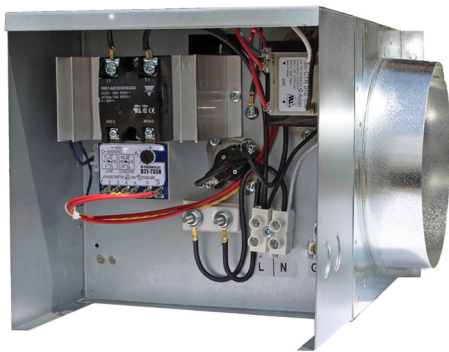


RH SERIES ELECTRIC DUCT HEATERS

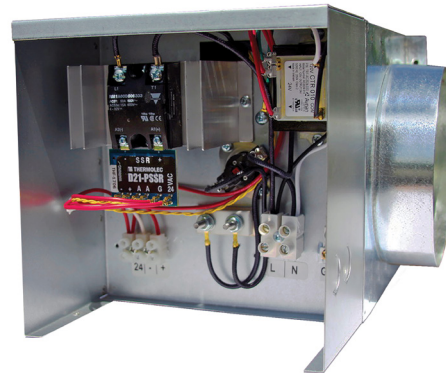
Installation, Operation and Maintenance Manual

RH-D Series (Integral Thermostat)

RH-W Series (Wall Mount Thermostat)



Model RH-D



Model RH-W

⚠ WARNING**ARC FLASH AND ELECTRIC SHOCK HAZARD**

All models of Electric Heaters as discussed in this manual operate on high voltages that can cause severe electric shock. Some models of Electric Heaters use high voltages that are capable of causing dangerous arc flash. Whenever accessing any part or component of the heater, disconnect all electric power supplies, verify with a voltmeter that electric power is OFF and wear protective equipment per NFPA 70E when working within the electric enclosure. Failure to comply can cause serious injury or death.

The terminal blocks contain live high-voltage.

The only way to ensure that there is NO voltage inside the unit is to install and open a remote disconnect switch and verify that power is off with a voltmeter. Refer to unit electrical schematic.

Follow all local codes and verify that power is off with a voltmeter. Refer to unit electrical schematic.

Follow all local codes.

⚠ AVERTISSEMENT**RISQUE FLASH D'ARC OU DE CHOC ÉLECTRIQUE GRAVE**

Tous les modèles de radiateurs électriques décrits dans ce manuel fonctionnent avec des tensions élevées pouvant causer un choc électrique grave. Certains modèles de radiateurs électriques utilisent des tensions élevées susceptibles de provoquer des arcs électriques dangereux. Lorsque vous accédez à une pièce ou à un composant du chauffe-eau, débranchez toutes les alimentations électriques, vérifiez avec un voltmètre que le courant est coupé et portez un équipement de protection conformément à NFPA 70E lorsque vous travaillez dans le boîtier électrique. Ne pas se conformer peut entraîner des blessures graves ou la mort.

Les borniers contiennent une haute tension sous tension.

Le seul moyen de s'assurer qu'il n'y a PAS de tension à l'intérieur de l'unité est d'installer et d'ouvrir un sectionneur à distance et de vérifier que l'alimentation est coupée avec un voltmètre. Reportez-vous au schéma électrique de l'unité.

Suivez tous les codes locaux.

⚠ CAUTION**RISK OF ELECTRIC SHOCK OR EQUIPMENT DAMAGE**

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

⚠ ATTENTION**RISQUE DE CHOC ÉLECTRIQUE OU DE DOMMAGES MATÉRIELS**

Chaque fois que le câblage électrique est connecté, déconnecté ou modifié, l'alimentation électrique du radiateur électrique et de ses commandes doit être déconnectée. Verrouillez et étiquetez le sectionneur ou le disjoncteur pour empêcher toute reconnexion accidentelle de l'alimentation électrique.

⚠ CAUTION**RISK OF BURNS**

This device is an electric heater and produces very high temperatures, capable of causing severe burns. Use caution when working on the heater and wear appropriate Personal Protective Equipment (PPE) whenever working on the unit.

⚠ ATTENTION**RISQUE DE BRÛLURES**

Cet appareil est un radiateur électrique et est capable de produire des températures très élevées, susceptibles de provoquer de graves brûlures. Soyez prudent lorsque vous travaillez sur le radiateur et portez un équipement de protection individuelle (EPI) approprié lorsque vous travaillez sur l'appareil.

IMPORTANT

This equipment is to be installed by following Industry Best Practices and all applicable codes. Any damage to components, assemblies or subassemblies which is caused by improper installation practices will void the warranty.

IMPORTANT

Only persons who have been properly trained and authorized are to access the electric heater and its controls. Changes to the electric heater wiring and controls are to be made only by trained and authorized personnel.

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, to be found on the outside of the appliance.

NOTE: This information is for purposes of identifying the specific appliance. Unit-specific option data can then be obtained, as needed, from the Model Number.

Electric Duct Heater Type: - (D or W)

Electric Duct Heater Model: - -

Serial 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.

RenewAire
Energy Recovery Ventilation

RH-W Residential Electric Heater

MODEL SER. NO.

FC-ZON-12-12240 388123-001

⚠ WARNING

DANGER OF ARC FLASH OR SEVERE ELECTRICAL SHOCK
Disconnect all electrical supplies and use appropriate PPE when working on this device

⚠ AVERTISSEMENT

RISQUE FLASH D'ARC OU DE CHOC ELECTRIQUE GRAVE
Débrancher toutes les alimentations électriques et portez des vêtements de protection lorsque vous travaillez sur cet appareil.

⚠ CAUTION

RISK OF BURNS This device becomes very hot in use. Use caution and wear appropriate PPE when working on it.

⚠ ATTENTION

RISQUE DE BRULURES Cet appareil devient très chaud en cours d'utilisation. Faites attention et portez des vêtements de protection lorsque vous travaillez sur cet appareil.

KW	AMPS	VOLTS	PH	HZ
11.5	47.9	240	1	60

MINIMUM AIRFLOW **345** CFM

RenewAire Part # **131351**

Control circuit is Class 2
All wiring must be rated for 167 °F

CLEARANCES TO COMBUSTIBLE MATERIALS:
- clearances of 0 inches to combustibles for horizontal operation
- 1 inch clearance for 6 feet downstream for vertical operation


Maximum output air temperature is 200 °F
Maximum inlet air temperature is 79 °F

IMPORTANT

For installation clearances, refer to the RenewAire Installation, Operation and Maintenance manual.

Installation orientation for all units is critical. For complete information, see the RenewAire Installation, Operation and Maintenance manual.

Airflow direction is critical for all RH-D units. Read the RenewAire Installation, Operation and Maintenance manual for complete information.


C US
LR 30551

TYPICAL UNIT LABEL (FOUND OUTSIDE OF THE APPLIANCE)

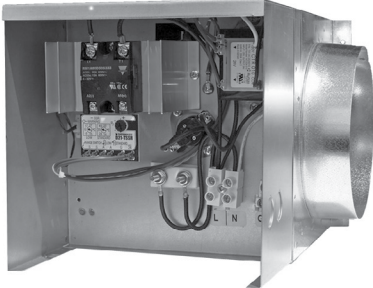
RH SERIES

ELECTRIC DUCT HEATER

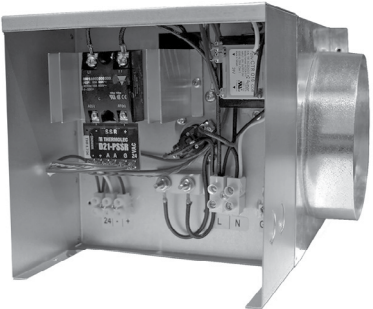
Electric Duct Heater (1-11.5 kW) Accessory



SPECIFICATIONS



RH-D (Integral Thermostat)



RH-W (Wall-Mount Thermostat)

Heater Type:
Electric Duct Heater

Typical KW Range:
1–11.5 kW (1, 2, 3, 4, 5, 6, 8, 10, 11.5 kW)

Voltages & Phase:
Single phase - 120, 208 and 240V

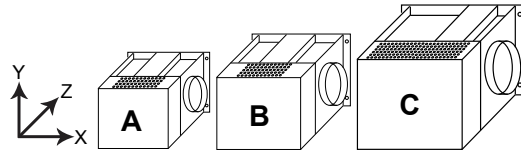
Control Voltage:
24 VAC

Controllable Output Temperature Range:
RH-D: 5 to 131° F
RH-W: -3 to 130° F

Standard Features:
Open-coil element
High-grade, nickel-chrome element wire
Thermostat - Integral (RH-D),
Wall mount (RH-W)
Modulating heat output (SCR control)
Vertical or horizontal operation
Automatic limit switch for primary
over-temperature protection
Manual reset limit switch for secondary
over-temperature protection
Airflow sensor
Standard control transformer - 24 VAC
Corrosion-resistant galvanized steel
Round duct collars
High-voltage terminal block connections
Grounding lug
Mounting flanges

Accessories:
Temperature sensor - Duct mount (DS-600)
Digital time clock - wall mount (TC7D-W),
in exterior enclosure (TC7D-E)
Motion occupancy sensor/control -
ceiling mount (MC-C), wall mount (MC-W)

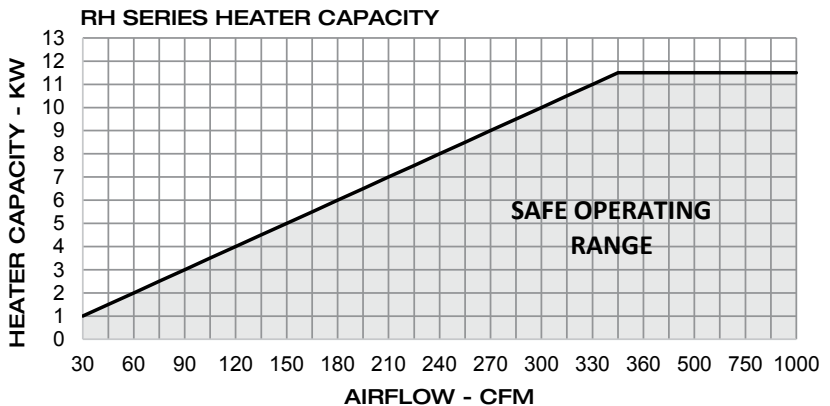
Note: Electric duct heater designed for indoor ductwork installation only.



Download specification at:
renewaire.com/specifications

Duct Collars	kW	V	Size	Width (X)	Height (Y)	Depth (Z)	Max. Wt. (lbs.)
6"	1, 2	120, 208, 240	A	11 1/2"	8"	11 1/2"	10
8"	3, 4, 5	208	B	11 1/2"	10"	13 1/2"	15
8"	3, 4, 5, 6	240	B	11 1/2"	10"	13 1/2"	15
10"	3, 4, 5	208	C	15 1/2"	12"	15 1/2"	20
10"	3, 4, 5, 6, 8, 10, 11.5	240	C	15 1/2"	12"	15 1/2"	20
12"	6, 8, 10, 11.5	240	C	15 1/2"	12"	15 1/2"	20

Minimum Airflow (CFM)	Heater Capacity (kW)
30	1.00
60	2.00
90	3.00
120	4.00
150	5.00
180	6.00
240	8.00
300	10.00
345	11.50



Specifications may be subject to change without notice.

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MINIMUM AIRFLOW AND AIR VELOCITIES

Minimum Airflow (CFM) = 30 (CFM) x Heater Capacity (kW).

EXAMPLE: Heater Capacity = 4 kW $30 \text{ CFM} \times 4\text{kW} = 120 \text{ CFM}$ Minimum Airflow

Minimum Velocity = Minimum Airflow (CFM) / Round Duct Area (ft²).

EXAMPLE: Heater Capacity = 4 kW Area of 8" Round Duct Size = 0.349 ft²

120 CFM Minimum Airflow / 0.349 ft^2 duct area = 344 FPM minimum cross sectional velocity

LINE CURRENT CALCULATION

Line Current (Amperes (A)) = Watts (W)/Line Voltage (V)

EXAMPLE: 4 kW Heater = 4000 W Line Voltage = 240 V

Line Current = $4000 \text{ W} / 240 \text{ V} = 16.7 \text{ A}$

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 (°F) are known:

$$\text{kW} = (\text{CFM} \times \Delta T) / 3150$$

DUCT HEATER TEMPERATURE RISE

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

$$\Delta T = (\text{kW} \times 3150) / \text{CFM}.$$



NOTE: This unit is a high-voltage open coil electric heater, used for both commercial and residential applications. It is commonly referred to in this manual as an “electric heater.”

