RenewAire
Energy Recovery Ventilation

EK SERIES Electric Duct Heater

Installation, Operation and Maintenance Manual

EK Series for Commercial Indoor Applications

EK Series shown

c UL us
LISTED
DUCTED HEAT RECOVERY VENTILATOR
89S5

⚠ WARNING

Arc flash and electric shock hazard

Arc flash and electric shock hazard. Disconnect all electric power supplies, verify with a voltmeter that electric power is off and wear protective equipment per NFPA 70E before working within electric control enclosure. Failure to comply can cause serious injury or death.

Customer must provide earth ground to heater, per NEC, CEC and local codes, as applicable.

Before proceeding with installation, read all instructions, verifying that all the parts are included and check the nameplate to be sure the voltage matches available utility power.

The line side of the disconnect switch contains live high-voltage.

The only way to ensure that there is NO voltage inside the heater is to install and open a remote disconnect switch and verify that power is off with a volt meter. Refer to unit electrical schematic. Follow all local codes.

⚠ CAUTION

Risk of contact with HOT SURFACES

This heater, including the heating elements and their support structure are extremely hot during operation. Allow sufficient time for them to cool before working within the cabinet. Use extreme caution and wear protective gloves and arm protection when working on or near the heater.

⚠ CAUTION

Risk of electric shock or equipment damage

Whenever electrical wiring is connected, disconnected or changed, the power supply to the heater and its controls must be disconnected. Lock and tag the disconnect switch or circuit breaker to prevent accidental reconnection of electric power.

SAVE THIS MANUAL

UNIT RECORDS

Record information as shown below. In the unlikely event that factory assistance is ever required, this information will be needed.

Locate the RenewAire unit label, found on the door of the electric duct heater.

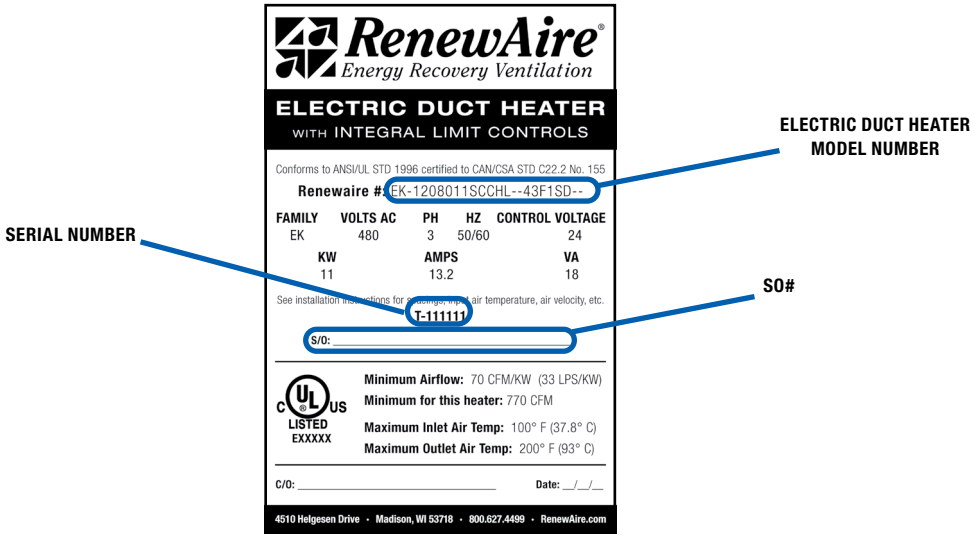
NOTE: This information is for purposes of identifying the specific furnace. Unit-specific option data can then be obtained, as needed, from the Model Number. See Electric Heater Code in this manual for further details.

Heater Model No: ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

Serial Number: ☐☐☐☐☐☐☐

SO Number: ☐☐☐☐☐☐

NOTE: This page is to be completed by the installing contractor. The completed document is to be turned over to the owner after start-up.



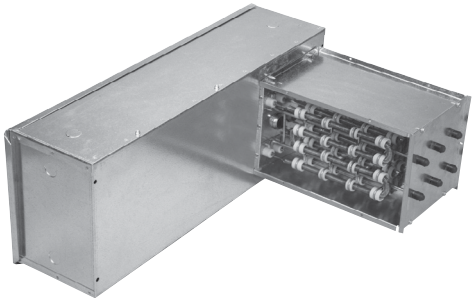
TYPICAL ELECTRIC DUCT HEATER LABEL

EK SERIES

Electric Duct Heater (1-175 kW)
Accessory

c UL us LISTED DUCTED HEAT RECOVERY VENTILATOR 8955

ELECTRIC DUCT HEATER



Download specification at:
renewaire.com/specifications

SPECIFICATIONS

Heater Type:
Electric Duct Heater

Typical KW Range:
1–175 kW

Standard Features:
A disconnecting magnetic control contactor per stage or each 48 Amp circuit within a stage
Open-coil element
Staged on/off
Control terminal board
Grounding lugs
Automatic limit switch for primary over-temperature protection
Manual reset limit switch for secondary over-temperature protection
Non-adjustable airflow switch
Standard control transformer - 24 VAC
Disconnect switch
Duct thermostat with sensor for on/off control
60-20-20 (Ni/Cr/Fe) C Grade element wire with nickel-plated terminals
Slip-in mount
No left/right hand
Vertical up/down flow

Voltages & Phase:
Single phase - 120, 208, 240, 277
Three phase - 208, 240, 480, 600

Control Voltage:
24 VAC

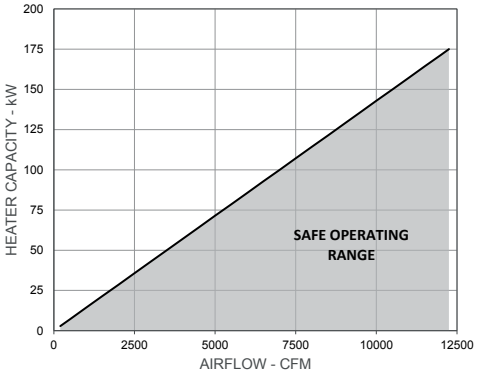
Dimensions:
Minimum - 8" x 8" (W x H)
Maximum - 99" x 99" (W x H)

Options:
Flange mount
80-20 (Ni/Cr) A Grade element wire with stainless steel terminals
Recessed control box 1"
Gasketed cover - dust tight
Power fusing, standard for heaters drawing more than 48 Amps
2-stage
Electronic step controller (4-stage)
SCR (up to 96 Amps)
SCR Vernier (over 96 Amps)
Pilot light

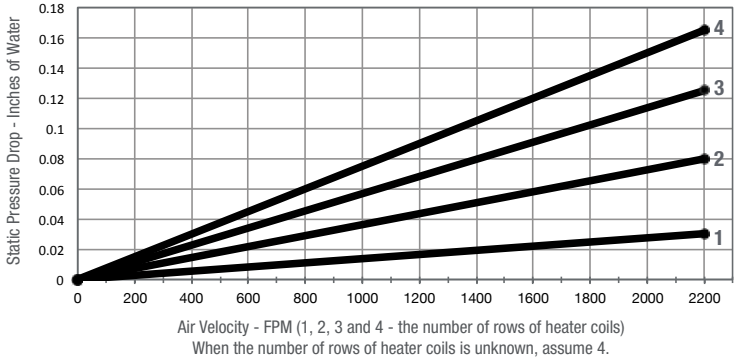
Accessory:
Room thermostat
Room/duct thermostat-sensor kit for SCR control

Note: Electric duct heater designed for indoor ductwork installation only.

EK SERIES HEATER CAPACITY



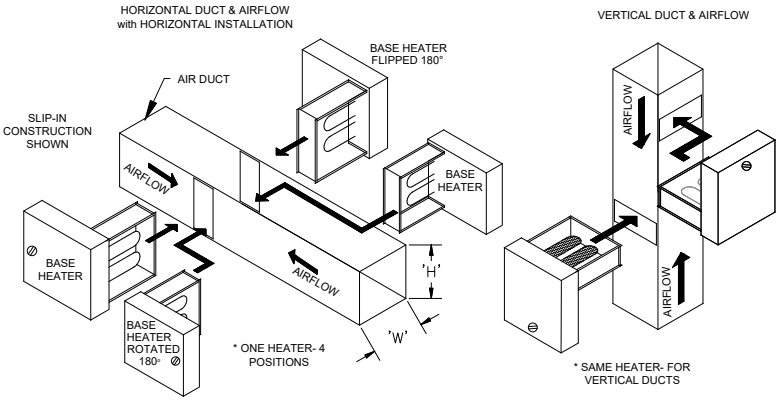
PRESSURE DROP THROUGH HEATER



Air Velocity - FPM (1, 2, 3 and 4 - the number of rows of heater coils)
When the number of rows of heater coils is unknown, assume 4.

FLIPPABLE CAPABILITIES

Unique to the EK series, this unit has the ability to flip 180°. Additionally, EK heaters features both vertical up and vertical down airflow.



Specifications may be subject to change without notice.

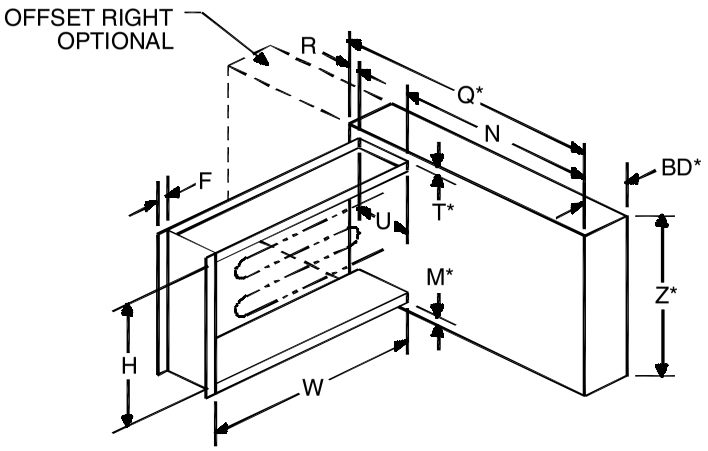
RenewAire Energy Recovery Ventilation

RenewAire Energy Recovery Ventilation

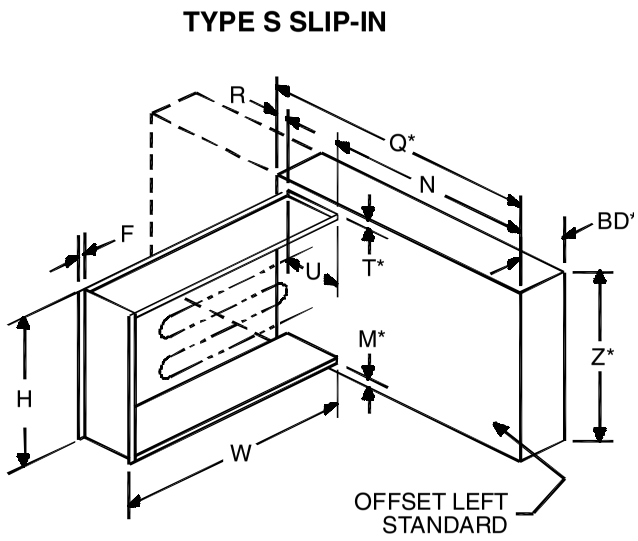
PRODUCT DIMENSIONS
ELECTRIC DUCT HEATER

ABBREVIATIONS

W Width
H Height



TYPE F FLANGE MOUNT



TYPE S SLIP-IN

* = Dimensions do not include allowance for control box cover. Control box cover will be larger than the control box.

