

# INSTALLATION INSTRUCTIONS

## R-410A Single Package Rooftop Electric Cooling

### RAH120

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, turn off main power switch to unit and install lockout tag. Ensure electrical service to rooftop unit agrees with voltage and amperage listed on the unit rating plate. 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, and/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

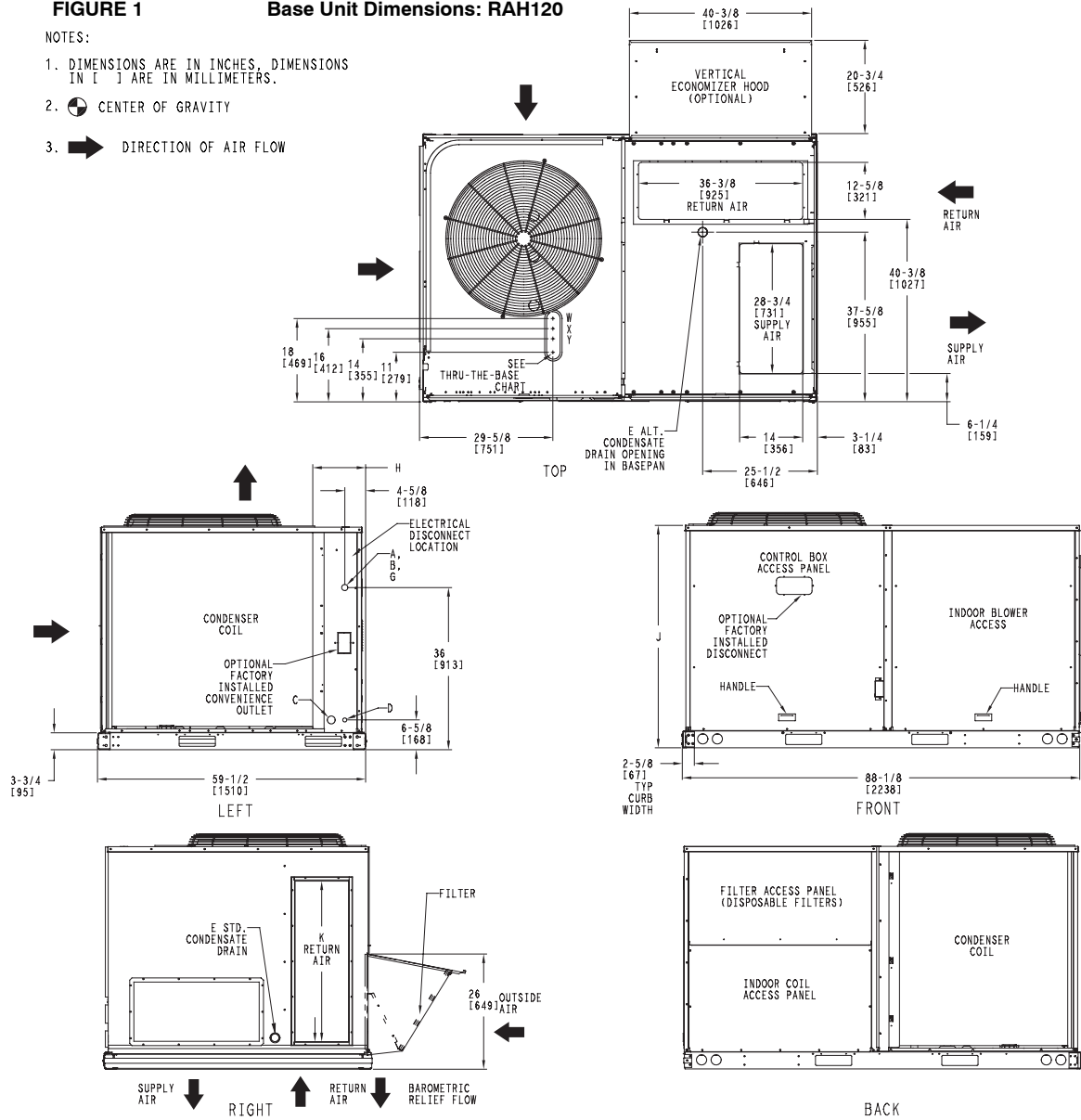
Failure to follow this caution may result in personal injury.

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 units.

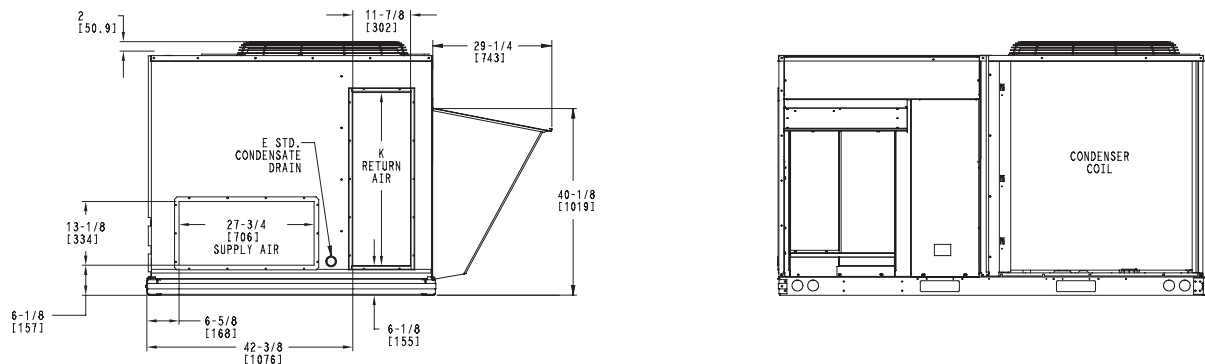
**FIGURE 1 Base Unit Dimensions: RAH120**

**NOTES:**

1. DIMENSIONS ARE IN INCHES. DIMENSIONS IN [ ] ARE IN MILLIMETERS.
2.  CENTER OF GRAVITY
3.  DIRECTION OF AIR FLOW



**Vertical Connections / Economizer**



	CONNECTION SIZES
A	1 3/8" [35] DIA FIELD POWER SUPPLY HOLE
B	2 1/2" [64] DIA POWER SUPPLY KNOCKOUT
C	1 3/4" [51] DIA GAUGE ACCESS PLUG
D	7/8" [22] DIA FIELD CONTROL WIRING HOLE
E	3/4"-14 NPT CONDENSATE DRAIN
G	2" [51] DIA POWER SUPPLY KNOCK-OUT

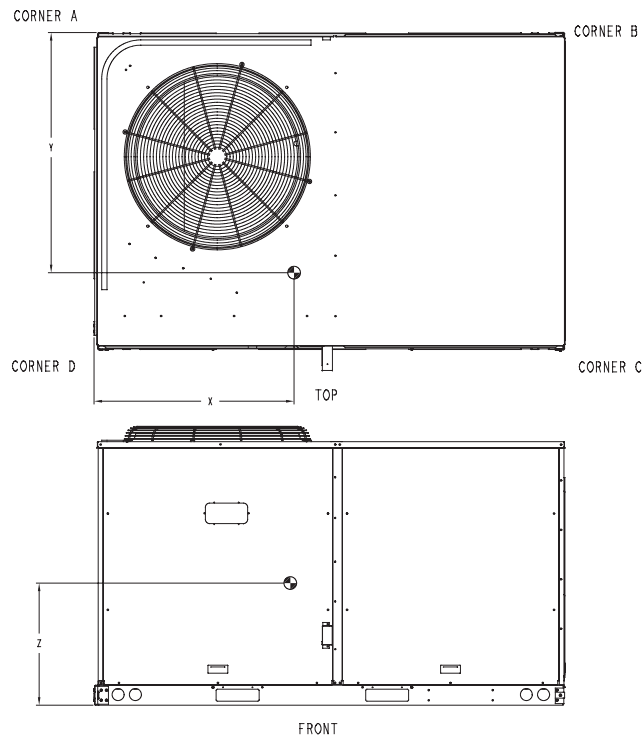
THRU-THE-BASE CHART THESE HOLES REQUIRED FOR USE CRBTMPWR002A01			
	THREADED CONDUIT SIZE	WIRE USE	REQ'D HOLE SIZES (MAX.)
W	1/2"	ACC.	7/8" (22.2)
X	1/2"	24V	7/8" (22.2)
Y	1 1/4" (002)	POWER	1 3/4" (44.4)
FOR "THRU-THE-BASEPAN" FACTORY OPTION, FITTINGS FOR ONLY X & Y ARE PROVIDED			

UNIT	H	J	K
RAH120	11 3/8 [289]	49 3/8 [1253]	35 5/8 [905]

**Figure 1A**

**Base Unit Dimensions and Weight:  
RAH120**

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
RAH120	1025	465	333	151	290	132	187	85	215	98	41 [1041]	23 3/8 [594]	23 3/4 [603]



## INSTALLATION

### Jobsite Survey

Complete the following checks before installation.