1.0 OVERVIEW

1.1 DESCRIPTION

The RH-D and RH-W heaters are open-coil, electric resistance duct heaters that come in several different models with different wattages and duct sizes. The RH-D heater has an internal temperature sensor mounted in the outlet side of the unit and has an adjustable thermostat that determines what the outlet air temperature is to be. The controller then modulates current to the heating coil to maintain that temperature setting. The RH-W heater requires an external analog 0–10 VDC control signal, supplied by wall-mount thermostat, a RenewAire Premium Commercial Controller or a Building Management System (BMS). A wall-mount thermostat is provided with each RH-W unit. Every heater is equipped with an airflow sensor to detect minimum allowable airflow. If there is inadequate airflow, current to the heating coils is reduced to a level that corresponds to the detected airflow volume. All heaters use a Solid State Relay (SSR) to modulate the heat output.

1.2 APPLICATIONS

These heaters are ideally suited for use in tempering air that is delivered directly to an Occupied Space or they can also be used as a primary heat source. They can be used as pre-heat (RH-W with remote duct temperature sensor) or post-heat (RH-W or RH-D) devices in conjunction with an Energy Recovery Ventilator (ERV) or a Dedicated Outdoor Air System (DOAS). The RH-D can operate independently by setting an on-board potentiometer to maintain a constant output temperature while the RH-W uses an external temperature control signal (wall thermostat) to modulate the heat output. These heaters are suitable for use in both residential and commercial indoor applications.

1.3 SAFETY FEATURES

1.3.1 Low Air Flow Modulation/Shut Off

The heater has a thermistor airflow sensor that will detect any overheating condition caused by low airflow. The sensor has a threshold of 111°F [44°C]. If a temperature higher than 111°F is detected, it will cause the controller to begin reducing the pulse width of the control signal being sent to the SSR. The reduction in pulse width begins at a detected temperature of 111°F and the reduction will increase proportionally up to a detected temperature of 124°F [51°C], at which point the sensor will shut off the control signal to the SSR. In this mode, the unit's Red (or Yellow) warning light is ON steady.

1.3.2 Auto-Reset Thermal Cutout

The heater has an auto-reset thermal cutout having a threshold of 125°F. If a temperature higher than 125°F is detected, the auto-reset cutout will shut off power to the heater element. Once the detected temperature drops below 125°F, the cutout will reset itself and restore power to the heater element.

1.3.3 Manual Reset Thermal Cutout

The heater has a manual reset thermal cutout having a threshold of 200°F. If a temperature higher than 200°F is detected, power to the heater element is shut off until the heater cools and the cutout is manually reset.

1.3.4 Maintenance

There is no required annual maintenance for these units.

1.4 AIRFLOW DIRECTION

1.4.1 RH-D

Airflow direction in the RH-D must be coordinated with the Output Air Temperature Sensor. The sensor must be located on the outlet side of the unit in order to properly monitor the output temperature. See the figures on page 12 and 20. If airflow direction other than as shown is desired, the sensor must be relocated to the alternate location, as shown.

Alternatively, the output Air Temperature Sensor can be replaced with Remote Duct Sensor accessory DS-600 (PN 131319) when connected to the 'ss' terminals on RH-D controller. Using the DS-600 Remote Duct Sensor may be desired when the output temperature of the heater needs to be controlled some distance from the RH-D heater.

1.4.2 RH-W

Airflow direction in the RH-W can be in either direction, with no changes to the unit hardware.

1.5 RH-D and RH-W models

Both the RH-D and RH-W heaters are available in several different duct sizes and wattages. Note that type RH-D uses an internal temperature sensor to regulate the heat output while type RH-W uses a wall-mount thermostat that operates on 24 VAC, which is provided with the heater. The RH-W can also be controlled by a BMS or by a RenewAire Premium Programmable Controller.

The heater should be supplied by a separate cable, of appropriate gauge and with appropriate protection. Use wire suited for 167°F. Conform to all local and national electrical codes for wiring.

Configuration	Part Number	Model	Duct Collar Size				Kilowattage										Voltage (1P, 60 Hz)			Line Amps	Wire Gauge	Fuse Amps	
			6"	8"	10"	12"	1	2	3	4	5	6	8	10	11.5	120	208	240					
RHD1120-6	131320	TER-6-1120	●				●											●			8.33	12	15
RHD1208-6	131352	TER-6-1208	●				●											●			4.80	12	15
RHD1240-6	131353	TER-6-1240	●				●											●			4.16	12	15
RHD2120-6	131321	TER-6-2120	●					●										●			16.7	12	20
RHD2208-6	131354	TER-6-2208	●					●										●			9.61	12	15
RHD2240-6	131355	TER-6-2240	●					●										●			8.33	12	15
RHD3208-8	131356	TER-8-3208		●					●									●			14.4	12	20
RHD3240-8	131322	TER-8-3240		●					●									●			12.5	12	15
RHD4208-8	131357	TER-8-4208		●						●								●			19.2	10	30
RHD4240-8	131323	TER-8-4240		●						●								●			16.7	12	20
RHD5208-8	131358	TER-8-5208		●							●							●			24.0	10	30
RHD5240-8	131359	TER-8-5240		●								●						●			20.8	10	30
RHD6240-8	131360	TER-8-6240		●									●					●			25.0	10	40
RHD3208-10	131336	TER-10-3208			●					●								●			14.4	12	20
RHD3240-10	131337	TER-10-3240			●					●								●			12.5	12	15
RHD4208-10	131338	TER-10-4208			●						●							●			19.2	10	30
RHD4240-10	131339	TER-10-4240			●						●							●			16.7	12	20
RHD5208-10	131340	TER-10-5208			●							●						●			24.0	10	30
RHD5240-10	131341	TER-10-5240			●								●					●			20.8	10	30
RHD6240-10	131342	TER-10-6240			●									●				●			25.0	10	40
RHD8240-10	131343	TER-10-8240			●										●			●			33.3	8	50
RHD10240-10	131361	TER-10-10240			●											●		●			41.7	6	60
RHD11-1/2240-10	131362	TER-10-12240			●											●		●			47.9	6	60
RHD6240-12	131344	TER-12-6240				●											●				25.0	10	40
RHD8240-12	131345	TER-12-8240				●											●				33.3	8	50
RHD10240-12	131346	TER-12-10240				●											●				41.7	6	60
RHD11-1/2240-12	131347	TER-12-12240				●											●				47.9	6	60
RHW1120-6	131324	ZON-6-1120	●					●										●			8.33	12	15
RHW1208-6	131363	ZON-6-1208	●					●										●			4.80	12	15
RHW1240-6	131364	ZON-6-1240	●					●										●			4.16	12	15
RHW2120-6	131325	ZON-6-2120	●						●									●			16.7	12	20
RHW2208-6	131365	ZON-6-2208	●						●									●			9.61	12	15
RHW2240-6	131366	ZON-6-2240	●						●									●			8.33	12	15
RHW3208-8	131367	ZON-8-3208		●						●								●			14.4	12	20
RHW3240-8	131326	ZON-8-3240		●						●								●			12.5	12	15
RHW4208-8	131368	ZON-8-4208		●							●							●			19.2	10	30
RHW4240-8	131327	ZON-8-4240		●							●							●			16.7	12	20
RHW5208-8	131369	ZON-8-5208		●								●						●			24.0	10	30
RHW5240-8	131370	ZON-8-5240		●									●					●			20.8	10	30
RHW6240-8	131371	ZON-8-6240		●										●				●			25.0	10	40
RHW3208-10	131328	ZON-10-3208			●					●								●			14.4	12	20
RHW3240-10	131329	ZON-10-3240			●					●								●			12.5	12	15
RHW4208-10	131330	ZON-10-4208			●						●							●			19.2	10	30
RHW4240-10	131331	ZON-10-4240			●						●							●			16.7	12	20
RHW5208-10	131332	ZON-10-5208			●							●						●			24.0	10	30
RHW5240-10	131333	ZON-10-5240			●								●					●			20.8	10	30
RHW6240-10	131334	ZON-10-6240			●									●				●			25.0	10	40
RHW8240-10	131348	ZON-10-8240			●										●			●			33.3	8	50
RHW10240-10	131372	ZON-10-10240			●											●		●			41.7	6	60
RHW11-1/2240-10	131373	ZON-10-12240			●											●		●			47.9	6	60
RHW6240-12	131335	ZON-12-6240				●											●				25.0	10	40
RHW8240-12	131349	ZON-12-8240				●											●				33.3	8	50
RHW10240-12	131350	ZON-12-10240				●											●				41.7	6	60
RHW11-1/2240-12	131351	ZON-12-12240				●											●				47.9	6	60

FIGURE 1.5.0 RH SERIES CONFIGURATIONS

2.0 COMPONENT DESCRIPTIONS

2.1 RH-D

RH-D heaters use open coil, electric resistance hardware to provide an adjustable heat output. An airflow sensor is provided, checking for minimum airflow. There are two separate thermal cutout devices, the first of which will shut down the heater at 125°F and then automatically reset itself and there is a second cutout that will shut down the heater at 200°F. The second cutout must be manually reset. The controller operates on 24 VAC provided by an on-board transformer. The controller has a potentiometer to set the desired output air temperature between 32°F and 108°F from the unit and heat output is modulated by the controller, which causes the SSR to provide pulsed current to the heating coil.

The electronic controller modulates the heater's capacity according to the quantity of air flowing through the heater by responding to the radiant heat of the elements even at very low CFMs. With normal airflow, the controller will operate at full power. When the airflow drops below the minimum airflow (30 CFM per kW), the controller will still operate, but at reduced power. It will also safely shut down the heater in case of a total loss of airflow.