NOTES:

1. W and H determined by duct size
A. For slip-in
   W = Duct width minus 1/4 inch
   H = Duct height minus 1/16 inch
B. flange mount
   W and H=Duct size
2. U = (W+H Up to 60"=4 7/8), (61" and over U=6")
   (W greater than 36" U=6")
3. BD = 4 1/4, 6, 8 1/2, or 10 1/4 depth of control box depends on the components required and size of power entry holes
4. Z = (H+2" standard for slip in) (H+4" for flange mount)
5. T = 1" standard
6. M = 1" standard
7. Q = (12" minimum) Size depends on required components.
   Consult factory for dimensions
8. F = 9/16" for slip-in type
   1" for flange mount
9. R = 1 1/2" when using 4 7/8" U dimension
   15/16" when using 6" U dimension
10. N = Q minus R and U

NOTE: R and N dimensional values exchange position for right hand offset.

TABLE OF ILLUSTRATIONS

TABLE OF WIRING SCHEMATICS

ELECTRIC DUCT HEATER CONFIGURATION CODE

Each RenewAire Electric Duct Heater is assigned a 25 digit Model Number. The Model Number can be used to identify the various options as ordered by the customer.

MODEL NUMBER																									
			-																						
DIGIT NUMBER	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25

Digits 1 - 2:	Heater Type
"EK "= Electric Heater (Standard)	

Digits 4 - 5:	Width in Inches (see Restriction 1)
08-99	

Digits 6 - 7:	Height in Inches (see Restriction 2)
08-99	

Digits 8 - 10:	Capacity in kW (see Restrictions 3, 4 & 5)
001-175	

Digit 11:	Mount
"S" = Slip In (Standard) "F = Flanged	

Digit 12:	Element Style
"C" = Open Coil (Standard)	

Digit 13:	Element Material
"C" = 60-20-20 Ni-Cr-Fe with Nickel Plate Terminal Pins (Standard) "A" = 80-20 Ni-Cr with Stainless Steel Terminal Pins	

Digit 14:	Airflow Orientation
"H" = Horizontal (Standard) "V" = Vertical	

Digit 15:	Control Box Offset
"L" = Left Hand (Standard) "R" = Right Hand	

Digit 16:	Control Box Recessed
"-" = None (Standard) "R" = Recessed 1"	

Digit 17:	Control Box Dust Tight
"-" = None (Standard) "D" = Dust Tight	

Digit 18:	Voltage (see Restrictions 7 & 8)
"1" = 120V "2" = 208V "3" = 240V "4" = 480V "8" = 600V "9" = 277V	

Digit 19:	Phase
"1" = Single-Phase "3" = Three-Phase	

Digit 20:	Power Fusing (see Restriction 9)
"-" = None "F" = Fusing	

Digit 21:	Stage
"1" = Single (Standard) "2" = 2-Stage "4" = 4-Stage	

Digit 22:	Control Voltage
"S" = 24VAC	

Digit 23:	Control Type (see Restrictions 10, 11 & 12)
"D" = Staged with Thermostat and Sensor (Standard) "E" = Electronic Step Control with Thermostat and Sensor "S" = SCR (control by others) "V" = SCR with Thermostat and Sensor	

Digit 24:	Time Delay
"-" = None (Standard)	

Digit 25:	Pilot Light (See Restriction 13)
"N" = None (Standard) "L" = Light	

***NOTES:**
Digit 3 is not used in this model.
All heaters come with standard features: Disconnect Switch, Air Flow Switch (non adjustable), Control Transformer
Descriptions of feature and options are found in the installation and operation manual.

Restrictions:

1: Width inches entered as a whole number.
2: Height inches entered as a whole number.
3: Heater density should be less than 30kW/ft². $\text{DENSITY} = \frac{\text{HEATER CAPACITY (kW)}}{(\text{W" x H"})/144} < 30$
4: Heater capacity kW entered as a whole number.
5: Formulas for calculating kW and temperature rise: $kW = \frac{CFM \times \Delta T}{3150}$ $\Delta T = \frac{kW \times 3150}{CFM}$
7: Voltage Codes "1" & "9" only available with Phase Code "1" (Single-Phase).
8: Voltage Codes "4" & "8" only available with Phase Code "3" (Three-Phase).
9: Power Fusing Code "F" required when amperage is >48A. (based on kW and voltage)
10: Control Type Code "D" only available with Stage Code "1" & "2".
11: Control Type Code "E" only available with Stage Code "4".
12: Control Type Code "S" & "V" only available with Stage Code "1", unless amperage is greater than or equal to 96A, then Stage Code "4" is automatically selected.
13: Pilot Light Code "L" only available with Control Type Code "D".

DEFINITIONS FOR CONFIGURATION CODE

Heater Type:

EK—(Standard) heater 8"–99" height and width.

Width:

W—Width of duct ID in inches. For slip-in type the W dimension is undersized by ¼" to allow heater to slip into ductwork.

Range 8"–99"

Height:

H—Height of duct ID in inches. For slip-in type the H dimension is undersized by 1/16" to allow heater to slip into ductwork.

Range 8"–99"

Capacity:

KW—Kilowatt rating of heater. Determined by airflow (CFM) and temperature rise (rT).

Range 1–175 KW

Mount:

Slip-in (Standard)—heater is installed through opening cut into side of duct and the control box is attached to duct.

Flanged (Option)—heater is installed between two sections of flanged duct and bolted in place.

Element Style:

Open Coil (Standard)—open coil resistance wire. Used in most applications.

Element Material:

60-20-20 NI-CR-FE with nickel plate terminal pins (Standard)—standard “C” grade element wire. 60% nickel, 20% chromium, 20% iron.

80-20 NI-CR with stainless steel terminal pins (Option)—premium “A” grade element wire. 80% nickel, 20% chromium.

Airflow Orientation:

Horizontal (Standard)—heater installed where airflow in ductwork is horizontal through the heater.

Vertical (Option)—heater installed where airflow in ductwork is vertical through the heater. Vertical up and down airflow available in EK series.

Control Box Offset:

Left Hand (Standard)—the control panel is offset to the left side of the heating elements as determined when looking into the control box.

Right Hand (Option)—the control panel is offset to the right side of the heating elements as determined when looking into the control box.

Control Box Recessed (Option):

Recessed 1"—Control box is designed to extend 1" beyond internally insulated duct. Heater element width construction is automatically reduced by 1". Heater element height construction is automatically reduced by 2". Recess depth dimension is 1". Only allowed for internally insulated ducts of 1" insulation thickness.

Control Box Dust Tight (Option):

Dust Tight—Compression type gasket installed on control box flanges to seal door opening. Control box seams are filled to prevent dust intrusion. Typically specified when local code requires it.

Voltage and Phase:

Single Phase—120V, 208V, 240V, 277V

3-Phase—208V, 240V, 480V, 600V

Power Fusing:

Required by UL and NEC if amperage is over 48A. Otherwise is an option.

Stage:

Single Stage (Standard)—All heating elements are energized simultaneously. SCR control is always single stage.

2-Stage (Option)—Heating capacity is divided into two sections. Half of the heating capacity can be energized when less heating is required. Both stages are energized when full heating is required. Can be for on/off control.

4-Stage—Heating capacity is divided into four sections. 4-stage for Electronic Step Control only.

Control Voltage:

24 VAC (Standard)—secondary voltage

Control Type:

Duct Thermostat with sensor—standard thermostat with on/off control. Sensor is duct mounted. Thermostat must be programmed by installer for the number of stages. (Standard)

Electronic Step Control—provides sequencing control in steps of 4 for duct heater. Converts analog input signal into discrete steps or stages. As an example, if you have a 4-stage heater the step controller would be 4-stage. For an analog signal greater than 4Vdc the first stage would energize, for an analog signal greater than 6Vdc the first and second stages would energize, for an analog signal greater than 8Vdc the first, second, and third stages would energize, and for an analog signal at 10Vdc all stages would energize.

Silicon Controlled Rectifier (SCR)—100% step-less modulating control. Accepts 0-10Vdc or 4-20mA as control signal. Utilizes solid state relays (SSR) to switch current to the heating elements, on a time-proportioned basis.

SCR Vernier—When SCR control is selected and the heater is greater than 96A then an SCR vernier control is implemented. This combines an SCR with 4-stage electronic step control as a cost effective method for providing modulating control on heaters greater than 96A.

A SSR is an electronic switching device similar to an electromechanical relay (contactor) but has no moving parts which allows very fast switching of high current loads without arcing or wearing out. A heater with an SCR controller must be installed in such a way as to provide good ventilation to the heat sink so that the life of the SSR is prolonged. Over-heating of an SSR causes it to fail so the heater must be installed such that the heat sink is positioned either vertically on the side of the control cabinet or on top of the control cabinet—never on the bottom.

Pilot Light Option:

Light to indicate heater energized. Control voltage same as transformer secondary voltage (24 VAC).

Airflow Switch: (Standard)

Non-adjustable pressure switch that prevents the heater from being energized when no or very low air flow is present through the heater. Minimum air flow pressure is 0.05 in.w.c + .02.

Auto Reset: (Standard)

Automatic reset limit switch for primary over-temperature protection. Required by UL.

Manual Reset: (Standard)

Manual reset limit switch for secondary over-temperature protection. Required by UL.

Disconnect Switch: (Standard)

Non-fused interlocking switch mounted in the door of the heater control box. Must be turned off to open door on control box. Interrupts power to the heater when turned off.

Terminal Block: (Standard)

Low voltage control terminal block included.