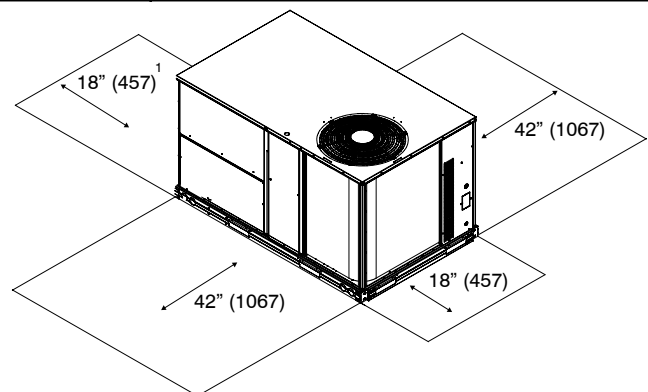
1. Consult local building codes and the NEC (National Electrical Code) ANSI/NFPA 70 for special installation requirements.
2. Determine unit location (from project plans) or select unit location.
3. Check for possible overhead obstructions which may interfere with unit lifting or rigging.

### Step 1 — Plan for Unit Location

Select a location for the unit and its support system (curb or other) that provides for 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.

**FIGURE 2**

**Service Clearance Dimensional Drawing**



<sup>1</sup> Required bottom condensate drain connection.  
Otherwise, 36" (914mm) for condensate connection.

**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 or other sources of contaminated air.

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 installation of condensate trap per requirements. Refer to Step 9 — 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.

**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 roof curb
- Install field-fabricated ductwork inside curb
- Install accessory thru-base service connection package, if used, (affects curb and unit) (refer to accessory installation instructions for details)
- Prepare 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

**Table 1—Operating Weights**

RAH120	UNITS LB (KG)
Base Unit	1025 (465)
Economizer	
Vertical	90 (36)
Horizontal	105 (48)
Powered Outlet	32 (15)
Curb	
14-in/356 mm	133 (60)
24-in/610 mm	174 (79)

**Pad-mounted installation —**

- Prepare pad and unit supports
- Check and tighten the bottom condensate drain connection plug

- Rig and place unit
- Install outdoor air hood
- Convert unit to side duct connection arrangement
- Install field-fabricated ductwork at unit duct openings
- 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 show 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. The accessory thru-the-base power and gas connection package must be installed before the unit is set on the roof curb.*

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 gRAHs 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

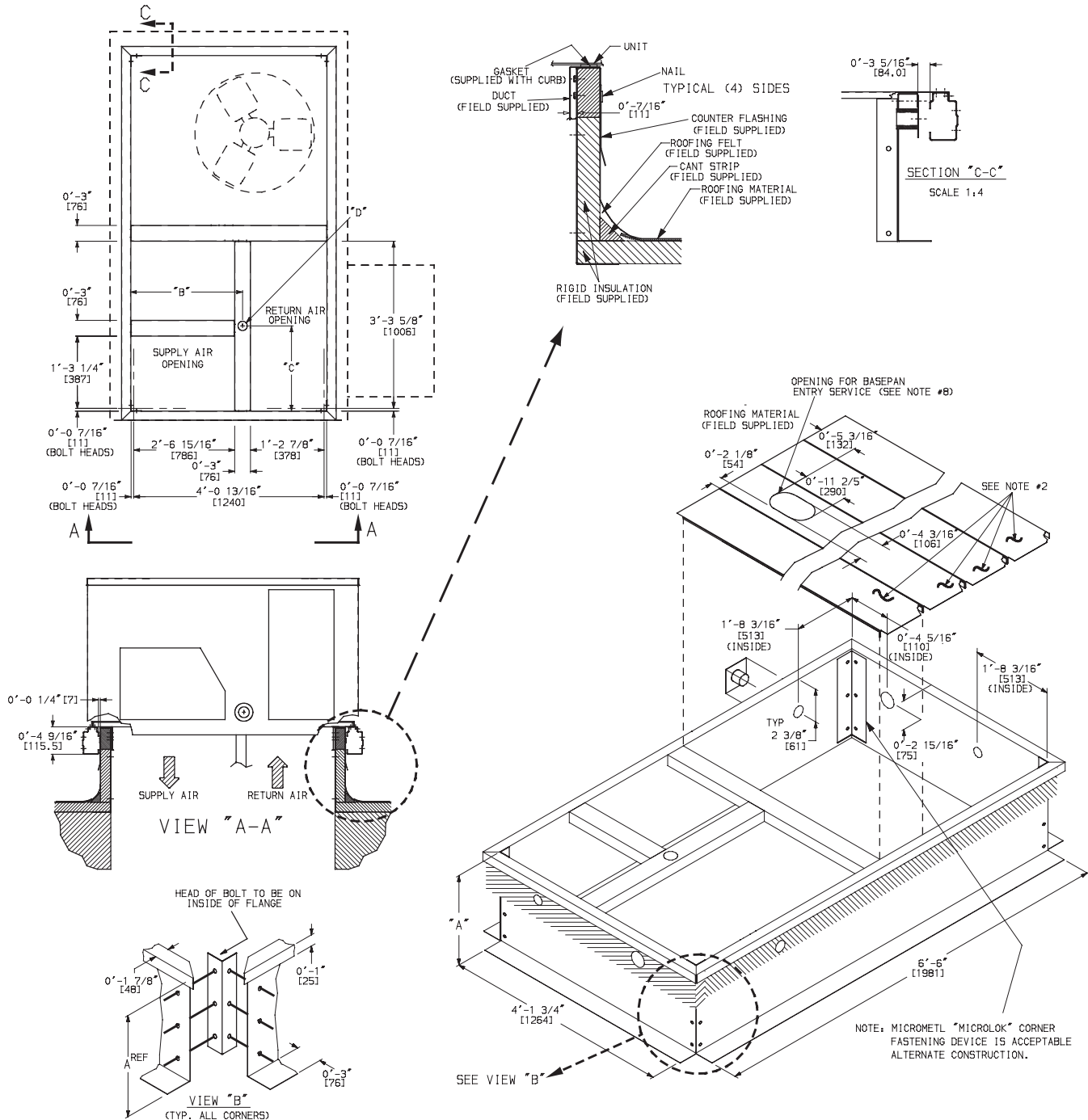
## Roof Curb Details

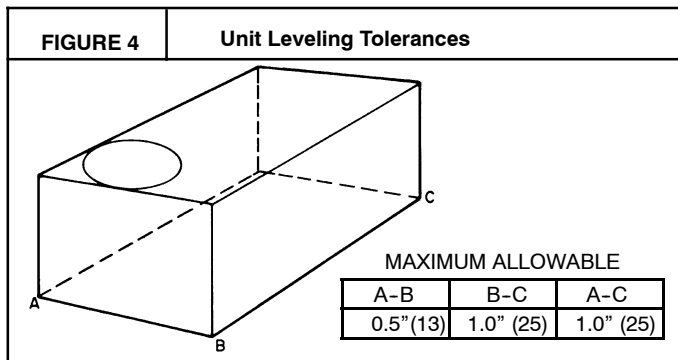
ROOFCURB ACCESSORY	A	UNIT SIZE
CRRFCURB003A02	1'-2" [356]	RAH120
CRRFCURB004A02	2'-0" [610]	

## NOTES:

1. ROOFCURB ACCESSORY IS SHIPPED DISASSEMBLED.
2. INSULATED PANELS: 1" THK. POLYURETHANE FOAM, 1-3/4 # DENSITY.
3. DIMENSIONS IN [ ] ARE IN MILLIMETERS.
4. ROOFCURB: 18 GAGE STEEL ON 14" CURB, AND 16 GAGE STEEL ON 24" CURB.
5. ATTACH DUCTWORK TO CURB. (FLANGES OF DUCT REST ON CURB)
6. SERVICE CLEARANCE 4' ON EACH SIDE.
7.  DIRECTION OF AIR FLOW.

CONNECTOR PKG. ACC.	B	C	D ALT DRAIN HOLE	POWER	CONTROL	ACCESSORY PWR
CRBTMPWR001A01 CRBTMPWR002A01	2'-8 7/16" [827]	1'-10 15/16" [583]	1 3/4" [44.5]	3/4" [19]NPT 1 1/4" [31.7]	1/2" [12.7]NPT	1/2" [12.7]NPT
CRBTMPWR003A01				3/4" [19]NPT		
CRBTMPWR004A01				1 1/4" [31.7]		





### Step 5 — Field Fabricate Ductwork

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: Horizontal applications require a minimum clearance to combustible surfaces of 1-in (25 mm) from duct for first 12-in (305 mm) away from unit. Vertical applications do not require a minimum clearance.

A minimum clearance is not required around ductwork. 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.

### Step 6 — Rig and Place Unit

Keep unit upright and do not drop. Spreader bars are not required if top crating is left on unit. 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.

