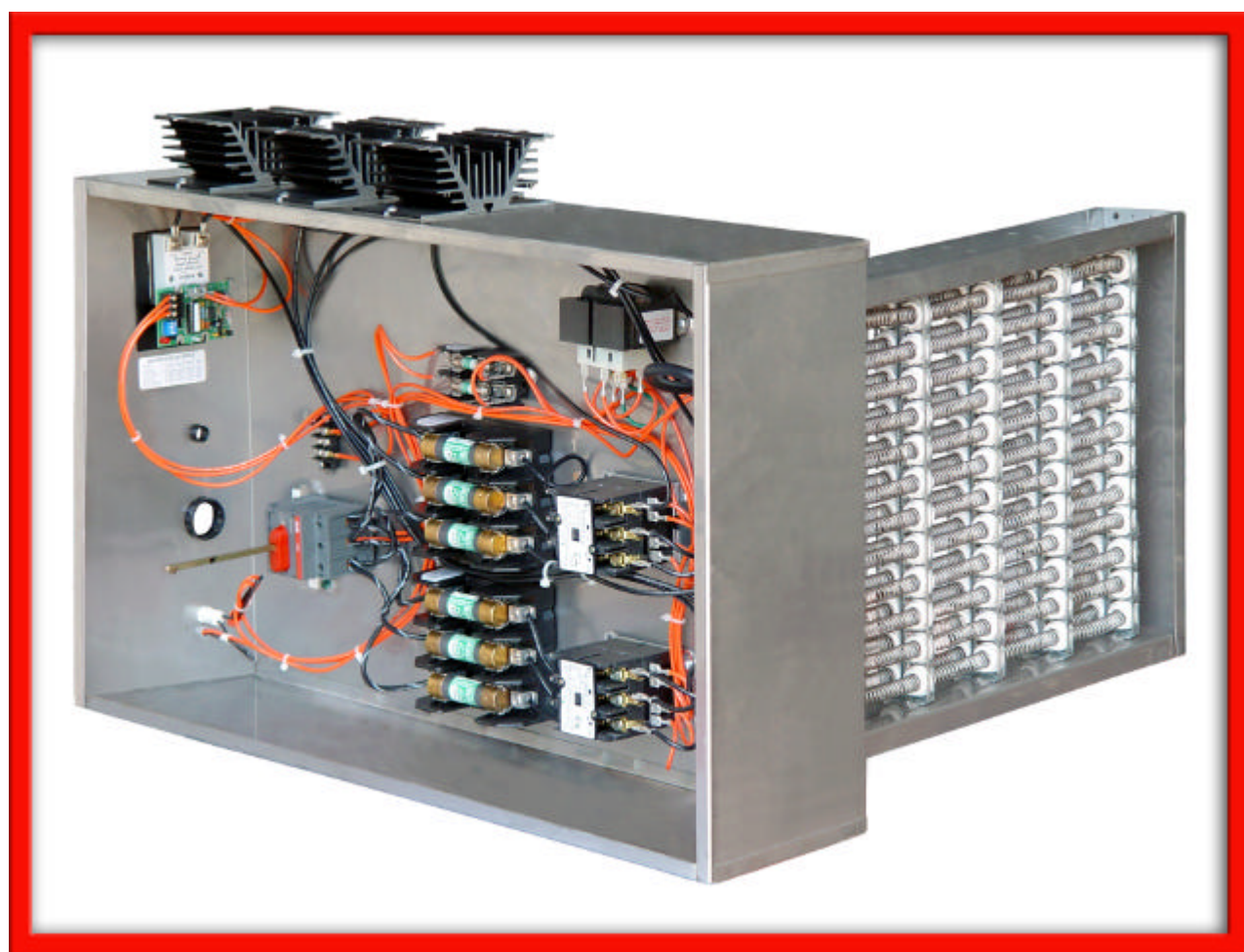


# ELECTRIC DUCT HEATERS



**UL & CSA LISTED ELECTRIC DUCT HEATERS**  
**STOCK- LINE SERIES · QUICKSILVER SERIES · CUSTOM BUILT SERIES**



**WARREN** TECHNOLOGY, INC

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## **PRODUCT LINE**

- Unitary Residential & Commercial Heaters
- Custom-Built (CBK) Duct Heaters
- Stock-Line (SL) Duct Heaters
- Quicksilver (QS) Duct Heaters
- Remote Panel Duct Heaters
- Bottom Mount Duct Heaters
- Flanged Mount Duct Heaters
- Discharge Mount Duct Heaters
- Round Duct Heaters



# Warren Technology

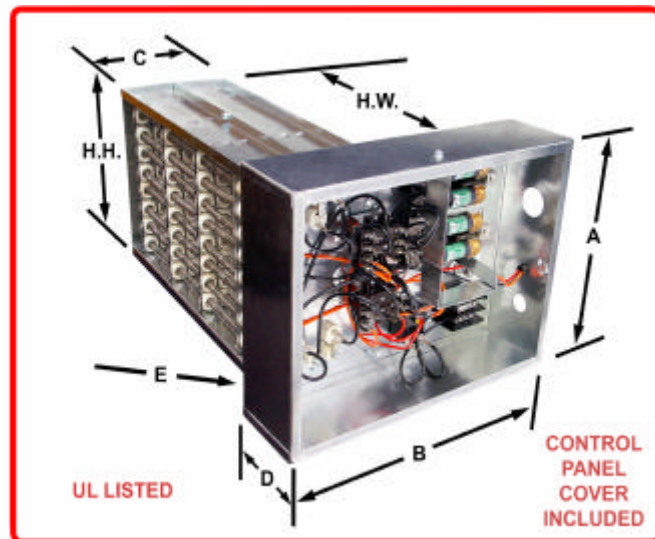
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# WARREN TECHNOLOGY STOCK-LINE ELECTRIC DUCT HEATERS

## FITS MOST DUCT SIZES



Stock-Line slip-in type duct heaters are designed to meet most residential and light commercial requirements for use in forced air duct systems. They may be used as the primary source of heat or as supplementary or stand-by heat to Heat Pump, Gas or Oil Fired Systems. Several units may be used in a large duct or systems with branch ducts for zoning or separate thermostat for zoning or separate thermostat control. The heaters are designed to operate in a variety of duct sizes.

Stock-Line units are UL listed and meet the requirements of the National Electric Code (NEC). The units have multi-voltage ratings, high grade nickel chrome elements, galvanized steel control panel and frame, and Warren's exclusive element support system. Built-in components include primary and secondary limit protection, magnetic disconnecting contactors (24 volt control), a fan relay, and circuit fusing where required by UL and NEC.

Custom built Model CBK electric duct heaters are available for units with accessories not furnished on Stock-Line electric duct heaters. (Consult representative for price and delivery information).

MODEL	KW	VOLTS	PHASE	STEPS	AMPS	DUCT SIZE LIMITS				DIMENSIONS					H-W	H-H	SHIP WEIGHT
						WIDTH		HEIGHT		A	B	C	D	E			
						MIN.	MAX.	MIN.	MAX.								
SL5A	4.8	240	1	1	20.0	8	16	8	12	9	11	3	4	1	7.5	7.25	10#
	4.4	230			19.1												
	4.0	220			18.3												
	3.6	208			17.3												
SL5T	5.0	240	3	1	12.1	8	16	8	12	9	13	3	4	1	7.5	7.25	11#
	4.6	230			11.5												
	4.1	220			10.9												
	3.7	208			10.4												
SL5TX	5.0	480	3	1	6.0	8	16	8	12	9	13	3	4	1	7.5	7.25	12#
SL10A	9.6	240	1	1	40.0	12	20	8	14	9	12	3	4	1	11.5	7.25	12#
	8.8	230			38.2												
	8.0	220			36.6												
	7.2	208			34.6												
SL10B	9.6	240	1	1	40.0	10	18	10	16	11	12	3	4	1	9.5	9.25	13#
	8.8	230			38.2												
	8.0	220			36.6												
	7.2	208			34.6												
SL15A*	14.4	240	1	2	60.0	18	24	8	12	9	19	3	4	1	17.5	7.25	20#
	13.2	230			57.5												
	12.0	220			55.0												
	10.0	208			51.9												
SL15B*	14.4	240	1	2	60.0	15	22	10	14	11	18	3	4	1	14.5	9.25	20#
	13.2	230			57.5												
	12.0	220			55.0												
	10.0	208			51.9												
SL20A*	19.2	240	1	2	80.0	16	22	10	14	11	20	6	4	1	15.5	9.25	25#
	17.6	230			76.6												
	16.1	220			73.3												
	14.4	208			69.2												
SL10T	9.9	240	3	1	23.9	12	20	8	14	9	12	3	4	1	11.5	7.25	12#
	9.0	230			22.7												
	8.3	220			21.9												
	7.4	208			20.7												
SL10TX	10.0	480	3	1	12.0	12	20	8	14	9	13	3	4	1	11.5	7.25	13#
SL15T	15.0	240	3	2	36.0	15	22	10	14	11	15	6	4	1	14.5	9.25	23#
	13.6	230			34.0												
	12.6	220			33.0												
	11.2	208			31.0												
SL15TX	15.0	480	3	2	18.1	15	22	10	14	11	14	6	4	1	14.5	9.25	22#
SL20T	19.8	240	3	2	47.7	16	22	11	14	12	14	6	4	1	15.5	9.25	22#
	18.0	230			45.3												
	16.6	220			43.7												
	14.8	208			41.3												
SL20TX	20.0	480	3	2	24.1	16	22	11	14	12	15	6	4	1	15.5	9.25	23#

\*DENOTES UNITS WITH CIRCUIT FUSING.

## STOCK-LINE ACCESSORY LIST

### PART NO. SLTR ( TRANSFORMER KIT)

The STOCK-LINE Transformer Kit (P / N SLTR) comes complete with all the necessary parts (transformer, wire leads, screws, terminals, etc.) and instructions for external mounting.