Ground Lug: (Standard)

Connection point for grounding field connected line voltage.

All heaters are designed for zero clearance.

Control box is constructed of galvanized steel.

Control box has hinged access door with interlocking disconnect switch.

All heaters are UL and cUL listed and tested in accordance with Standard UL1996.

1.0 OVERVIEW

1.1 DESCRIPTION

The model EK electric duct heater is an open-coil type heater for indoor installation only. Multiple voltages and heater sizes are offered. A number of different control options are offered.

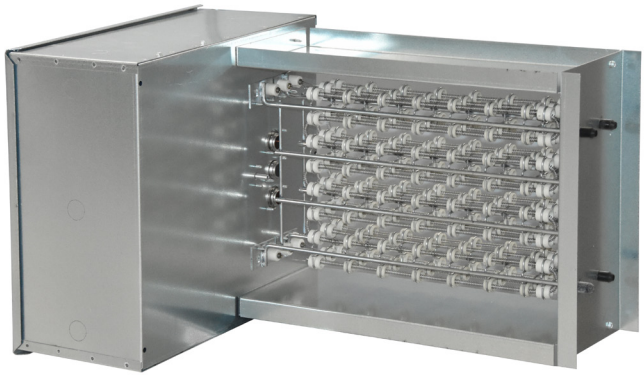


FIGURE 1.1.0 ELECTRIC HEATER (TYPICAL)

FIGURE 1.1.1 CONTROL PANEL COVER

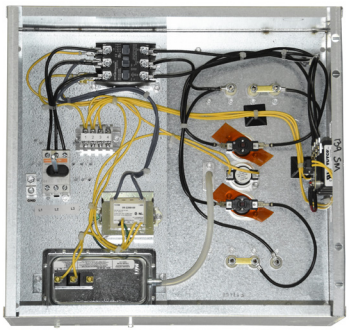


FIGURE 1.1.2 BASIC CONTROL PANEL

1.2 ELECTRICAL SUPPLY

The electric duct heater requres both line voltage and low voltage circuits with correct polarity and clean neutral and ground. Line voltage readings between each leg should be within +/- 3 volts of the voltage rating on the heater rating label, found on the door of the control panel.

1.3 HEATER CAPACITY IN KILOWATTS

Electric heater capacity is based on kilowatts (kW). Electric heaters are nearly 100% efficient, so output capacity equals input capacity. Heaters are available in capacities from 1 - 175 kW.

1.4 HEATER ELEMENTS

A choice of two different types of heater elements is offered: either 60–20–20 Ni–Cr –Fe with nickel plated terminal pins (standard) or 80-20 Ni-Cr with stainless steel terminal pins.

1.5 SAFETY FEATURES

Each heater is equipped with the following:

1.5.1 Airflow Switch

The airflow switch is a non-adjustable pressure switch that prevents the heater from being energized when no or very low air flow is present.

1.5.2 Automatic Reset Limit Switch

The auto reset limit switch is mounted on the heater next to the elements. If the limit switch detects temperatures greater than 130 degrees Fahrenheit [54.4^0 C], it shuts down the heater until the temperature drops and then the limit switch automatically resets itself.

1.5.3 Manual Reset Limit Switches

There are two manual reset limit switches on the heater, located next to the heater elements. If the limit switch detects temperatures in excess of 200 degrees Fahrenheit [93.3^0 C], the limit switch trips and shuts off the heater. The limit switch must be manually reset.

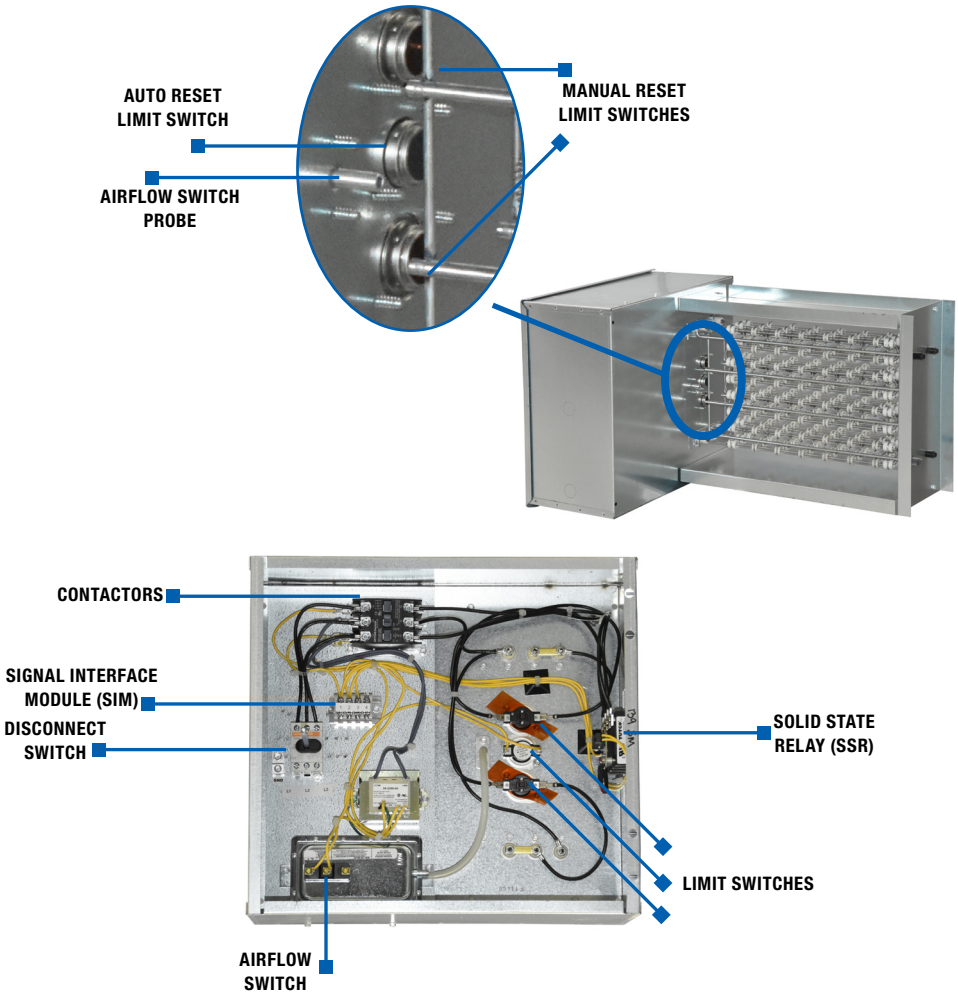


FIGURE 1.5.0 HEATER CONTROLS IDENTIFICATION

1.6 HEATER CONTROL

Electric duct heaters are configured with either staged or modulating control. The options available are:

- Single Stage
- 2-stage
- 4-stage

Single stage control is when all heating elements are energized simultaneously. Single stage control can be either simple ON/OFF or modulating.

2-stage control has the heating capacity divided into two sections. Half of the heating capacity is energized when less heating is required. Both stages are energized when full heating is required. 2-stage control is always ON/OFF.

4-stage control is when the heating capacity is divided into four sections. This provides sequencing control in four steps for the heater. The heater controller converts an analog input signal into discrete steps or stages to energize each stage of the heating elements. 4-stage control is always Electronic Step Control.

1.7 HEAT RISE

- Maximum allowable discharge temperature is 120˚ F [48.9˚ C] for any installation.
- Maximum allowable temperature rise is 90˚ F [50˚ C].
- Maximum design duct static pressure is 3.0 InWC .

Note that the example below is based upon a specific Entering Air temperature. As Entering Air temperatures vary, the resulting temperature rise will also vary.

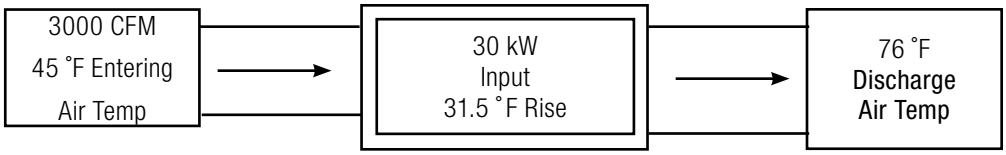


FIGURE 1.7.0 HEAT RISE CALCULATION

1.8 USER INTERFACE

The User Interface (U/I) is the device used to control operation of the electric duct heater. Single and 2-stage heaters are ordered with a 2-stage duct thermostat and sensor. Modulating heaters can be ordered with an analog thermostat and sensor. The user interface may be a simple ON/OFF thermostat, modulating thermostat, or even a Building Management System (BMS).

2.0 SYSTEM REQUIREMENTS

2.1 GENERAL OPERATING REQUIREMENTS

Minimum Air Velocity: 70 CFM per KW (75-80 Recommended)
Maximum Inlet Air Temp: 100 Deg. F [37.80 C]
Maximum Heater KW: 30 kW per square foot of heater cross section.

2.2 SIZING AN ELECTRIC DUCT HEATER

An electric duct heater can be sized from the following information:

- Duct Width (W") and Duct Height (H")
- Heater voltage and phase
- Heater Capacity rating (kW)
- Or Design Air Flow (CFM) and
- Desired Temperature Rise (Δ °F)

NOTE: The air temperature entering the heater should not exceed that marked on the heater nameplate label.

2.3 AMPERAGE DRAW

Any electric duct heater with line current over 48 amps automatically receives fusing per UL and NEC requirements. Electric duct heaters over 48 amps are subdivided into loads less than 48 amps. Formula for calculating line current are:

Single Phase: Amps = Watts/Line Voltage

Three Phase: Amps = Watts/(Line Voltage x 1.73)

To convert kW to Watts multiply kW by 1000

2.4 KW AND TEMPERATURE RISE

The following formula may be used to determine the approximate total kW required when the CFM (air volume) and desired temperature rise are known:

$$kW = \frac{CFM \times \triangle T}{3150}$$

2.5 DUCT HEATER TEMPERATURE RISE

The following formula may be used to determine the approximate temperature rise of a duct heater when the kW and CFM are known:

$$\triangle T = \frac{KW \times 3150}{CFM}$$

2.6 DETERMINING MAXIMUM HEATER KW

MAXIMUM WATTS PER SQ. IN. OF DUCT AREA

Duct width (inches) x duct height (inches) = duct watts total sq. in.

