

INSTALLATION INSTRUCTIONS

R-410A Single Package Rooftop, Cooling Only

RAH150

These instructions must be read and understood completely before attempting installation

Safety Labeling and Signal Words

DANGER, WARNING, CAUTION, and NOTE

The signal words **DANGER**, **WARNING**, **CAUTION**, and **NOTE** are used to identify levels of hazard seriousness. The signal word **DANGER** is only used on product labels to signify an immediate hazard. The signal words **WARNING**, **CAUTION**, and **NOTE** will be used on product labels and throughout this manual and other manual that may apply to the product.

DANGER – Immediate hazards which will result in severe personal injury or death.

WARNING – Hazards or unsafe practices which could result in severe personal injury or death.

CAUTION – Hazards or unsafe practices which may result in minor personal injury or product or property damage.

NOTE – Used to highlight suggestions which will result in enhanced installation, reliability, or operation.

Signal Words in Manuals

The signal word **WARNING** is used throughout this manual in the following manner:

 **WARNING**

The signal word **CAUTION** is used throughout this manual in the following manner:

 **CAUTION**

Signal Words on Product Labeling

Signal words are used in combination with colors and/or pictures or product labels.

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 **WARNING**

PERSONAL INJURY, AND/OR PROPERTY DAMAGE HAZARD

Failure to carefully read and follow this warning could result in equipment malfunction, property damage, personal injury and/or death.

Installation or repairs made by unqualified persons could result in equipment malfunction, property damage, personal injury and/or death.

The information contained in this manual is intended for use by a qualified service technician familiar with safety procedures and equipped with proper tools and test instruments.

Installation must conform with local building codes and with the national Electrical Code NFPA70 current edition or Canadian Electrical Code part 1 CSA C.22.1.

IMPORTANT – READ BEFORE INSTALLING


1. Read and become familiar with these installation instructions before installing this unit.
2. Be sure the installation conforms to all applicable local and national codes.
3. These instructions contain important information for the proper maintenance and repair of this equipment. Retain these instructions for future use.

SAFETY CONSIDERATIONS

Improper installation, adjustment, alteration, service, maintenance, or use can cause explosion, fire, electrical shock or other conditions which may cause personal injury or property damage. Consult a qualified installer, service agency, or your distributor or branch for information or assistance. The qualified installer or agency must use factory–authorized kits or accessories when modifying this product. Refer to the individual instructions packaged with the kits or accessories when installing.

Follow all safety codes. Wear safety glasses and work gloves. Use quenching cloths for brazing operations and have a fire extinguisher available. Read these instructions thoroughly and follow all warnings or cautions attached to the unit. Consult local building codes and appropriate national electrical codes (in USA, ANSI/NFPA70, National Electrical Code (NEC); in Canada, CSA C22.1) for special requirements.

Recognize safety information. This is the safety–alert symbol.

When you see this symbol  in instructions or manuals, be alert to the potential for personal injury.

Understand the signal words **DANGER**, **WARNING**, **CAUTION**, and **NOTE**. These words are used with the safety–alert symbol. **DANGER** identifies the most serious hazards which **will** result in serious injury or death. **WARNING** signifies a hazard which **could** result in serious injury or death. **CAUTION** is used to identify unsafe practices which **may** result in minor personal injury or product and property damage. **NOTE** is used to highlight suggestions which **will** result in enhanced installation, reliability, or operation.

These instructions cover minimum requirements and conform to existing national standards and safety codes. In some instances, these instructions exceed certain local codes and ordinances, especially those that may not have kept up with changing residential construction practices. We require these instructions as a minimum for a safe installation.

WARNING

ELECTRICAL SHOCK HAZARD

Failure to follow this warning could cause personal injury or death.

Before performing service or maintenance operations on unit, always turn off main power switch to unit and install lockout tag. Unit may have more than one power switch.

WARNING

UNIT OPERATION AND SAFETY HAZARD

Failure to follow this warning could cause personal injury, death and/or equipment damage.

R-410A refrigerant systems operate at higher pressures than standard R-22 systems. Do not use R-22 service equipment or components on R-410A refrigerant equipment.

WARNING

PERSONAL INJURY AND ENVIRONMENTAL HAZARD

Failure to follow this warning could cause personal injury, or death.

Relieve pressure and recover all refrigerant before system repair or final unit disposal.

Wear safety glasses and gloves when handling refrigerants. Keep torches and other ignition sources away from refrigerants and oils.

CAUTION

CUT HAZARD

Failure to follow this caution may result in personal injury

Sheet metal parts may have sharp edges or burrs. Use care and wear appropriate protective clothing, safety glasses and gloves when handling parts and servicing equipment.

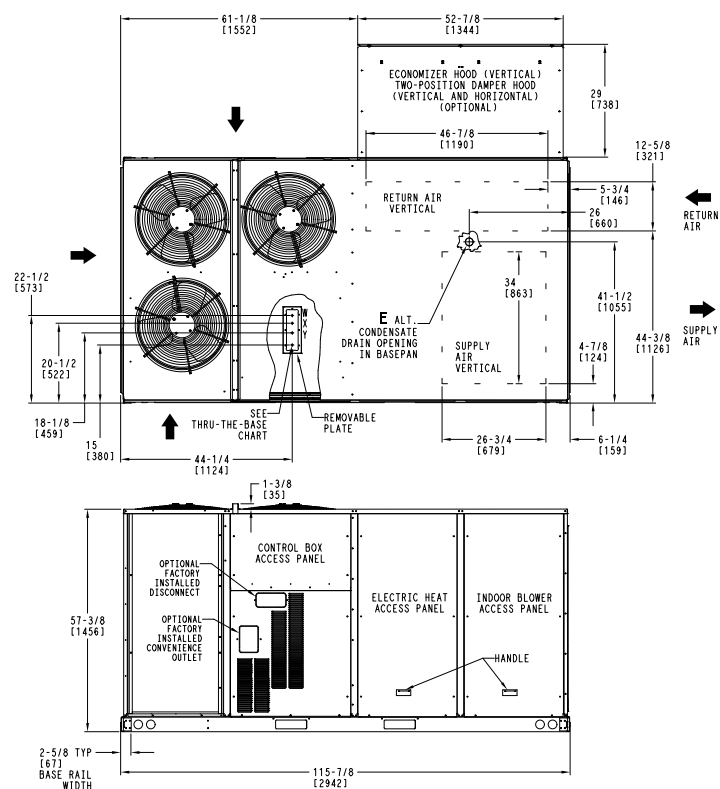
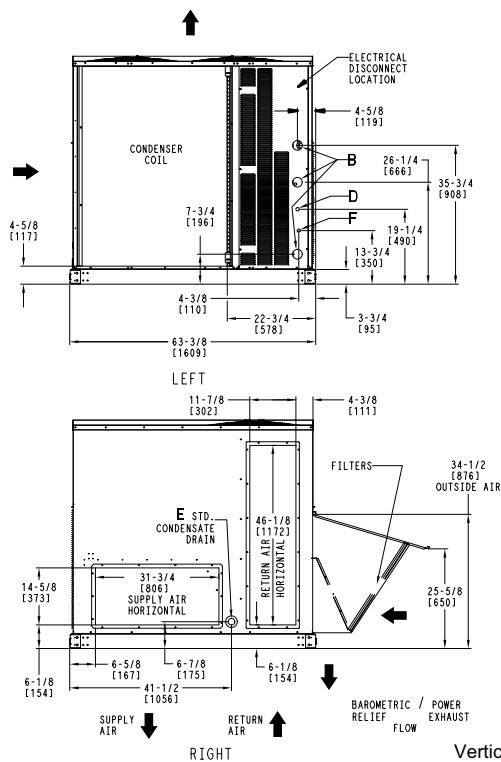
FIGURE 1 Unit Dimensional Drawing

NOTES:

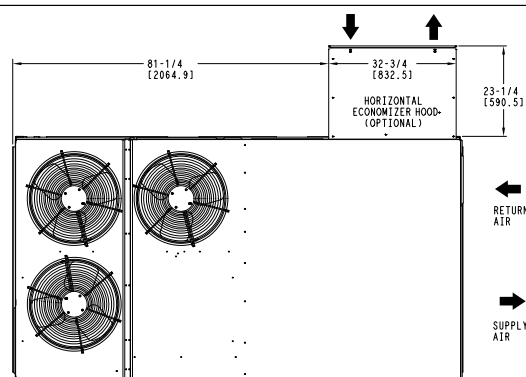
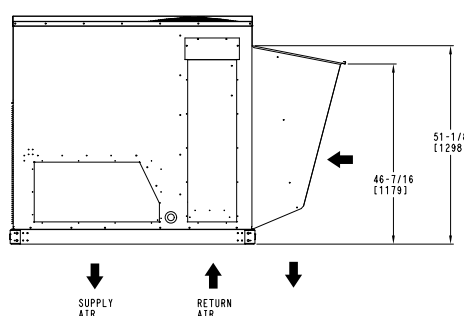
1. DIMENSIONS ARE IN INCHES, DIMENSIONS
IN [] ARE IN MILLIMETERS.

2. CENTER OF GRAVITY

3. DIRECTION OF AIR FLOW



Vertical Connections / Economizer



Horizontal Connections / Economizer

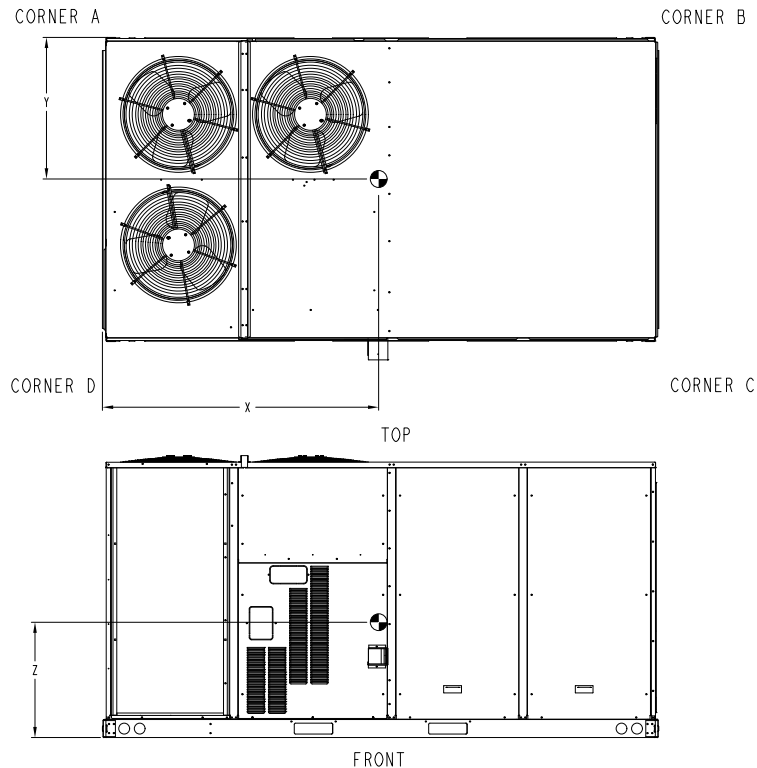
	CONNECTION SIZES
B	2 1/2" [64] DIA POWER SUPPLY HOLE
D	7/8" [22] DIA FIELD CONTROL WIRING HOLE
E	3/4"-14 NPT CONDENSATE DRAIN
F	7/8" [22] DIA FIELD CONVENIENCE OUTLET HOLE

THRU-THE-BASE CHART				
THESE HOLES REQUIRED FOR USE CRBTMPW005A00, 006A00, 007A00				
ACCESSORY NO.	THREADED CONDUIT SIZE	WIRE USE	REQ'D HOLE SIZES (MAX.)	
005	W 1/2"	ACC.	7/8" [22.2]	
	X 1/2"	24V	7/8" [22.2]	
	Y 1 1/4"	POWER	1 1/2" [38.1]	
006	W 1/2"	ACC.	7/8" [22.2]	
	X 1/2"	24V	7/8" [22.2]	
	Y 1 1/2"	POWER	2" [50.8]	
007	W 1/2"	ACC.	7/8" [22.2]	
	X 1/2"	24V	7/8" [22.2]	
	Y 2"	POWER	2 1/2" [63.5]	
FOR "THRU-THE-BASEPAN" FACTORY OPTION, FITTINGS FOR X & Y ARE PROVIDED AS SPECIFIED ON "006"				

Fig. 1 – Unit Dimensional Drawing (cont.)