### PART NO. SLAS (AIR PRESSURE SWITCH KIT)

The STOCK-LINE Air Pressure Switch Kit (P / N SLAS) comes complete with all the necessary parts (air pressure switch, wire leads, screws, terminals, etc.) and instructions for external mounting.



**CAUTION: In some installations provisions must be made to allow for adequate mixing of by-pass air and heater air to prevent stratification.**



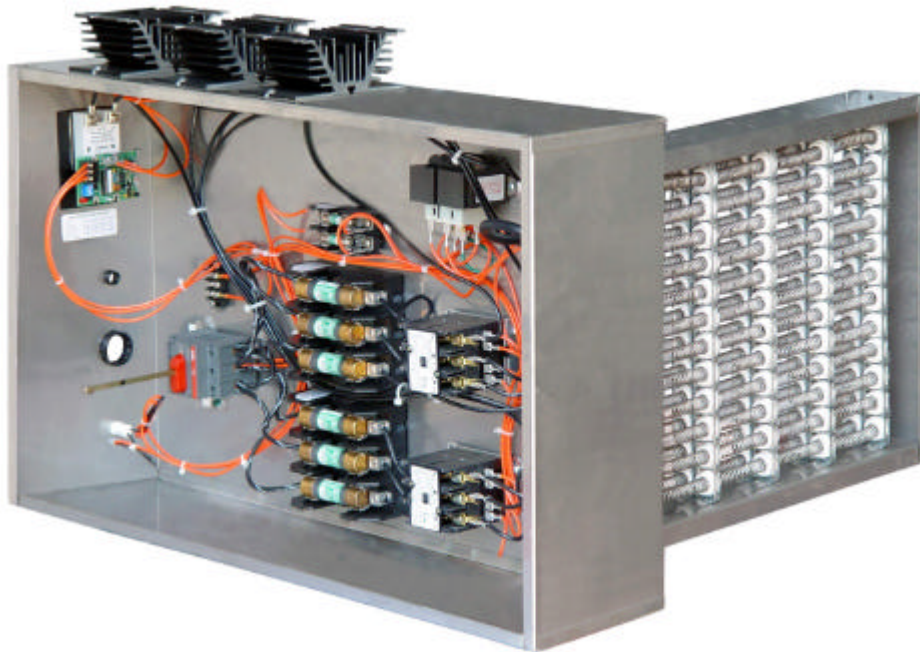
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### WARREN MODULAR ELECTRIC DUCT HEATERS CUSTOM BUILT MODELS



#### MODEL CBK INTEGRAL PANEL SLIP-IN MOUNT

- The Warren Modular Duct Heater offers the most modern engineering design, with maximum versatility and dependability.
- Elements are computer selected by the calculated wire temperature method to insure that exact electrical and heat characteristics are achieved.
- The element support ceramics are held by the unique element support rack permitting them to expand without cracking or breaking.
- The computer selected elements always utilize every necessary ceramic element support insuring that the elements evenly fill the open area of every duct.
- Virtually unlimited KW capacities and element size combinations insure that any requirements can be met.
- Multiple airflow positions are available assuring maximum position flexibility.
- Heaters for all voltages can be provided.
- Heaters are U.L. listed zero clearance and meet all applicable requirements of The National Electric Code (N.E.C.).
- Heater frames and boxes are constructed of 20 gauge or heavier galvanized steel.
- A hinged control panel cover for all units with fuses, door disconnects, or manual limits is standard.
- Disconnecting magnetic contactors are standard on all heaters.
- Heaters are available as Slip-In or Flanged Mount.
- Factory pre-wiring of accessory components eliminates costly field installation.
- A specific wiring diagram is furnished for every heater regardless of the accessories.
- A broad range of control options and accessories is offered to meet all needs and allows true customizing of heater requirements.
- Completely serviceable without removal from the installation.





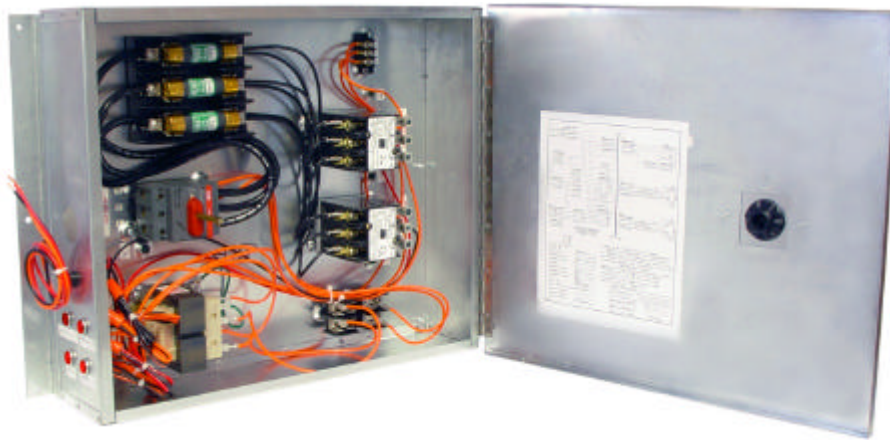
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## CUSTOM BUILT MODELS

### REMOTE PANEL (V1)

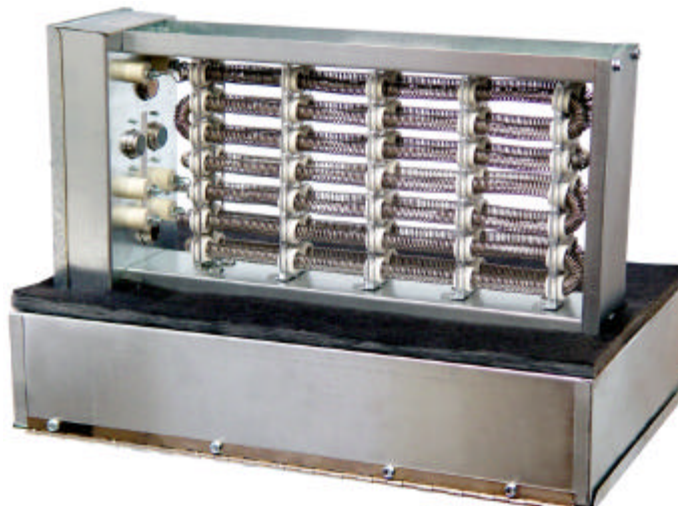
- Control Section can be mounted in any convenient location.
- Connections between Control Panel and Heater section are easily made through the use of factory installed terminals.
- Heater Section available as Slip-In or Flanged Mount.
- All construction features of the Custom Built Heaters are incorporated in the Remote Panel Heater.
- Disconnecting contactors meet UL requirements for remote location.
- Control Panel components are completely factory wired and only the connections made between the panel and the heater need to be field connected.
- All accessories available for Custom Built Heaters are available for Remote Panel Heaters.



---

### BOTTOM MOUNT (V8)

- UL Listed as Bottom Mount Heater.
- Controls are accessible without the need to remove the heater.
- Factory pre-wiring of accessory components eliminates costly field installation.
- Provides maximum ease of serviceability in limited installation space.
- All construction features of the Custom Built Heater are incorporated in the Bottom Mount Heater.



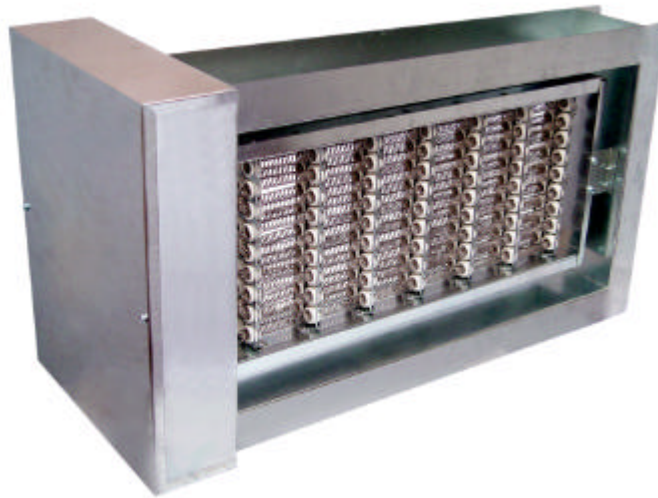


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### FLANGED MOUNT (V2)

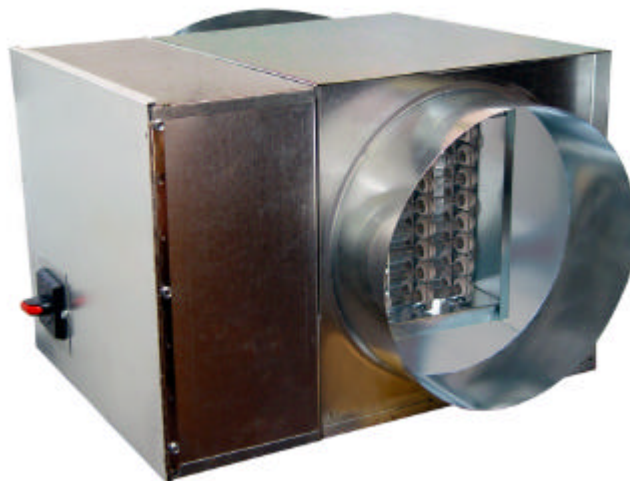
- Flanged Mount provides maximum duct rigidity.
- Standard 1" flange matches standard SMACNA duct flange.
- Heater flange and boxes are constructed of 20 gauge or heavier galvanized steel.
- Design allows virtually unlimited duct size match-ups.
- Deeper flange depth available where required.
- With required information regarding exact blower configuration, and with proper air baffle, flange mount heaters can be close-coupled to blower units.



---

### ROUND DUCT (V7)

- 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.



