



# Service and Maintenance Instructions

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SAFETY CONSIDERATIONS

Installation and servicing of air-conditioning equipment can be hazardous due to system pressure and electrical components. Only trained and qualified service personnel should install, repair, or service air-conditioning equipment. Untrained personnel can perform the basic maintenance functions of replacing filters. Trained service personnel should perform all other operations.

When working on air-conditioning equipment, observe precautions in the literature, tags and labels attached to the unit, and other safety precautions that may apply. Follow all safety codes. Wear safety glasses and work gloves. Use quenching cloth for unbrazing operations. Have fire extinguishers available for all brazing operations.

Follow all safety codes. Wear safety glasses and work gloves. Use quenching cloth for brazing operations. Have fire extinguisher available. Read these instructions thoroughly and follow all warnings or cautions attached to the unit. Consult local building codes and National Electrical Code (NEC) for special requirements.

Recognize safety information. This is the safety ALERT symbol ⚠. When you see this symbol on the unit and in instructions or manuals, be aware of the potential for physical injury hazards.

Understand the signal words DANGER, WARNING, and CAUTION. These words are used with the safety ALERT symbol. DANGER indicates a hazardous situation which, if not avoided, will result in death or severe personal injury. WARNING indicates a hazardous situation which, if not avoided, could result in death or personal injury. CAUTION indicates a hazardous situation which, if not avoided, could result in minor to moderate injury or product and property damage. IMPORTANT is used to address practices not related to physical injury. NOTE is used to highlight suggestions which will result in enhanced installation, reliability, or operation.

⚠ 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

FIRE, EXPLOSION HAZARD

Failure to follow this warning could result in death, serious personal injury and/or property damage.

Disconnect gas piping from unit when pressure testing at pressure greater than 0.5 psig (3450 Pa). Pressures greater than 0.5 psig will cause gas valve damage resulting in hazardous condition. If gas valve is subjected to pressure greater than 0.5 psig, it must be replaced before use. When pressure testing field-supplied gas piping at pressures of 0.5 psig or less, a unit connected to such piping must be isolated by closing the manual gas valve(s).

⚠ WARNING

FIRE, EXPLOSION HAZARD

Failure to follow this warning could result in death, serious personal injury and/or property damage.

Never use non-certified refrigerants in this product. Non-certified refrigerants could contain contaminants that could lead to unsafe operating conditions. Use ONLY refrigerants that conform to AHRI Standard 700.

⚠ CAUTION

UNIT DAMAGE HAZARD

Failure to follow this caution may result in reduced unit performance or unit shutdown.

High velocity water from a pressure washer, garden hose, or compressed air should never be used to clean a coil. The force of the water or air jet will bend the fin edges and increase airside pressure drop.

⚠ WARNING

ELECTRICAL OPERATION HAZARD

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

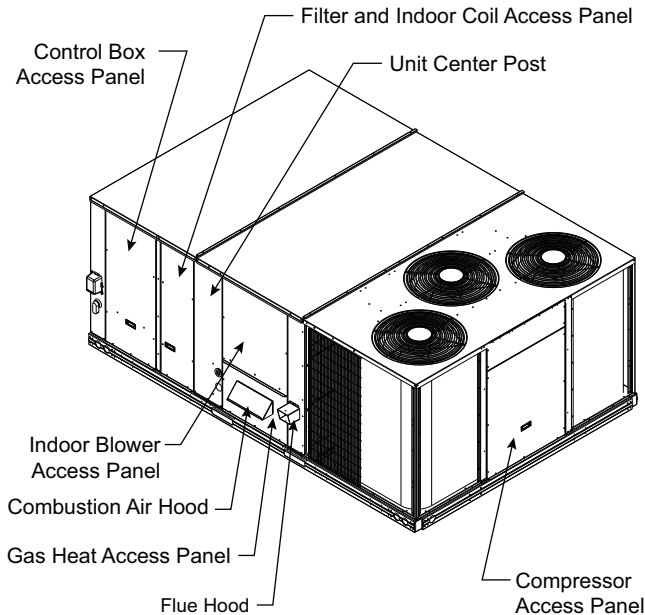
Units with convenience outlet circuits can use multiple disconnects. Check convenience outlet for power status before opening unit for service. Locate the disconnect switch and lock it in the open position it. LOCKOUT/TAGOUT this switch to notify others.

IMPORTANT: Lockout/tag-out is a term used when electrical power switches are physically locked preventing power to the unit. A placard is placed on the power switch alerting service personnel that the power is disconnected.

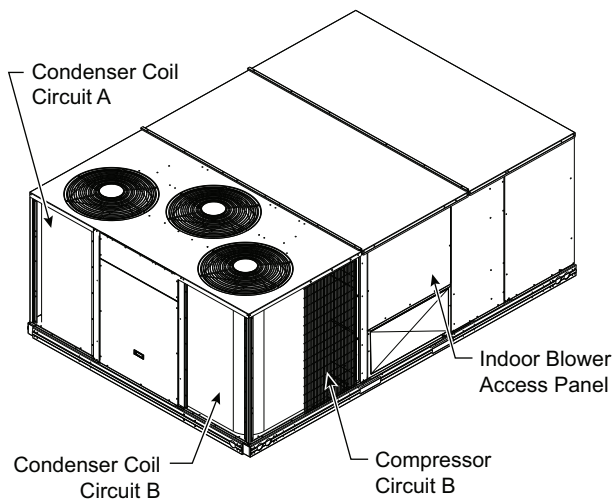
## UNIT ARRANGEMENT AND ACCESS

### General

Figures 1 and 2 show general unit arrangement and access locations.



**Fig. 1 — Typical Access Panel Locations (Front)**



**Fig. 2 — Typical Access Panel Location (Back)**

### Routine Maintenance

These items should be part of a routine maintenance program, to be checked every month or two, until a specific schedule for each can be identified for this installation:

#### QUARTERLY INSPECTION (AND 30 DAYS AFTER INITIAL START)

- Return air filter replacement
- Outdoor hood inlet filters cleaned
- Condenser coil cleanliness checked
- Condensate drain checked

#### SEASONAL MAINTENANCE

These items should be checked at the beginning of each season (or more often if local conditions and usage patterns dictate):

### Air Conditioning

- Ensure outdoor fan motor mounting bolts are tight
- Ensure compressor mounting bolts are tight
- Inspect outdoor fan blade positioning
- Ensure control box is clean
- Check control box wiring condition
- Ensure wire terminals are tight
- Check refrigerant charge level
- Ensure indoor coils are clean
- Check supply blower motor amperage

### Heating

- Heat exchanger flue passageways cleanliness
- Gas burner condition
- Gas manifold pressure
- Heating temperature rise

### Economizer or Outside Air Damper

- Check inlet filters condition
- Check damper travel (economizer)
- Check gear and dampers for debris and dirt

### Air Filters and Screens

Each unit is equipped with return air filters. If the unit has an economizer, it will also have an outside air screen. If a manual outside air damper is added, an inlet air screen will also be present.

Each of these filters and screens will need to be periodically replaced or cleaned.

### Filters

#### RETURN AIR FILTERS

#### ⚠ CAUTION

##### EQUIPMENT DAMAGE HAZARD

Failure to follow this CAUTION can result in premature wear and damage to equipment.

**DO NOT OPERATE THE UNIT WITHOUT THE RETURN AIR FILTERS IN PLACE.**

Dirt and debris can collect on heat exchangers and coils possibly resulting in a small fire. Dirt buildup on components can cause excessive current used resulting in motor failure.

Return air filters are disposable fiberglass media type. Access to the filters is through the vertical panel to the right of the control box. Filters are situated on slide out racks for easy inspection and repair. (See Fig. 1.)

To remove the filters:

1. Remove the six (6) screws holding the access panel in place.
2. Grasp the bottom flange of the access panel.
3. Lift up and swing the bottom out until the panel disengages and pulls out.
4. Pull the slide out filter rack to access all of the filters.
5. Replace filters as required with similar replacement filters of same size.

To re-install the access panel:

1. Slide the top of the panel up under the unit top panel.
2. Slide the bottom into the side channels.
3. Push the bottom flange down until it contacts the base.
4. Reinstall the six access panel screws.

## OUTSIDE AIR HOOD SCREENS

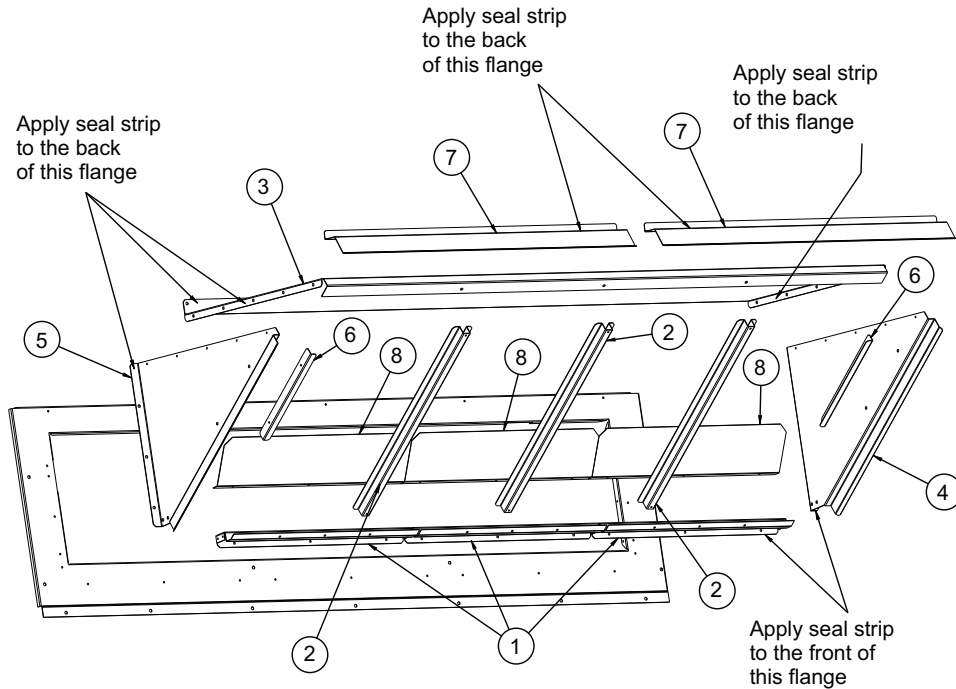
Outside air hood inlet screens are permanent aluminum-mesh type filters. Check these for cleanliness. Remove the screens when cleaning is required. Clean by washing with hot low-pressure water and soft detergent and replace all screens before re-starting the unit. Observe the flow direction arrows on the side of each screen frame.

These inlet screens are secured by a retainer angle across the top edge (see Fig. 3, Item #3 and Fig. 4) and bottom edge of the hood (see Fig. 3, Item #1 and Fig. 4).

To remove the screen, lift the screen towards the upper retainer angle created by the angle along the top edge (Fig. 3, Item #3). This will lift the screen above the bottom edge of the lower retainer angle (Fig. 3, Item #1). Pull the bottom of the filter forward to remove.

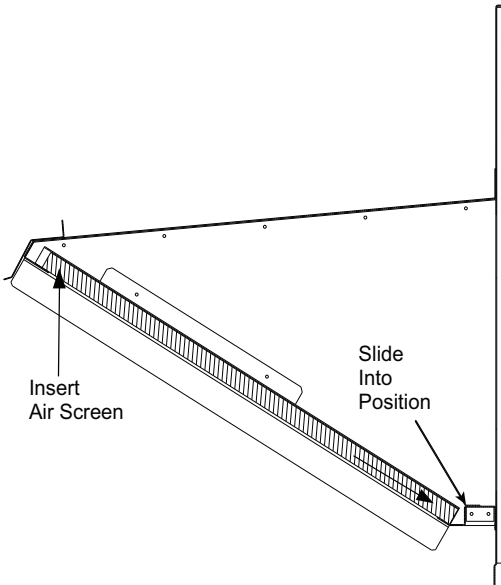
To re-install, placing the screen frame in retainer angle along the top edge (Fig. 3, Item #3). Rotate the bottom of the screen frame toward the unit into position and slide the frame down into the retainer angle along the bottom edge (see Fig. 4).

Figure 5 shows the completed hood assembly.

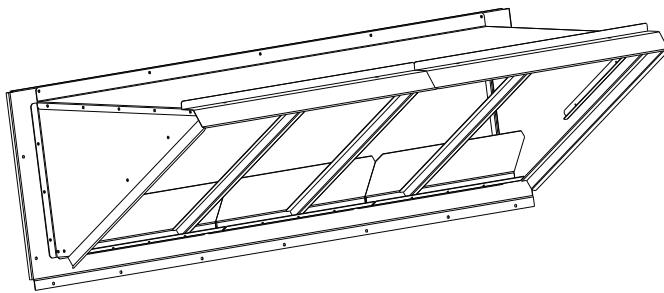


| ITEM # | DESCRIPTION      | QTY |
|--------|------------------|-----|
| 1      | Filter Support   | 3   |
| 2      | Central Retainer | 3   |
| 3      | Side Retainer    | 2   |
| 4      | Hood Top         | 1   |
| 5      | Left Hood Side   | 1   |
| 6      | Right Hood Side  | 1   |
| 7      | Top Diverters    | 2   |
| 8      | Deflector        | 3   |

**Fig. 3 — Hood Assembly and Hood Part Identification/Seal Strip Application Areas**



**Fig. 4 — Air Screen Installation**



**Fig. 5 — Hood Assembly Complete**

## SUPPLY FAN (BLOWER) SECTION

### **⚠ WARNING**

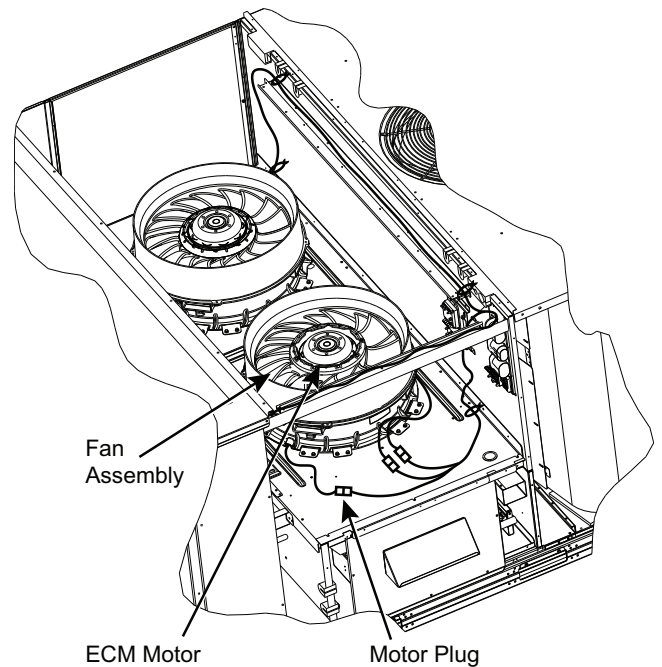
#### **ELECTRICAL SHOCK HAZARD**

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

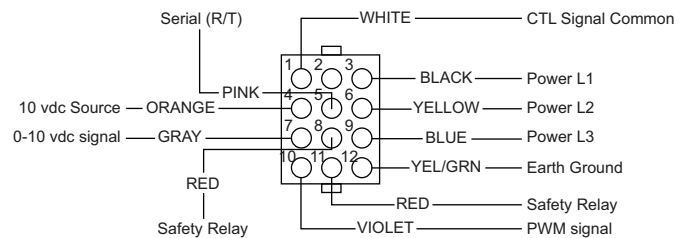
Before performing service or maintenance operations on unit, LOCKOUT/TAG-OUT the main power switch to unit. Electrical shock and rotating equipment could cause severe injury.

## Supply Fan (Direct-Drive)

All FC units have the EcoBlue™ direct drive vane axial fan system. The fan is driven by an ECM motor with speed that is user set through the Unit Control Board (UCB). Speeds are fully configurable from 40% to 100% of motor's maximum speed. See Fig. 6 and 7.



**Fig. 6 — Direct-Drive Supply Fan Assembly**



**Fig. 7 — ECM Motor Plug Connectors**

## EVALUATING MOTOR SPEED

The direct drive ECM blower motor uses a constant speed design. Motor speed is controlled by a 0-10 vdc signal, where 10 vdc is equal to motor's maximum rpm.

## SELECTING FAN SPEED

All units come factory set for 7.8 vdc or approximately 78% of the motor's maximum speed. Fan speed should be set per job specification cfm (cubic feet per minute) and ESP (external static pressure) required and per Fan Speed Set Up label included on the unit's high voltage cover. In some cases, the Fan Speed Set Up label may already include the field setting if unit was previously installed. Check the box on the lower half of the label to see if the field voltage setting was filled in and if so, set fan speed to that voltage. Otherwise see detailed instructions below.

NOTE: Fan Speed Set Up is for full load airflow. If the unit has multiple stages of cooling, low cool and ventilation may operate at lower fan rpms. This offset is factory set and controlled by the UCB. If fan speed verification is being done with a strobe, fan speed should be verified in all unit operation modes.

### *Units with electromechanical controls*

The Fan Speed Set Up controls are located on the lower section of the Unit Control Board (UCB). See Fig. 8 for location.

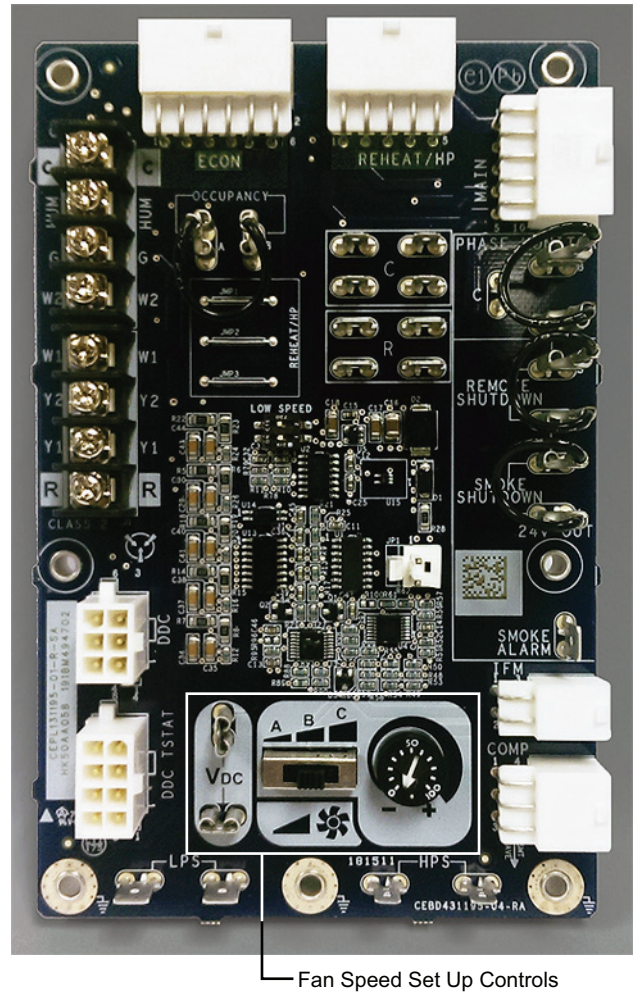
1. Check the job specifications for the cfm (cubic feet per minute) and ESP (external static pressure) required.
2. Using the chart on the Fan Speed Set Up labels (see Fig. 9), calculate the vdc from the cfm and ESP for the base.
3. If installing any accessories listed at the bottom of the Fan Speed Set Up Label, add accessory vdc to base unit vdc in upper portion of label.

NOTE: The Fan Speed Set Up labels are located on the High Voltage cover in the Control Box.

4. Connect a multimeter to the vdc terminals on the UCB.
5. Set the Range Switch to either A, B, or C per the Switch Range table.
6. Using a straight blade screwdriver turn the vdc control dial to fine tune the vdc reading.
7. Record the reading in the Field Setting field.

NOTE: Fan set-up vdc is not affected by the operating stage of the unit.

NOTE: For units equipped with the Humidi-MiZer® option, when replacing the UCB cut JMP 1,2 and 3 in the REHEAT/HP section of the replacement UCB.



**Fig. 8 — UCB Fan Speed Controls - 3-Phase Units**

## FAN SPEED SET UP:

**1** Calculate VDC from CFM and ESP plus field accessories.

**2** Connect multimeter

**3** Set Switch to A, B, or C from Switch Range chart below.

**4** Turn dial to fine tune VDC reading.

**5** Fill in Field Setting.

| Vdc Calculator     |     | ESP in. wg |     |     |     |     |      |     |     |     |     |     |
|--------------------|-----|------------|-----|-----|-----|-----|------|-----|-----|-----|-----|-----|
|                    |     | 0.2        | 0.4 | 0.6 | 0.8 | 1.0 | 1.2  | 1.4 | 1.6 | 1.8 | 2.0 |     |
| UNIT MODEL NUMBER  | CFM | 6000       | 5.6 | 6.1 | 6.5 | 6.9 | 7.3  | 7.6 | 8.0 | 8.3 | 8.6 | 8.9 |
|                    |     | 6500       | 6.0 | 6.4 | 6.8 | 7.2 | 7.6  | 7.9 | 8.3 | 8.6 | 8.9 | 9.2 |
|                    |     | 7000       | 6.4 | 6.8 | 7.2 | 7.6 | 7.9  | 8.2 | 8.6 | 8.9 | 9.2 | 9.5 |
|                    |     | 7500       | 6.8 | 7.2 | 7.5 | 7.9 | 8.2  | 8.6 | 8.9 | 9.2 | 9.5 | 9.7 |
|                    |     | 8000       | 7.2 | 7.6 | 7.9 | 8.2 | 8.6  | 8.9 | 9.2 | 9.5 | 9.8 |     |
|                    |     | 8500       | 7.6 | 8.0 | 8.3 | 8.6 | 8.9  | 9.2 | 9.5 | 9.8 |     |     |
|                    |     | 9000       | 8.0 | 8.4 | 8.7 | 9.0 | 9.3  | 9.6 | 9.8 |     |     |     |
|                    |     | 9500       | 8.5 | 8.8 | 9.1 | 9.3 | 9.6  | 9.9 |     |     |     |     |
|                    |     | 10000      | 8.9 | 9.2 | 9.4 | 9.7 | 10.0 |     |     |     |     |     |
| Field Accessories: |     |            |     |     |     |     |      |     |     |     |     |     |
| Economizer         |     | 0.4        | 0.4 | 0.4 | 0.4 | 0.4 | 0.4  | 0.4 | 0.4 | 0.4 | 0.4 |     |
|                    |     |            |     |     |     |     |      |     |     |     |     |     |
|                    |     |            |     |     |     |     |      |     |     |     |     |     |

**Factory Setting:**

**9.0 VDC**

**Field Setting:**

*Record field setting here*

\_\_\_\_\_ VDC

**Switch Range: \***

A B C

A 4.1 - 7.5

B 6.9 - 8.7

C 7.7 - 10.0

\* Overlap in A, B, C switch range designed for maximum field adjustment potential. For example 7.2 can be set at either A or B.

NOTE(S):  
Values in the Field Accessories section are VDC adders.

**Fig. 9 — Example of Fan Speed Set Up Labels for Electromechanical Controls**

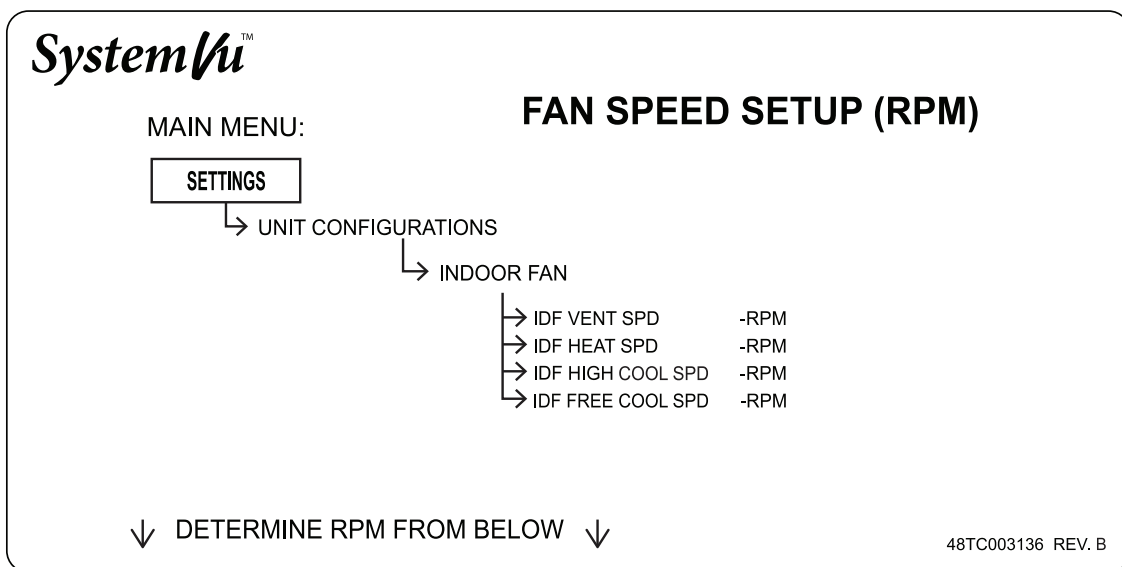
### Units with SystemVu™ controls

On units equipped with the factory-installed SystemVu controller the Fan Speed settings are accessed through the SystemVu interface.

1. Check the job specifications for the cfm (cubic feet per minute) and ESP (external static pressure) required.
2. Using the chart on the Fan Speed Set Up labels (see Fig. 10), calculate the rpm from the cfm and ESP for the base unit.
3. If installing any accessories listed at the bottom of the Set Up Label, add accessory rpm to base unit rpm in upper portion of label.  
NOTE: The Fan Speed Set Up labels are located on the High Voltage cover in the Control Box.
4. Press any key on the SystemVu interface to activate the display backlight and then press the MENU key.
5. Using the UP and DOWN arrow keys highlight SETTINGS and then press ENTER.

6. Use the DOWN arrow key highlight the UNIT CONFIGURATIONS menu then press ENTER.
7. Highlight UNIT CONFIGURATIONS then press ENTER.
8. Highlight INDOOR FAN and then press ENTER.
9. Refer to the job specifications to set the following, determining the values per the rpm Calculator label (see Fig. 10). Use the UP and DOWN arrow keys and the BACK key to set the values. Press ENTER after setting each value to continue to the next selection.
  - IDF VENT SPD
  - IDF HEAT SPD
  - IDF LOW COOL SPD
  - IDF HIGH SPD
  - IDF FREE COOL SPD

For further details see the *FC/GC Series Single Package Rooftop Units with SystemVu Controller Controls, Start-up, Operation and Troubleshooting* manual.



| RPM Calculator    |     | ESP in. wg         |      |      |      |      |      |      |      |      |      |      |
|-------------------|-----|--------------------|------|------|------|------|------|------|------|------|------|------|
|                   |     | 0.2                | 0.4  | 0.6  | 0.8  | 1.0  | 1.2  | 1.4  | 1.6  | 1.8  | 2.0  |      |
| UNIT MODEL NUMBER | CFM | 6000               | 1250 | 1348 | 1441 | 1528 | 1610 | 1688 | 1762 | 1832 | 1899 | 1963 |
|                   |     | 6500               | 1336 | 1428 | 1515 | 1598 | 1677 | 1753 | 1824 | 1893 | 1959 | 2021 |
|                   |     | 7000               | 1423 | 1509 | 1591 | 1670 | 1746 | 1819 | 1888 | 1955 | 2020 | 2081 |
|                   |     | 7500               | 1510 | 1591 | 1669 | 1744 | 1817 | 1887 | 1954 | 2019 | 2082 | 2143 |
|                   |     | 8000               | 1598 | 1675 | 1749 | 1820 | 1890 | 1957 | 2022 | 2085 | 2146 |      |
|                   |     | 8500               | 1687 | 1759 | 1829 | 1898 | 1964 | 2029 | 2092 | 2153 |      |      |
|                   |     | 9000               | 1776 | 1845 | 1912 | 1977 | 2041 | 2103 | 2163 |      |      |      |
|                   |     | 9500               | 1866 | 1931 | 1995 | 2057 | 2118 | 2178 |      |      |      |      |
|                   |     | 10000              | 1955 | 2018 | 2079 | 2138 | 2197 |      |      |      |      |      |
|                   |     | Field Accessories: |      |      |      |      |      |      |      |      |      |      |
| Economizer        |     | 89                 | 89   | 89   | 89   | 89   | 89   | 89   | 89   | 89   | 89   |      |
|                   |     |                    |      |      |      |      |      |      |      |      |      |      |
|                   |     |                    |      |      |      |      |      |      |      |      |      |      |

NOTE(S):  
Values in the Field Accessories section are RPM adders.

**Fig. 10 — Example of Fan Speed Set Up Labels for SystemVu™ Controls**

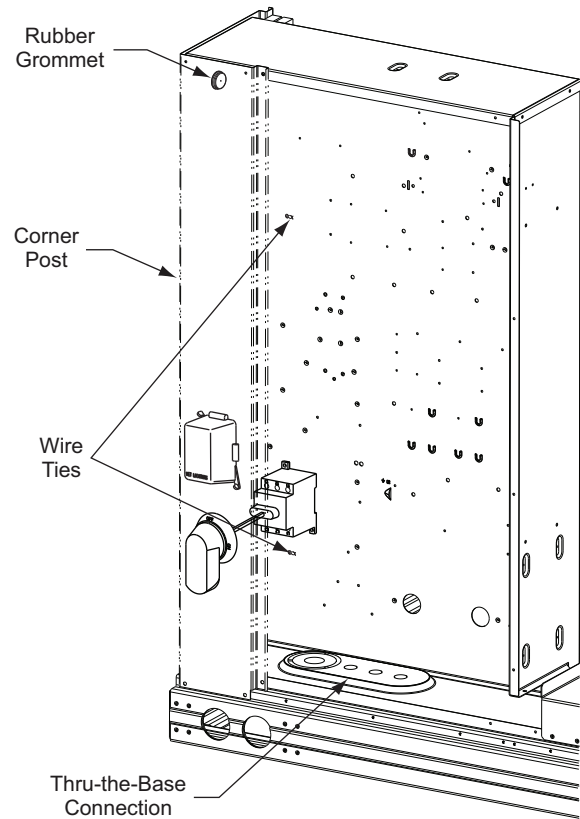
## TROUBLESHOOTING THE ECM MOTOR

EcoBlue™ motors are designed with several built-in protections included in the motor software. If the motor detects a fault it will safely shut down. See Table 4, “Supply Fan Motor Logic and Safety Relays” on page 37 for a complete list.

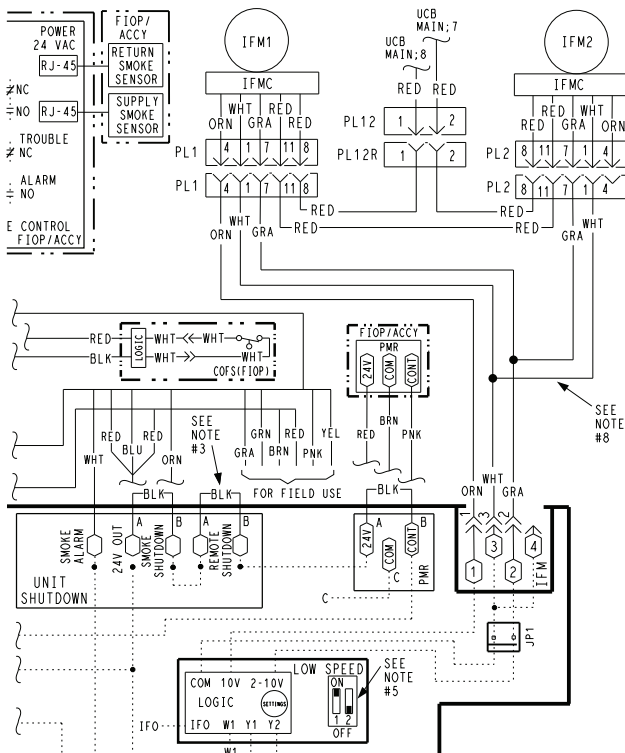
Troubleshooting the motor requires a voltmeter.

1. Disconnect main power to the unit.
  2. Disconnect motor plug in supply section of the unit.
  3. Restore main unit power.
  4. Check for proper line voltage at motor power leads Black (PL1-1), Yellow (PL1-2), and Blue (PL1-3). Blue is only present on 3-phase motors. See the following table.
- | 48FC UNIT VOLTAGE | MOTOR VOLTAGE | MIN-MAX VOLTS |
|-------------------|---------------|---------------|
| 208/230           | 230           | 187-253       |
| 460               | 460           | 360-506       |
| 575               | 575           | 517-633       |
5. Disconnect main power.
  6. Reconnect motor plug in supply section of unit.
  7. Restore main power.
  8. Check for proper motor control voltage signal of 9.7 vdc to 10.3 vdc at IFM-1 and IFM-3 on Unit Control Board (UCB). See Fig. 11.
  9. Using a jumper wire from unit control terminals R to G, engage motor operation.
  10. Verify control signal from user speed selection switch by placing voltmeter taps in provided terminals marked Vdc. Signal should be between 3.8 vdc and 10.3 vdc.
  11. If the motor does not start and run, remove the fan assembly and replace the motor with one having the same part number. Do not substitute with an alternate design motor as the voltage/speed programming will not be the same as that on an original factory motor.

All low voltage wiring should be routed through the provided wire ties (see Fig. 12) down the left side of the control box or secured to the unit control box with an electrical conduit in order to provide UL-required clearance between high-voltage and low voltage wiring.



**Fig. 12 — Low Voltage Wiring Raceway**



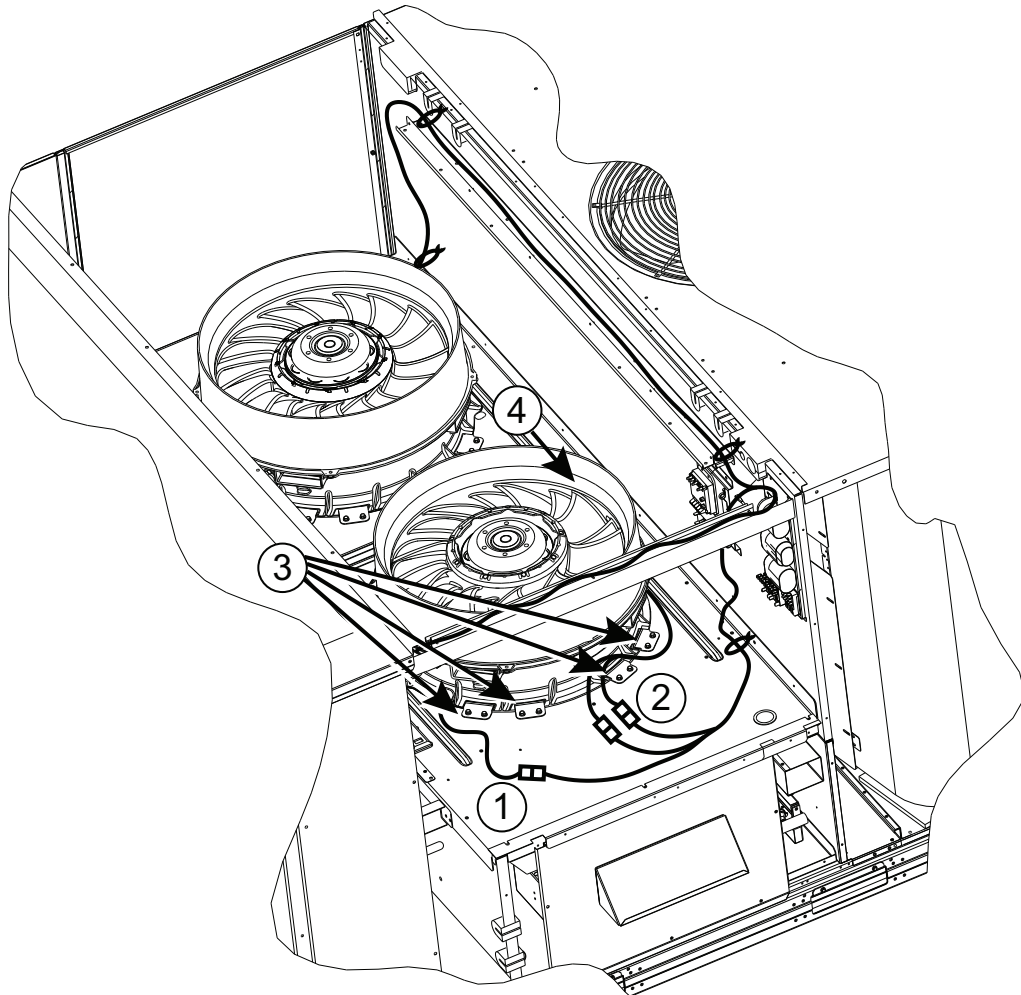
**Fig. 11 — Supply Fan Control Wiring Diagram**

### ***Removing the Motor and Fan Assembly***

NOTE: Due to press fit design of composite Rotor on Motor, it is highly recommended that any time a motor is replaced the fan rotor is replaced as well. The rest of the assembly may be reused.

See Fig. 13.

1. Unplug motor harness from control box harness and cut wire tie at the fan deck.
2. Unplug connectors from stator temperature limit switch.
3. Remove four brackets at front of stator on fan deck.
4. Slide fan assembly forward a couple of inches to clear rear brackets and lift assembly out.



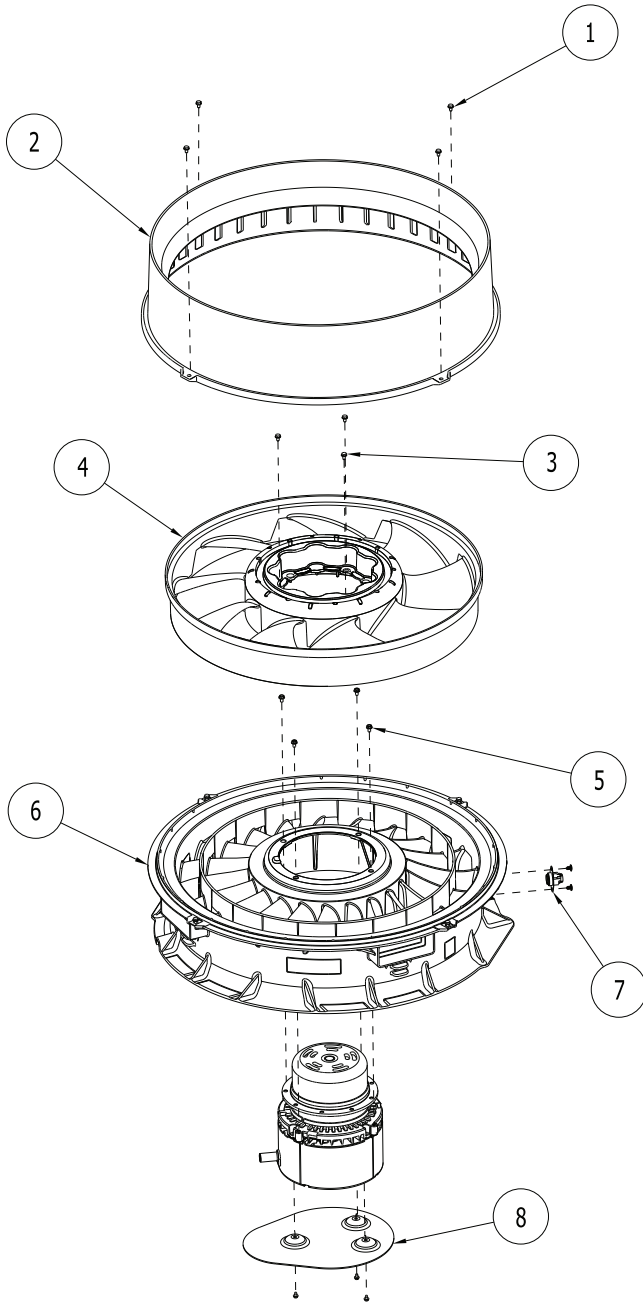
**Fig. 13 — Fan Assembly Removal**

### ***Disassembling Standard/Medium Motor and Fan Assembly***

See Fig. 14.

NOTE: Refer to “MODEL NUMBER NOMENCLATURE” on page 79, position 10 for specific unit requirements.

1. Remove 4 screws from U-clips in fan casing.
2. Remove casing from assembly.
3. Remove 3 screws connecting rotor to motor flange.
4. Remove rotor from motor.
5. Remove 4 screws connecting motor to stator.
6. Remove stator from motor.
7. If required, remove fan limit switch from stator.
8. If replacing motor, remove heat shield from motor and keep.



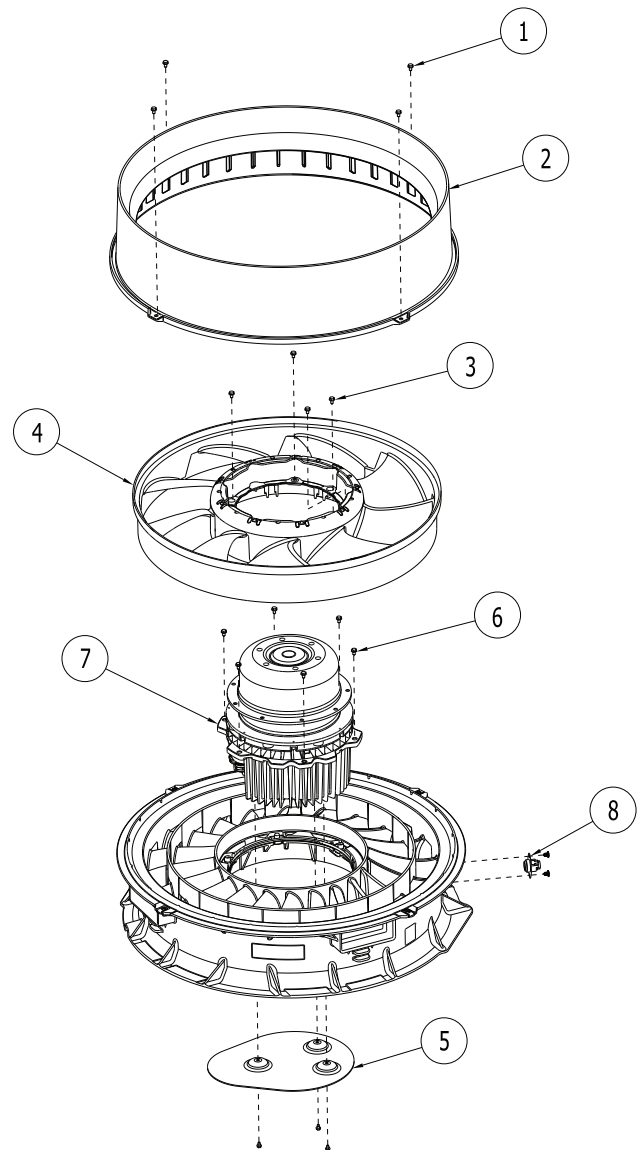
**Fig. 14 — Disassembling Standard or Medium Static Motor and Fan Assembly**

### ***Disassembling High Static Motor and Fan Assembly***

See Fig. 15.

NOTE: Refer to “MODEL NUMBER NOMENCLATURE” on page 79, position 10 for specific unit requirements.

1. Remove 4 screws from U-clips in fan casing.
2. Remove casing from assembly.
3. Remove 3 screws connecting rotor to motor flange.
4. Remove rotor from motor.
5. Remove heat shield from motor. Keep.
6. Remove 6 screws connecting motor to stator.
7. Remove motor from stator.
8. If required, remove fan limit switch from stator.