UNIT	STD UNIT WEIGHT		CORNER WEIGHT (A)		CORNER WEIGHT (B)		CORNER WEIGHT (C)		CORNER WEIGHT (D)		C.G.		
	LBS.	KG.	LBS.	KG.	LBS.	KG.	LBS.	KG.	LBS.	KG.	X	Y	Z
RAH150	1360	617	335	151	361	164	344	156	320	145	60-1/8 [1527]	31 [787]	21-1/8 [536]

STANDARD UNIT WEIGHT IS WITHOUT PACKAGING.
FOR OPTIONS & ACCESSORIES, REFER TO THE PRODUCT DATA CATALOG.



INSTALLATION

Jobsite Survey

Complete the following checks before installation.

1. Consult local building codes and the NEC (National Electrical Code) ANSI/NFPA 70 for special installation requirements.
2. Determine unit location (from project plans) or select unit location.
3. Check for possible overhead obstructions which may interfere with unit lifting or rigging.

Step 1 — Plan for Unit Location

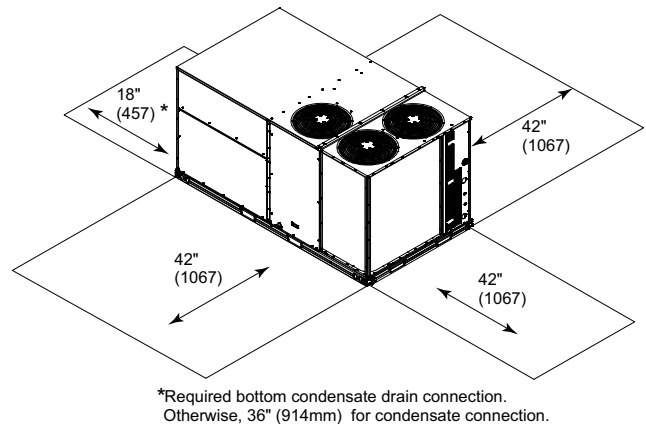
Select a location for the unit and its support system (curb or other) that provides for at least the minimum clearances required for safety. This includes the clearance to combustible surfaces, unit performance and service access below, around and above unit as specified in unit drawings. See Fig. 2.

NOTE: Consider also the effect of adjacent units.

Unit may be installed directly on wood flooring or on Class A, B, or C roof-covering material when roof curb is used

Do not install unit in an indoor location. Do not locate air inlets near exhaust vents, relief valves, or other sources of contaminated air.

FIGURE 2 Service Clearance Dimensional Drawing



Although unit is weatherproof, avoid locations that permit water from higher level runoff and overhangs to fall onto the unit.

Select a unit mounting system that provides adequate height to allow for removal and disposal of frost and ice that will form during the heating-defrost mode as well as allow installation of condensate trap per requirements. Refer to Step 11 — Install External Condensate Trap and Line – for required trap dimensions.

Roof Mount —

Check building codes for weight distribution requirements. Unit operating weight is shown in Table 1.

Table 1—Operating Weights

RAH	
COMPONENT	UNITS LB (KG)
Base Unit	1360 (617)
Economizer	
Vertical	100 (45)
Horizontal	115 (52)
Powered Outlet	32 (15)
Curb	
14-in/356 mm	180 (82)
24-in/610 mm	235 (107)

Step 2 — Plan for Sequence of Unit Installation

The support method used for this unit will dictate different sequences for the steps of unit installation. For example, on curb-mounted units, some accessories must be installed on the unit before the unit is placed on the curb. Review the following for recommended sequences for installation steps.

Curb-mounted installation —

- Install curb
- Install field-fabricated ductwork inside curb
- Install accessory thru-base service connection package (affects curb and unit) (refer to accessory installation instructions for details)
- Prepare bottom condensate drain connection to suit planned condensate line routing (refer to Step 9 for details)
- Rig and place unit
- Install outdoor air hood
- Install condensate line trap and piping
- Make electrical connections
- Install other accessories

Pad-mounted installation —

- Prepare pad and unit supports
- Check and tighten the bottom condensate drain connection plug
- Rig and place unit
- Convert unit to side duct connection arrangement
- Install field-fabricated ductwork at unit duct openings
- Install outdoor air hood

Install condensate line trap and piping

Make electrical connections

Install other accessories

Frame-mounted installation —

Frame-mounted applications generally follow the sequence for a curb installation. Adapt as required to suit specific installation plan.

Step 3 — Inspect Unit

Inspect unit for transportation damage. File any claim with transportation agency.

Confirm before installation of unit that voltage, amperage and circuit protection requirements listed on unit data plate agree with power supply provided.

Step 4 — Provide Unit Support

Roof Curb Mount —

Accessory roof curb details and dimensions are shown in Fig. 3. Assemble and install accessory roof curb in accordance with instructions shipped with the curb.

NOTE:The gasketing of the unit to the roof curb is critical for a watertight seal. Install gasket supplied with the roof curb as shown in Fig. 3. Improperly applied gasket can also result in air leaks and poor unit performance.

Curb should be level. This is necessary for unit drain to function properly. Unit leveling tolerances are shown in Fig. 4. Refer to Accessory Roof Curb Installation Instructions for additional information as required.

Install insulation, cant strips, roofing felt, and counter flashing as shown. *Ductwork must be attached to curb and not to the unit.*

If electric and control wiring is to be routed through the basepan, attach the accessory thru-the-base service connections to the basepan in accordance with the accessory installation instructions.

Slab Mount (Horizontal Units Only) —

Provide a level concrete slab that extends a minimum of 6 in. (150 mm) beyond unit cabinet. Install a gravel apron in front of condenser coil air inlet to prevent grass and foliage from obstructing airflow.

NOTE:Horizontal units may be installed on a roof curb if required.

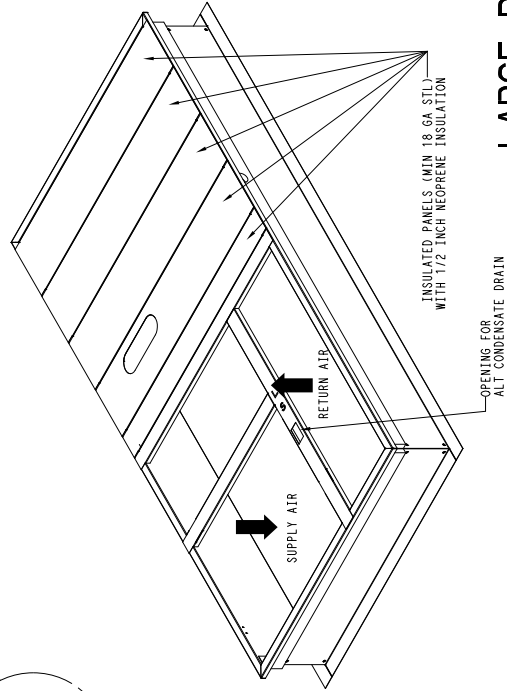
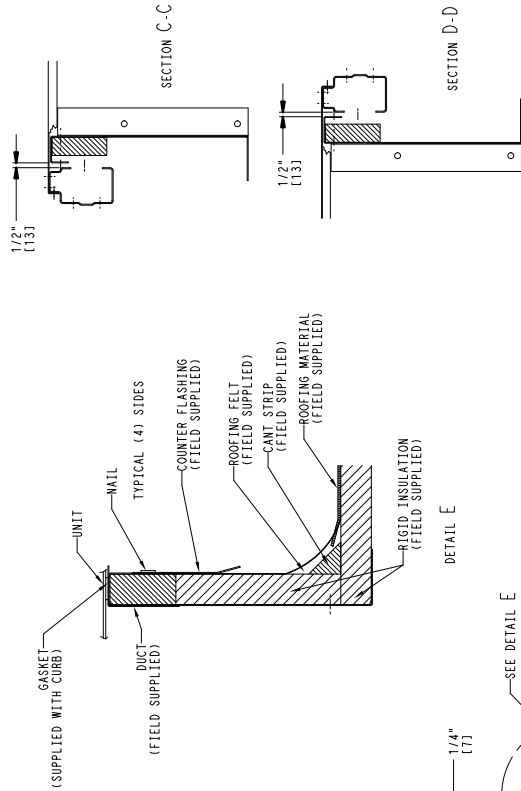
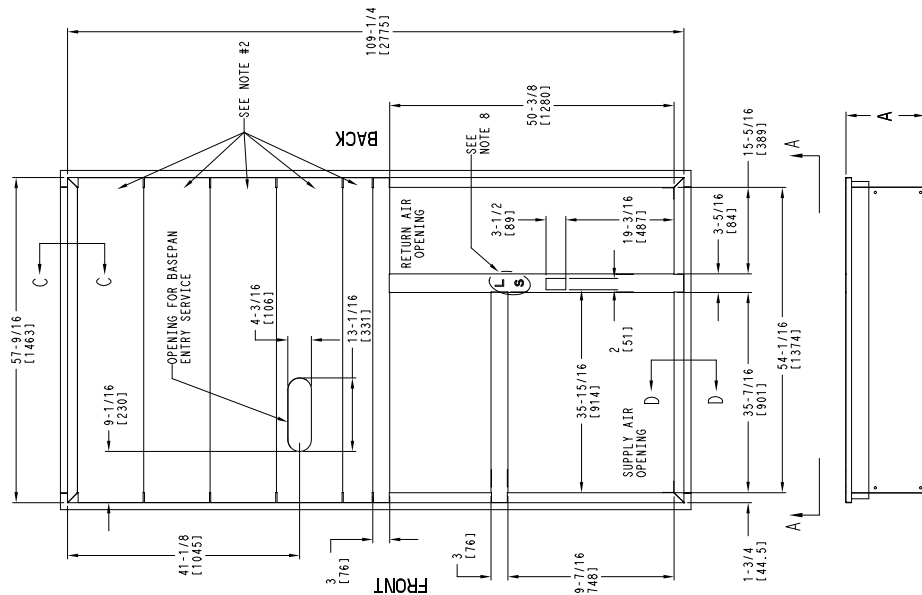
Alternate Unit Support (In Lieu of Curb or Slab Mount) —

A non-combustible sleeper rail can be used in the unit curb support area. If sleeper rails cannot be used, support the long sides of the unit with a minimum of 3 equally spaced 4-in. x 4-in. (102 mm x 102 mm) pads on each side.

FIGURE 3 Roof Curb Details

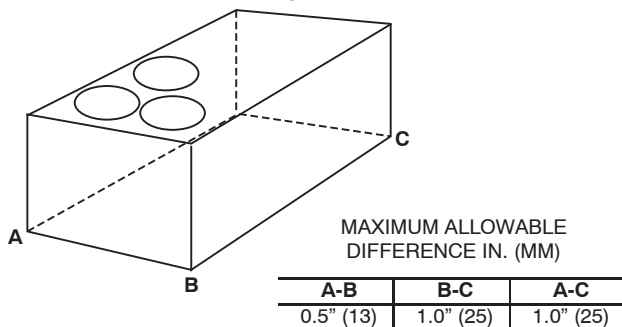
- NOTES:**
1. ROOFCURB ACCESSORY IS SHIPPED DISASSEMBLED.
 2. INSULATED PANELS: 1/2" THK NEOPRENE FOAM, 1.0# DENSITY.
 3. DIMENSIONS IN [] ARE IN MILLIMETERS.
 4. ROOFCURB SIDEWALLS: 16 GAGE STEEL.
5. ATTACH DUCTWORK TO CURB. (FLANGES OF DUCT REST ON CURB).
 6. SERVICE CLEARANCE FOR EACH SIDE.
 7. SERVICE CLEARANCE FOR EACH SIDE.
 8. "L" & "S" DESIGNATIONS DENOTE LOCATION OF COMMON CROSS RAIL. (POSITION "L" FOR LARGE DUCT OPENING CURB).

ROOF CURB ACCESSORY #	A
CRRCURB074A00	14" [356]
CRRCURB075A00	24" [610]



LARGE DUCT OPENINGS

FIGURE 4 Unit Leveling Tolerances



Step 5 — Field Fabricate Ductwork

NOTE: Cabinet return-air static pressure (a negative condition) shall not exceed 0.35 in. wg (87 Pa) with economizer or 0.45 in. wg (112 Pa) without economizer.

For vertical ducted applications, secure all ducts to roof curb and building structure. *Do not connect ductwork to unit.*

Insulate and weatherproof all external ductwork, joints, and roof openings with counter flashing and mastic in accordance with applicable codes.

Ducts passing through unconditioned spaces must be insulated and covered with a vapor barrier.

If a plenum return is used on a vertical unit, the return should be ducted through the roof deck to comply with applicable fire codes.