# NEMA WEATHER PROTECTED CONSTRUCTION



## N4 Accessory Code

NEMA enclosures for duct heaters and remote panels are available in a corrosion-resistant stainless steel or powder coated construction. They are designed for indoor and outdoor use, providing protection against windblown dust and rain. These enclosures are hinged with fully insulated covers that include pressure latches on all sides.

\* The rear of the enclosure includes dense foam insulation but it is the responsibility of the installing contractor to completely seal the duct penetration and the back of the enclosure where it meets the duct work.



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## HEATER DESIGN FEATURES

### UNIQUE ELEMENT DESIGN

Warren Technology's design criterion for heating element selection is based on actual element operating temperature.

Warren selects all elements by its exclusive "Calculated Wire Temperature Method" a method which insures that elements in heaters operate within the designed electrical and temperature requirements, and do not exceed the melting point of the alloy **even in still free air**.

The system allows Warren to determine the exact operating temperature of the heater elements in specific condition.

The elements are designed to operate below the maximum allowable temperature recommended by the element alloys manufacturer under the worst possible condition. This process eliminates most problems associated with hot spots in heaters caused by poor air distribution.

This method of design allows Warren's Technology to predict operating temperatures and life spans of any given element in our duct heater product line and has resulted in a zero failure rate on units installed in the field over the past 10 years.

### COMPUTERIZED SELECTION

A Computer Selection Program developed after years of research insures that Warren Technology's heater can meet an infinite number of size and voltage requirements. Utilizing a computer insures that every heater is going to perform consistently. Warren can tell exactly how the element is going to operate and how long it can be expected to last under specific requirements. Computer selection of component parts permits complete compatibility utilizing a manufacturing process where all duct heaters are produced from standard components incorporated in an exclusive modular design. This computer selection method is applied on all three basic product line categories, including Custom Built (CBK), Stock-Line (SL), and Quick Silver (QS) electric duct heaters.

### CERAMIC SUPPORT SYSTEM

Warren Technology utilizes an element support system, which permits the ceramic element supports to expand and contract freely without cracking or breaking. The heavy support frame completely surrounds the individual ceramic insulators while allowing the insulators to "float" freely, eliminating any binding. The modular concept lends itself to selection of pre-determined distances between the exclusive support frames thus assuring optimum element support.

### HEATER FRAME

Warren Technology employs the most modern technology available in the industry to construct the heater frames and boxes. Predetermined optimum element support spacing allows the modular concept to offer the choice of virtually any element rack size combination, and yet utilize the cost savings of volume production. All frames and boxes are constructed of 20 gauges, or heavier, hot dipped galvanized steel. The frame is integrally tied to the control box providing solid one-piece construction for ease of installation. Additionally, this construction allows almost any location relationship between the element rack and control box giving unlimited sizing flexibility.

### PERMANENT ELECTRONIC FILE

A permanent electronic file is made for each control panel. The electronic file is retained as a future reference. Having this record on file allows Warren Technology to produce identical heaters at a later date, offer precise engineering assistance to the installing contractor or service personnel should it be required, or supply replacement parts identical to those originally furnished if necessary. This is a feature offered exclusively by Warren.



## ENGINEERING INFORMATION

### UL AND NEC REQUIREMENTS

The information listed is offered as a guide for electric duct heater requirements. It is based on the National Electric Code (NEC) and Underwriters Laboratory (UL) Space Heating Standard No. 1096. Although this is intended to assure that these heaters are manufactured to meet NEC and UL requirements, local electrical codes should be considered for compliance.

**Over-temperature Protection** - UL and NEC requires the manufacturer to provide two types of over-temperature protection. Warren supplies as standard a disc type automatic reset limit, which de-energizes the heater in the event of overheating. A secondary limit, consisting of a replaceable fuse link is provided, which operates at a higher temperature and de-energizes the heater in case of failure of the primary limit.

**Over -current Protection** - UL and NEC require that a heater in excess of 48 AMPS be subdivided into circuit of less than 48 AMPS each and built-in fusing be provided by the heater manufacturer. The over-current device (fuse or circuit breaker) must be rated for 125% of the circuit load and limited to 60 AMPS maximum. UL requires the over-current protective devices be supplied by the heater manufacturer.

**Loss of Airflow Protection** - UL and NEC require that a method be provided to prevent the duct heater element from being energized unless the fan circuit is energized and airflow is present. Warren provides a choice of 4 integral methods to meet this requirement: Fan Connection, Fan Control Relay, Fan Interlock Relay and Air Pressure Switch.

**Transformer Protection** - Transformers are required for heater operation unless an external control voltage source is available and where the heater power voltage is different from the control voltage. UL requires transformers to have primary over- current protection. The Class II transformer meets this requirement with built-in protection while all other non-Class II transformers supplied are primary fused externally. Secondary transformer fusing is available as an option to protect the control circuit but is not required by UL.

**Equipment Grounding** - UL requires a grounding lug be installed by the manufacturer for field wiring connection. All Warren heater control panels contain a UL approved grounding lug.

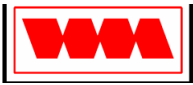
**Disconnect Location** - NEC requires an equipment disconnect switch be installed at or within sight of the heater. Warren offers factory-installed disconnect switches (or they may be field supplied to comply with this requirement).

**Contactors** - UL requires that the heater manufacturer supply the contactors as a built-in integral component of the heater.

## INSTALLATION INFORMATION

Good installation practice dictates certain guidelines be followed. Although the guidelines listed are general recommendations, Warren has the unique ability to custom design heaters to specifications involving unusual applications. Consult the factory for deviations to usual installation practices.

- Always consult local codes for compliance.
- Follow SMACNA guides and recommendations.
- Install heaters with the airflow in the proper direction as indicated by the arrow.
- Make electrical connections per UL and NEC.
- The heater should be installed 4ft. from air handler unless designed for internal mount or close coupling.
- Provide minimum 4ft. clearance from elbows, transitions, extractors, or similar turbulence producing devices.
- Reinforce duct where necessary to support the weight of the heater and prevent sagging.
- Allow sufficient clearance for servicing and removal if necessary.
- Units greater than 50KW should be controlled by a system with a recycling feature that will not allow all steps to be energized simultaneously. The absence of such a device causes severe damage to the equipment.
- The use of discharge air sensing devices to control this heating unit is **not** factory recommended and may void the warranty.



## PRIMARY INTEGRAL COMPONENTS - ACCESSORY OPTIONS

### UL LISTED ELECTRIC DUCT HEATERS

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

#### MAGNETIC CONTACTOR

Disconnecting magnetic contactors (Option B6) are so arranged as to break all ungrounded lines. Disconnecting contactors, both magnetic or mercury type, that break all ungrounded lines are required on all UL listed duct heaters.

The number and amperage of the contactors will vary depending upon the KW and voltage.

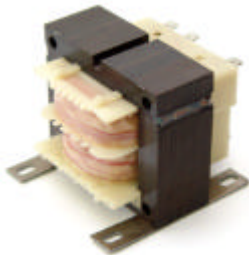


#### MERCURY CONTACTOR

Disconnecting Mercury contactors (Option B3/B6) are usually used where silent operation and/or frequent cycling is desired. The design of the contactor virtually eliminates contact noise and provides for long expectant life under heavy use. Mercury contactors can only be installed in the vertical position.

#### 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, 240. 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.



## 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 ampereage limits. Consult factory for details. 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 lights 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)
5. Pilot Light Power On (Option G5)
6. Pilot Light Fan On (Option G6)

### SCR (Silicone Controlled Rectifier) CONTROL

The SCR control (Option L1) is used to provide continuous modulation from 0 to 100% of the heater capacity. It is available with a wall mounted controller (Option LA) or duct mounted controller (Option LB). The SCR Control can also be configured to accept a field supplied control signal: 0-10VDC interface (Option LC), 4-20ma interface (Option LD), 0-135 ohm interface (Option LE). If the SCR is to be controlled by a pneumatic or pulsed width modulated signal then a transducer (Option L3) must be selected.



### 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.



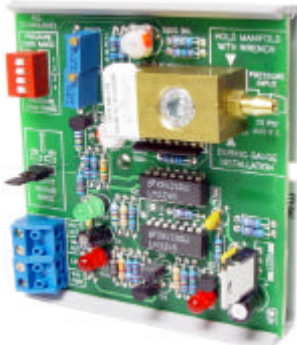
### P.E. (PNEUMATIC-ELECTRIC) SWITCH

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 step controller (Option K1) is required to be controlled with a pneumatic or pulsed width modulated signal. The transducer converts the pneumatic or pulsed width modulated input signal into a 0-10VDC analog signal that will directly control the SCR or step controller.

### 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).



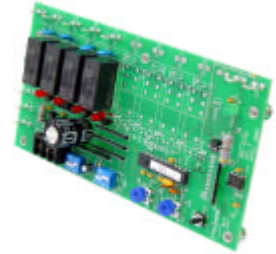




## ACCESSORY OPTIONS

### 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.

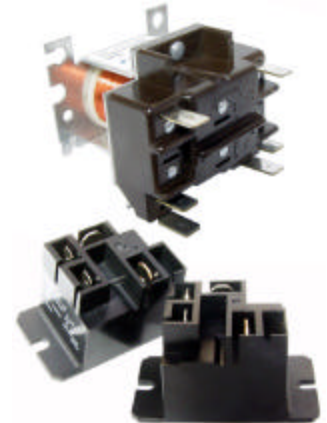


### ROUND DUCT CONNECTION

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.