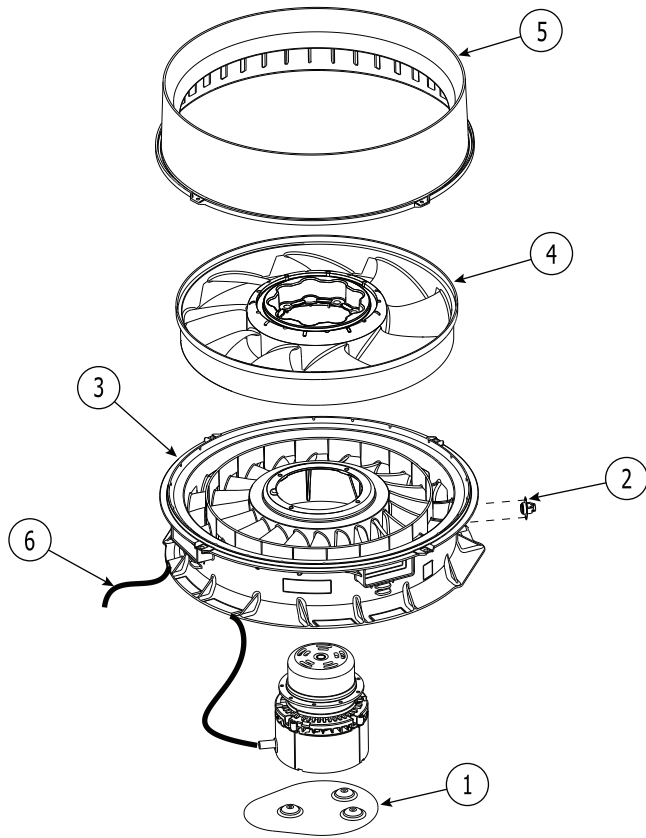
**Fig. 15 — Disassembling High Static Motor and Fan Assembly**

### Reassembly of Standard/Medium Motor and Fan Assembly

See Fig. 16.

NOTE: Refer to “MODEL NUMBER NOMENCLATURE” on page 79, position 10 for specific unit requirements.

1. Place motor on flat surface. Install Heat shield on back of motor.
2. If required, reinstall limit switch on stator with two plastic fastener plugs (P/N: 48TM005675).
3. Line up keying features on stator and motor and set stator onto motor. Install four 1/4-20 x 1-in. screws (P/N: AC67AP170) to attach stator to motor. Tighten to 50 in.-lb (5.65 Nm).
4. Set rotor onto motor flange. Install three 1/4-20 x 1-in. screws (P/N: AC67AP170) to attach rotor to motor. Tighten to 50 in.-lb (5.65 Nm).
5. Set casing onto stator. Install four #10-16 x 3/4-in. screws (P/N: AP13AD128) through U-Clips in casing. Tighten to 14 in.-lb (1.58 Nm).
6. Pull motor harness out through guide feature in stator if not already completed.



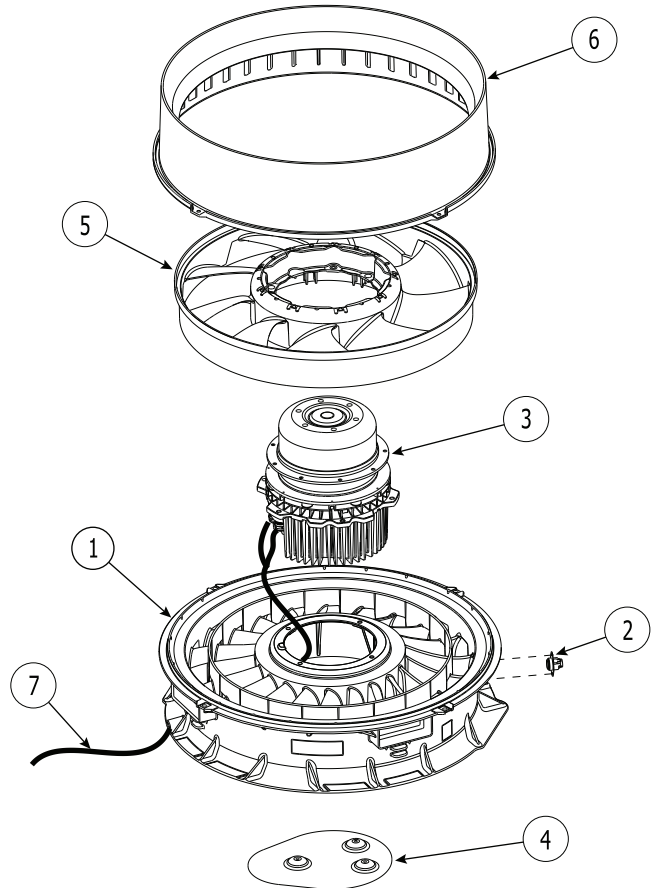
**Fig. 16 — Standard/Medium Fan System Re-Assembly**

### Reassembly of High Static Motor and Fan Assembly

See Fig. 17.

NOTE: Refer to “MODEL NUMBER NOMENCLATURE” on page 79, position 10 for specific unit requirements.

1. Place stator on flat surface.
2. If required, reinstall limit switch on stator with two plastic fastener plugs (P/N: 48TM005675).
3. Line up keying features on stator and motor and set motor onto stator. Motor wire Harness should align with guide feature in stator. Install six 1/4-20 x 1-in. screws (P/N: AC67AP170) to attach stator to motor. Tighten to 30 in.-lb (3.39 Nm).
4. Install Heat shield on back of motor.
5. Set rotor onto motor flange. Install three 1/4-20 x 1-in. screws (P/N: AC67AP170) to attach rotor to motor. Tighten to 50 in.-lb (5.65 Nm).
6. Set casing onto stator. Install four #10-16 x 3/4-in. screws (P/N: AP13AD128) through U-Clips in casing. Tighten to 14 in.-lb (1.58 Nm).
7. Pull motor harness out through guide feature in stator if not already completed.

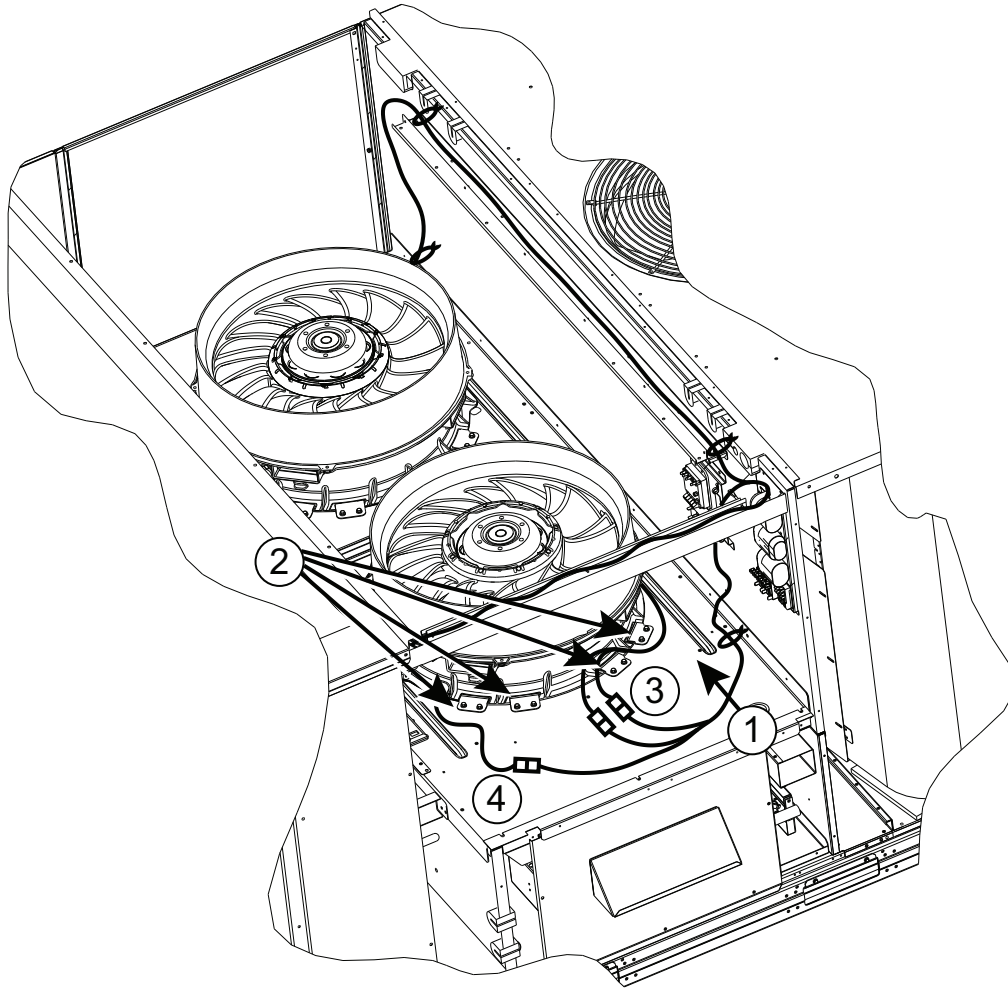


**Fig. 17 — High Static Fan System Re-Assembly**

### ***Reinstalling Motor and Fan Assembly***

See Fig. 18.

1. Align motor harness/grommet at ~7 o'clock (facing installer) and align the bottom flats on right and left sides of fan stator with fan deck ribs. Drop fan assembly down into fan deck opening and slide back until aluminum stator is under the rear fan deck brackets.
2. Replace four front brackets and secure each with 2 #10 x 5/8-in. hex head screws (P/N: AL48AM217). Tighten to 50 in.-lb (5.65 Nm).
3. Reconnect wires for stator temperature limit switch.
4. Pull motor harness tight through grommet and plug it in to the control box harness and secure in the corner with snap-in wire tie.



**Fig. 18 — Fan Assembly Installation**

## Staged Air Volume

All 48FC units with EcoBlue™ technology come factory set to automatically adjust the indoor fan motor speed in sequence with the unit's ventilation, cooling, and heating operation. When the first stage of cooling is requested, unit fan will operate at 66% of the user set full load airflow. When the second stage of cooling is required, UCB will allow the full design airflow rate for the unit (100%). During the heating mode, the unit will allow total design airflow rate (100%). During ventilation mode, the fan will operate at 66% speed.

## COOLING

### ⚠ WARNING

#### UNIT OPERATION AND SAFETY HAZARD

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

This system uses Puron® refrigerant which has higher pressures than R-22 and other refrigerants. No other refrigerant may be used in this system. Gauge set, hoses, and recovery system must be designed to handle Puron refrigerant. If unsure about equipment, consult the equipment manufacturer.

## Condenser Coil

The condenser coil is fabricated with round tube copper hairpins and plate fins of various materials and/or coatings (see MODEL NUMBER NOMENCLATURE in Appendix A to identify the materials provided in this unit). The coil may be one-row or composite-type two-row. Composite two-row coils are two single-row coils fabricated with a single return bend end tubesheet.

## Condenser Coil Maintenance and Cleaning Recommendation

Routine cleaning of coil surfaces is essential to maintain proper operation of the unit. Elimination of contamination and removal of harmful residues will greatly increase the life of the coil and extend the life of the unit. The following maintenance and cleaning procedures are recommended as part of the routine maintenance activities to extend the life of the coil.

### REMOVE SURFACE LOADED FIBERS

Surface loaded fibers or dirt should be removed with a vacuum cleaner. If a vacuum cleaner is not available, a soft non-metallic bristle brush may be used. In either case, the tool should be applied in the direction of the fins. Coil surfaces can be easily damaged (fin edges can be easily bent over and damage to the coating of a protected coil) if the tool is applied across the fins.

NOTE: Use of a water stream, such as a garden hose, against a surface loaded coil will drive the fibers and dirt into the coil. This will make cleaning efforts more difficult. Surface loaded fibers must be completely removed prior to using low velocity clean water rinse.

### PERIODIC CLEAN WATER RINSE

A periodic clean water rinse is very beneficial for coils that are applied in coastal or industrial environments. However, it is very important that the water rinse is made with a very low velocity water stream to avoid damaging the fin edges. Monthly cleaning as described below is recommended. Rinsing coils in the opposite direction of airflow is recommended.

## ROUTINE CLEANING OF COIL SURFACES

Periodic cleaning with Totaline® environmentally balanced coil cleaner is essential to extend the life of coils. This cleaner is available from Replacement Components Division as P/N: P902-0301 for a one gallon container, and P/N: P902-0305 for a 5 gallon container. It is recommended that all coils, including standard aluminum, pre-coated, copper/copper or e-coated coils be cleaned with the Totaline environmentally balanced coil cleaner as described below. Coil cleaning should be part of the unit's regularly scheduled maintenance procedures to ensure long life of the coil. Failure to clean the coils may result in reduced durability in the environment.

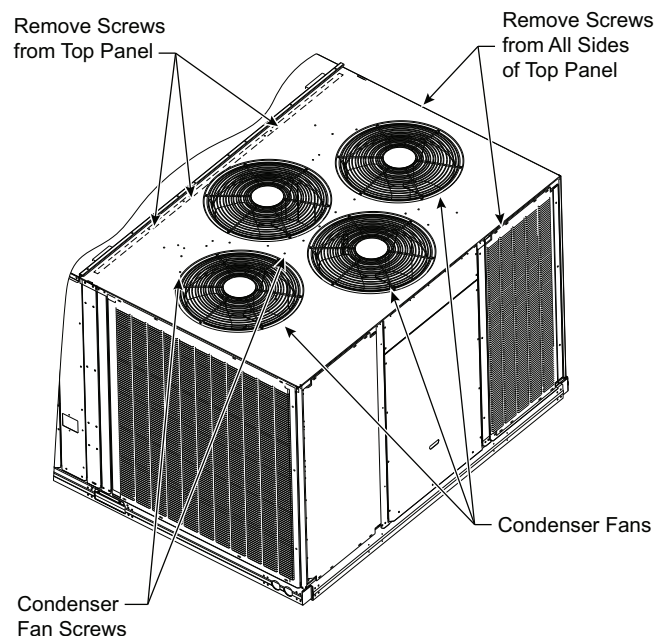
Avoid use of:

- coil brighteners
- acid cleaning prior to painting
- high pressure washers
- poor quality water for cleaning

Totaline environmentally balanced coil cleaner is nonflammable, hypo-allergenic, non-bacterial, and a USDA accepted biodegradable agent that will not harm the coil or surrounding components such as electrical wiring, painted metal surfaces, or insulation. Use of non-recommended coil cleaners is strongly discouraged since coil and unit durability could be affected.

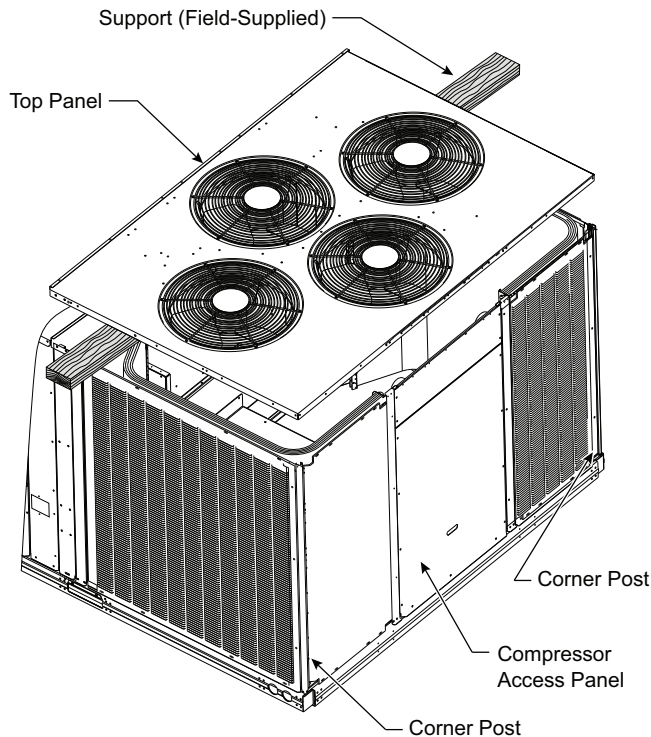
Clean coil as follows:

1. Turn off unit power, tag disconnect.
2. Remove all screws from the top panel except the screws securing the condenser fan to the top panel. See Fig. 19.



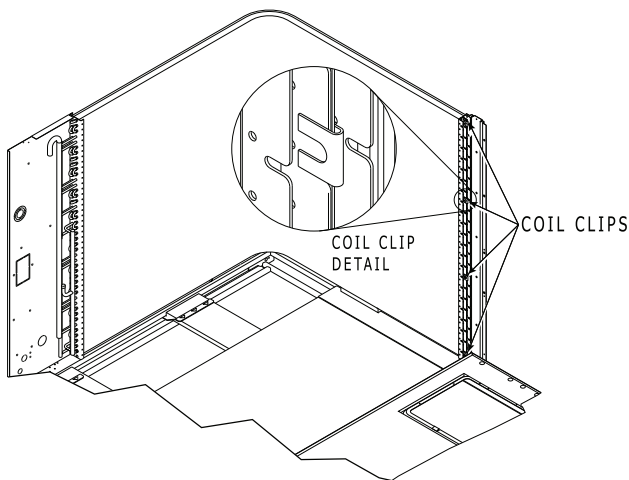
**Fig. 19 — Location of Top Panel Screws and Coil Corner Post**

3. Lift the top panel at the condenser fan end and support the top panel so it remains level while resting on the condenser fans as shown in Fig. 20.



**Fig. 20 — Top Panel Removal**

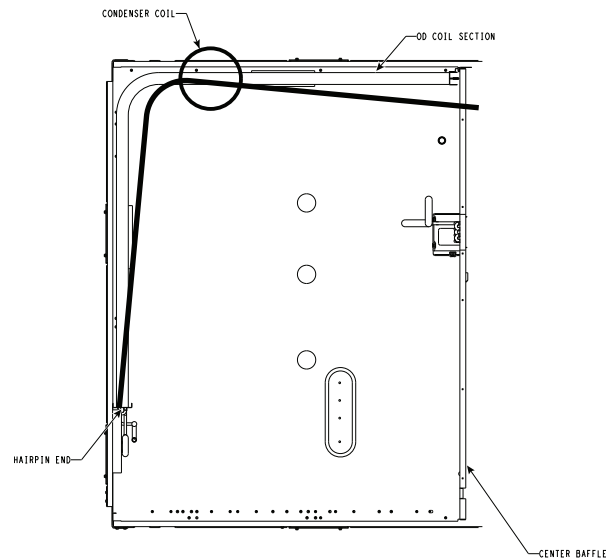
4. Remove the compressor access panel to access the lower coil clips. The condenser coil corner post may also be removed. See Fig. 20.
5. Remove the screws from both sides of the 4 coil retaining clips on the hairpin end of the coil tube sheets. See Fig. 21.
6. Remove the 4 retaining clips.



**Fig. 21 — Condenser Coil Clips**

7. Draw the inner coil inward to separate the coils for cleaning.
8. Insert a spacer (field-supplied) between the tube sheets to hold the coils apart. See Fig. 22.

9. Clean the outer coil surface to remove surface loaded fibers or dirt. See “Remove Surface Loaded Fibers” on page 14 for details.
10. Use a water hose or other suitable equipment to flush down between the 2 coil sections to remove dirt and debris. If a coil cleaner is used be sure to rinse the coils completely before reassembly.
11. Move the inner coil back into position. Reinstall the 4 coil clips. Reinstall the top panel and replace all screws. Replace the compressor access panel.



**Fig. 22 — Separating Coil Sections (Top View)**

**CAUTION**

**UNIT DAMAGE HAZARD**

Failure to follow this caution may result in reduced unit performance or unit shutdown.

High velocity water from a pressure washer or garden hose, or compressed air should never be used to clean a coil. The force of the water or air jet will bend the fin edges and increase airside pressure drop.

**CAUTION**

**UNIT DAMAGE HAZARD**

Failure to follow this caution may result in accelerated corrosion of unit parts.

Harsh chemicals, household bleach or acid or basic cleaners should not be used to clean outdoor or indoor coils of any kind. These cleaners can be very difficult to rinse out of the coil and can accelerate corrosion at the fin/tube interface where dissimilar materials are in contact. If there is dirt below the surface of the coil, use the Totaline environmentally balanced coil cleaner.

### Totaline Environmentally Balanced Coil Cleaner Application Equipment

- 2-1/2 gallon garden sprayer
- Water rinse with low velocity spray nozzle

### Totaline Environmentally Balanced Coil Cleaner Application Instructions

1. Proper eye protection such as safety glasses is recommended during mixing and application.
2. Remove all surface loaded fibers and dirt with a vacuum cleaner as described above.
3. Thoroughly wet finned surfaces with clean water and a low velocity garden hose, being careful not to bend fins.
4. Mix Totaline environmentally balanced coil cleaner in a 2-1/2 gallon garden sprayer according to the instructions included with the cleaner. The optimum solution temperature is 100°F.

NOTE: Do NOT USE water in excess of 130°F, as the enzymatic activity will be destroyed.

5. Thoroughly apply Totaline environmentally balanced coil cleaner solution to all coil surfaces including finned area, tube sheets and coil headers.
6. Hold garden sprayer nozzle close to finned areas and apply cleaner with a vertical, up-and-down motion. Avoid spraying in horizontal pattern to minimize potential for fin damage.
7. Ensure cleaner thoroughly penetrates deep into finned areas. Interior and exterior finned areas must be thoroughly cleaned. Finned surfaces should remain wet with cleaning solution for 10 minutes. Ensure surfaces are not allowed to dry before rinsing. Reapply cleaner as needed to ensure 10-minute saturation is achieved.
8. Thoroughly rinse all surfaces with low velocity clean water using downward rinsing motion of water spray nozzle. Protect fins from damage from the spray nozzle.

### **Evaporator Coil**

#### Cleaning the Evaporator Coil

1. Turn unit power off. Install lockout tag. Remove evaporator coil access panel.
2. If economizer or two-position damper is installed, remove economizer by disconnecting Molex<sup>®1</sup> plug and removing mounting screws.
3. Slide filters out of unit.
4. Clean coil using a commercial coil cleaner or dishwasher detergent in a pressurized spray canister. Wash both sides of coil and flush with clean water. For best results, back-flush toward return-air section to remove foreign material. Flush condensate pan after completion.
5. Reinstall economizer and filters.
6. Reconnect wiring.
7. Replace access panels.

### **Evaporator Coil Metering Devices**

48FC 20-30 units with or without the Humidi-MiZer option use a TXV-distributor system.

### **THERMOSTATIC EXPANSION VALVE (TXV)**

The TXV is a bi-flow, bleed port expansion valve with an external equalizer. The TXVs are specifically designed to operate with Puron<sup>®</sup> refrigerant. Use only factory-authorized TXVs.

### **TXV Operation**

The TXV is a metering device that is used in air conditioning and heat pump systems to adjust to the changing load conditions by maintaining a preset superheat temperature at the outlet of the evaporator coil.

The volume of refrigerant metered through the valve seat is dependent upon the following:

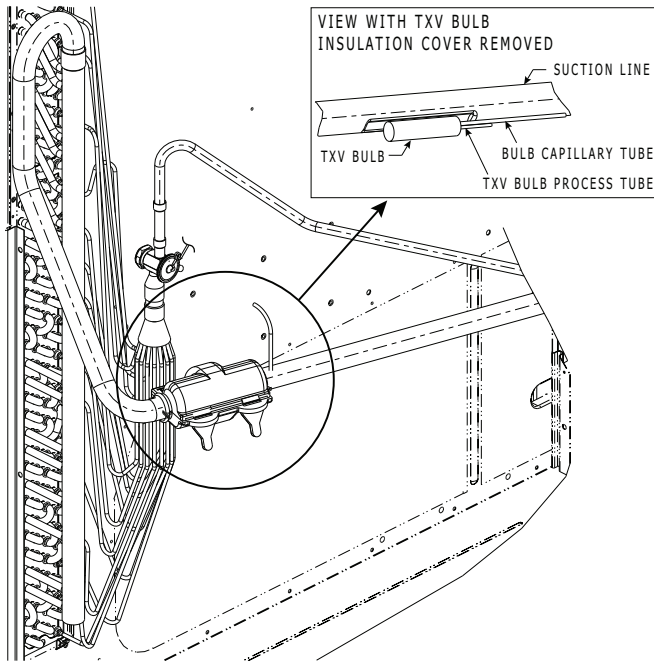
1. Superheat temperature is sensed by cap tube sensing bulb on suction tube at outlet of evaporator coil. This temperature is converted into pressure by refrigerant in the bulb pushing downward on the diaphragm, which opens the valve using the push rods.
2. The suction pressure at the outlet of the evaporator coil is transferred through the external equalizer tube to the underside of the diaphragm.
3. The pin is spring loaded, which exerts pressure on the underside of the diaphragm. Therefore, the bulb pressure works against the spring pressure and evaporator suction pressure to open the valve. If the load increases, the temperature increases at the bulb, which increases the pressure on the top side of the diaphragm. This opens the valve and increases the flow of refrigerant. The increased refrigerant flow causes the leaving evaporator temperature to decrease. This lowers the pressure on the diaphragm and closes the pin. The refrigerant flow is effectively stabilized to the load demand with negligible change in superheat.

### **Replacing TXV**

1. Recover refrigerant.
2. Remove TXV support clamp using a 5/16-in. nut driver.
3. Remove TXV using a wrench and an additional wrench on connections to prevent damage to tubing.
4. Remove equalizer tube from suction line of coil. Use file or tubing cutter to cut brazed equalizer line approximately 2 inches above suction tube.
5. Remove bulb from vapor tube inside cabinet.
6. Install the new TXV using a wrench and an additional wrench on connections to prevent damage to tubing while attaching TXV to distributor.
7. Attach the equalizer tube to the suction line. If the coil has a mechanical connection, then use a wrench and an additional wrench on connections to prevent damage. If the coil has a brazed connection, use a file or a tubing cutter to remove the mechanical flare nut from the equalizer line. Then use a new coupling to braze the equalizer line to the stub (previous equalizer line) in suction line.
8. Attach TXV bulb in the same location where the original (in the sensing bulb indent) was when it was removed, using the supplied bulb clamps. See Fig. 23.
9. Route equalizer tube through suction connection opening (large hole) in fitting panel and install fitting panel in place.
10. Sweat the inlet of TXV marked "IN" to the liquid line. Avoid excessive heat which could damage the TXV valve. Use quenching cloth when applying heat anywhere on TXV.

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1. Third-party trademarks and logos are the property of their respective owners.

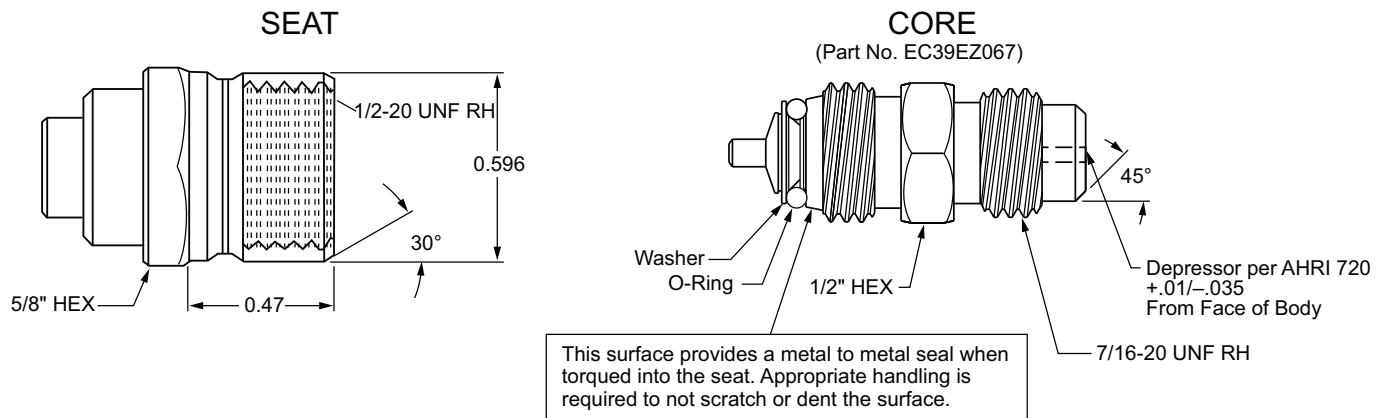


**Fig. 23 — TXV Valve and Sensing Bulb Location**

## Refrigerant System Pressure Access Ports

There are two access ports in the system: on the suction tube near the compressor and on the discharge tube near the compressor. These are brass fittings with black plastic caps. The hose connection fittings are standard 1/4-in. SAE male flare couplings.

The brass fittings are two-piece high flow valves, with a receptacle base brazed to the tubing and an integral spring-closed check valve core screwed into the base. See Fig. 24. This check valve is permanently assembled into this core body and cannot be serviced separately; replace the entire core body if necessary. Service tools are available from RCD that allow the replacement of the check valve core without having to recover the entire system refrigerant charge. Apply compressor refrigerant oil to the check valve core's bottom o-ring. Install the fitting body with  $96 \pm 10$  in.-lb ( $10.85 \pm 1.1$  Nm) of torque; do not over-tighten.



**Fig. 24 — CoreMax™<sup>1</sup> Access Port Assembly**

1. Third-party trademarks and logos are the property of their respective owners.

## PURON (R-410A) REFRIGERANT

This unit is designed for use with Puron® (R-410A) refrigerant. Do not use any other refrigerant in this system.

Puron (R-410A) refrigerant is provided in pink (rose) colored cylinders. These cylinders are available with and without dip tubes; cylinders with dip tubes will have a label indicating this feature. For a cylinder with a dip tube, place the cylinder in the upright position (access valve at the top) when removing liquid refrigerant for charging. For a cylinder without a dip tube, invert the cylinder (access valve on the bottom) when removing liquid refrigerant.

Because Puron (R-410A) refrigerant is a blend, it is strongly recommended that refrigerant always be removed from the cylinder as a liquid. Admit liquid refrigerant into the system in the discharge line. If adding refrigerant into the suction line, use a commercial metering/expansion device at the gauge manifold; remove liquid from the cylinder, pass it through the metering device at the gauge set and then pass it into the suction line as a vapor. Do not remove Puron (R-410A) refrigerant from the cylinder as a vapor.

### Refrigerant Charge

Amount of refrigerant charge is listed on the unit's nameplate. Refer to *Carrier GTAC2-5 Charging, Recovery, Recycling and Reclamation* training manual and the following procedures.

Unit panels must be in place when unit is operating during the charging procedure.

#### NO CHARGE

Use standard evacuating techniques. After evacuating system, weigh in the specified amount of refrigerant.

## LOW-CHARGE COOLING

Using Cooling Charging Charts, Fig. 25-32, vary refrigerant until the conditions of the appropriate chart are met. Note the charging charts are different from type normally used. Charts are based on charging the units to the correct sub-cooling for the various operating conditions. Accurate pressure gauge and temperature sensing device are required. Connect the pressure gauge to the service port on the liquid line. Mount the temperature sensing device on the liquid line and insulate it so that outdoor ambient temperature does not affect the reading. Indoor-air cfm must be within the normal operating range of the unit.

| 48FC SIZE DESIGNATION | NOMINAL TONS REFERENCE |
|-----------------------|------------------------|
| 20                    | 17.5                   |
| 24                    | 20.0                   |
| 28                    | 25.0                   |
| 30                    | 27.5                   |

### EXAMPLE:

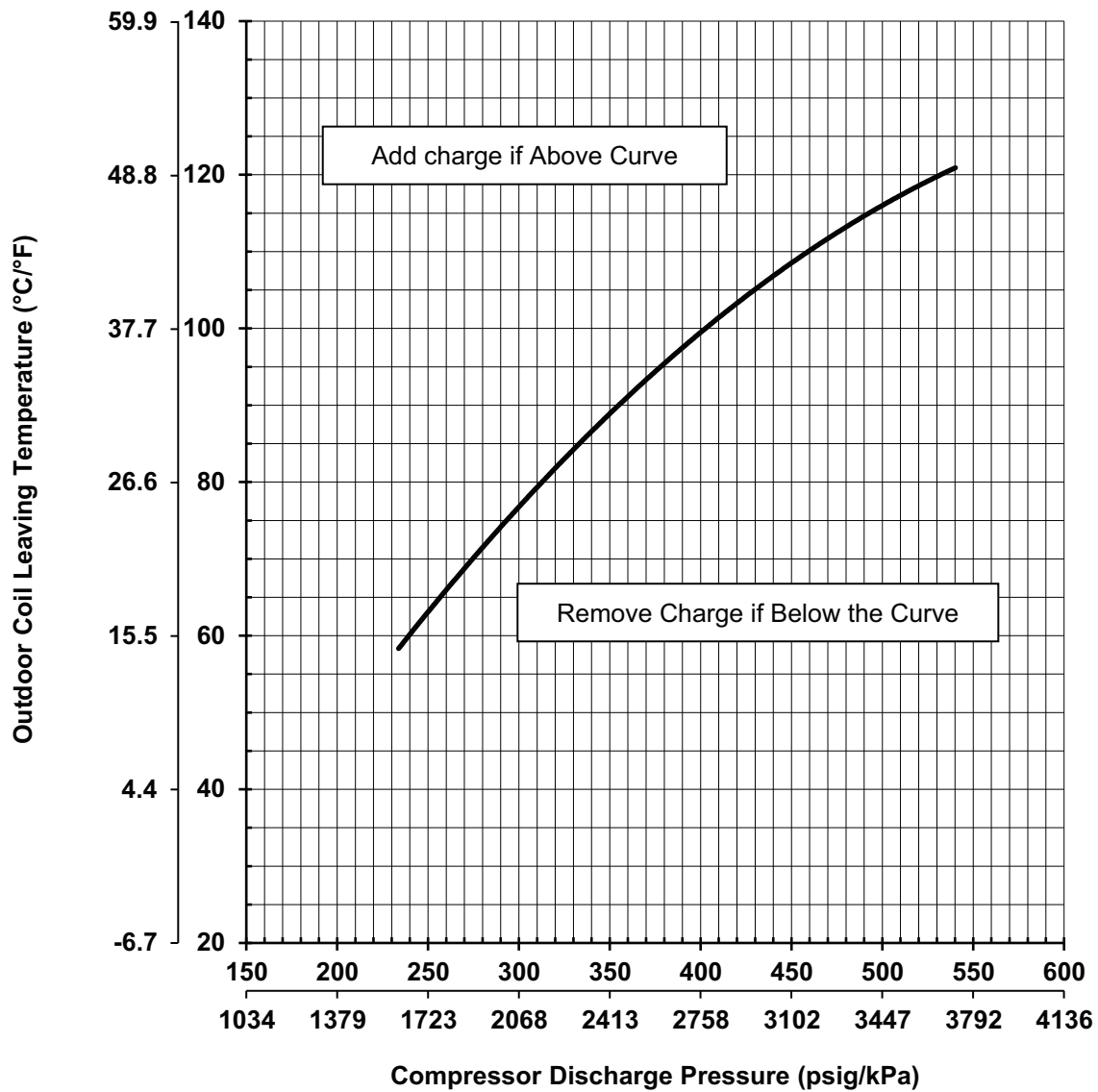
Model ..... 48FC\*\*24  
Outdoor Temperature ..... 85°F (29°C)  
Suction Pressure ..... 140 psig (965 kPa)  
Suction Temperature should be ..... 65°F (18°C)

### USING COOLING CHARGING CHARTS

Take the outdoor ambient temperature and read the liquid pressure gauge. Refer to chart to determine what liquid temperature should be. If liquid temperature is low, add refrigerant. If liquid temperature is high, carefully recover some of the charge. Recheck the liquid pressure as charge is adjusted.

## COOLING CHARGING CHARTS

**17.5 Ton Entry Tier R-410A — Charging Chart**  
 (Unit must have both compressors and outdoor fans on high speed)



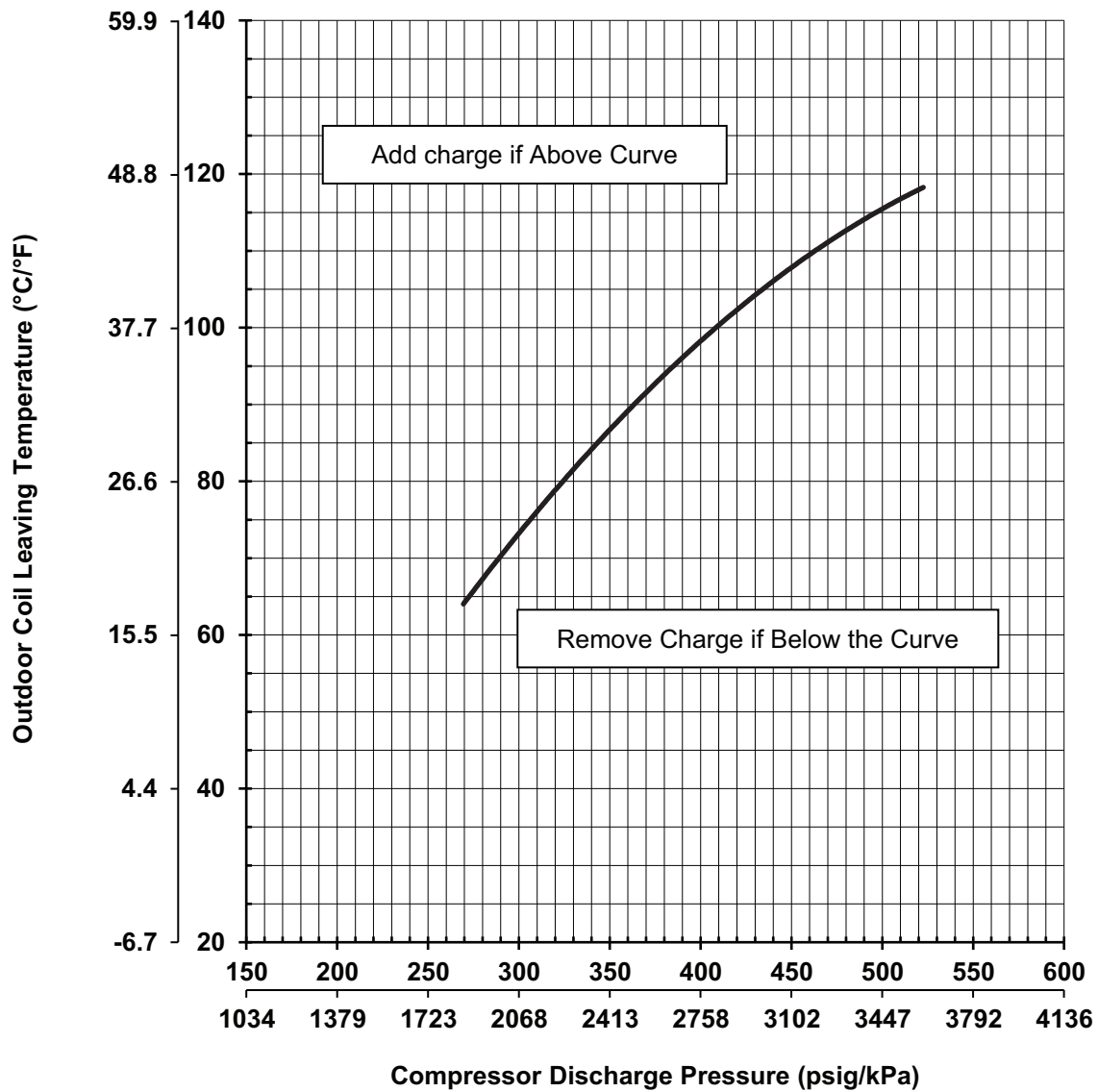
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Fig. 25 — Cooling Charging Chart — 17.5 Ton

## COOLING CHARGING CHARTS

**20 Ton Entry Tier R-410A — Charging Chart**  
**(Unit must have both compressors and outdoor fans on high speed)**



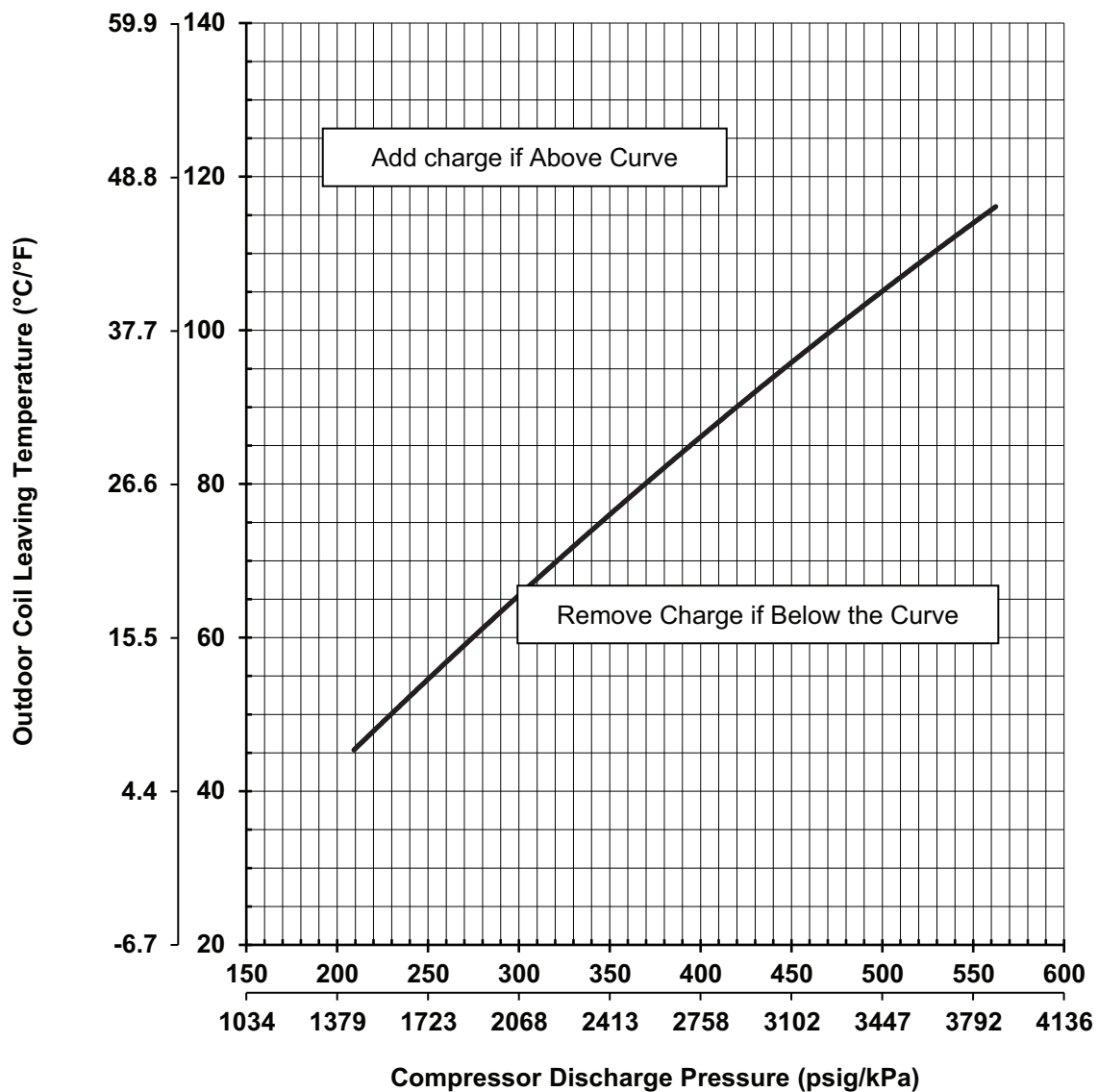
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**Fig. 26 — Cooling Charging Chart — 20 Ton**