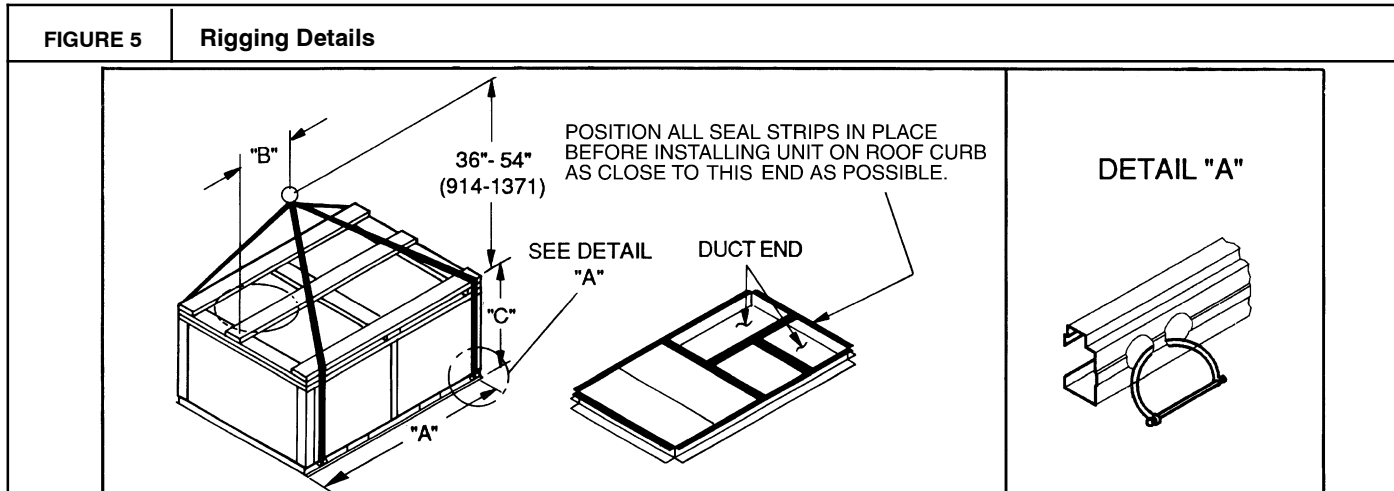
## ⚠ CAUTION

### 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.



#### NOTES:

1. Dimensions in ( ) are in millimeters.
2. 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 skid when rigging to prevent rigging straps from damaging unit.

3. Unit weights do not include economizer. See Table 1 for economizer weights.

**Table 2—Unit Weights**

UNIT	MAX WEIGHT		DIMENSIONS					
			A		B		C	
	LB	KG	IN	MM	IN	MM	IN	MM
RAH120	1580	718	88.0	2235	31.5	775	49.5	1255

#### NOTES:

1. Dimensions in ( ) are in millimeters.
2. 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

Position unit on roof curb so that the following clearances are maintained: 1/4 in. (6.4 mm) clearance between the roof curb and the base rail inside the front and rear, 0.0 in. clearance between the roof curb and the base rail inside on the duct end of the unit. This will result in the distance between the roof curb and the base rail inside on the condenser end of the unit being approximately equal to Fig. 3, section C-C.

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

## ⚠ CAUTION

### UNIT DAMAGE HAZARD

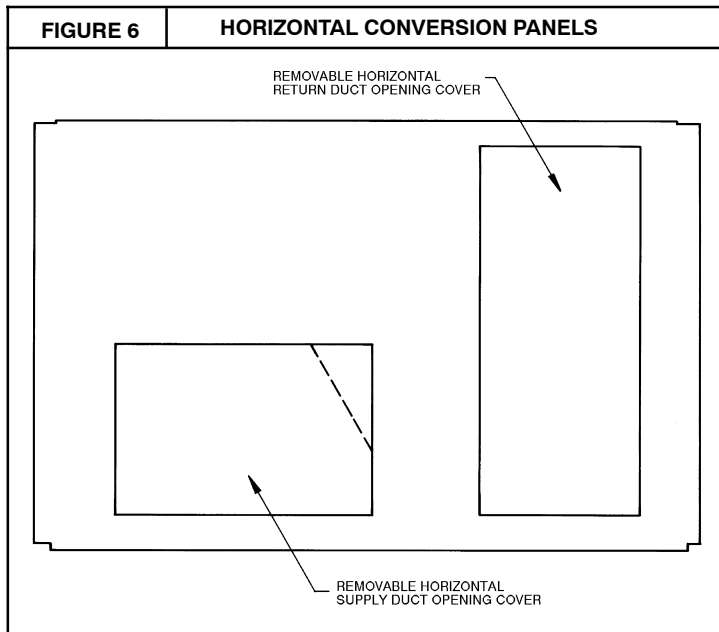
Failure to follow this caution may result in equipment damage.

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

After unit is in position, remove rigging skids and 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. To convert to horizontal configuration, remove screws from side duct opening covers and remove covers. Using the same screws, install covers on vertical duct openings with the insulation-side down. Seals around duct openings must be tight. See Fig. 6.



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 Optional Outside Air Hood

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. 7.)
3. Locate and cut the (2) plastic tie-wraps, being careful to not damage any wiring. (See Fig. 8.)
4. Carefully lift the hood assembly through the filter access opening and assemble per the steps outlined in Economizer Hood and Two-Position Hood.

FIGURE 7 Typical Access Panel Locations

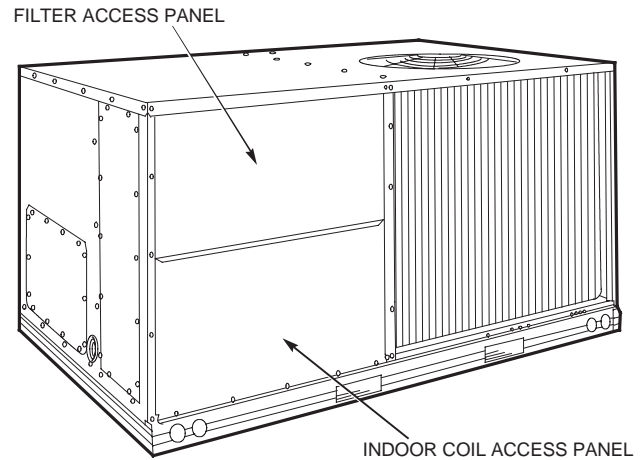
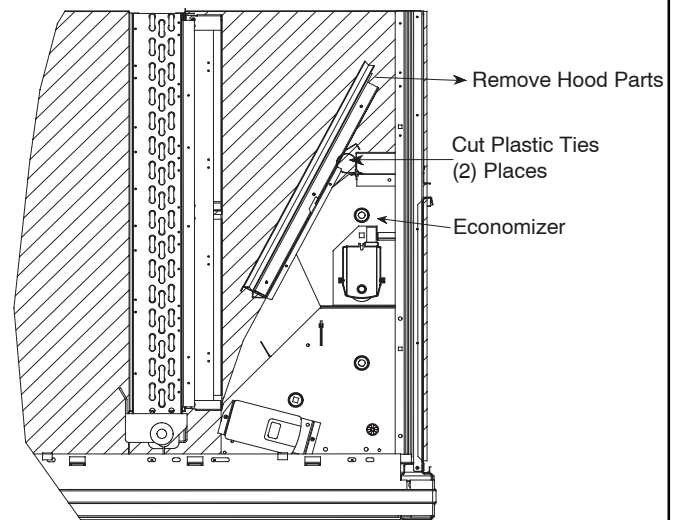


FIGURE 8 Economizer Wiring



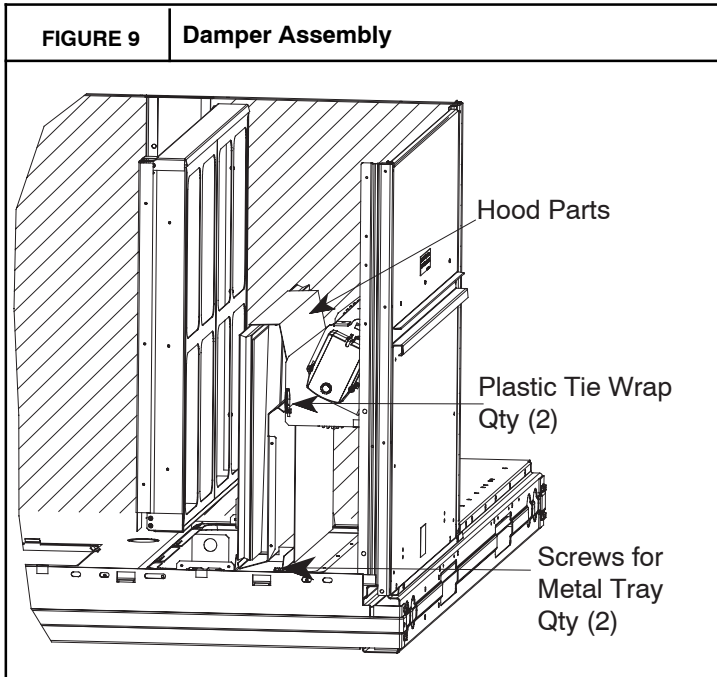
## Two Position Damper Hood Removal and Setup

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. 7.)
3. Locate the (2) screws holding the metal tray to the basepan and remove. Locate and cut the (2) plastic



tie-wraps securing the assembly to the damper. (See Fig. 9.) Be careful to not damage any wiring or cut tie-wraps securing any wiring.