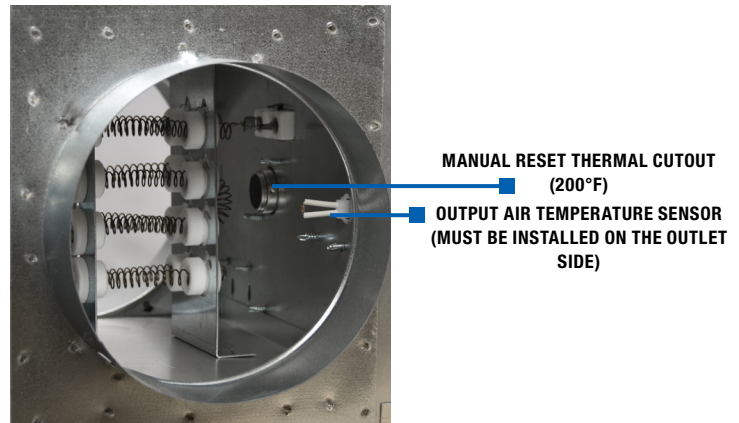


FIGURE 2.1.0 RH-D MANUAL RESET THERMAL CUTOUT AND OUTPUT AIR TEMPERATURE SENSOR

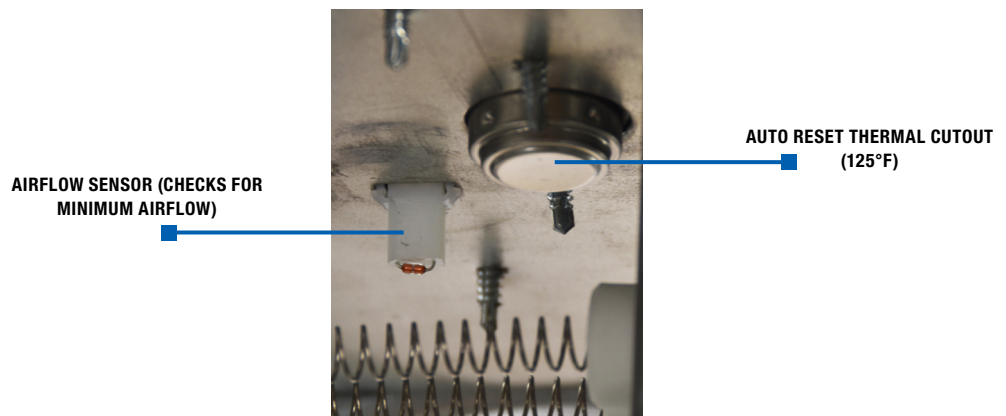


FIGURE 2.1.1 RH-D AIRFLOW SENSOR AND AUTO RESET THERMAL CUTOUT

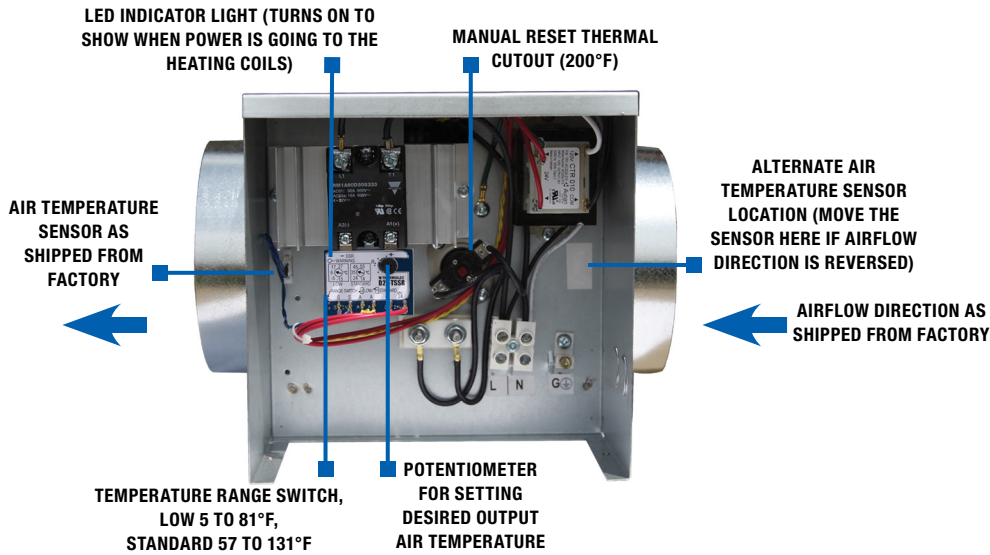


FIGURE 2.1.2 RH-D CONTROLS (TYP)

2.2 RH-W

RH-W heaters use open coil, electric resistance hardware to provide an adjustable heat output. An airflow sensor is provided, checking for minimum airflow. There are two separate thermal cutout devices, the first of which will shut down the heater at 125°F and then automatically reset itself and there is a second cutout that will shut down the heater at 200°F. The second cutout must be manually reset. The controller operates on 24 VAC provided by an on-board transformer. Output temperature is controlled by an analog 0–10 VAC signal provided by either the wall thermostat supplied with RH-W heaters, a BMS or by a RenewAire Premium Programmable Controller. The heat output of the unit is modulated by means of pulsed current supplied to the heating coils by the SSR, which is controlled by the on-board controller.

The electronic controller modulates the heater's capacity according to the quantity of air flowing through the heater by responding to the radiant heat of the elements even at very low CFMs. With normal airflow, the controller will operate at full power. When the airflow drops below the minimum airflow (30 CFM per kW), the controller will still operate, but at reduced power. It will also safely shut down the heater in case of a total loss of airflow.

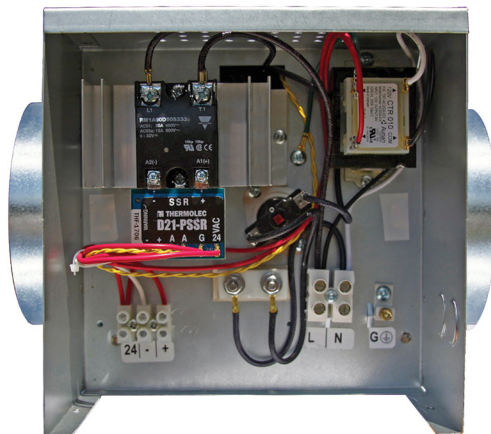


FIGURE 2.2.0 RH-W CONTROLS (TYP)

2.2.1 CTH291 Thermostat (supplied with RH-W heaters)

The CTH291 Thermostat is an 0–10 VDC output, dual mode device. It provides an analog 0–10 VDC output signal to the RH-W controller, enabling the controller to modulate the heat output, as needed. It has a Comfort mode and an Economy mode, which is a temperature setback of 8°F. Comfort Mode is the standard mode of operation with controllable temperature range of 50–130°F using the thermostat's internal temperature sensor and Economy mode can only be enabled if there is either an occupancy sensor or a timer wired to the thermostat. Economy mode will remain active until the Normally Closed (NC) contacts on either the timer or the occupancy sensor open, indicating an occupied condition for the Occupied Space. When the NC contacts open, the device will switch back to Comfort mode automatically. While the thermostat is in Economy mode, the mode can be overridden by pressing the UP or DOWN arrow buttons to change the setpoint and then pressing the hand button to enter the new setpoint. This override condition remains in effect for two hours.



FIGURE 2.2.1 CTH291 WALL THERMOSTAT (TYP)