## COOLING CHARGING CHARTS

**25 Ton Entry Tier R-410A — Charging Chart**  
(Unit must have both compressors and outdoor fans on high speed)



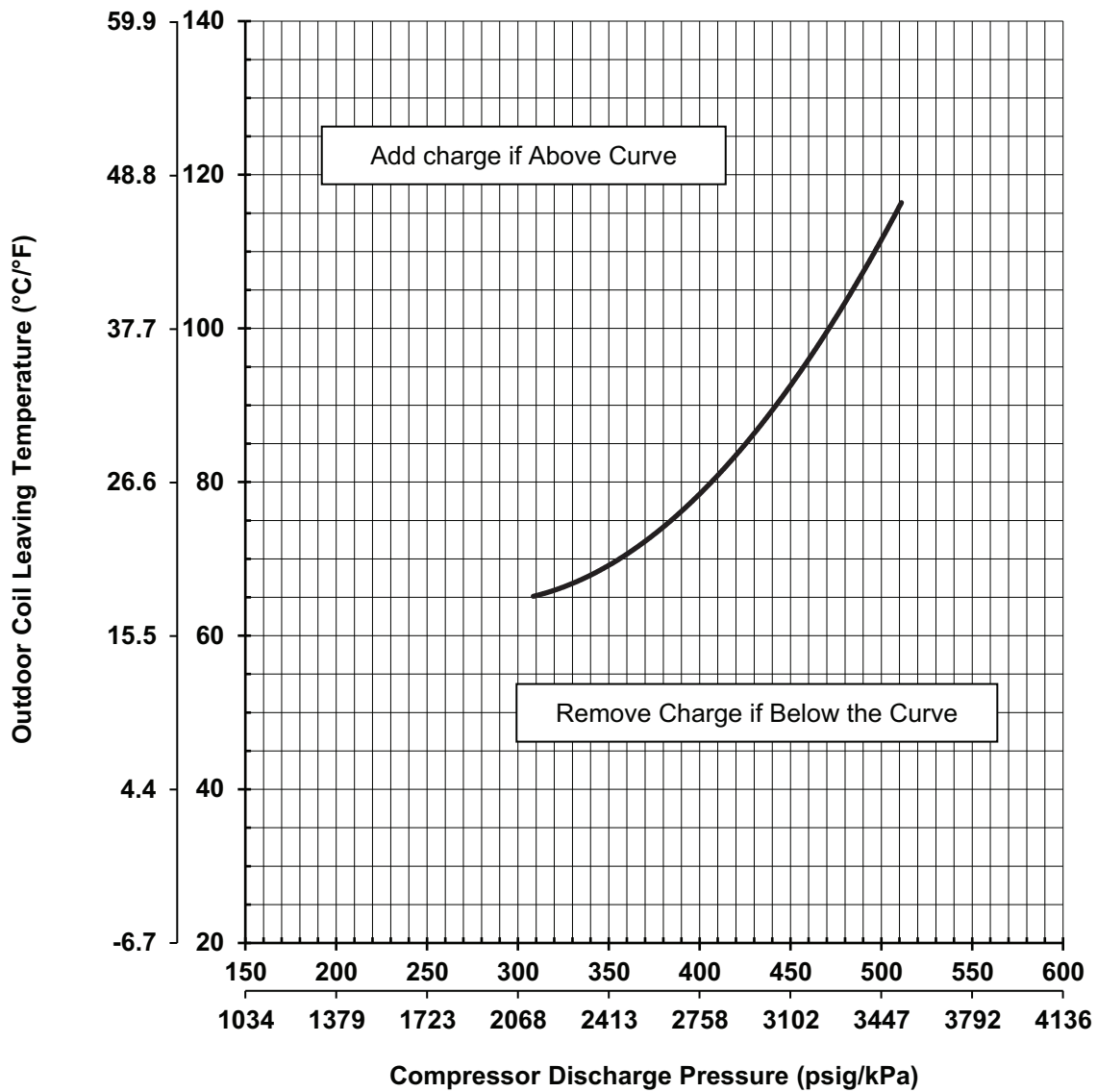
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**Fig. 27 — Cooling Charging Chart — 25 Ton**

## COOLING CHARGING CHARTS

**27.5 Ton Entry Tier R-410A — Charging Chart**  
 (Unit must have both compressors and outdoor fans on high speed)

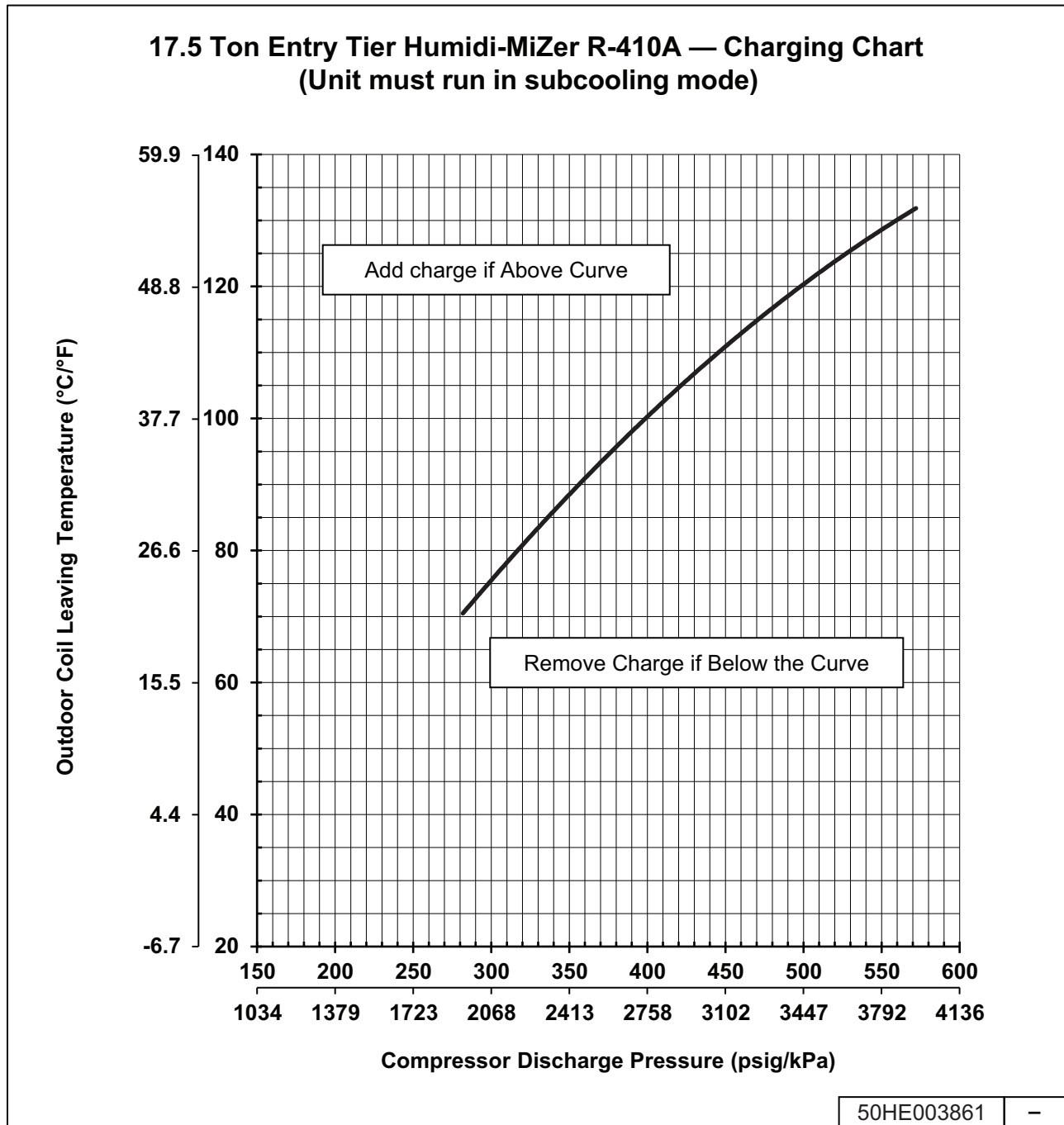


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Fig. 28 — Cooling Charging Chart — 27.5 Ton

## COOLING CHARGING CHARTS



**Fig. 29 — Cooling Charging Chart with Humidi-MiZer System — 17.5 Ton**

## COOLING CHARGING CHARTS

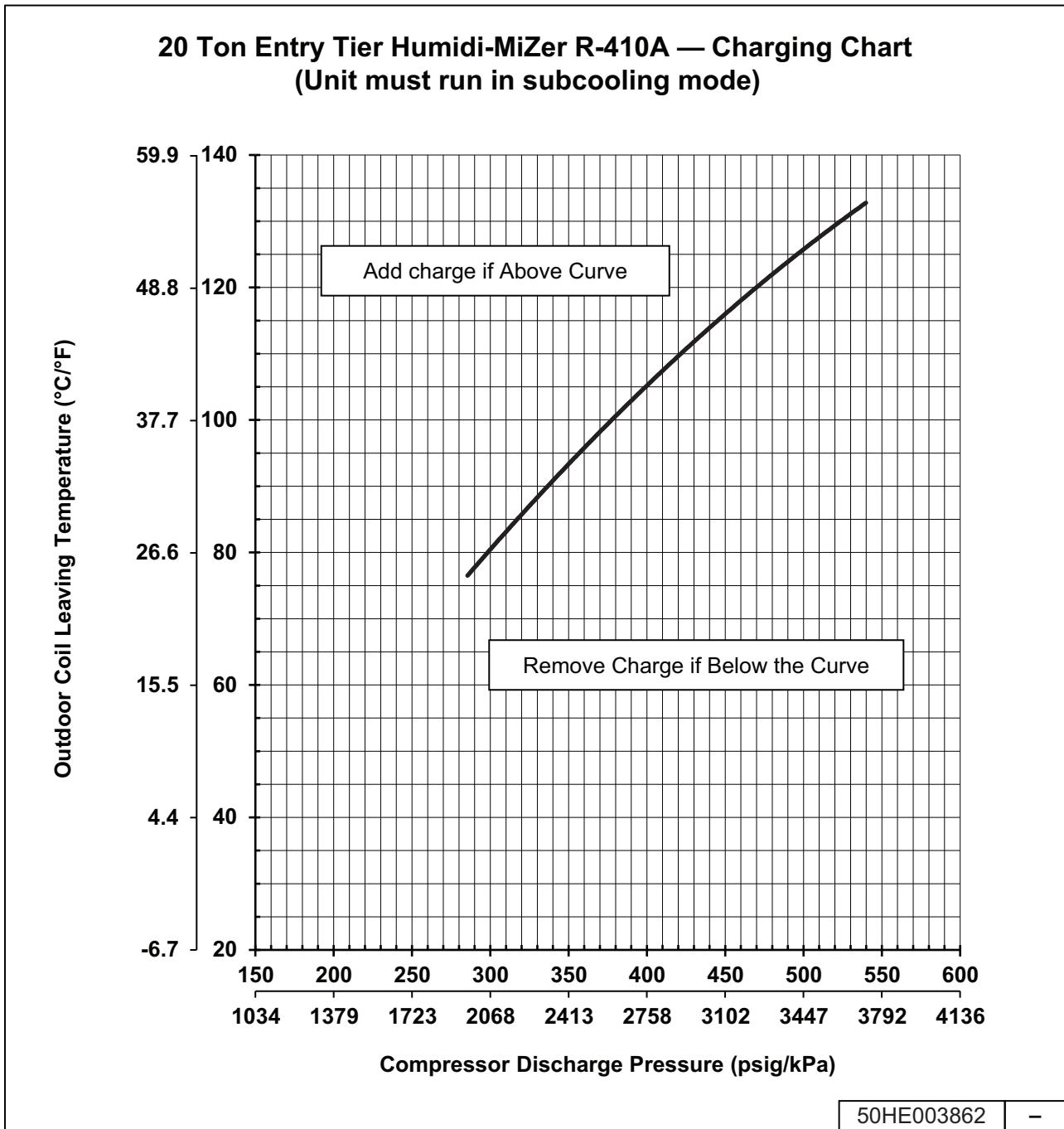
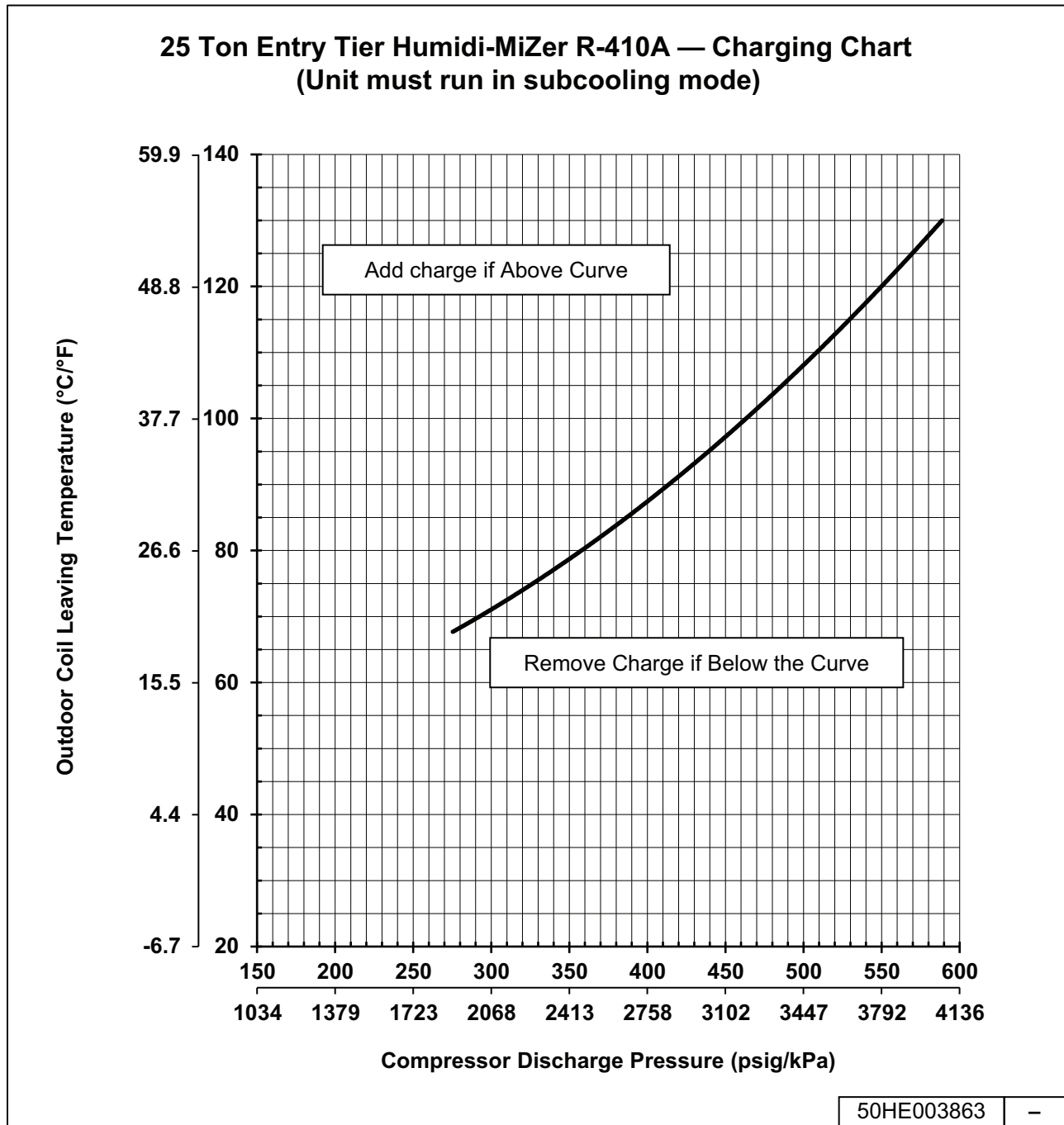


Fig. 30 — Cooling Charging Chart with Humidi-MiZer System — 20 Ton

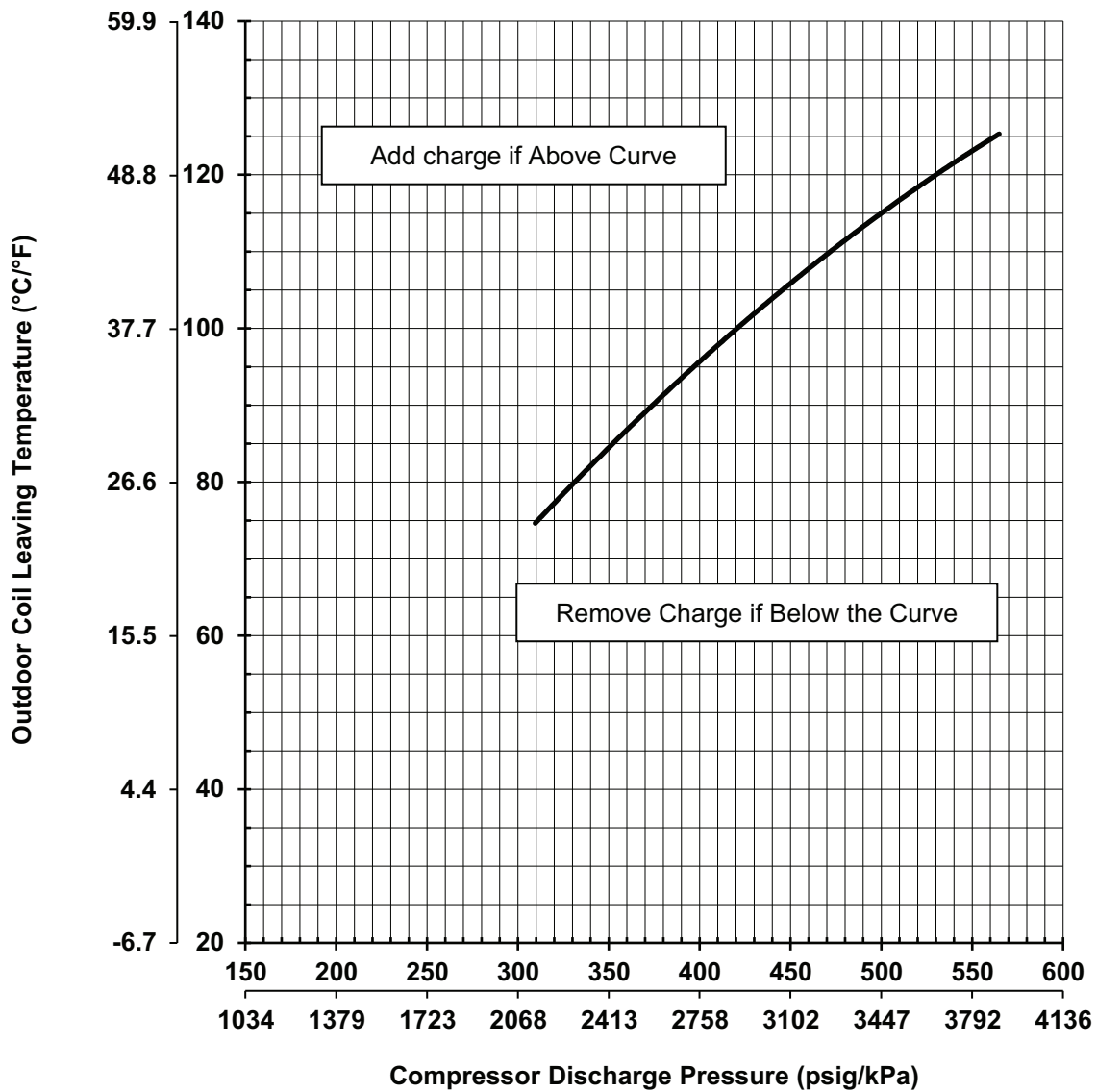
## COOLING CHARGING CHARTS



**Fig. 31 — Cooling Charging Chart with Humidi-MiZer System — 25 Ton**

## COOLING CHARGING CHARTS

**27.5 Ton Entry Tier Humidi-MiZer R-410A — Charging Chart**  
(Unit must run in subcooling mode)



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**Fig. 32 — Cooling Charging Chart with Humidi-MiZer System — 27.5 Ton**

## COMPRESSOR

### Lubrication

The compressor is charged with the correct amount of oil at the factory.

#### ⚠ CAUTION

##### UNIT DAMAGE HAZARD

Failure to follow this caution may result in damage to components.

The compressor is in a Puron® refrigerant system and uses a polyolester (POE) oil. This oil is extremely hygroscopic, meaning it absorbs water readily. POE oils can absorb 15 times as much water as other oils designed for HCFC and CFC refrigerants. Avoid exposure of the oil to the atmosphere.

#### ⚠ WARNING

##### FIRE, EXPLOSION HAZARD

Failure to follow this warning could result in death, serious personal injury and/or property damage.

Never use air or gases containing oxygen for leak testing or for operating refrigerant compressors. Pressurized mixtures of air or gases containing oxygen can lead to an explosion.

#### ⚠ WARNING

##### FIRE, EXPLOSION HAZARD

Failure to follow this warning could result in death, serious personal injury and/or property damage.

Never use non-certified refrigerants in this product. Non-certified refrigerants could contain contaminants that could lead to unsafe operating conditions. Use ONLY refrigerants that conform to AHRI Standard 700.

### Replacing Compressor

NOTE: Only factory-trained service technicians should remove and replace compressor units.

#### ⚠ CAUTION

##### INSTALLATION SITE DAMAGE

Failure to follow this caution can result in damage to equipment location site.

Puron (R-410A) refrigerant contains polyolester (POE) oil that can damage the roof membrane. Caution should be taken to prevent POE oil from spilling onto the roof surface.

The factory also recommends that the suction and discharge lines be cut with a tubing cutter instead of using a torch to remove brazed fittings.

## Compressor Rotation

#### ⚠ CAUTION

##### EQUIPMENT DAMAGE HAZARD

Failure to follow this caution can result in premature wear and damage to equipment.

Scroll compressors can only compress refrigerant if rotating in the right direction. Reverse rotation for extended times can result in internal damage to the compressor. Scroll compressors are sealed units and cannot be repaired on site location.

NOTE: When the compressor is rotating in the wrong direction, the unit makes an elevated level of noise and does not provide cooling.

On 3-phase units with scroll compressors, it is important to be certain compressor is rotating in the proper direction. To determine whether or not compressor is rotating in the proper direction:

1. Connect service gauges to suction and discharge pressure fittings.
2. Energize the compressor.
3. The suction pressure should drop and the discharge pressure should rise, as is normal on any start-up.

NOTE: If the suction pressure does not drop and the discharge pressure does not rise to normal levels, the evaporator fan is probably also rotating in the wrong direction.

4. Turn off power to the unit.
5. Reverse any two of the three unit power leads.
6. Reapply electrical power to the compressor. The suction pressure should drop and the discharge pressure should rise which is normal for scroll compressors on start-up.
7. Replace compressor if suction/discharge pressures are not within specifications for the specific compressor.

The suction and discharge pressure levels should now move to their normal start-up levels.

### Filter Drier

Replace whenever refrigerant system is exposed to atmosphere. Only use factory specified liquid-line filter driers with working pressures no less than 650 psig. Do not install a suction-line filter drier in liquid line. A liquid-line filter drier designed for use with Puron refrigerant is required on every unit.

### Condenser-Fan Adjustment

1. Shut off unit power supply. Install lockout tag.
2. Remove condenser-fan assembly (grille, motor, and fan). See Fig. 33.
3. Loosen fan hub setscrews.
4. Adjust fan height by pushing fan until it stops on the fan shaft.
5. Tighten set screw to 84 in.-lb (9.5 Nm)  $\pm$  12 in.-lb (1.5 Nm).
6. Replace condenser-fan assembly.

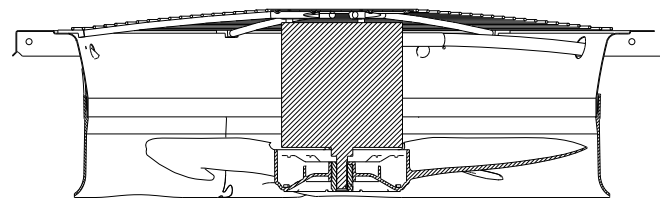


Fig. 33 — Condenser Fan Adjustment

## Troubleshooting Cooling System

Refer to Table 1 for additional troubleshooting topics.

**Table 1 — Troubleshooting**

| SYMPTOM                                                              | CAUSE                                                                      | SOLUTION                                                                                          |
|----------------------------------------------------------------------|----------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|
| <b>Compressor and Outdoor Fan Will Not Start</b>                     | Power failure.                                                             | Call power company.                                                                               |
|                                                                      | Fuse blown or circuit breaker tripped.                                     | Replace fuse or reset circuit breaker. Determine root cause.                                      |
|                                                                      | Defective thermostat, contactor, transformer, control relay, or capacitor. | Replacement component.                                                                            |
|                                                                      | Insufficient line voltage.                                                 | Determine cause and correct.                                                                      |
|                                                                      | Incorrect or faulty wiring.                                                | Check wiring diagram and rewire correctly.                                                        |
|                                                                      | Thermostat setting too high.                                               | Lower thermostat setting below room temperature.                                                  |
|                                                                      | High pressure switch tripped.                                              | See problem "Excessive head pressure."                                                            |
|                                                                      | Low pressure switch tripped.                                               | Check system for leaks. Repair as necessary.                                                      |
|                                                                      | Freeze-up protection thermostat tripped.                                   | See problem "Suction pressure too low."                                                           |
| <b>Compressor Will Not Start but Outdoor Fan Runs</b>                | Faulty wiring or loose connections in compressor circuit.                  | Check wiring and repair or replace.                                                               |
|                                                                      | Compressor motor burned out, seized, or internal overload open.            | Determine cause. Replace compressor or allow enough time for internal overload to cool and reset. |
|                                                                      | Defective run/start capacitor, overload, start relay.                      | Determine cause. Replace compressor or allow enough time for internal overload to cool and reset. |
|                                                                      | One leg of 3-phase power dead.                                             | Replace fuse or reset circuit breaker. Determine cause.                                           |
| <b>Compressor Cycles (Other Than Normally Satisfying Thermostat)</b> | Refrigerant overcharge or undercharge.                                     | Recover refrigerant, evacuate system, and recharge to nameplate.                                  |
|                                                                      | Defective compressor.                                                      | Replace and determine cause.                                                                      |
|                                                                      | Insufficient line voltage.                                                 | Determine cause and correct.                                                                      |
|                                                                      | Blocked outdoor coil or dirty air filter.                                  | Determine cause and correct.                                                                      |
|                                                                      | Defective Run/Start capacitor, overload, start relay.                      | Determine cause and correct.                                                                      |
|                                                                      | Defective thermostat.                                                      | Replace thermostat.                                                                               |
|                                                                      | Faulty outdoor-fan (cooling) or indoor-fan (heating) motor or capacitor.   | Replace faulty part.                                                                              |
|                                                                      | Restriction in refrigerant system.                                         | Locate restriction and remove.                                                                    |
|                                                                      | Defective loader plug.                                                     | Determine cause and replace.                                                                      |
| <b>Compressor Operates Continuously</b>                              | Dirty air filter.                                                          | Replaced filter.                                                                                  |
|                                                                      | Unit undersized for load.                                                  | Decrease load or increase unit size.                                                              |
|                                                                      | Thermostat set too low (cooling).                                          | Reset thermostat.                                                                                 |
|                                                                      | Low refrigerant charge.                                                    | Locate leak; repair and recharge.                                                                 |
|                                                                      | Air in system.                                                             | Recover refrigerant, evacuate system, and recharge.                                               |
|                                                                      | Outdoor coil dirty or restricted.                                          | Clean coil or remove restriction.                                                                 |
| <b>Compressor Makes Excessive Noise</b>                              | Compressor rotating in the wrong direction.                                | Reverse the 3-phase power leads as described in Start-Up.                                         |
| <b>Excessive Head Pressure</b>                                       | Dirty outside.                                                             | Replace filter.                                                                                   |
|                                                                      | Dirty outdoor coil (cooling).                                              | Clean coil.                                                                                       |
|                                                                      | Refrigerant overcharged.                                                   | Recover excess refrigerant.                                                                       |
|                                                                      | Air in system.                                                             | Recover refrigerant, evacuate system, and recharge.                                               |
|                                                                      | Condensing air restricted or air short-cycling.                            | Determine cause and correct.                                                                      |
| <b>Head Pressure Too Low</b>                                         | Low refrigerant charge.                                                    | Check for leaks; repair and recharge                                                              |
|                                                                      | Compressor scroll plates defective.                                        | Replace compressor                                                                                |
|                                                                      | Restriction in liquid tube.                                                | Remove restriction.                                                                               |
| <b>Excessive Suction Pressure</b>                                    | High heat load.                                                            | Check for source and eliminate.                                                                   |
|                                                                      | Compressor scroll plates defective.                                        | Replace compressor.                                                                               |
|                                                                      | Refrigerant overcharge.                                                    | Recover excess refrigerant.                                                                       |
| <b>Suction Pressure Too Low</b>                                      | Dirty air filter (cooling).                                                | Replace filter.                                                                                   |
|                                                                      | Dirt or heavily iced outdoor coil (heating).                               | Clean outdoor coil. Check defrost cycle operation.                                                |
|                                                                      | Low refrigerant charge.                                                    | Check for leaks; repair and recharge.                                                             |
|                                                                      | Metering device or low side restricted                                     | Remove source of restriction.                                                                     |
|                                                                      | Insufficient indoor airflow (cooling mode).                                | Increase air quantity. Check filter and replace if necessary.                                     |
|                                                                      | Temperature too low in conditioned area.                                   | Reset thermostat.                                                                                 |
|                                                                      | Field-installed filter drier restricted.                                   | Replace.                                                                                          |
|                                                                      | Outdoor ambient temperature below 25°F (cooling).                          | Install low-ambient kit.                                                                          |
|                                                                      | Outdoor fan motor(s) not operating (heating).                              | Check fan motor operation.                                                                        |

## 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.

### Convenience Outlets

Two types of convenience outlets are offered on 48FC models: non-powered and unit-powered. Both types provide a 125 vac ground-fault circuit-interrupt (GFCI) duplex receptacle rated at 15A behind a hinged waterproof access cover, located on the end panel of the unit. See Fig. 34.

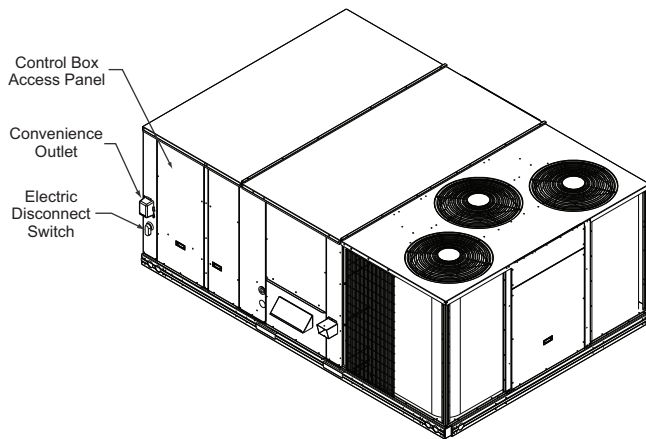


Fig. 34 — Convenience Outlet Location

### 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 to its depth. The cover 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.

NOTE: DISCONNECT ALL POWER TO UNIT AND CONVE-NIENCE OUTLET. Use approved lockout/tag-out procedures.

1. Remove the blank cover plate at the convenience outlet; discard the blank cover.
2. Loosen the two screws at the GFCI duplex outlet, until approximately 1/2-in. (13 mm) under screw heads is exposed.
3. 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).

4. Mount the weatherproof cover to the backing plate as shown in Fig. 35.
5. Remove two slot fillers in the bottom of the cover to permit service tool cords to exit the cover.
6. Check cover installation for full closing and latching.

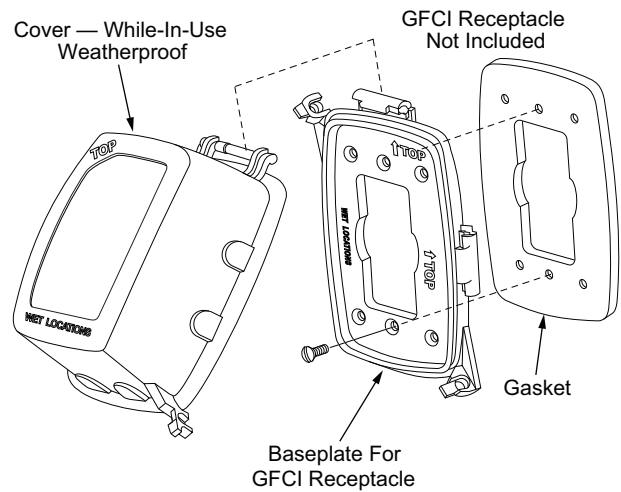


Fig. 35 — Weatherproof Cover Installation

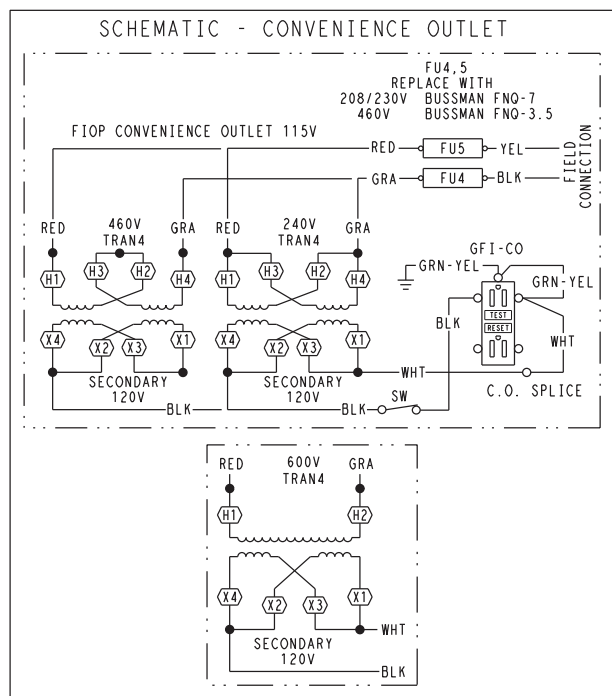
### Non-Powered Type

This type requires the field installation of a general-purpose 125-v 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.

### Unit-Powered Type

A unit-mounted transformer is factory-installed to step-down the main power supply voltage to the unit to 115-v at the duplex receptacle. This option also includes a manual switch with fuse, located in a utility box and mounted on a bracket behind the convenience outlet; access is through the unit's control box access panel. See Fig. 34.

The primary leads to the convenience outlet transformer are not factory-connected. Selection of primary power source is a customer option. If local codes permit, the transformer primary leads can be connected at the line-side terminals on a unit-mounted non-fused disconnect or Heating, Air Conditioning and Refrigeration (HACR) breaker switch; this will provide service power to the unit when the unit disconnect switch or HACR switch is open. Other connection methods will result in the convenience outlet circuit being de-energized when the unit disconnect or HACR switch is open. See Fig. 36.



| UNIT<br>VOLTAGE | CONNECT<br>AS | PRIMARY<br>CONNECTIONS                 | TRANSFORMER<br>TERMINALS |
|-----------------|---------------|----------------------------------------|--------------------------|
| 208,230         | 240           | L1: RED +YEL<br>L2: BLU + GRA          | H1 + H3<br>H2 + H4       |
| 460             | 480           | L1: RED<br>Splice BLU + YEL<br>L2: GRA | H1<br>H2 + H3<br>H4      |
| 575             | 600           | L1: RED<br>L2: GRA                     | H1<br>H2                 |

### Fig. 36 — Powered Convenience Outlet Wiring

## Duty Cycle

The unit-powered convenience outlet has a duty cycle limitation. The transformer is intended to provide power on an intermittent basis for service tools, lamps, etc; it is not intended to provide 15A loading for continuous duty loads (such as electric heaters for overnight use). Observe a 50% limit on circuit loading above 8A (i.e., limit loads exceeding 8A to 30 minutes of operation every hour).

## Maintenance

Periodically test the GFCI receptacle by pressing the TEST button on the face of the receptacle. This should cause the internal circuit of the receptacle to trip and open the receptacle. Check for proper grounding wires and power line phasing if the GFCI receptacle does not trip as required. Press the RESET button to clear the tripped condition.

## Fuse on Powered Type

The factory fuse is a Bussmann Fusetron™ T-15, non-renewable screw-in (Edison base) type plug fuse.

## 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.

## SMOKE DETECTORS

Smoke detectors are available as factory-installed options on 48FC models. Smoke detectors may be specified for supply air only, 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.

## System

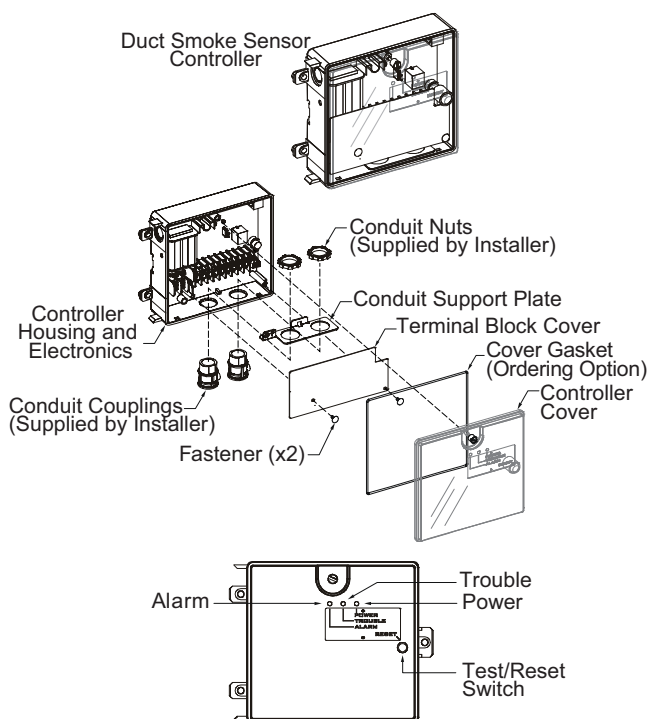
The smoke detector system consists of a four-wire controller and one or two sensors. Its primary function is to shut down the rooftop unit in order to prevent smoke from circulating throughout the building. It is not to be used as a life saving device.

## Controller

The controller (see Fig. 37) 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).

## Smoke Detector Sensor

The smoke detector sensor (see Fig. 38) 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).



**Fig. 37 — Controller Assembly**

1. Third-party trademarks and logos are the property of their respective owners.

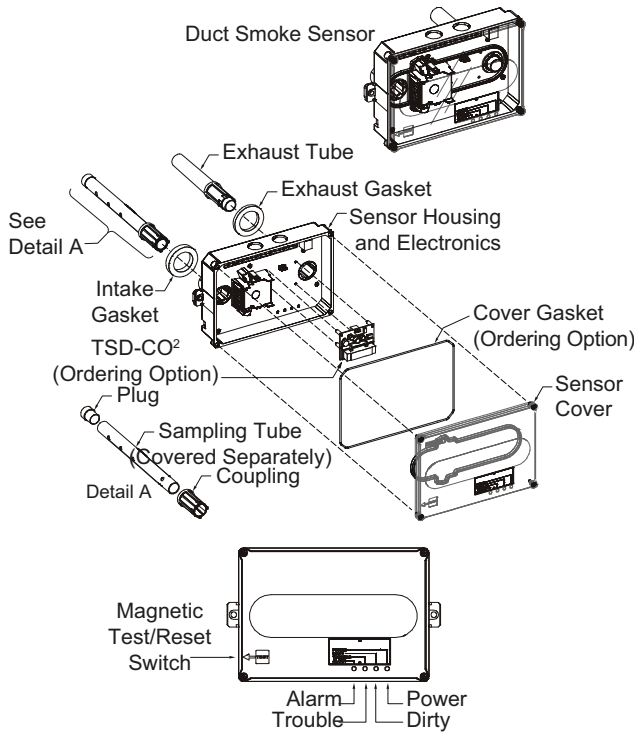
Air is introduced to the duct smoke detector sensor's sensing chamber through a sampling tube that extends into the HVAC duct and is directed back into the ventilation system through a (shorter) exhaust tube.

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.

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.

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

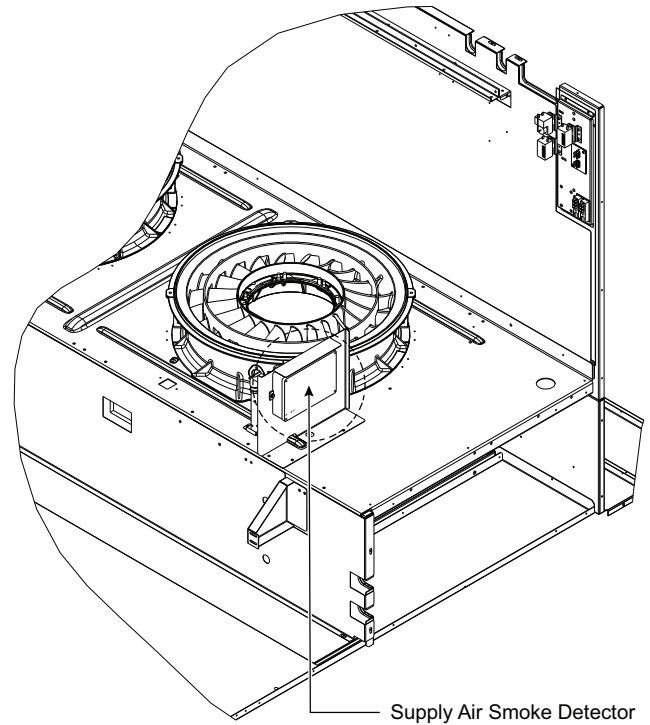


**Fig. 38 — Smoke Detector Sensor**

## Smoke Detector Locations

### SUPPLY AIR

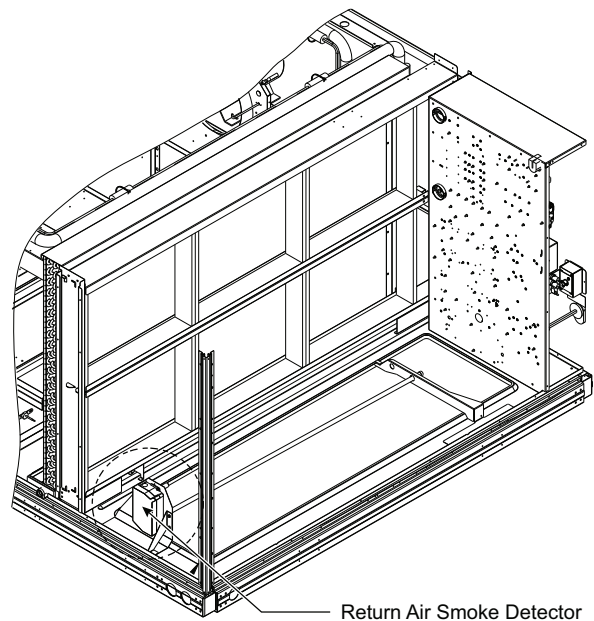
The supply air smoke detector sensor is located to the right of the unit's indoor (supply) fan. See Fig. 39. Access is through the fan access panel. The sampling tube inlet extends through the fan deck (into a high pressure area). The controller is located on a bracket to the right of the return filter, accessed through the lift-off filter panel.