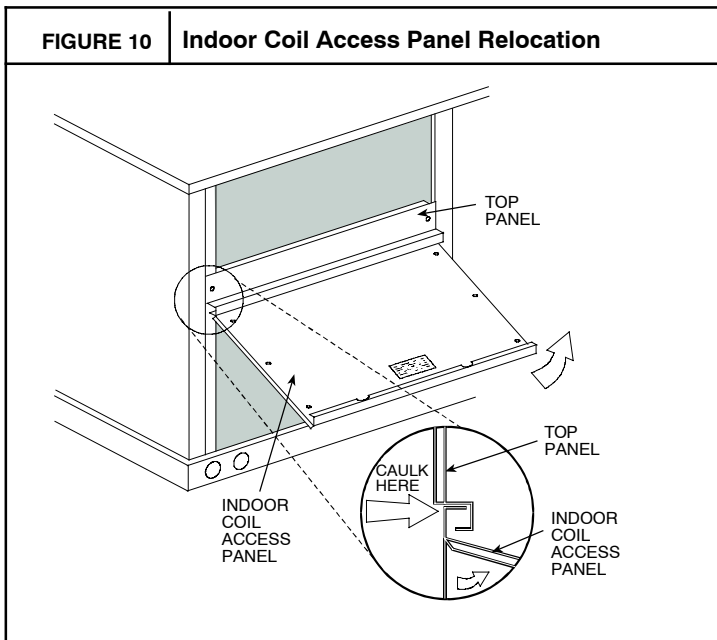
4. Carefully lift the hood assembly (with metal tray) through the filter access opening and assemble per the steps outlined in Economizer Hood and Two-Position Hood.



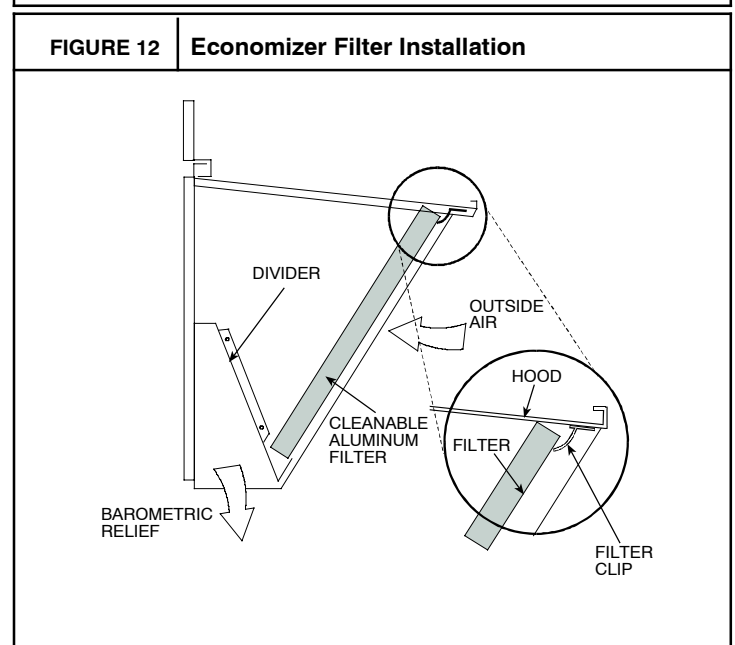
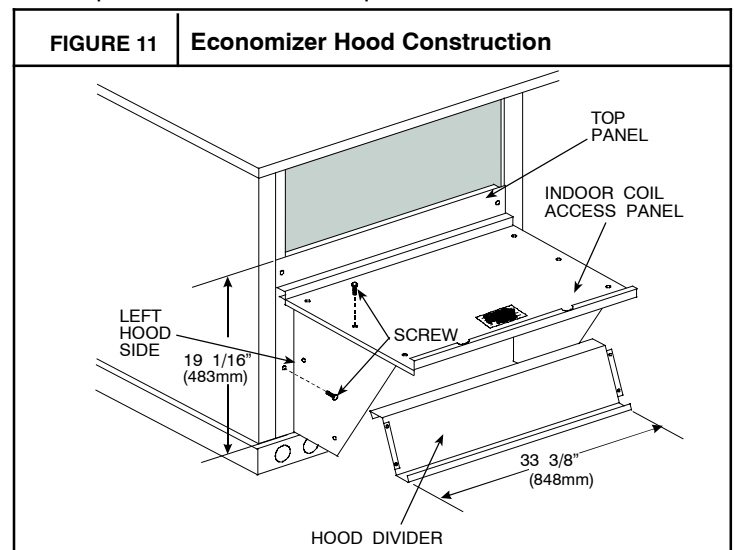
### Economizer Hood and Two-Position Hood

**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. Remove the screws along the sides and bottom of the indoor coil access panel. See Fig. 10.



2. Swing out indoor coil access panel and insert the hood sides under the panel (hood top). 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. 11.
3. Remove the shipping tape holding the economizer barometric relief damper in place.
4. Insert the hood divider between the hood sides. See Fig. 11 and 12. Secure hood divider with 2 screws on each hood side. The hood divider is also used as the bottom filter rack for the aluminum filter.
5. Open the filter clips which are located underneath the hood top. Insert the aluminum filter into the bottom filter rack (hood divider). Push the filter into position past the open filter clips. Close the filter clips to lock the filter into place. See Fig. 12.
6. Caulk the ends of the joint between the unit top panel and the hood top.
7. Replace the filter access panel.

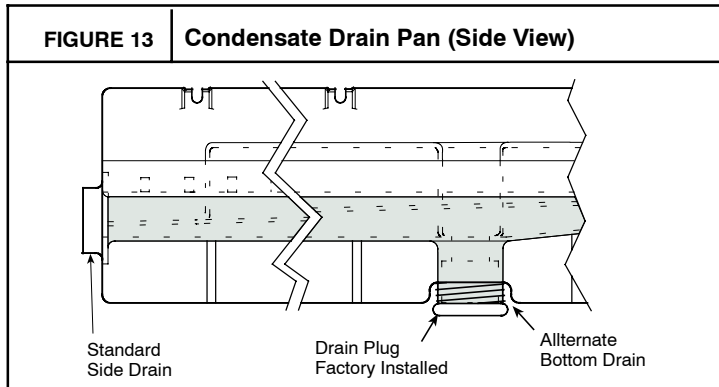


## Step 9 — Install External Condensate Trap and Line

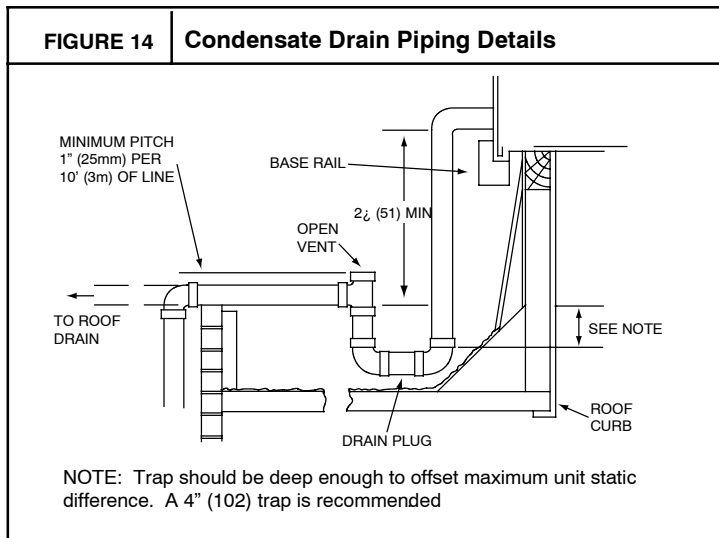
The unit has one  $\frac{3}{4}$ -in. condensate drain connection on the end of the condensate pan and an alternate connection on the bottom. See Fig. 13. Unit airflow configuration does not determine which drain connection to use. Either drain connection can be used with vertical or horizontal applications.

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.



The piping for the condensate drain and external trap can be completed after the unit is in place. See Fig. 14.



*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 —

Field power wires are connected to the unit at line-side pressure lugs on compressor contactor C and indoor fan contactor IFC (see wiring diagram label for control box component arrangement) or at factory-installed option non-fused disconnect switch. Max wire size is #2 AWG (copper only).

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 will be connected line-side pressure lugs on the power terminal block or at factory-installed option non-fused disconnect.

**NOTE:** TEST LEADS - Unit may be equipped with short leads (pigtailed) on the field line connection points on contactor C or 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.

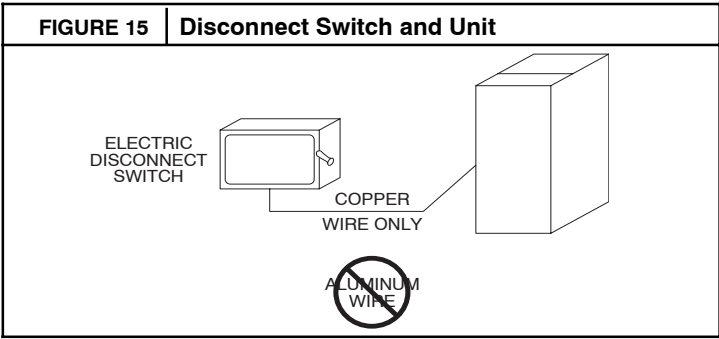


### WARNING

#### FIRE HAZARD

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

Do not connect aluminum wire between disconnect switch and RAH unit. Use only copper wire. (See Fig. 15.)