For Units with Accessory Electric Heaters

All installations require a minimum clearance to combustible surfaces of 1-in (25 mm) from duct for first 12-in (305 mm) away from unit.

Outlet grilles must not lie directly below unit discharge.

NOTE: A 90-degree elbow must be provided in the ductwork to comply with UL (Underwriters Laboratories) code for use with electric heat.

⚠ WARNING

PERSONAL INJURY HAZARD

Failure to follow this warning could cause personal injury.

For vertical supply and return units, tools or parts could drop into ductwork and cause an injury. Install a 90 degree turn in the return ductwork between the unit and the conditioned space. If a 90 degree elbow cannot be install, then a grill of sufficient strength and density should be installed to prevent objects from falling into the conditioned space. Due to electric heater, supply duct will require 90 degree elbow.

⚠ CAUTION

PROPERTY DAMAGE HAZARD

Failure to follow this caution may result in damage to roofing materials.

Membrane roofs can be cut by sharp sheet metal edges. Be careful when placing any sheet metal parts on such roof.

Step 6 — Rig and Place Unit

When the unit is ready to be rigged and no longer will be lifted by a fork truck, the wood protector under the basepan must be removed. Remove 4 screws from each base rail. Wood protector will drop to the ground. See instructions on the unit base rails.

Keep unit upright and do not drop. Spreader bars are required. Rollers may be used to move unit across a roof. Level by using unit frame as a reference. See Table 1 and Fig. 5 for additional information.

Lifting holes are provided in base rails as shown in Fig. 5. Refer to rigging instructions on unit.

⚠ CAUTION

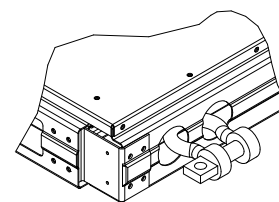
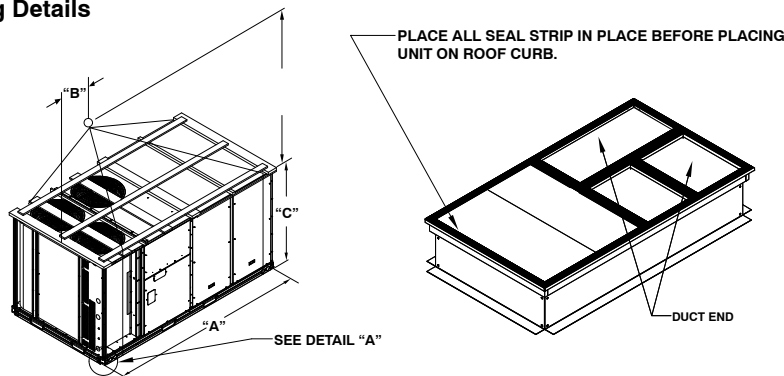
UNIT DAMAGE HAZARD

Failure to follow this caution may result in equipment damage.

All panels must be in place when rigging. Unit is not designed for handling by fork truck.

Before setting the unit onto the curb, recheck gasketing on curb.

FIGURE 5 Rigging Details



DETAIL "A"

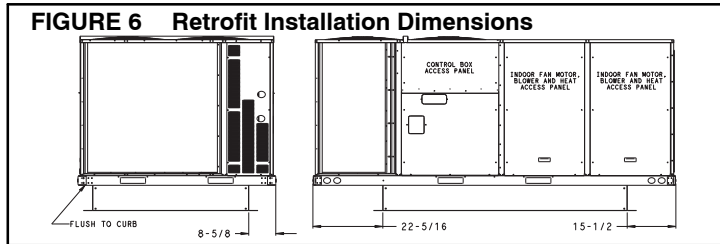
UNIT	MAX WEIGHT		DIMENSIONS					
			A		B		C	
	LB	KG	IN	MM	IN	MM	IN	MM
RAH150	2105	957	116.0	2945	62	1575	59.5	1510

NOTES:

1. SPREADER BARS REQUIRED — Top damage will occur if spreader bars are not used.
2. Dimensions in () are in millimeters.
3. Hook rigging shackles through holes in base rail, as shown in detail "A." Holes in base rails are centered around the unit center of gravity. Use wooden top to prevent rigging straps from damaging unit.

Positioning on Curb —

For full perimeter curbs CRRFCURB074A00 and 075A00, the clearance between the roof curb and the front and rear base rails should be $\frac{1}{4}$ in (6.4 mm). The clearance between the curb and the end base rails should be $\frac{1}{2}$ in (13 mm). For retrofit applications with curbs CRRFCURB003A01 and 4A01, the unit should be positioned as shown in Fig. 6. Maintain the 15.5 in (394 mm) and $8\frac{5}{8}$ in (220 mm) clearances and allow the $22\frac{5}{16}$ in (567 mm) dimension to float if necessary.



If the alternative condensate drain location through the bottom of the unit is used in conjunction with a retrofit curb, the hole in the curb must be moved 12.5 in (320 mm) towards the end of the unit.

Although unit is weatherproof, guard against water from higher level runoff and overhangs.

Remove all shipping materials and top skid. Remove extra center post from the condenser end of the unit so that the condenser end of the unit matches Fig. 23 – 25. Recycle or dispose of all shipping materials.

Step 7 — Convert to Horizontal and Connect Ductwork (when required)

Unit is shipped in the vertical duct configuration. Unit *without* factory-installed economizer or return air smoke detector option may be field-converted to horizontal ducted configuration using accessory CRDUCTCV001A00. To convert to horizontal configuration, remove screws from side duct opening covers and remove covers.

Discard the supply duct cover. Install accessory CRDUCTCV001A00 to cover the vertical supply duct opening. Use the return duct cover removed from the end panel to cover the vertical return duct opening.

Field-supplied flanges should be attached to horizontal duct openings and all ductwork should be secured to the flanges. Insulate and weatherproof all external ductwork, joints, and roof or building openings with counter flashing and mastic in accordance with applicable codes.

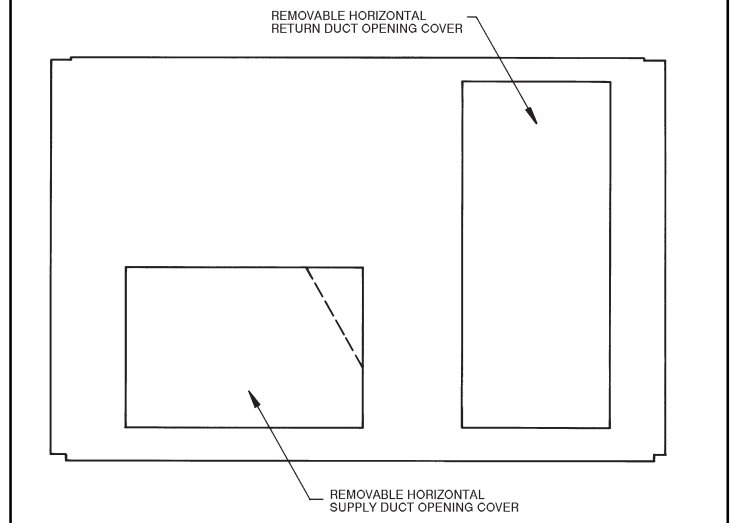
Do not cover or obscure visibility to the unit's informative data plate when insulating horizontal ductwork.

Step 8 — Install Outside Air Hood

Economizer Hood Removal and Setup – Factory Option —

1. The hood is shipped in knock-down form and located in the return air compartment. It is attached to the economizer using two plastic tie-wraps.
2. To gain access to the hood, remove the filter access panel. (See Fig. 8.)
3. Locate and cut the (2) plastic tie-wraps, being careful to not damage any wiring. (See Fig. 9.)

FIGURE 7 Horizontal Conversion Panels



4. Carefully lift the hood assembly through the filter access opening and assemble per the steps outlined in *Economizer Hood and Two-Position Hood* on page 9.

FIGURE 8 Typical Access Panel Locations

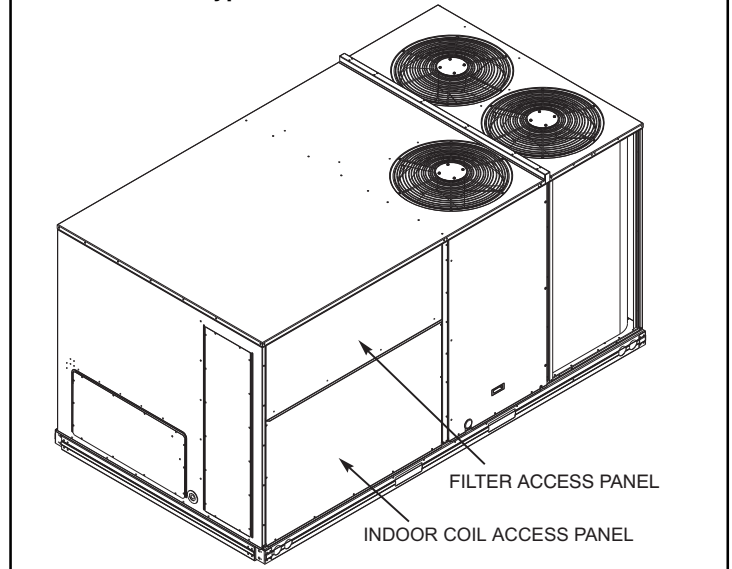
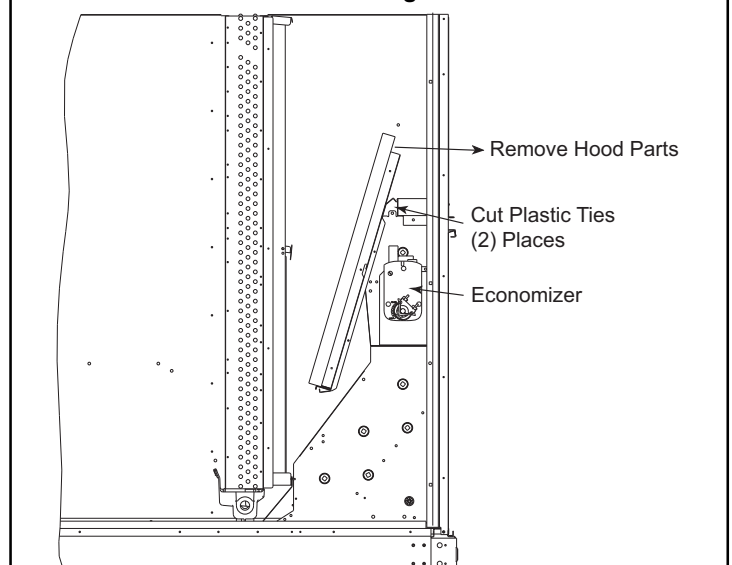


FIGURE 9 Economizer Wiring



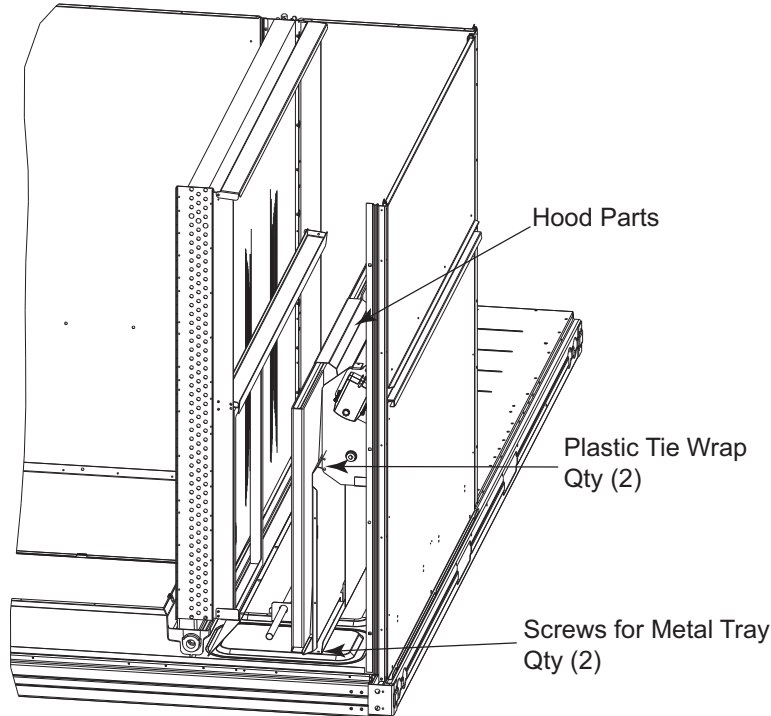
Two Position Damper Hood Removal and Setup – Factory Option —

1. The hood is shipped in knock-down form and assembled to a metal support tray using plastic stretch wrap. Located in the return air compartment, the assembly's metal tray is attached to the basepan and also attached to the damper using two plastic tie-wraps.
2. To gain access to the hood, remove the filter access panel. (See Fig. 8.)
3. Locate the (2) screws holding the metal tray to the basepan and remove. In order to remove the screws, it may be

necessary to remove the panel underneath the two-position damper. Remove the two screws. Locate and cut the (2) plastic tie-wraps securing the assembly to the damper. (See Fig. 10.) Be careful to not damage any wiring or cut tie-wraps securing any wiring.