**Fig. 39 — Typical Supply Air Smoke Detector Sensor Location**

### RETURN AIR SMOKE DETECTOR SENSOR WITHOUT ECONOMIZER

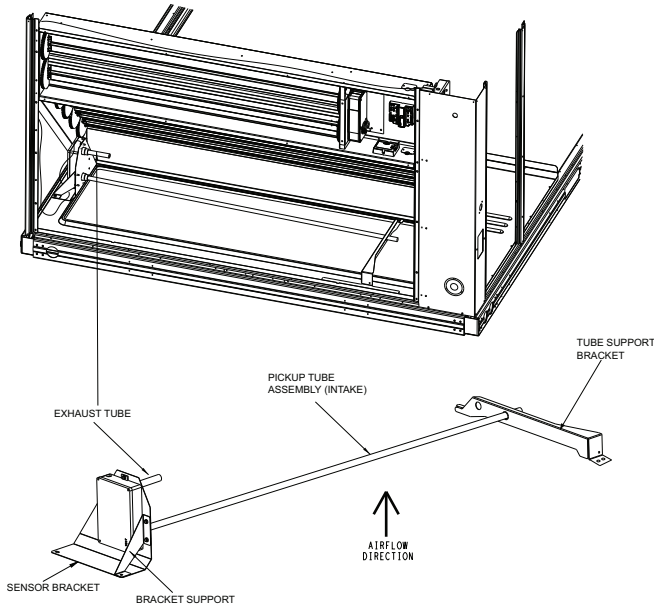
The sampling tube is located across the return air opening on the unit basepan. See Fig. 40. The holes in the sampling tube face into the return air stream. The sampling tube is connected through tubing to the return air sensor that is mounted in the unit control box. The smoke control harness is located in the box and should be routed through the return air section and connected to the smoke detector sensor.



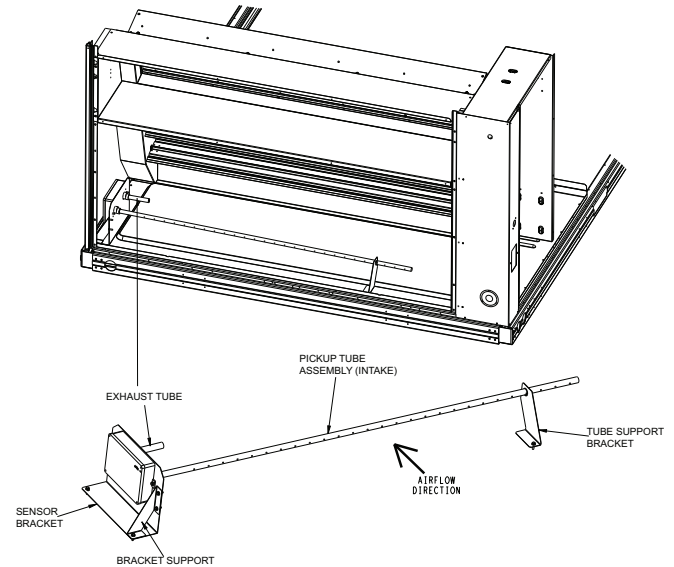
**Fig. 40 — Typical Return Air Smoke Detector Location**

## RETURN AIR SMOKE DETECTOR SENSOR 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. The holes in the sampling tube face into the return air stream. See figures 41 and 42 for sensor assembly locations, sampling tube location and orientation, and airflow direction example. The sampling tube is connected using tubing to the return air sensor mounted on a bracket low on the partition, near the return air filter and opposite the controller location.



**Fig. 41 — Vertical Return Air Sampling Sensor Assembly and Tube Location**  
(View reoriented to show opposite side for clarity.)



**Fig. 42 — Horizontal Return Air Sampling Sensor Assembly and Tube Location**  
(View reoriented to show opposite side for clarity.)

## FIOP Smoke Detector Wiring and Response

### ALL UNITS

The FIOP smoke detector is configured to automatically shut down all unit operations when a smoke condition is detected. See Fig. 43, Smoke Detector Wiring.

### HIGHLIGHT A

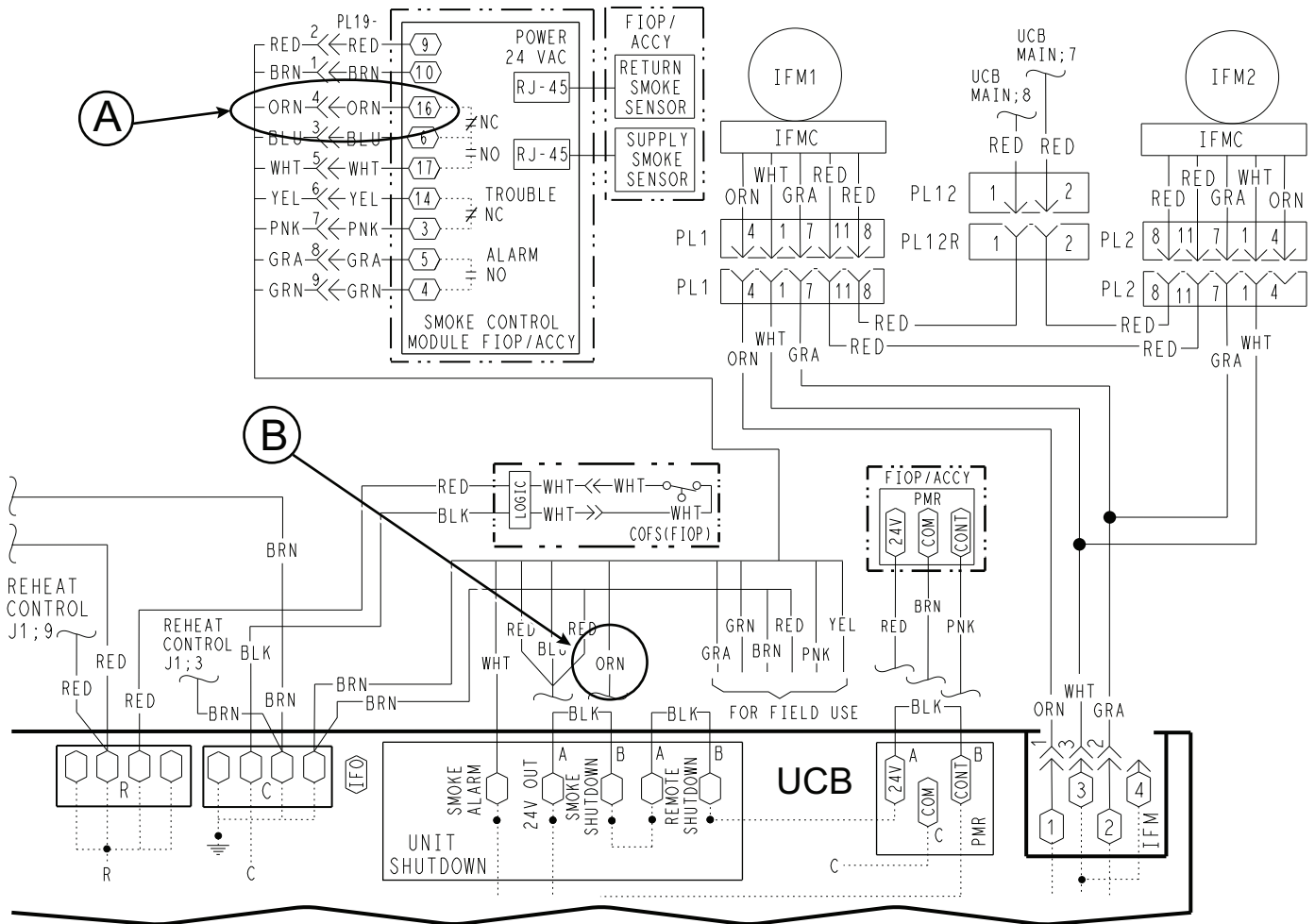
Smoke detector NC contact set will open on smoke alarm condition, de-energizing the ORN conductor.

### HIGHLIGHT B

24-v power signal using the ORN lead is removed at the smoke detector input on UCB; all unit operations cease immediately.

### ADDITIONAL APPLICATION DATA

Refer to the application data document “Factory Installed Smoke Detectors for Small and Medium Rooftop Units 2-25 Tons” for discussions on additional control features of these smoke detectors including multiple unit coordination.



**Fig. 43 — Typical Smoke Detector System Wiring**

## SENSOR AND CONTROLLER TESTS

### Sensor Alarm Test

The sensor alarm test checks a sensor's ability to signal an alarm state. This test requires use of a field provided SD-MAG test magnet.

**IMPORTANT:** Failure to follow this ALERT can result in an unnecessary evacuation of the facility.

This test places the duct detector into the alarm state. Unless part of the test, disconnect all auxiliary equipment from the controller before performing the test. If the duct detector is connected to a fire alarm system, notify the proper authorities before performing the test.

#### SENSOR ALARM TEST PROCEDURE

1. Hold the test magnet where indicated on the side of the sensor housing for seven seconds.
2. Verify that the sensor's Alarm LED turns on.
3. Reset the sensor by holding the test magnet against the sensor housing for two seconds.
4. Verify that the sensor's Alarm LED turns off.

### Controller Alarm Test

The controller alarm test checks the controller's ability to initiate and indicate an alarm state.

#### Controller Alarm Test Procedure

1. Press the controller's test/reset switch for seven seconds.
2. Verify that the controller's Alarm LED turns on.
3. Reset the sensor by pressing the test/reset switch for two seconds.
4. Verify that the controller's Alarm LED turns off.

**IMPORTANT:** Failure to follow this ALERT can result in an unnecessary evacuation of the facility.

This test places the duct detector into the alarm state. Unless part of the test, disconnect all auxiliary equipment from the controller before performing the test. If the duct detector is connected to a fire alarm system, notify the proper authorities before performing the test.

### Dirty Controller Test

The dirty controller test checks the controller's ability to initiate a dirty sensor test and indicate its results.

**IMPORTANT:** Failure to follow this ALERT can result in an unnecessary evacuation of the facility.

Pressing the controller's test/reset switch for longer than seven seconds will put the duct detector into the alarm state and activate all automatic alarm responses.

#### DIRTY CONTROLLER TEST PROCEDURE

1. Press the controller's test/reset switch for two seconds.
2. Verify that the controller's Trouble LED flashes.

### Dirty Sensor Test

The dirty sensor test provides an indication of the sensor's ability to compensate for gradual environmental changes. A sensor that can no longer compensate for environmental changes is considered 100% dirty and requires cleaning or replacing. A field provided SD-MAG test magnet must be used to initiate a sensor dirty test. The sensor's Dirty LED indicates the results of the dirty test as shown in Table 2.

**IMPORTANT:** Failure to follow this ALERT can result in an unnecessary evacuation of the facility.

Holding the test magnet against the sensor housing for more than seven seconds will put the duct detector into the alarm state and activate all automatic alarm responses.

**Table 2 — Dirty LED Test**

| FLASHES | DESCRIPTION                                          |
|---------|------------------------------------------------------|
| 1       | 0-25% dirty. (Typical of a newly installed detector) |
| 2       | 25-50% dirty                                         |
| 3       | 51-75% dirty                                         |
| 4       | 76-99% dirty                                         |

#### DIRTY SENSOR TEST PROCEDURE

1. Hold the test magnet where indicated on the side of the sensor housing for two seconds.
2. Verify that the sensor's Dirty LED flashes.

**IMPORTANT:** Failure to follow this ALERT can result in an unnecessary evacuation of the facility.

Changing the dirty sensor test operation will put the detector into the alarm state and activate all automatic alarm responses. Before changing dirty sensor test operation, disconnect all auxiliary equipment from the controller and notify the proper authorities if connected to a fire alarm system.

### Changing the Dirt Sensor Test

By default, sensor dirty test results are indicated by:

- The sensor's Dirty LED flashing.
- The controller's Trouble LED flashing.
- The controller's supervision relay contacts toggle.

The operation of a sensor's dirty test can be changed so that the controller's supervision relay is not used to indicate test results. When two detectors are connected to a controller, sensor dirty test operation on both sensors must be configured to operate in the same manner.

#### TO CONFIGURE THE DIRTY SENSOR TEST OPERATION

1. Hold the test magnet where indicated on the side of the sensor housing until the sensor's Alarm LED turns on and its Dirty LED flashes twice (approximately 60 seconds).
2. Reset the sensor by removing the test magnet then holding it against the sensor housing again until the sensor's Alarm LED turns off (approximately 2 seconds).

### Remote Station Test

The remote station alarm test checks a test/reset station's ability to initiate and indicate an alarm state.

**IMPORTANT:** Failure to follow this ALERT can result in an unnecessary evacuation of the facility.

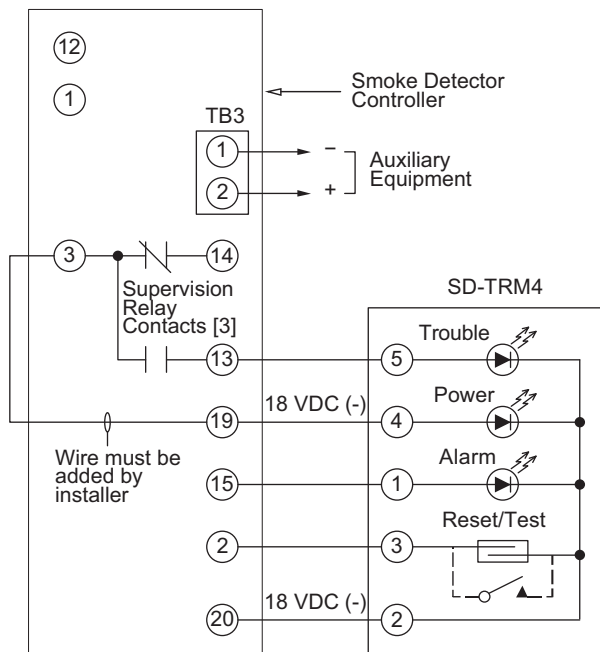
This test places the duct detector into the alarm state. Unless part of the test, disconnect all auxiliary equipment from the controller before performing the test. If the duct detector is connected to a fire alarm system, notify the proper authorities before performing the test.

### SD-TRK4 Remote Alarm Test Procedure

1. Turn the key switch to the RESET/TEST position for seven seconds.
2. Verify that the test/reset station's Alarm LED turns on.
3. Reset the sensor by turning the key switch to the RESET/TEST position for two seconds.
4. Verify that the test/reset station's Alarm LED turns off.

### Remote Test/Reset Station Dirty Sensor Test

The test/reset station dirty sensor test checks the test/reset station's ability to initiate a sensor dirty test and indicate the results. It must be wired to the controller as shown in Fig. 44 and configured to operate the controller's supervision relay. For more information, see "Dirty Sensor Test" on page 34.



**Fig. 44 — Remote Test/Reset Station Connections**

**IMPORTANT:** Failure to follow this ALERT can result in an unnecessary evacuation of the facility.

If the test/reset station's key switch is left in the RESET/TEST position for longer than seven seconds, the detector will automatically go into the alarm state and activate all automatic alarm responses.

**IMPORTANT:** Failure to follow this ALERT can result in an unnecessary evacuation of the facility.

Holding the test magnet to the target area for longer than seven seconds will put the detector into the alarm state and activate all automatic alarm responses.

### Dirty Sensor Test Using an SD-TRK4

1. Turn the key switch to the RESET/TEST position for two seconds.
2. Verify that the test/reset station's Trouble LED flashes.

### Detector Cleaning

#### CLEANING THE SMOKE DETECTOR

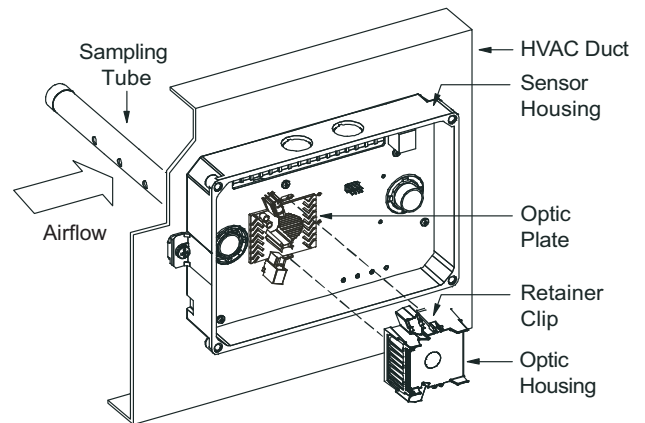
Clean the duct smoke sensor when the Dirty LED is flashing continuously or sooner, if conditions warrant.

#### IMPORTANT: OPERATIONAL TEST ALERT

Failure to follow this ALERT can result in an unnecessary evacuation of the facility.

If the smoke detector is connected to a fire alarm system, first notify the proper authorities that the detector is undergoing maintenance then disable the relevant circuit to avoid generating a false alarm.

1. Disconnect power from the duct detector then remove the sensor's cover. See Fig. 45.
2. Using a vacuum cleaner, clean compressed air, or a soft bristle brush, remove loose dirt and debris from inside the sensor housing and cover. Use isopropyl alcohol and a lint-free cloth to remove dirt and other contaminants from the gasket on the sensor's cover.



**Fig. 45 — Sensor Cleaning Diagram**

3. Squeeze the retainer clips on both sides of the optic housing.
4. Lift the housing away from the printed circuit board.
5. Gently remove dirt and debris from around the optic plate and inside the optic housing.
6. Replace the optic housing and sensor cover.
7. Connect power to the duct detector then perform a sensor alarm test.

## Indicators

### NORMAL STATE

The smoke detector operates in the normal state in the absence of any trouble conditions and when its sensing chamber is free of smoke. In the normal state, the Power LED on both the sensor and the controller are on and all other LEDs are off.

### ALARM STATE

The smoke detector enters the alarm state when the amount of smoke particulate in the sensor's sensing chamber exceeds the alarm threshold value. (See Table 3.) Upon entering the alarm state:

- The sensor's Alarm LED and the controller's Alarm LED turn on.
- The contacts on the controller's two auxiliary relays switch positions.
- The contacts on the controller's alarm initiation relay close.
- The controller's remote alarm LED output is activated (turned on).
- The controller's high impedance multiple fan shutdown control line is pulled to ground Trouble state.

The SuperDuct™ duct smoke detector enters the trouble state under the following conditions:

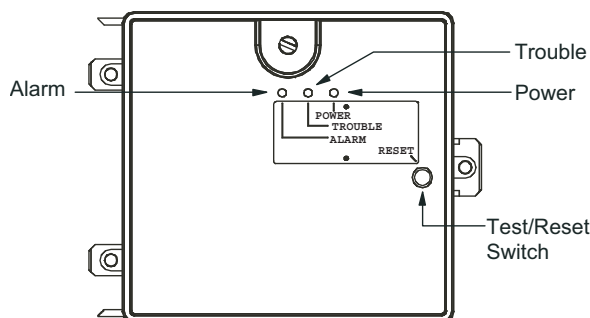
- A sensor's cover is removed and 20 minutes pass before it is properly secured.
- A sensor's environmental compensation limit is reached (100% dirty).
- A wiring fault between a sensor and the controller is detected.

An internal sensor fault is detected upon entering the trouble state:

- The contacts on the controller's supervisory relay switch positions. (See Fig. 46.)
- If a sensor trouble, the sensor's Trouble LED the controller's Trouble LED turn on.
- If 100% dirty, the sensor's Dirty LED turns on and the controller's Trouble LED flashes continuously.
- If a wiring fault between a sensor and the controller, the controller's Trouble LED turns on but not the sensor's.

**Table 3 — Detector Indicators**

| CONTROL OR INDICATOR              | DESCRIPTION                                                                                                               |
|-----------------------------------|---------------------------------------------------------------------------------------------------------------------------|
| <b>Magnetic test/reset switch</b> | Resets the sensor when it is in the alarm or trouble state. Activates or tests the sensor when it is in the normal state. |
| <b>Alarm LED</b>                  | Indicates the sensor is in the alarm state.                                                                               |
| <b>Trouble LED</b>                | Indicates the sensor is in the trouble state.                                                                             |
| <b>Dirty LED</b>                  | Indicates the amount of environmental compensation used by the sensor (flashing continuously = 100%)                      |
| <b>Power LED</b>                  | Indicates the sensor is energized.                                                                                        |



**Fig. 46 — Controller Assembly**

**NOTE:** All troubles are latched by the duct smoke detector. The trouble condition must be cleared and then the duct smoke detector must be reset in order to restore it to the normal state.

### RESETTING ALARM AND TROUBLE CONDITION TRIPS

Manual reset is required to restore smoke detector systems to Normal operation. For installations using two sensors, the duct smoke detector does not differentiate which sensor signals an alarm or trouble condition. Check each sensor for Alarm or Trouble status (indicated by LED). Clear the condition that has generated the trip at this sensor. Then reset the sensor by pressing and holding the reset button (on the side) for 2 seconds. Verify that the sensor's Alarm and Trouble LEDs are now off. At the controller, clear its Alarm or Trouble state by pressing and holding the manual reset button (on the front cover) for 2 seconds. Verify that the controller's Alarm and Trouble LEDs are now off. Replace all panels.

## Troubleshooting

### CONTROLLER'S TROUBLE LED IS ON

1. Check the Trouble LED on each sensor connected to the controller. If a sensor's Trouble LED is on, determine the cause and make the necessary repairs.
2. Check the wiring between the sensor and the controller. If wiring is loose or missing, repair or replace as required.

### CONTROLLER'S TROUBLE LED IS FLASHING

1. One or both of the sensors is 100% dirty.
2. Determine which Dirty LED is flashing then clean that sensor assembly as described in the detector cleaning section.

### SENSOR'S TROUBLE LED IS ON

1. Check the sensor's Dirty LED. If it is flashing, the sensor is dirty and must be cleaned.
2. Check the sensor's cover. If it is loose or missing, secure the cover to the sensor housing.
3. Replace sensor assembly.

### SENSOR'S POWER LED IS OFF

1. Check the controller's Power LED. If it is off, determine why the controller does not have power and make the necessary repairs.
2. Check the wiring between the sensor and the controller. If wiring is loose or missing, repair or replace as required.

### CONTROLLER'S POWER LED IS OFF

1. Make sure the circuit supplying power to the controller is operational. If not, make sure JP2 and JP3 are set correctly on the controller before applying power.
2. Verify that power is applied to the controller's supply input terminals. If power is not present, replace or repair wiring as required.

### REMOTE TEST/RESET STATION'S TROUBLE LED DOES NOT FLASH WHEN PERFORMING A DIRTY TEST, BUT THE CONTROLLER'S TROUBLE LED DOES

1. Verify that the remote test/station is wired as shown in Fig. 44. Repair or replace loose or missing wiring.
2. Configure the sensor dirty test to activate the controller's supervision relay. See "Dirty Sensor Test" on page 34.

### SENSOR'S TROUBLE LED IS ON, BUT THE CONTROLLER'S TROUBLE LED IS OFF

Remove JMP1 on the controller.

## PROTECTIVE DEVICES

### Compressor Protection

#### OVERCURRENT

The compressor has internal line-break motor protection.

#### OVERTEMPERATURE

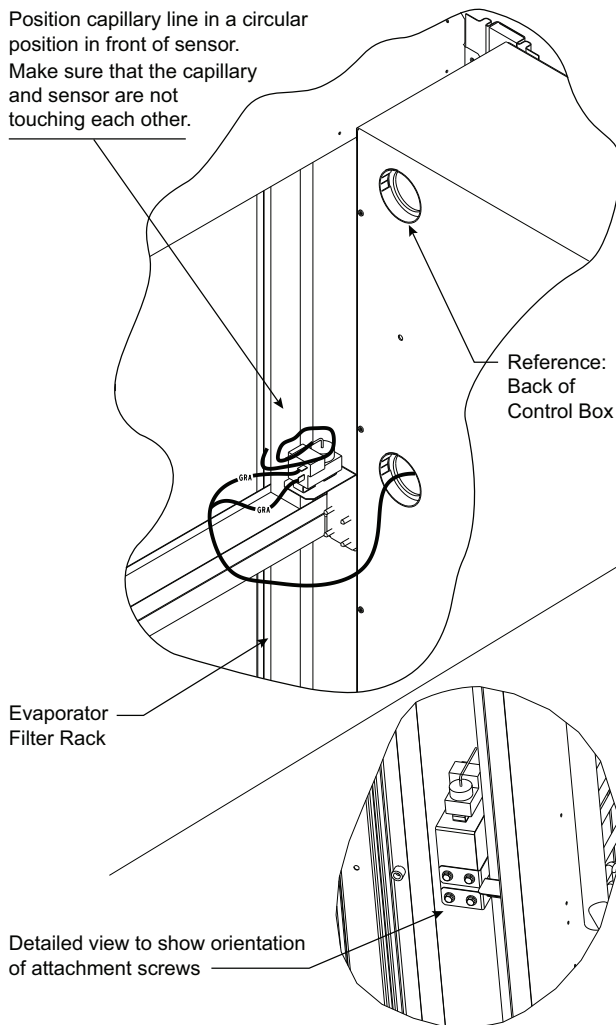
The compressor has an internal protector to protect it against excessively high discharge gas temperatures.

#### MIXED TEMPERATURE SENSOR

The Mixed Temperature Sensor (MTS) is installed on the return side of the unit filter bracket. See Fig. 47.

The switch opens to prevent mechanical cooling operation at low return temperatures (below 60°F [ $\pm 1.5^\circ\text{F}$ ]). When the switch is open, compressor operation is disabled but indoor fan and economizer operation may continue.

The switch closes when return air warms to 65°F ( $\pm 1.5^\circ\text{F}$ ) allowing compressor operation to resume.



**Fig. 47 — Mixed Temperature Sensor Location**

#### HIGH PRESSURE SWITCH

The system is provided with a high pressure switch mounted on the discharge line. The switch is stem-mounted and brazed into the discharge tube. Trip setting is 630 psig  $\pm 10$  psig (4344  $\pm 69$  kPa) when hot. Reset is automatic at 505 psig (3482 kPa).

#### LOW PRESSURE SWITCH

The system is protected against a loss of charge and low evaporator coil loading condition by a low pressure switch located on the suction line near the compressor. The switch is stem-mounted. Trip setting is 54 psig  $\pm 5$  psig (372  $\pm 34$  kPa). Reset is automatic at 117  $\pm 5$  psig (807  $\pm 34$  kPa).

#### EVAPORATOR FREEZE PROTECTION

The system is protected against evaporator coil frosting and low temperature conditions by a temperature switch mounted on the evaporator coil hairpin. Trip setting is 30°F  $\pm 5^\circ\text{F}$  ( $-1^\circ\text{C} \pm 3^\circ\text{C}$ ). Reset is automatic at 45°F (7°C).

#### SUPPLY (INDOOR) FAN MOTOR PROTECTION

Disconnect and lockout power when servicing fan motor.

Supply fan motors contain a safety relay that opens in the event of a fault. This relay protects the motor against certain supply power conditions as well as over-temperature and over-current protection. If the relay is open it will remove 24V to R on the UCB and will also prevent cooling/heating operation to protect the unit until the fault condition clears. Do not bypass this switch to correct trouble. Determine the cause and correct it. (See Table 4.)

#### CONDENSER FAN MOTOR PROTECTION

The condenser fan motor is internally protected against over-temperature.

#### Relief Device

A soft solder joint at the suction service access port provides pressure relief under abnormal temperature and pressure conditions (i.e., fire in building). Protect this joint during brazing operations near this joint.

#### Control Circuit, 24-V

The control circuit is protected against over-current conditions by a circuit breaker mounted on control transformer TRAN. Reset is manual.

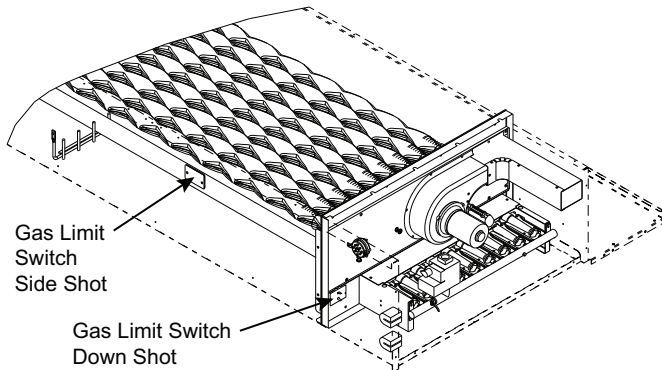
**Table 4 — Supply Fan Motor Logic and Safety Relays**

| DESCRIPTION                       | START DELAY                                                                                                                                                                                                                              |
|-----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| No Error                          | —                                                                                                                                                                                                                                        |
| NTC Over-Temperature Protection   | Automatic Reset – Motor starts 12 seconds after the temperature falls below reset limit.                                                                                                                                                 |
| Phase Fault                       | Automatic Reset – Motor to start after 3 phases present.                                                                                                                                                                                 |
| Over Current Protection           | Automatic Reset – If motor over-current protection trips, motor restarts after 20 seconds off time. If over-current is detected 3 times consecutively, the motor is off for 3 minutes and restarts. Cycle starts again after 20 seconds. |
| Locked Rotor Protection, Start-up | Automatic Reset – If motor detects locked rotor, it attempts to restart after 5 seconds.                                                                                                                                                 |
| Locked Rotor Protection, Running  | If motor detects 3 consecutive faults, the motor waits 3 minutes and restarts. Cycle starts again after 20 seconds.                                                                                                                      |
| Over/Under Voltage                | Automatic Reset – Motor restarts as soon as input voltage is back within $\pm 10\%$ .                                                                                                                                                    |
| Current Sampling Error            | Manual Reset – Power off and wait 2 minutes and restart motor.                                                                                                                                                                           |
| Microelectronic (MCU) Fault       | Automatic Reset – Motor restarts 3 minutes after fault clears.<br>Manual Reset – Power off and wait 2 minutes and restart motor.                                                                                                         |

## GAS HEATING SYSTEM

### General

The heat exchanger system consists of a gas valve feeding multiple in-shot burners off a manifold. The burners fire into matching primary tubes. The primary tubes discharge into combustion plenum where gas flow converges into secondary tubes. The secondary tubes exit into the induced draft fan wheel inlet. The induced fan wheel discharges into a flue passage and flue gases exit out a flue hood on the side of the unit. The induced draft fan motor includes a flue gas pressure switch circuit that confirms adequate wheel speed through the Integrated Gas Control (IGC) board. Safety switches include a Rollout Switch (located in the burner section; see Fig. 54) and a limit switch (mounted through the side of the heat exchanger cover panel [Gas Limit Switch Side Shot] and through the vestibule plate [Gas Limit Switch Down Shot]). (See Fig. 48.)



**Fig. 48 — Gas Limit Switch Location**

### Fuel Types and Pressures

#### NATURAL GAS

The 48FC unit is factory-equipped for use with natural gas (NG) fuel at elevation under 2000 ft (610 m). See section “Orifice Replacement” for information in modifying this unit for installation at elevations above 2000 ft (610 m).

Gas line pressure entering the unit’s main gas valve must be within specified ranges (see Table 5). Adjust unit gas regulator valve as required or consult local gas utility.

**Table 5 — Natural Gas Supply Line Pressure Ranges**

| UNIT MODEL | UNIT SIZE      | MIN.                    | MAX.                     |
|------------|----------------|-------------------------|--------------------------|
| 48FC**     | 20, 24, 28, 30 | 5.0 in. wg<br>(1246 Pa) | 13.0 in. wg<br>(3240 Pa) |

Manifold pressure is factory-adjusted for NG fuel use. Adjust as required to obtain best flame characteristic (see Table 6).

**Table 6 — Natural Gas Manifold Pressure Ranges**

| UNIT MODEL | UNIT SIZE      | HIGH FIRE              | LOW FIRE               |
|------------|----------------|------------------------|------------------------|
| 48FC**     | 20, 24, 28, 30 | 3.0 in. wg<br>(748 Pa) | 2.0 in. wg<br>(498 Pa) |

#### LIQUID PROPANE

Accessory packages are available for field-installation that will convert the 48FC unit to operate with liquid propane (LP) fuels. These kits include new orifice spuds, new springs for gas valves and a supply line low pressure switch. See High Altitude Gas Conversion Kit Gas Heating/Electric Cooling 3-15 Ton Small Rooftop Units Accessory LP (Liquid Propane) Installation Instructions for details on orifice size selections.

Fuel line pressure entering unit gas valve must remain within specified range (see Table 7).

**Table 7 — Liquid Propane Supply Line Pressure Ranges**

| UNIT MODEL | UNIT SIZE      | MIN.                     | MAX.                     |
|------------|----------------|--------------------------|--------------------------|
| 48FC**     | 20, 24, 28, 30 | 11.0 in. wg<br>(2740 Pa) | 13.0 in. wg<br>(3240 Pa) |

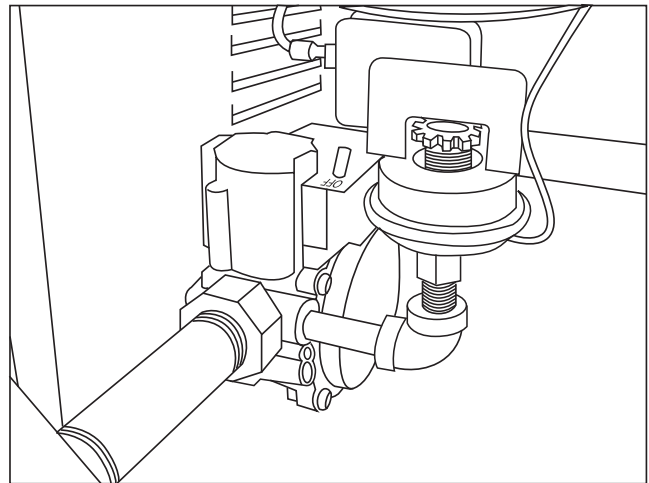
Manifold pressure for LP fuel use must be adjusted to specified range (see Table 8). Follow instructions in the accessory kit to make initial readjustment.

**Table 8 — Liquid Propane Manifold Pressure Ranges**

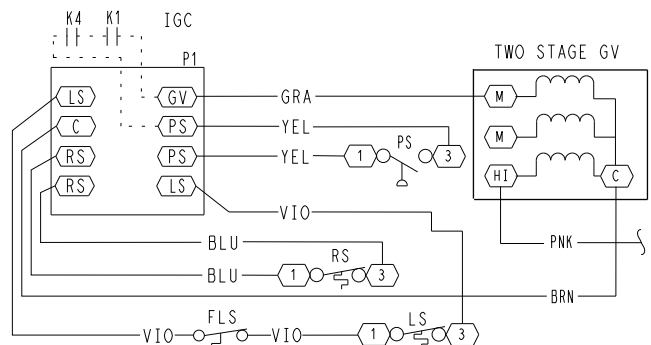
| UNIT MODEL | UNIT SIZE      | HIGH FIRE                | LOW FIRE                |
|------------|----------------|--------------------------|-------------------------|
| 48FC**     | 20, 24, 28, 30 | 11.0 in. wg<br>(2740 Pa) | 7.3 in. wg<br>(1819 Pa) |

#### SUPPLY PRESSURE SWITCH

The LP conversion kit includes a supply low pressure switch. The switch contacts (from terminal C to terminal NO) will open the gas valve power whenever the supply line pressure drops below the set point. See Fig. 49 and 50. If the low pressure remains open for 15 minutes during a call for heat, the IGC circuit will initiate a Ignition Fault (5 flashes) lockout. Reset of the low pressure switch is automatic on rise in supply line pressure. Reset of the IGC requires a recycle of unit power after the low pressure switch has closed.



**Fig. 49 — LP Low Pressure Switch (Installed)**



**Fig. 50 — LP Supply Line Low Pressure Switch Wiring**

This switch also prevents operation when the propane tank level is low, which can result in gas with a high concentration of impurities, additives, and residues that have settled to the bottom of the tank. Operation under these conditions can cause harm to the heat exchanger system. Contact your fuel supplier if this condition is suspected.

## Flue Gas Passageways

To inspect the flue collector box and upper areas of the heat exchanger:

1. Remove the combustion blower wheel and motor assembly according to directions in Combustion-Air Blower section. See Fig. 51.
2. Remove the vestibule plate to inspect the heat exchanger.
3. Clean all surfaces as required using a wire brush.

## Combustion-Air Blower

Clean periodically to assure proper airflow and heating efficiency. Inspect blower wheel every fall and periodically during heating season. For the first heating season, inspect blower wheel every two months to determine proper cleaning frequency.

To access burner section, slide the burner partition panel out of the unit.

To inspect blower wheel, shine a flashlight into draft hood opening. If cleaning is required, remove motor and wheel as follows:

1. Remove the screw at the base of the burner partition panel (see Fig. 53) and slide out the panel.
2. Remove the seven screws attaching the induced-draft motor housing to the vestibule plate. (See Fig. 51.)

3. The blower wheel can be cleaned at this point. If additional cleaning is required, continue with Steps 4 and 5.
4. Remove the blower from the motor shaft by removing two setscrews.
5. Removing motor: remove the four screws holding the motor to the mounting plate. Remove the motor cooling fan by removing one setscrew. Remove nuts that hold the motor to the mounting plate.
6. Reverse the procedure outlined above to reinstall the motor.

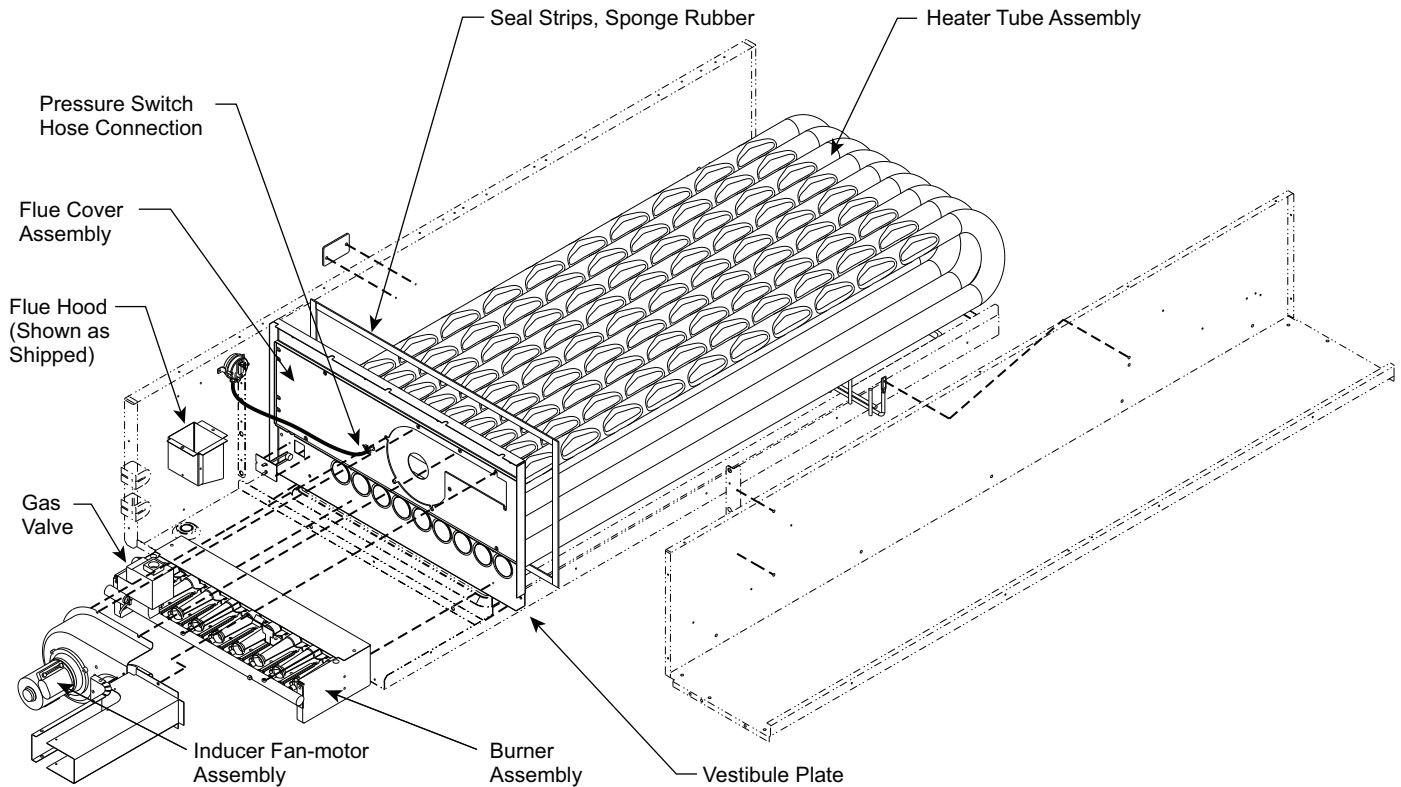
## Burners and Igniters

### ⚠ CAUTION

#### EQUIPMENT DAMAGE HAZARD

Failure to follow this CAUTION can result in premature wear and damage to equipment.

When working on gas train, do not hit or plug orifice spuds.



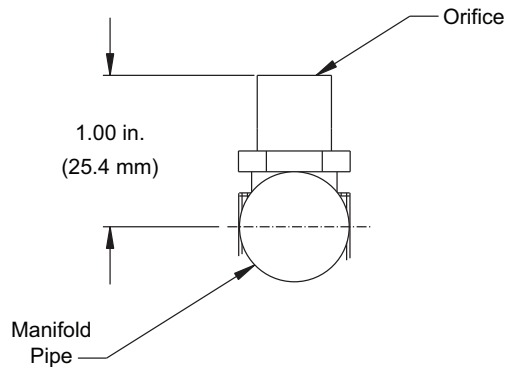
**Fig. 51 — Heat Exchanger Assembly**

## MAIN BURNERS

To access burners, remove the control box access panel and slide out burner partition panel. At the beginning of each heating season, inspect for deterioration or blockage due to corrosion or other causes. Observe the main burner flames and adjust, if necessary.

### Orifice projection

Refer to Fig. 52 for maximum projection dimension for orifice face to manifold tube.



**Fig. 52 — Orifice Projection**

## REMOVAL AND REPLACEMENT OF GAS TRAIN

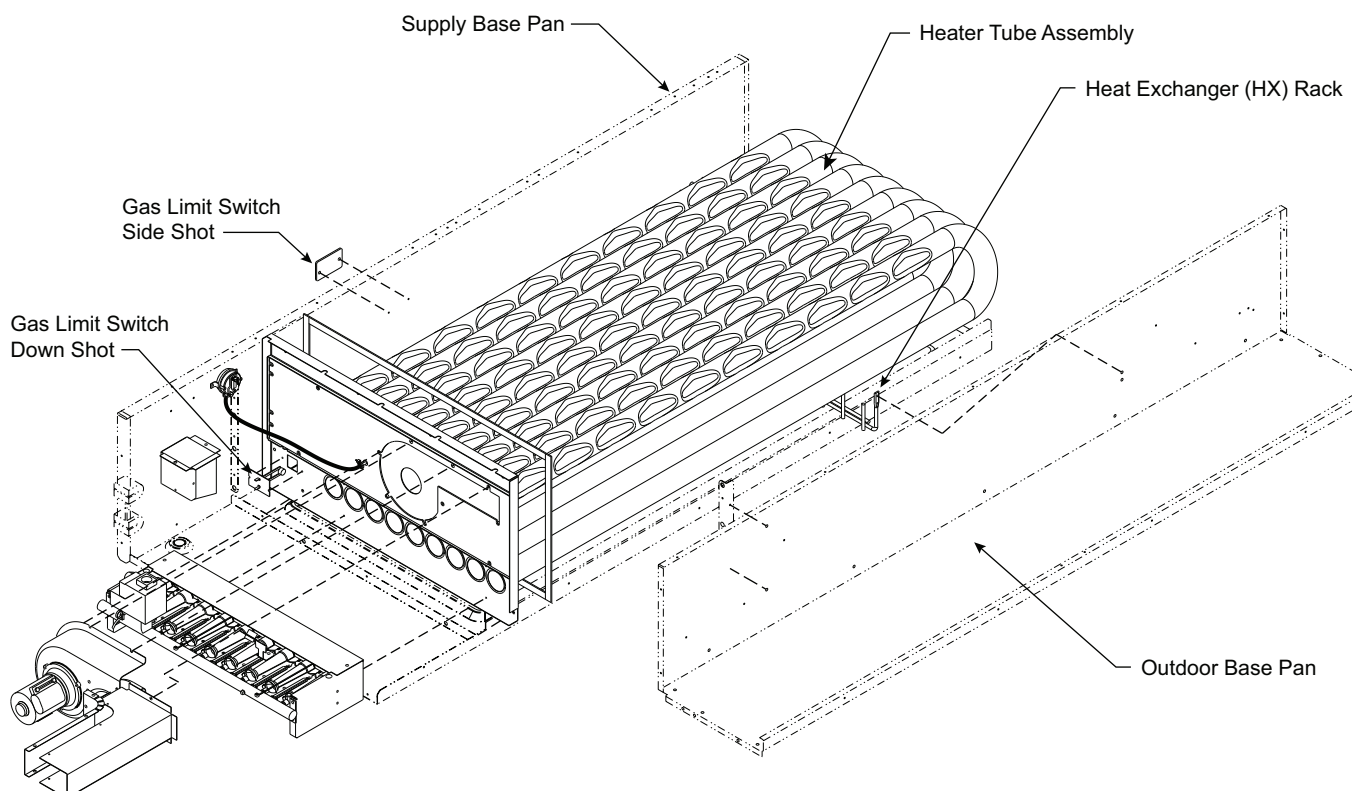
See Fig. 51, 53, 54, 55 and 56.