Units Without Factory-Installed Disconnect —

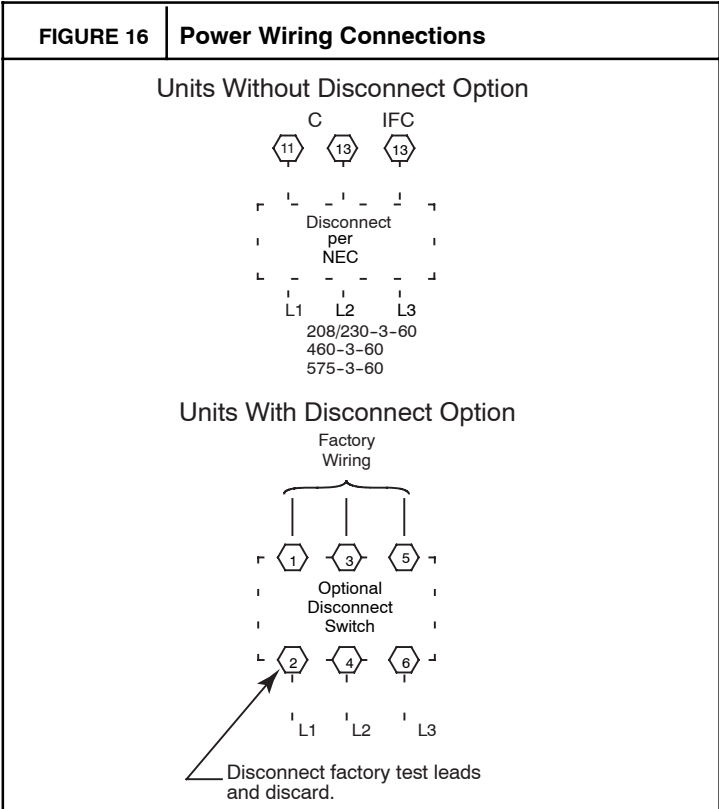
When installing units, provide a disconnect switch per NEC (National Electrical Code) of adequate size. Disconnect sizing data is provided on the unit informative plate. Locate on unit cabinet or within sight of the unit per national or local codes. Do not cover unit informative plate if mounting the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

All units -

All field wiring must comply with NEC and all local codes. Size wire based on MCA (Minimum Circuit Amps) on the unit informative plate. See Fig. 16 for power wiring connections to the unit power terminal block and equipment ground. Maximum wire size is #4 ga 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. All field wiring must comply with the NEC and local requirements.

Convenience Outlets (Non-Powered) —

⚠

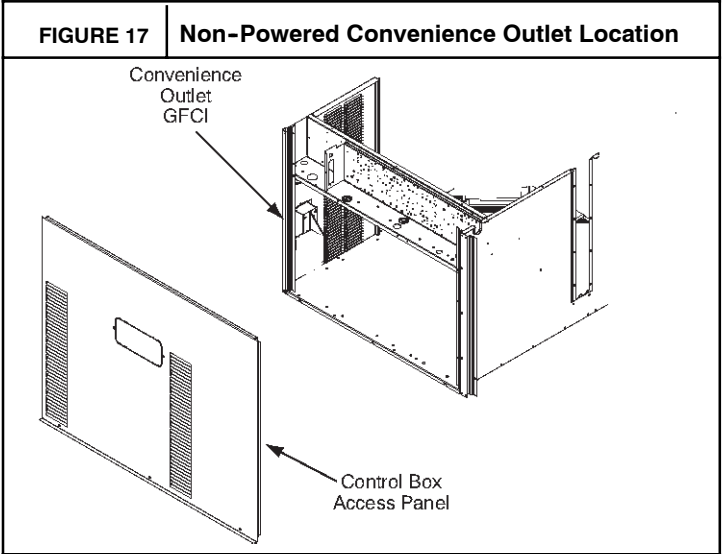
WARNING

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.

An optional non-powered convenience outlet are offered on RAH models: Non-powered provide a 125-volt GFCI (ground-fault circuit-interrupter) duplex receptacle rated at 15-A behind a hinged waterproof access cover, located on the end panel of the unit. See Fig. 17.



Installing Weatherproof Cover —

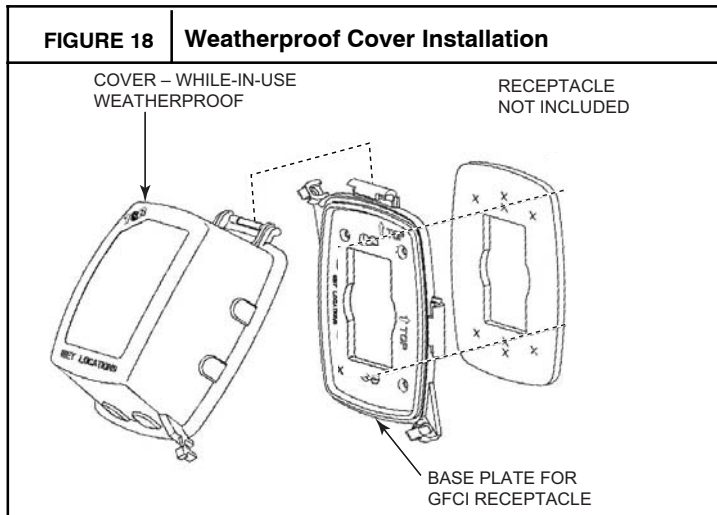
A weatherproof while-in-use cover for the factory-installed convenience outlets is now required by UL standards. This cover cannot be factory-mounted due its depth; it must be installed at unit installation. For shipment, the convenience outlet is covered with a blank cover plate.

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

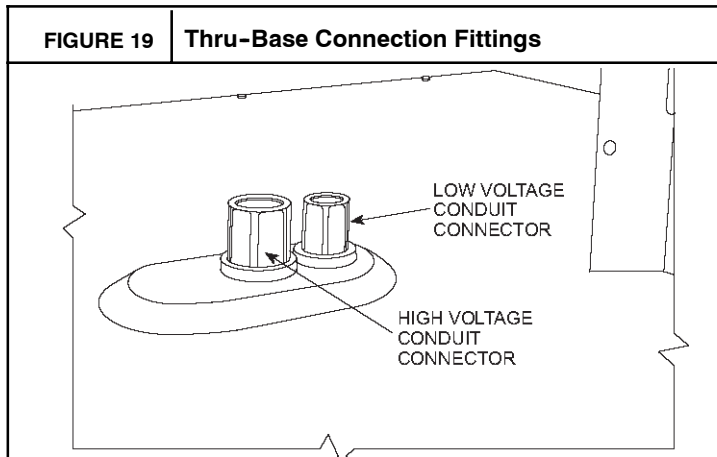
Remove the blank cover plate at the convenience outlet; discard the blank cover.

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).



**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, 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.



#### Optional Thru-Base Connections —

This accessory (field installed) service connection kit consists of a 1/2 in and a 1-1/4 in electrical bulkhead connector, all must be 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 1-1/4 in electrical bulkhead connector allows the high-voltage power wires to pass through the basepan. See Fig. 19.

**Note:** This must be installed prior to mounting unit on roof curb.

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.

#### All Units —

Voltage to compressor terminals during operation must be within voltage range indicated on unit nameplate. See Table 3. 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 3, Note 2 to determine the percent of voltage imbalance. 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.

#### Field Control Wiring —

The RAH unit requires an external temperature control device. This device typically applied with a commercial thermostat (field-supplied) with both occupied and unoccupied setpoints at a minimum.