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## - ACCESSORIES -

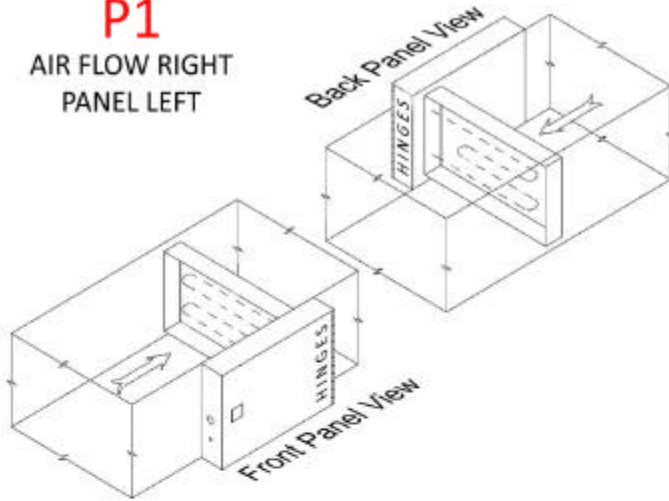
- **A1 FAN CONNECTION (Line Voltage Control Only)**
  - A2 Terminal Blocks (Standard)
- **B1 FAN CONTROL RELAY**
  - B2 Pilot Relay
  - B3 Mercury Contactors
  - B5 Back-Up Contactors or Safety Contactors (Disconnecting All Lines)
  - B6 Disconnecting Contactors
- **B7 FAN INTERLOCK RELAY (Specify Interlock Voltage)**
- **C1 AIR PRESSURE SWITCH**
  - C2 Time Delay Between Steps (Non-Adjustable)
  - CA Time Delay Between Steps (Adjustable)
  - C3 Pilot Switch (De-Energize All Contactors)
  - C4 Pilot Switch (De-Energize Each Step)
  - C5 P.E. Switches (Furnished and Factory Wired)
  - C6 P.E. Switches (Furnished by Others Factory Wired)
  - C7 P.E. Switches - Load Carrying (Furnished and Factory Wired)
- **D1 TRANSFORMER CLASS II**
- **D2 D2 TRANSFORMER WITH PRIMARY FUSING**
  - D3 D3 Replaceable Fuse for Option D1 or D2
  - E1 E1 Manual Reset High Limit
  - E5 E5 Remote Manual Reset
- **F1 F1 CIRCUIT FUSING PER U.L. AND N.E.C.**
  - F2 F2 One Fuse Block Per Step (For Heaters Less Than 48 Amps)
  - F3 F3 One Fuse Block Per Heater (For Heaters Less Than 48 Amps)
  - G1 G1 Pilot Light (Control Circuit On)
  - G2 G2 Pilot Light (Each Step is On)
  - G3 G3 Pilot Light (Thermal Cut Out is Open)
  - G4 G4 Pilot Light (Air Switch is Open)
  - G5 Pilot Light (Power On)
  - G6 Pilot Light (Fan On)
  - HZ 50 HZ
  - J1 Door-Interlock Disconnect Switch (Fused)
  - J2 Door-Interlock Disconnect Switch (Non-Fused)
  - J3 Circuit Breakers
  - J6 Panel Mount Disconnect Switch (52 Amps Max.)
  - K1 Step Controller
  - KA Wall Thermostat for Step Controller (Standard)
  - KB Duct Thermostat for Step Controller
  - KC 0-10V Interface Standard thru 10 Steps
  - KD 4-20 Milliamp Standard thru 10 Steps
  - KE 135 Ohm Interface Standard thru 10 Steps
  - L1 SCR Controls (Furnished and Factory Wired)
  - L2 SCR Controls (Furnished by Others Factory Wired)
  - L3 Transducer
  - LA Wall Thermostat for SCR Control (Standard)
  - LB Duct Thermostat for SCR Control
  - LC 0-10V Interface for SCR Control - Field Calibrated
  - LD 4-20 Milliamp Interface for SCR Control
  - LE 135 Ohm Interface for SCR Control
  - LL Full SCR
  - M1 Derated Elements (Specify Watt/Density Required)
  - M2 80/20 Nickel Chrome Element
  - N1 Stainless Steel Element Connections
  - N4 Nema 4 Enclosure
  - Q1 Insulated Control Panel
  - Q2 Hinged Lid (Std. With Fuses, Door Disconnect, Manual Reset)
  - Q3 Panel Lock and Keys
  - Q4 Allow for 1" Duct Insulation
  - Q5 Allow for 1/2" Duct Insulation
  - Q6 Allow for 2" Duct Insulation
  - Q7 Allow for 1.5" Duct Insulation
  - R1 Aluminized Steel Construction
  - R2 Stainless Steel Construction
  - S1 Single Point Terminal Block (Fusing if Required)
  - V1 Remote Control Panel (size varies with control options)
  - V2 Flanged Mount
  - V3 Unequal KW Per Steps
  - V4 Recessed Terminal Box (Specified Depth Required)
  - V5 Dust Tight Panel
  - V6 Protective Screen - Air Entering Side (Std. Over 48")
  - V7 Round Duct Connection Accessory (Specified size required)
  - V8 Bottom Mount - U.L. Listed
  - V9 Rain Tight Panel

1. **AT LEAST ONE OF THE ACCESSORIES MARKED WITH (\*) IS NECESSARY TO MEET U.L. REQUIREMENTS.**
2. **U.L. AND N.E.C. REQUIRE CIRCUIT FUSING FOR EACH HEATER OVER 48 AMPS.**
3. **SPECIFY IF HEATER REQUIRES U.L. LABEL.**
4. Specify KW per step if steps are not equal.
5. Heaters will be sized for unlined ducts unless otherwise specified.
6. Control panel will be offset to the left of the element section (Position 1) when airflow is in a left to right direction unless otherwise specified.
7. When specifying RP models select heater section(s) the same as CBK models. Terminal blocks and air pressure switch (if specified) are contained in the heater section(s). All other components are contained in the coordinated remote control panel(s) and disconnecting contactors (B6) are required.
8. All heaters over 50 KW and higher, 4 steps and higher, require time delay relays (C2 or CA) between steps with the following exceptions:
  1. Heaters with step controllers (K1) or SCR controls (L1) installed by Warren.
  2. Written confirmation (CF) from customer that Warren approved control device will be installed in field.