1. Shut off manual gas valve.
2. Shut off power to unit.
3. Remove the indoor blower access panel.
4. Remove the gas access panel.
5. Remove the screws at the base of the burner partition panel (see Fig. 55) and slide out the panel.

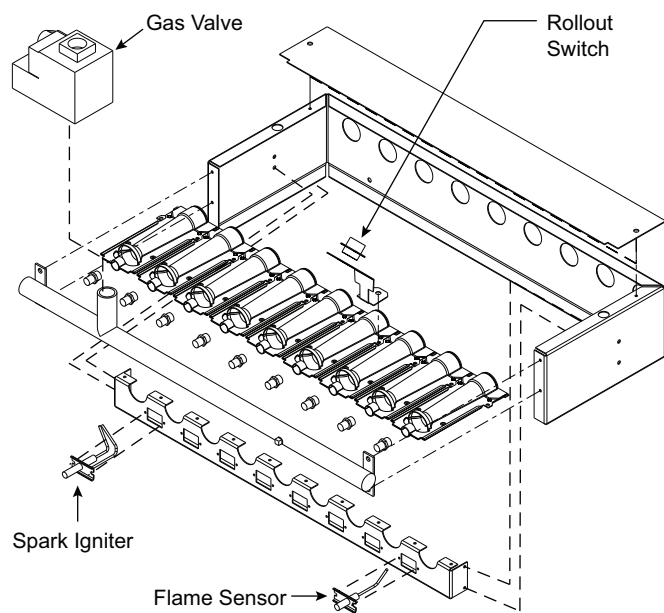
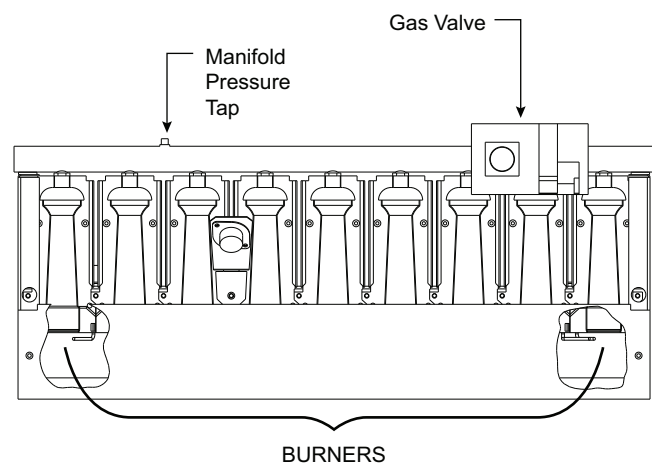
6. Disconnect gas piping at unit gas valve.
7. Remove wires connected to gas valve. Mark each wire.
8. Remove igniter wires and sensor wires at the Integrated Gas Unit Controller (IGC). (See Fig. 56.)
9. Remove the two screws attaching the burner rack to the vestibule plate (see Fig. 51).
10. Slide the burner tray out of the unit. (See Fig. 54.)
11. Reverse the procedures outlined above to reinstall the burner rack.

## CLEANING AND ADJUSTMENT

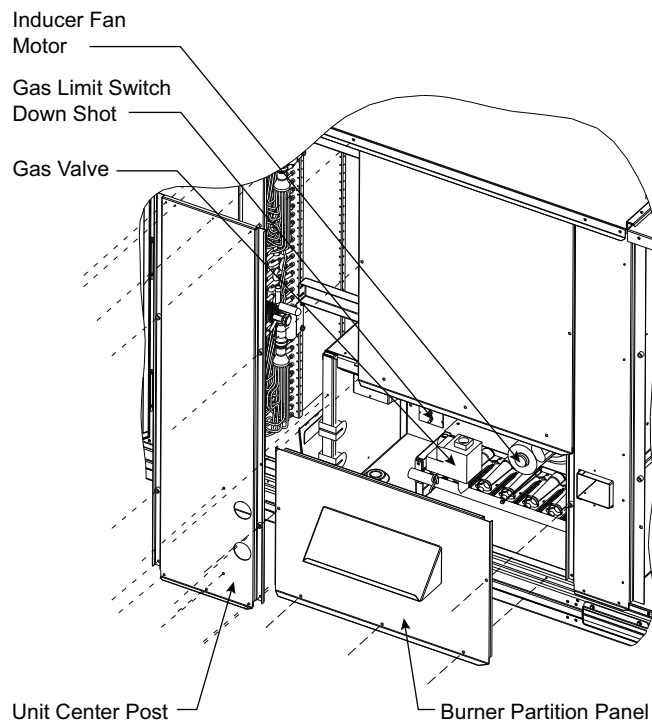
1. Remove burner rack from unit as described in "Removal and Replacement of Gas Train" section.
2. Inspect burners; if dirty, remove burners from rack. (Mark each burner to identify its position before removing from the rack.)
3. Use a soft brush to clean burners and cross-over port as required.
4. Adjust spark gap. (See Fig. 57.)
5. If factory orifice has been removed, check that each orifice is tight at its threads into the manifold pipe and that orifice projection does not exceed maximum value. (See Fig. 52.)
6. Reinstall burners on rack in the same locations as factory-installed. (The outside crossover flame regions of the outermost burners are pinched off to prevent excessive gas flow from the side of the burner assembly. If the pinched crossovers are installed between two burners, the flame will not ignite properly.)
7. Reinstall burner rack as described in "Removal and Replacement of Gas Train" section.



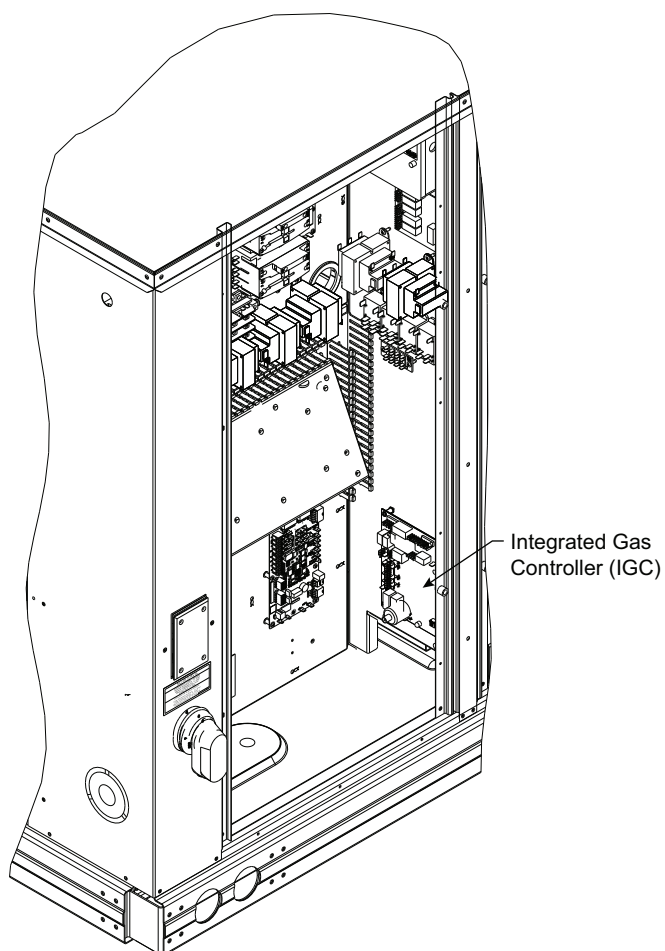
**Fig. 53 — Heat Exchanger Access - Gas Limit Switches and HX Rack Locations**



**Fig. 54 — Burner Tray Details**



**Fig. 55 — Burner Partition Pane and Unit Center Post**



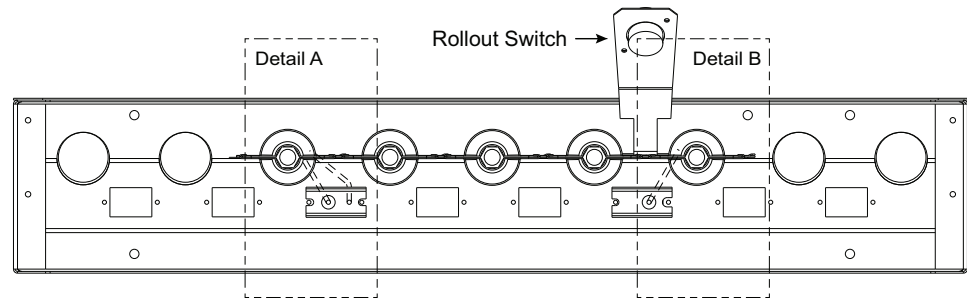
**Fig. 56 — Unit Control Box/IGC Location**

## REMOVING THE HEAT EXCHANGER

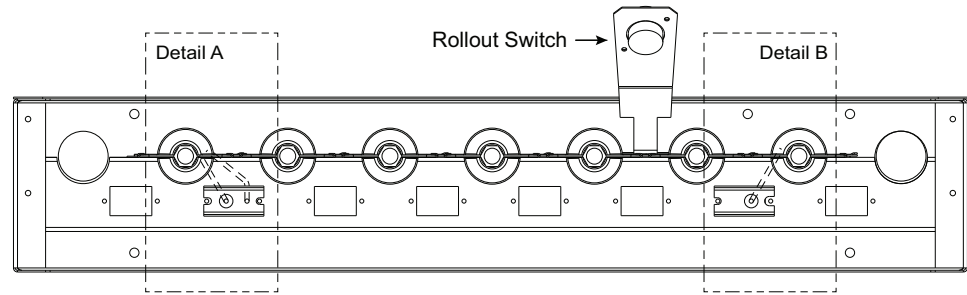
The following procedure details the steps to remove the heat exchanger from the unit.

1. Turn off electric power to the unit and shut off the unit's gas supply.
2. Remove the two exterior panels: control box access panel and indoor blower access panel.
3. Remove the unit center post (see Fig. 55).
4. Disconnect the two wires from the gas limit switch.
5. Remove the three interior panels: control box high voltage panel, burner partition panel, and heat exchanger cover panel.
6. Disconnect the wires connected to the gas valve. Mark each wire.
7. Disconnect the igniter wires and sensor wires at the integrated gas controller (IGC).
8. Disconnect a gas pipe union and remove the gas manifold with the gas valve.
9. Remove the two screws attaching the burner rack to the vestibule plate (see Fig. 51).
10. Remove the pressure switch hose from the connection on the flue cover assembly (see Fig. 51).
11. Remove the screws around the vestibule plate.
12. Remove the nuts holding the heat exchanger support rack to the fan deck (see Fig. 53).
13. Remove the heat exchanger from the unit.
14. Separate the following from the heat exchanger: inducer fan-motor assembly, flue cover assembly, retainer, regulator, and regulator gasket.

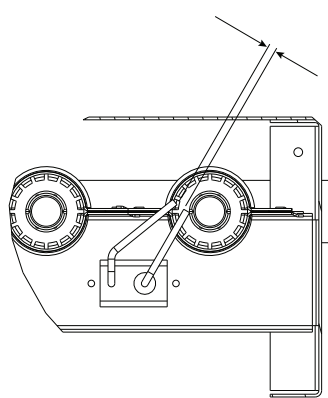
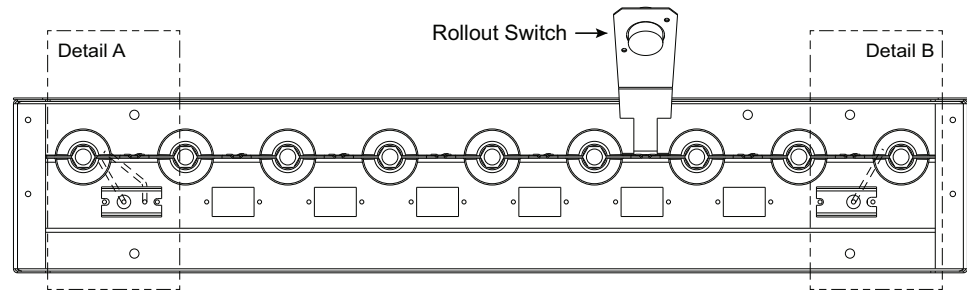
Low Heat



Medium Heat

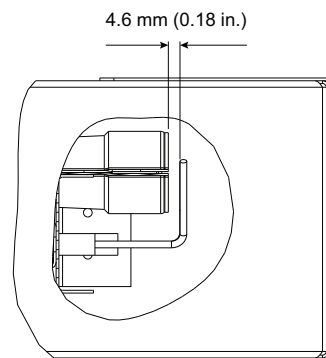


High Heat



Detail B

3.05 mm (0.12 in.)  
3.56 mm (0.14 in.)  
SPARK GAP

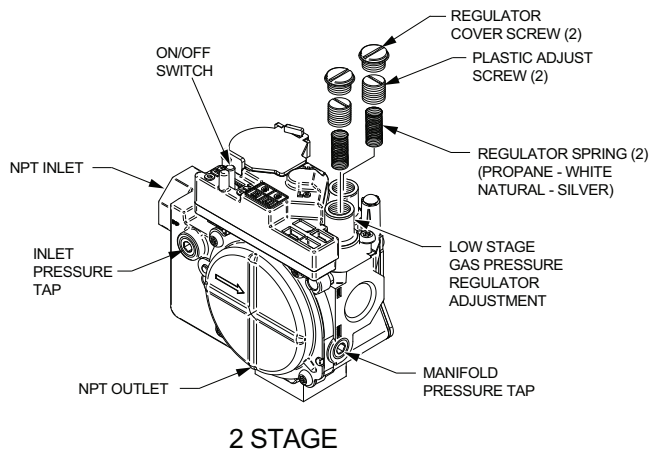


Detail A

**Fig. 57 — Spark Adjustment**

## GAS VALVE

All three-phase models are equipped with 2-stage gas valves. See Fig. 58 for locations of adjustment screws and features on the gas valve.



**Fig. 58 — Typical 2 Stage Gas Valve**

To adjust gas valve pressure settings:

**IMPORTANT:** Leak check all gas connections including the main service connection, gas valve, gas spuds, and manifold pipe plug. All leaks must be repaired before firing unit.

### CHECK UNIT OPERATION AND MAKE NECESSARY ADJUSTMENTS

**NOTE:** Gas supply pressure at gas valve inlet must be within specified ranges for fuel type and unit size. For natural gas see Tables 5 and 6. For liquid propane see Tables 7 and 8.

1. Slide out the burner partition panel.
2. Remove manifold pressure tap plug from manifold and connect pressure gauge or manometer. (See Fig. 54.)
3. Turn on electrical supply.
4. Turn on unit main gas valve.
5. Set room thermostat to call for heat. If unit has two-stage gas valve, verify high-stage heat operation before attempting to adjust manifold pressure.
6. When main burners ignite, check all fittings, manifold, and orifices for leaks.
7. Adjust high-stage pressure to specified setting by turning the plastic adjustment screw clockwise to increase pressure, counter-clockwise to decrease pressure.
8. For two-stage gas valves, set room thermostat to call for low-stage heat. Adjust low-stage pressure to specified setting.
9. Replace regulator cover screw(s) when finished.
10. Observe unit heating operation in both high stage and low stage operation if so equipped. Observe burner flames to see if they are blue in appearance, and that the flames are approximately the same for each burner.
11. Turn off unit, remove pressure manometer and replace the manifold pressure tap plug. (See Fig. 54.)

### LIMIT SWITCH

Remove the indoor blower access panel. Limit switch is located on the heat exchanger cover panel. See Fig. 53.

## Burner Ignition

Unit is equipped with a direct spark ignition 100% lockout system. The Integrated Gas Unit Controller (IGC) is located in the control box (see Fig. 56). The IGC contains a self-diagnostic LED (light-emitting diode). A single LED (see Fig. 59) on the IGC provides a visual display of operational or sequential problems when the power supply is uninterrupted. When a break in power occurs, the IGC will be reset (resulting in a loss of fault history) and the indoor (evaporator) fan ON/OFF times will be reset. The LED error code can be observed through the viewport. During servicing, refer to the label on the control box cover or Table 9 for an explanation of LED error code descriptions.

If lockout occurs, unit may be reset by interrupting power supply to unit for at least 5 seconds.

**Table 9 — LED Error Code Descriptions<sup>a</sup>**

| LED INDICATION       | ERROR CODE DESCRIPTION                              |
|----------------------|-----------------------------------------------------|
| ON                   | Normal Operation                                    |
| OFF                  | Hardware Failure                                    |
| 1 Flash <sup>b</sup> | Evaporator Fan On/Off Delay Modified                |
| 2 Flashes            | Limit Switch Fault                                  |
| 3 Flashes            | Flame Sense Fault                                   |
| 4 Flashes            | 4 Consecutive Limit Switch Faults                   |
| 5 Flashes            | Ignition Lockout Fault                              |
| 6 Flashes            | Induced-Draft Motor Fault/<br>Pressure Switch Fault |
| 7 Flashes            | Rollout Switch Fault                                |
| 8 Flashes            | Internal Control Fault                              |
| 9 Flashes            | Software Lockout                                    |

**NOTE(S):**

- a. A 3-second pause exists between LED error code flashes. If more than one error code exists, all applicable codes will be displayed in numerical sequence.
- b. Indicates a code that is not an error. The unit will continue to operate when this code is displayed.

### LEGEND

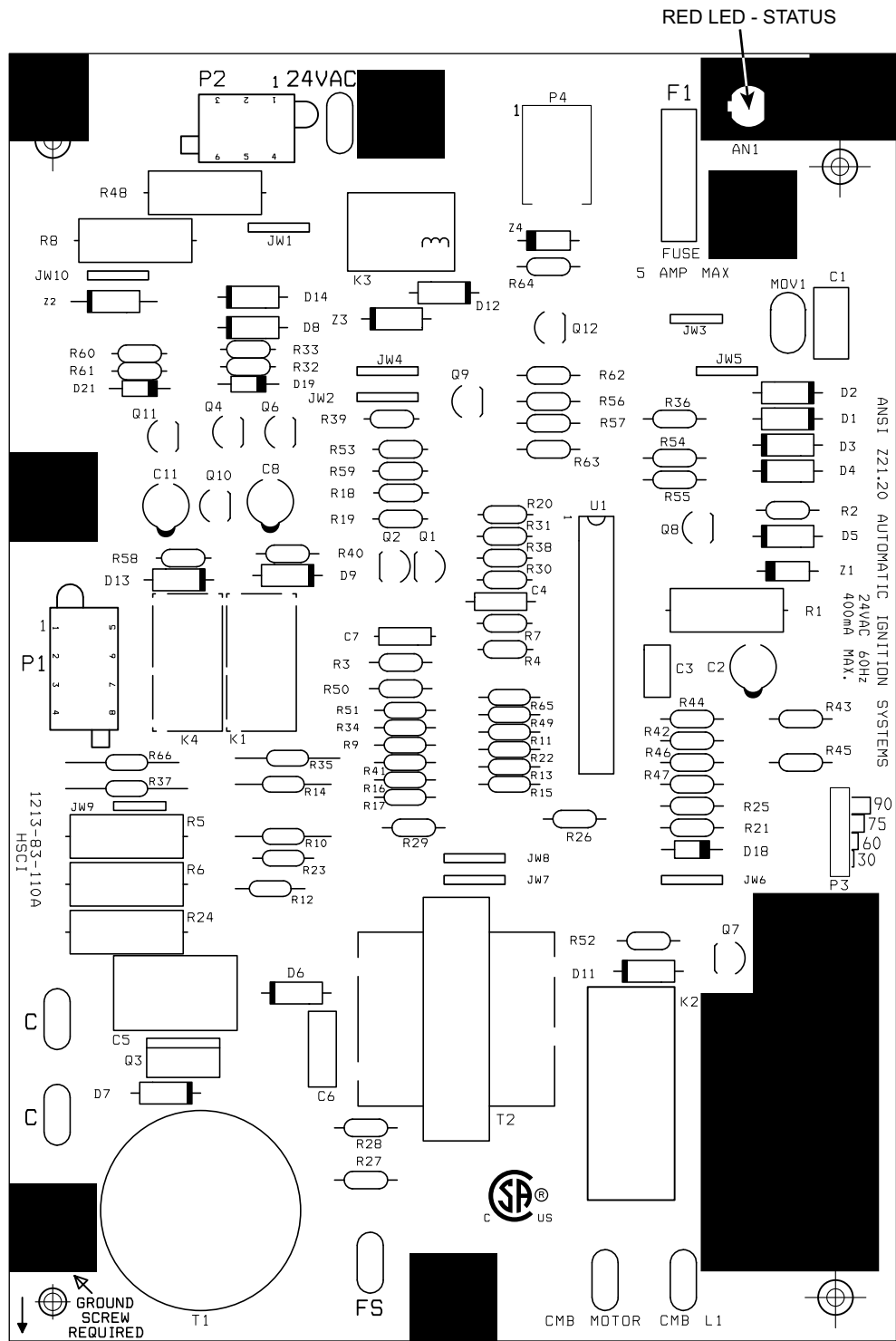
**LED** — Light Emitting Diode

**IMPORTANT:** Refer to Tables 10 and 11 for additional troubleshooting information.

## Orifice Replacement

This unit uses orifice type LH32RFnnn (where “nnn” indicates orifice reference size). When replacing unit orifices, order the necessary parts through RCD. See the High Altitude Gas Conversion Kit Gas Heating/Electric Cooling 3-15 Ton Small Rooftop Units Accessory LP (Liquid Propane) Installation Instructions for details.

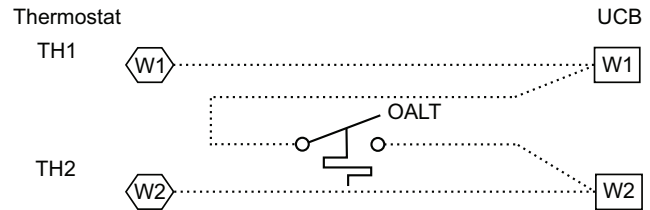
Ensure each replacement orifice is tight as its threads into the manifold pipe and the orifice projection does not exceed maximum value. See Fig. 52.



**Fig. 59 — Integrated Gas Control (IGC) Board**

## MINIMUM HEATING ENTERING AIR TEMPERATURE

When operating on first stage heating, the minimum temperature of air entering the dimpled heat exchanger is 50°F continuous and 45°F intermittent for standard heat exchangers and 40°F continuous and 35°F intermittent for stainless steel heat exchangers. To operate at lower mixed-air temperatures, a field-supplied outdoor-air thermostat must be used to initiate both stages of heat when the temperature is below the minimum required temperature to ensure full fire operation. Wire the outdoor-air thermostat OALT (P/N: HH22AG106) in series with the second stage gas valve. See Fig. 60. Set the outdoor-air thermostat at 35°F for stainless steel heat exchangers or 45°F for standard heat exchangers. This temperature setting will bring on the second stage of heat whenever the ambient temperature is below the thermostat set point. Indoor comfort may be compromised when heating is initiated using low entering air temperatures with insufficient heating temperature rise.



**Fig. 60 — OALT Connections**

## Troubleshooting Heating System

Refer to Tables 10 and 11 for additional troubleshooting topics.

**Table 10 — Heating Service Troubleshooting**

| PROBLEM                            | CAUSE                                                                                                            | REMEDY                                                                                                                                                                          |
|------------------------------------|------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Burners Will Not Ignite.</b>    | Misaligned spark electrodes.                                                                                     | Check flame ignition and sensor electrode positioning. Adjust as needed.                                                                                                        |
|                                    | No gas at main burners.                                                                                          | Check gas line for air, purge as necessary. After purging gas line of air, allow gas to dissipate for at least 5 minutes before attempting to relight unit.<br>Check gas valve. |
|                                    | Water in gas line.                                                                                               | Drain water and install drip leg to trap water.                                                                                                                                 |
|                                    | No power to furnace.                                                                                             | Check power supply, fuses, wiring, and circuit breaker.                                                                                                                         |
|                                    | No 24-v power supply to control circuit.                                                                         | Check transformer. Transformers with internal overcurrent protection require a cool down period before resetting.                                                               |
|                                    | Miswired or loose connections.                                                                                   | Check all wiring and wire nut connections.                                                                                                                                      |
|                                    | Burned-out heat anticipator in thermostat.                                                                       | Replace thermostat.                                                                                                                                                             |
|                                    | Broken thermostat wires.                                                                                         | Run continuity check. Replace wires, if necessary.                                                                                                                              |
| <b>Inadequate Heating.</b>         | Dirty air filter.                                                                                                | Clean or replace filter as necessary.                                                                                                                                           |
|                                    | Gas input to unit too low.                                                                                       | Check gas pressure at manifold. Clock gas meter for input. If too low, increase manifold pressure, or replace with correct orifices.                                            |
|                                    | Unit undersized for application.                                                                                 | Replace with proper unit or add additional unit.                                                                                                                                |
|                                    | Restricted airflow.                                                                                              | Clean filter, replace filter, or remove any restrictions.                                                                                                                       |
|                                    | Blower speed too low.                                                                                            | Use high speed tap, increase fan speed, or install optional blower, as suitable for individual units.                                                                           |
|                                    | Limit switch cycles main burners.                                                                                | Check thermostat heat anticipator settings, and temperature rise of unit. Adjust as needed.                                                                                     |
|                                    | Too much outdoor air.                                                                                            | Adjust minimum position.<br>Check economizer operation.                                                                                                                         |
| <b>Poor Flame Characteristics.</b> | Incomplete combustion (lack of combustion air) results in: Aldehyde odors, CO, sooting flame, or floating flame. | Check all screws around flue outlets and burner compartment. Tighten as necessary.                                                                                              |
|                                    |                                                                                                                  | Cracked heat exchanger.                                                                                                                                                         |
|                                    |                                                                                                                  | Overfired unit — reduce input, change orifices, or adjust gas line or manifold pressure.                                                                                        |
|                                    |                                                                                                                  | Check vent for restriction. Clean as necessary.<br>Check orifice to burner alignment.                                                                                           |
| <b>Burners Will Not Turn Off.</b>  | Unit is locked into Heating mode for a one minute minimum.                                                       | Wait until mandatory one-minute time period has elapsed or reset power to unit.                                                                                                 |

**Table 11 — IGC Board LED Alarm Codes<sup>a,b,c,d</sup>**

| LED FLASH CODE   | DESCRIPTION                               | ACTION TAKEN BY CONTROL                                                              | RESET METHOD                                   | PROBABLE CAUSE                                                                                                                                                                                                                   |
|------------------|-------------------------------------------|--------------------------------------------------------------------------------------|------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>On</b>        | Normal Operation                          | —                                                                                    | —                                              | —                                                                                                                                                                                                                                |
| <b>Off</b>       | Hardware Failure                          | No gas heating.                                                                      | —                                              | Loss of power to the IGC. Check 5 amp fuse on IGC, power to unit, 24-v circuit breaker, transformer, and wiring to the IGC.                                                                                                      |
| <b>1 Flash</b>   | Indoor Fan On/Off Delay Modified          | 5 seconds subtracted from On delay. 5 seconds added to Off delay (3 minute maximum). | Power reset.                                   | High temperature limit switch opens during heat exchanger warm-up period before fan-on delay expires. High temperature limit switch opens within 10 minutes of heat call (W) Off. See Limit Switch Fault.                        |
| <b>2 Flashes</b> | Limit Switch Fault                        | Gas valve and igniter Off. Indoor fan and inducer On.                                | Limit switch closed or heat call (W) Off.      | High temperature limit switch is open. Check the operation of the indoor (evaporator) fan motor. Ensure that the supply-air temperature rise is within the range on the unit nameplate. Check wiring and limit switch operation. |
| <b>3 Flashes</b> | Flame Sense Fault                         | Indoor fan and inducer On.                                                           | Flame sense normal. Power reset for LED reset. | The IGC sensed a flame when the gas valve should be closed. Check wiring, flame sensor, and gas valve operation.                                                                                                                 |
| <b>4 Flashes</b> | Four Consecutive Limit Switch Fault       | No gas heating.                                                                      | Heat call (W) Off. Power reset for LED reset.  | Four consecutive limit switch faults within a single call for heat. See Limit Switch Fault.                                                                                                                                      |
| <b>5 Flashes</b> | Ignition Fault                            | No gas heating.                                                                      | Heat call (W) Off. Power reset for LED reset.  | Unit unsuccessfully attempted ignition for 15 minutes. Check igniter and flame sensor electrode spacing, gaps, etc. Check flame sense and igniter wiring. Check gas valve operation and gas supply.                              |
| <b>6 Flashes</b> | Induced Draft Motor/Pressure Switch Fault | If heat off: no gas heating.<br>If heat on: gas valve Off and inducer On.            | Inducer sense normal or heat call (W) Off.     | Inducer sense On when heat call Off, or inducer sense Off when heat call On. Check wiring, voltage, and operation of IGC motor. Check inducer motor and flue gas pressure switch.                                                |
| <b>7 Flashes</b> | Rollout Switch Lockout                    | Gas valve and igniter Off. Indoor fan and inducer On.                                | Power reset.                                   | Rollout switch has opened. Check gas valve operation. Check induced-draft blower wheel is properly secured to motor shaft.                                                                                                       |
| <b>8 Flashes</b> | Internal Control Lockout                  | No gas heating.                                                                      | Power reset.                                   | IGC has sensed internal hardware or software error. If fault is not cleared by resetting 24-v power, replace the IGC.                                                                                                            |
| <b>9 Flashes</b> | Temporary Software Lockout                | No gas heating.                                                                      | One hour auto reset or power reset.            | Electrical interference is disrupting the IGC software.                                                                                                                                                                          |

NOTE(S):

- a. There is a 3-second pause between alarm code displays.
- b. If more than one alarm code exists, then all applicable alarm codes will be displayed in numerical sequence.
- c. Alarm codes on the IGC will be lost if power to the unit is interrupted.
- d. If the flue gas inducer pressure switch is stuck closed on a W1 call, then the unit will sit idle, and the IGC will produce no fault codes.

LEGEND

**IGC** — Integrated Gas Unit Control  
**LED** — Light-Emitting Diode

## SYSTEMVU CONTROL SYSTEM

The SystemVu™ control is a comprehensive unit-management system. The control system is easy to access, configure, diagnose and troubleshoot.

The SystemVu control system is fully communicating and cable-ready for connection to the Carrier Comfort Network® (CCN), Carrier i-Vu®, and Third Party BACnet<sup>1</sup> building management systems. The control provides high-speed communications for remote monitoring via the Internet. Multiple units can be linked together (and to other Direct Digital Control (DDC) equipped units) using a 3-wire communication bus.

The SystemVu control system is easy to access through the use of a integrated display module. A computer is not required for start-up. Access to control menus is simplified by the ability to quickly select from 7 main menu items. An expanded readout provides detailed explanations of control information. Only six buttons are required to maneuver through the entire controls menu. The display readout is designed to be visible even in bright sunlight. See Fig. 61.

1. Third-party trademarks and logos are the property of their respective owners.

## SystemVu Interface

This integrated device is the keypad interface used to access the control information, read sensor values, and test the unit. The interface is located in the main control box.

Through the SystemVu interface, the user can access all of the inputs and outputs to check on their values and status, configure operating parameters, and evaluate the current decision status for operating modes. The control also includes an alarm history which can be accessed from the display. The user can access a built-in test routine that can be used at start-up commissioning and troubleshooting.

## Additional SystemVu Installation and Troubleshooting

Additional installation, wiring and troubleshooting information for the SystemVu Controller can be found in the following manual: “48/50FC04-30, 48/50GC04-06 Single Package Rooftop Units with SystemVu™ Controls Version X.X Controls, Start-up, Operation and Troubleshooting.”

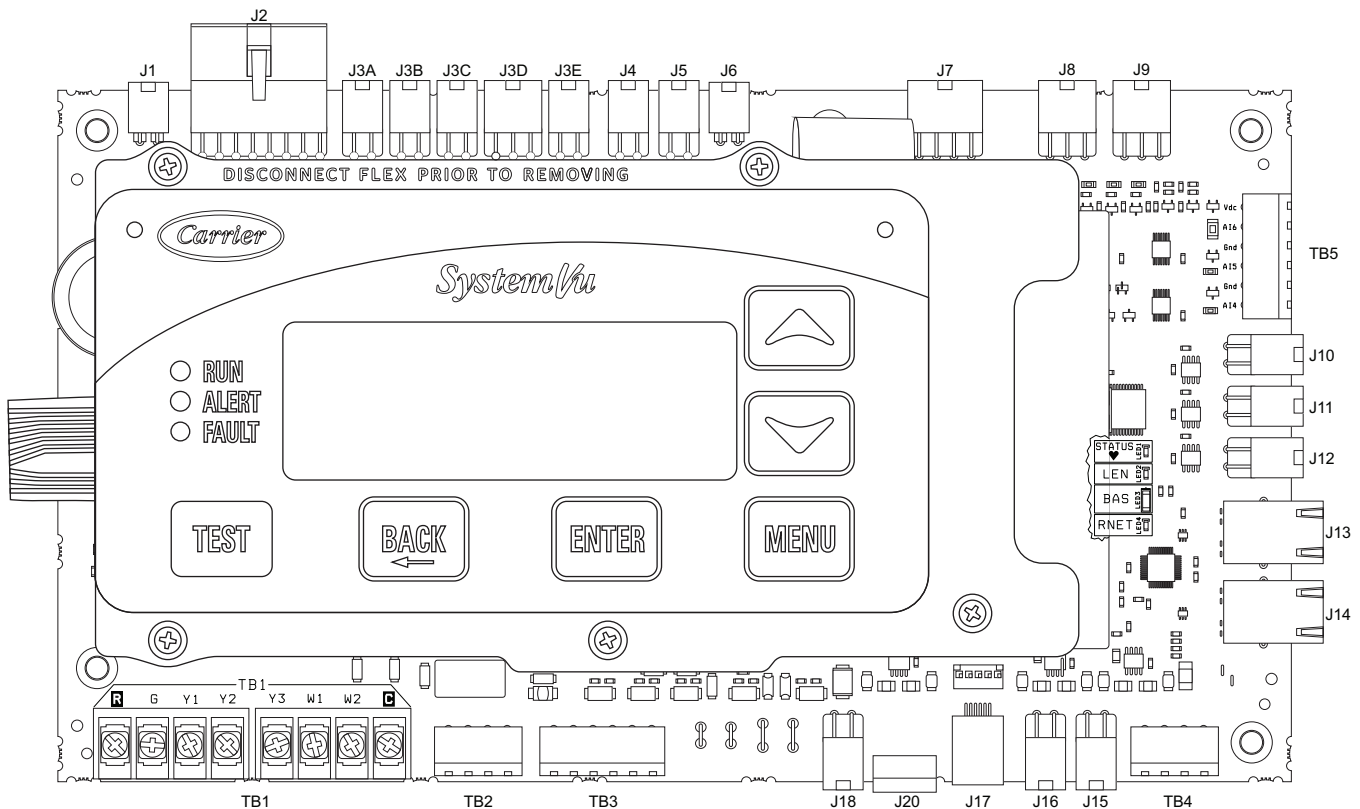


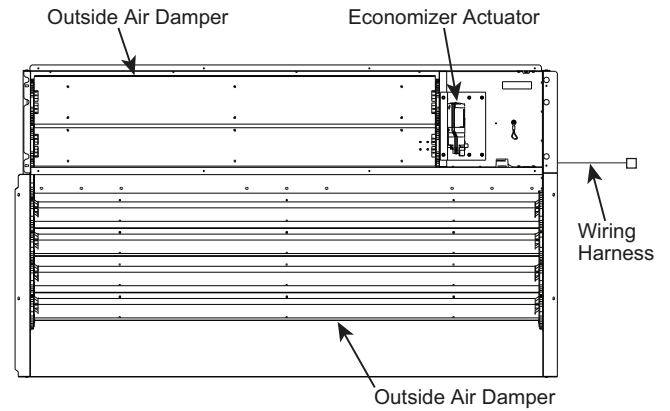
Fig. 61 — SystemVu Control

## ECONOMIZER SYSTEMS

The unit may be equipped with a factory-installed or accessory (field-installed) economizer system. Two types are available: one with a logic control system (EconomizerONE) and one without a control system (EconoMiSer® 2). See Fig. 62 for typical component locations on each type.

Economizers use direct-drive damper actuators.

**IMPORTANT:** Any economizer that meets the economizer requirements as laid out in California's Title 24 mandatory section 120.2 (fault detection and diagnostics) and/or prescriptive section 140.4 (life-cycle tests, damper leakage, 5 year warranty, sensor accuracy, etc), will have a label on the economizer. Any economizer without this label does not meet California's Title 24. The five year limited parts warranty referred to in section 140.4 only applies to factory installed economizers. Please refer to your economizer on your unit.



**Fig. 62 — Typical Economizer Component Locations**

EconoMi\$er2

IMPORTANT: The optional EconoMi\$er®2 does not include a controller. The EconoMi\$er2 is operated by a 4 mA to 20 mA signal from an existing field-supplied controller. See Fig. 63 for wiring information.

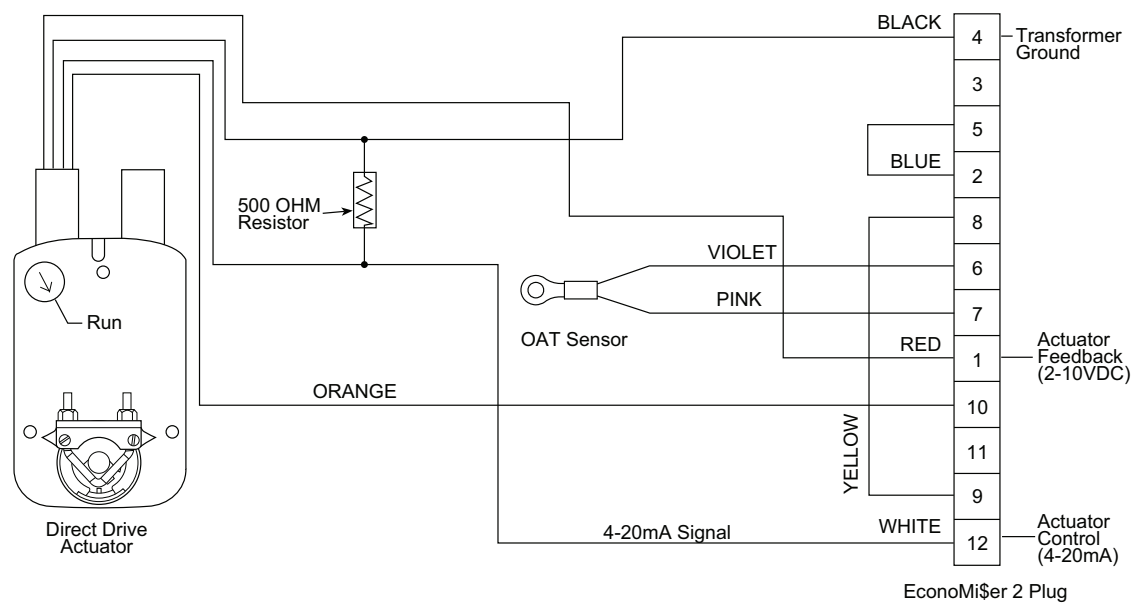


Fig. 63 — EconoMi\$er2 with 4 to 20 mA Control Wiring

## EconomizerONE (Field-Installed Accessory)

### MOUNTING, INSTALLATION, AND WIRING

#### ⚠ WARNING

Failure to follow this caution may result in damage to equipment. Be sure to allow enough time for compressor startup and shutdown between checkout tests so that the compressors do not short-cycle.

#### ***Mounting the Economizer Controller Base Module***

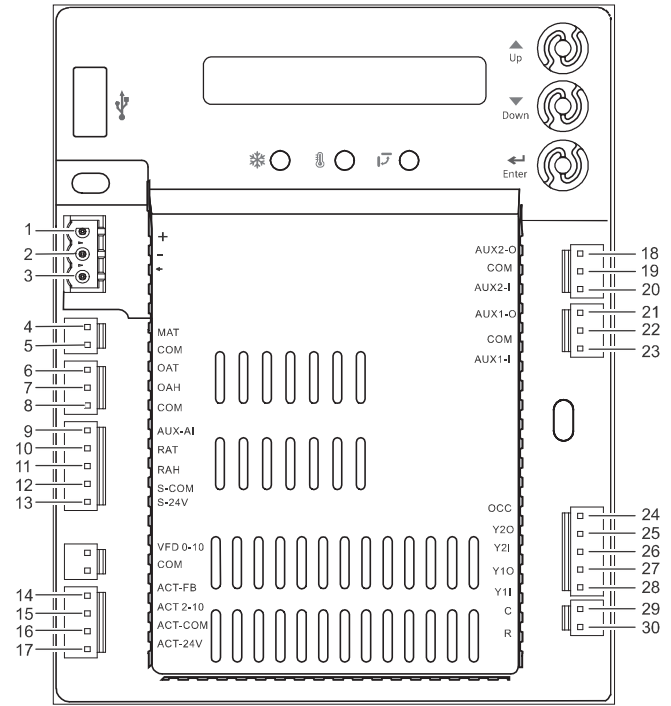
Before mounting, leave specific mounting clearances so that there is space for mounting, wiring, and servicing. See Fig. 64 and Table 12 for economizer controller wiring details.

POL224 can be mounted to sheet metal. Use two no. 6-3/4 in. self-tapping screws to mount POL224. Order screws and spacers separately, as they are not provided with the products.

See the installation instructions included with the controller for detailed clearance requirements and graphical mounting instructions.

#### ***Mounting Devices Connected to the Economizer Controller***

Devices like damper actuators, sensors (temperature sensor, humidity sensor, combination temperature and humidity sensor, CO<sub>2</sub> sensor), thermostats, and exhaust fans can be connected to the economizer controller. For information on how to mount the devices, see the device's installation instructions.