3.0 DIMENSIONED DRAWINGS

3.1 RH-D AND RH-W WITH 6" DUCT COLLAR

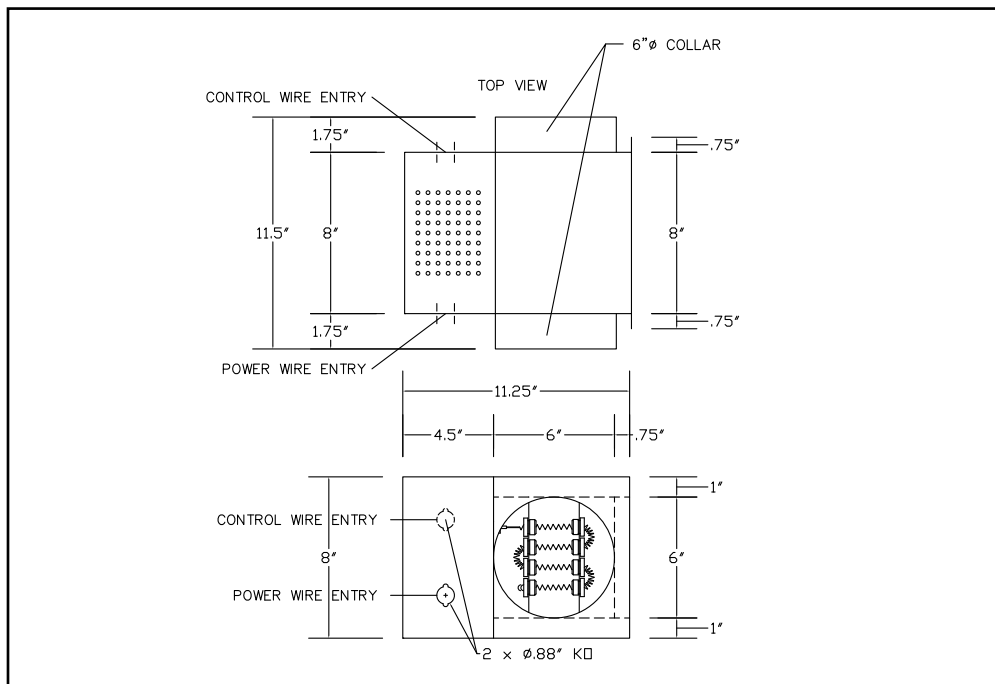


FIGURE 3.1.0 RH-D AND RH-W 6" DUCT COLLAR DIMENSIONED DRAWING

3.2 RH-D AND RH-W WITH 8" DUCT COLLAR

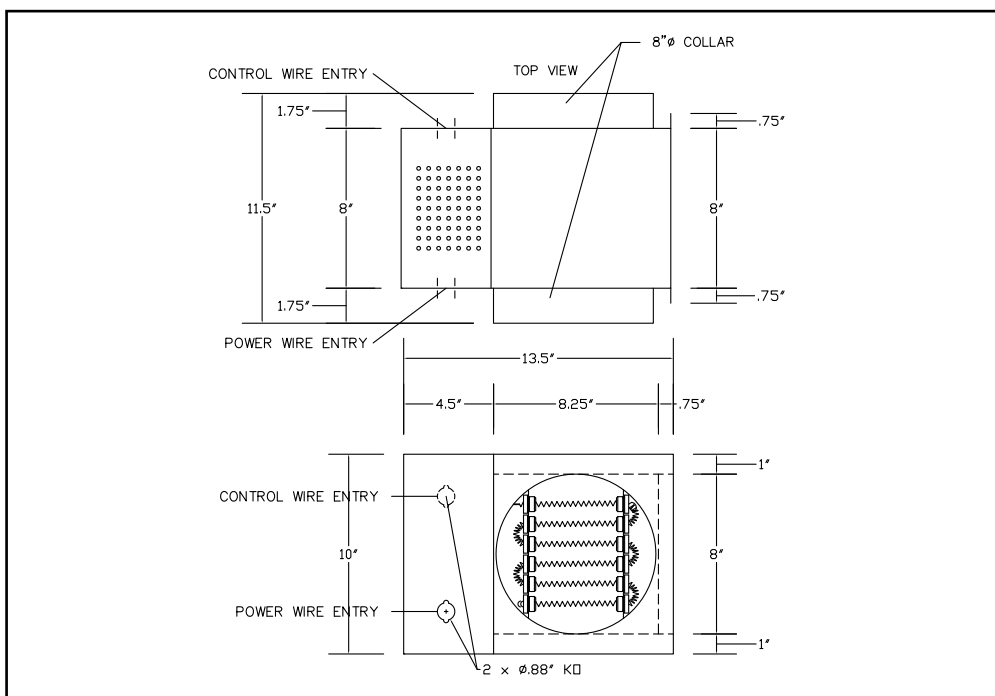


FIGURE 3.2.0 RH-D AND RH-W 8" DUCT COLLAR DIMENSIONED DRAWING

3.3 RH-D AND RH-W WITH 10" DUCT COLLAR

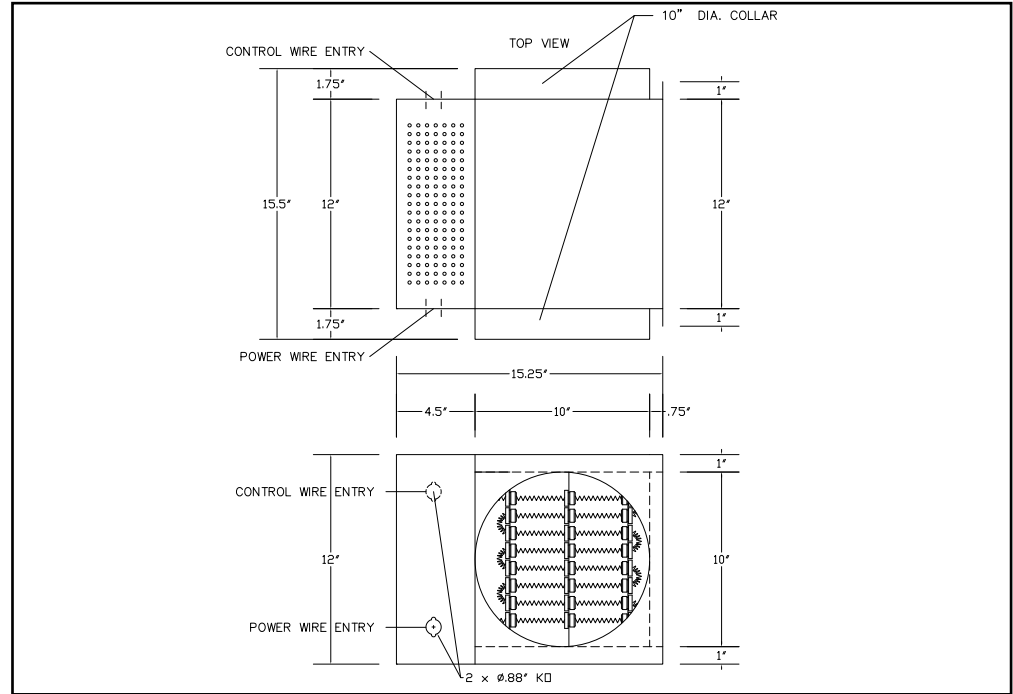


FIGURE 3.3.0 RH-D AND RH-W 10" DUCT COLLAR DIMENSIONED DRAWING

3.4 RH-D AND RH-W WITH 12" DUCT COLLAR

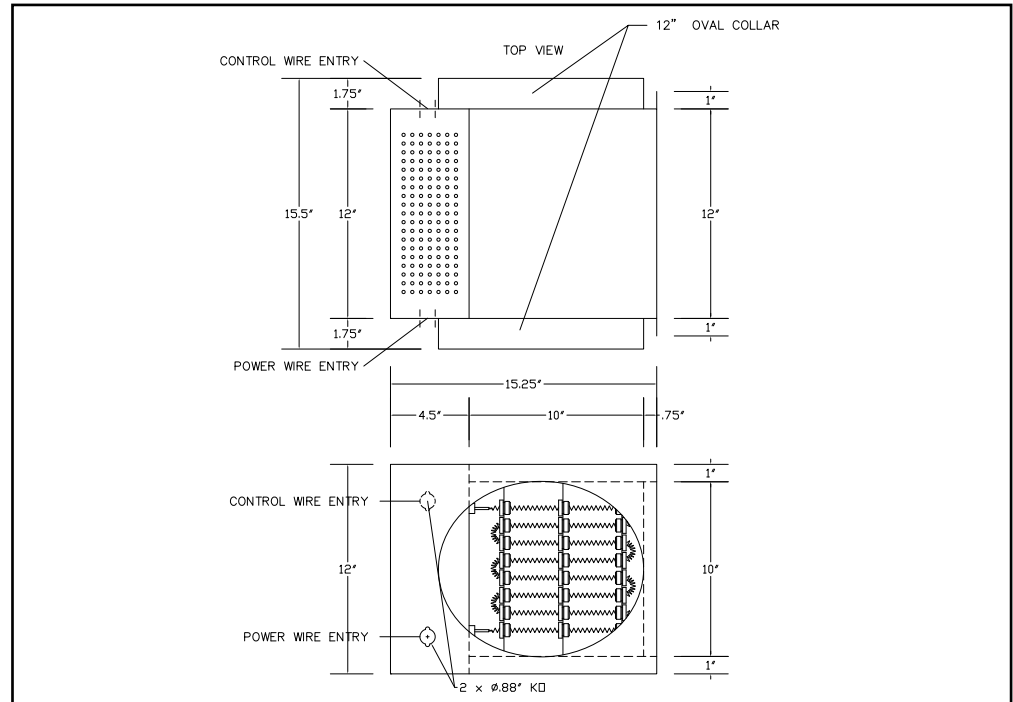


FIGURE 3.4.0 RH-D 12" DUCT COLLAR DIMENSIONED DRAWING

4.0 WIRING SCHEMATICS

4.1 RH-D 120 VAC

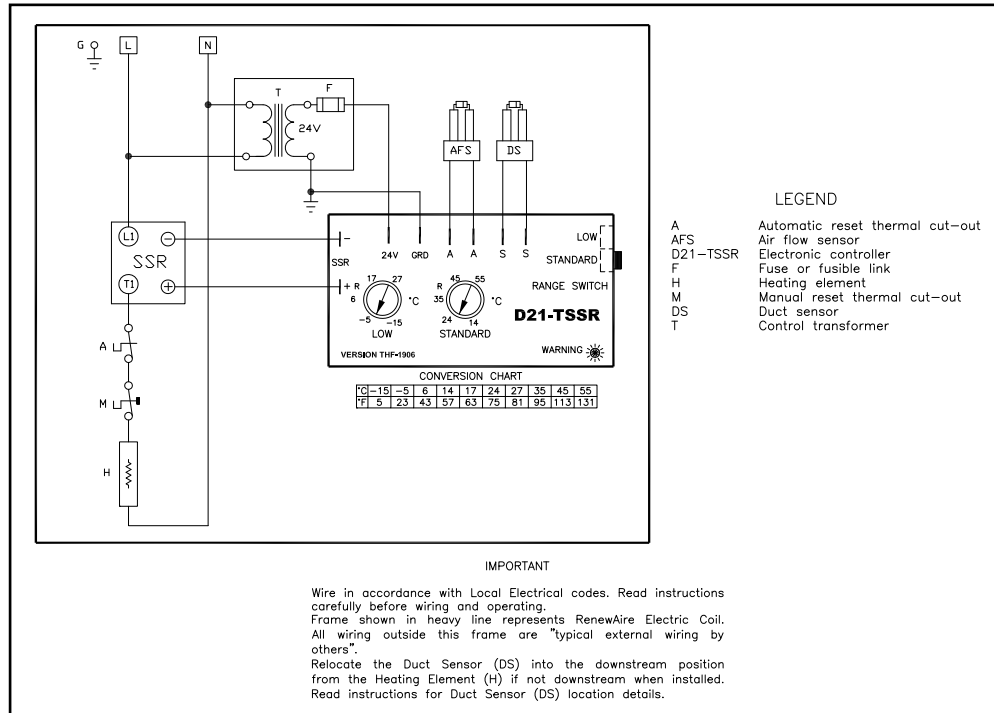


FIGURE 4.1.0 RH-D 120 VAC WIRING SCHEMATIC

4.2 RH-D 208/240 VAC (1, 2, 3, 4, 5, AND 6 KW)

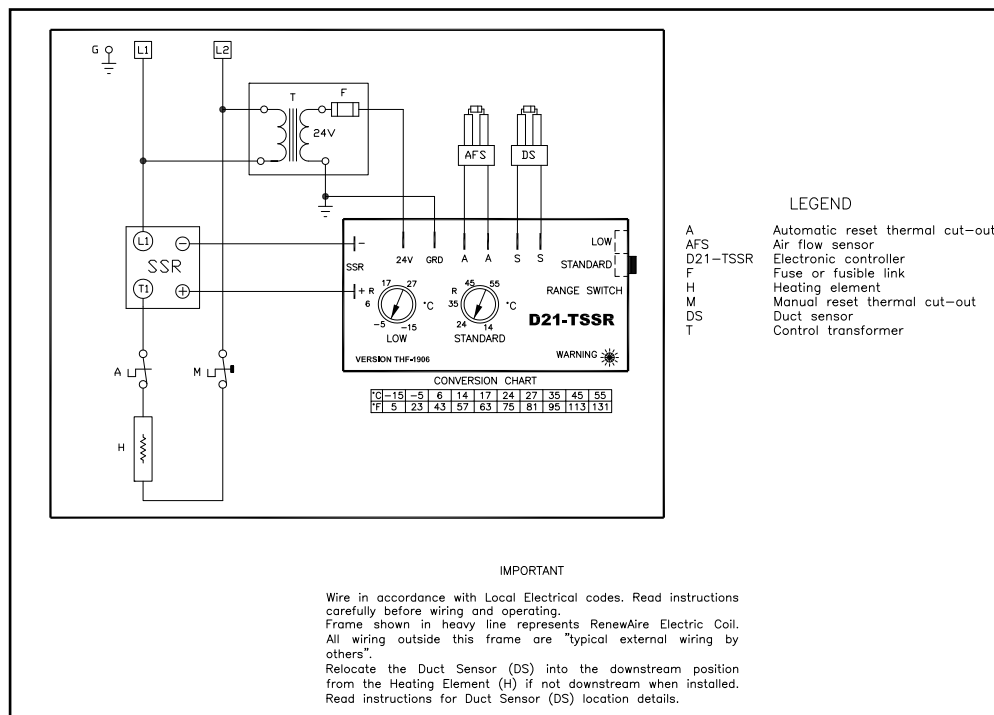


FIGURE 4.2.0 RH-D 208/240 VAC WIRING SCHEMATIC (1, 2, 3, 4, 5, 6 KW)

4.3 RH-D 240 VAC (8, 10, AND 11.5 KW)

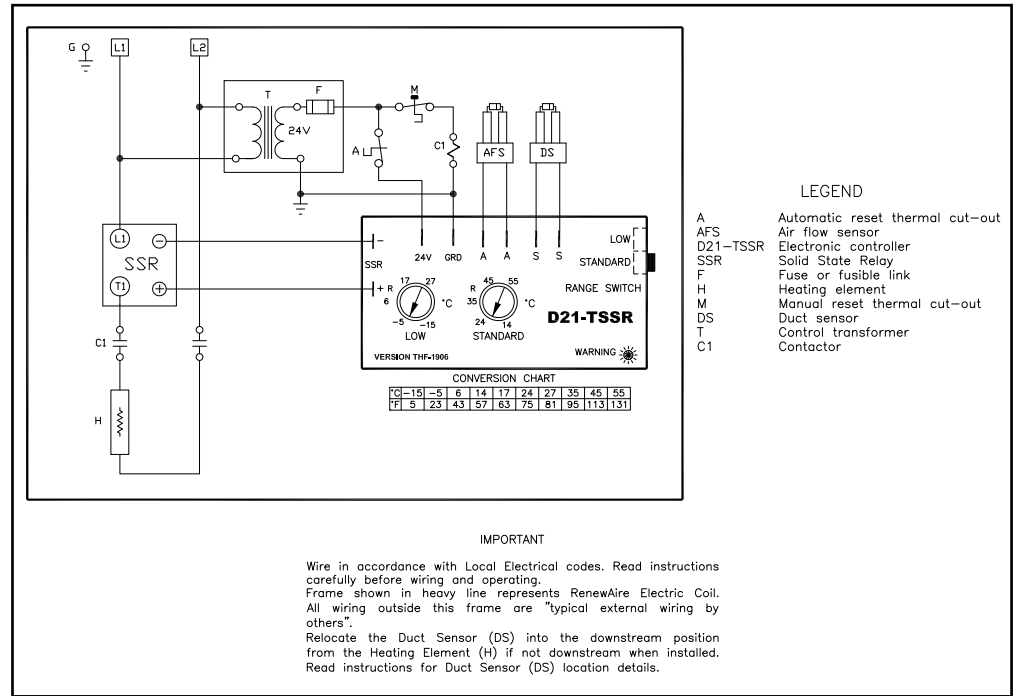


FIGURE 4.3.0 RH-D 240 VAC WIRING SCHEMATIC (8, 10, 11.5 KW)