Max W = $X\left(\frac{W}{in^2}\right)$ x duct area in^2

For EK, $X = 208.33\ \left(\frac{W}{in^2}\right)$

MAXIMUM KW FOR SQ. FT. OF DUCT AREA

Duct width (feet) x duct height (feet) = duct area total ft^2

Max W = $X\left(\frac{kW}{ft^2}\right)$ x duct area ft^2

For EK, $X = 30\ \left(\frac{kW}{ft^2}\right)$

2.7 MINIMUM AIR VELOCITIES

The minimum uniform airflow in a duct heater is directly related to the inlet air temperature. Consideration must be given to both airflow across the heater and inlet air temperature, (shown below).

To calculate the kilowatts per sq. ft. of duct area, divide the total kilowatts required by the duct area.

EXAMPLE: Duct Size = 2ft. x 3ft.

Total kilowatts = 20

KW/Sq. Ft. = $\frac{20}{6}$ = 3.333

If the air handler equipment is expressed in FPM then a direct cross reference can be made by comparing the temperature of the air (as it enters the Duct Heater) to the KW rating on the chart of rated velocity.

a. Draw a line horizontally from the KW/Sq. Ft. required to the inlet air temperature being used.

b. From this point of intersection on the Inlet Air Curve, draw a line down vertically to establish the air velocity.

c. The velocity should never be lower than the velocity as determined from the chart. In cases where this is not true, the velocity must be increased or the KW required must be reduced.

In cases where the air handling equipment is expressed in CFM then convert to FPM by dividing the CFM by the duct area.

EXAMPLE: FPM = $\frac{\text{CFM}}{\text{Duct Area}}$

NOTE: Minimum airflow must be maintained at any point over the face of the heater.

NOTE: Observe at least one complete heating cycle to ensure that cycling of the safety limit controls does not occur before leaving the installation.

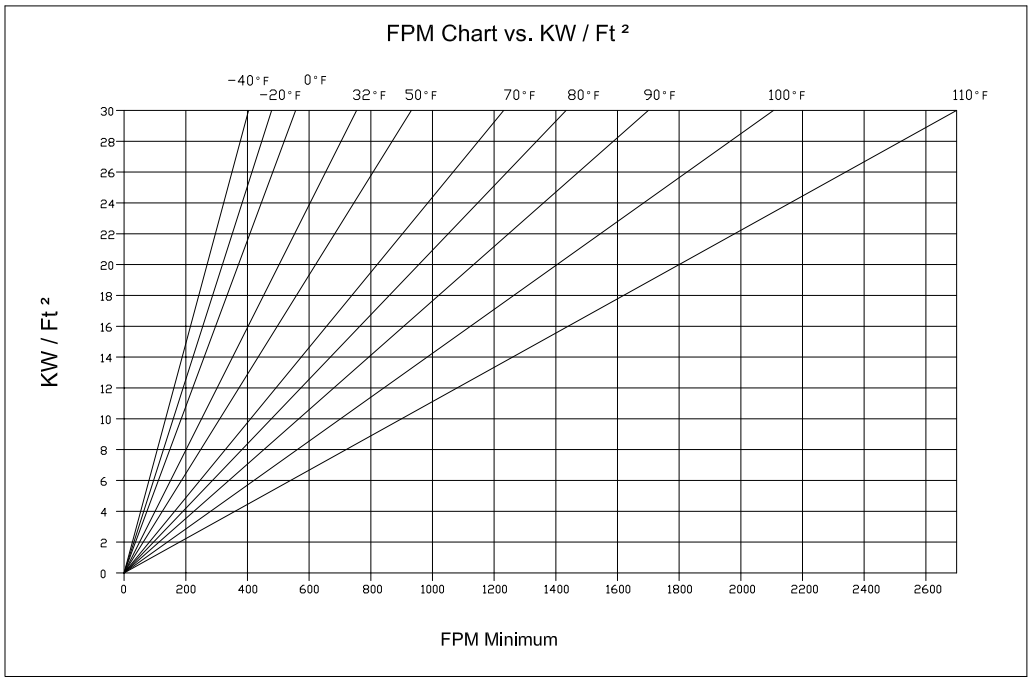


FIGURE 2.7.0 FPM VS KW/ FT^2 CHART

3.0 HEATER PLACEMENT

3.1 GENERAL

A duct heater must be installed according to the installation instructions, wiring diagram and labeling supplied with the heater.

Listed below are some important items when installing an electric duct heater:

NOTE: An airflow switch only proves that airflow exists (a differential in static pressure), not that the minimum air velocities and proper air distribution for the duct heater exist.

NOTE: All figures are showing a top view of a horizontal duct.

1. Never operate a duct heater without airflow. The heater must always be interlocked with the fan. This may be accomplished by either an airflow switch or fan interlock relay.
2. Never operate heater without achieving at least the minimum airflow required. Always refer to the installation instructions and the nameplate label to determine your minimum air velocities based on your inlet air temperature. If the minimum airflow requirements are not present the heater will not function properly and safely. (see Figure 3.1.0)
3. Never operate the heater with uneven airflow. The minimum airflow requirements must be present at all points over the heater face. (see Figure 3.1.0)
4. The air must be filtered. The incoming air must be free from all debris, combustible particles, and hazardous vapors.
5. Always locate the heater at least 24" from an elbow or turn. (See Figure 3.1.1)
6. Always locate the heater at least 48" from an ERV, heat pump or central air conditioner. (See Figure 3.1.2)

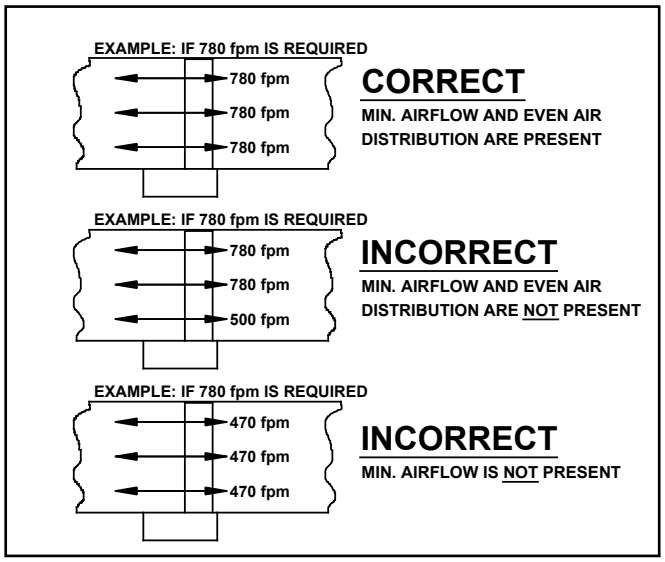


FIGURE 3.1.0 PLACEMENT:MINIMUM AIRFLOWS

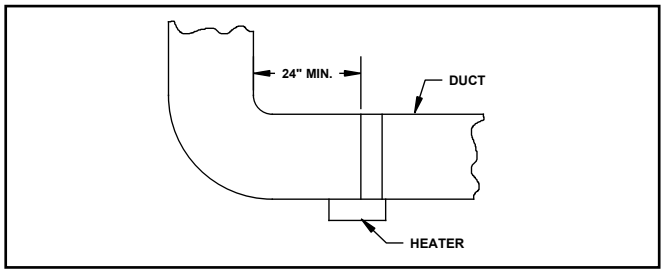


FIGURE 3.1.1 PLACEMENT: ELBOW MINIMUM REQUIREMENT

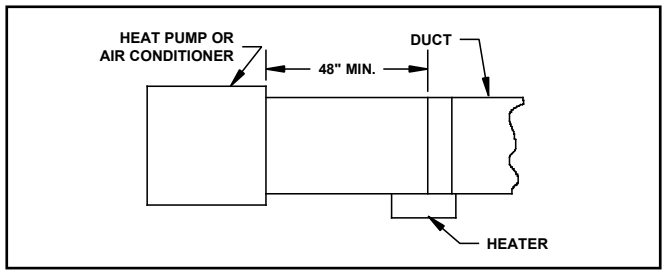


FIGURE 3.1.2 PLACEMENT: LOCATION REQUIREMENTS

7. Always locate the heater at least 48" from any canvas duct connector or transition section for change in duct size. If connecting to round duct, install heater in a rectangular duct section. Use round-to-rectangular pyramidal transitions to connect round duct to rectangular duct. Always locate the heater at least 48" from any transition section for change in duct size. Follow installation guidelines given in manual and in accordance with SMACNA guidelines (see Figure 3.1.3)
8. Always locate the heater at least 48" downstream from an air handler. (See Figure 3.1.4)
9. Always locate the heater at least 48" upstream from an humidifier. (See Figure 3.1.5)
10. Always locate the heater at least 48" downstream from an air filter. (See Figure 3.1.6)

