes the heater element after the temperature has lowered, is provided as standard equipment. The standard cutout temperature is 145°F.

A disc type manual reset thermal safety cutout (Option E1, 175° F.) can be provided as a secondary limit control in addition to the standard automatic reset. This device requires a reset button to be engaged to restore power to the heater element. The reset button may be located in the control panel door. A hinged control panel lid is supplied with this option. Also available is a remote manual reset (Option E5) which allows the device to be reset by use of a lock-out circuit utilizing a thermostat or remote switch to reset the limit.

A one-time manually replaceable secondary fuse link heat limit is provided as standard equipment. This device is installed in the line side of the heater element and has a standard cutout temperature of 300° F. This is replaceable without removal of the heater.

### DISCONNECT SWITCH

A door interlocking disconnect switch can be provided to prevent the control panel door from being opened until the power to the heater is disconnected. This switch can be either non-fused (Option J2) or fused (Option J1). A hinged control panel door is standard with this option.

A non-door-interlocking panel mount disconnect switch (Option J6) can be provided within the amperage limits listed in the pricing pages. This allows the power to be disconnected independent of the control panel door. A non-hinged control panel door is standard with this option. This disconnect switch can be used in connection with circuit fusing (Option F3) to provide a fused disconnect.



### PILOT LIGHTS



Indicator light may be installed on the side of the control panel to virtually show the heater operation mode. Pilot lights available are:

1. Control Circuit On (Option G1)
2. Each Step is On (Option G2)
3. Thermal Cutout is Open (Option G3)
4. Air Switch is Open (Option G4)

### SCR CONTROL

The SCR (Silicone Controlled Rectifier) control (Option L1) is used to provide continuous modulation from zero to the maximum and provides output from the heater in direct proportion to the temperature demand. It is available with either a wall mount thermostat or a duct mount thermostat. Temperature can be maintained to within  $\pm 1^\circ$  F of the set point. Back-up contactors (Option B5) and a 24-volt transformer (Option D1/D2) are required with the use of SCR controls. Units over 40 AMPS – Vernier type.



### TIME DELAY BETWEEN STEPS



To prevent all stages of an electric heater from being energized simultaneously, a time relay (Option C2-non-adjustable or Option CA – adjustable) may be employed. This relay will cause a predetermined delay between energizing of each additional stage after the previous stage has been energized.

### PILOT RELAY

A pilot relay (Option B2) can be provided where the VA load of the contactor coils exceeds the load capacity of the thermostat or the low voltage transformer. When provided, the pilot relay is controlled by a 24-volt control circuit which in turn activates the coils of the heater contactors.





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## ACCESSORY OPTIONS

### PROTECTIVE SCREEN

A protective screen (Option V6), that is installed on either the air inlet side or the air outlet side of the heater element, can be provided where it is possible for debris to be in the air stream of the duct and come in contact with the heater elements or for personal protection. The protective screen is standard on all heaters that are over 48" in either width or height.



### P.E. (PNEUMATIC-ELECTRIC) SWITCH

P.E. Switch (Option C5, C6, C7) is used to change a pneumatic air pressure signal to an electric signal for the control circuit. The thermostat regulates the air pressure signal to the P.E. Switch which in turn opens and closes regulating the electric signal to the coil of the contactor. A load-carrying P.E. (Option C7) can be provided on most heaters less than 15 AMPS per step, thus eliminating the need for a contactor.

### INSULATED CONTROL PANEL

To prevent possible condensation from forming in the heater control panel when the heater is installed in an air conditioning duct, an insulated control panel (Option Q1) is often specified.

This consists of insulating the outside of the control box closest to the duct to prevent metal contact between the control box and the duct, reducing or eliminating the condensation possibility.



### TRANSDUCER

A transducer (Option L3) is used when an SCR control system (Option L1) or electric step controller (Option K1) is required with a pneumatic control system. This device interfaces with the pneumatic system and converts the air pressure changes to the electrical signal needed for the SCR control. This option must be used when an SCR control system is being used in conjunction with a pneumatic control system.

### RECESSED TERMINAL BOX

A recessed terminal box (Option V4) is used when a restriction or obstruction may cause a lack of airflow across the electric heater surface. With this option, the distance between the control box and the heater element is increased as necessary to avoid the restriction. It is designed to allow the entire element to be exposed to the airflow.

The recessed depth can vary as required (1" Standard).





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## ACCESSORY OPTIONS

### STEP CONTROLLER

A step controller (Option K1) is available for multiple heating stages in a pre-determined sequence. The number of steps being energized will be controlled by a proportional thermostat available in either a wall mount or duct mount style. The first stage of the element on is the last stage off. A power failure causes the step controller to recycle from start.



### ROUND DUCT CONNECTION

The round duct connection (Option V7) accessory allows an easy method of installing an electric duct heater in a round sheet metal duct. The electric heater section comes factory installed in an adapter section with appropriately sized round pipe connections provided at the inlet and outlet for field connection.

### FAN INTERLOCK RELAY

A fan interlock relay (Option B7) is supplied that utilizes external voltage either from the load side of the fan starter or from the fan control voltage circuit to prevent the heater from operating unless the fan is energized. The interlock voltage must be specified when this option is ordered. This option is often used with continuous fan operation systems.



### FAN CONTROL RELAY

A fan control relay (Option B1) energizes the fan simultaneously with the first stage of the heater. It utilizes the heater control circuit to energize the relay, which closes the relay contacts to energize the fan. This option is used where intermittent fan operation is desired. Not available on units with SCR controls.



### CIRCUIT BREAKER

Circuit breakers (Option J3) may be supplied in place of power fusing for over-current protection. This device automatically trips to the disconnect (off) position in an over-current situation. After correcting the over-current situation it can be reset without requiring replacement.

### PILOT SWITCH

A pilot switch (Option C3, C4) consists of a toggle switch installed on the control panel, that is wired in the control circuit to prevent the energizing of a heater stage (C4), or the entire heater (C3), by de-energizing the control voltage to the contactors. The pilot switch cannot be used as the disconnect switch as required by NEC.