4. Carefully lift the hood assembly (with metal tray) through the filter access opening and assemble per the steps outlined in *Economizer Hood and Two-Position Hood*.
5. If removed, reattach the panel under the damper.

FIGURE 10 Damper Assembly

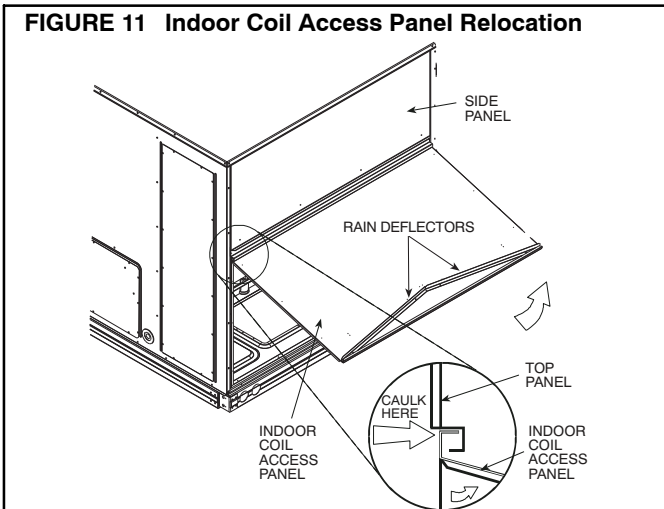


Economizer Hood and Two-Position Hood —

NOTE: If the power exhaust accessory is to be installed on the unit, the hood shipped with the unit will not be used and must be discarded. Save the aluminum filter for use in the power exhaust hood assembly.

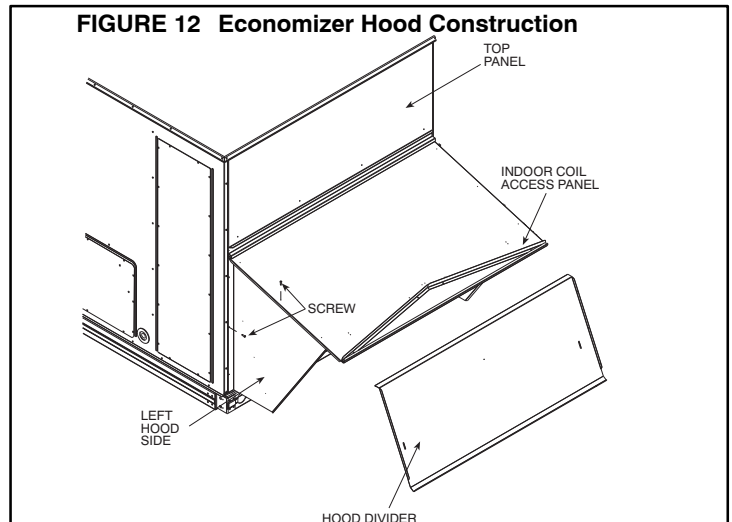
1. The indoor coil access panel will be used as the top of the hood. If the panel is still attached to the unit, remove the screws along the sides and bottom of the panel. See Fig. 11.

FIGURE 11 Indoor Coil Access Panel Relocation



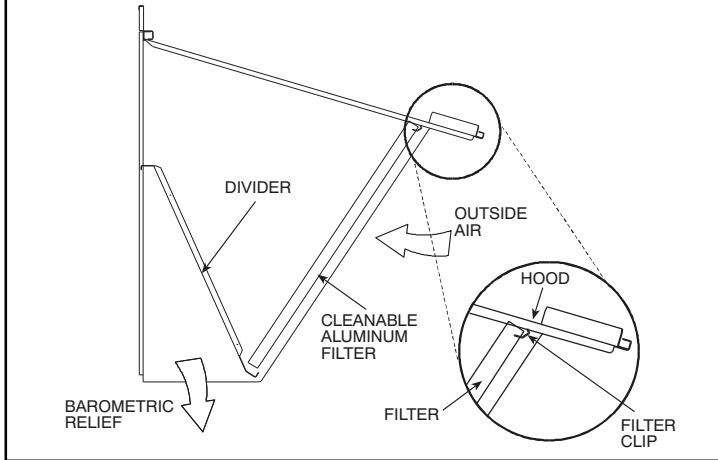
2. Swing out indoor coil access panel and insert the hood sides under the panel (hood top). **Be careful not to lift the panel too far as it might fall out.** Use the screws provided to attach the hood sides to the hood top. Use screws provided to attach the hood sides to the unit. See Fig. 12.

FIGURE 12 Economizer Hood Construction



- Remove the shipping tape holding the economizer barometric relief damper in place.
- Insert the hood divider between the hood sides. See Fig. 12 and 13. Secure hood divider with 3 screws on each hood side. The hood divider is also used as the bottom filter rack for the aluminum filter.
- Attach the post that separates the filters with the screws provided.
- Open the filter clips which are located underneath the hood top. Insert the aluminum filters into the bottom filter rack (hood divider). Push the filter into position past the open filter clips. Close the filter clips to lock the filters into place. See Fig. 13.
- Install the two rain deflectors on the edge of the hood top as shown in Fig. 11.

FIGURE 13 Economizer Filter Installation



- Caulk the ends of the joint between the unit top panel and the hood top as shown in Fig. 11.
- Replace the filter access panel.

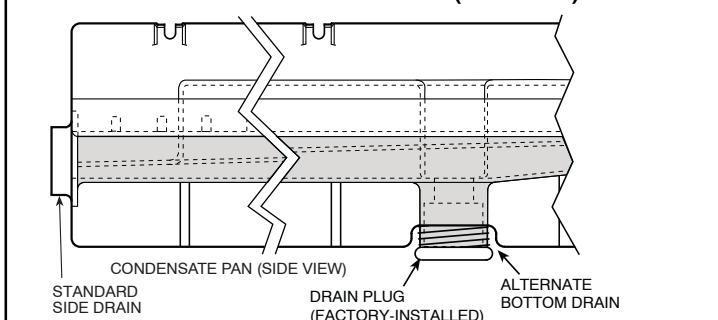
Step 9 — Install External Condensate Trap and Line

The unit has one $\frac{3}{4}$ -in. condensate drain connection on the end of the condensate pan and an alternate connection on the bottom. See Fig. 14. Unit airflow configuration does not determine which drain connection to use. Either drain connection can be used with vertical or horizontal applications.

When using the standard side drain connection, ensure the red plug in the alternate bottom connection is tight. Do this before setting the unit in place. The red drain pan can be tightened with a $\frac{1}{2}$ -in. square socket drive extension.

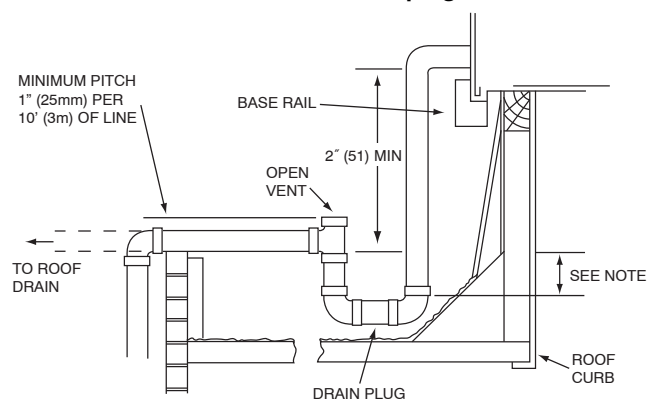
To use the alternate bottom drain connection, remove the red drain plug from the bottom connection (use a $\frac{1}{2}$ -in. square socket drive extension) and install it in the side drain connection.

FIGURE 14 Condensate Drain Pan (Side View)



The piping for the condensate drain and external trap can be completed after the unit is in place. See Fig. 15.

FIGURE 15 Condensate Drain Piping Details



NOTE: Trap should be deep enough to offset maximum unit static difference. A 4" (102) trap is recommended

All units must have an external trap for condensate drainage. Install a trap at least 4-in. (102 mm) deep and protect against freeze-up. If drain line is installed downstream from the external trap, pitch the line away from the unit at 1-in. per 10 ft (25 mm in 3 m) of run. Do not use a pipe size smaller than the unit connection ($\frac{3}{4}$ -in.).

Step 10 — Make Electrical Connections

⚠ WARNING

ELECTRICAL SHOCK HAZARD

Failure to follow this warning could result in personal injury or death.

Do not use gas piping as an electrical ground. Unit cabinet must have an uninterrupted, unbroken electrical ground to minimize the possibility of personal injury if an electrical fault should occur. This ground may consist of electrical wire connected to unit ground lug in control compartment, or conduit approved for electrical ground when installed in accordance with NEC (National Electrical Code); ANSI/NFPA 70, latest edition (in Canada, Canadian Electrical Code CSA [Canadian Standards Association] C22.1), and local electrical codes.

NOTE: Check all factory and field electrical connections for tightness. Field-supplied wiring shall conform with the limitations of 63°F (33°C) rise.

Field Power Supply —

For those units without through-the-curb power, conduit must be used to route the main power from the condenser end of the unit to either the factory option disconnect, the bottom of the control box or the single point box accessory. 1" conduit is provided wrapped around compressor. A second conduit is provided with factory installed powered convenience outlet. For those units that require conduit larger than 1", it must be field supplied. Figs 16, 17, and 18 show the various wire routings.

FIGURE 16 Conduit in Factory Option Disconnect

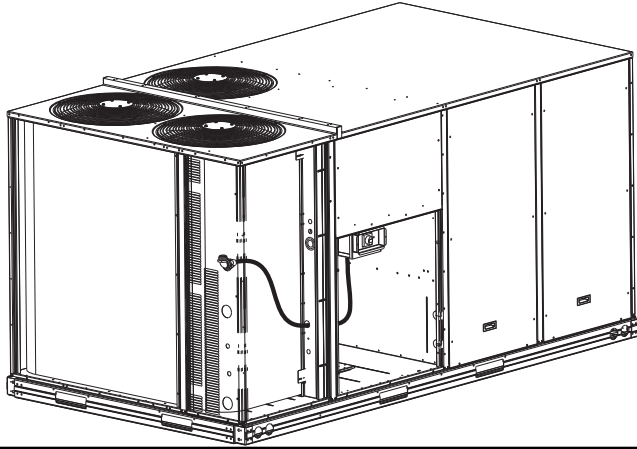


FIGURE 17 Conduit into Control Box

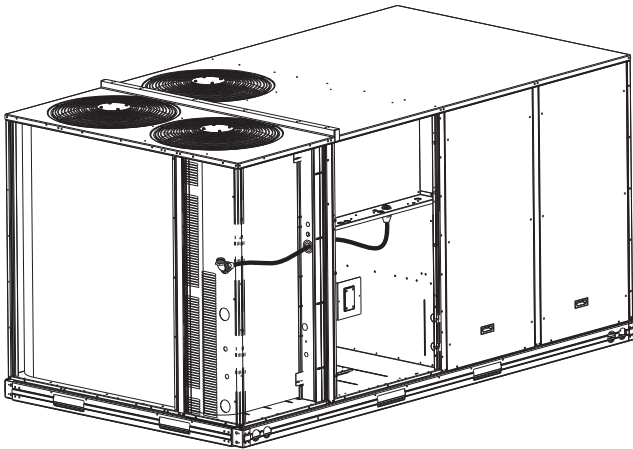
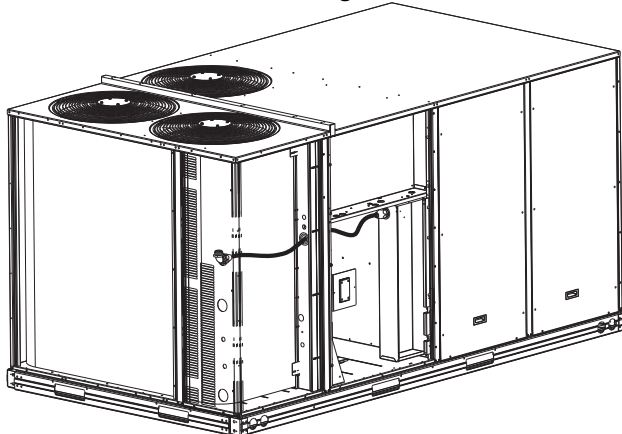


FIGURE 18 Conduit into Single Point Box



If the field disconnect is larger than 100A, it must be attached to the unit using accessory CRDISBKT001A00 (see Fig. 19). Follow the instructions provided with this accessory. For smaller field disconnects, be sure to use $\frac{1}{2}$ " screws to mount the disconnect directly to the end panel (see Fig. 20). In either case, set the disconnect vertical location on the unit so that a 90° fitting can be used to connect the conduit to the disconnect.