# HORIZONTAL MOUNTING POSITIONS

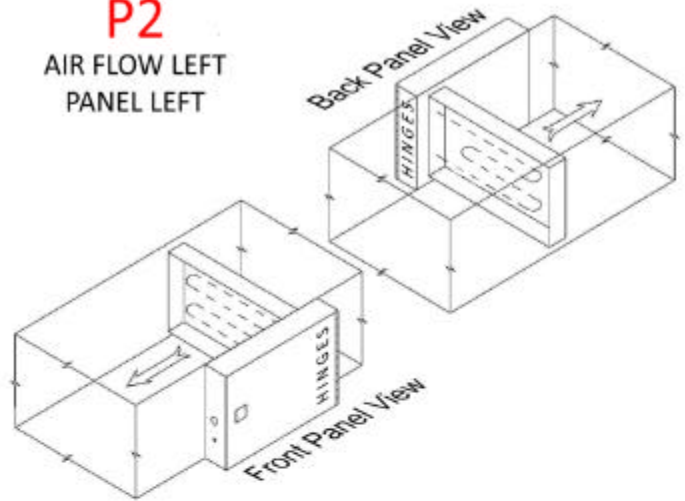
**P1**

AIR FLOW RIGHT  
PANEL LEFT



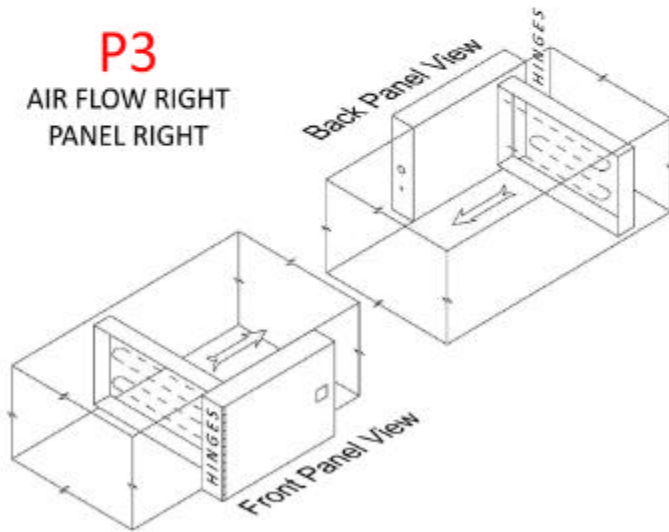
**P2**

AIR FLOW LEFT  
PANEL LEFT



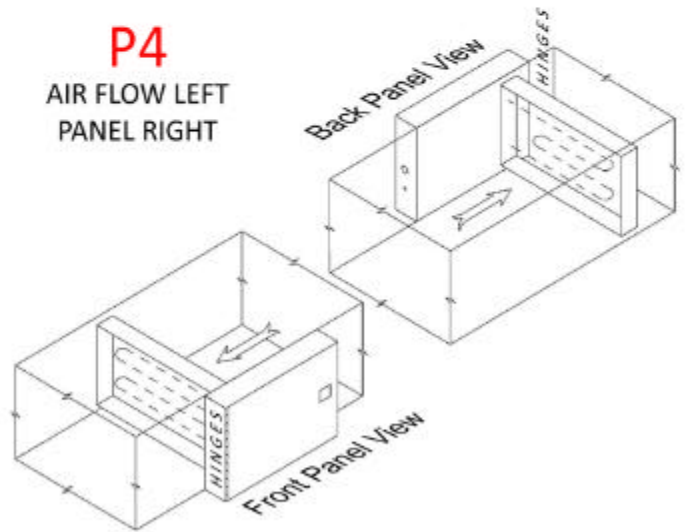
**P3**

AIR FLOW RIGHT  
PANEL RIGHT



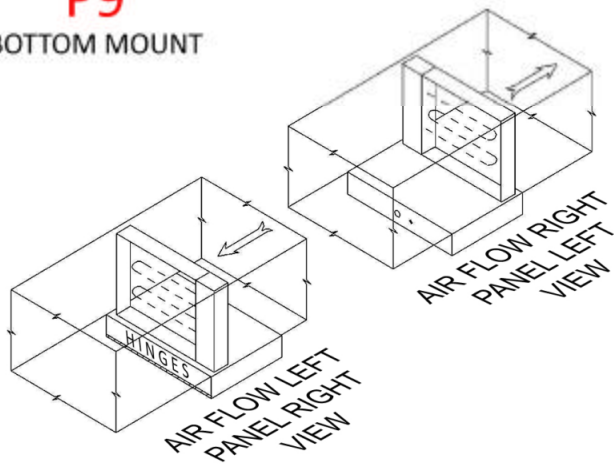
**P4**

AIR FLOW LEFT  
PANEL RIGHT



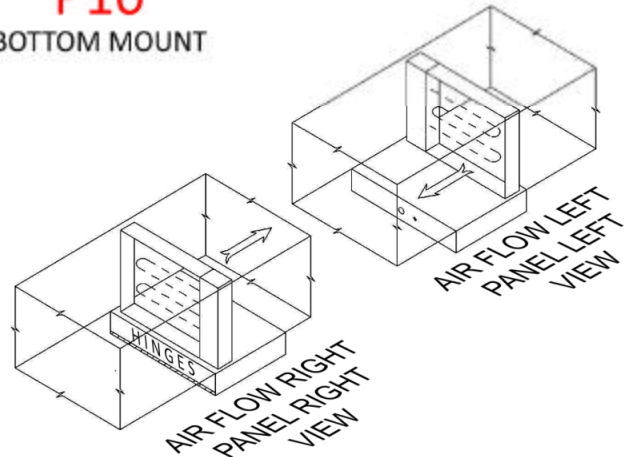
**P9**

BOTTOM MOUNT



**P10**

BOTTOM MOUNT



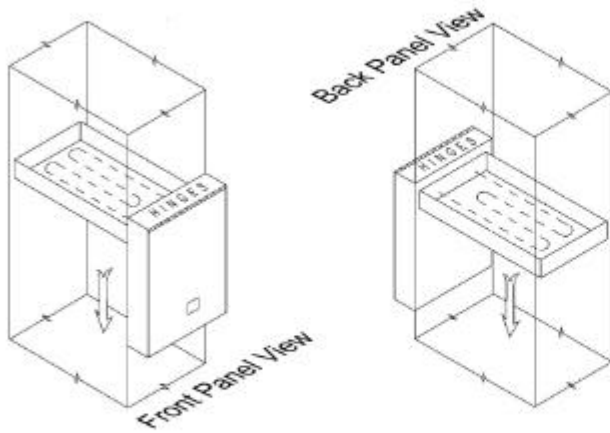
**Warren Technology**

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# VERTICAL MOUNTING POSITIONS

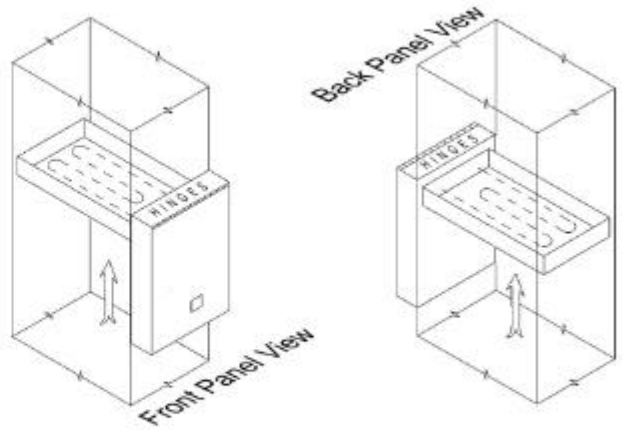
**P5**

AIR FLOW DOWN  
PANEL DOWN



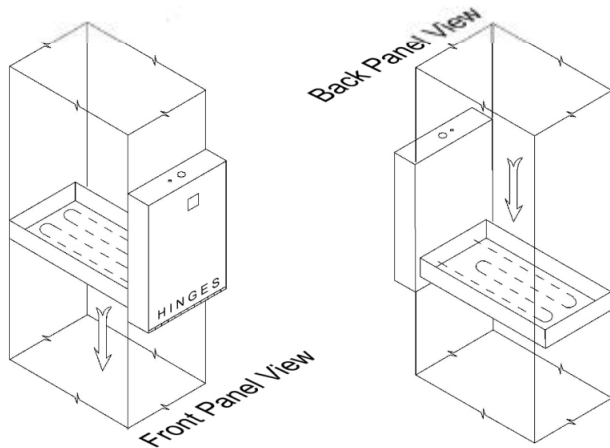
**P6**

AIR FLOW UP  
PANEL DOWN



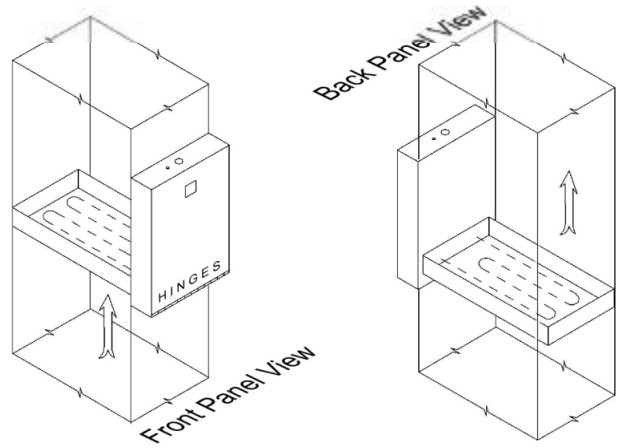
**P7**

AIR FLOW DOWN  
PANEL UP

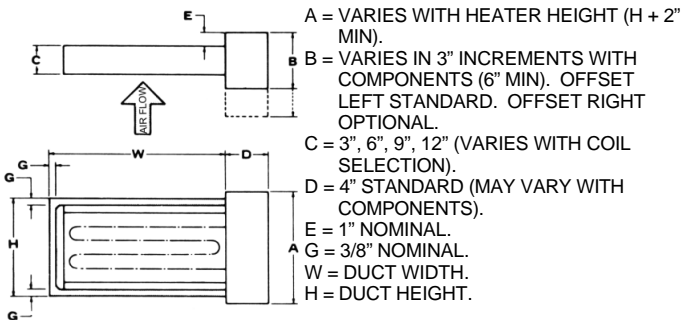


**P8**

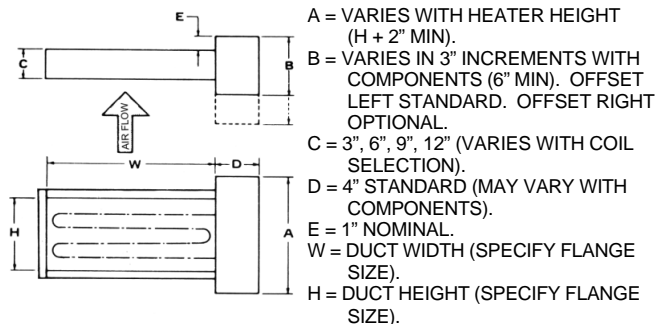
AIR FLOW UP  
PANEL UP



## MODULAR DUCT HEATER DIMENSIONS



SLIP-IN MODELS CBK & RP HEATER SECTION



FLANGED MOUNT MODELS CBK & RP HEATER SECTION



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## ELECTRIC DUCT HEATER SPECIFICATION GUIDE AND ENGINEERING DATA

### SAMPLE SPECIFICATION

1. Electric Duct Heaters shall be open coil type as manufactured by Warren Technology. Voltage, KW, size number of steps, and accessories shall be as shown. Units shall be U.L. Listed for zero clearance and meet all applicable requirements of the latest National Electric Code and A.N.S.I. standards.
2. Heating elements shall be high-grade nickel-chrome. Element temperature shall not exceed 400°F below the melting point of the element allowed when energized with design voltage in still, free air at 75°F ambient.
3. Heater frames and control boxes shall be constructed of 20 gauge-galvanized steel or heavier. Frames shall be hot dipped galvanized after fabrication if spot welds are used.
4. Mounting assemblies for the element support insulators shall pass between the insulators permitting free expansion of the insulators under high temperature conditions without cracking or breaking.
5. Each heater shall have its load divided into equal steps as shown. All necessary controls for recycling shall be provided in heaters of more than 48 amps.
6. The following features and accessories shall be furnished as an integral part of each unit. (See current Warren Model CBK spec. sheet.)

### EXPLANATION

1. U. L. listing indicates that the units have passed certain safety tests and contain safety thermal cutouts, airflow interlock, etc. N.E.C. and U.L. requirements insure adequate fusing and safety devices. A.N.S.I. C84.1— 1970 provides utilization voltage variance and nameplate rating standards.
2. The resistance element is the heart of the heater and should be designed with the operating temperature of the element alloy as the most important criterion. Because no-air-flow is likely to occur in at least some areas of the heater, this condition will be the basis for design for the entire element.
3. Spot welding must be coated after fabrication to prevent corrosion.
4. Free ceramic expansion will prevent the insulators from rupturing when heated.
5. The total load of a heater should be divided into steps of no more than 30 amps for good design practice, or less if finer control is required. The recycling feature prevents all steps from being energized simultaneously on power interruptions, cold-start, thermostat manipulation, or other abnormal situations.
6. Recommended minimum accessories are: air pressure switch, door-interlock disconnect switch, and transformer.