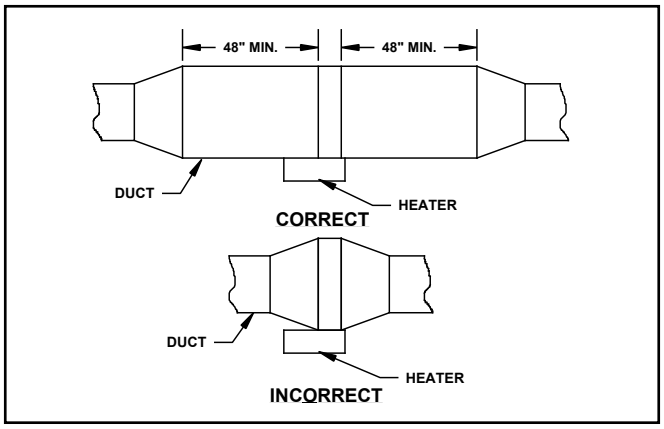


FIGURE 3.1.3 PLACEMENT: TRANSITION REQUIREMENTS

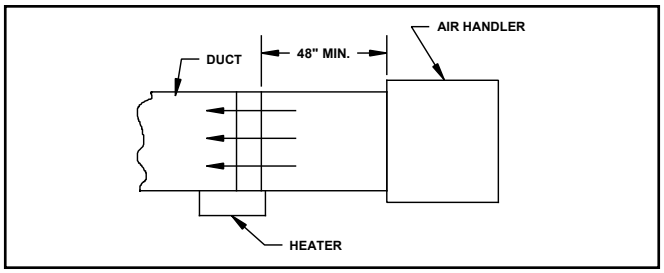


FIGURE 3.1.4 PLACEMENT: DOWNSTREAM REQUIREMENTS

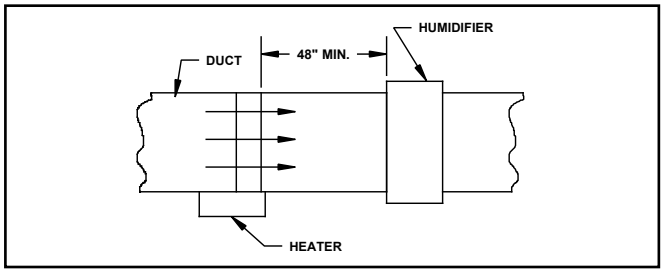


FIGURE 3.1.5 PLACEMENT: HUMIDIFIER REQUIREMENTS

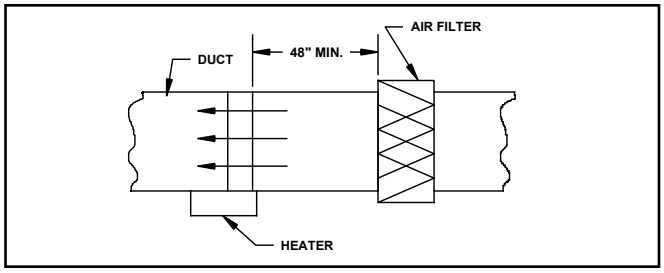


FIGURE 3.1.6 PLACEMENT: AIR FILTER REQUIREMENTS

11. Never install a standard heater into a duct with an internal obstruction. Due to the fact that an obstruction can block airflow at the temperature limit controls and element terminations. If this situation exists, it can be corrected by using a heater with a recessed control box and reduced wrapper size. This situation is common with internally insulated ducts. (see Figure 3.1.7)
12. Never insulate the exterior of the control box. The control box must be completely accessible and located where ventilation can be provided at all times. (see Figure 3.1.8)
13. Never install a heater near a double blower outlet. A heater must be installed far enough away from a double blower outlet that even and proper airflow is present or separate duct heaters placed in the duct runouts of each blower. (all installation must conform with the heater installation instructions.) (see Figure 3.1.9)
14. Never install a heater less than 48" from any fan. Mounting a heater any closer than 48" to a fan will result in uneven airflow.

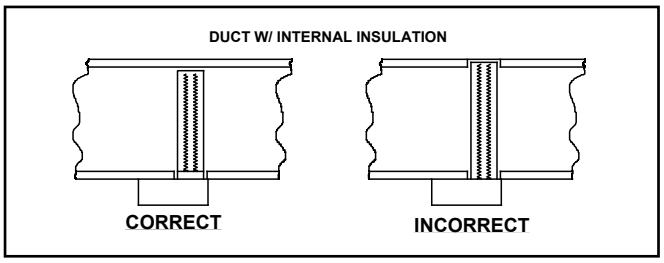


FIGURE 3.1.7 PLACEMENT: OBSTRUCTION REQUIREMENTS

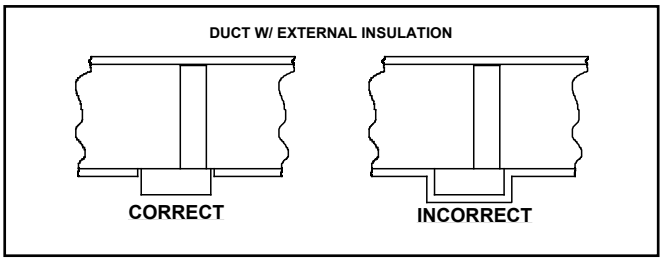


FIGURE 3.1.8 PLACEMENT: CONTROL BOX REQUIREMENTS

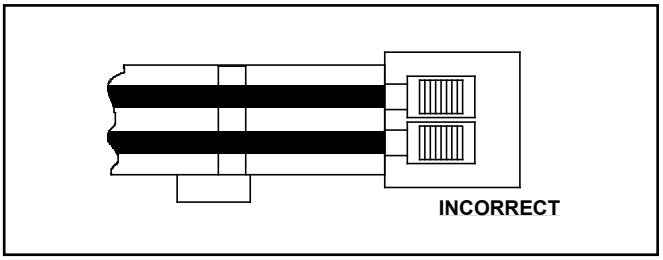


FIGURE 3.1.9 PLACEMENT: DOUBLE BLOWER REQUIREMENTS

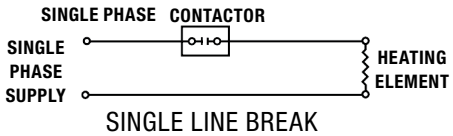
15. Never use aluminum conductors. Use copper conductors only for all incoming wiring.
16. Never install a standard heater outdoors without making special provisions to protect the heater and control box from the elements.
17. Never bundle, tie or wrap power wiring. The wire could overheat or the insulation could breakdown.
18. Never use a different voltage and/or phase than what is listed on the heater nameplate label. The duct heater is to be used only at the voltage and phase that is listed on the nameplate label.

4.0 ELECTRICAL DATA

4.1 TYPICAL CONTACTOR POWER CIRCUITRY

(Only power circuit shown, safety devices etc., omitted)

DISCONNECTING TYPE:

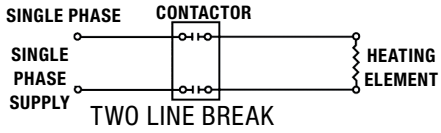


SINGLE LINE BREAK

This type would be disconnecting for 120V and 277V, providing the contactor opens the ungrounded line.

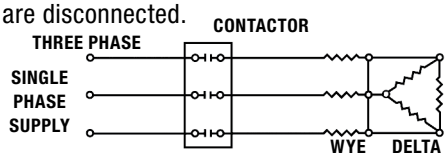
Heating elements, namely those used in three phase, balanced, configurations are factory wired, as manufacturers standard in two basic configurations delta or WYE.

DISCONNECTING TYPE:



TWO LINE BREAK

Heating power is completely disconnected by breaking both sides of the power source. All ungrounded power conductors are disconnected.

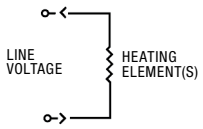


All ungrounded conductors disconnected.
Both WYE and Delta configurations shown.

FIGURE 4.1.0 TYPICAL CONTACTOR POWER CIRCUITRY

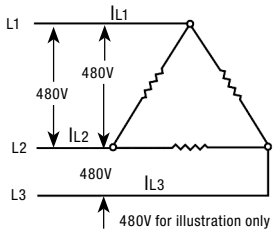
4.2 HEATING ELEMENT WIRING CONFIGURATIONS AND PROPERTIES

SINGLE PHASE



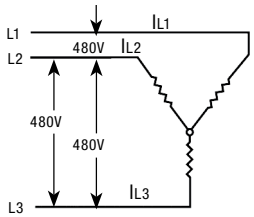
Element Voltage = Line Voltage

THREE PHASE



THREE WIRE DELTA CONNECTION

1. Element Voltage = Line Voltage
2. Phase Currents In = $I_{L1} = I_{L2} = I_{L3}$
3. Voltage measured between any two power legs (L1 to L2 etc.) should be equal to the three phase line voltage.



THREE WIRE WYE CONNECTION

1. Element Voltage = $\frac{\text{Line Voltage}}{1.73}$
2. Phase Currents In = $I_{L1} = I_{L2} = I_{L3}$
3. Voltage measured between any two power legs (L1 to L2 etc.) should be equal to the three phase line voltage.

FIGURE 4.2.0 HEATING ELEMENT WIRING PROPERTIES

4.3 HEATER WIRING SCHEMATICS

NOTE: See low voltage control connections, pages 23-25, for external control wiring.

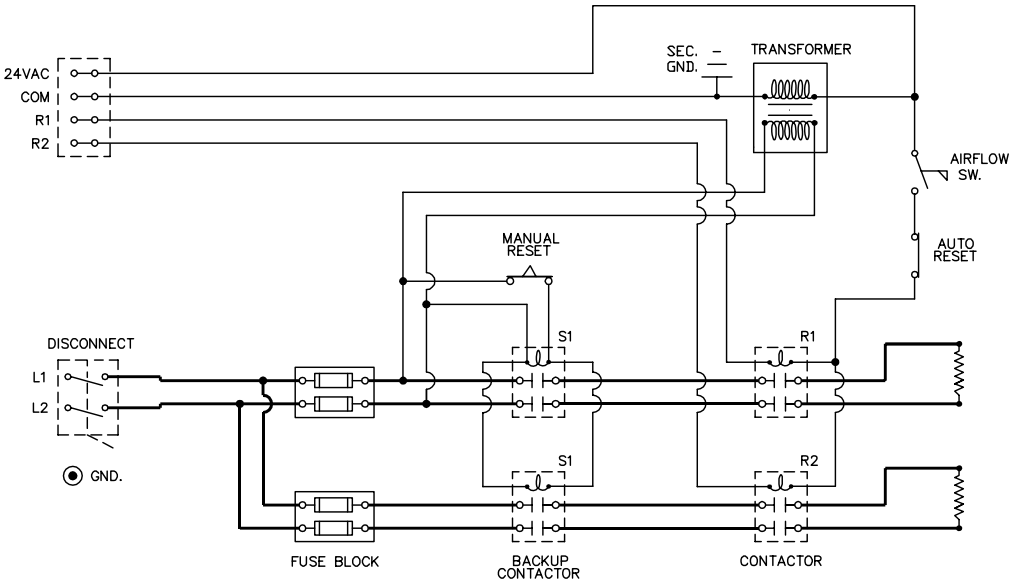


FIGURE 4.3.0 SINGLE PHASE ON-OFF HEATER WIRING

NOTE: See low voltage control connections, pages 23-25, for external control wiring.