FIGURE 19 Mounting Position for Field Disconnects (over 100A)

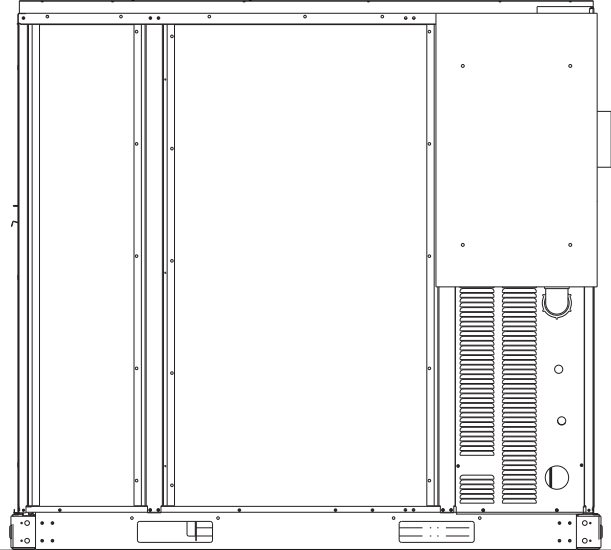
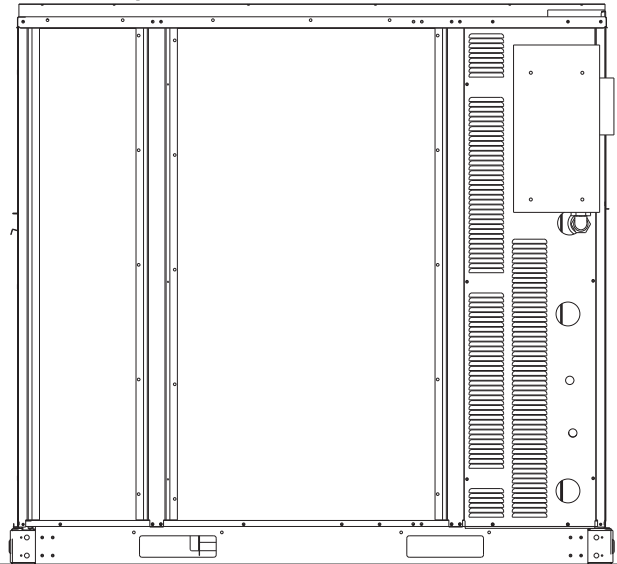


FIGURE 20 Mounting Position for Field disconnects (up to 100A)



All units except 208/230-v units are factory wired for the voltage shown on the nameplate. *If the 208/230-v unit is to be connected to a 208-v power supply, the control transformer must be rewired by moving the black wire with the $\frac{1}{4}$ -in. female spade connector from the 230-v connection and moving it to the 200-v $\frac{1}{4}$ -in. male terminal on the primary side of the transformer.* Refer to unit label diagram for additional information.

Field power wires are connected to the unit at line-side pressure lugs at the main terminal block (TB1) or at factory-installed option non-fused disconnect switch. Max wire size is #2 AWG (copper only). (See Fig. 22)

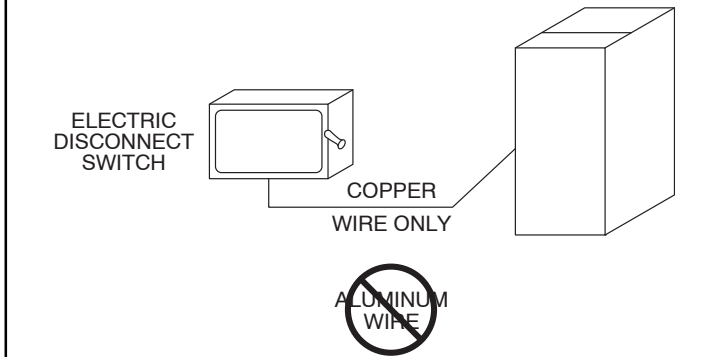
NOTE:TEST LEADS – Unit may be equipped with short leads (pigtailed) on the field line connection points off the optional disconnect switch. These leads are for factory run-test purposes only; remove and discard before connecting field power wires to unit connection points. Make field power connections directly to line connection pressure lugs only.

⚠ WARNING

FIRE HAZARD

Failure to follow this warning could result in intermittent operation or performance satisfaction. Do not connect aluminum wire between disconnect switch and furnace. Use only copper wire. (See Fig. 21.)

FIGURE 21 Disconnect Switch and Unit



All Units —

All field wiring must comply with the NEC and local requirements.

Size wire based on MCA (Minimum Circuit Amps) on the unit informative plate. See Fig. 22 and the unit label diagram for power wiring connections to the unit power terminal blocks and equipment ground. Maximum wire size is #2/0 AWG per pole.

Provide a ground-fault and short-circuit over-current protection device (fuse or breaker) per NEC Article 440 (or local codes). Refer to unit informative data plate for MOCP (Maximum Over-current Protection) device size.

Voltage to compressor terminals during operation must be within voltage range indicated on unit nameplate. See Table 4. On 3-phase units, voltages between phases must be balanced within 2% and the current within 10%. Use the formula shown in the legend for Table 2 (see Note 2) to determine the percent of voltage imbalance.

⚠ CAUTION

UNIT DAMAGE HAZARD

Failure to follow this caution may result in equipment damage.

Operation on improper line voltage or excessive phase imbalance constitutes abuse and may cause damage to electrical components. Such operation would invalidate any applicable warranty.

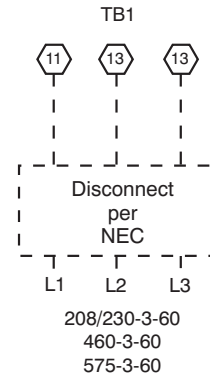
Units Without Factory-Installed Disconnect —

When installing units, provide a disconnect switch of adequate size per NEC (National Electrical Code). Disconnect sizing data is provided on the unit informative plate. Locate on unit cabinet or within sight of the unit per national or local codes. Do not cover unit informative plate if mounting the disconnect on the unit cabinet.

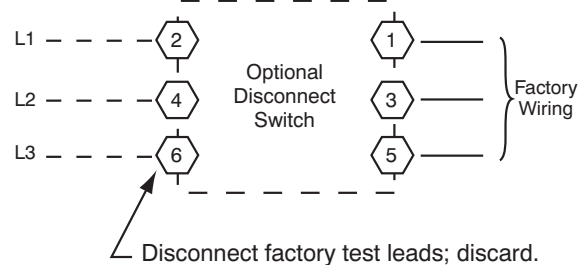
Units with Factory-Installed Disconnect —

The factory-installed option disconnect switch is located in a weatherproof enclosure located under the main control box. The manual switch handle is accessible through an opening in the access panel. Discard the factory test leads (see Fig. 29). The factory disconnect is an 80A disconnect.

FIGURE 22 Power Wiring Connections
Units Without Disconnect Option



Units With Disconnect Option



Convenience Outlets —

⚠ WARNING

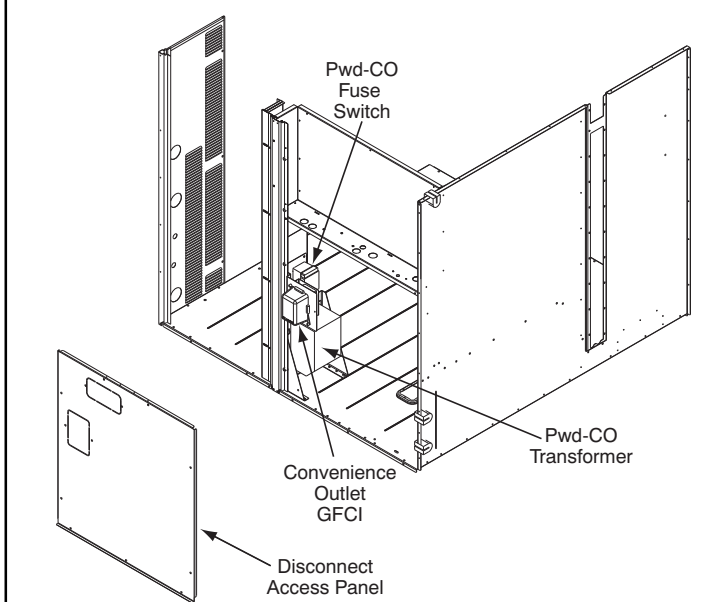
ELECTRICAL OPERATION HAZARD

Failure to follow this warning could result in personal injury or death.

Units with convenience outlet circuits may use multiple disconnects. Check convenience outlet for power status before opening unit for service. Locate its disconnect switch, if appropriate, and open it. Tag-out this switch, if necessary.

Non-powered convenience outlets are offered on the RAH. It provides a 125-volt GFCI (ground-fault circuit-interrupter) duplex receptacle rated at 15-A behind a hinged waterproof access cover, located on the panel beneath the control box. See Fig. 23.

FIGURE 23 Convenience Outlet Location



Non-powered type: This type requires the field installation of a general-purpose 125-volt 15-A circuit powered from a source elsewhere in the building. Observe national and local codes when selecting wire size and conduit requirements, fuse or breaker requirements and disconnect switch size and location. Route 125-v power supply conductors into the bottom of the utility box containing the duplex receptacle.

WARNING

ELECTRICAL OPERATION HAZARD

Failure to follow this warning could result in personal injury or death.

Using unit-mounted convenience outlets: Units with unit-mounted convenience outlet circuits will often require that two disconnects be opened to de-energize all power to the unit. Treat all units as electrically energized until the convenience outlet power is also checked and de-energization is confirmed. Observe National Electrical Code Article 210, Branch Circuits, for use of convenience outlets.

Installing Weatherproof Cover: A weatherproof while-in-use cover for the factory-installed convenience outlets is now required by UL standards. This cover cannot be factory-mounted due its depth; it must be installed at unit installation. For shipment, the convenience outlet is covered with a blank cover plate.

The weatherproof cover kit is shipped in the unit's control box. The kit includes the hinged cover, a backing plate and gasket.

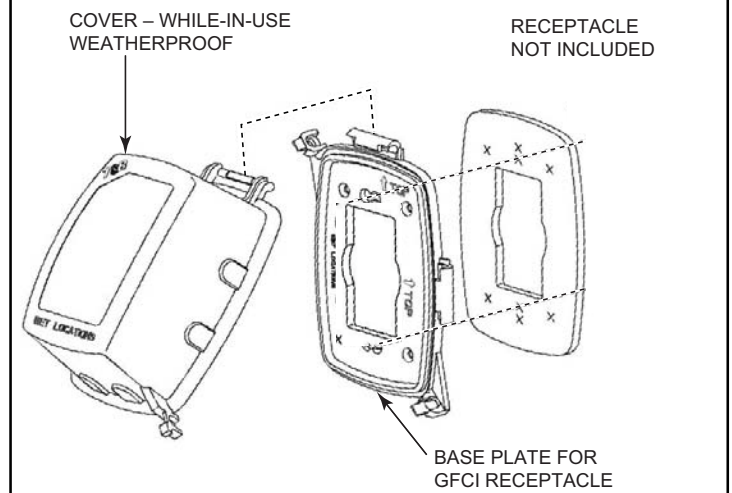
DISCONNECT ALL POWER TO UNIT AND CONVENIENCE OUTLET.

Remove the blank cover plate at the convenience outlet; discard the blank cover.

Loosen the two screws at the GFCI duplex outlet, until approximately 1/2-in (13 mm) under screw heads are exposed. Press the gasket over the screw heads. Slip the backing plate over the screw heads at the keyhole slots and align with the gasket; tighten the two screws until snug (do not over-tighten).

Mount the weatherproof cover to the backing plate as shown in Fig. 24. Remove two slot fillers in the bottom of the cover to permit service tool cords to exit the cover. Check for full closing and latching.