### TYPICAL DUCT HEATER SCHEDULE

UNIT OR TAG NO.	CFM	KW	LINE VOLT.	PHASE	CONTROL VOLTAGE	STEPS	DUCT SIZE		ACCESSORIES
							W	H	





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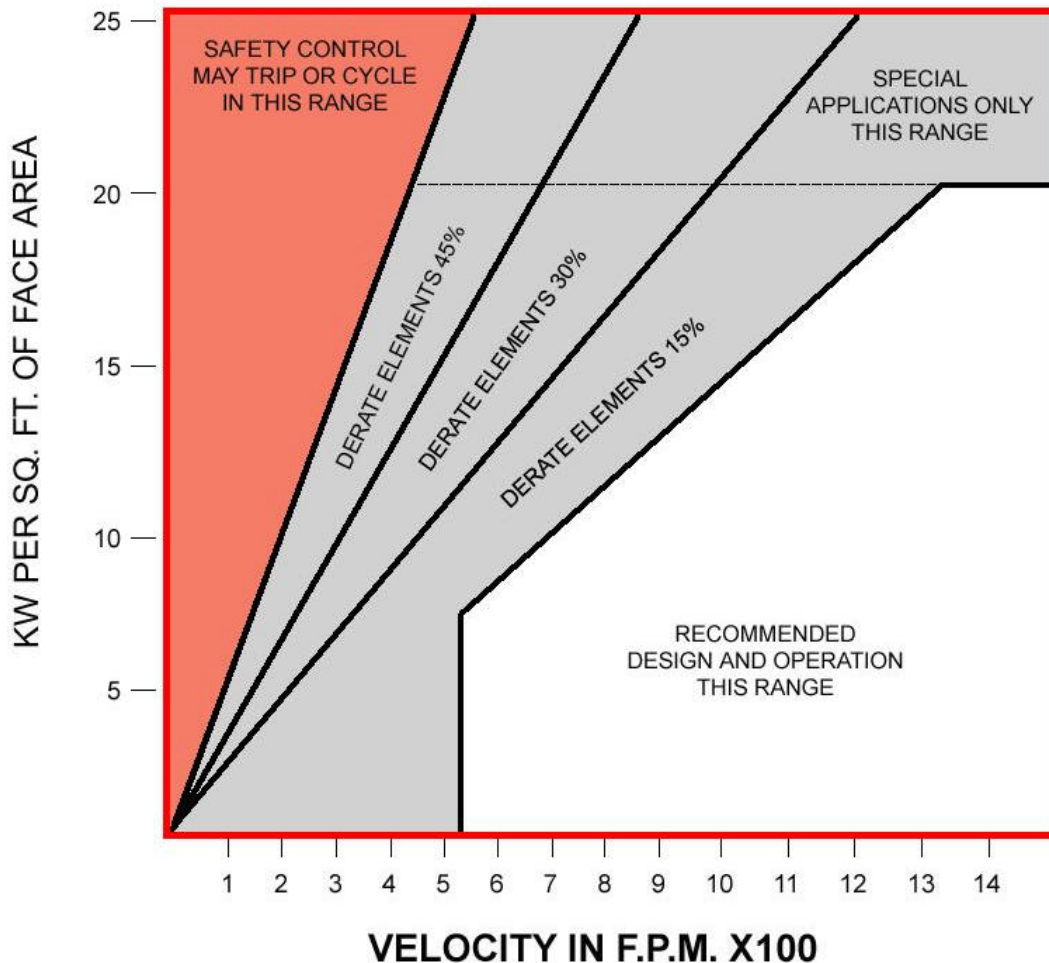
## ENGINEERING DATA

The following load calculations and recommended operating ranges are based on standard 75°F entering air (comforting heating). Consult factory for other applications.

1. Conversion: 1 KW = 3413 B.T.U.
2. Load Requirement: KW = (cubic Feet per Min. x Temperature Rise) / 3160
3. Ohm's Law: Watts =  $(\text{Volts})^2 / \text{Resistance} = \text{Volts} \times \text{Amps}$
4. Line Current, 1 phase: Amps = Watts / Volts
5. Line Current, 3 phase: Amps = Watts / (Volts x 1.73)
6. Pressure Drop: Inches  $\text{H}_2\text{O} = [(KW / \text{ft}^2) / 760] \times [(\text{velocity in f.p.m.}) / 500]^2$
7. C.F.M. / F.P.M. Velocity VEL./F.P.M. = C.F.M. / (Duct Area/Ft.<sup>2</sup>)
8. Relationship  
KW per square foot: KW / sq. ft = KW / [ (Duct width {inches} x Duct height {inches}) / 144 ]

## HEAT-VELOCITY RELATIONSHIP

The following graph shows the recommended ranges for combinations of heat and velocity, which will result in safe operating temperatures.





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## VOLTAGE/AMPERAGE CHART

K.W.	B.T.U./H	208 VOLTS		220 VOLTS		230 VOLTS		240 VOLTS		277 VOLTS	440 VOLTS	460 VOLTS	480 VOLTS
		1 PH	3 PH	1 PH	3 PH	1 PH	3 PH	1 PH	3 PH	1 PH	3 PH	3 PH	3 PH
1	3,413	4.8	2.8	4.5	2.6	4.3	2.5	4.2	2.4	3.6	1.3	1.3	1.2
2	6,826	9.6	5.6	9.1	5.3	8.7	5.0	8.3	4.8	7.2	2.6	2.5	2.4
3	10,239	14.4	8.3	13.6	7.9	13.0	7.5	12.5	7.2	10.8	3.9	3.8	3.6
4	13,652	19.2	11.1	18.2	10.5	17.4	10.1	16.7	9.6	14.4	5.3	5.0	4.8
5	17,065	24.0	13.9	22.7	13.1	21.7	12.6	20.8	12.0	18.1	6.6	6.3	6.0
6	20,478	28.8	16.7	27.3	15.8	26.1	15.1	25.0	14.5	21.7	7.9	7.5	7.2
7	23,891	33.7	19.5	31.8	18.4	30.4	17.6	29.2	16.9	25.3	9.2	8.8	8.4
8	27,304	38.5	22.2	36.4	21.0	34.8	20.1	33.3	19.3	28.9	10.5	10.1	9.6
9	30,717	43.3	25.0	40.9	23.6	39.1	22.6	37.5	21.7	32.5	11.8	11.3	10.8
10	34,130	48.1	27.8	45.5	26.3	43.5	25.1	41.7	24.1	36.1	13.1	12.6	12.0
11	37,543	52.9	30.6	50.0	28.9	47.8	27.6	45.8	26.5	39.7	14.5	13.8	13.2
12	40,956	57.7	33.3	54.5	31.5	52.2	30.2	50.0	28.9	43.3	15.8	15.1	14.5
13	44,369	62.5	36.1	59.1	34.2	56.5	32.7	54.2	31.3	46.9	17.1	16.3	15.7
14	47,782	67.3	38.9	63.6	36.8	60.9	35.2	58.3	33.7	50.5	18.4	17.6	16.9
15	51,195	72.1	41.7	68.2	39.4	65.2	37.7	62.5	36.1	54.2	19.7	18.8	18.1
16	54,608	76.9	44.5	72.7	42.0	69.6	40.2	66.7	38.5	57.8	21.0	20.1	19.3
17	58,021	81.7	47.2	77.3	44.7	73.9	42.7	70.8	40.9	61.4	22.3	21.4	20.5
18	61,434	86.5	50.0	81.8	47.3	78.3	45.2	75.0	43.4	65.0	23.6	22.6	21.7

## RECOMMENDED KW PER CROSSECTIONAL DUCT AREA

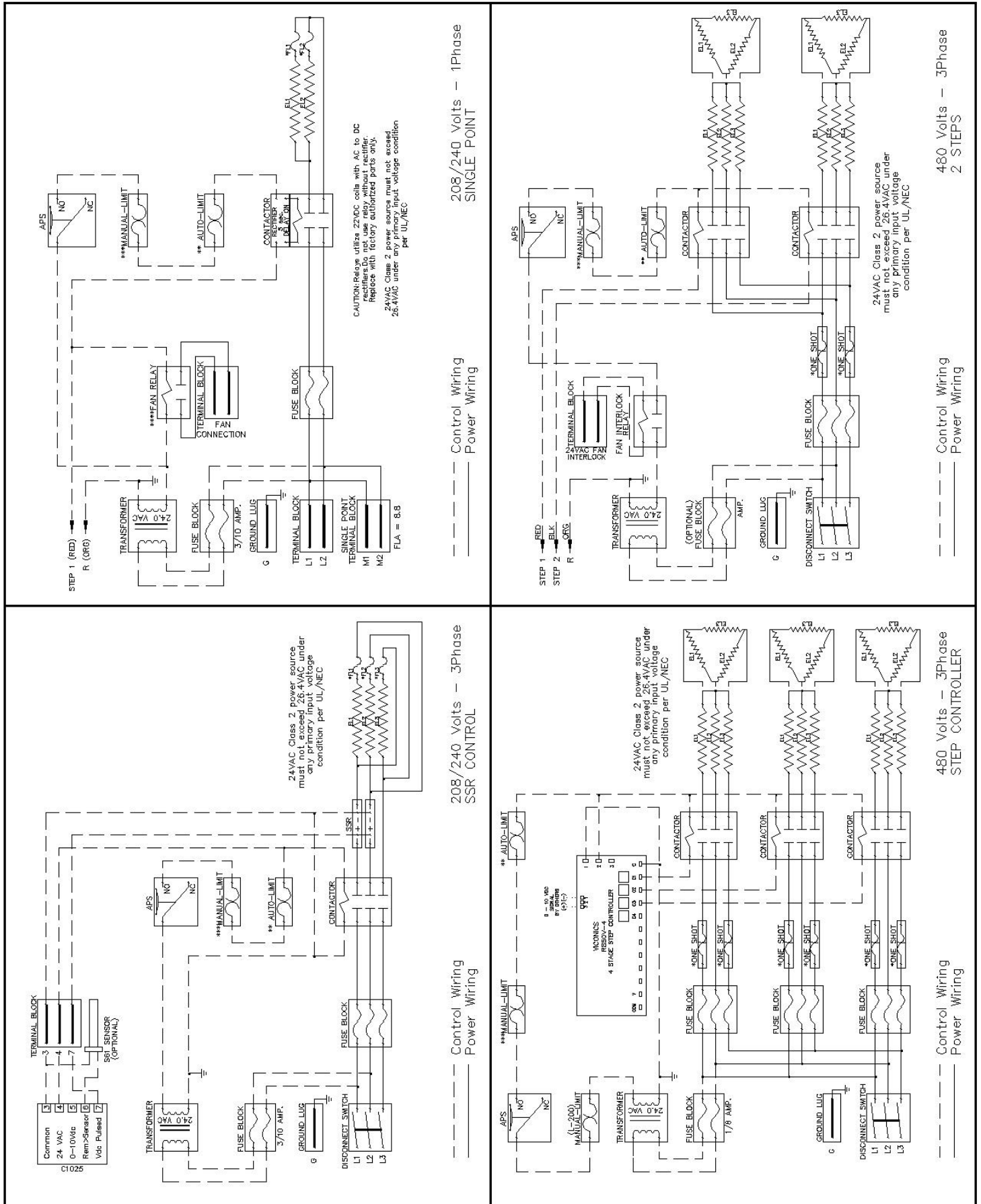
DUCT	HEIGHT	WIDTH	6	8	10	12	14	16	18	20	22	24	26	28	30	32	36	42	48
			MAXIMUM KW - STANDARD DESIGN																
4			2	3	4	5	5	6	7	8	9	10	10	11	12	13	15	17	19
6			3	5	6	7	8	10	11	12	13	15	16	17	18	19	22	26	30
8			5	6	8	10	11	13	15	16	18	20	21	23	25	26	30	35	40
10			6	8	10	12	14	16	18	20	23	25	27	29	31	33	37	43	50
12			7	10	12	15	17	20	22	25	27	30	32	35	37	40	45	52	60
14			8	11	14	17	20	23	26	29	32	35	37	40	43	46	52	61	70
16			10	13	16	20	23	26	30	33	36	40	43	46	50	53	60	70	80
18			11	15	18	22	26	30	33	37	41	45	48	52	56	60	67	78	90
20			12	16	20	25	29	33	37	41	45	50	54	58	62	66	75	87	100
22			13	18	22	27	32	36	41	45	50	55	60	64	68	73	82	96	110