4.4 RH-W 120 VAC

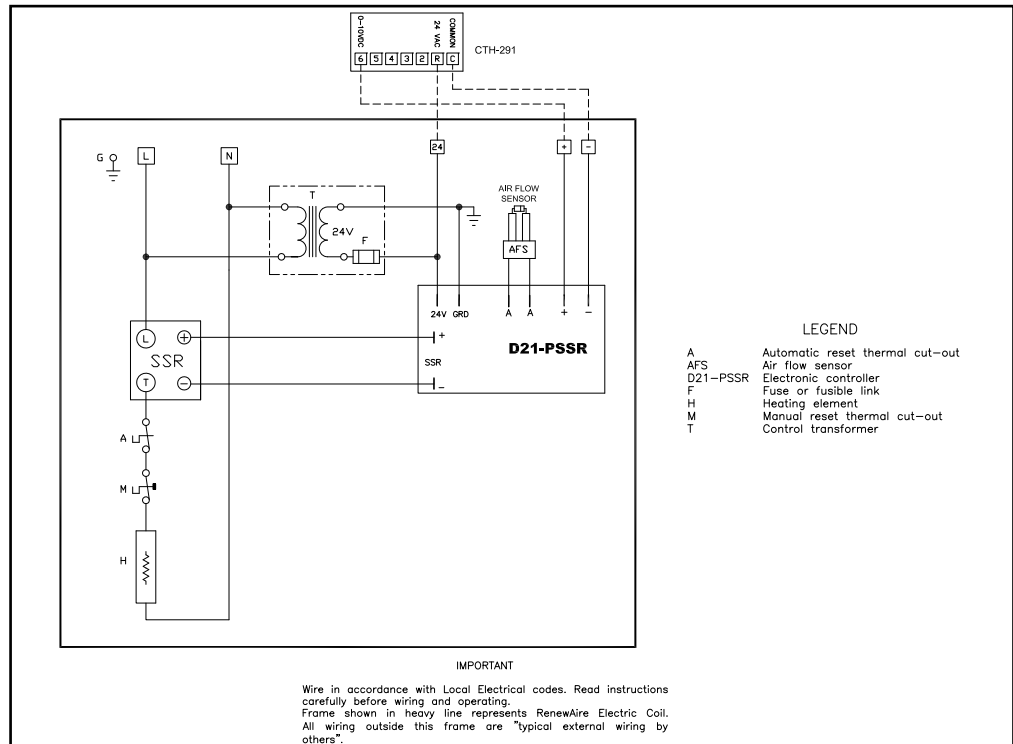


FIGURE 4.4.0 RH-W 120 VAC WIRING SCHEMATIC

4.5 RH-W 208/240 VAC (1, 2, 3, 4, 5, AND 6 KW)

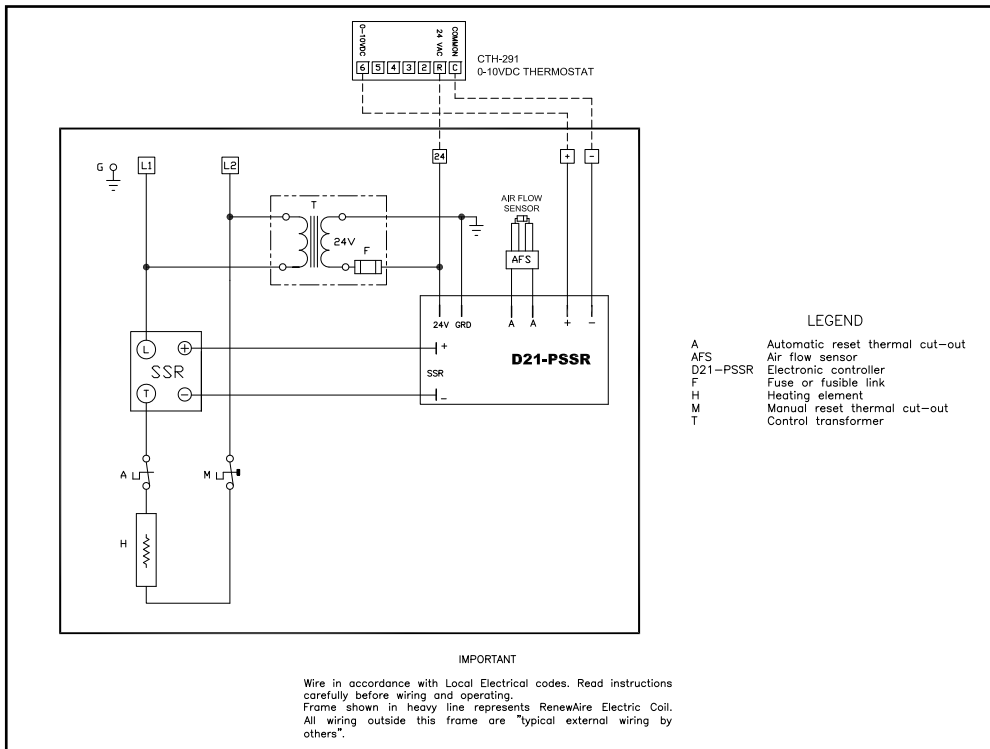


FIGURE 4.5.0 RH-W 208/240 VAC WIRING SCHEMATIC (1, 2, 3, 4, 5, 6 KW)

4.6 RH-W 240 VAC (8, 10, AND 11.5 KW)

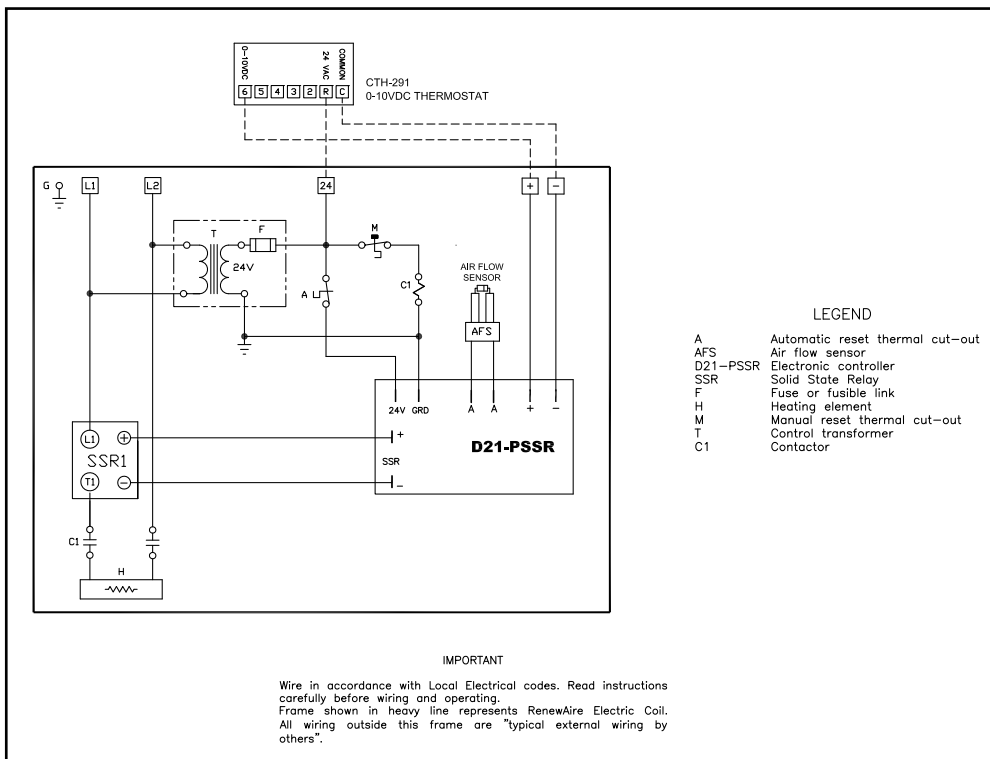


FIGURE 4.6.0 RH-W 240 VAC WIRING SCHEMATIC (8, 10, 11.5 KW)

5.0 UNIT WEIGHTS

5.1 RH-D AND RH-W WITH 6" DUCT

All Electric Duct Heaters with 6" diameter duct collars weigh 10 pounds or less.

5.2 RH-D AND RH-W WITH 8" DUCT

All Electric Duct Heaters with 8" diameter duct collars weigh 15 pounds or less.

5.3 RH-D AND RH-W WITH 10" OR 12" DUCTS

All units having duct collars of either 10" or 12" and a capacity of up to 6 KW weigh 15 pounds or less. Units having a capacity greater than 6 KW weigh 20 pounds or less.

6.0 INSTALLATION

6.1 MINIMUM AIRFLOW REQUIREMENTS

All heaters require a minimum airflow in order to operate properly. The rule of thumb is that 30 CFM is required for each kilowatt of electric heat. See the chart on page 4 of this manual. If airflow through the heater is less than 30 CFM per kilowatt, the airflow sensor will detect the reduced airflow and will cause the controller to modulate the heat output to a level that is consistent with the airflow volume sensed in the heater. See the figure on Page 11 of this manual.

6.2 INSTALLATION LOCATION

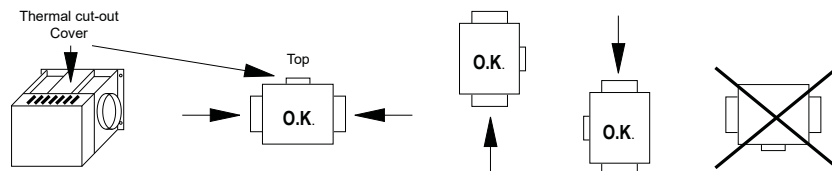
The Electric Duct Heater should be installed indoors, as near as possible to the Occupied Space in order to reduce heat loss from duct runs but no closer than 4 feet to other installed equipment, canvas duct connector, transition section for change in duct size or obstruction in the same duct run. Observe all local codes.

6.3 UNIT ORIENTATION

All RH-D and RH-W heaters may be installed either horizontally or vertically. When installed horizontally, the unit top must be installed UP. See image below. There is a removable sheet metal cover installed on the top that covers the auto reset temperature cutout and the airflow sensor.

6.4 INSTALLATION CLEARANCES

All RH-D and RH-W Electric Heater housings are rated for zero clearance to combustible surfaces. There are ventilation openings in the top and bottom of the unit control box that require a minimum of 1/2 inch clearance for cooling of the control box. If any heater is installed horizontally, maintain a minimum of 1/2 inch clearance above and beneath the unit with Auto Reset Thermal Cutout and Airflow Sensor at the top of internal duct work. In addition, any heater that is installed vertically must maintain a clearance of 1 inch around ductwork for a distance of 6 feet downstream from the heater.



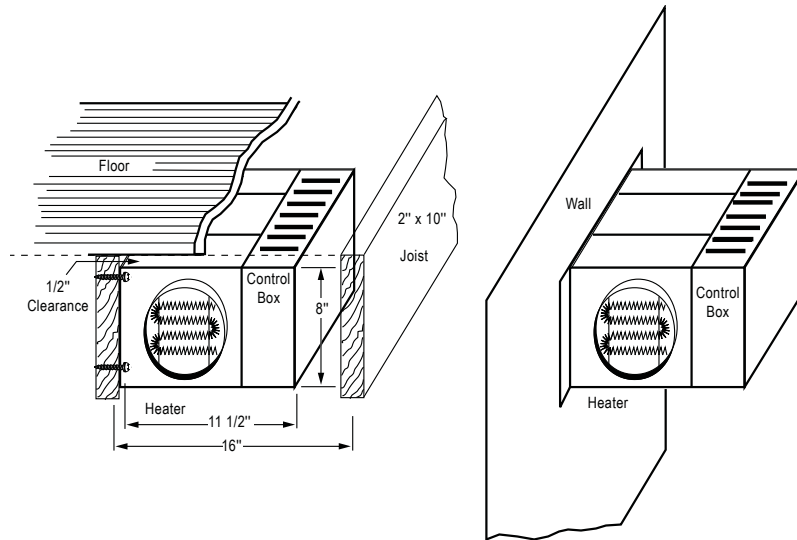


FIGURE 6.4.2 INSTALLATION SUPPORTS

Attach the unit to a suitable support. The 6" model is small enough to be located between standard 16" spaced floor joists. Always allow a minimum 1/2" clearance above the heater.

6.5 DUCTWORK CONNECTIONS

Ductwork connections are to be made in accordance with SMACNA guidelines. All ductwork and its insulation must be rated for a minimum of 200°F. Ductwork should be attached with both mechanical fasteners and UL 181-rated duct mastic. DO NOT INSTALL ANY DUCTWORK ELBOWS CLOSER THAN 12 INCHES TO THE HEATER.

6.6 DUCTWORK INSULATION

The Supply Air ductwork leading from the output side of the heater to the Occupied Space should be insulated to prevent heat loss. Individual job-site conditions will dictate whether the duct leading to the inlet side of the heater should also be insulated. In some cases, the air being supplied to the heater is coming from an ERV and the connecting duct passes through a space that is not conditioned. In this case, the ductwork from the ERV to the heater should also be insulated.

6.7 VERIFY AIRFLOW DIRECTION (RH-D UNITS ONLY)

The Outlet Air Temperature Sensor must be positioned on the outlet side of the heater. Check the airflow direction through the heater. If necessary, move the sensor to the outlet side, clipped in the pre-punched rectangular hole provided to accommodate this change as shown below and in Section 2.1 of this manual.