#### Thermostat —

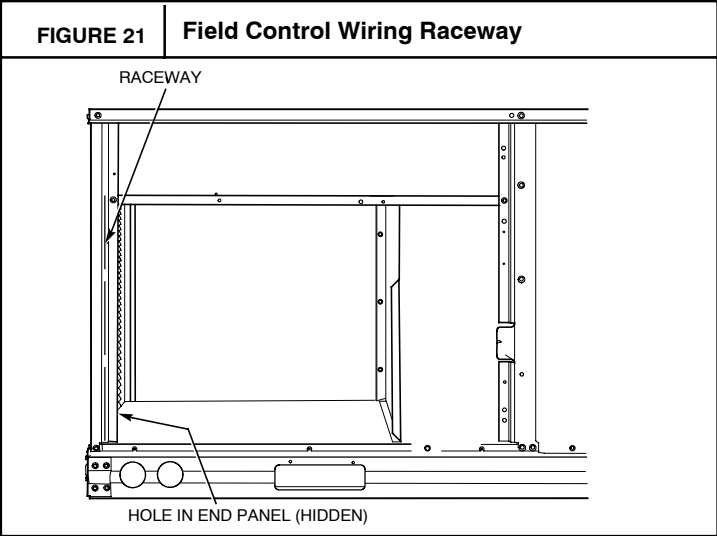
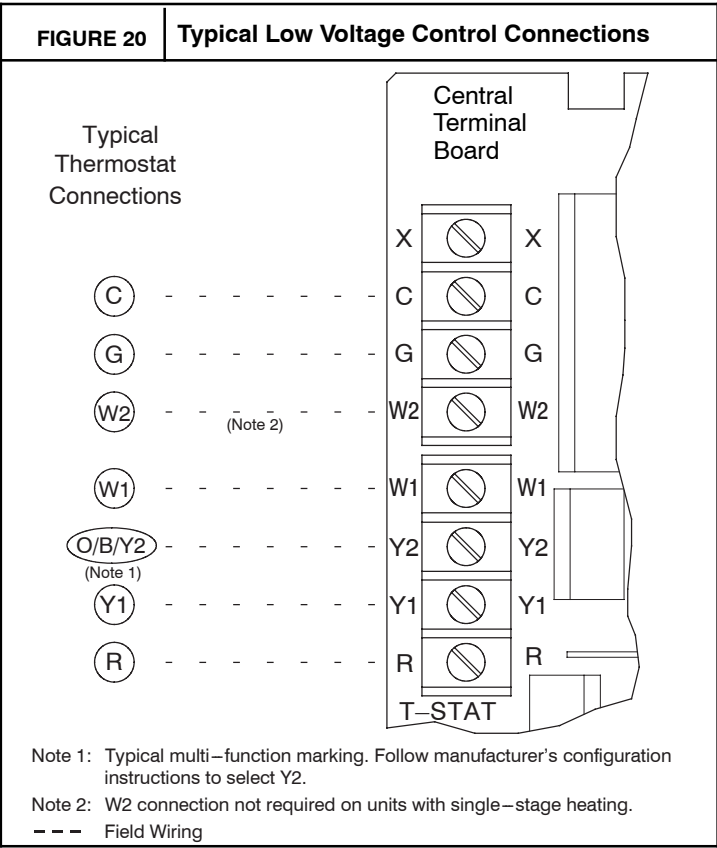
Install an approved accessory commercial thermostat according to installation instructions included with the accessory. For complete economizer function, select a two-stage cooling thermostat. Locate the thermostat accessory on a solid wall in the conditioned space to sense average temperature in accordance 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 hole provided in the corner post; then feed the wires through the raceway built into the corner post to the control box. Pull the wires over to the terminal strip on the upper-left corner of the Controls Connection Board. See Fig. 20.



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

Table 3—Heater Model Number

Bare Heater Model Number	C	R	H	E	A	T	E	R	0	0	1	A	0	0
Heater Sales Package PNO Includes: Bare Heater Carton and packing materials Installation sheet	C	R	H	E	A	T	E	R	1	0	1	A	0	0

### 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

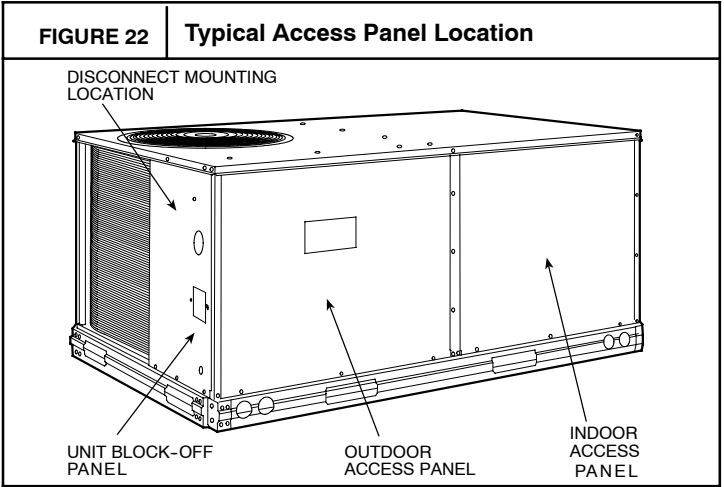
RAH units may be equipped with field-installed accessory electric heaters. The heaters are modular in design, with heater frames holding open coil resistance wires strung through ceramic insulators, line-break limit switches and a control contactor. One or two heater modules may be used in a unit.

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. 22, Fig. 23 and Fig. 24.

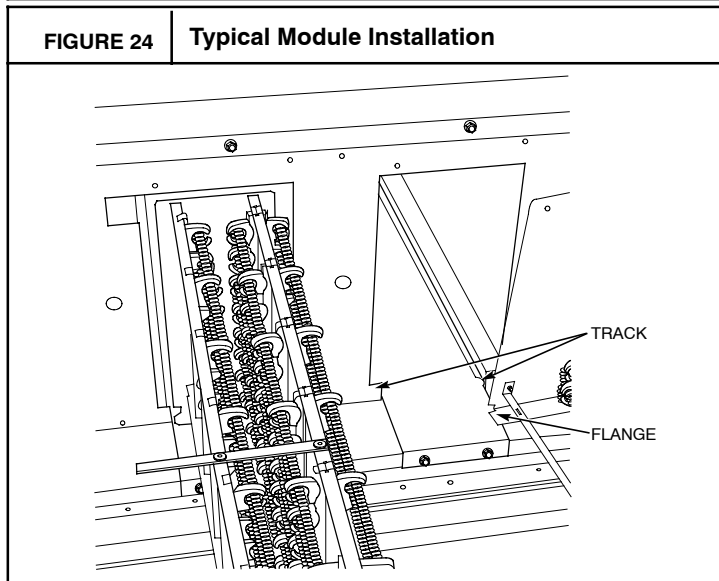
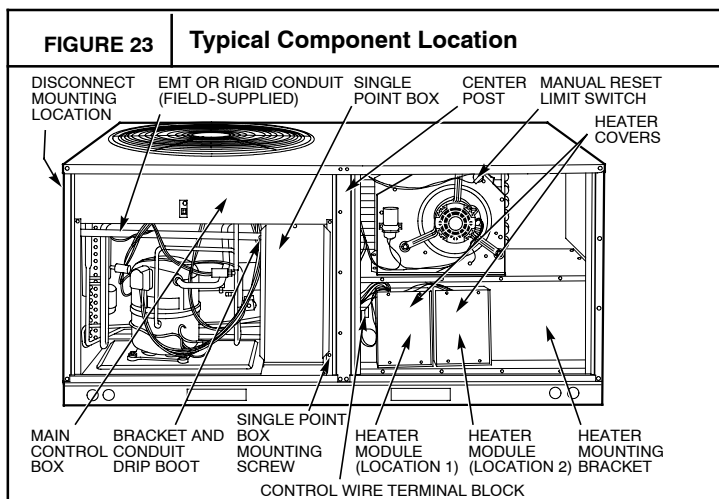
Not all available heater modules may be used in every unit. Use only those heater modules that are UL listed for use in a specific size unit. Refer to the label on the unit cabinet for the list of approved heaters.

Unit heaters are marked with Heater Model Numbers. But heaters are ordered as and shipped in cartons marked with a corresponding heater Sales Package part number. See Table 2 for correlation between heater Model Number and Sales Package part number.

**NOTE:**The value in position 9 of the part number differs between the sales package part number (value is 1) and a bare heater model number (value is 0).



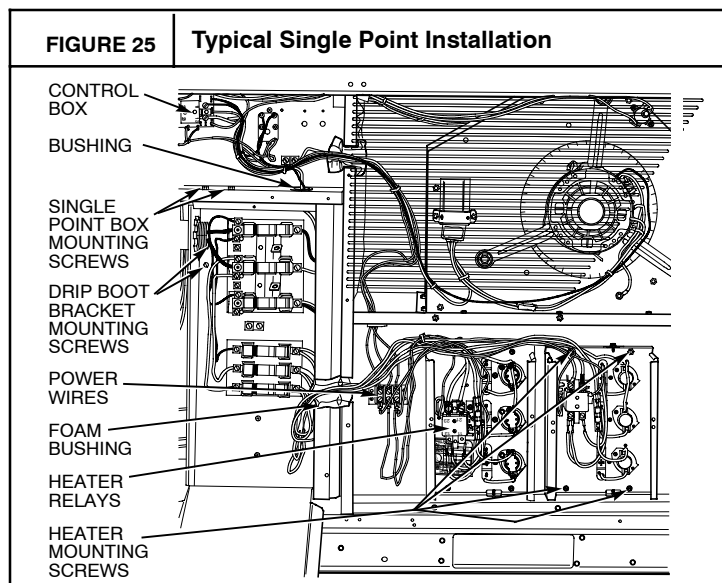




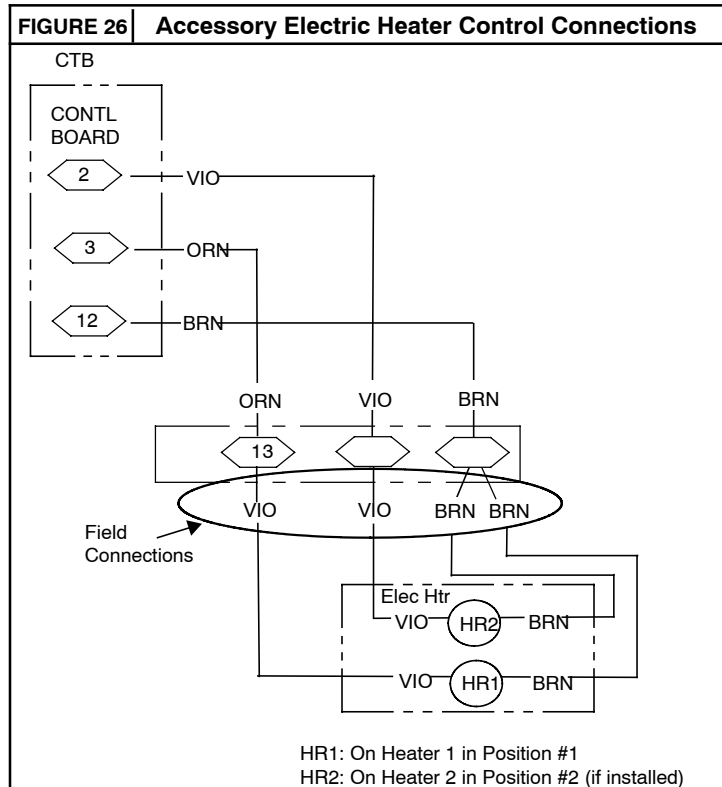
**Single Point Boxes and Supplementary Fuses** — When the unit MOCP device value exceeds 60-A, unit-mounted supplementary fuses are required for each heater circuit. These fuses are included in accessory Single Point Boxes, with power distribution and fuse blocks. The single point box will be installed 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. 25. The Single Point Box also includes a set of power taps and 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.