NOTE: Higher KW Capacities may be applicable. Consult factory for additional design criteria.



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## TYPICAL WIRING DIAGRAMS

## DUCT HEATER PRICING



# Warren Technology

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PAGE \_\_\_\_\_ OF \_\_\_\_\_

DATE \_\_\_\_\_

P.O. NO \_\_\_\_\_

REQUESTED SHIP DATE

SHIP VIA

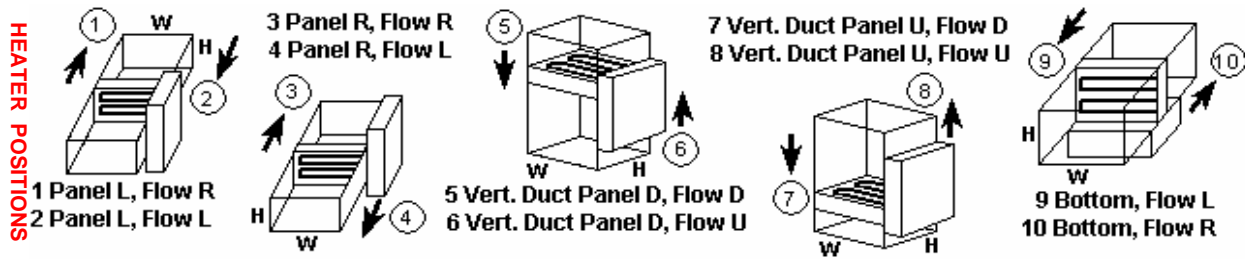
SHIPPING INSTR.

INVOICE OR \_\_\_\_\_

SHIP TO OR

**CUSTOMER**

## PROJECT

[illegible]

## TOTAL LIST

MULTIPLIER X

**EXTRA CHARGE** \_\_\_\_\_ %

## HEATER NET

## FREIGHT

TOTAL NET



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### What the Wholesaler, Distributor or Counter Sales Person Must Know Before Selling a *Warren* Duct Heater

1. How many Kilowatts (KW)? \_\_\_\_\_
  2. What Line Voltage, Phase and Hertz? \_\_\_\_\_
  3. What Control Voltage? \_\_\_\_\_
  4. What duct size? (Dim. In inches)
    - a. Width \_\_\_\_\_
    - b. Height \_\_\_\_\_
- Note: Control panel always mounts on duct height
5. What type of construction? Check one:
    - a. Slip-In \_\_\_\_\_
    - b. Flange Mount 1" \_\_\_\_\_
    - c. Slip-In with Remote Panel \_\_\_\_\_
    - d. Flanged 1" w/Remote Panel \_\_\_\_\_
    - e. Bottom Mount Application \_\_\_\_\_
  6. What type of ductwork?
    - a. Sheet Metal, No Insulation \_\_\_\_\_
    - b. Sheet Metal, Internally Lined \_\_\_\_\_
    - c. Sheet Metal, Externally Wrap \_\_\_\_\_
    - d. Fiber Board \_\_\_\_\_
  7. Heaters require either a fan interlock relay or an air pressure switch for interlock to meet code and UL.  
Fan Interlock Relay? \_\_\_\_\_  
A/P Switch? \_\_\_\_\_
  8. Heaters drawing 48 amps or more, total load, must have their circuits fused by the manufacturer. **Under 48 Amps, They Do Not!**  
Fuse the Circuits? \_\_\_\_\_  
Do not fuse? \_\_\_\_\_
  9. Do you need a control transformer to get you low voltage control or is there already one in the system?  
Need a Transformer \_\_\_\_\_  
Don't need Transformer \_\_\_\_\_
  10. How many steps (or stages) in the heater? \_\_\_\_\_

#### MAXIMUM KW PER STEP (OR STAGE)

120 Volt	1 Phase	5.5 KW
208 Volt	1 Phase	9.8 KW
240 Volt	1 Phase	11.5 KW
277 Volt	1 Phase	13.0 KW
208 Volt	3 Phase	15.0 KW
240 Volt	3 Phase	17.2 KW
480 Volt	3 Phase	25.0 KW

11. Other optional controls or remarks? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_





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## APPLIED VS. RATED KW FACTORS

RATED VOLTAGE	APPLIED VOLTAGE								
	120	208	220	230	240	277	440	460	480
120	1.00	3.00	3.36	3.67	4.00	5.33	13.44	14.69	16.00
208	.33	1.00	1.12	1.22	1.33	1.77	4.47	4.89	5.32
220	.30	.89	1.00	1.09	1.19	1.58	4.00	4.37	4.76
230	.27	.82	.91	1.00	1.09	1.45	3.66	4.00	4.36
240	.25	.75	.84	.92	1.00	1.33	3.36	3.67	4.00
277	.19	.56	.63	.69	.75	1.00	2.52	2.76	3.00
440	.07	.22	.25	.27	.30	.40	1.00	1.09	1.19
460	.07	.20	.23	.25	.27	.36	.91	1.00	1.09
480	.06	.19	.21	.23	.25	.33	.84	.92	1.00

1. Locate heater Rated Voltage.
2. Locate Actual Applied Voltage.
3. Multiply Heater Rated KW by Percentage Shown to Obtain Actual KW Capacity.

## MARKET EVALUATION

### WARREN TECHNOLOGY

#### I. COMPLETE LINE OF HEATING PRODUCTS

- A. Stock line – U.L. Listed
- B. Custom Built - U.L. Listed
- C. Special Application – E.T.L., U.L. or A.R.L. Listings Available

#### II. ENGINEERING FEATURES

- A. Patented Element Support System
- B. Exclusive Method of Element Selection
- C. Modular Construction
- D. CAD/CAM Record Of All Models

#### III. MARKETING FEATURES

- A. Competitive Pricing
- B. Market Acceptance
- C. Rush Shipment Service
- D. Comp-U-Quote

#### IV. PRICING FEATURES

- A. Stock-Line (*In Pricing Catalog*)
- B. Quicksilver – Form #QS
- C. Custom Built (*In Pricing Catalog or by Comp-U-Quote*)
- D. Special Application (*Covered By Specific Sheets – Other Models Available From Factory*)

#### V. MARKETS

- A. Commercial
- B. Wholesaler
- C. O.E.M.
- D. Export
- E. Other (i.e., Industrial – Consult Factory)

**WARREN TECHNOLOGY  
IS TOTALLY COMMITTED  
TO QUALITY AND SERVICE  
THANK YOU FOR ALLOWING US TO SERVE YOU.**

CONTACT US BY:  
TELEPHONE (305) 556-6933; (800)-FAST-HOT  
FAX (305) 557-6157  
OR EMAIL [warren@warrenhvac.com](mailto:warren@warrenhvac.com)

# PRICING AND SHIPPING POLICIES – April 1, 2011

## PRICING

All prices shown are list F.O.B. factory, Hialeah, Florida.

Multipliers are shown on current discount sheets.

Special quotations for non-standard equipment or large orders may be obtained from factory.

### FIVE METHODS OF PRICING ARE AVAILABLE:

1. **Warren's** Comp-U-Quote via telephone 1-800-327-8468. **Standard Custom Built units only. Limit quote to five line items.**
2. Request Comp-U-Quotes via Fax or E-mail.
3. Special quotations – for special construction, pricing, industrial, etc. Consult factory (305) 556-6933.
4. **Warren** unitary price lists for wholesalers and distributors.
5. Register on-line at [www.warrenhvac.com](http://www.warrenhvac.com) for access to quote CBKs, 24 hrs a day, 7 days a week.

## TERMS

All orders are subject to the following terms and conditions of sale – Terms are 1% 10 days, net 30 days, 2% per month service charge.