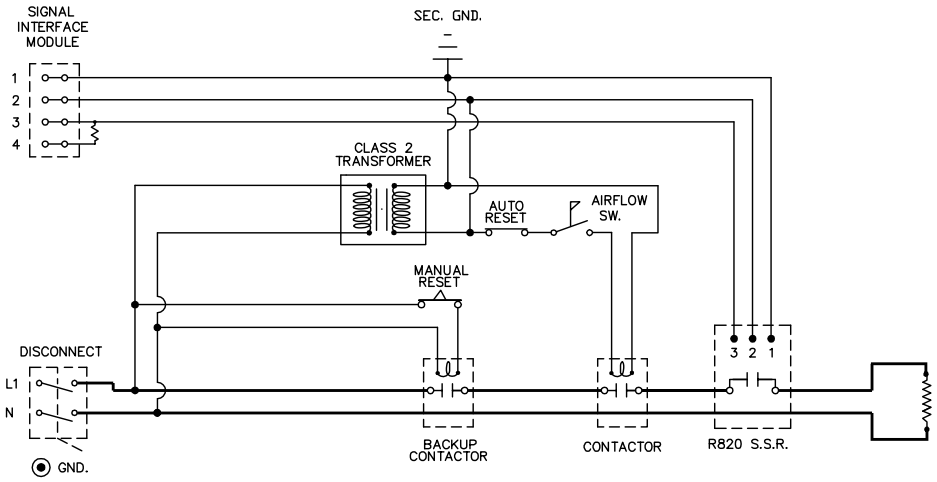
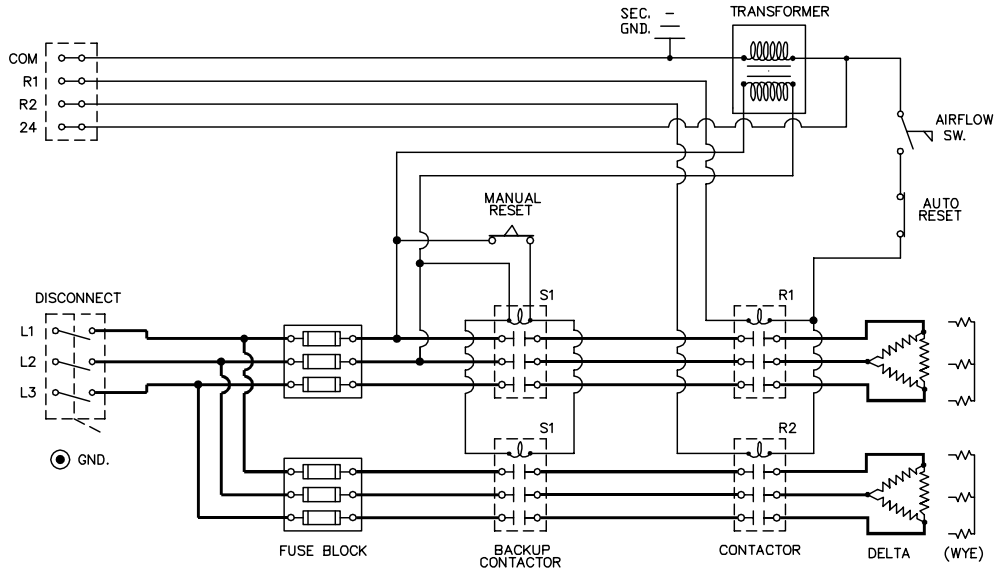
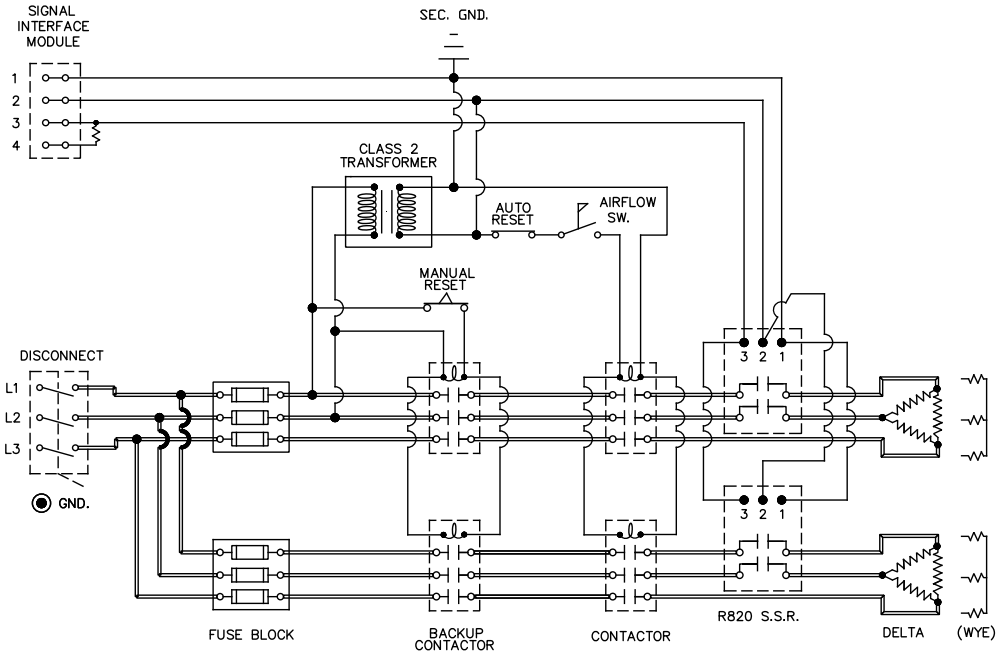


FIGURE 4.3.1 SINGLE PHASE SCR HEATER WIRING



NOTE: See low voltage control connections, pages 23-25, for external control wiring.

FIGURE 4.3.2 THREE PHASE ON-OFF HEATER WIRING



NOTE: See low voltage control connections, pages 23-25, for external control wiring.

FIGURE 4.3.3 THREE PHASE SCR HEATER WIRING

⚠ WARNING

RISK OF FIRE, ELECTRIC SHOCK, OR INJURY. OBSERVE ALL CODES AND THE FOLLOWING:

1. Before servicing or cleaning the heater, switch power off at disconnect switch or service panel and lock-out/tag-out to prevent power from being switched on accidentally. More than one disconnect switch may be required to de-energize the equipment for servicing.
2. This installation manual shows the suggested installation method. Additional measures may be required by local codes and standards.
3. Installation work and electrical wiring must be done by qualified professional(s) in accordance with all applicable codes, standards and licensing requirements.
4. Any structural alterations necessary for installation must comply with all applicable building, health, and safety code requirements.
5. This heater must be grounded.
6. Use the heater only in the manner intended by the manufacturer. If you have questions, contact the manufacturer.

4.4 LOW VOLTAGE CONTROL SYSTEM

⚠ CAUTION

1. Connect only to components intended for use with 24 VAC power.
2. Do not undersize the low-voltage wires connected to this device. Observe the wire length and gauge limits indicated in this manual.
3. Do not overload this unit's 24 VAC power supply system. Confirm that the power requirements of devices you connect to this power supply system do not exceed transformer available power.

This heater is provided with a Class II 24 VAC power supply system that operates the unit's contactor(s). The 24 VAC Power Supply can also be used to power the externally-installed controls system.

In the event of a short-circuit or overload, the transformer itself is designed to fail safely.

4.4.1 Specifications

- Nominal Output Voltage under load: 24 VAC
- Typical Output Voltage at no load: 29-31V
- Minimum contact rating for connected control device: (50mA (1.2VA))

4.4.2 Limits of Power Output

If limits on wire gauge and length are observed, you may connect control devices that draw up to 8VA to the provided terminals. More than one device can be connected as long as total steady-state load does not exceed transformer available power.

OBSERVE THESE LIMITS TO WIRE LENGTH AND GAUGE
in order to ensure reliable operation of the control system.

Wire Gauge	#22	#20	#18	#16	#14	#12
Circuit Length	100'	150'	250'	400'	700'	1000'

"Circuit Length" is distance from Heater to Control Device.

4.5 LOW VOLTAGE CONTROLS CONNECTIONS

These heaters may be ordered with factory-supplied thermostats.

NOTE: Installation details for Electric Duct Heaters equipped with SCR's or Electronic Step Controllers (Including SCR Vernier Control)

This heater is designed to accept an analog control signal. The heater will need to be supplied with either a 0(2) to 10 VDC or a 4 to 20 mA signal.

4.5.1 Interface Module Control Signal Wiring Connection Diagram

FIGURE 4.5.0

STAND ALONE THERMOSTAT FOR MODULATING CONTROL: Use this schematic if thermostat requires 24 VAC power and is to be powered by the heater transformer.

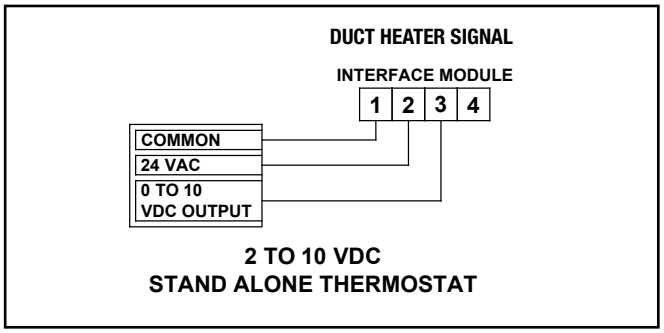


FIGURE 4.5.0 STANDALONE THERMOSTAT FOR MODULATING CONTROL

⚠ CAUTION

This heater will NOT operate with a standard 24 VAC control signal.

FIGURE 4.5.1

DDC BAS FOR MODULATING CONTROL (2-10VDC): Use this schematic if the Building Automation System provides a 2-10 Vdc signal to control the heater.

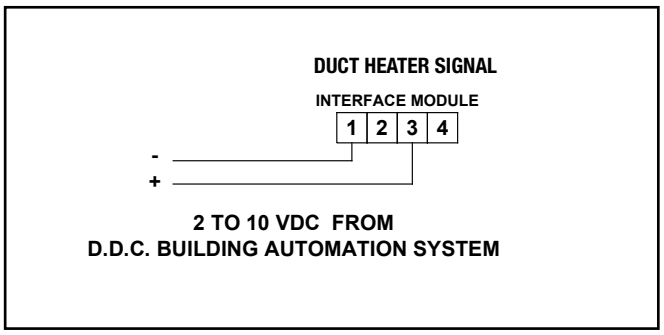


FIGURE 4.5.1 DDC BAS FOR MODULATING CONTROL (2-10 VDC)

⚠ CAUTION

Do NOT adjust any dip switches on the controls within the heater!

They are factory set-control. Signal is determined by interface module connection.

FIGURE 4.5.2

DDC BAS FOR MODULATING CONTROL (4-20 MA): Use this schematic if the Building Automation System provides a 4-20 mA signal to control the heater.

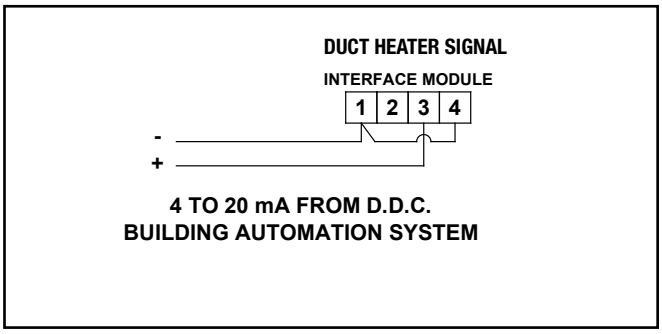


FIGURE 4.5.2 DDC BAS FOR MODULATING CONTROL (4-20 MA)

NOTE: See documentation with thermostat for complete installation instructions.