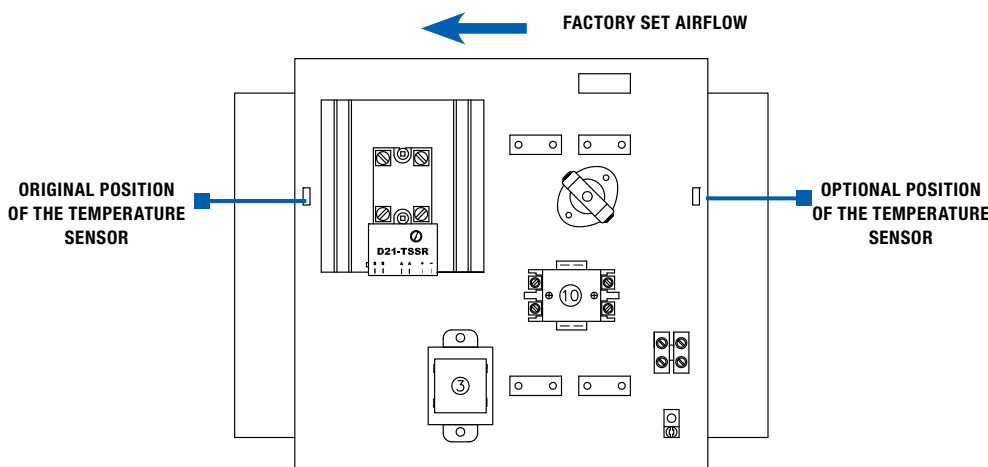


FIGURE 6.7.0 AIRFLOW DIRECTIONS

6.8 CONNECT ELECTRIC SERVICE

WARNING

ARC FLASH AND ELECTRIC SHOCK HAZARD

All models of Electric Heaters as discussed in this manual operate on high voltages that can cause severe electric shock. Some models of Electric Heaters use high voltages that are capable of causing dangerous arc flash. Whenever accessing any part or component of the heater, disconnect all electric power supplies, verify with a voltmeter that electric power is OFF and wear protective equipment per NFPA 70E when working within the electric enclosure. Failure to comply can cause serious injury or death.

The terminal blocks contain live high-voltage.

The only way to ensure that there is NO voltage inside the unit is to install and open a remote disconnect switch and verify that power is off with a voltmeter. Refer to unit electrical schematic.

Follow all local codes.

CAUTION

RISK OF ELECTRIC SHOCK OR EQUIPMENT DAMAGE

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

6.8.1 Line Voltage Wiring Entry Point

High voltage electric service is to be brought into the unit through one of the factory-provided knockouts located on the side of the control box. Wiring is to be terminated on the terminal block and grounding lug as shown in Figure 6.9.1 in this manual. Also, see the wiring schematics in Section 4.0 of this manual. Observe all local codes.

6.9 CONNECT THERMOSTAT (RH-W ONLY)

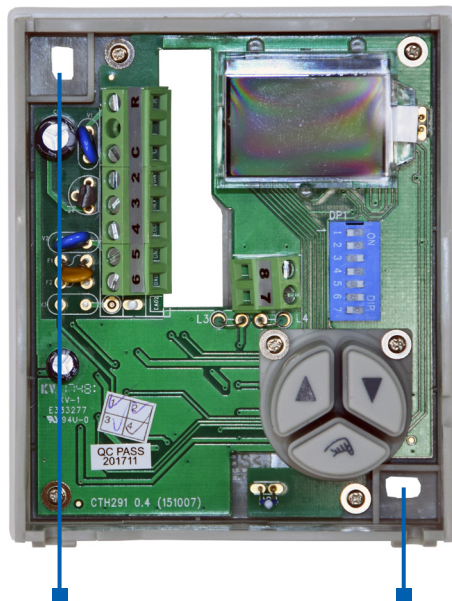
RH-W heaters require an external 0–10 VDC signal to control the heater output. The 0–10 VDC signal could be supplied from a controller or BMS however this is normally accomplished by using the CTH291 wall thermostat supplied with RH-W heaters, which also requires 24 VAC to operate. The low voltage thermostat wiring should enter the heater through the second knockout located on the side of the control box. Wiring is to be terminated as shown in the wiring schematics in Section 4.0 of this manual.

⚠ CAUTION**RISK OF ELECTRIC SHOCK OR EQUIPMENT DAMAGE**

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

Each thermostat is provided with a mounting base plate and all necessary mounting hardware.

- Mount the base plate on the wall using provided anchors and screws or mount it directly on a standard 2" x 4" electrical junction box.
- Open the thermostat housing by removing two screws on the bottom of the thermostat and lift the cover off.
- Pull low voltage wiring through the opening in the back of the thermostat and then mount the thermostat on the base plate using the provided two short screws.
- Connect low voltage wiring as shown in the figure below.
- Set the DIP switches to desired settings. See chart and figure on the following page.
- Reinstall the front cover.
- Reconnect power to the heater, which will provide 24 VAC to the thermostat.



PULL LOW-VOLTAGE WIRING THROUGH OPENING IN THE BACK OF THE THERMOSTAT AND THEN ATTACH THERMOSTAT TO BASE PLATE USING THE PROVIDED TWO SHORT SCREWS.

FIGURE 6.9.0 RH-W THERMOSTAT

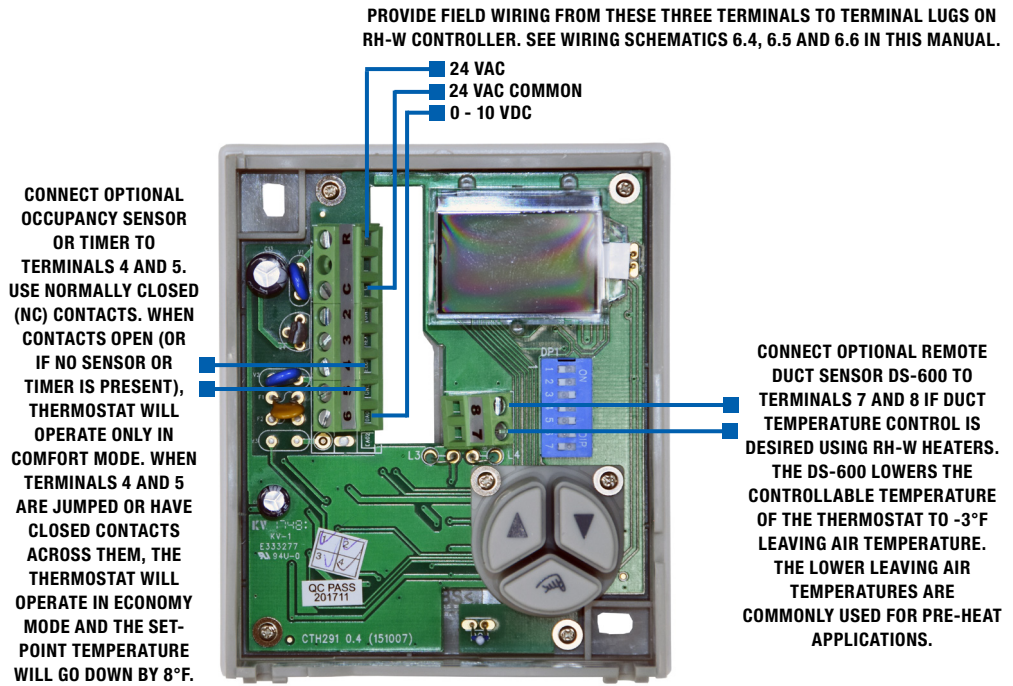


FIGURE 6.9.1 THERMOSTAT WIRING ILLUSTRATION

SWITCH	OFF POSITION	ON POSITION
1	°C	°F
2	REVERSE ACTING OUTPUT	NOT USED
3	INTERNAL SENSOR	REMOTE SENSOR*
4	0 - 10 VDC	NOT USED
5	LIMITED SET POINT RANGE **	FULL SET POINT RANGE
6	RH-W ROOM APPLICATION	RH-W DUCT APPLICATION*
7	NOT USED	NOT USED

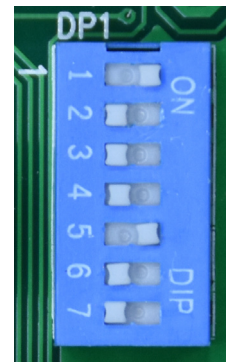


FIGURE 6.9.2 DIP SWITCH POSITIONS

*DIP switches 3 and 6 should be in “ON” position if DS-600 Remote Duct Temperature Sensor is attached across terminals 7 and 8 shown in the Thermostat Wiring Illustration above.

**With DIP switch 5 in “OFF” position, a limited set-point temperature range can be selected to reduce the likelihood of undesired set-point temperature adjustment to more extreme temperatures. See tables below.

FULL SET POINT RANGE (USING REMOTE SENSOR)			FULL SET POINT RANGE (USING INTERNAL SENSOR)			LIMITED SET POINT RANGE		
Temperature Unit	Economy Mode	Comfort Mode	Temperature Unit	Economy Mode	Comfort Mode	Temperature Unit	Economy Mode	Comfort Mode
°F (1°F resolution)	-3 to 122°F	5 to 130°F	°F (1°F resolution)	42 to 122°F	50 to 130°F	°F (1°F resolution)	56 to 68°F	64 to 76°F

FOR THERMOSTATS THAT DO NOT HAVE EITHER AN OCCUPANCY SENSOR OR A TIMER:

When line voltage is applied to the heater, it automatically provides power to the CTH291 thermostat. The LCD screen on the thermostat will show the current (ambient) temperature and a small indicator symbol at the bottom shows whether or not there is a call for heat. If the current setpoint is less than the ambient temperature, there will be no call for heat and the indicator symbol will remain on constantly. When the setpoint temperature is greater than the ambient temperature, a call for heat will be provided by the thermostat to the heater controller and the indicator symbol will blink as long as there is a call for heat. The thermostat will put out an analog 0–10 VDC control signal to the heater controller, which ramps UP and DOWN slowly.

To change the desired temperature setpoint, press either the UP or DOWN arrow button. The view on the screen will change from the current ambient temperature to show the active setpoint. To change the setpoint, continue to press either the UP or DOWN arrow.

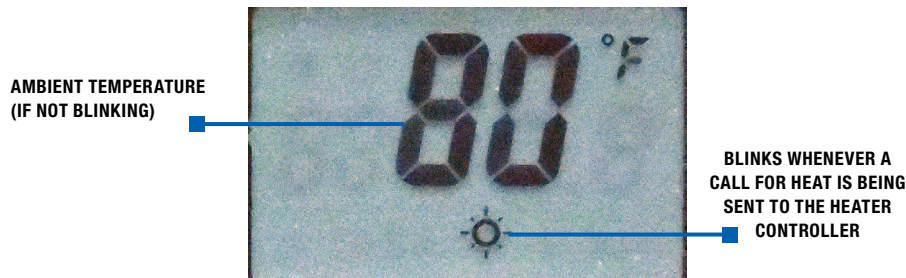


FIGURE 6.9.3 COMFORT MODE SCREEN SHOT

FOR THERMOSTATS THAT HAVE EITHER AN OCCUPANCY SENSOR OR A TIMER CONNECTED:

When an occupancy sensor or a timer is connected to terminals 4 and 5 on the terminal strip (see figure on page 24) in the thermostat, the thermostat will go into Economy mode as long as the NC contacts are closed. When the contacts open, this represents an occupied mode for the Occupied Space and the thermostat will switch from Economy mode to Comfort mode.

Economy mode can be overridden for up to two hours without the NC contacts opening, and a temporary setpoint can be installed. Press either the UP or the DOWN arrow button and both the temperature reading and the indicator dot will blink. Continue pressing the UP and DOWN arrow buttons as needed to establish the new setpoint and then press the Hand button to enter the new reading.

The Economy mode setpoint is always 8°F less than the Comfort mode setpoint unless it is being temporarily overridden.

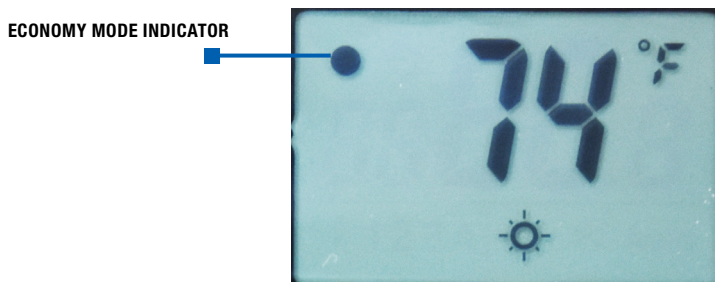


FIGURE 6.9.4 ECONOMY MODE SCREEN SHOT

6.9.1 Low Voltage Wiring Entry Point (RH-W Only)

Low voltage wiring is to be brought into the unit through one of the factory-provided knockouts located on the side of the control box. See the dimensioned drawings in Section 3.0 of this manual.