## ORDERING

Make sure your order is complete. To avoid delay the following information must be shown on the order:

1. Model.
2. List of accessories.
3. Special instructions if required.
4. Quotation number.

## ACKNOWLEDGEMENTS

**Acknowledgements are mailed immediately after each order is placed. It is the customer's responsibility to check the acknowledgement for accuracy and notify the factory in writing of any discrepancies. Acknowledgements can be faxed or e-mailed upon request.**

## PRODUCTION – STANDARD

Normal production times are 4 to 6 weeks with estimated ship date shown on the order acknowledgement. Orders may extend beyond the estimated ship date depending on the availability of component parts and seasonal workload. Please advise at the time of order if the required ship date is critical for any reason. We reserve the right to ship earlier than the estimated ship date. All shipments will be made best way unless otherwise specified. Minimum order: \$50.00

## PRODUCTION – RUSH

**72 Hour Production** – Add 40% to total list price for premium time. Shipments will be made within 72 hours of the date of entry. Stock-Line heaters are shipped in 72 hours at no additional charge.

**One-Week Production** – Add 25% to total list price for premium time. Shipments will be made within 1 week (holidays excluded) of the date of order.

**Two-Week Production** – Add 20% to total list price for premium time. Shipments will be made within 2 weeks (holidays excluded) of the date of order.

**Three-Week Production** – Add 15% to total list price for premium time. Shipments will be made within 3 weeks (holidays excluded) of the date of order.

- **Orders entered after 12 Noon (Eastern Standard Time) are dated for the following day.**
- **Rush orders may be delayed and premium will be charged where special accessories or controls such as mercury contactors, SCR's, transducers, step controllers, etc. are required, or when heaters are not picked up on time by the freight carrier. Extra 5% premium charge will be required for orders containing non-standard parts.**

## CANCELLATIONS AND CONDITIONS

Orders **MUST** be confirmed via mail, e-mail or Fax. All orders are subject to a cancellation charge.

**NOTE: Verbal orders, changes, or instructions will not be binding on *Warren* in any way.**

## DAMAGED SHIPMENTS

Shipments should be inspected at time of receipt and any damages noted on the Bill of Lading. Claims to the freight company must be made by the consignee.

## RETURNS

All returned goods must be authorized by the factory. Please contact **Warren** Customer Service Department to receive a "Returned Goods Authorization" number which must be shown on the Bill of Lading or the shipment will not be accepted. **Do not return any units without the RGA number.** All units are custom manufactured and cannot be restocked. Credit will be given for salvage value of the electrical components only, less removal and restocking labor charges.

## FIELD REPAIRS

Any field repairs, modifications, troubleshooting and expenses incurred are solely the responsibility of the purchaser unless written authorization is obtained from the factory. **No "back charges" or costs to *Warren* will be honored unless a predetermined work authorization agreement is issued by *Warren*.**

PRICES SUBJECT TO CHANGE WITHOUT NOTICE.



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# ELECTRIC DUCT HEATER MAINTENANCE AND SERVICE INSTRUCTIONS

Warren electric duct heaters are constructed in such a manner that requires little or no maintenance, including parts supplied with your heater.

Always make sure all connections are tight before heater is turned on.

Be sure heater elements are free of dirt and foreign matter.

Units greater than 50KW should be controlled by a system with a recycling feature that will not allow all steps to be energized simultaneously. The absence of such a device causes severe damage to the equipment.

The use of discharge air sensing devices to control this heating unit is not factory recommended and may void the warranty.

Even though your heater requires no periodic maintenance check, if your heater is not functioning properly, the following are some points to check:

1. Check installation instructions and wiring diagram to make sure heater was wired and installed properly.
2. Check all connections points and make sure they are tight, before initial startup and before each heating season.
3. Fuses.... One of the most common problems. Check to see they are not blown.
4. Automatic hi-limit or manual reset – temperature may be too high because airflow is insufficient.
5. Air filter may be clogged.
6. Is sufficient airflow "even" over coils?
7. Check for transformers and control voltage flow.
8. Make sure that the thermostat is operating properly and current flow is to heater, both control and power voltage.
9. When air pressure switches are used, they must have the proper airflow. Sensing tube should be curved toward the airflow.
10. Internal insulation may be interfering with safety device.

The above are the most common problems. Other problems may be caused by accessories or related items.



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## INSTALLATION INSTRUCTIONS

Before installing the heater, inspect thoroughly for shipping damages. Notify carrier immediately if any damage is found. Check all porcelain insulators for breakage and inspect heater element wire to see that none have been deformed.

The minimum air velocity as shown on the heater label is required and must be even across the face of the heater. The temperature of the air entering the heater must not exceed 77° F.

Connect heater as shown on heater schematic wiring diagram. All electrical connections, wire sizes and type and conduit sizes shall meet the National Electric Code.

Main power supply, minimum wire sizes, circuits, fusing, etc. is shown on schematic wiring diagram.

The air duct system should be designed and installed in accordance with the standards of the National Fire Protection Association for the installation of Air-Conditioning and Ventilation Systems. (Pamphlet 90A or 90B)

Heaters should be mounted in the duct far enough away from the blower for any change in the direction of airflow to insure even airflow over the entire face area of the heater. If a heater cannot be mounted at least 48 inches downstream from the blower or a change in direction of airflow baffles must be installed in the duct ahead of the heater to insure even airflow across the face of the heater.

Air filters, humidifiers, or cooling coils must be at least 48 inches from the nearest heating element.

The heater control circuit or relay contacts are interlocked with the air system of either an integral air pressure switch or a blower relay, which must be wired as indicated on the wiring diagram. If a blower relay has been used (see diagram) the fan motor, or motor controller amperage must not exceed that given on the diagram.

All heaters are suitable for zero clearance between duct and combustible material.

Model CB-HOK heaters must be used with a remote panel and must be wired in accordance with the accompanying diagram.

CBK Insert Heater: The heating element is enclosed by a sheet metal wrapper. This wrapper is not to be used as part of the duct. To install, cut a hole in the side of the duct, 1/2" larger than the insert portion. Insert the heating element and fasten control panel to the side of the duct by means of sheet metal screws. If the duct is internally lined, then use a recessed element equal to the thickness of the internal insulation.

CBKF Flange Mount: The flange portion of the heater is matched to the out-turned flanges of the duct. There is no flange on the control side of the duct. Fasten heater flange to duct flange by means of sheet metal screws or bolts. Fasten control panel to side of duct by means of sheet metal screws.

BCB Bottom Mount: a sheet metal wrapper encloses the heating element with the heating element being terminated inside a control panel. This entire portion (element and element termination control panel) is to be inserted into the duct from the bottom. Cut a hole in the bottom of the duct 1/2" larger than the insert portion. Insert the element (and panel) and fasten the control box to the bottom of the duct by means of sheet metal screws.

## CHECKOUT

Before energizing this equipment for operation be sure that all electrical terminal connections, clamps, screws, etc. are tight as these may have become loose in shipment. It is advisable to retighten all electrical connections after the equipment has been in operation and the components have reached operating temperature. In addition to the above, the following tests and procedures should be followed.

- A) Clean all dirt, dust and moisture from equipment.
- B) Check for loose terminal connections.
- C) Check for proper clearances of live parts, between phases and to ground and make sure that all required barriers are in place.
- D) Check for missing insulation in equipment and on conductors.
- E) Check for any modifications, alterations, for the use of unapproved parts.
- F) Check that all fuse and circuit breaker short circuit interrupting ratings are adequate.
- G) The equipment room or area should be dried of all dampness and moisture accumulations.
- H) Check conductors run in multiple to insure that they are properly phased.
- I) Conduct a "megger" test of all equipment and wiring.

For maximum safety on fused feeders of 200 amperes and over, it is recommended that a low amperage test fuse (15 amps or less) be used and the circuit energized without load. This will insure the safe interruption of the circuit if a fault exists.

Any modifications or repairs to the equipment without written permission from the factory will be done at the installer's own risk and expense.



## *Electric Duct Heater*

# *W a r r a n t y   T e r m s*

*Warren Technology guarantees the heater section consisting of the resistance coils and supporting racks for a period of one year from the date of installation or one year from the date of manufacture, whichever occurs first when, in the opinion of Warren, the heater has been properly installed and is energized under normal operation.*

*Heaters to be properly installed must be in a duct of not more than 21 KW per square foot of duct area. Airflow must cover the entire face area of the heater and should not be less than 70 CFM per KW.*

*Normal operation means that the airflow must not be interrupted or stopped when the heater is energized. Airflow must not be decreased by dirty filters and/or other causes and must not be operated on other than rated voltage.*

*Warren guarantees the controls, consisting of contactors, thermal hi-limit, terminal and fuse blocks, etc., for a period of (1) one year in normal operation, and at rated voltage.*

*Warren reserves the right to determine its obligation under this Warranty by checking and testing the heater and/or parts at the factory. Return transportation to be prepaid by the customer.*

*The obligation of Warren hereunder is limited to making repairs at the factory, or replacement parts available to the customer, and does not include the furnishing of any labor involved, or connected therewith, such as that required to diagnose trouble, remove or install any replacement parts, nor does it include responsibility for any transportation expenses in connection therewith. It is agreed that this shall be buyer's exclusive remedy pursuant to the warranty. Any modifications made to Warren equipment without specific prior written authorization from Warren will render this warranty null and void.*

*For the purpose of identification, the serial number of the heater involved under this Warranty must be furnished in any correspondence.*

*WARREN DISCLAIMS ALL OTHER WARRANTIES, EXPRESS, IMPLIED, OR STATUTORY, INCLUDING THE IMPLIED WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.*

*In any case, Warren shall not be responsible for any special or consequential damages. Warren neither assumes nor authorizes any person to assume for it any other obligation or liability in connection with the sale of Warren heaters.*