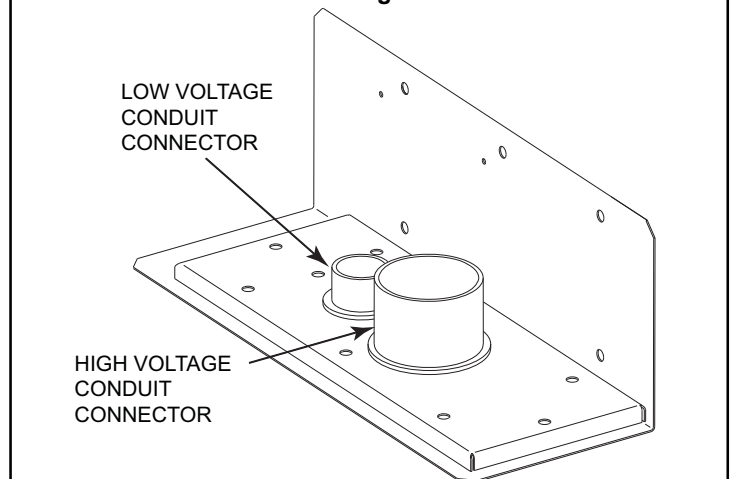
FIGURE 24 Weatherproof Cover Installation



Factory-Option Thru-Base Connections (Electrical Connections)—

This service connection kit consists of a 1/2-in electrical bulkhead connector and a 1 1/2-in electrical bulkhead connector, all factory-installed in the embossed (raised) section of the unit basepan in the condenser section. The 1/2-in bulkhead connector enables the low-voltage control wires to pass through the basepan. The 1 1/2-in electrical bulkhead connector allows the high-voltage power wires to pass through the basepan.

FIGURE 25 Electrical Fittings



Remove the "L" bracket assembly from the unit (see Fig. 32). Remove connector plate assembly from the "L" bracket and discard the "L" bracket, but retain the washer head screws. Install the connector plate assembly to the basepan using 8 of the washer head screws.

Check tightness of connector lock nuts before connecting electrical conduits.

Field-supplied and field-installed liquid tight conduit connectors and conduit may be attached to the connectors on the basepan. Pull correctly rated high voltage and low voltage through appropriate conduits. Connect the power conduit to the internal disconnect (if unit is so equipped) or to the external disconnect (through unit side panel). A hole must be field cut in the main control box bottom on the left side so the 24-v control connections can be made. Connect the control power conduit to the unit control box at this hole.

Units without Thru-Base Connections —

- 1. Install power wiring conduit through side panel openings. Install conduit between disconnect and control box.
- 2. Install power lines to terminal connections as shown in Fig. 29.

Field Control Wiring —

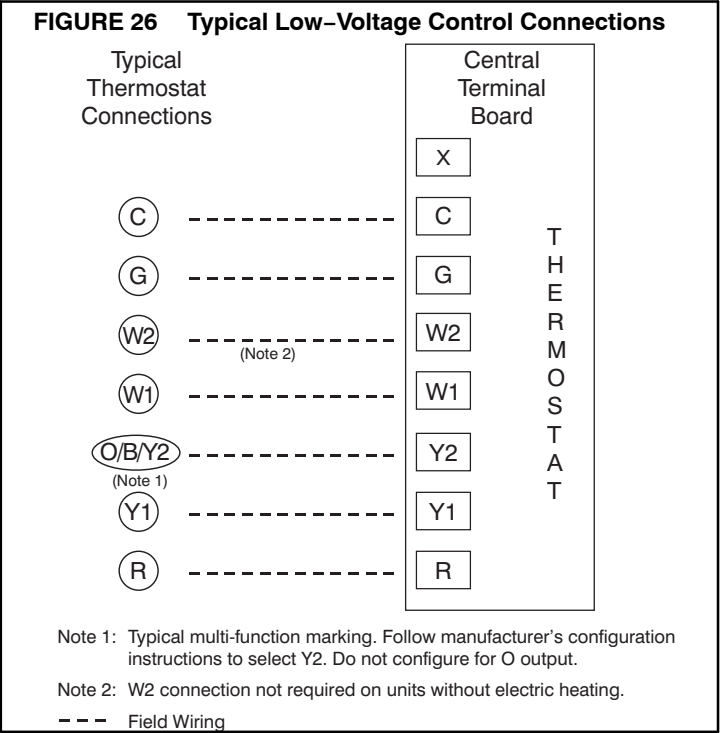
The RAH unit requires an external temperature control device. This device can be a thermostat emulation device provided as part of a third-party Building Management System.

Thermostat —

Install an approved accessory 2 stage Cooling/Heating thermostat according to installation instructions included with the accessory. RAH units do not require a thermostat with an O function to control the reversing valve operation. If using an electronic thermostat, configure it for “non-heat pump” operation. Locate the thermostat accessory on a solid wall in the conditioned space to sense average temperature in accordance with the thermostat installation instructions.

If the thermostat contains a logic circuit requiring 24-v power, use a thermostat cable or equivalent single leads of different colors with minimum of seven leads. If the thermostat does not require a 24-v source (no “C” connection required), use a thermostat cable or equivalent with minimum of six leads. Check the thermostat installation instructions for additional features which might require additional conductors in the cable.

For wire runs up to 50 ft. (15 m), use no. 18 AWG (American Wire Gage) insulated wire (35°C minimum). For 50 to 75 ft. (15 to 23 m), use no. 16 AWG insulated wire (35°C minimum). For over 75 ft. (23 m), use no. 14 AWG insulated wire (35°C minimum). All wire sizes larger than no. 18 AWG cannot be directly connected to the thermostat and will require a junction box and splice at the thermostat.



Unit without Thru-Base Connection Kit —

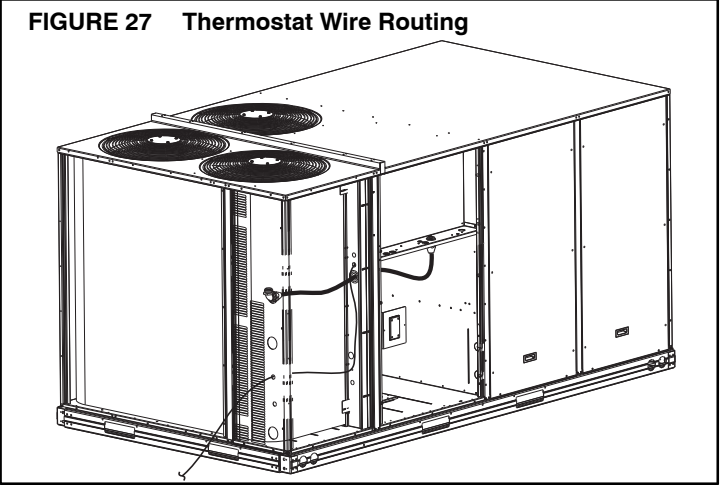
Pass the thermostat control wires through the bushing on the unit end panel. Route the wire through the snap-in wire tie and up to

the web bushing near the control box. Route the wire through the bushing and into the bottom left side of the control box after removing one of the two knockouts in the corner of the box. Using a connector at the control box to protect the wire as it passes into the control box. Pull the wires over to the terminal strip at the upper left corner of the Central Terminal Board (CTB). Use the connector at the control box and the wire tie to ensure that the thermostat wire is tight and will not be damaged by contact with the condenser coil. See Fig. 28.

NOTE:If thru-the-bottom connections accessory is used, refer to the accessory installation instructions for information on routing power and control wiring.

Heat Anticipator Settings —

Set heat anticipator settings at 0.14 amp for the first stage and 0.14 amp for second-stage heating, when available.



Electric Heaters

RAH units may be equipped with field-installed accessory electric heaters. The heaters are modular in design, with heater frames holding open coil resistance wires strung through ceramic insulators, line-break limit switches and a control contactor. One or two heater modules may be used in a unit.

Heater modules are installed in the compartment below the indoor (supply) fan outlet. Access is through the indoor access panel. Heater modules slide into the compartment on tracks along the bottom of the heater opening. See Fig. 28.

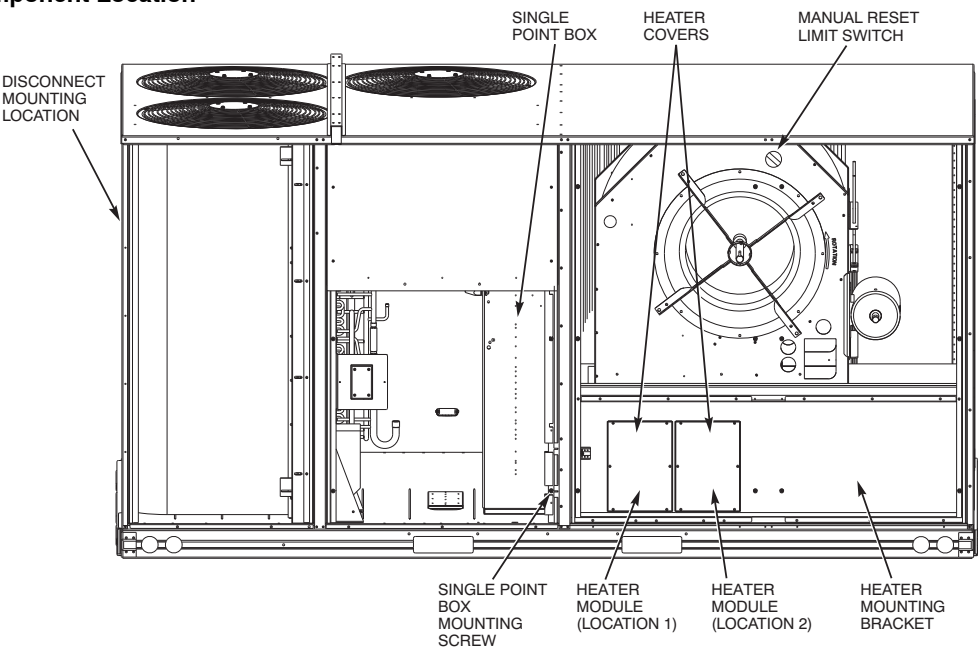
⚠ CAUTION

UNIT DAMAGE HAZARD

Failure to follow this caution may result in equipment damage.

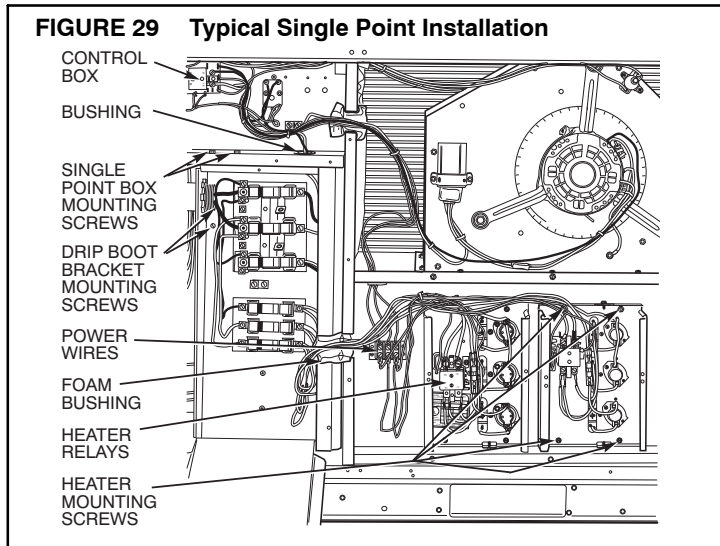
Not all available heater modules and single point boxes may be used in every unit. Use only those heater modules that are UL listed for use in a specific size unit. Refer to the label on the unit cabinet for the list of approved heaters and single point boxes.

FIGURE 28 Typical Component Location



Single Point Boxes

When heaters are installed, power wiring to both heaters and the rest of the unit is connected via the single point box accessory, which will be installed directly under the unit control box, just to the left of the partition separating the indoor section (with electric heaters) from the outdoor section. The single point box has a hinged access cover. See Fig. 30. The single point box also includes pigtails to complete the wiring between the single point box and the unit's main control box terminals. Refer to the accessory heater and Single Point Box installation instructions for details on tap connections.



Heater and Supplementary Fuses —

When the unit MOCP device value exceeds 60-A, unit-mounted supplementary fuses are required for each heater circuit. These fuses are included in accessory Single Point Boxes, with power distribution and fuse blocks.

All fuses on RAH units are 60-A. (Note that all heaters are qualified for use with a 60-A fuse, regardless of actual heater ampacity, so only 60-A fuses are necessary.)

Heater Low-Voltage Control Connections —

One or two heaters can be installed in the unit. Use the wiring procedure listed below for each heater as determined by the number of stages in the heater.