**Fig. 64 — Economizer Control Wiring**

**Table 12 — Economizer Control Wiring Settings**

| NO. | LABEL   | TYPE                          | DESCRIPTION                                                                                                                                                           |
|-----|---------|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1   | +       | RS485 Modbus A                | Line A                                                                                                                                                                |
| 2   | -       | RS485 Modbus B                | Line B                                                                                                                                                                |
| 3   | ⏏       | GND_ISO                       | Earth Ground                                                                                                                                                          |
| 4   | MAT     | Type II NTC 10K or 0-10 vdc   | Mixed or Discharge Air Temperature Sensor                                                                                                                             |
| 5   | COM     | COM                           | Mixed or Discharge Air Temperature Sensor Common                                                                                                                      |
| 6   | OAT     | Type II NTC 10K or 0-10 vdc   | Outside Air Temperature Sensor                                                                                                                                        |
| 7   | OAHR    | 0-10 vdc or 4-20mA            | Outside Air Relative Humidity Sensor                                                                                                                                  |
| 8   | COM     | COM                           | Outside Air Temperature Sensor or Outside Air Relative Humidity Sensor Common                                                                                         |
| 9   | AUX-AI  | 0-10 vdc, 2-10 vdc or 0-5 vdc | Air Quality Sensor or Pressure Sensor                                                                                                                                 |
| 10  | RAT     | Type II NTC 10K or 0-10 vdc   | Return Air Temperature Sensor                                                                                                                                         |
| 11  | RAHR    | 0-10 vdc or 4-20mA            | Return Air Relative Humidity Sensor                                                                                                                                   |
| 12  | S-COM   | COM                           | 24 vac Common                                                                                                                                                         |
| 13  | S-24V   | 24 vac                        | 24 vac Power Out to Sensors                                                                                                                                           |
| 14  | ACT-FB  | 2-10 vdc                      | Damper Actuator Feedback                                                                                                                                              |
| 15  | ACT2-10 | 2-10 vdc                      | Damper Actuator Output                                                                                                                                                |
| 16  | ACT-COM | COM                           | Damper Actuator Output Common                                                                                                                                         |
| 17  | ACT-24V | 24 vac                        | 24 vac Power Out to Damper Actuator                                                                                                                                   |
| 18  | AUX2-O  | 24 vac OUT                    | Configurable:<br>• Cooling Stage 3 Output<br>• Exhaust Fan (1 or 2)<br>• System Alarm Output (Title 24)                                                               |
| 19  | COM     | COM                           | 24 vac Common                                                                                                                                                         |
| 20  | AUX2-1  | 24 vac IN                     | Configurable:<br>• Cooling Stage 3 Input<br>• Shut Down<br>• Heat Conventional (W1)<br>• Heat Pump Changeover (reversing valve OB)<br>• Pre-Occupancy                 |
| 21  | AUX1-O  | 24 vac OUT                    | Configurable:<br>• Cooling Stage 3 Output<br>• Exhaust Fan (1 or 2)<br>• VFD On/Off (Variable Speed Supply Fan Enable or Disable)<br>• System Alarm Output (Title 24) |
| 22  | COM     | COM                           | 24 vac Common                                                                                                                                                         |
| 23  | AUX1-I  | 24 vac IN                     | Configurable:<br>• Cooling Stage 3 Input<br>• Shut Down<br>• Heat Conventional (W1)<br>• Heat Pump Changeover (reversing valve OB)<br>• Pre-Occupancy                 |
| 24  | OCC     | 24 vac IN                     | Occupancy Input                                                                                                                                                       |
| 25  | Y2O     | 24 vac OUT                    | Cooling Stage 2 Output to Stage 2 Mechanical Cooling                                                                                                                  |
| 26  | Y2I     | 24 vac IN                     | Cooling Stage 2 Input from Commercial Thermostat                                                                                                                      |
| 27  | Y1O     | 24 vac OUT                    | Cooling Stage 1 Output to Stage 1 Mechanical Cooling                                                                                                                  |
| 28  | Y1I     | 24 vac IN                     | Cooling Stage 1 Input from Commercial Thermostat                                                                                                                      |
| 29  | C       | COM                           | 24 vac Common                                                                                                                                                         |
| 30  | R       | 24 vac                        | 24 vac Power                                                                                                                                                          |

CONNECTING PERIPHERAL DEVICES TO THE  
ECONOMIZER CONTROLLER

See Fig. 65-69 for wiring details.

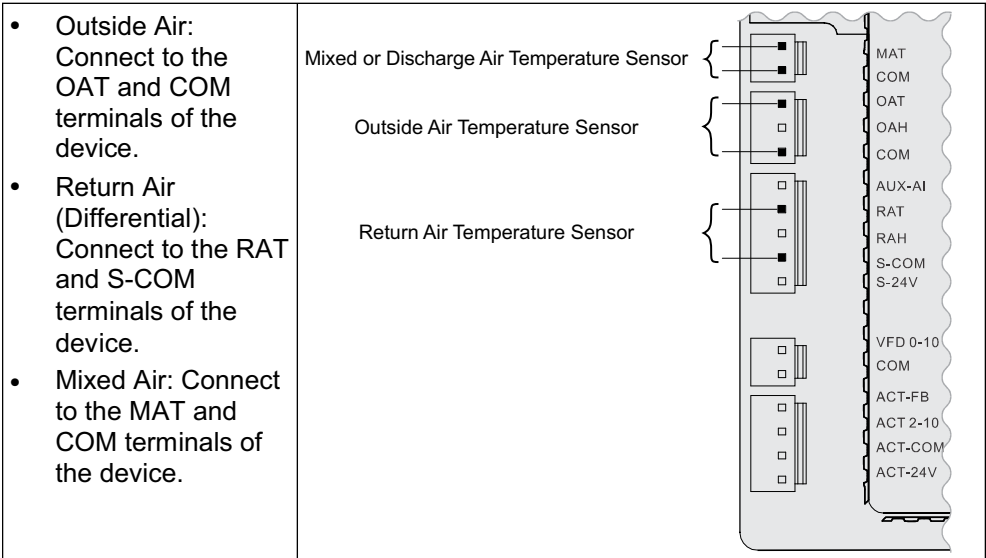


Fig. 65 — Temperature Sensor Connection

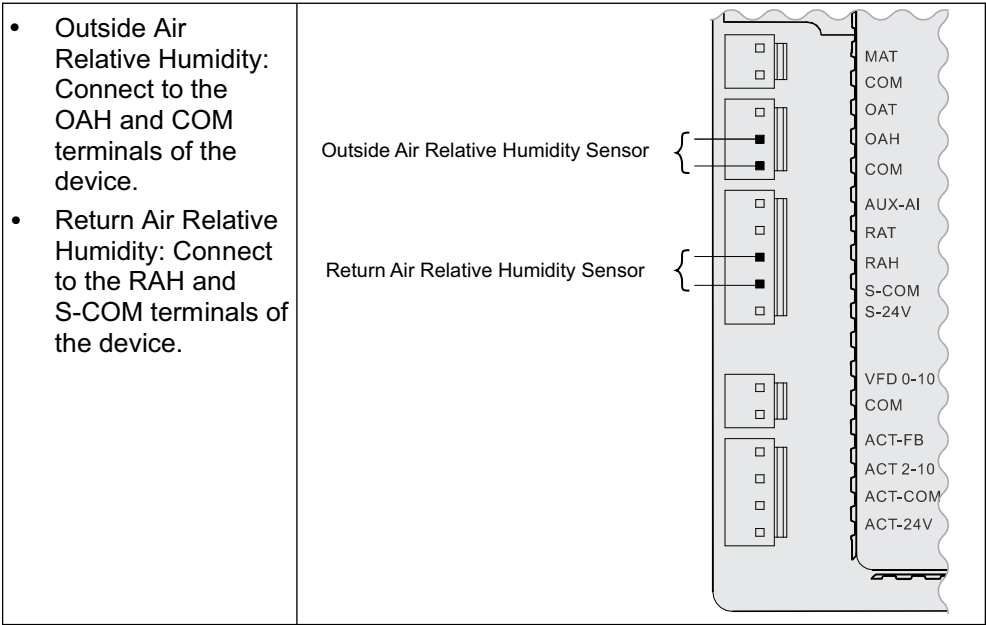
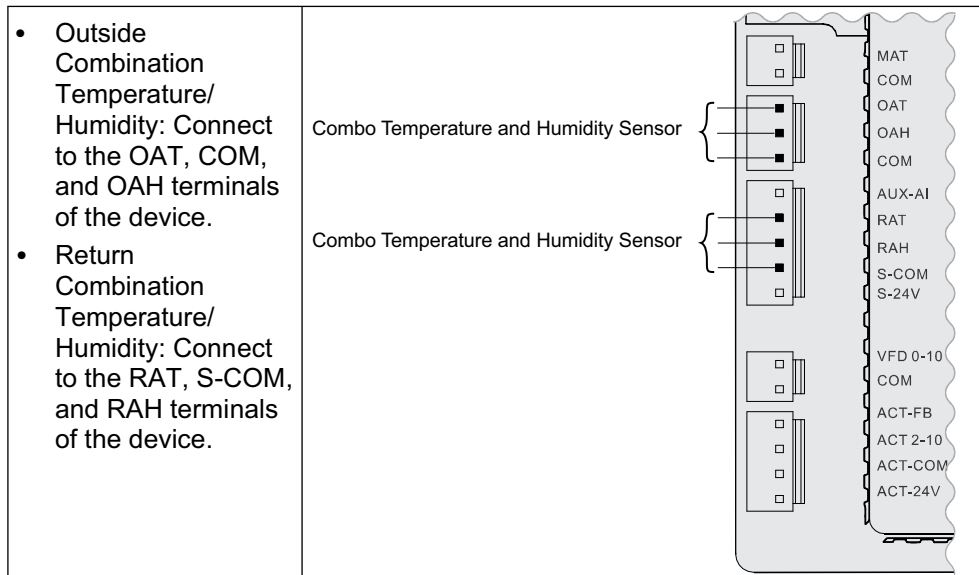
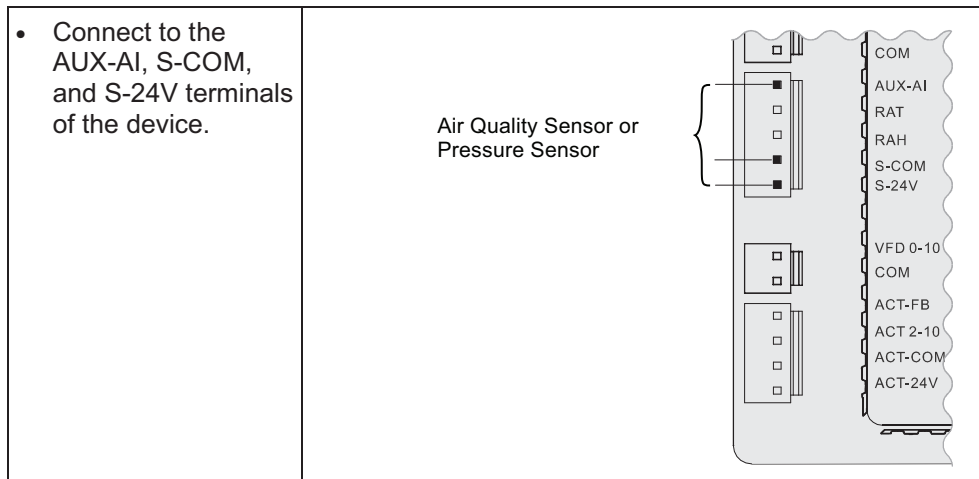


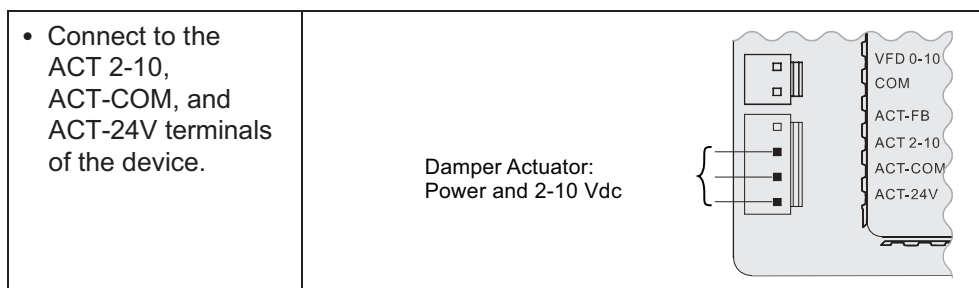
Fig. 66 — Relative Humidity Sensor Connection



**Fig. 67 — Combination Temperature/Humidity Sensor Connection**



**Fig. 68 — CO<sub>2</sub>/Pressure Sensor Connection**



**Fig. 69 — Damper Actuator Connection**

## EconomizerONE (Factory Option)

### ECONOMIZER SETTINGS

#### Interface Overview

##### EconomizerONE

The factory-installed accessory consists of the following:

- Ultra Low Leak Economizer Assembly
- HH79NZ039 OA Dry Bulb Sensor
- HH79NZ039 Mixed Air Sensor
- POL224 Controller
- 50HE005489 Harness

##### POL224 Economizer Module Wiring

The economizer controller used on electromechanical units is a Siemens POL224, which is to be located in the RTU base unit's control box. See Fig. 70 for a button description for the POL224 controller. Refer to the unit dimensional drawings for the location of the control box access panel.

The POL224 controller provides the following:

1. One-line LCD — After a period of inactivity, the controller displays the default HMI screen (free cooling status, 1FREE-COOL YES, or 1FREE COOL NO). See Fig. 70-74.
2. Operation button (Up button) — Move to the previous value, step, or category.
3. Operation button (Down button) — Move to the next value, step, or category.
4. Operation button (Enter button):
  - a. Press Enter to edit the current value or option.
  - b. Press Enter to confirm a newly selected value or option.
  - c. Press Enter + Up to jump up one entire category.
5. Press Enter + Down to jump down one entire category.

##### User Interface and Keypad

The controller user interface consists of an LCD display and a 3-button keypad for input. The LCD is a 16 character by 1-line dot matrix display. The keypad is used to navigate and change the desired menu items on the display. See Fig. 70.

The Climatix™ mobile application allows for installation, commissioning, and servicing. Scanning a QR code on the controller allows users to download the mobile application on Android™ or Apple iOS®, but a Wi-Fi/WLAN stick is needed. See Fig. 70 and 71. Plug Wi-Fi/WLAN stick into controller USB port for temporary connection for mobile application setup. The Wi-Fi/WLAN stick can be used for multiple units.

##### Menu Structure

Menus are displayed in the economizer controller in categories. There are 8 first-level menus, each of which is represented by a number at the beginning of the line on the LCD. Pressing Enter + Up or Down can toggle between different first-level menus. Sub-menus follow the numbered first-level menus closely. Pressing Up or Down can toggle between different submenus.

At the end of the line, the LCD displays the value of the current submenu (if any). If the value is editable, pressing Enter will put the terminal in Edit mode. The value is then highlighted for change. After making a change by pressing Up or Down, press Enter to confirm the change and exit the Edit mode. See Fig. 73.

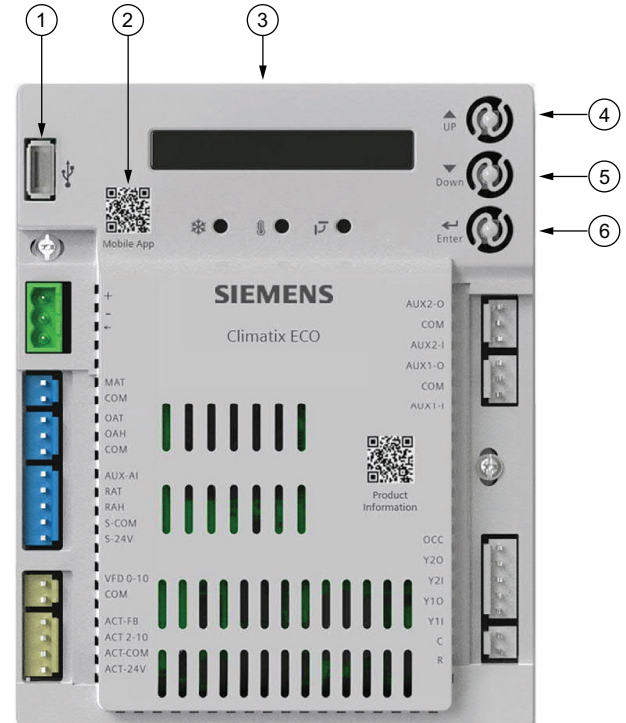
##### Powering the Economizer Controller

The POL224 controller power connections are made through the economizer harness (P/N 50HE005489). Connections from the harness are made to the C (24 vac common) and R (24 vac power) terminals of the economizer controller. See Fig. 72.

##### LED Indication

NOTE: If different faulty events occur at the same time, the sensor/DAC LED lights up following this priority: Red → Yellow → Off. For example, if there is a humidity sensor error and air temperature failure at the same time, the sensor LED turns red rather than yellow. See Fig. 74 and Table 13.

**IMPORTANT:** After the economizer controller enters the running state, it may take one minute for peripheral devices to complete initialization. Before that, LED indication might be unstable.



NOTE: QR codes in this image are for reference only.

| NO. | DESCRIPTION                                                                                                                                                                                                                                                                                                               |
|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1   | USB port for Wi-Fi/WLAN stick                                                                                                                                                                                                                                                                                             |
| 2   | QR code to download Climatix™ mobile application                                                                                                                                                                                                                                                                          |
| 3   | One-line LCD. After a period of inactivity, the controller displays the default HMI screen (free cooling status, 1FREECOOL YES or 1FREECOOL NO)                                                                                                                                                                           |
| 4   | Operation button (Up button) - Move to the previous value, step or category                                                                                                                                                                                                                                               |
| 5   | Operation button (Down button) - Move to the next value, step or category                                                                                                                                                                                                                                                 |
| 6   | Operation button (Enter button): <ul style="list-style-type: none"> <li>• Press to edit the current value or option.</li> <li>• Press to confirm a newly selected value or option.</li> <li>• Press Enter + Up to jump up one entire category.</li> <li>• Press Enter + Down to jump down one entire category.</li> </ul> |

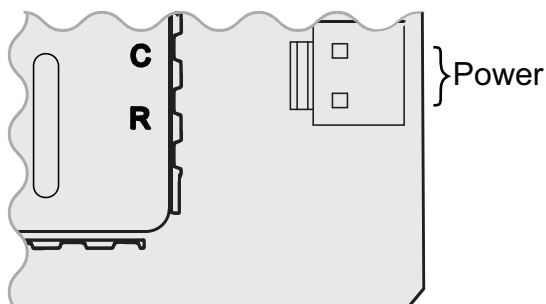
**Fig. 70 — POL224 Controller**



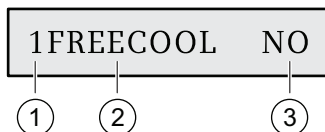
NOTE: QR codes in this image are for reference only.

**Fig. 71 — Wi-Fi/WLAN Stick**

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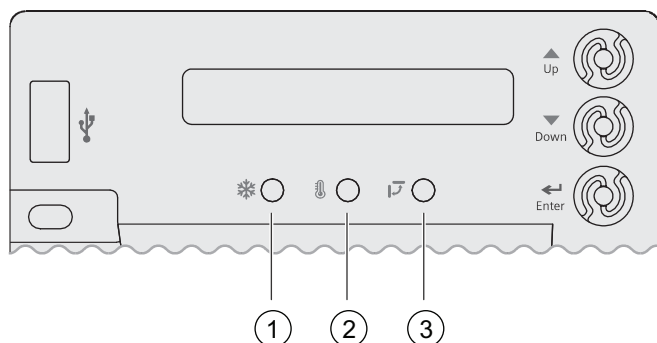
**Fig. 72 — Powering the Economizer Controller**



| No. | Description                                                                                                                                                                                                                                                                                        |
|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1   | Number representing the first-level menu of <b>Status Display</b> . Different numbers represent different menus:<br>1: Status Display<br>2: Basic Settings<br>3: Advanced Settings<br>4: Alarms<br>5: Enter Configuration State and Reset<br>6: I/O Config<br>7: Testing<br>8: Enter Running State |
| 2   | Submenu <sup>a</sup>                                                                                                                                                                                                                                                                               |
| 3   | Value of the current submenu <sup>a</sup>                                                                                                                                                                                                                                                          |

a. See Setup and Configuration on page 65 for detailed submenus, together with possible values or ranges.

**Fig. 73 — Menu Structure Descriptions**



| NO. | DESCRIPTION      |
|-----|------------------|
| 1   | Free Cooling LED |
| 2   | Sensor LED       |
| 3   | DAC LED          |

**Fig. 74 — LED Indication**

**Table 13 — LED Indication**

| STATUS                                                                | FREE COOLING LED | SENSOR LED      | DAC LED           |
|-----------------------------------------------------------------------|------------------|-----------------|-------------------|
| <b>Commissioning mode</b>                                             | Yellow Blinking  | Yellow Blinking | Yellow Blinking   |
| <b>Power start-up</b>                                                 | Yellow On        | Yellow On       | Yellow On         |
| <b>Free cooling is running</b>                                        | Green On         | —               | —                 |
| <b>Free cooling is available but not running</b>                      | Green Blinking   | —               | —                 |
| <b>Not economizing when it should</b>                                 | Red Blinking     | —               | —                 |
| <b>Economizing when it should not</b>                                 | Red On           | —               | —                 |
| <b>Sensor working okay</b>                                            | —                | Green On        | —                 |
| <b>Humidity sensor error</b>                                          | —                | Yellow On       | —                 |
| <b>CO<sub>2</sub> sensor error</b>                                    | —                | LED Off         | —                 |
| <b>Air temperature fault/failure</b>                                  | —                | Red On          | —                 |
| <b>Excess outdoor air</b>                                             | —                | Red Blinking    | —                 |
| <b>Damper working okay</b>                                            | —                | —               | Green On          |
| <b>Damper not modulating</b>                                          | —                | —               | Red On            |
| <b>Damper slippage</b>                                                | —                | —               | Red Blinking      |
| <b>Damper unplugged</b>                                               | —                | —               | Fast Red Blinking |
| <b>Terminal ACT-FB is configured but no available feedback signal</b> | —                | —               | LED Off           |

## Functions

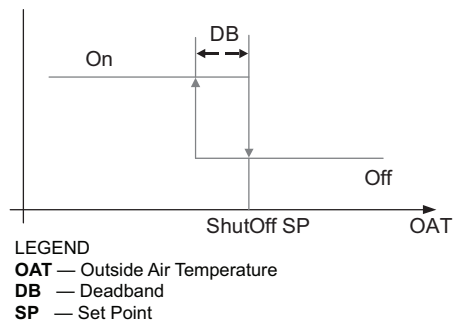
### Free Cooling Economizing

Free cooling uses unconditioned outside air to cool the space directly. The economizer controller enables or disables free cooling after it judges which control mode is active. It also uses hysteresis to ensure a smooth switchover.

Depending on the sensors that are used, there are 4 different control modes. In different control modes, the assessed conditions are different. See Table 14.

### Default Hysteresis Setting

Hysteresis setting (DB) defaults to 2°F (−16.6°C). See Fig. 75.



**Fig. 75 — Hysteresis Settings**

**Table 14 — Free Cooling Functions**

| CONTROL MODE                                                                       | SENSORS USED                                                                                      | ENABLE FREE COOLING?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Control Mode 1</b><br>• Fixed Dry Bulb                                          | OA (outside air) Temperature Sensor and MA (Mixed Air) Temperature Sensor                         | The outside air dry bulb temperature is compared with the set temperature shutoff set point. If the outside air dry bulb temperature is below the temperature shutoff set point, then the outside air is used to meet all or part of the cooling demand.                                                                                                                                                                                                                                                                            |
| <b>Control Mode 2</b><br>• Differential Dry Bulb (Dual Dry Bulbs)                  | OA Temperature Sensor, RA (Return Air) Temperature Sensor, and MA Temperature Sensor              | The outside air dry bulb temperature is compared with the return air dry bulb temperature. If both OAT and RAT are higher than the temperature high limitation, then free cooling is prohibited. If OAT or RAT is lower than the temperature high limitation and the outside air dry bulb temperature is lower than the return air dry bulb temperature, then the outside air is used to meet all or part of the cooling demand.                                                                                                    |
| <b>Control Mode 3</b><br>• Combination Fixed Enthalpy and Fixed Dry Bulb Control   | OA Temperature and Humidity Sensor and MA Temperature Sensor                                      | The outside air dry bulb temperature and enthalpy are compared with the set temperature and enthalpy shutoff set points. If the outside air enthalpy is lower than the set enthalpy shutoff set point, and the outside air dry bulb temperature is lower than the temperature shutoff set point, then the outside air can be used for economizing.                                                                                                                                                                                  |
| <b>Control Mode 4</b><br>• Combination of Differential Enthalpy and Fixed Dry Bulb | OA Temperature and Humidity Sensor, RA Temperature and Humidity Sensor, and MA Temperature Sensor | The outside air dry bulb temperature and enthalpy are compared with the temperature shutoff set point and return air enthalpy. If both OA enthalpy and RA enthalpy are higher than the enthalpy high limitation, then free cooling is prohibited. If OA enthalpy or RA enthalpy is lower than the enthalpy high limitation, outside air enthalpy is lower than the return-air enthalpy, and the outside air dry bulb temperature is lower than the set temperature shutoff set point, then outside air can be used for economizing. |

### Damper Modulation During Free Cooling

Once outside air is suitable for free cooling, the controller modulates the damper based on MAT (mixed air temperature, default) or OAT (outside air temperature). Refer to Table 14.

If MAT is used when free cooling is enabled, then MAT set point (**3MAT SET**, configurable in Parameter Settings — Advanced — see page 68) is used for MAT modulating. When MAT falls below the anti-freeze set point (**3FRZ PROT**), the damper either fully closes or opens to the minimum position (configurable in Parameter Settings — Advanced — see page 68).

1. If MAT is lower than MAT set point, then the damper is modulated to maintain MAT set point, toward fully closed or open to the minimum position based on occupancy status if MAT continues dropping.
2. If MAT is in the range [MAT set point, (MAT set point + neutral zone band [1°F (0.5°C) by default])], then the damper position does not change.
3. If MAT is higher than (MAT set point + neutral zone band), then the damper modulates toward fully open.
4. If MAT is 10°F (5.5°C) higher than MAT set point, then the damper fully opens to 100%.

If OAT is used when there is a cooling demand, then the damper can be opened to different positions depending on different outside air temperatures:

1. If outside air is higher than 50°F (10°C) but lower than the temperature shutoff set point, then the damper is fully open.
2. If outside air is higher than OAT lockout set point but lower than 50°F (10°C), then linear modulation is applied when only Cooling Stage 1 Input (Y1I) is ON. Result of the following formula indicate the damper's open position:

$$([OAT - OAT Lockout Set Point] / [50 - OAT Lockout Set Point]) * (80\% - MIN POS) + MIN POS$$

NOTE: When both free cooling and mechanical cooling are on, damper remains fully open regardless of the modulating logic.

### Location-Based Shutoff Set Points

The economizer controller can get location-based temperature and enthalpy shutoff set points automatically if it is connected to the Climatix™ mobile application. Once a Wi-Fi/WLAN stick is plugged in, the economizer controller can establish network connection with the mobile application. The temperature and enthalpy shutoff set points obtained via the phone or tablet's GPS functionality can then be synchronized to the economizer controller.

### Cooling Stage Operation

The economizer controller accepts inputs for 1 and 2-stage cooling inputs, and reroutes to the RTU through the relay connection Y1 and Y2.

The operation of the cooling stages is determined by the availability of Free Cooling provided by the economizer operation mode. See Cooling Stage I/O Logic tables, see Tables 15-16. Based on the use of Free Cooling, the operating modes are as follows:

- Y1 is Stage 1 Cooling Demand
- Y2 is Stage 2 Cooling Demand
- Free Cooling is always the first cooling stage
- Cooling Stage 1 call from the Commercial Thermostat (Y1) energizes the Y1 input to the Economizer Controller
- Cooling Stage 2 call from the Commercial Thermostat (Y2) energizes the Y2 input to the Economizer Controller

**Table 15 — 1 and 2-Stage Cooling Stage I/O Logic**

| ECONOMIZER<br>CONDITION MET | Y1  | Y2  | COOLING<br>STAGE 1 | COOLING<br>STAGE 2  |
|-----------------------------|-----|-----|--------------------|---------------------|
| NO                          | On  | On  | On                 | On                  |
| NO                          | On  | Off | On                 | Off                 |
| NO                          | Off | Off | Off                | Off                 |
| YES                         | On  | On  | On                 | On/Off <sup>a</sup> |
| YES                         | On  | Off | Off                | Off                 |
| YES                         | Off | Off | Off                | Off                 |

NOTE(S):

- a. If  $OAT \leq MAT$  set point (**3MAT SET**), then Relay 2 is always **OFF** to disable Cooling Stage 2. Otherwise, if both stages of cooling (Y1 and Y2) are **ON** for more than a set time (15 minutes by default), Y2 remains **ON**, and the OAT is higher than MAT set point, then Relay 2 energizes to allow Y2 pass-through to enable Cooling Stage 2.

**Table 16 — 2-Stage Cooling Stage I/O Logic**

| ECONOMIZER<br>CONDITION MET | Y1  | Y2  | COOLING<br>STAGE 1 | COOLING<br>STAGE 2 |
|-----------------------------|-----|-----|--------------------|--------------------|
| NO                          | On  | On  | On                 | On                 |
| NO                          | On  | On  | On                 | On                 |
| NO                          | On  | Off | On                 | Off                |
| NO                          | Off | Off | Off                | Off                |
| YES                         | On  | On  | On                 | On                 |
| YES                         | On  | On  | On                 | On/Off             |
| YES                         | On  | Off | Off                | Off                |
| YES                         | Off | Off | Off                | Off                |

**IMPORTANT:** The Economizer Controller can tolerate thermostat wiring mismatch, e.g., Thermostat Y1 → Economizer Y2-IN, Thermostat Y2 → Economizer Y1-IN. The handling logic is Stage = Y1I + Y2I. For example, Y1O = 1 if Stage >= 1, Y2O = 1 if Stage >= 2.

#### Multi-Speed Fan Support

The Economizer Controller supports connection to 1 and 2-speed fans. When the unit is equipped with a multi-speed fan, the damper responds to multiple fan speeds via multiple minimum positions (**MIN POS**) to keep minimum airflow. See Tables 17-19.

**Table 17 — Damper MIN POS for 2-Speed Fan<sup>a</sup>**

| Y1 | Y2 | W1 or O/B | Spd L | Spd H | Pos L | Pos H |
|----|----|-----------|-------|-------|-------|-------|
| X  | —  | —         | X     | —     | X     | —     |
| X  | X  | —         | —     | X     | —     | X     |
| —  | —  | X         | —     | X     | —     | X     |

NOTE(S):

- a. A multi-speed fan is not controlled by the economizer controller but an external logic board.

LEGEND

**Pos L** — Damper MIN POS for Low-Speed Fan  
**Pos H** — Damper MIN POS for High-Speed Fan  
**Spd L** — Low Speed (Fan)  
**Spd H** — High Speed (Fan)

**Table 18 — Different Fan Speeds with Different Configured Outputs<sup>a</sup>**

| FAN TYPE                       | 1-SPEED COOLING <sup>b</sup>                                   | 2-STAGE COOLING <sup>b</sup>                                   |
|--------------------------------|----------------------------------------------------------------|----------------------------------------------------------------|
| <b>1-SPEED FAN<sup>c</sup></b> | • Spd H (regardless of cooling demand, OCC=Yes)                | • Spd H (regardless of cooling demand, OCC=Yes)                |
| <b>2-SPEED FAN<sup>c</sup></b> | • Spd L (0 or 1 cooling demand)<br>• Spd H (2 cooling demands) | • Spd L (0 or 1 cooling demand)<br>• Spd H (2 cooling demands) |

NOTE(S):

- a. If a single-speed fan connects to the controller, then it opens directly on the call of cooling/heating. The damper position is Pos H.  
b. Configured by Y1O or Y2O.  
c. Configured by 6FAN.

LEGEND

**Spd L** — Low Speed (Fan)  
**Spd H** — High Speed (Fan)

**Table 19 — Different Damper Minimum Positions with Different Configured Outputs**

| FAN TYPE                       | 1-SPEED COOLING <sup>a</sup>                    | 2-STAGE COOLING <sup>a</sup>                                   |
|--------------------------------|-------------------------------------------------|----------------------------------------------------------------|
| <b>1-SPEED FAN<sup>b</sup></b> | • Pos H (regardless of cooling demand, OCC=Yes) | • Pos H (regardless of cooling demand, OCC=Yes)                |
| <b>2-SPEED FAN<sup>b</sup></b> | • Pos H (regardless of cooling demand, OCC=Yes) | • Pos L (0 or 1 cooling demand)<br>• Pos H (2 cooling demands) |

NOTE(S):

- a. Configured by Y1O or Y2O.  
b. Configured by 6FAN.

LEGEND

**Pos L** — Damper MIN POS for Low-Speed Fan  
**Pos H** — Damper MIN POS for High-Speed Fan

If DCV (demand controlled ventilation) is enabled, then each fan speed corresponds to 2 damper position ventilation set points (**VENT MIN**, **VENT MAX**), e.g., Pos L corresponds to 2VENTMIN L... 2VENTMAX L. See Table 20 for Different Damper Position Setting with Different Configured Outputs with DCV enabled.

If CO<sub>2</sub> sensor is connected but DCV is disabled, then each fan speed corresponds to one minimum damper position ventilation set point. See Table 21 for Different Damper Position Setting with Different Configured Outputs with DCV disabled.

**Table 20 — Different Damper Position Setting with Different Configured Outputs (DCV is Enabled)**

| FAN TYPE                       | 1-STAGE COOLING <sup>a</sup>                                                                                       | 2-STAGE COOLING <sup>a</sup>                                                                                                                             |
|--------------------------------|--------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1-SPEED FAN<sup>b</sup></b> | <ul style="list-style-type: none"> <li>2VENTMIN H to 2VENTMAX H (regardless of cooling demand, OCC=Yes)</li> </ul> | <ul style="list-style-type: none"> <li>2VENTMIN H to 2VENTMAX H (regardless of cooling demand, OCC=Yes)</li> </ul>                                       |
| <b>2-SPEED FAN<sup>b</sup></b> | <ul style="list-style-type: none"> <li>2VENTMIN H to 2VENTMAX H (regardless of cooling demand, OCC=Yes)</li> </ul> | <ul style="list-style-type: none"> <li>2VENTMIN L to 2VENTMAX L (0 or 1 cooling demand)</li> <li>2VENTMIN H to 2VENTMAX H (2 cooling demands)</li> </ul> |

NOTE(S):

a. Configured by Y1O or Y2O.

b. Configured by 6FAN.

**Table 21 — Different Damper Position Setting with Different Configured Outputs (DCV is Disabled, CO<sub>2</sub> sensor is connected)**

| FAN TYPE                       | 1-STAGE COOLING <sup>a</sup>                                                                         | 2-STAGE COOLING <sup>a</sup>                                                                                                 |
|--------------------------------|------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|
| <b>1-SPEED FAN<sup>b</sup></b> | <ul style="list-style-type: none"> <li>2VENTMIN H (regardless of cooling demand, OCC=Yes)</li> </ul> | <ul style="list-style-type: none"> <li>2VENTMIN H (regardless of cooling demand, OCC=Yes)</li> </ul>                         |
| <b>2-SPEED FAN<sup>b</sup></b> | <ul style="list-style-type: none"> <li>2VENTMIN H (regardless of cooling demand, OCC=Yes)</li> </ul> | <ul style="list-style-type: none"> <li>2VENTMIN L (0 or 1 cooling demand)</li> <li>2VENTMIN H (2 cooling demands)</li> </ul> |

NOTE(S):

a. Configured by Y1O or Y2O.

b. Configured by 6FAN.

### Cooling Delay via Increasing Fan Speed

If there is cooling demand while outside air is suitable for economizing, then the economizer controller tries to increase fan speed to maximize the use of outside air first. If the cooling demand is not reached within a set time, then mechanical cooling will be enabled.

Typical field application:

- Prerequisites:
  - Outside air is suitable for economizing and free cooling is ON.
  - Fan connected to the controller supports multiple speeds. Cooling delay function does not work if only a one-speed fan is connected to the controller.
- If it is a 2-speed fan and there are 2 cooling demand inputs/outputs, when Y1-Input is called, the controller sets fan speed to Speed Low. Damper is fully open (100%).  
If Y2-Input is also called, then the controller increases fan speed to Speed High and starts fan delay (**2FAN DLY**) time. After the delay time runs out, the controller starts Y1-Output.

### Demand Controlled Ventilation (DCV)

If a field-installed CO<sub>2</sub> sensor is connected to the EconomizerONE controller, then a demand-controlled ventilation strategy will operate automatically. As the CO<sub>2</sub> level in the space increases above the set point (on the EconomizerONE controller), the minimum position of the dampers will be increased proportionally until the Maximum Ventilation setting is reached. As the space CO<sub>2</sub> level decreases because of the increase in fresh air, the outdoor damper will follow the higher demand condition from the DCV mode or from the free cooling mode.

The controller modulates the outside air damper based on the CO<sub>2</sub> level through the ppm value selected between the range of 500 and 2000 ppm. The measured CO<sub>2</sub> concentration value is compared with the set DCV set point. If the measured CO<sub>2</sub> concentration value is below the DCV set point, keep the damper to the minimum position. Otherwise, enable DCV. Once DCV is enabled, the DCV PID starts to run to control the indoor CO<sub>2</sub> concentration value towards the DCV set point. The damper opens to the maximum position.

NOTE: DCV is disabled if the controller receives no occupancy signal.

DCV operation is available in Occupied and Unoccupied periods with EconomizerONE system. However, a control modification will be required on the unit system to implement the Unoccupied period function. Refer to controller accessory installation instruction manual for further controls and command operation information.

### High Humidity Limitation

The economizer controller applies high limit of humidity to enthalpy-based economizing. When the OA dew point is below the dew point set point, enthalpy-based economizing is available. Otherwise, enthalpy-based economizing is unavailable.

### Anti-Freeze Protection

The economizer controller initiates the anti-freeze protection if MAT or OAT temperature falls below the anti-freeze set point.

### MAT-Based Anti-Freeze Protection

- If MAT temperature falls below the anti-freeze set point (**3FRZ PROT**) and:
  - If unit type is conventional unit and cooling/heating conventional operation mode is enabled, then the controller closes both damper and compressor.
  - If unit type is heat pump and heat pump operation mode is enabled, then the controller closes the damper.
- If the MAT sensor fails, MAT is substituted by OAT to continue the anti-freeze assessment. If OAT sensor also fails, then the controller closes the damper immediately.

### OAT-Based Anti-Freeze Protection

If OAT temperature falls below the OAT lockout set point (**3OAT LOCK**) and:

- If unit type is conventional unit and cooling/heating conventional operation mode is enabled, then the controller stops the compressor from running.
- If unit type is heat pump and heat pump operation mode is enabled, then the controller compressor is bypassed.

### Exhaust Fan Operation

Up to 2 exhaust fans can be connected to the economizer controller.

- If Exhaust Fan 1 is connected and configured, then Exhaust Fan 1 parameter group (L, M, and H) is available, depending on fan configuration.

- If Exhaust Fan 2 is connected and configured, then Exhaust Fan 2 parameter group (L, M, and H) is available, depending on fan configuration.
- The controller energizes Exhaust Fan Relay 1 and Exhaust Fan Relay 2 if the damper position reaches Exhaust Fan 1 parameter setting and Exhaust Fan Relay 2 parameter setting respectively. The selection of L, M, or H matches the current fan speed.

NOTE: If terminal ACT-FB is configured, then the damper position is the damper feedback position. If feedback signal is unavailable, then it is the simulated position.

#### Occupancy Input

The economizer controller can receive an occupancy signal from the connected thermostat or work under Occupied mode all the time. This is configurable in the Thermostat setup from Climatix™ mobile application or under the menu of I/O Configuration on the inbuilt display. See “Parameter Settings — I/O Configurations” on page 68 for more information.

**IMPORTANT:** On the call of cooling, when the controller is configured to receive signal from the thermostat but the thermostat is working under the Unoccupied mode, the damper is fully closed if outside air is not suitable for economizing. If outside air is suitable for economizing, then the damper is fully open.

#### Pre-occupancy Purge

The Pre-Occupancy purge demand comes from the configuration of the Auxiliary features in Climatix™ mobile application or **6AUX2-I** under the menu of I/O Configuration on the inbuilt display.

During pre-occupancy purge on the call of heating, or when there is no cooling/heating demand, the damper position is MIN POS.

During pre-occupancy purge on the call of cooling, the damper position is MIN POS if outside air is not suitable for economizing. If outside air is suitable for economizing, then the damper is fully open.

#### Airflow Commissioning

Airflow measurement station (differential pressure signal) can connect to the controller temporarily to run airflow commissioning to calculate, calibrate, and store 4 fan speed characteristic curves automatically at damper positions 40%, 60%, 80%, and 100%. The controller places the damper to a proper position to meet minimum or any other airflow requests in cfm. Users can enable this function only from the mobile application if the related function is available in the current mobile application version.

#### Fault Detection and Diagnostics

The economizer controller can detect and diagnose free cooling faults, sensor operation faults, and damper modulating faults. It can also report anti-freeze and shutdown notifications and actuator errors. Following is a list of all detectable or reportable information:

- Sensor disconnected or has no signal.
- Sensor short or high signal (under range or over range).
- Not economizing.
- Unexpected economizing.
- Excess outdoor air.
- Damper not modulating.
- Input power monitor and brownout. After detecting brownout, the economizer controller enters the brownout protection mode and disables all of the relay outputs.
- Anti-freeze notifications.
- Shutdown notifications.
- Actuator errors.
- Leaving air temperature is too low or too high.
- Cooling/heating error.
- Damper actuator cycle count. Parameter **1ACT CNT** indicates number of times actuator has cycled. It is resettable via HMI item **8ACT CNT RESET**.

**IMPORTANT:** The first 6 faults are detectable via LEDs or alarm reports on the LCD. See LED Indication on page 56 and Alarms on page 69 for fault indications. These faults can also be displayed in the Operating section of the Climatix™ mobile application.

#### Firmware Update

NOTE: Back up configurations before firmware update. All the previous configuration data are erased after firmware update.

NOTE: Contact Application Engineering for more information on support for firmware.

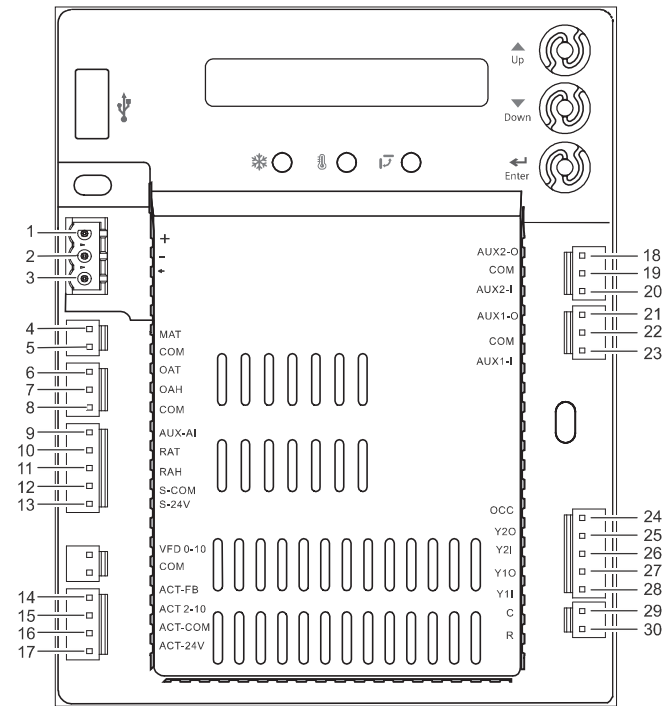
**IMPORTANT:** If the controller enters the configuration state for the convenience of I/O configurations, then users can manually switch to the running state after finishing configurations. To do so, press Enter + Up at the same time, then press Enter to confirm the switch after 8RUN STATE appears on the LCD.