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.)

**Single Point Boxes without Fuses** — Unit heater applications not requiring supplemental fuses require a special Single Point Box without any fuses. The accessory Single Point Boxes contain a set of power taps and pigtails to complete the wiring between the Single Point Box and the unit's main control box terminals. Refer to accessory heater and Single Point Box installation instructions for details on tap connections.



**Low-Voltage Control Connections** — Pull the low-voltage control leads from the heater module(s) - VIO and BRN (two of each if two modules are installed; identify for Module #1) - to the 4-pole terminal board TB4 located on the heater bulkhead to the left of Heater #1. Connect the VIO lead from Heater #1 to terminal TB4-1. For 2 stage heating, connect the VIO lead from Heater #2 to terminal TB4-2. For 1 stage heating with 2 heater modules connect the VIO lead from both Heater #1 and #2 to terminal TB4-1. Connect both BRN leads to terminal TB4-3. See Fig. 26.



## SMOKE DETECTORS

Smoke detectors are available as factory-installed options on RAH models. Smoke detectors may be specified for Supply Air only without or with economizer. 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:” for details.

### 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. Do not use as a life saving device.

### Controller

The controller (see Fig. 27) 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 (on the cover face).

### Sensor

The sensor (see Fig. 28) 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 is shipped in the blower section and is wire tied to the blower housing. See Fig. 29. 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).

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.

FIGURE 27 Controller Assembly

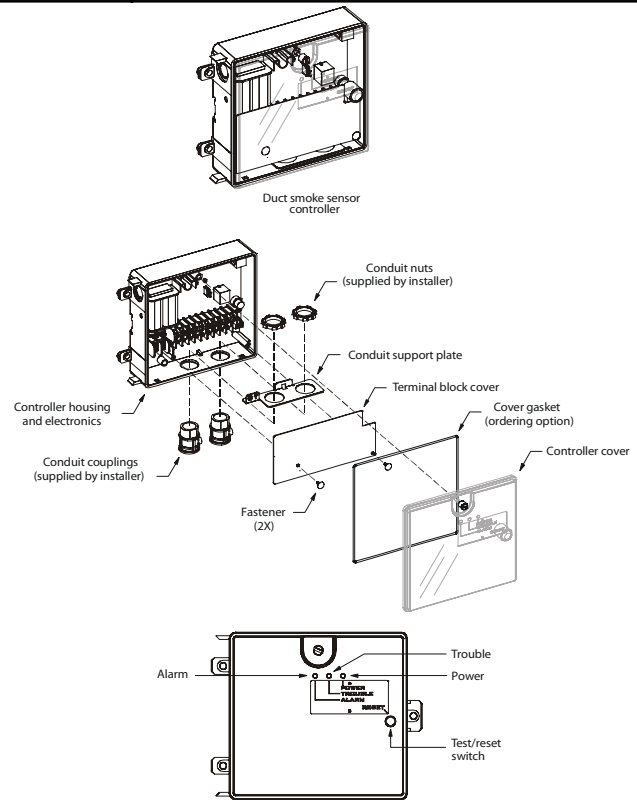
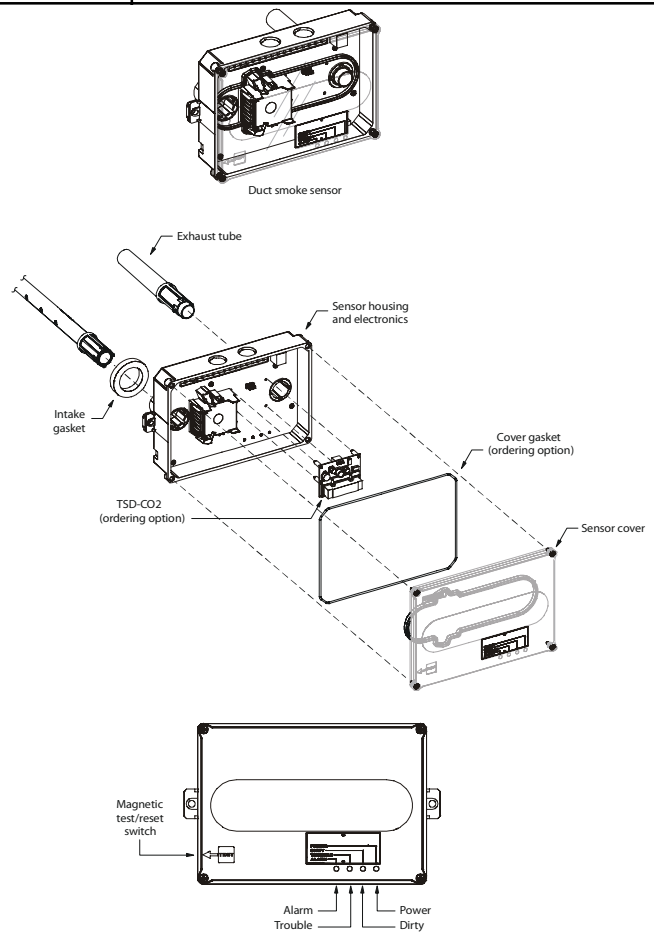
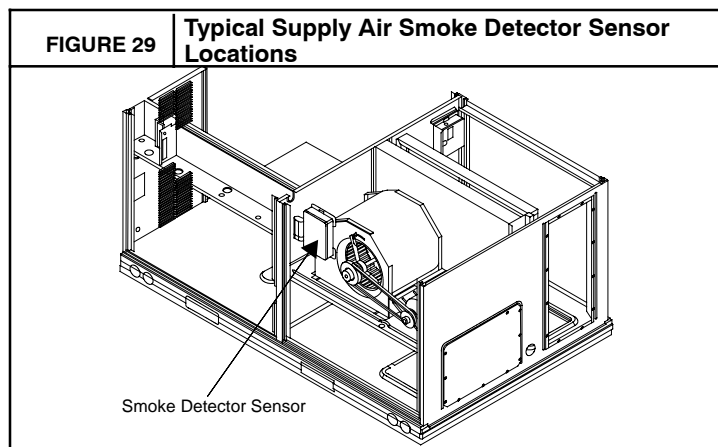


FIGURE 28 Smoke Detector Sensor



## 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. 29. Access is through the fan 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.