Single Stage Heaters: Single-stage heaters will have an orange and a brown control wire. Connect these to the orange and brown wires located on TB4.

Two Stage Heaters: Two-stage heaters will have orange, purple, red and brown wires. The orange and the purple are the control wires and the red and brown wires feed the safety circuit. Connect both the orange and the purple wires to the orange wire locations of TB4. Connect the red and brown wires to red and brown wires on TB4. If more than one heater is installed, repeat the wiring procedure for the second heater. The 3 locations across the top of TB4 do allow a switch to be installed in series with some of the heaters in order to add additional heater control.

Smoke Detectors

Smoke detectors are available as factory-installed options on RAH units. Smoke detectors may be specified for Supply Air only or for Return Air without or with economizer or in combination of Supply Air and Return Air. Return Air smoke detectors are arranged for vertical return configurations only. All components necessary for operation are factory-provided and mounted. The unit is factory-configured for immediate smoke detector shutdown operation; additional wiring or modifications to unit terminal board may be necessary to complete the unit and smoke detector configuration to meet project requirements.

Units equipped with factory-optional Return Air smoke detectors require a relocation of the sensor module at unit installation. See “Completing Installation of Return Air Smoke Sensor.”

System —

The smoke detector system consists of a four-wire controller and one or two sensors. Its primary function is to shut down the rooftop unit in order to prevent smoke from circulating throughout the building. It is not to be used as a life saving device.

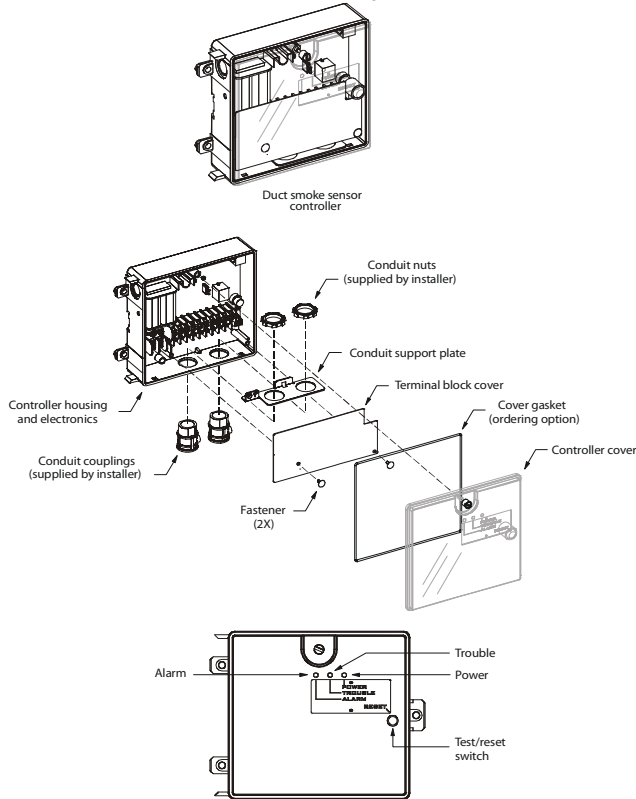
Controller —

The controller (see Fig. 31) includes a controller housing, a printed circuit board, and a clear plastic cover. The controller can be connected to one or two compatible duct smoke sensors. The clear plastic cover is secured to the housing with a single captive screw for easy access to the wiring terminals. The controller has three LEDs (for Power, Trouble and Alarm) and a manual test/reset button, all located on the cover face.

Sensor —

The sensor (see Fig. 32) includes a plastic housing, a printed circuit board, a clear plastic cover, a sampling tube inlet and an exhaust tube. The sampling tube (when used) and exhaust tube are attached during installation. The sampling tube varies in length depending on the size of the rooftop unit. The clear plastic cover permits visual inspections without having to disassemble the sensor. The cover attaches to the sensor housing using four captive screws and forms an airtight chamber around the sensing electronics. Each sensor includes a harness with an RJ45 terminal for connecting to the controller. Each sensor has four LEDs (for Power, Trouble, Alarm and Dirty) and a manual test/reset button (on the left-side of the housing).

FIGURE 30 Controller Assembly



Air is introduced to the duct smoke detector sensor's sensing chamber through a sampling tube that extends into the HVAC duct and is directed back into the ventilation system through a (shorter) exhaust tube. The difference in air pressure between the two tubes pulls the sampled air through the sensing chamber. When a sufficient amount of smoke is detected in the sensing chamber, the sensor signals an alarm state and the controller automatically takes the appropriate action to shut down fans and blowers, change over air handling systems, notify the fire alarm control panel, etc.

The sensor uses a process called differential sensing to prevent gradual environmental changes from triggering false alarms. A rapid change in environmental conditions, such as smoke from a fire, causes the sensor to signal an alarm state but dust and debris accumulated over time does not.

For installations using two sensors, the duct smoke detector does not differentiate which sensor signals an alarm or trouble condition.

Smoke Detector Locations

Supply Air —

The Supply Air smoke detector sensor is located to the left of the unit's indoor (supply) fan. See Fig. 33. Access is through the left side blower access panel. There is no sampling tube used at this location. The sampling tube inlet extends through the side plate of the fan housing (into a high pressure area). The controller is located on a bracket to the right of the return filter, accessed through the lift-off filter panel.

FIGURE 31 Smoke Detector Sensor

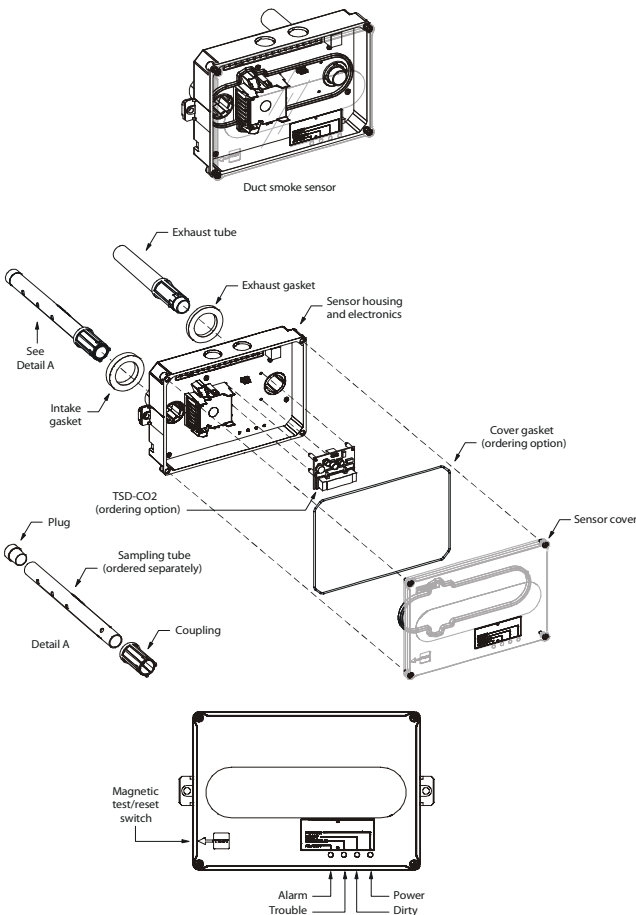
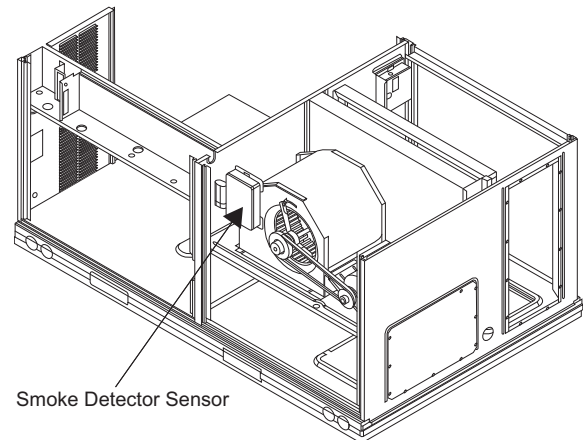


FIGURE 32 Typical Supply Air Smoke Detector Sensor Location



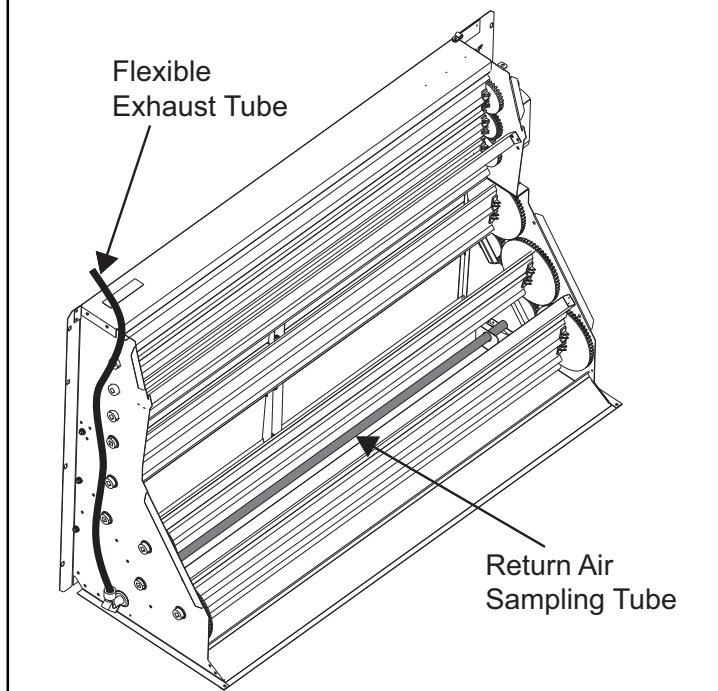
Return Air without Economizer —

The sampling tube is located across the return air opening on the unit basepan. See Fig. 34. The holes in the sampling tube face downward, into the return air stream. The sampling tube is connected via tubing to the return air sensor that is mounted on a bracket high on the partition between return filter and controller location. (This sensor is shipped in a flat-mounting location. Installation requires that this sensor be relocated to its operating location and the tubing to the sampling tube be connected. See "Completing Installation of Return Air Smoke Sensor:" for details.)

Return Air with Economizer —

The sampling tube is inserted through the side plates of the economizer housing, placing it across the return air opening on the unit basepan. See Fig. 34. The holes in the sampling tube face downward, into the return air stream. The sampling tube is connected via tubing to the return air sensor that is mounted on a bracket high on the partition between return filter and controller location. (This sensor is shipped in a flat-mounting location. Installation requires that this sensor be relocated to its operating location and the tubing to the sampling tube be connected. See the following installation procedure.)

FIGURE 33 Return Air Sampling Tube Location



Completing Installation of Return Air Smoke Sensor:

1. Unscrew the two screws holding the Return Air Sensor detector plate. See Fig. 35. Save the screws.
2. Remove the Return Air Sensor and its detector plate.
3. Rotate the detector plate so the sensor is facing outwards and the sampling tube connection is on the bottom. See Fig. 36.
4. Screw the sensor and detector plate into its operating position using screws from Step 1. Make sure the sampling tube con-

nection is on the bottom and the exhaust tube is on the top. See Fig. 36.