**⚠ WARNING**

Failure to follow this caution may result in damage to equipment. Be sure to allow enough time for compressor startup and shutdown between checkout tests so that the compressors do not short-cycle.

***Mounting Devices Connected to the Economizer Controller***

Devices like damper actuators, sensors (temperature sensor, humidity sensor, combination temperature and humidity sensor, CO<sub>2</sub> sensor), thermostats, and exhaust fans can be connected to the economizer controller. For information on how to mount the devices, see the device’s installation instructions. See Fig. 76 and Table 22 for economizer controller wiring details.



**Fig. 76 — Economizer Control Wiring**

**Table 22 — Economizer Control Wiring Settings**

| NO. | LABEL   | TYPE                          | DESCRIPTION                                                                                                                |
|-----|---------|-------------------------------|----------------------------------------------------------------------------------------------------------------------------|
| 1   | +       | RS485 Modbus A                | Line A                                                                                                                     |
| 2   | -       | RS485 Modbus B                | Line B                                                                                                                     |
| 3   | ⏏       | GND_ISO                       | Earth Ground                                                                                                               |
| 4   | MAT     | Type II NTC 10K or 0-10 vdc   | Mixed or Discharge Air Temperature Sensor                                                                                  |
| 5   | COM     | COM                           | Mixed or Discharge Air Temperature Sensor Common                                                                           |
| 6   | OAT     | Type II NTC 10K or 0-10 vdc   | Outside Air Temperature Sensor                                                                                             |
| 7   | OAH     | 0-10 vdc or 4-20mA            | Outside Air Relative Humidity Sensor                                                                                       |
| 8   | COM     | COM                           | Outside Air Temperature Sensor or Outside Air Relative Humidity Sensor Common                                              |
| 9   | AUX-AI  | 0-10 vdc, 2-10 vdc or 0-5 vdc | Air Quality Sensor or Pressure Sensor                                                                                      |
| 10  | RAT     | Type II NTC 10K or 0-10 vdc   | Return Air Temperature Sensor                                                                                              |
| 11  | RAH     | 0-10 vdc or 4-20mA            | Return Air Relative Humidity Sensor                                                                                        |
| 12  | S-COM   | COM                           | 24 vac Common                                                                                                              |
| 13  | S-24V   | 24 vac                        | 24 vac Power Out to Sensors                                                                                                |
| 14  | ACT-FB  | 2-10 vdc                      | Damper Actuator Feedback                                                                                                   |
| 15  | ACT2-10 | 2-10 vdc                      | Damper Actuator Output                                                                                                     |
| 16  | ACT-COM | COM                           | Damper Actuator Output Common                                                                                              |
| 17  | ACT-24V | 24 vac                        | 24 vac Power Out to Damper Actuator                                                                                        |
| 18  | AUX2-O  | 24 vac OUT                    | Configurable:<br>• Exhaust Fan (1 or 2)<br>• System Alarm Output (Title 24)                                                |
| 19  | COM     | COM                           | 24 vac Common                                                                                                              |
| 20  | AUX2-I  | 24 vac IN                     | Configurable:<br>• Shut Down<br>• Heat Conventional (W1)<br>• Heat Pump Changeover (reversing valve OB)<br>• Pre-Occupancy |
| 21  | AUX1-O  | 24 vac OUT                    | Configurable:<br>• Exhaust Fan (1 or 2)<br>• System Alarm Output (Title 24)                                                |
| 22  | COM     | COM                           | 24 vac Common                                                                                                              |
| 23  | AUX1-I  | 24 vac IN                     | Configurable:<br>• Shut Down<br>• Heat Conventional (W1)<br>• Heat Pump Changeover (reversing valve OB)<br>• Pre-Occupancy |
| 24  | OCC     | 24 vac IN                     | Occupancy Input                                                                                                            |
| 25  | Y2O     | 24 vac OUT                    | Cooling Stage 2 Output to Stage 2 Mechanical Cooling                                                                       |
| 26  | Y2I     | 24 vac IN                     | Cooling Stage 2 Input from Commercial Thermostat                                                                           |
| 27  | Y1O     | 24 vac OUT                    | Cooling Stage 1 Output to Stage 1 Mechanical Cooling                                                                       |
| 28  | Y1I     | 24 vac IN                     | Cooling Stage 1 Input from Commercial Thermostat                                                                           |
| 29  | C       | COM                           | 24 vac Common                                                                                                              |
| 30  | R       | 24 vac                        | 24 vac Power                                                                                                               |

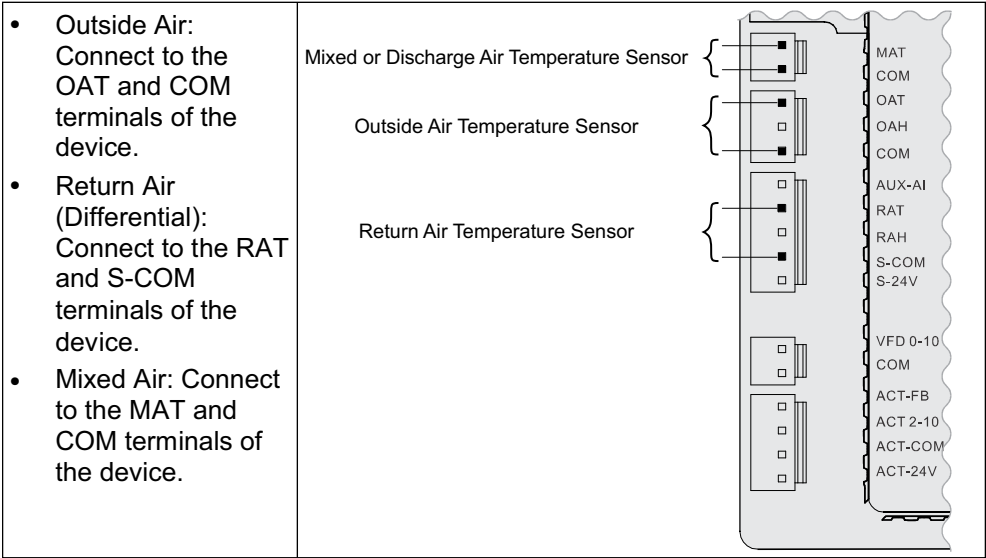


Fig. 77 — Temperature Sensor Connection

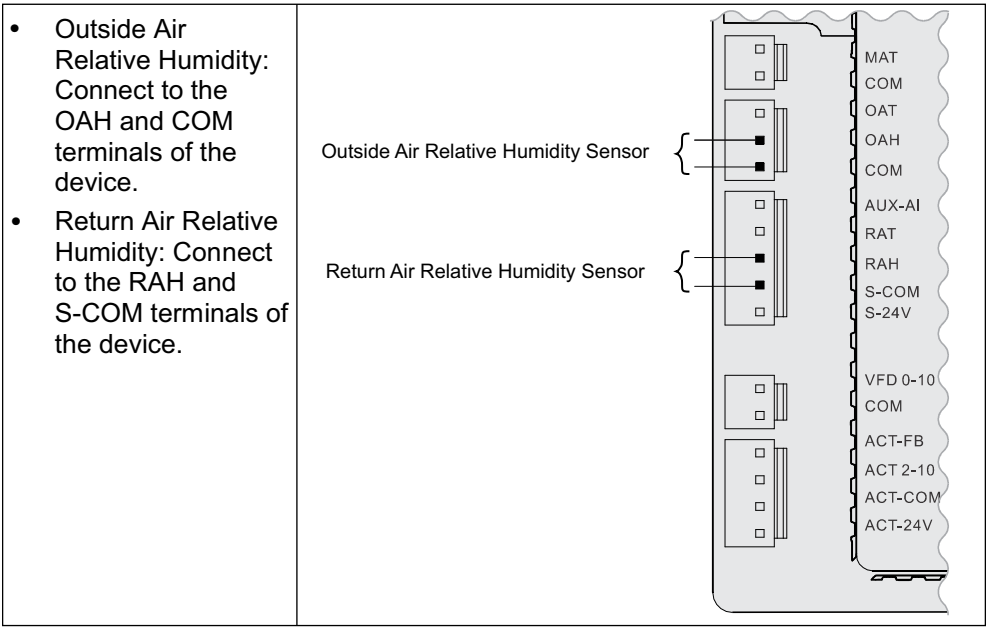
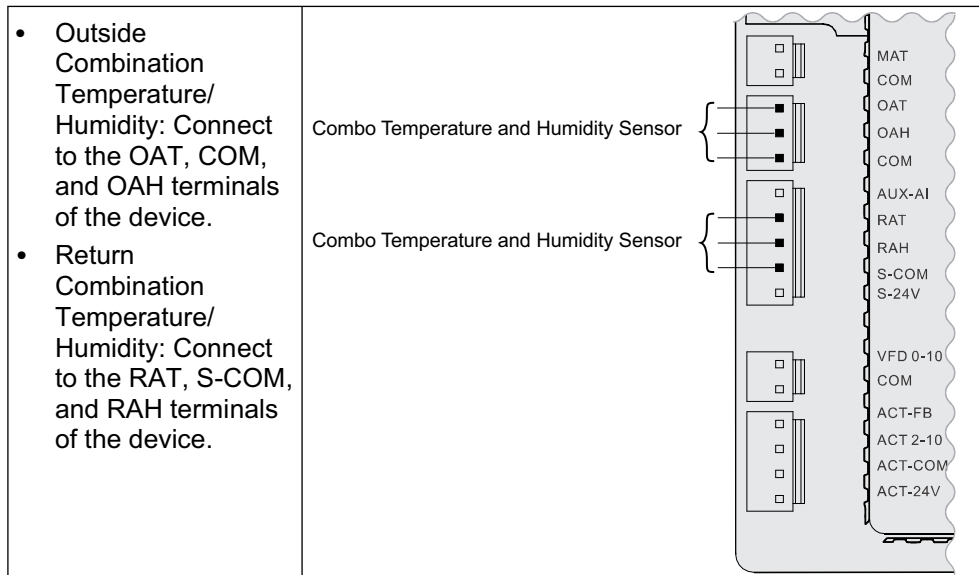
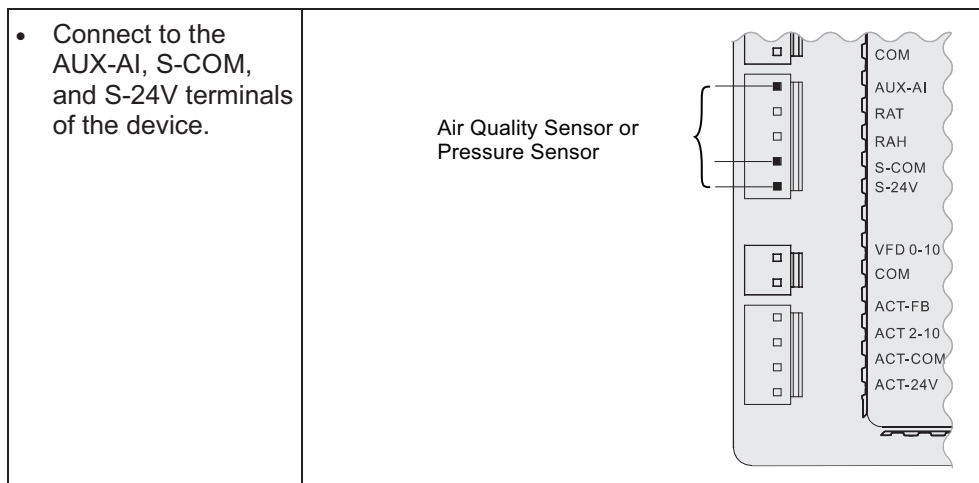


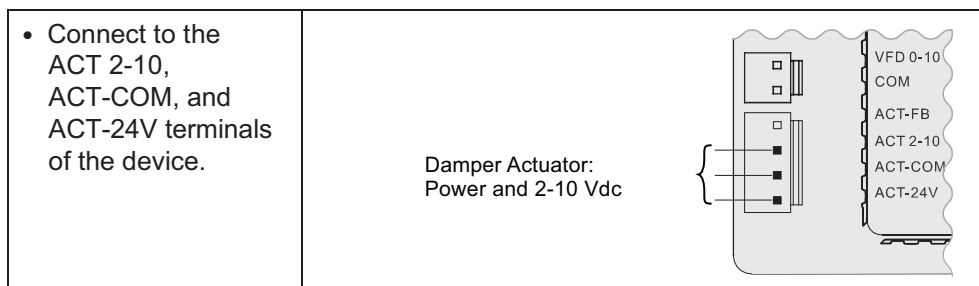
Fig. 78 — Relative Humidity Sensor Connection



**Fig. 79 — Combination Temperature/Humidity Sensor Connection**



**Fig. 80 — CO<sub>2</sub>/Pressure Sensor Connection**



**Fig. 81 — Damper Actuator Connection**

## SETUP AND CONFIGURATION

**IMPORTANT:** Before setup and configuration, it is recommended to obtain some location-based values, such as shutoff points, or utilize the location services in the Climatix™ mobile application.

Set up and configure the economizer controller before putting it into usage. This can be accomplished by using the Climatix™ mobile application or the inbuilt display. After sensor, compressor, thermostat, or actuator is connected to the economizer controller, values/statuses are displayed in the Operating section of the mobile application and on the LCD. Users can manually change basic and advanced settings, configure I/Os, and test the damper operation and any configured outputs by modifying the corresponding parameter values in the local device or mobile application. See Tables 23-30 for a complete list of all parameters that users can find on the LCD display. Refer to it during the setup and configuration process.

**NOTE:** For all units, the Climatix application login is: **Administrator**. For units coming from the factory with CO<sub>2</sub> configuration or single enthalpy (control mode 3), the controller password is OneBT2.1. For all other units, use the controller password OneBT.

**NOTE:** Parameters and display menus may display differently/dynamically if different applications are configured. See Tables 23-30.

**IMPORTANT:** Not all operations are available on the local POL 224. For example, users can only obtain shutoff set points and perform cfm commissioning via the Climatix™ mobile application. Setup and configuration on the local device are only recommended if operations from the mobile application are unavailable. Check the mobile application for all operations that can be performed from the mobile application end.

**IMPORTANT:** By connecting the RS485 port to a PC, all parameters are also readable or writable from PC tools such as Modbus Poll.exe via Modbus®<sup>a</sup> and Yabe.exe via BACnet™<sup>a</sup> MSTP (Bps 38400 [default], Bps 9600, Bps 19200, Bps 115200). Note that an external End of Line (EOL) element is required to achieve Baud Rate 115200 at a maximum cable length of 4000 ft (1.2 km).

**NOTE(S):**

a. Third-party trademarks and logos are the property of their respective owners.

**Table 23 — Status Display**

| PARAMETER           | DESCRIPTION                                                                                                                                                                                                                                                                                                                          | VALUE                                                     |
|---------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------|
| <b>1FREECOOL</b>    | Indicates if the system can use outdoor air for free cooling.                                                                                                                                                                                                                                                                        | YES<br>NO                                                 |
| <b>1ECON ENAB</b>   | Indicates if outdoor air is being used for the first stage of cooling.                                                                                                                                                                                                                                                               |                                                           |
| <b>1OCCUPIED</b>    | Indicates if the space is occupied. If users choose <b>ALWAYS</b> for <b>6OCC</b> when configuring I/Os, the parameter value is <b>YES</b> ; if users keep the default selection <b>T-STAT</b> for <b>6OCC</b> and the controller receives 24-v signal from OCC input, the value is <b>YES</b> . Otherwise, the value is <b>NO</b> . |                                                           |
| <b>1Y1-IN</b>       | Y1-IN call from thermostat for Cooling Stage 1.                                                                                                                                                                                                                                                                                      | ON<br>OFF                                                 |
| <b>1Y1-OUT</b>      | Y1-OUT signal to compressor for Cooling Stage 1.                                                                                                                                                                                                                                                                                     |                                                           |
| <b>1Y2-IN</b>       | Y2-IN call from thermostat for Cooling Stage 2.                                                                                                                                                                                                                                                                                      |                                                           |
| <b>1Y2-OUT</b>      | Y2-OUT signal to compressor for Cooling Stage 2.<br><b>Dynamic item:</b> Appears only if Y2-OUT terminal is configured.                                                                                                                                                                                                              |                                                           |
| <b>1AUX1-I</b>      | Aux1-IN signal.<br><b>Dynamic item:</b> Appears only if Aux1-In terminal is configured.                                                                                                                                                                                                                                              |                                                           |
| <b>1AUX1-O</b>      | Aux1-OUT signal.<br><b>Dynamic item:</b> Appears only if Aux1-OUT terminal is configured.                                                                                                                                                                                                                                            |                                                           |
| <b>1AUX2-I</b>      | Aux2-IN signal.<br><b>Dynamic item:</b> Appears only if Aux2-In terminal is configured.                                                                                                                                                                                                                                              |                                                           |
| <b>1AUX2-O</b>      | Aux2-OUT signal.<br><b>Dynamic item:</b> Appears only if Aux2-OUT terminal is configured.                                                                                                                                                                                                                                            |                                                           |
| <b>1COMP STAGE</b>  | Indicates compressor current stage.                                                                                                                                                                                                                                                                                                  | Off<br>1<br>2<br>3                                        |
| <b>1HEAT ENAB</b>   | Indicates if heating is enabled.                                                                                                                                                                                                                                                                                                     | YES<br>NO                                                 |
| <b>1MIX AIR LOW</b> | Indicates if the anti-freeze protection function is enabled for a mixed air temperature sensor. If the detected air temperature is lower than the anti-freeze protection set point (3FRZ PROT), the parameter value is <b>YES</b> . Otherwise, it is <b>NO</b> .                                                                     |                                                           |
| <b>1MAT PRES</b>    | Indicates the present value of the mixed air temperature (MAT) sensor.<br><b>Dynamic item:</b> Appears only if <b>MAT</b> or <b>AUTO</b> is selected for <b>3DIF T LOC</b> under Parameter Settings — Advanced on page 68.                                                                                                           | The corresponding detected value is displayed on the LCD. |
| <b>1LAT PRES</b>    | Indicates the present value of the leaving air temperature (LAT) sensor.<br><b>Dynamic item:</b> Appears only if <b>LAT</b> or <b>AUTO</b> is selected for <b>3DIF T LOC</b> .                                                                                                                                                       |                                                           |
| <b>1OAT PRES</b>    | Indicates the present value of the outdoor air temperature (OAT) sensor.<br><b>Dynamic item:</b> Appears only if an OAT sensor is configured.                                                                                                                                                                                        |                                                           |
| <b>1OAH PRES</b>    | Indicates the present value of the outdoor air relative humidity (OAH) sensor.<br><b>Dynamic item:</b> Appears only if an OAH sensor is configured.                                                                                                                                                                                  |                                                           |
| <b>1RAT PRES</b>    | Indicates the present value of the return air temperature (RAT) sensor.<br><b>Dynamic item:</b> Appears only if a RAT sensor is configured.                                                                                                                                                                                          |                                                           |
| <b>1RAH PRES</b>    | Indicates the present value of the return air relative humidity (RAH) sensor.<br><b>Dynamic item:</b> Appears only if a RAH sensor is configured.                                                                                                                                                                                    |                                                           |
| <b>1CO2 PRES</b>    | Indicates the present value of the CO <sub>2</sub> sensor.<br><b>Dynamic item:</b> Appears only if a CO <sub>2</sub> sensor is configured.                                                                                                                                                                                           |                                                           |
| <b>1DCV STATUS</b>  | Indicates the demand controlled ventilation (DCV) status.<br><b>Dynamic item:</b> Appears only if a CO <sub>2</sub> sensor is configured. Displays ON if the measured CO <sub>2</sub> concentration value is above the DCV set point and OFF if below the DCV set point.                                                             | ON<br>OFF                                                 |
| <b>1FAN SPD LV</b>  | Indicates the current fan speed status (low, medium, or high). If a one-speed fan is connected and configured, this item is invisible.<br><b>Dynamic item:</b> Appears only if “ <b>6FAN</b> ” is configured as “ <b>2SPEED</b> ” under Parameter Settings — I/O Configurations on page 68.                                          | L<br>H                                                    |
| <b>1ACT OUT</b>     | Indicates current position of damper actuator in v.                                                                                                                                                                                                                                                                                  | The corresponding detected value is displayed on the LCD. |
| <b>1ACT FB</b>      | Indicates feedback signal of damper actuator in v.                                                                                                                                                                                                                                                                                   |                                                           |
| <b>1ACT POS</b>     | Indicates current position of damper actuator in % Open.                                                                                                                                                                                                                                                                             |                                                           |
| <b>1ACT CNT</b>     | Indicates number of times actuator has cycled (1 cycle = 180 degrees of movement in any direction). Resettable via HMI item <b>8ACT CNT RESET</b> under Enter Running State on page 70.                                                                                                                                              |                                                           |
| <b>1EQUIP</b>       | Indicates the equipment type. If <b>HP(O)</b> or <b>HP(B)</b> is chosen for <b>6AUX1-I</b> , the parameter value is <b>HP(O)</b> or <b>HP(B)</b> respectively. If neither is chosen, the value is <b>CON RTU</b> .                                                                                                                   | HP(O)<br>HP(B)<br>CON RTU                                 |
| <b>1OAT LOCK</b>    | Indicates status of the OAT cooling lockout function.                                                                                                                                                                                                                                                                                | NO<br>LCKOUT<br>OVRD                                      |
| <b>1INS</b>         | Indicates the installation date of the Economizer Controller. If the installation date is incorrect, press Enter to change and confirm month, date and year.                                                                                                                                                                         | —                                                         |

**Table 24 — Parameter Settings — Basic**

| PARAMETER         | DESCRIPTION                                                                                                                                                                                                                                                                                                                                                                                      | RANGE                             | DEFAULT    |
|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|------------|
| <b>2 TEMP OFF</b> | Temperature shutoff set point can be obtained automatically if a smartphone or tablet is connected to the network provided by a Wi-Fi/WLAN stick plugged into the Economizer Controller and the mobile application is installed on the phone or tablet. This can also be a manually defined set point.                                                                                           | 48...80°F; increment by 1         | 63°F       |
| <b>2ENTH OFF</b>  | Enthalpy shutoff set point can be obtained automatically if a smartphone or tablet is connected to the network provided by a Wi-Fi/WLAN stick plugged into the Economizer Controller and the mobile application is installed on the phone or tablet. This can also be a manually defined set point.<br><b>Dynamic item:</b> Appears only if an OAH sensor is configured.                         | 22...30 Btu/lbm; increment by 1   | 28 Btu/lbm |
| <b>2DVC</b>       | Demand controlled ventilation set point can be obtained automatically if a smartphone or tablet is connected to the network provided by a Wi-Fi/WLAN stick plugged into the Economizer Controller and the mobile application is installed on the phone or tablet. This can also be a manually defined set point.<br><b>Dynamic item:</b> Appears only if a CO <sub>2</sub> sensor is configured. | 300...2000PPM; increment by 100   | 1100PPM    |
| <b>2FAN L ACT</b> | Damper minimum position when fan runs at a low speed.<br><b>Dynamic item:</b> Appears only if "6FAN" is configured as "2SPEED" under Parameter Settings — I/O Configurations on page 68.                                                                                                                                                                                                         | 2...10V; increment by 0.1         | 3.6V       |
| <b>2FAN H ACT</b> | Damper minimum position when fan runs at a high speed.<br><b>Dynamic item:</b> Appears only if "6FAN" is configured as "1SPEED" or "2SPEED".                                                                                                                                                                                                                                                     | 2...10V; increment by 0.1         | 2.8V       |
| <b>2VENTMAX L</b> | DCV maximum position when fan runs at a low speed.<br><b>Dynamic item:</b> Appears only if a CO <sub>2</sub> sensor is configured and "6FAN" is configured as "2SPEED".                                                                                                                                                                                                                          | 2...10V; increment by 0.1         | 3.6V       |
| <b>2VENTMAX H</b> | DCV maximum position when fan runs at a high speed.<br><b>Dynamic item:</b> Appears only if a CO <sub>2</sub> sensor is configured and "6FAN" is configured as "1SPEED" or "2SPEED".                                                                                                                                                                                                             | 2...10V; increment by 0.1         | 3.6V       |
| <b>2VENTMIN L</b> | DCV minimum position when fan runs at a low speed.<br><b>Dynamic item:</b> Appears only if a CO <sub>2</sub> sensor is configured and "6FAN" is configured as "2SPEED".                                                                                                                                                                                                                          | 2...10V; increment by 0.1         | 3.1V       |
| <b>2VENTMIN H</b> | DCV minimum position when fan runs at a high speed.<br><b>Dynamic item:</b> Appears only if a CO <sub>2</sub> sensor is configured and "6FAN" is configured as "1SPEED" or "2SPEED".                                                                                                                                                                                                             | 2...10V; increment by 0.1         | 2.3V       |
| <b>CFM COMM</b>   | Air Flow Chart: <b>CFM commissioning</b> can only be initiated from the mobile application. When <b>CFM commissioning</b> is in progress, the local device reads "CFM COMM".                                                                                                                                                                                                                     | —                                 | —          |
| <b>2DEGREES</b>   | Temperature unit (°F or °C).                                                                                                                                                                                                                                                                                                                                                                     | —                                 | °F         |
| <b>2FAN</b>       | Fan cfm.                                                                                                                                                                                                                                                                                                                                                                                         | 100...50,000cfm; increment by 100 | 5000cfm    |
| <b>2EX1 L</b>     | Exhaust Fan 1 low-speed parameter setting.<br><b>Dynamic item:</b> Appears only if:<br>• Exhaust Fan 1 is configured.<br>• "6FAN" is configured as "2SPEED".                                                                                                                                                                                                                                     | 0...100%; increment by 1          | 65%        |
| <b>2EX1 H</b>     | Exhaust Fan 1 high-speed parameter setting.<br><b>Dynamic item:</b> Appears only if:<br>• Exhaust Fan 1 is configured.<br>• "6FAN" is configured as "1SPEED" or "2SPEED".                                                                                                                                                                                                                        | 0...100%; increment by 1          | 50%        |
| <b>2EX2 L</b>     | Exhaust Fan 2 low-speed parameter setting.<br><b>Dynamic item:</b> Appears only if:<br>• Exhaust Fan 2 is configured.<br>• "6FAN" is configured as "2SPEED".                                                                                                                                                                                                                                     | 0...100%                          | 80%        |
| <b>2EX2 H</b>     | Exhaust Fan 2 high-speed parameter setting.<br><b>Dynamic item:</b> Appears only if:<br>• Exhaust Fan 2 is configured.<br>• "6FAN" is configured as "1SPEED" or "2SPEED".                                                                                                                                                                                                                        | 0...100%; increment by 1          | 75%        |
| <b>2THL</b>       | Temperature high limitation.<br><b>Dynamic item:</b> Appears only if an RAT sensor is configured.                                                                                                                                                                                                                                                                                                | 0...100%; increment by 1          | 83%        |
| <b>2EHL</b>       | Enthalpy high limitation.<br><b>Dynamic item:</b> Appears only if an RAH sensor is configured.                                                                                                                                                                                                                                                                                                   | 30...50 Btu/lbm, increment by 1   | 33 Btu/lbm |
| <b>2FAN DLY</b>   | Cooling delay via increasing fan speed.                                                                                                                                                                                                                                                                                                                                                          | 0...30 min; increment by 1        | 5 min.     |

**Table 25 — Parameter Settings — Advanced**

| PARAMETER           | DESCRIPTION                                                                                                                                                                                                                                                                                                                            | VALUE/RANGE                    | DEFAULT |
|---------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|---------|
| <b>3FREEZE POS</b>  | Anti-freeze protection damper position (closed or minimum).                                                                                                                                                                                                                                                                            | CLO<br>MIN                     | CLO     |
| <b>3SD ACT POS</b>  | Damper position during shutdown (open or closed).                                                                                                                                                                                                                                                                                      | CLO<br>OPN                     | CLO     |
| <b>3DIF T LOC</b>   | MAT sensor location:<br><ul style="list-style-type: none"> <li>Choose <b>MAT</b> if the sensor is installed before the DX (Direct Expansion) coil.</li> <li>Choose <b>LAT</b> if the sensor is installed after the DX coil.</li> <li>Choose <b>AUTO</b> to let the Economizer Controller automatically detect the location.</li> </ul> | MAT<br>LAT<br>AUTO             | LAT     |
| <b>3LAT LOW</b>     | Low limit of leaving air temperature.<br><b>Dynamic item:</b> Appears only if <b>LAT</b> or <b>AUTO</b> is selected for <b>3DIF T LOC</b> .                                                                                                                                                                                            | 35...65°F; increment by 1      | 45°F    |
| <b>3LAT HIGH</b>    | High limit of leaving air temperature.<br><b>Dynamic item:</b> Appears only if <b>LAT</b> or <b>AUTO</b> is selected for <b>3DIF T LOC</b> .                                                                                                                                                                                           | 70...180°F; increment by 1     | 80°F    |
| <b>3OAT CAL</b>     | OAT sensor calibration.                                                                                                                                                                                                                                                                                                                | –2.5...2.5°F; increment by 0.5 | 0°F     |
| <b>3RAT CAL</b>     | RAT sensor calibration.<br><b>Dynamic item:</b> Appears only if an RAT sensor is configured.                                                                                                                                                                                                                                           | –2.5...2.5°F; increment by 0.5 | —       |
| <b>3OAH CAL</b>     | OAH sensor calibration.<br><b>Dynamic item:</b> Appears only if an OAH sensor is configured.                                                                                                                                                                                                                                           | –10...10%; increment by 0.5    | 0%      |
| <b>3RAH CAL</b>     | RAH sensor calibration.<br><b>Dynamic item:</b> Appears only if an RAH sensor is configured.                                                                                                                                                                                                                                           |                                |         |
| <b>3MAT CAL</b>     | MAT or LAT sensor calibration.                                                                                                                                                                                                                                                                                                         | –2.5...2.5°F; increment by 0.5 | 0°F     |
| <b>3MAT SET</b>     | Set point of MAT or LAT sensor.                                                                                                                                                                                                                                                                                                        | 38...70°F; increment by 1      | 53°F    |
| <b>3FRZ PROT</b>    | Anti-freeze protection set point of MAT sensor.                                                                                                                                                                                                                                                                                        | 35...55°F; increment by 1      | 45°F    |
| <b>3ACT TOLR</b>    | Actuator tolerance setpoint between output (in percent) and feedback (in percent).                                                                                                                                                                                                                                                     | 0...15%; increment by 1        | 8%      |
| <b>3OAT LOCK</b>    | OAT lockout set point for anti-freeze protection.                                                                                                                                                                                                                                                                                      | –45...80°F; increment by 1     | 32°F    |
| <b>3OAT LCKOVRD</b> | When OAT LOCKOUT is enabled, choose to override the cooling lockout function or not.                                                                                                                                                                                                                                                   | YES<br>NO                      | NO      |
| <b>3OAT LOCKODY</b> | Indicates the overridden time if “YES” is selected for “3OAT LCKOVRD”.                                                                                                                                                                                                                                                                 | 0...300 min; increment by 1    | 45 min. |

**Table 26 — Parameter Settings — I/O Configurations**

| PARAMETER                    | DESCRIPTION                                                                                                                                                                                                                                                                                                                                                                                     | VALUE                                             | DEFAULT |
|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|---------|
| <b>6OCC</b>                  | Configures if occupancy status receives signal from the connected thermostat or is displayed as ALWAYS in the Economizer Controller.                                                                                                                                                                                                                                                            | T-STAT<br>ALWAYS                                  | T-STAT  |
| <b>6AUX1-I</b>               | Auxiliary DI-1. Configurable as:<br><ul style="list-style-type: none"> <li>None.</li> <li>Heat Conventional (W1) from thermostat.</li> <li>Heat pump (reversing valve O).</li> <li>Heat pump (reversing valve B).</li> <li>Pre-occupancy signal from thermostat.</li> <li>Shutdown signal from unit.</li> </ul>                                                                                 | NONE<br>HP(O)<br>HP(B)<br>PREOCC<br>SHUTDWN       | W1      |
| <b>6AUX2-I</b>               | Auxiliary DI-2. Configurable as:<br><ul style="list-style-type: none"> <li>None.</li> <li>Heat stage 1 (W1) from thermostat.</li> <li>Heat pump (reversing valve O).</li> <li>Heat pump (reversing valve B).</li> <li>Pre-occupancy signal from thermostat.</li> <li>Shutdown signal from unit.</li> </ul> <b>NOTE:</b> Whichever is chosen for 6AUX1-I does not appear in the list of 6AUX2-I. | NONE<br>W1<br>HP(O)<br>HP(B)<br>PREOCC<br>SHUTDWN | NONE    |
| <b>6OAT SIG</b>              | Configures signal type of OAT sensor.                                                                                                                                                                                                                                                                                                                                                           | 0-10V<br>NTC10K                                   | NTC10K  |
| <b>6RAT SIG</b>              | Configures signal type of RAT sensor.                                                                                                                                                                                                                                                                                                                                                           | 0-10V<br>NTC10K<br>NONE                           | NONE    |
| <b>6OAH SIG</b>              | Configures signal type of OAH sensor.                                                                                                                                                                                                                                                                                                                                                           | 0-10V<br>4-20mA<br>NONE                           | NONE    |
| <b>6RAH SIG</b>              | Configures signal type of RAH sensor.                                                                                                                                                                                                                                                                                                                                                           |                                                   |         |
| <b>6MAT SIG</b>              | Configures signal type of MAT or LAT sensor.                                                                                                                                                                                                                                                                                                                                                    | 0-10V<br>NTC10K                                   | NTC10K  |
| <b>6AUX-AI1</b>              | Auxiliary AI-1. Configurable as:<br><ul style="list-style-type: none"> <li>CO<sub>2</sub> sensor.</li> <li>Static pressure (temporarily for CFM commissioning) sensor.</li> <li>None.</li> </ul>                                                                                                                                                                                                | PRESSURE<br>CO <sub>2</sub><br>NONE               | NONE    |
| <b>6X-AI1 SIG</b>            | Configures CO <sub>2</sub> sensor type.<br><b>Dynamic item:</b> Appears only if “CO <sub>2</sub> ” is selected for “6AUX-AI1”.                                                                                                                                                                                                                                                                  | 0-10V<br>2-10V<br>0-5V                            | 0-10V   |
| <b>6CO<sub>2</sub> Rng L</b> | Configures the low limit of CO <sub>2</sub> measuring range.<br><b>Dynamic item:</b> Appears only if “CO <sub>2</sub> ” is selected for “6AUX-AI1”.                                                                                                                                                                                                                                             | 0...500; increment by 10                          | 0       |
| <b>6CO<sub>2</sub> Rng H</b> | Configures the high limit of CO <sub>2</sub> measuring range.<br><b>Dynamic item:</b> Appears only if “CO <sub>2</sub> ” is selected for “6AUX-AI1”.                                                                                                                                                                                                                                            | 1000...3000;<br>increment by 50                   | 2000    |

**Table 26 — Parameter Settings — I/O Configurations (cont)**

| PARAMETER | DESCRIPTION                                                                                                                                                                                                                                                                             | VALUE                    | DEFAULT |
|-----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|---------|
| 6AUX-AI2  | Choose <b>ACT FB</b> if feedback signal is available from the connected damper actuator. Otherwise, choose <b>NONE</b> .                                                                                                                                                                | ACT FB<br>NONE           | ACT FB  |
| 6Y2O      | Choose " <b>COOL 2</b> " if Cooling Stage 2 is available (another compressor is connected to the Economizer). Otherwise, choose " <b>NONE</b> ".                                                                                                                                        | COOL 2<br>NONE           | COOL 2  |
| 6AUX1-O   | Auxiliary DO-1. Configurable as:<br><ul style="list-style-type: none"> <li>None.</li> <li>Exhaust fan (1 or 2).</li> <li>Alarm output to thermostat (Title 24).</li> </ul>                                                                                                              | NONE<br>ALARM<br>EXHAUST | EXHAUST |
| 6AUX2-O   | Auxiliary DO-2. Configurable as:<br><ul style="list-style-type: none"> <li>None.</li> <li>Exhaust fan (1 or 2).</li> <li>Alarm output to thermostat (Title 24).</li> </ul> <b>NOTE:</b> Except for Exhaust Fan, whichever is chosen for 6AUX1-O does not appear in the list of 6AUX2-O. | NONE<br>ALARM<br>EXHAUST | ALARM   |
| 6RS485    | Switch between MSTP and Modbus.                                                                                                                                                                                                                                                         | MSTP<br>MODBUSLV         | MSTP    |

**Table 27 — Alarm Parameters<sup>a,b</sup>**

| PARAMETER       | DESCRIPTION                                                                         |
|-----------------|-------------------------------------------------------------------------------------|
| NO ALARM        | No alarm is activated.                                                              |
| 4MAT SEN ALARM  | MAT sensor has failed, gone out of range or become disconnected.                    |
| 4CO2 SEN ALARM  | CO <sub>2</sub> sensor has failed, gone out of range or become disconnected.        |
| 4OAT SEN ALARM  | OAT sensor has failed, gone out of range or become disconnected.                    |
| 4OAH SEN ALARM  | OAH sensor has failed, gone out of range or become disconnected.                    |
| 4RAT SEN ALARM  | RAT sensor has failed, gone out of range or become disconnected.                    |
| 4RAH SEN ALARM  | RAH sensor has failed, gone out of range or become disconnected.                    |
| 4FREEZE ALARM   | Anti-freeze notification when MAT sensor is below anti-freeze protection set point. |
| 4RTU SHUTDOWN   | Notification of Shutdown Active when SHUTDWN is chosen for 6AUX1-I or 6AUX2-I.      |
| 4ACTUATOR ALARM | Actuator gets disconnected or has failed.                                           |
| 4ACT UNDER V    | Voltage received by the actuator is below expected range.                           |
| 4ACT OVER V     | Voltage received by the actuator is above expected range.                           |
| 4ACT STALLED    | Damper actuator stopped before achieving commanded position.                        |
| 4ACT SLIPPING   | Damper actuator slips after reaching commanded position.                            |
| 4NOT ECON       | Not Economizing when it should.                                                     |
| 4ECON SHOULDNT  | Economizing when it should not.                                                     |
| 4EXCESS OA      | Excess outdoor air. Outside air intake is significantly higher than it should be.   |
| 4LLA ALARM      | Leaving air temperature is lower than the low limit (3LAT LOW).                     |
| 4HLA ALARM      | Leaving air temperature is higher than the high limit (3LAT HIGH).                  |

NOTE(S):

- All alarms are dynamic items. An alarm appears only if a related symptom mentioned above is detected.
- An alarm activation triggers a general alarm, then the configured system alarm output (AUX1-O or AUX2-O) is activated. If there is no alarm, NO ALARM is displayed on the HMI.

**Table 28 — Test Commands**

| PARAMETER       | DESCRIPTION                                                                                                                |
|-----------------|----------------------------------------------------------------------------------------------------------------------------|
| 7DAMPER MIN POS | Press Enter to test if the Economizer Controller can drive damper to minimum position.                                     |
| 7DAMPER CLOSE   | Press Enter to test if the Economizer Controller can drive damper to 100% Closed.                                          |
| 7DAMPER OPEN    | Press Enter to test if the Economizer Controller can drive damper to 100% Open.                                            |
| 7DAMPER ALL     | Press Enter to perform all the above tests.                                                                                |
| 7DAMPER         | Press Enter to test if the Economizer Controller can drive damper to the selected voltage.                                 |
| 7Y1O            | Press Enter to test if the Economizer Controller can turn on or off the first stage of cooling (close or open relay Y1O).  |
| 7Y2O            | Press Enter to test if the Economizer Controller can turn on or off the second stage of cooling (close or open relay Y2O). |
| 7AUX1-O         | Press Enter to test AUX1-O connection (close or open relay AUX1-O).                                                        |
| 7AUX2-O         | Press Enter to test AUX2-O connection (close or open relay AUX2-O).                                                        |

**Table 29 — Enter Running State**

| PARAMETER      | DESCRIPTION                                                                                                              |
|----------------|--------------------------------------------------------------------------------------------------------------------------|
| 8RUN STATE     | Change to Running State. Press Enter to confirm the change.                                                              |
| 8ENTER RUN?    | Confirm the change to Running State.                                                                                     |
| 8FACTORY DEF   | Perform factory reset. Press Enter to confirm the reset. (This action resets the controller password to default: OneBT.) |
| 8DEF CONFIRM?  | Confirm the factory reset.                                                                                               |
| 8ACT CNT RESET | Damper count reset.                                                                                                      |
| 8VER x.x.x     | Firmware version information such as 0.1.10.                                                                             |

**Table 30 — Enter Configuration State and Restart**

| PARAMETER      | DESCRIPTION                                                            |
|----------------|------------------------------------------------------------------------|
| 5CONFIG STATE  | Change to Configuration State. Press Enter to confirm the change.      |
| 5ENTER CONFIG? | Confirm the change to Configuration State.                             |
| 5RESTART       | Restart the Economizer Controller. Press Enter to confirm the restart. |
| 5CONF RESTART  | Confirm the restart.                                                   |

#### INSTALLING OPTIONAL HH57LW001 SINGLE OUTSIDE AIR ENTHALPY SENSOR

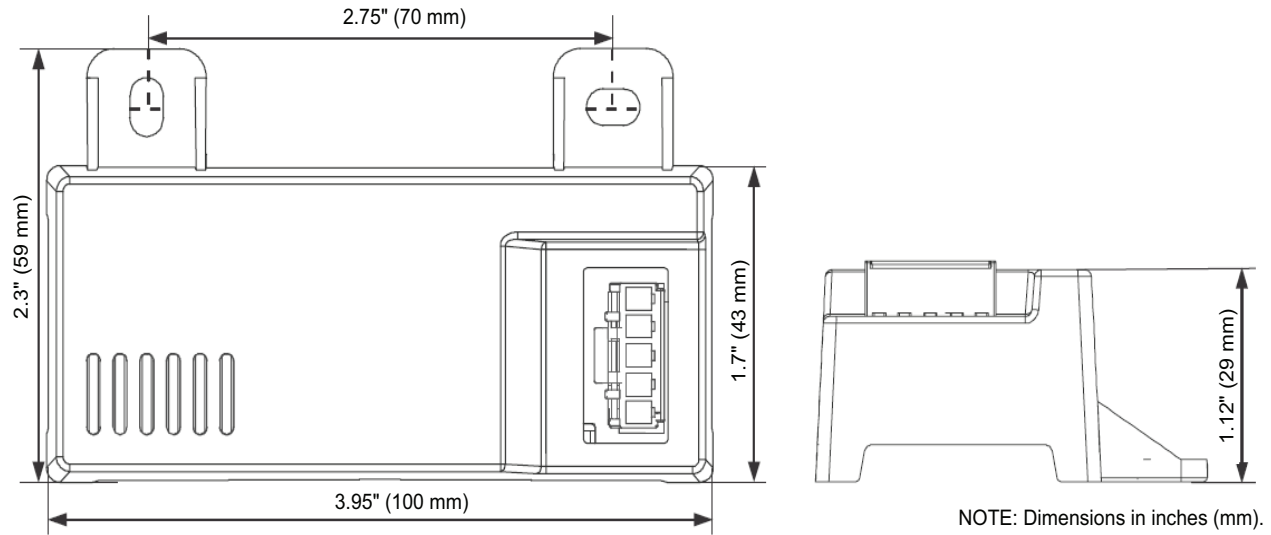
When using the HH57LW001 enthalpy sensor (see Fig. 82) for outside air changeover, the existing HH79NZ039 dry bulb sensor (see Fig. 83) must be removed. The enthalpy sensor will be mounted in the same location as the dry bulb sensor (see Fig. 84). When the enthalpy sensor's OA (Outside Air) temperature, enthalpy, and dew point are below their respective set points, outside air can be used for free cooling. When any of these are above their set point, free cooling will not be available. Enthalpy set points are configurable and create an enthalpy boundary according to the user's input. For additional details, see Fig. 85-86 and Table 31.