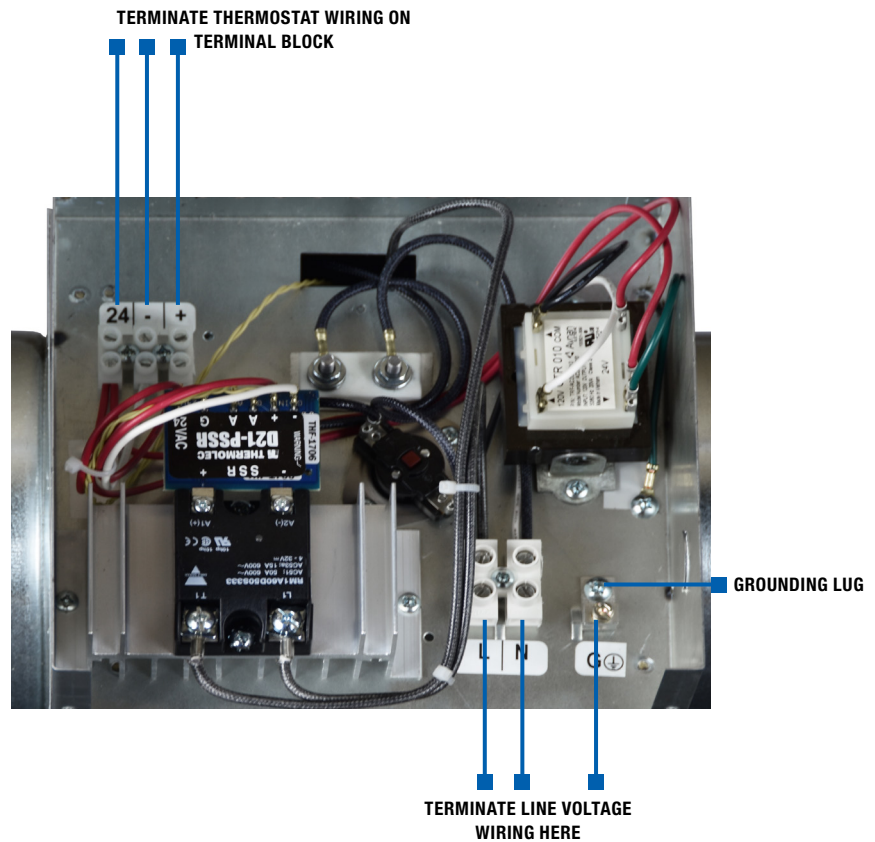


FIGURE 6.9.5 WIRING TERMINATION ILLUSTRATION

6.10 SET CONTROLLER POTENTIOMETER (RH-D ONLY)

Set the selected low or standard range potentiometer to the desired output temperature from the heater. See Figure 2.1.2 on page 11 of this manual.

⚠ CAUTION**RISK OF BURNS**

This device is an electric heater and produces very high temperatures, capable of causing severe burns. Use caution when working on the heater and wear appropriate Personal Protective Equipment (PPE) whenever working on the unit.

7.0 MAINTENANCE**7.1 RH-D ANNUAL MAINTENANCE**

There is no required annual maintenance for any RH-D heater.

7.2 RH-W ANNUAL MAINTENANCE

RH-W heaters have a fault indicator LED. RenewAire suggests that the LED be checked annually for indication of detected problems.

7.3 RH-D TROUBLE SHOOTING**7.3.1 Testing AFS (PN 990804) and DS (PN 990805) Sensors**

Remove AFS and/or DS sensor from D21-TSSR board and measure the ohms across the Thermistor:

The reading should be 10K Ω at 77°F. If the temperature is higher, the resistance will go down and if the temperature is lower, the resistance will go up. If the sensor reads OPEN LINE, replace sensor.

7.3.2 Testing Control Module D21-TSSR (PN 990821)

Here are the steps to follow to test and troubleshoot these boards:

The first step in testing the D21-TSSR controller is to confirm that there is 24 VAC powering the board, so please verify.

The airflow sensor is a device that protects the heater element section from overheating. If there is a lack of proper airflow, the controller and the airflow sensor will make the unit modulate proportionally with the airflow. This simply means that, if the element section is getting half of the needed airflow, the heater will work at half the capacity. This prevents overheating of the elements which would damage them. Note: With zero airflow, the heating will not immediately be limited. Once heating has begun however, the airflow sensor will detect abundance/uncirculated heat and then it will limit heat proportionally to this limited airflow.

If no heat is being produced and the yellow LED is continuously lit, it is a sign that too much heat is being detected by the internal airflow sensor (>44°C). This is a good indication for not enough airflow, or for faulty SSR (i.e. the heating elements staying always on even when no demand).

If no heat is being produced and the yellow LED is flashing slowly, it is a sign that the Airflow sensor is bad, shorted, not properly connected, or temperature detected exceeded 100°C (which may be caused due to lack of airflow). To test the airflow sensor, turn all power off, remove the wires from the terminals A and A and measure approx. 10Kohm (at room temp) with an ohmmeter across those wires. If good please re-install those wires. Note: To reset, turn power off and on.

If no yellow LED lit on the D21-TSSR and no green LED lit on the SSR (with thermostat full on), verify greater than 4VDC on the SSR +/- control input. If voltage is there then most probably bad SSR.

Alternative Simple Quick tests:

This will allow to turn on the SSR/elements full heat (to verify the load current, operation etc.) for 1 minute.

1. Turn ON the Power.
2. Remove one of the AIR_FLOW connection. The Yellow LED begins to flash quickly.
3. Short together the AIR_FLOW Sensor connections (A-A) momentarily for at least two seconds;
 - The Yellow Light continues to flash.
 - The SSR/heater elements will turn instantly ON for total of 1minute (regardless of the thermostat pot position).
4. After 1 min. with Full ON, the controller turns OFF the SSR/elements and the Yellow Warning LED light flashes slowly with a pattern of 1 second ON and 2 seconds OFF.
5. To return to normal operation; remove the short (if still connected), connect back the AIR_FLOW sensor wires and turn power OFF then ON.

7.3.3 Testing Heating Elements

Make sure the automatic and manual thermal reset are in the closed position. Measure the resistance between LOAD 1 on the D21-TSSR board and L2. If the reading is OPEN LINE, replace the heater.

7.3.4 Testing the Transformer

Power the primary side of the transformer. Measure Voltage across the secondary terminals. Voltage should be 24 VAC.

7.4 RH-W TROUBLE SHOOTING

7.4.1 Testing the CTH291 Thermostat (supplied with RH-W heaters)

Review wiring of thermostat (and sensor, if duct control application). (Refer to instructions on page 22).

Review Dip Switches settings. (Refer to instructions on page 20).

Note for Dip switch 2:

- Reverse acting: 0-VDC = Full OFF/10VDC = Full ON (RenewAire DEFAULT).
- Direct acting: 0-VDC = Full ON/10VDC = Full OFF

Troubleshooting notes:

1. If the display is showing two straight lines, the external sensor is defective or not connected to terminal 7 and 8 (if configured for external sensor - Dip switch 3 = ON). Circuit is open: resistance is infinite or high.
2. If the temperature sensor is out of measurable range, the display will indicate HI (when the measured temperature is higher than the top bracket of the temperature range) or Lo (when the measured temperature is lower than the lower bracket of the temperature range).
3. Power has to be switch off and on (RESET) after dip switch is changed.

Example: If dip switch 3 is set to external sensor (ON) and no sensor is connected, the screen will show 2 lines; if dip switch 3 is then set to internal sensor (OFF), 2 lines remain as long power has not been reset.

4. When the thermostat is in heating mode, a sun will appear on the display. It will flash when there is a call for heat. When the thermostat is in cooling mode, a snowflake will appear on the display. (To set cooling mode, install a jumper between terminals 2 and 3).

7.4.2 Testing the AFS Airflow Sensor (PN 990804)

Remove S2 airflow sensor from PSSR board and measure the ohms across the Thermistor:

The reading should be 10K Ω at 77°F. If the temperature is higher, the resistance will go down and if the temperature is lower, the resistance will go up. If the sensor reads OPEN LINE, replace sensor.

7.4.3 Testing the D21-PSSR Control Module (PN 990814) Input: 0–10VDC

Shorted or broken Airflow sensor detection:

If the airflow sensing Thermistor connection (A-A) of the D21-PSSR controller is either shorted or open, the controller will continue to work normally for about 60 seconds. While in this 60 second period, the yellow (or red) light begins to quickly blink indicating this warning mode. If the normal airflow condition is reinstated within that 60 seconds, the controller goes back to normal operation and the yellow (or red) light turns OFF. If the normal airflow condition does NOT come back within the 60 second time frame, the yellow (or red) Warning LED light begins to flash with a pattern of 1-second ON and 2-seconds OFF, and the controller switches off the SSR output (i.e. lockdown).

To cancel: fix the short or open airflow sensor connection, and then turn the controller's power OFF and then ON.

Useful diagnostic/testing process:

To force FULL power to the elements to verify the load current, operation etc. with out requiring thermostat control.

1. Turn the Power ON.
2. Remove one of the airflow sensor connections. The yellow (or red) light begins to blink quickly.
3. Short together the airflow sensor connections (A-A) momentarily for 2-seconds. The program goes to a "Diagnose Heater" process. The yellow (or red) light keeps blinking. The heater instantly turns FULL ON, regardless of the 0-10V input voltage.

After 1 minute with FULL ON, the controller turns OFF the elements and the yellow (or red) warning LED light flashes with a pattern of 1-second ON and 2-seconds OFF.

4. To put to normal operation: Remove the short, connect back the airflow sensor and then turn controller's power off and on (to reset).

7.4.4 Testing the SSR

SSR relays are Solid State Relays. They respond to an input signal of 4VDC to 32 VDC. That input is sent from the controller in the unit. For this reason, it is the normal process to first test the controller and then proceed with the testing of the relays. The typical failures of relays come from the fact that those relays are designed to switch a certain number of times. After this, the contact in the relay will eventually get stuck either in an open position or a closed position. If the contact is stuck closed, the elements will eventually overheat and the thermal cut-outs will cut the operation of the unit. If the contact is stuck open, the unit will never heat even when there is a demand for heat. Please note that heat is the most common source of problem that can damage relays. This is why it is recommended to have air circulate through the venting holes of the control box. Refer to section "Useful diagnostic testing process:" in the PSSR testing procedure to force relays on and off for troubleshooting purposes.

7.4.5 Testing the Heating Elements

Make sure the automatic and manual thermal reset are in the closed position. Measure the resistance between T on the SSR Relay and L2. If the reading is OPEN LINE, replace the heater.

7.4.6 Testing the Transformer

Apply power to the primary side of the transformer and measure the voltage across the secondary side. Voltage on the secondary side should be 24 VAC.

7.5 SEQUENCE OF OPERATION

7.5.1 RH-D Heaters

The heater operates on either 120 VAC or 240 VAC, 1 phase, 60 Hz.

The heater will maintain outlet air temperature set by a potentiometer on the controller whenever there is airflow. Outlet air temperature is sensed by the Outlet Air Temperature Sensor, located on the outlet side of the unit.

The heater is fully modulated, single stage that is enabled by the Outlet Air Temperature Sensor. See figure in Section 2.1 of this manual. The Outlet Air Temperature Sensor is identified as item 5, Duct Sensor on the Repair Parts drawing.

The heat output of the RH-D is SSR controlled.

- When voltage is applied to the power side of the heater (L/N for 120 VAC, L1/L2 for 240 VAC), the transformer will send 24 VAC to the control circuit and energize the D21-TSSR controller.
- The Outlet Air Temperature Sensor detects the temperature of the air at the outlet of the heater.
- The controller reads the detected temperature and then modulates the current going to the heater element as required to maintain the setpoint on the potentiometer. Modulation is accomplished by the controller sending measured pulses of high voltage AC to the heater element.
- The automatic reset cut-out (125°F) and the manual reset cut-out (200°F) will cut off power to the heating element if overheating within the heater module is detected.
- The Output Air Temperature Sensor (connected to terminals “S” and “S” on the D21-TSSR controller) must be installed on the outlet side of the heater.
- The electronic Airflow Sensor monitors airflow through the heater and will cause the controller to reduce current flow to the heater element if there is insufficient airflow.