5. Connect the flexible tube on the sampling inlet to the sampling tube on the basepan.

FIGURE 34 Return Air Detector Shipping Position

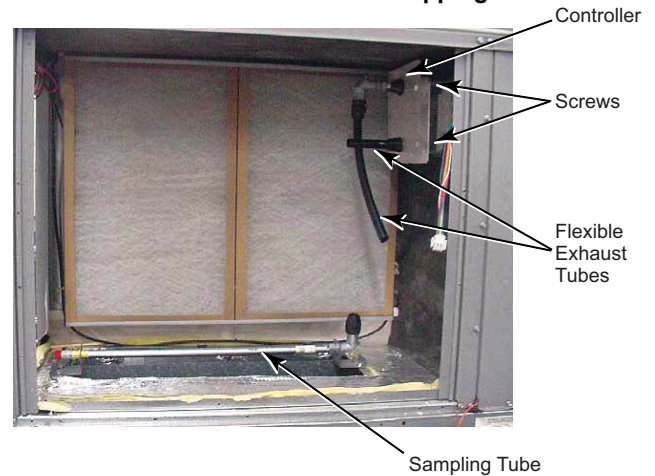


FIGURE 35 Return Air Sensor Operating Position



Table 2—Unit Wire/Fuse or HACR Breaker Sizing Data

UNIT	NOM. V—Ph—Hz	IFM TYPE	ELEC. HTR			PE	NO C.O. or UNPWR C.O.								
			CRHEATER ***A00	Nom (kW)	FLA		FLA	NO P.E.				w/ P.E. (pwrdr fr/unit)			
								MCA	FUSE or HACR BRKR	DISC. SIZE		MCA	FUSE or HACR BRKR	DISC. SIZE	
										FLA	LRA			FLA	LRA
RAH150	208/230—3—60	STD	NONE	—	—	3.8	54.8	60	58	314	58.6	70	62	318	
			291A00	12.4/16.5	34.4/39.7		54.8/59.0	60/60	58/58	314/314	58.6/63.8	70/70	62/62	318/318	
			288A00,291A00	19.9/26.5	55.3/63.8		78.5/89.1	80/90	72/82	314/314	83.3/93.9	90/100	77/86	318/318	
			294A00	25.2/33.5	69.9/80.6		96.8/110.1	100/125	89/101	314/314	101.5/114.9	110/125	93/106	318/318	
			288A00,294A00	32.7/43.5	90.7/104.7		122.8/140.3	125/150	113/129	314/314	127.5/145.0	150/150	117/133	318/318	
			291A00,294A00	37.6/50.0	104.3/120.3		139.8/129.7	150/150	129/147	314/314	144.5/134.4	150/150	133/151	318/318	
		MED	NONE	—	—	3.8	57.3	70	60	331	61.1	80	65	335	
			291A00	12.4/16.5	34.4/39.7		57.3/62.1	70/70	60/60	331/331	61.1/66.9	80/80	65/65	335/335	
			288A00,291A00	19.9/26.5	55.3/63.8		81.6/92.3	90/100	75/85	331/331	86.4/97.0	90/100	79/89	335/335	
			294A00	25.2/33.5	69.9/80.6		99.9/113.3	100/125	92/104	331/331	104.6/118.0	110/125	96/109	335/335	
			288A00,294A00	32.7/43.5	90.7/104.7		125.9/143.4	150/150	116/132	331/331	130.6/148.1	150/150	120/136	335/335	
			291A00,294A00	37.6/50.0	104.3/120.3		142.9/132.8	150/150	131/150	331/331	147.6/137.6	150/150	136/154	335/335	
		HIGH	NONE	—	—	3.8	68.0	80	72	350	71.8	80	77	354	
			291A00	12.4/16.5	34.4/39.7		68.5/75.1	80/80	72/72	350/350	73.3/79.9	80/80	77/77	354/354	
			288A00,291A00	19.9/26.5	55.3/63.8		94.6/105.3	100/110	87/97	350/350	99.4/110.0	100/125	91/101	354/354	
			294A00	25.2/33.5	69.9/80.6		112.9/126.3	125/150	104/116	350/350	117.6/131.0	125/150	108/121	354/354	
			288A00,294A00	32.7/43.5	90.7/104.7		138.9/156.4	150/175	128/144	350/350	143.6/161.1	150/175	132/148	354/354	
			291A00,294A00	37.6/50.0	104.3/120.3		155.9/145.8	175/175	143/162	350/350	160.6/150.6	175/175	148/166	354/354	
	460—3—60	STD	NONE	—	—	1.8	27.6	35	29	158	29.4	35	31	160	
			292A00	16.5	19.9		29.1	35	29	158	31.4	35	31	160	
			289A00,292A00	26.5	31.9		44.1	45	41	158	46.4	50	43	160	
			295A00	33.5	40.3		54.6	60	50	158	56.9	60	52	160	
			289A00,295A00	43.5	52.3		69.6	70	64	158	71.9	80	66	160	
			292A00,295A00	50.0	60.2		64.5	70	73	158	66.7	70	75	160	
		MED	NONE	—	—	1.8	28.6	35	30	167	30.4	40	32	169	
			292A00	16.5	19.9		30.4	35	30	167	32.6	40	32	169	
			289A00,292A00	26.5	31.9		45.4	50	42	167	47.6	50	44	169	
			295A00	33.5	40.3		55.9	60	51	167	58.1	60	53	169	
			289A00,295A00	43.5	52.3		70.9	80	65	167	73.1	80	67	169	
			292A00,295A00	50.0	60.2		65.7	80	74	167	68.0	80	76	169	
		HIGH	NONE	—	—	1.8	34.6	40	37	176	36.4	45	39	178	
			292A00	16.5	19.9		37.6	40	37	176	39.9	45	39	178	
			289A00,292A00	26.5	31.9		52.6	60	48	176	54.9	60	50	178	
			295A00	33.5	40.3		63.1	70	58	176	65.4	70	60	178	
			289A00,295A00	43.5	52.3		78.1	80	72	176	80.4	90	74	178	
			292A00,295A00	50.0	60.2		73.0	80	81	176	75.2	80	83	178	
575—3—60	STD	NONE	—	—	3.8	21.6	25	23	128	25.4	30	27	132		
		293A00	16.5	15.9		23.4	25	23	128	28.1	30	27	132		
		290A00,293A00	26.5	25.5		35.4	40	33	128	40.1	45	37	132		
		296A00	33.5	32.2		43.8	45	40	128	48.5	50	45	132		
		290A00,296A00	43.5	41.8		55.8	60	51	128	60.5	70	56	132		
		293A00,296A00	50.0	48.1		51.6	60	59	128	56.4	60	63	132		
	MED	NONE	—	—	3.8	21.6	25	23	128	25.4	30	27	132		
		293A00	16.5	15.9		23.4	25	23	128	28.1	30	27	132		
		290A00,293A00	26.5	25.5		35.4	40	33	128	40.1	45	37	132		
		296A00	33.5	32.2		43.8	45	40	128	48.5	50	45	132		
		290A00,296A00	43.5	41.8		55.8	60	51	128	60.5	70	56	132		
		293A00,296A00	50.0	48.1		51.6	60	59	128	56.4	60	63	132		
	HIGH	NONE	—	—	3.8	28.2	35	30	140	32.0	40	34	144		
		293A00	16.5	15.9		31.1	35	30	140	35.9	40	34	144		
		290A00,293A00	26.5	25.5		43.1	45	40	140	47.9	50	44	144		
		296A00	33.5	32.2		51.5	60	47	140	56.3	60	52	144		
		290A00,296A00	43.5	41.8		63.5	70	58	140	68.3	70	63	144		
		293A00,296A00	50.0	48.1		59.4	70	66	140	64.1	70	70	144		

NOTE:See page 20 for table legend and notes.

Legend and Notes for Table 2

LEGEND:

- BRKR – Circuit breaker
- CO – Convenience outlet
- DISC – Disconnect
- FLA – Full load amps
- IFM – Indoor fan motor
- LRA – Locked rotor amps
- MCA – Minimum circuit amps
- PE – Power exhaust
- PWRD CO – Powered convenient outlet
- UNPWR CO – Unpowered convenient outlet



NOTES:

- 1. In compliance with NEC requirements for multimotor and combination load equipment (refer to NEC Articles 430 and 440), the overcurrent protective device for the unit shall be fuse or HACR breaker. Canadian units may be fuse or circuit breaker.
- 2. **Unbalanced 3-Phase Supply Voltage**
Never operate a motor where a phase imbalance in supply voltage is greater than 2%. Use the following formula to determine the percentage of voltage imbalance.

% Voltage Imbalance = 100 x $\frac{\text{max voltage deviation from average voltage}}{\text{average voltage}}$

Example: Supply voltage is 230-3-60



AB = 224 v
BC = 231 v
AC = 226 v

Average Voltage = $\frac{(224 + 231 + 226)}{3} = \frac{681}{3}$
= 227

Determine maximum deviation from average voltage.

(AB) 227 – 224 = 3 v

(BC) 231 – 227 = 4 v

(AC) 227 – 226 = 1 v

Maximum deviation is 4 v.

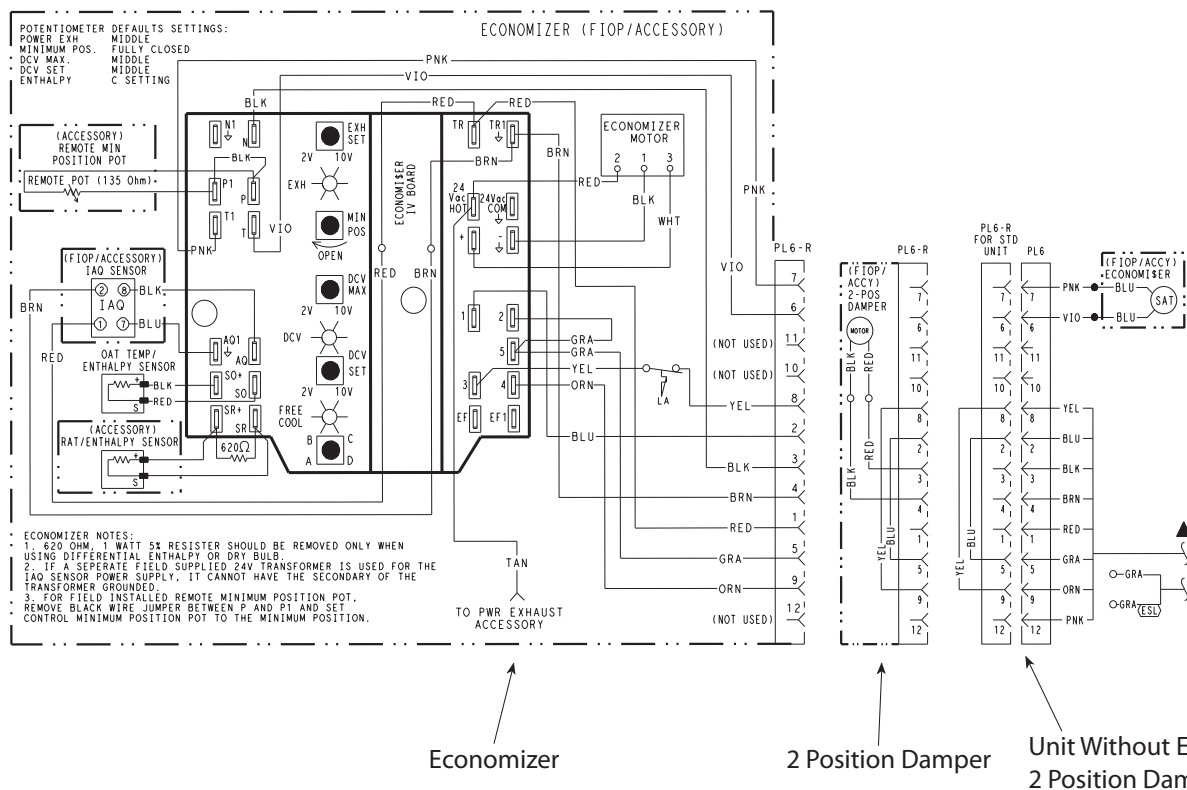
Determine percent of voltage imbalance.

% Voltage Imbalance = 100 x $\frac{4}{227}$
= 1.76%

This amount of phase imbalance is satisfactory as it is below the maximum allowable 2%.

IMPORTANT: If the supply voltage phase imbalance is more than 2%, contact your local electric utility company immediately.

FIGURE 36 Wiring for Optional Economizer



Step 11 — Adjust Factory-Installed Options

Smoke Detectors —

Smoke detector(s) will be connected at the Central Terminal Board (CTB, at terminals marked "Smoke Shutdown". Remove jumper JMP 3 when ready to energize unit.

EconoMi\$er IV Occupancy Switch —

Refer to Fig. 37 for general EconoMi\$er IV wiring. External occupancy control is managed through a connection on the Central Terminal Board.

If external occupancy control is desired, connect a time clock or remotely controlled switch (closed for Occupied, open for Unoccupied sequence) at terminals marked OCCUPANCY on CTB. Remove or cut jumper JMP 2 to complete the installation.

Step 12 — Install Accessories

Available accessories include:

- Roof Curb (must be installed before unit)
- Thru-base connection kit (must be installed before unit is set on curb)
- Manual outside air damper
- Two-Position motorized outside air damper
- EconoMi\$er IV (with control and integrated barometric relief)

Barometric relief

Power Exhaust

Differential dry-bulb sensor (EconoMi\$er IV)

Outdoor enthalpy sensor

Differential enthalpy sensor

Time Guard II compressor anti-cycle control

Outdoor coil protector grille

Head pressure control

Programmable thermostat

Electrical/Mechanical thermostat and subbase

Electric Heaters

Single Point kits

Thermostat / Sensors

CO₂ sensor

Louvered hail guard

Phase monitor control

Refer to separate installation instructions for information on installing these accessories.