4.5.2 Electronic Step Controller or SCR Control

NOTE: See documentation with thermostat for complete installation instructions.

FIGURE 4.5.3

VICONICS ROOM THERMOSTAT WITHOUT REMOTE SENSOR FOR MODULATING CONTROL: Use this schematic if a Viconics thermostat without remote sensor is used to control the heater.

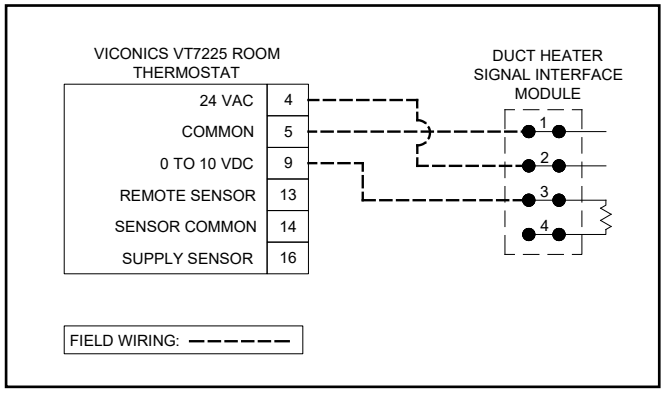


FIGURE 4.5.3 VICONICS ROOM THERMOSTAT WITHOUT REMOTE SENSOR FOR MODULATING CONTROL

FIGURE 4.5.4

VICONICS ROOM THERMOSTAT WITH REMOTE SENSOR FOR MODULATING CONTROL: Use this schematic if a Viconics thermostat with remote sensor is used to control the heater for return air temeprature.

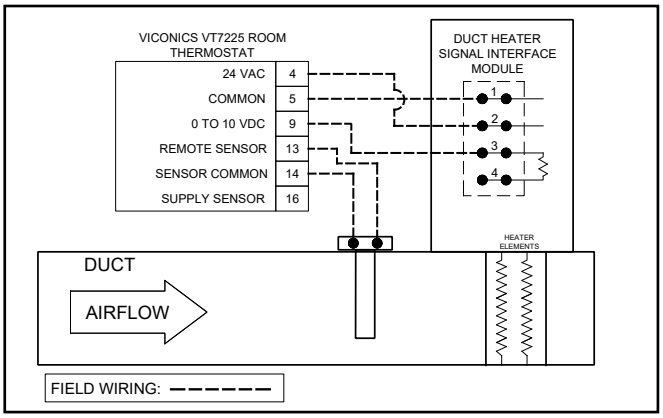


FIGURE 4.5.4 VICONICS ROOM THERMOSTAT WITH REMOTE SENSOR FOR MODULATING CONTROL - RETURN AIR TEMPERATURE

FIGURE 4.5.5

VICONICS ROOM THERMOSTAT WITH REMOTE SENSOR FOR MODULATING CONTROL: Use this schematic if a Viconics thermostat with remote sensor is used to control the heater for supply air temperature.

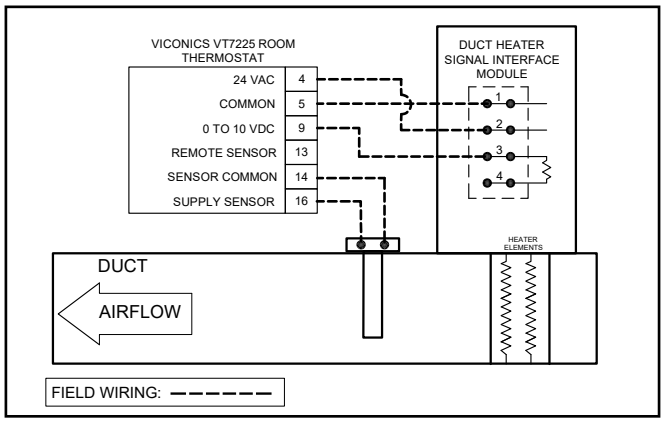


FIGURE 4.5.5 VICONICS ROOM THERMOSTAT WITH REMOTE SENSOR FOR MODULATING CONTROL - SUPPLY AIR TEMPERATURE

4.5.3 Staged Control

FIGURE 4.5.6

SINGLE STAGE THERMOSTAT WITH REMOTE SENSOR FOR ON/OFF CONTROL: Use this schematic to control a single stage heater.

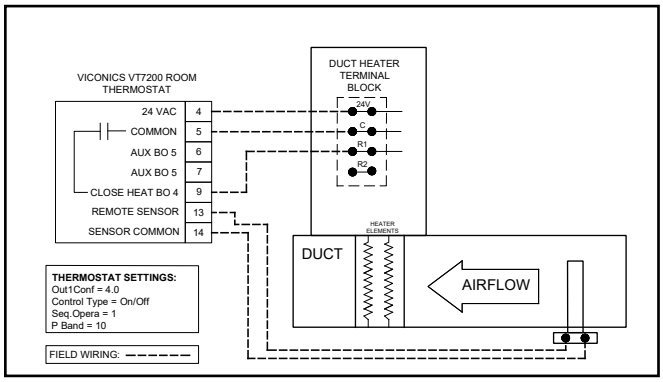


FIGURE 4.5.6 SINGLE STAGE THERMOSTAT WITH REMOTE SENSOR FOR ON/OFF CONTROL

NOTE: See documentation with thermostat for complete installation instructions.

FIGURE 4.5.7

2-STAGE THERMOSTAT WITH REMOTE SENSOR FOR ON/OFF CONTROL: Use this schematic to control a 2-stage heater.

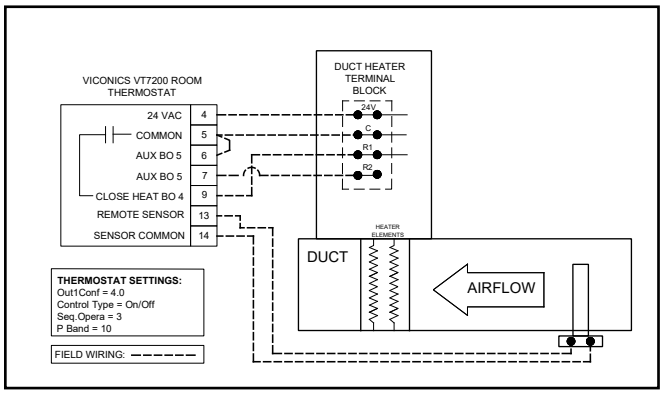


FIGURE 4.5.7 2-STAGE THERMOSTAT WITH REMOTE SENSOR FOR ON/OFF CONTROL

5.0 INSTALLATION

5.1 PLACEMENT OF THE ELECTRIC DUCT HEATER

- The information and instructions in this sheet apply to Duct Heater models for zero clearance installation in ducts.
- The Duct Heaters are approved for use Post ERVs with heat pumps, air conditioners, or other forced air systems. They may be controlled by contactors, relays, sequencers or solid state devices.
- The Duct Heaters are prewired, have voltage ratings to 600 volts, both single phase and three phase.
- The Duct Heaters are furnished with integral controls.

⚠ CAUTION

The air duct should be installed in accordance with the Standards of the National Fire Protection Agency for the Installation of Air-Conditioning and Ventilating Systems (Pamphlet No. 90A) and Warm-Air Heating and Air-Conditioning Systems (Pamphlet No. 90B).

⚠ CAUTION

Do not “Bank” heaters (side by side). If greater capacity is required, proportion smaller heaters in separate runouts.

⚠ CAUTION

Heater control boxes must be completely accessible and located to provide ventilation at all times.

5.2 HEATER INSPECTION

Inspect heater for any possible shipping damage. Check all insulators for breakage and inspect heater element wire for any deformation that could cause a short circuit or ground. Make sure all fasteners are tight.

Electrical connections such as pressure terminals should be checked for tightness.

INSTALLATION

For safe operation and best performance, the following installation procedures must be adhered to:

Heaters may be installed in the sides of either horizontal or vertical ducts but never in the top or bottom of a horizontal duct. Vertical up and down airflow available in EK series.

Install a heater a minimum of (4) feet from heat pumps or central air conditioners.

At least 4 feet downstream from an air handler.

At least 2 feet either side of an elbow or turn.

At least 4 feet from any canvas duct connector or transition section for change in duct size.

At least 4 feet downstream from an air filter.

At least 4 feet upstream from a humidifier.

DISCLAIMER

Model EK duct heaters offered by RenewAire are not to be installed in, on, or directly attached to any equipment and further must be installed according to the installation instructions shipped with each and every duct heater.

Refer to Page 15 for duct and air velocity requirements.

5.3 DUCT INSTALLATION

To install a slip-in heater **FIGURE 5.3.0**, cut an opening, as required in the side of the duct. Slide heater in the duct using control box as template to mark the mounting screw holes. Remove unit and drill mounting holes. Mount unit to duct with sheet metal screws. Connect high and low voltage supplies along with fan interlock circuit (if no airflow switch is furnished). Larger heaters may require hangers.

To install a flange type heater **FIGURE 5.3.1**, insert heater between two sections of flanged duct and bolt in place. For additional strength, the duct flange should be doubled as shown in the figure. Large heaters may require hanger straps. Connect high and low voltage supplies along with fan interlock circuit (if no airflow switch is furnished).

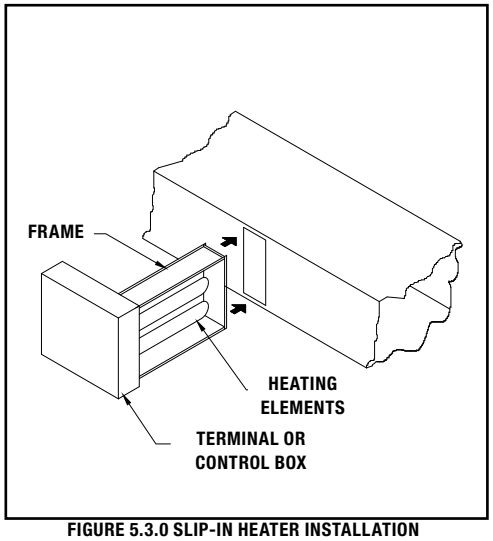


FIGURE 5.3.0 SLIP-IN HEATER INSTALLATION

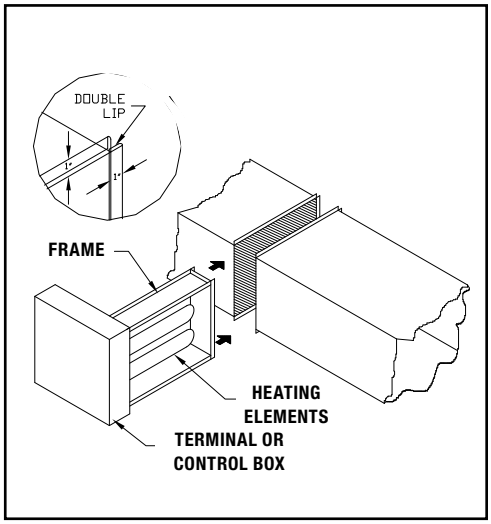


FIGURE 5.3.1 FLANGE HEATER INSTALLATION

See **Figure 5.3.2** for examples of some common installation approaches.