7.5.2 RH-W Heaters

The heater operates on either 120 VAC or 240 VAC, 1 phase, 60 Hz.

The heater is fully modulated, single stage and is energized by a 0–10 VDC signal.

The heat output of the RH-W is SSR controlled.

- When voltage is applied to the power side of the heater (L/N for 120 VAC, L1/L2 for 240 VAC), the transformer will send 24 VAC to the control circuit and energize the D21-PSSR controller, as well as provide a 24 VAC output to power the CTH-291 thermostat.
- The CTH-291 thermostat (or other source) commands the heater through terminals “+” and “-” on the controller.
- Upon receiving a call for heat from the CTH-291 thermostat or other source (such as a BMS), the controller will output a DC signal to trigger the SSR (Solid State Relay). The SSR will close when it receives a signal and open when there is no signal. The frequency of the DC signal to the SSR depends on the 0–10 VDC signal coming from the CTH-291 thermostat. At 0 VDC, the heater will be completely OFF and at 10 VDC, the heater will operate at maximum capacity. Any voltage between 0 VDC and 10 VDC will result in a proportional output from the heater. The controller requires a minimum of 0.1 VDC to initiate heating.
- The automatic reset cut-out (125°F) and the manual reset cut-out (200°F) will cut off power to the heating element if overheating within the heater module is detected.
- The electronic Airflow Sensor monitors airflow through the heater and will cause the controller to reduce current flow to the heater element if there is insufficient airflow.

8.0 FACTORY ASSISTANCE

In the unlikely event that you need assistance from the factory for a specific issue with the RH Electric Duct Heaters, 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

Remember that RenewAire Customer Service can only assist with the products sold by RenewAire and their options, it cannot resolve engineering issues that result from air handling system design by others.

9.0 SERVICE PARTS

9.1 RH-D 1, 2, 3, 4, 5, AND 6 KW SERVICE PARTS

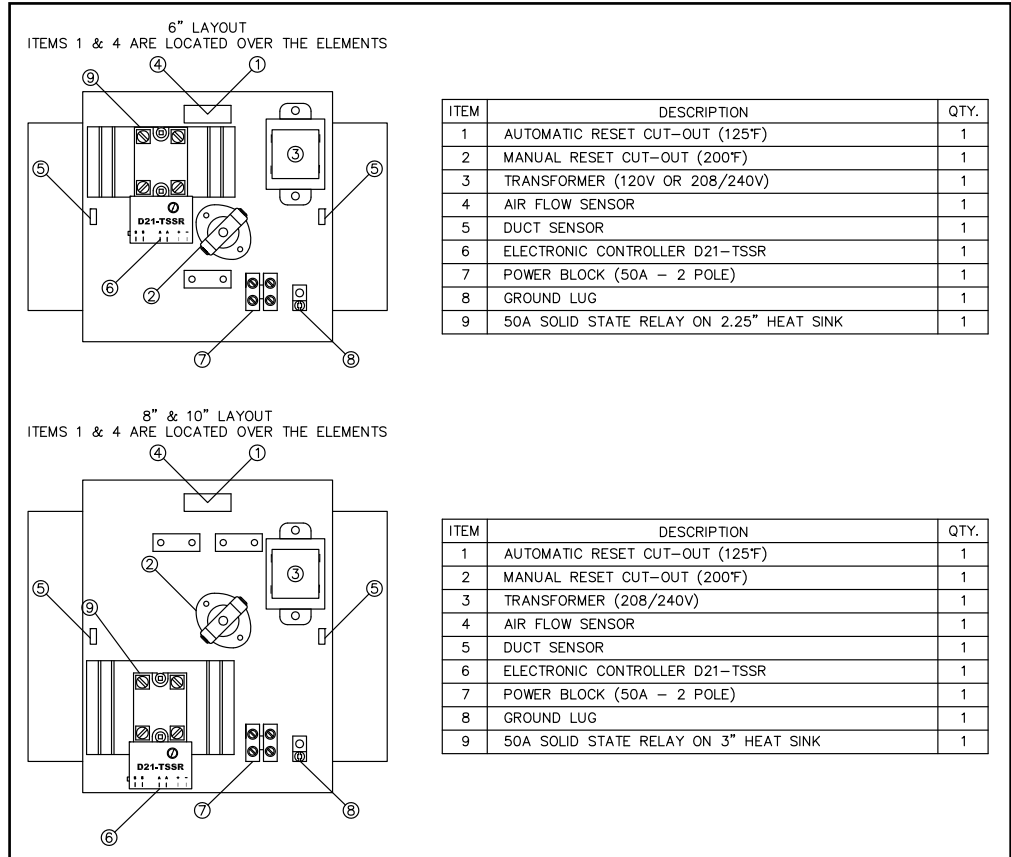


FIGURE 9.1.0 RH-D 1, 2, 3, 4, 5, AND 6 KW SERVICE PARTS

9.2 RH-D 8, 10, AND 11.5 KW SERVICE PARTS

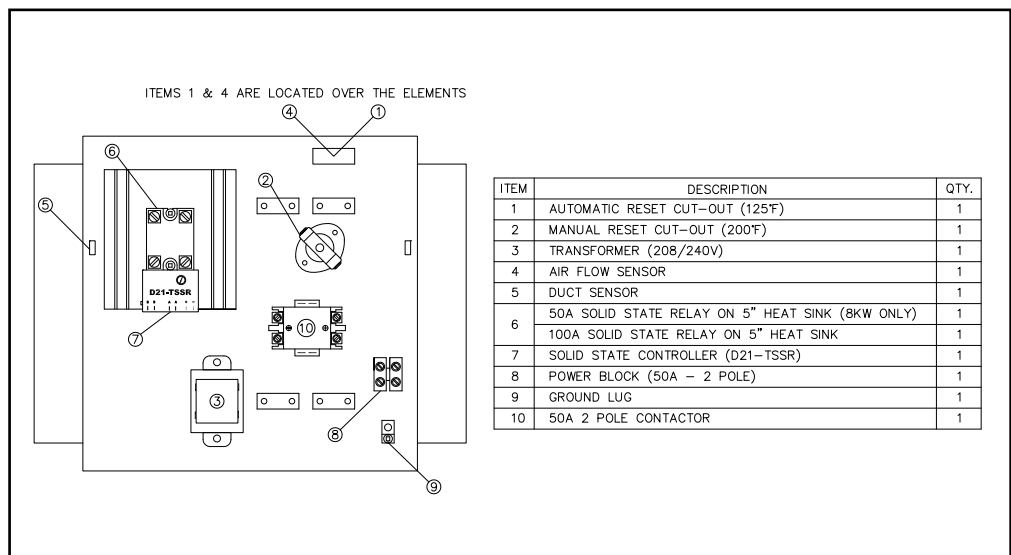


FIGURE 9.2.0 RH-D 8, 10, AND 11.5 KW SERVICE PARTS

9.3 RH-W 1, 2, 3, 4, 5, AND 6 KW SERVICE PARTS

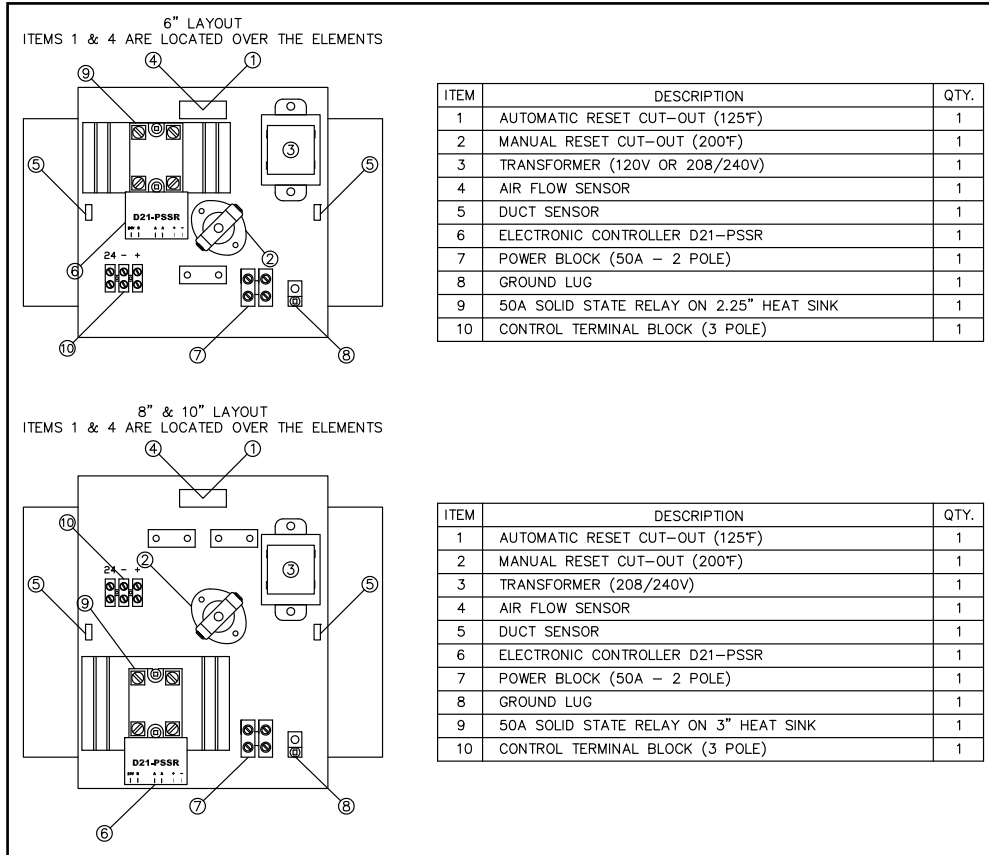


FIGURE 9.3.0 RH-W 1, 2, 3, 4, 5, AND 6 KW SERVICE PARTS

9.4 RH-W 8, 10, AND 11.5 KW SERVICE PARTS

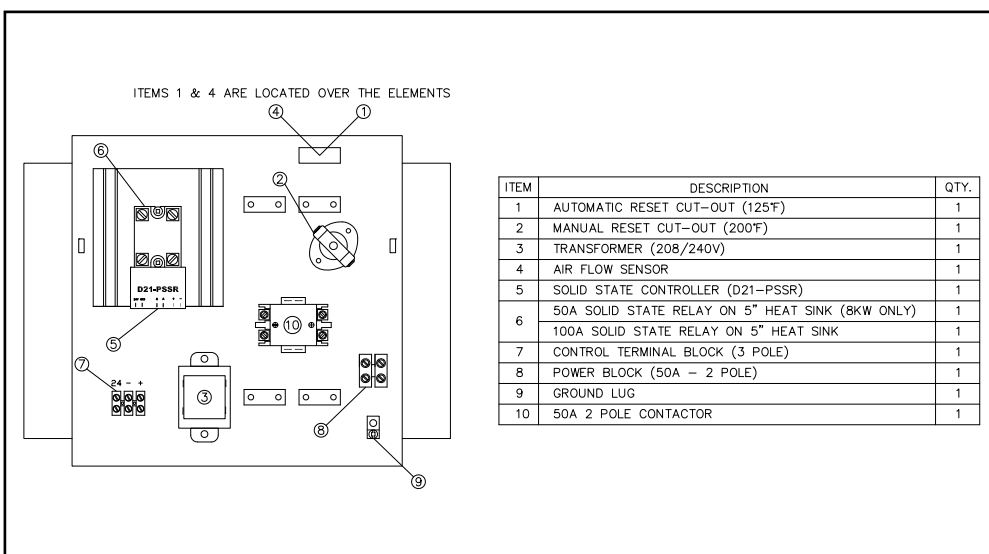


FIGURE 9.4.0 RH-W 8, 10, AND 11.5 KW SERVICE PARTS



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

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