**Table 4—MCA/MOCP Determination No C.O. or UNPWRD C.O. - RAH120**

UNIT	Volt—Ph—Hz	IFM TYPE	ELEC. HTR			P.E.	NO C.O. or UNPWR C.O.							
			CRHEATER***A00	NOM (KW)	FLA	FLA	NO P.E.				w/PE. (pwrd fr/unit)			
							MCA	FUSE or HACR BRKR	DISC. SIZE		MCA	FUSE or HACR BRKR	DISC. SIZE	
									FLA	LRA			FLA	LRA
RAH120	208/230—3—60	STD	NONE	—	—	3.8	47.2	60	50	282	51.0	60	54	286
			117A00	7.8/10.4	21.7/25.0		47.2/47.2	60/60	50/50	282/282	51.0/51.0	60/60	54/54	286/286
			110A00	12.0/16.0	33.4/38.5		48.3/54.6	60/60	50/50	282/282	53.0/59.4	60/60	54/55	286/286
			112A00	24.0/32.0	66.7/77.0		89.9/102.8	90/110	83/95	282/282	94.6/107.5	100/110	87/99	286/286
			112A00/117A00	31.8/42.4	88.4/102.0		117.0/134.0	125/150	108/123	282/282	121.8/138.8	125/150	112/128	286/286
		112A00/110A00	37.6/50.0	104.2/120.3	136.8/126.8	150/150	126/144	282/282	141.5/131.6	150/150	130/149	286/286		
		MED	NONE	—	—	3.8	52.0	60	55	325	55.8	60	60	329
			117A00	7.8/10.4	21.7/25.0		52.0/52.0	60/60	55/55	325/325	55.8/55.8	60/60	60/60	329/329
			110A00	12.0/16.0	33.4/38.5		54.3/60.6	60/70	55/56	325/325	59.0/65.4	60/70	60/60	329/329
			112A00	24.0/32.0	66.7/77.0		95.9/108.8	100/110	88/100	325/325	100.6/113.5	110/125	93/104	329/329
			112A00/117A00	31.8/42.4	88.4/102.0		123.0/140.0	125/150	113/129	325/325	127.8/144.8	150/150	118/133	329/329
		112A00/110A00	37.6/50.0	104.2/120.3	142.8/132.8	150/150	131/150	325/325	147.5/137.6	150/150	136/154	329/329		
		HIGH	NONE	—	—	3.8	57.0	70	61	334	60.8	70	65	338
			117A00	7.8/10.4	21.7/25.0		57.0/57.0	70/70	61/61	334/334	60.8/60.8	70/70	65/65	338/338
			110A00	12.0/16.0	33.4/38.5		60.5/66.9	70/70	61/62	334/334	65.3/71.6	70/80	65/66	338/338
	112A00		24.0/32.0	66.7/77.0	102.1/115.0		110/125	94/106	334/334	106.9/119.8	110/125	98/110	338/338	
	112A00/117A00		31.8/42.4	88.4/102.0	129.3/146.3		150/150	119/135	334/334	134.0/151.0	150/175	123/139	338/338	
	112A00/110A00	37.6/50.0	104.2/120.3	149.0/139.1	150/175	137/156	334/334	153.8/143.8	175/175	141/160	338/338			
	460—3—60	STD	NONE	—	—	1.8	23.0	30	24	135	24.8	30	26	137
			116A00	13.9	16.7		24.1	30	24	135	26.4	30	26	137
			113A00	16.5	19.8		28.0	30	26	135	30.3	35	28	137
			115A00	33.0	39.7		52.9	60	49	135	55.1	60	51	137
			114A00/116A00	41.7	50.2		66.0	70	61	135	68.3	70	63	137
			115A00/113A00	50.0	60.1		63.4	70	72	135	65.6	70	74	137
		MED	NONE	—	—	1.8	24.8	30	26	157	26.6	30	28	159
			116A00	13.9	16.7		26.4	30	26	157	28.6	30	28	159
			113A00	16.5	19.8		30.3	35	28	157	32.5	35	30	159
			115A00	33.0	39.7		55.1	60	51	157	57.4	60	53	159
			114A00/116A00	41.7	50.2		68.3	70	63	157	70.5	80	65	159
			115A00/113A00	50.0	60.1		65.6	80	74	157	67.9	80	76	159
		HIGH	NONE	—	—	1.8	27.8	30	30	161	29.6	35	32	163
			116A00	13.9	16.7		30.1	35	30	161	32.4	35	32	163
			113A00	16.5	19.8		34.0	35	31	161	36.3	40	33	163
115A00			33.0	39.7	58.9		60	54	161	61.1	70	56	163	
114A00/116A00			41.7	50.2	72.0		80	66	161	74.3	80	68	163	
115A00/113A00			50.0	60.1	69.4		80	78	161	71.6	80	80	163	
575—3—60	STD	NONE	—	—	3.8	17.3	20	18	105	21.1	25	23	109	
		118A00	17.0	20.4		28.0	30	26	105	32.8	35	30	109	
		119A00	34.0	40.9		53.6	60	49	105	58.4	60	54	109	
		118A00/119A00	51.0	61.3		63.8	70	73	105	68.6	80	77	109	
	MED	NONE	—	—	3.8	18.1	20	19	116	21.9	25	24	120	
		118A00	17.0	20.4		29.0	30	27	116	33.8	35	31	120	
		119A00	34.0	40.9		54.6	60	50	116	59.4	60	55	120	
		118A00/119A00	51.0	61.3		64.8	70	74	116	69.6	80	78	120	
	HIGH	NONE	—	—	3.8	20.9	25	22	130	24.7	30	27	134	
		118A00	17.0	20.4		32.5	35	30	130	37.3	40	34	134	
		119A00	34.0	40.9		58.1	60	53	130	62.9	70	58	134	
		118A00/119A00	51.0	61.3		68.3	80	77	130	73.1	80	81	134	

See "Legend and Notes" on next page

**LEGEND:**

- CO - Convenient outlet
- DISC - Disconnect
- FLA - Full load amps
- IFM - Indoor fan motor
- LRA - Locked rotor amps
- MCA - Minimum circuit amps
- MOCP - Maximum over current protection
- PE - Power exhaust
- UNPWRD CO - Unpowered convenient outlet



**NOTES:**

3. 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.
4. **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

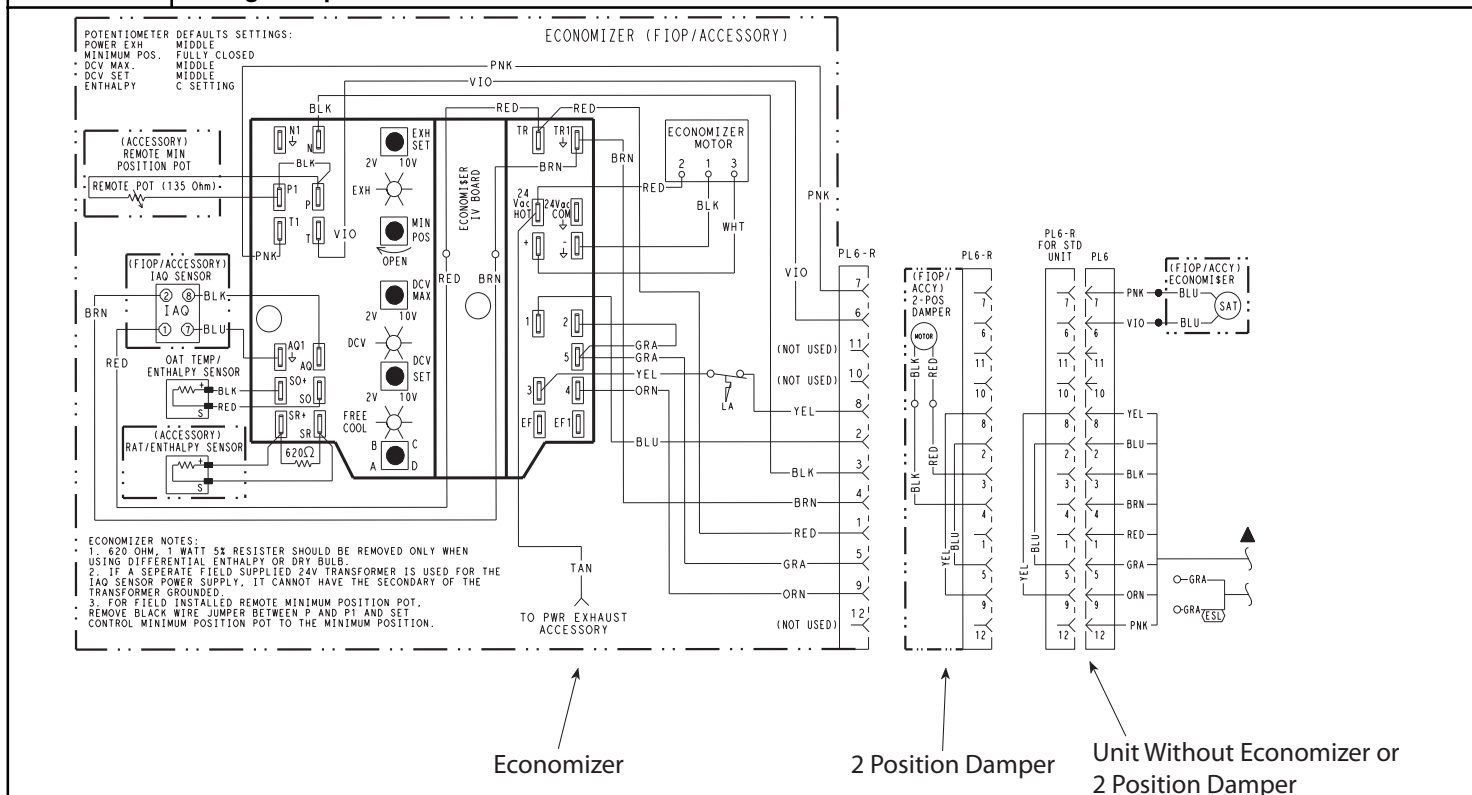
Average Voltage =  $\frac{(224 + 231 + 226)}{3} = \frac{681}{3}$   
= 227

Determine maximum deviation from average voltage.  
(AB) 227 – 224 = 3 v . . . . . Maximum deviation is 4 v.  
(BC) 231 – 227 = 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 30 Wiring for Optional Economizer****Step 11 — Adjust Factory-Installed Options****Smoke Detector —**

Smoke detector will be connected at the Controls Connections Board, at terminals marked “Smoke Shutdown”. Remove jumper JMP 3 when ready to energize unit.

**Economizer Occupancy Switch —**

Refer to Fig. 30 for general economizer wiring. External occupancy control is managed through a connection on the Controls Connections 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. Remove or cut jumper JMP 2 to complete the installation.

**Step 12 — Install Accessories, As Required**

Available accessories include:

- Roof Curb
- Thru-base connection kit (must be installed before unit is set on curb)
- Manual outside air damper
- Two-Position motorized outside air damper
- Economizer (with control and integrated barometric relief)
- Winter start kit
- Power exhaust
- Outdoor enthalpy sensor
- Differential enthalpy sensor
- Low ambient control
- Hail guards
- Phase monitor control

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