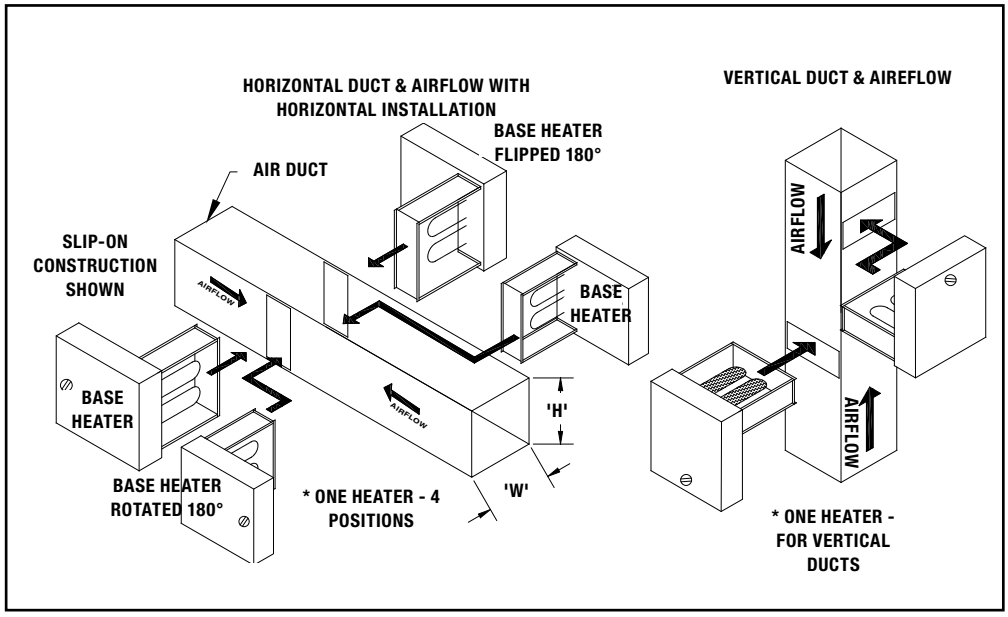


FIGURE 5.3.2 COMMON INSTALLATION APPROACHES

⚠ WARNING

This electric duct heater is intended for heating general ventilation air only. Do not use in airstreams containing hazardous or explosive materials or vapors.

NOTE: Minimum airflow or greater must be maintained uniformly over the entire face of the heater. The velocity of air should NEVER be lower than the specified minimum. In cases where this is not true the kW must be reduced or the velocity of air increased.

NOTE: Observe at least one heating cycle to verify proper operation; ensure that safety limit controls do not occur under normal operating conditions before leaving the installation.

NOTE: The air temperature entering the heater should not exceed that marked on the heater nameplate label.

6.0 OPERATING INSTRUCTIONS

6.1 ELECTRICAL REQUIREMENTS

Refer to attached wiring diagram and wiring diagram on inside of cover. Make sure line and control voltage of system matches that noted on wiring diagram.

Wire in accordance with N.E.C. and any existing local codes.

Check tightness of all factory and field electrical connections.

Make sure fan interlock is wired in if the Heater does not have an air flow switch.

Use 90 deg. C (194 deg. F) copper wire.

Control must be wired for N.E.C. Class 1 unless otherwise specified.

When Heater has integral transformer for control voltage to thermostat, use thermostat with isolating contacts to prevent interconnection of Class 2 outputs.

Disconnect all electrical power before servicing. When servicing heater, make sure all components are repositioned in the proper location and reconnect per wiring diagram.

Replacement parts must be identical to the original components.

Contact factory for replacement parts.

6.2 GENERAL OPERATING REQUIREMENTS

Minimum Air Velocity: 70 CFM per KW (75-80 Recommended)
Maximum Inlet Air Temperature: 100 Deg. F
Maximum Heater KW: 30 KW per square foot of duct cross section (EK-series)

Most models may be flipped and rotated.

7.0 MAINTENANCE

All RenewAire heaters are designed to be maintenance free and operate for a long time without problems.

The following are a few steps that are recommended:

1. Periodic inspection of the heater to check for any accumulation of dust on heating elements, any signs of rusting in the control panel and to check for any heater frame damage due to over heating.
2. Periodic inspection of the following heater components (during and before heating season):
    a. All fuses
    b. Resistance from phase to phase for each circuit
    c. Electrical connections to all contactors and heating elements
    d. All contactors
    e. Step controllers and modulating valves (SCR)
3. Always replace defective components with original parts. Contact factory for replacement parts.

⚠ WARNING

DO NOT ATTEMPT TO CLEAN OR SERVICE WITHOUT DISCONNECTING ALL SOURCES OF POWER

7.1 SERVICE PARTS

All RenewAire electric heaters are designed to be maintenance free and operate for a long time without problems.

The following are recommended steps:

- Perform annual maintenance and inspections as shown in Section 7.0 Maintenance in this manual.
- If defective parts are discovered, replace them with only factory-original parts.
- If repair parts are needed, see Section 8.0 Factory Assistance.

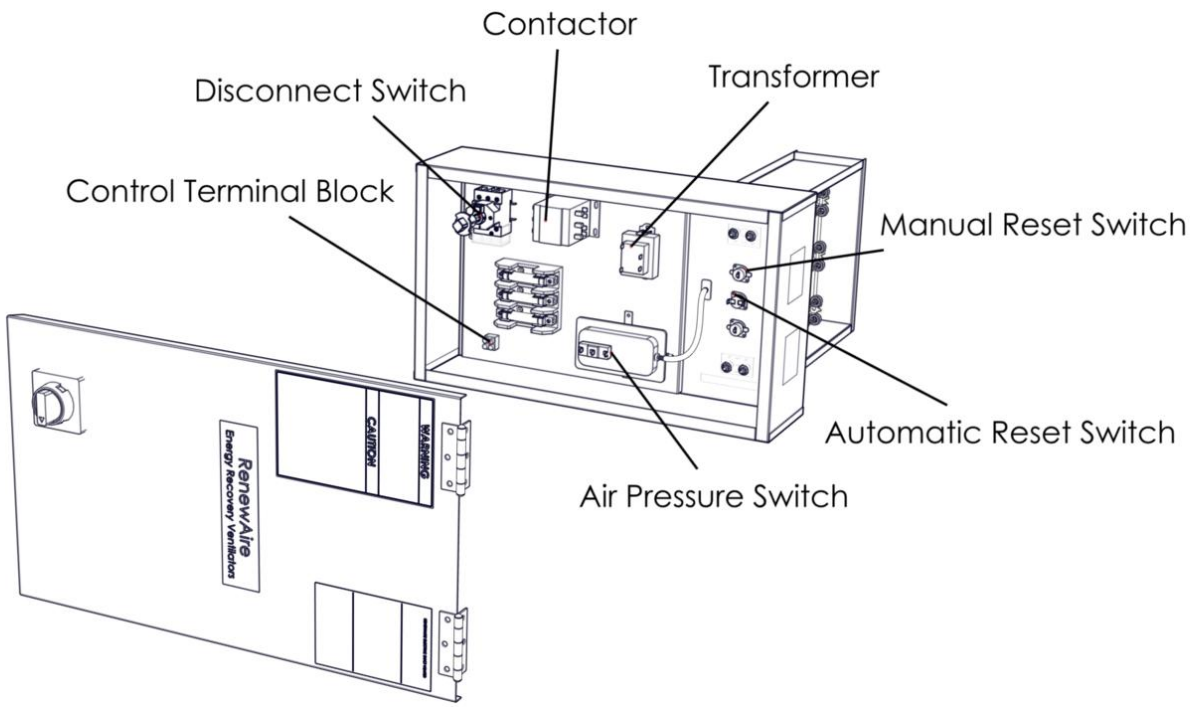


FIGURE 7.1.0 SERVICE PARTS

8.0 FACTORY ASSISTANCE

In the unlikely event that you need assistance from the factory for a specific issue with the Electric Duct Heaer, make sure that you have the information called for in the Unit Records page in the Owner Information section of this manual. The person you speak with at the factory will need that information to properly identify the unit and the installed options.

TO CONTACT RENEWAIRE CUSTOMER SERVICE:

CALL 800-627-4499

EMAIL: RenewAireSupport@RenewAire.com

THIS PAGE IS INTENTIONALLY LEFT BLANK

About RenewAire

For over 30 years, **RenewAire has been a pioneer in enhancing indoor air quality (IAQ)** in commercial and residential buildings of every size.This is achieved while maximizing sustainability through our fifth-generation, static-plate, enthalpic-core **Energy Recovery Ventilators (ERVs) that optimize energy efficiency**, lower capital costs via load reduction and decrease operational expenses by minimizing equipment needs, resulting in significant energy savings. Our ERVs are competitively priced, simple to install, easy to use and maintain and have a quick payback. They also enjoy the industry's best warranty with the lowest claims due to long-term reliability derived from innovative design practices, expert workmanship and **Quick Response Manufacturing (QRM)**.

As the pioneer of static-plate core technology in North America, RenewAire is the largest ERV producer in the USA. We're **committed to sustainable manufacturing** and lessening our environmental footprint, and to that end our Waunakee, WI plant is 100% powered by wind turbines. The facility is also one of the few buildings worldwide to be LEED and Green Globes certified, as well as having achieved ENERGY STAR Building status. In 2010, RenewAire joined the Soler & Palau (S&P) Ventilation Group in order to provide direct access to the latest in energy-efficient air-moving technologies. For more information, visit: renewaire.com

201 Raemisch Road | Waunakee, WI | 53597 | 800.627.4499 | RenewAire.com

Soler&Palau Ventilation Group
Member of the S&P Group
Family of Brands

RenewAire® Energy Recovery Ventilation