Harness 48TC005213 is required to be connected between the EconomizerONE harness in the return air chamber. Harness

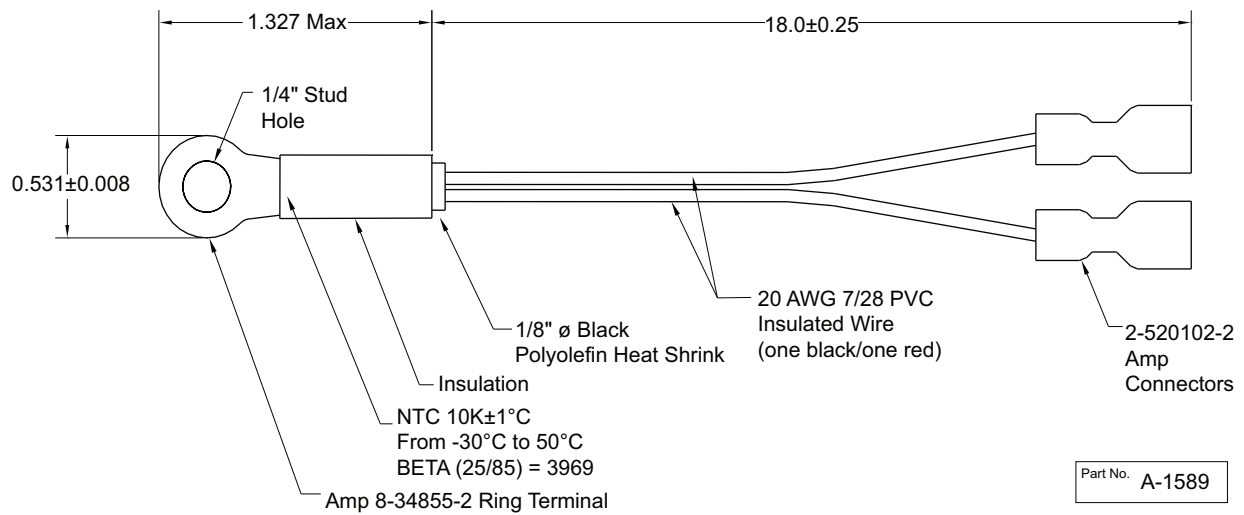
48TC005213 has a 5-pin plug that connects directly to the HH57LW001 enthalpy sensor. The CRENTSEN001A00 accessory kit includes enthalpy sensor (HH57LW001) and associated 5-pin plug (48TC005213) and may be ordered as a finished good.

#### *Enthalpy Control Sensor Configuration*

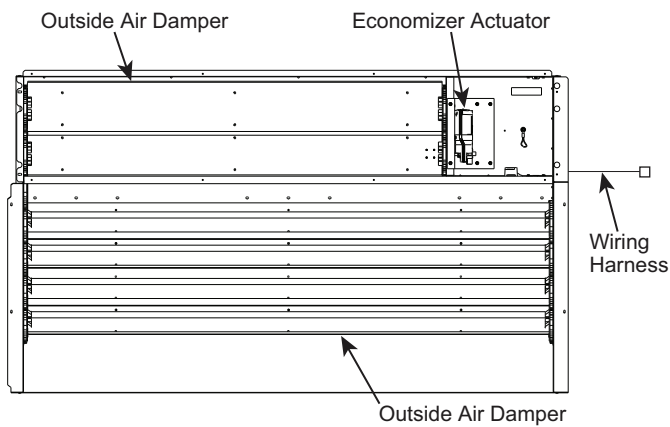
The optional enthalpy control sensor (P/N: HH57LW001) communicates with the POL224 economizer controller using the 5-wire harness, 48TC005213. The HH57LW001 sensor can be used as a single outside air enthalpy, a differential return enthalpy, or a differential return temperature sensor. Refer to the base unit control wiring diagrams found earlier in this book to wire the HH57LW001 enthalpy sensor for each option. See Fig. 82 and Table 33 on page 73 to locate the wiring terminals for each enthalpy control sensor.



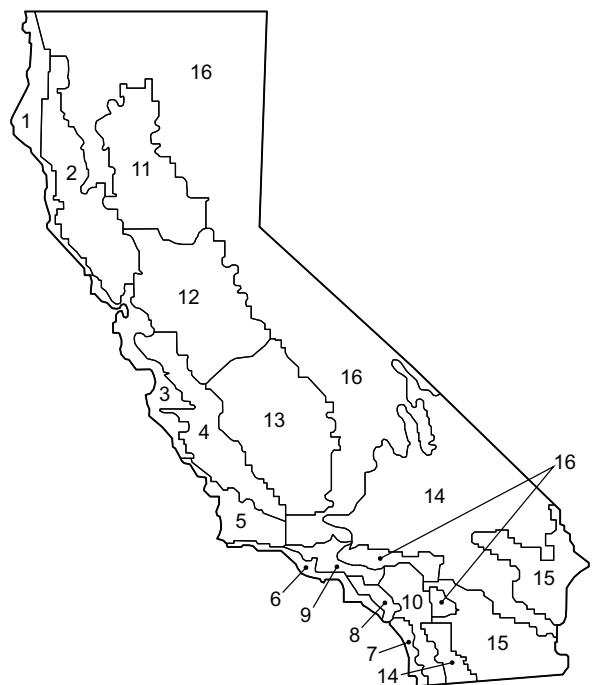
**Fig. 82 — HH57LW001 Dimensional, Connection and Switching Information**



**Fig. 83 — HH79NZ039 Dry Bulb and Mixed Air Sensor Wiring**



**Fig. 84 — EconomizerONE System Component Locations**



**Fig. 85 — California Title 24 Zones**

## APPENDIX A — Appendix Heading A

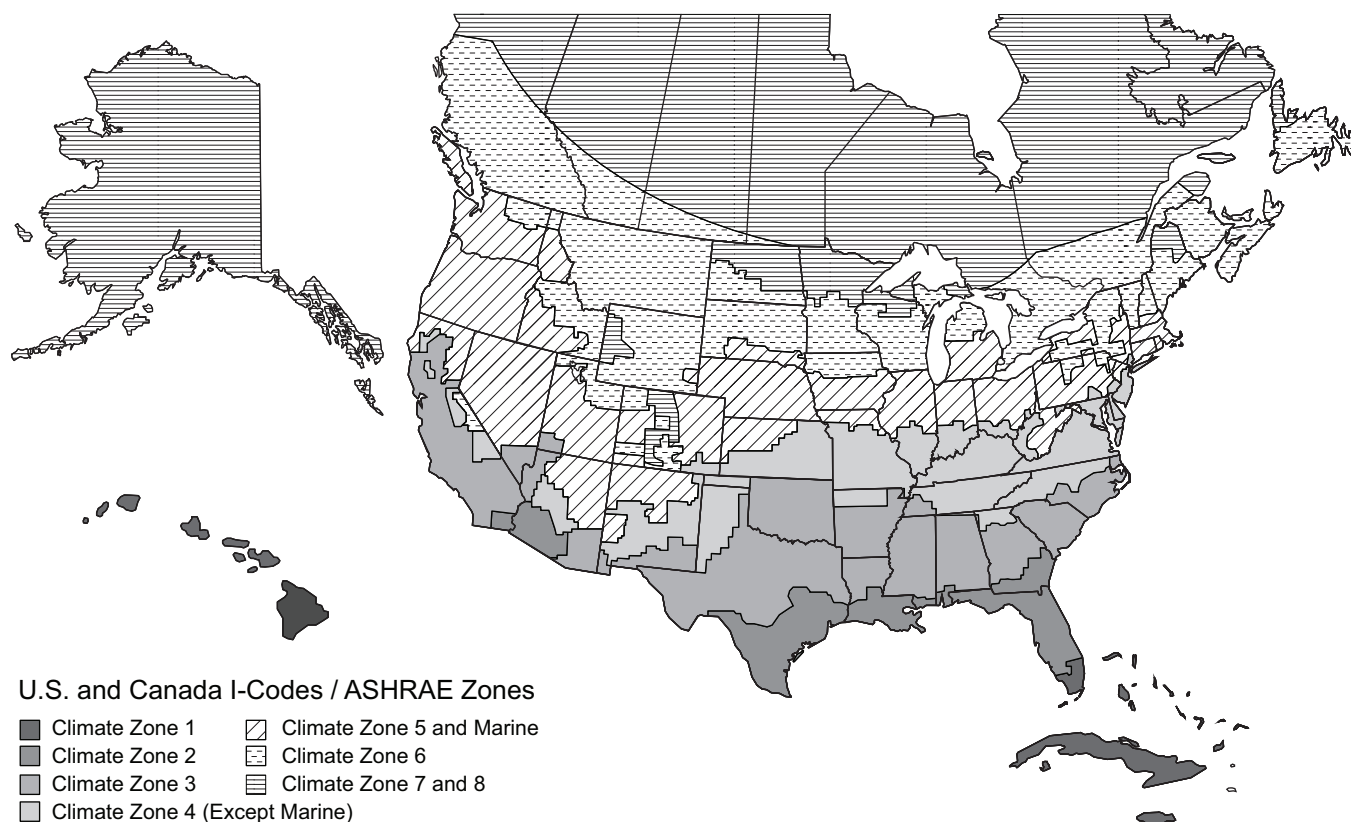


Fig. 86 — U.S. and Canada Climate Zones

Table 31 — Enthalpy Manual Entry Set Points for EconomizerONE Per Climate Zone

| CLIMATE ZONES <sup>a</sup>             | 2 TEMP OFF | LOWEST SETTING | RH% | 2 ENTH OFF | RH% | 2THL | 2EHL       | RH% |
|----------------------------------------|------------|----------------|-----|------------|-----|------|------------|-----|
| 1                                      | 65°F       | 22 Btu/lbm     | 43% | 28 Btu/lbm | 86% | 83°F | 33 Btu/lbm | 48% |
| 2                                      | 65°F       | 22 Btu/lbm     | 43% | 28 Btu/lbm | 86% | 83°F | 33 Btu/lbm | 48% |
| 3                                      | 65°F       | 22 Btu/lbm     | 43% | 28 Btu/lbm | 86% | 83°F | 33 Btu/lbm | 48% |
| 4                                      | 65°F       | 22 Btu/lbm     | 43% | 28 Btu/lbm | 86% | 83°F | 33 Btu/lbm | 48% |
| 5                                      | 70°F       | 22 Btu/lbm     | 28% | 28 Btu/lbm | 65% | 83°F | 33 Btu/lbm | 48% |
| 6                                      | 70°F       | 22 Btu/lbm     | 28% | 28 Btu/lbm | 65% | 83°F | 33 Btu/lbm | 48% |
| 7 and 8                                | 75°F       | 22 Btu/lbm     | 19% | 28 Btu/lbm | 50% | 83°F | 33 Btu/lbm | 48% |
| CALIFORNIA TITLE 24 ZONES <sup>b</sup> | 2 TEMP OFF | LOWEST SETTING | RH% | 2 ENTH OFF | RH% | 2THL | 2EHL       | RH% |
| 1                                      | 75°F       | 22 Btu/lbm     | 19% | 28 Btu/lbm | 50% | 83°F | 33 Btu/lbm | 48% |
| 2                                      | 73°F       | 22 Btu/lbm     | 22% | 28 Btu/lbm | 55% | 83°F | 33 Btu/lbm | 48% |
| 3                                      | 75°F       | 22 Btu/lbm     | 19% | 28 Btu/lbm | 55% | 83°F | 33 Btu/lbm | 48% |
| 4                                      | 73°F       | 22 Btu/lbm     | 22% | 28 Btu/lbm | 55% | 83°F | 33 Btu/lbm | 48% |
| 5                                      | 75°F       | 22 Btu/lbm     | 19% | 28 Btu/lbm | 50% | 83°F | 33 Btu/lbm | 48% |
| 6                                      | 71°F       | 22 Btu/lbm     | 28% | 28 Btu/lbm | 62% | 83°F | 33 Btu/lbm | 48% |
| 7                                      | 69°F       | 22 Btu/lbm     | 32% | 28 Btu/lbm | 68% | 83°F | 33 Btu/lbm | 48% |
| 8                                      | 71°F       | 22 Btu/lbm     | 28% | 28 Btu/lbm | 62% | 83°F | 33 Btu/lbm | 48% |
| 9                                      | 71°F       | 22 Btu/lbm     | 28% | 28 Btu/lbm | 62% | 83°F | 33 Btu/lbm | 48% |
| 10                                     | 73°F       | 22 Btu/lbm     | 22% | 28 Btu/lbm | 55% | 83°F | 33 Btu/lbm | 48% |
| 11                                     | 75°F       | 22 Btu/lbm     | 19% | 28 Btu/lbm | 50% | 83°F | 33 Btu/lbm | 48% |
| 12                                     | 75°F       | 22 Btu/lbm     | 19% | 28 Btu/lbm | 50% | 83°F | 33 Btu/lbm | 48% |
| 13                                     | 75°F       | 22 Btu/lbm     | 19% | 28 Btu/lbm | 50% | 83°F | 33 Btu/lbm | 48% |
| 14                                     | 75°F       | 22 Btu/lbm     | 19% | 28 Btu/lbm | 50% | 83°F | 33 Btu/lbm | 48% |
| 15                                     | 75°F       | 22 Btu/lbm     | 19% | 28 Btu/lbm | 50% | 83°F | 33 Btu/lbm | 48% |
| 16                                     | 75°F       | 22 Btu/lbm     | 19% | 28 Btu/lbm | 50% | 83°F | 33 Btu/lbm | 48% |
| CONTROLLER DEFAULT SETTINGS            | 2 TEMP OFF | —              | —   | 2 ENTH OFF | —   | 2THL | 2EHL       | RH% |
| DEFAULT SET POINTS                     | 63°F       | —              | —   | 28 Btu/lbm | 94% | 83°F | 33 Btu/lbm | 48% |

NOTE(S):

- Refer to Fig. 86 for map of U.S. and Canada climate zones.
- Refer to Fig. 85 for map of California Title 24 zones.

Economizers are shipped standard with an HH79NZ039 outside air dry bulb sensor (refer to Fig. 83). System default setting (high temp limit) is 63°F (17°C) and has a range of 48°F to 80°F (9°C to 27°C). Sensor is factory installed on economizer.

A second HH79NZ039 sensor is provided for mixed air temperature.

California high temperature setting requirements by region are shown in Table 32.

#### Enthalpy Settings (Enthalpy OPTION)

If installing the optional HH57LW001 enthalpy sensor, the HH79NZ039 dry bulb outside air sensor must first be removed. Wire sensor to harness 48TC005213 and the (5) wires from the harness to the EconomizerONE harness in the return air chamber. Harness 48TC005213 has a 5-pin plug that connects directly to the HH57LW001 enthalpy sensor. Refer to the base unit control wiring diagrams earlier in this book for wiring connections. Refer to Fig. 82 and see Table 33.

#### California's Title 24 High Temperature Limit Settings

California's Title 24 code requires a high temperature limit setting for all dry bulb outside air economizer changeover. The temperatures vary by the region within California. See Table 32 for high limit settings.

**Table 32 — California Title 24 Regional High Limit Dry Bulb Temperature Settings<sup>a</sup>**

| DEVICE TYPE <sup>b</sup>                           | CLIMATE ZONES  | REQUIRED HIGH LIMIT DESCRIPTION (ECONOMIZER OFF WHEN)                      |
|----------------------------------------------------|----------------|----------------------------------------------------------------------------|
| <b>FIXED DRY BULB</b>                              | 1, 3, 5, 11-16 | OAT exceeds 75°F (23.8°C)                                                  |
|                                                    | 2, 4, 10       | OAT exceeds 73°F (22.7°C)                                                  |
|                                                    | 6, 8, 9        | OAT exceeds 71°F (21.6°C)                                                  |
|                                                    | 7              | OAT exceeds 69°F (20.5°C)                                                  |
| <b>DIFFERENTIAL DRY BULB</b>                       | 1, 3, 5, 11-16 | OAT exceeds RA temperature                                                 |
|                                                    | 2, 4, 10       | OAT exceeds return air temperature -2°F (-18.8°C)                          |
|                                                    | 6, 8, 9        | OAT exceeds return air temperature -4°F (-20°C)                            |
|                                                    | 7              | OAT exceeds return air temperature -6°F (-21.1°C)                          |
| <b>FIXED ENTHALPY<sup>c</sup> + FIXED DRY BULB</b> | All            | OAT exceeds 28 Btu/lb of dry air <sup>b</sup> or OAT exceeds 75°F (23.8°C) |

NOTE(S):

- This table is sourced from 2019 California Energy Code, Title 24, Part 6, Table 140.4-E Air Economizer High Limit Shut Off Control Requirements.
- Only the high limit control devices listed are allowed to be used and at the set points listed. Others, such as Dew Point, Fixed Enthalpy, Electronic Enthalpy, and Differential Enthalpy Controls, may not be used in any climate zone for compliance with Section 140.4(e)1 unless approval for use is provided by the Energy Commission Executive Director.
- At altitudes substantially different than sea level, the Fixed Enthalpy limit value shall be set to the enthalpy value at 75°F and 50% relative humidity. As an example, at an approximately 6,000 foot elevation, the fixed enthalpy limit is approximately 30.7 Btu/lb.

#### LEGEND

**OAT** — Outdoor-Air Thermostat  
**RA** — Return Air

**Table 33 — HH57LW001 Sensor Wiring Terminations**

| TERMINAL |       | TYPE     | DESCRIPTION                                 |
|----------|-------|----------|---------------------------------------------|
| NUMBER   | LABEL |          |                                             |
| 1        | TCOM  | NTC 10k  | Outside Air Temperature Sensor Output       |
| 2        | TSIG  | NTC 10k  | Outside Air Temperature Sensor Output       |
| 3        | HSIG  | 0-10 vdc | Outside Air Relative Humidity Sensor Output |
| 4        | HCOM  | COMMON   | Sensor 24-v Common Input                    |
| 5        | H24V  | 24 vac   | Sensor 24-v Operating Voltage Input         |

## CHECKOUT

Inspect all wiring connections at the economizer module's terminals, and verify compliance with the installation wiring diagrams. For checkout, review the Status of each configured parameter and perform the Test Commands tests (refer to Table 28).

For information about menu navigation and use of the keypad see Interface Overview on page 55.

### **WARNING**

#### **ELECTRIC SHOCK HAZARD**

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

Before performing service or maintenance operations on unit, always turn off main power switch to unit and install lock(s) and lockout tag(s). Unit may have more than one power switch. Ensure electrical service to rooftop unit agrees with voltage and amperage listed on the unit rating plate.

If any wiring changes are required, first be sure to remove power from the economizer module before starting work. Pay particular attention to verifying the power connection (24 vac).

#### **Power Up**

After the POL224 module is mounted and wired, apply power.

#### **Initial Menu Display**

On initial start up, "Welcome" displays on the economizer HMI screen. After a brief pause, the Parameter Settings — I/O Configuration (refer to Table 26) of the software appears, allowing the user to check that presets and default values are configured correctly.

#### **Power Loss (Outage or Brownout)**

All set points and advanced settings are restored after any power loss or interruption.

NOTE: All settings are stored in non-volatile flash memory.

#### **Status**

Use the Status menu (refer to Table 23) to check the parameter values for the various devices and sensors configured.

NOTE: For information about menu navigation and use of the keypad, see Interface Overview on page 55.

#### **Checkout Tests**

Use the Test Commands menu (refer to Table 28) to test the damper operation and any configured outputs. Only items that are configured are shown in the Test Commands menu.

NOTE: For information about menu navigation and use of the keypad, see Interface Overview on page 55.

To perform a Test Command test:

1. Scroll to the desired test in Test Command menu 7 using the Up and Down buttons.
2. Press the Enter button to select the item. RUN? appears.
3. Press the Enter button to start the test. The unit pauses and then displays IN PROGRESS. When the test is complete, DONE appears.
4. When all desired parameters have been tested, press Enter + Up to end the test.

The Checkout tests can all be performed at the time of installation or at any time during the operation of the system as a test that the system is operable.

### **CAUTION**

#### **EQUIPMENT DAMAGE HAZARD**

Failure to follow this caution may result in equipment damage.

Be sure to allow enough time for compressor start-up and shutdown between checkout tests so that you do not short-cycle the compressors.

## TROUBLESHOOTING

For EconomizerONE troubleshooting issues, see Table 34.

**Table 34 – Operating Issues and Concerns**

| SYMPTOM                                                                                                                                | REASON                                                                                                             | SOLUTION                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|----------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>An alarm is displayed on the LCD</b>                                                                                                | Sensor, damper, or the whole working system may not work properly                                                  | Check sensor, damper, or the whole working system following the detailed alarm information.                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>DAC LED is blinking RED</b>                                                                                                         | Damper slippage                                                                                                    | Check whether the damper works properly.                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>DAC LED is blinking RED quickly</b>                                                                                                 | Damper unplugged                                                                                                   | Check whether the damper is connected.                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>DAC LED is OFF</b>                                                                                                                  | Terminal ACT-FB is configured but there is no available feedback signal                                            | Check whether the feedback signal is connected; check if ACT-FB is faulty.                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Economizer controller has no alarm, but the Free Cooling LED will not turn on when the OA seems to be suitable for Free Cooling</b> | Shutoff SP setting error                                                                                           | Shutoff temperature and/or enthalpy set point is incorrectly set up. Consult an HVAC professional to set up the shutoff set point correctly.                                                                                                                                                                                                                                                                                                                                            |
|                                                                                                                                        | OA temp is too low                                                                                                 | The OA temperature is too low; therefore, there is no cooling demand. This could possibly enable anti-freeze protection.                                                                                                                                                                                                                                                                                                                                                                |
|                                                                                                                                        | OA temp is too high or too humid                                                                                   | In DIFF mode, even though OA temperature is lower than RA temperature, if both OA and RA temperatures exceed the high limit, then Free Cooling turns off.<br>In Differential Enthalpy control mode, even though OA enthalpy is lower than RA enthalpy, if both OA and RA enthalpy exceed the high limit, then Free Cooling turns off.                                                                                                                                                   |
| <b>Economizer controller/mechanical cooling is not operating</b>                                                                       | No input power                                                                                                     | Use a multi-meter to check whether there is 24 vac $\pm$ 25% (18-30 vac) at the POWER terminals. If there is no voltage or if the voltage is significantly low, then check the transformer output voltage at the RTU. If 24-v is not present at the transformer secondary side, then check the primary line voltage to the transformer. If the line voltage is not present at the transformer primary side, then check the primary power to the RTU, fuses, circuit breaker, and so on. |
|                                                                                                                                        | Brownout                                                                                                           | If voltage is below 17-v, then the economizer controller may be in Brownout Protection mode. This mode disables all of the relay outputs. When the power is 19 vac or higher, the economizer controller and RTU operate normally.                                                                                                                                                                                                                                                       |
|                                                                                                                                        | Y1/Y2 signal is missing from the thermostat                                                                        | Mechanical cooling does not run until there is cooling demand (Y1/Y2 Active). Check the wiring from Y1 and Y2 terminals to the commercial thermostat. 24-v should be present between Y1/Y2 and Y1O/Y2O respectively.                                                                                                                                                                                                                                                                    |
|                                                                                                                                        | 24 vac~ and 24 vac $\perp$ are incorrectly wired                                                                   | 24 vac power supply has polarity when all devices are powered by the same 24 vac transformer; reversing polarity may cause a short circuit that can damage the system. Follow the transformer polarity mark, check the wiring of 24-v~ (or G or 24-v+), and ensure that they are tied to the same polar of 24 vac power supply; while checking the wiring of $\perp$ (or G0 or 24-v- or COM), ensure that they are all tied to another polar of 24 vac power supply.                    |
| <b>Firmware update failure</b>                                                                                                         | Application file is damaged, operation is incorrect, and/or USB flash disk does not work properly                  | Reload a BIN file, restart the controller, update firmware <sup>a</sup> , or change a USB flash disk. Contact service provider if failure still exists.                                                                                                                                                                                                                                                                                                                                 |
| <b>Free Cooling LED is solid RED</b>                                                                                                   | Sensor, damper, or whole working system may not work properly                                                      | Check sensor, damper, or the whole working system following the detailed alarm information.                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Free Cooling LED is blinking RED</b>                                                                                                | Not economizing when it should                                                                                     | Check the whole economizer working system, such as the sensor, damper, and thermostat.                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Incorrect controller password error on mobile application</b>                                                                       | For CO <sub>2</sub> and single enthalpy (control mode 3) configurations from the factory, the password has changed | For units coming from the factory with CO <sub>2</sub> configuration or single enthalpy (control mode 3), use the controller password OneBT2.1.<br>For all other units, use the controller password OneBT.<br>Performing a factory reset on the controller will also reset the password to OneBT.                                                                                                                                                                                       |
| <b>RS485 communication failure</b>                                                                                                     | RS485 signal or configuration error                                                                                | Check wiring, configuration, Baud Rate (using mobile application), and other network communication parameters.                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Sensor LED is blinking RED</b>                                                                                                      | Excess outdoor air                                                                                                 | Check the whole economizer working system, such as the sensor, damper, and thermostat.                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Sensor LED is solid RED</b>                                                                                                         | Mixed Air (MA) sensor error                                                                                        | Check the MA sensor. It must be either a Type II NTC 10K or 0-10 vdc sensor.                                                                                                                                                                                                                                                                                                                                                                                                            |
|                                                                                                                                        | Outside Air (OA)/Return Air (RA) sensor error                                                                      | Check the wiring and signal of the OA sensor. If in Differential (DIFF) mode, also check the RA sensor. The following sensor signals are valid:<br>Type II NTC 10K or 0-10 vdc temperature.<br>0-10 vdc or 4-20 mA humidity.                                                                                                                                                                                                                                                            |
|                                                                                                                                        | Air temperature failure/fault                                                                                      | Check the air temperature sensor signal. The valid signal must be Type II NTC 10K or 0-10 vdc.                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Sensor LED is OFF</b>                                                                                                               | CO <sub>2</sub> sensor error                                                                                       | Check CO <sub>2</sub> sensor connection, sensor signal (under range or over range), and sensor signal type.                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Sensor LED is YELLOW</b>                                                                                                            | Humidity sensor error                                                                                              | Check humidity sensor connection, sensor signal (under range or over range), and sensor signal type.                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Wi-Fi connection failure</b>                                                                                                        | Wi-Fi/WLAN stick error or wrong user name and password                                                             | Unplug and re-plug in the Wi-Fi/WLAN stick, enter a correct user name and password, restart the controller, or replace the Wi-Fi/WLAN stick. If the Wi-Fi/WLAN stick is POL903.00/100, then the default user name and password are Siemens-WLAN-Stick and SIBPAdmin. DNS name is siemens.wlanstick. Contact Application Engineering for information on this accessory.                                                                                                                  |

NOTE(S):

- Back up configurations before firmware update. All the previous configuration data is erased after firmware update. Contact Application Engineering for more information on support for firmware.  
IMPORTANT: If the controller enters the configuration state for the convenience of I/O configurations, then users can manually switch to the running state after finishing configurations. To do so, press Enter + Up at the same time, then press Enter to confirm the switch after 8RUN STATE appears on the LCD.

## PRE-START-UP/START-UP

### **WARNING**

#### PERSONAL INJURY HAZARD

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

1. Follow recognized safety practices and wear approved Personal Protective Equipment (PPE), including safety glasses and gloves when checking or servicing refrigerant system.
2. Do not use a torch to remove any component. System contains oil and refrigerant under pressure. To remove a component, wear PPE and proceed as follows:
  - a. Shut off all electrical power to unit. Apply applicable lockout/tag-out procedures.
  - b. Recover refrigerant to relieve all pressure from system using both high-pressure and low pressure ports.
  - c. Do not use a torch. Cut component connection tubing with tubing cutter and remove component from unit.
  - d. Carefully un-sweat remaining tubing stubs when necessary. Oil can ignite when exposed to torch flame.
3. Do not operate compressor or provide any electric power to unit unless compressor terminal cover is in place and secured.
4. Do not remove compressor terminal cover until all electrical power is disconnected and approved lockout/tagout procedures are in place.
5. Relieve all pressure from system before touching or disturbing anything inside terminal box whenever refrigerant leak is suspected around compressor terminals.
6. Never attempt to repair a soldered connection while refrigerant system is under pressure.

### **WARNING**

#### ELECTRICAL OPERATION HAZARD

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

The unit must be electrically grounded in accordance with local codes and NEC ANSI/NFPA 70 (American National Standards Institute/National Fire Protection Association).

Proceed as follows to inspect and prepare the unit for initial start-up:

1. Remove all access panels.
2. Read and follow instructions on all WARNING, CAUTION, and INFORMATION labels attached to, or shipped with, unit.
3. Make the following inspections:
  - a. Inspect for shipping and handling damages such as broken lines, loose parts, or disconnected wires, etc.
  - b. Inspect for oil at all refrigerant tubing connections and on unit base. Detecting oil generally indicates a refrigerant leak. Leak-test all refrigerant tubing connections using electronic leak detector, halide torch, or liquid-soap solution.

- c. Inspect all field-wiring and factory-wiring connections. Be sure that connections are completed and tight. Be sure that wires are not in contact with refrigerant tubing or sharp edges.
  - d. Inspect coil fins. If damaged during shipping and handling, carefully straighten fins with a fin comb.
4. Verify the following conditions:
  - a. Make sure that condenser-fan blade are correctly positioned in fan orifice. See Condenser Fan Adjustment section for more details.
  - b. Make sure that air filter(s) is in place.
  - c. Make sure that condensate drain trap is filled with water to ensure proper drainage.
  - d. Make sure that all tools and miscellaneous loose parts have been removed.

## START-UP, GENERAL

### Unit Preparation

Make sure that unit has been installed in accordance with installation instructions and applicable codes.

In addition to the base unit start-up (unit with electromechanical control), there are a few steps needed to properly start-up units with optional direct digital controls (DDC). The DDC's Service Test function should be used to assist in the base unit start-up and also allows verification of output operation. Controller configuration is also part of start-up. This is especially important when field accessories have been added to the unit. The factory pre-configures options installed at the factory. There may also be additional installation steps or inspection required during the start-up process.

### Additional Installation/Inspection

Inspect the field-installed accessories for proper installation, making note of which ones do or do not require configuration changes. Inspect the DDC Alarms for initial insight to any potential issues. Refer to the *Controls, Start-up, Operation and Troubleshooting Instructions* manual for the specific DDC. Inspect the SAT sensor for relocation as intended during installation. Inspect special wiring as directed below.

### Gas Piping

Check gas piping for leaks.

### **WARNING**

#### FIRE, EXPLOSION HAZARD

Failure to follow this warning could result in death, serious personal injury and/or property damage.

Disconnect gas piping from unit when pressure testing at pressure greater than 0.5 psig (3450 Pa). Pressures greater than 0.5 psig will cause gas valve damage resulting in hazardous condition. If gas valve is subjected to pressure greater than 0.5 psig, it must be replaced before use. When pressure testing field-supplied gas piping at pressures of 0.5 psig or less, a unit connected to such piping must be isolated by closing the manual gas valve(s).

## **WARNING**

### **RISK OF FIRE OR EXPLOSION**

If the information in this manual is not followed exactly, a fire or explosion may result causing property damage, personal injury or loss of life.

Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.

### **WHAT TO DO IF YOU SMELL GAS**

- Do not try to light any appliance.
- Do not touch any electrical switch; do not use any phone in your building.
- Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.
- If you cannot reach your gas supplier, call the fire department.

Installation and service must be performed by a qualified installer, service agency or the gas supplier.

## **AVERTISSEMENT**

### **RISQUE D'INCENDIE OU D'EXPLOSION**

Si les consignes de sécurité ne sont pas suivies à la lettre, cela peut entraîner la mort, de graves blessures ou des dommages matériels.

Ne pas entreposer ni utiliser d'essence ni autres vapeurs ou liquides inflammables à proximité de cet appareil ou de tout autre appareil.

### **QUE FAIRE SI UNE ODEUR DE GAZ EST DÉTECTÉE**

- Ne mettre en marche aucun appareil.
- Ne toucher aucun interrupteur électrique; ne pas utiliser de téléphone dans le bâtiment.
- Quitter le bâtiment immédiatement.
- Appeler immédiatement le fournisseur de gaz en utilisant le téléphone d'un voisin. Suivre les instructions du fournisseur de gaz.
- Si le fournisseur de gaz n'est pas accessible, appeler le service d'incendie.

L'installation et l'entretien doivent être effectués par un installateur ou une entreprise d'entretien qualifié, ou le fournisseur de gaz.

## **Return-Air Filters**

Ensure correct filters are installed in unit (see Appendix B — Physical Data). Do not operate unit without return-air filters.

## **Outdoor-Air Inlet Screens**

Outdoor-air inlet screen must be in place before operating unit.

## **Compressor Mounting**

Compressors are internally spring mounted. Do not loosen or remove compressor hold down bolts.

## **Internal Wiring**

Check all electrical connections in unit control boxes. Tighten as required.

## **Refrigerant Service Ports**

Each unit system has two 1/4-in. SAE flare (with check valves) service ports: one on the suction line, and one on the compressor discharge line. Be sure that caps on the ports are tight.

## **Compressor Rotation**

## **CAUTION**

### **EQUIPMENT DAMAGE HAZARD**

Failure to follow this caution can result in premature wear and damage to equipment.

Scroll compressors can only compress refrigerant if rotating in the right direction. Reverse rotation for extended times can result in internal damage to the compressor. Scroll compressors are sealed units and cannot be repaired on site location.

On 3-phase units with scroll compressors, it is important to be certain compressor is rotating in the proper direction. To determine whether or not compressor is rotating in the proper direction:

1. Connect service gauges to suction and discharge pressure fittings.
2. Energize the compressor.
3. The suction pressure should drop and the discharge pressure should rise, as is normal on any start-up.

If the suction pressure does not drop and the discharge pressure does not rise to normal levels:

1. Note that the evaporator fan is probably also rotating in the wrong direction.
2. Turn off power to the unit and install lockout tag.
3. Reverse any two of the unit power leads.
4. Re-energize to the compressor. Check pressures.

The suction and discharge pressure levels should now move to their normal start-up levels.

NOTE: When the compressor is rotating in the wrong direction, the unit will make an elevated level of noise and will not provide cooling.

## **Cooling**

Set space thermostat to OFF position. To start unit, turn on main power supply. Set system selector switch at COOL position and fan switch at AUTO. position. Adjust thermostat to a setting below room temperature. Compressor starts on closure of contactor.

Check unit charge. Refer to Refrigerant Charge section on page 18.

Reset thermostat at a position above room temperature. Compressor will shut off. Evaporator fan will shut off after a 30-second delay.

To shut off unit, set system selector switch at OFF position. Resetting thermostat at a position above room temperature shuts unit off temporarily until space temperature exceeds thermostat setting.

## **Main Burner**

Main burners are factory set and should require no adjustment.

To check ignition of main burners and heating controls, move thermostat setpoint above room temperature and verify that the burners light and evaporator fan is energized. Check heating effect, then lower the thermostat setting below the room temperature and verify that the burners and evaporator fan turn off.

When replacing unit orifices, order the necessary parts through RCD. See the "High Altitude Gas Conversion Kit Gas Heating/Electric Cooling 176,000-400,000 Btu/hr Heating" Installation Instructions for details.

## Heating

1. Purge gas supply line of air by opening union ahead of the gas valve. If gas odor is detected, tighten union and wait 5 minutes before proceeding.
2. Turn on electrical supply and manual gas valve.
3. Set system switch selector at HEAT position and fan switch at AUTO or ON position. Set heating temperature lever above room temperature.
4. The induced-draft motor will start.
5. After a call for heating, the main burners should light within 5 seconds. If the burner does not light, then there is a 22-second delay before another 5-second try. If the burner still does not light, the time delay is repeated. If the burner does not light within 15 minutes, there is a lockout. To reset the control, break the 24 v power to W1.
6. The evaporator-fan motor will turn on 45 seconds after burner ignition.
7. The evaporator-fan motor will turn off in 45 seconds after the thermostat temperature is satisfied.
8. Adjust airflow to obtain a temperature rise within the range specified on the unit nameplate.

NOTE: The default value for the evaporator-fan motor on/off delay is 45 seconds. The Integrated Gas Unit Controller (IGC) modifies this value when abnormal limit switch cycles occur. Based upon unit operating conditions, the on delay can be reduced to 0 seconds and the off delay can be extended to 180 seconds. When one flash of the LED is observed, the evaporator-fan on/off delay has been modified.

If the limit switch trips at the start of the heating cycle during the evaporator on delay, the time period of the on delay for the next cycle will be 5 seconds less than the time at which the switch tripped. (Example: If the limit switch trips at 30 seconds, the evaporator-fan on delay for the next cycle will occur at 25 seconds.) To prevent short-cycling, a 5-second reduction will only occur if a minimum of 10 minutes has elapsed since the last call for heating.

The evaporator-fan off delay can also be modified. Once the call for heating has ended, there is a 10-minute period during which the modification can occur. If the limit switch trips during this period, the evaporator-fan off delay will increase by 15 seconds. A maximum of 9 trips can occur, extending the evaporator-fan off delay to 180 seconds.

To restore the original default value, reset the power to the unit.

To shut off unit, set system selector switch at OFF position. Resetting heating selector lever below room temperature will temporarily shut unit off until space temperature falls below thermostat setting.

## Ventilation (Continuous Fan)

Set fan and system selector switches at ON and OFF positions, respectively. Evaporator fan operates continuously to provide constant air circulation. When the evaporator-fan selector switch is turned to the OFF position, there is a 30-second delay before the fan turns off.

### FASTENER TORQUE VALUES

|                                               |                                                |
|-----------------------------------------------|------------------------------------------------|
| <b>Stator motor mounting screws</b>           | 50 in.-lb (5.7 Nm) $\pm$ 5 in.-lb (0.6 Nm)     |
| <b>Fan rotor mounting screws (2.4 HP)</b>     | 50 in.-lb (5.7 Nm) $\pm$ 5 in.-lb (0.6 Nm)     |
| <b>Fan rotor mounting screws (3 and 5 HP)</b> | 30 in.-lb (3.4 Nm) $\pm$ 2 in.-lb (0.2 Nm)     |
| <b>Fan deck bracket screws</b>                | 50 in.-lb (5.7 Nm) $\pm$ 5 in.-lb (0.6 Nm)     |
| <b>Fan casing screws</b>                      | 10 in.-lb (1.1 Nm) $\pm$ 1 in.-lb (0.1 Nm)     |
| <b>Heat shield screws</b>                     | 30 in.-lb (3.4 Nm) $\pm$ 2 in.-lb (0.2 Nm)     |
| <b>Condenser motor mounting screws</b>        | 30 in.-lb (3.4 Nm) $\pm$ 2 in.-lb (0.2 Nm)     |
| <b>Condenser hub set screw</b>                | 84 in.-lb (9.5 Nm) $\pm$ 12 in.-lb (1.5 Nm)    |
| <b>Compressor mounting bolts</b>              | 12 ft-lb (16.2 Nm) $\pm$ 2 ft-lb (2.7 Nm)      |
| <b>Tandem rail mounting bolts</b>             | 8 ft-lb (10.8 Nm) $\pm$ 0.5 ft-lb (0.6 Nm)     |
| <b>Crankcase heater</b>                       | 22.5 in.-lb (2.5 Nm) $\pm$ 2.5 in.-lb (0.3 Nm) |

### START-UP, SYSTEMVU CONTROLS

#### IMPORTANT: SET-UP INSTRUCTIONS

Installation, wiring and troubleshooting information for the SystemVu™ Controller.: “48/50FC04-30, 48/50GC04-06 Single Package Rooftop Units with SystemVu Controls Version X.X Controls, Start-up, Operation and Troubleshooting.” Have a copy of this manual available at unit start-up.

## APPENDIX A — MODEL NUMBER NOMENCLATURE

|           |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |
|-----------|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|
| Position: | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
| Example:  | 4 | 8 | F | C | E | M | 2 | 4 | A | 2  | A  | 5  | -  | 0  | A  | 0  | A  | 0  |

### Unit Heat Type

48 — Gas Heat Packaged Rooftop

### Model Series - WeatherMaker®

FC — Standard Efficiency (EcoBlue™ Technology)

### Heat Options

D = Low Heat  
 E = Medium Heat  
 F = High Heat  
 S = Low Heat w/ Stainless Steel Heat Exchanger  
 R = Medium Heat w/ Stainless Steel Heat Exchanger  
 T = High Heat w/ Stainless Steel Heat Exchanger

### Refrig. Systems Options

M = Two Stage Cooling/Single Circuit Models  
 N = Two Stage Cooling/Single Circuit Models with Humidi-MiZer® System

### Cooling Tons

20 = 17.5 tons  
 24 = 20.0 tons  
 28 = 25.0 tons  
 30 = 27.5 tons

### Sensor Options

A = None  
 B = Return Air Smoke Detector (RA)  
 C = Supply Air Smoke Detector (SA)  
 D = RA + SA Smoke Detector  
 E = CO<sub>2</sub> Sensor  
 F = RA Smoke Detector and CO<sub>2</sub>  
 G = SA Smoke Detector and CO<sub>2</sub>  
 H = RA + SA Smoke Detector and CO<sub>2</sub>  
 J = Condensate Overflow Switch  
 K = Condensate Overflow Switch + RA Smoke Detectors  
 L = Condensate Overflow Switch + RA and SA Smoke Detectors  
 M = Condensate Overflow Switch + SA Smoke Detector  
 N = Condensate Overflow Switch + CO<sub>2</sub>  
 P = Condensate Overflow Switch + RA Smoke Detector and CO<sub>2</sub>  
 Q = Condensate Overflow Switch + SA Smoke Detector and CO<sub>2</sub>  
 R = Condensate Overflow Switch + RA and SA Smoke Detector and CO<sub>2</sub>

### Indoor Fan Options - Vane Axial EcoBlue Fan System

2 = Standard/Medium Static Motor - Vertical Supply  
 3 = High Static Motor - Vertical Supply  
 5 = Standard/Medium Static Motor - Vertical Supply and Filter Status Switch  
 6 = High Static Motor - Vertical Supply and Filter Status Switch  
 J = High Static Motor - Horizontal Supply  
 L = High Static Motor - Horizontal Supply and Filter Status Switch

### Coil Options — RTPF (Outdoor – Indoor – Hail Guard)

A = Al/Cu – Al/Cu  
 B = Precoat Al/Cu – Al/Cu  
 C = E-coat Al/Cu – Al/Cu  
 D = E-coat Al/Cu – E-coat Al/Cu  
 E = Cu/Cu – Al/Cu  
 F = Cu/Cu – Cu/Cu  
 M = Al/Cu – Al/Cu – Louvered Hail Guard  
 N = Precoat Al/Cu – Al/Cu – Louvered Hail Guard  
 P = E-coat Al/Cu – Al/Cu – Louvered Hail Guard  
 Q = E-coat Al/Cu – E-coat Al/Cu – Louvered Hail Guard  
 R = Cu/Cu – Al/Cu – Louvered Hail Guard  
 S = Cu/Cu – Cu/Cu – Louvered Hail Guard

### Voltage

1 = 575-3-60  
 5 = 208/230-3-60  
 6 = 460-3-60

### Packaging Compliance

0 = Standard

### Electrical Options

A = None  
 C = Non-Fused Disconnect  
 D = Thru-the-Base Connections  
 F = Non-Fused Disconnect and Thru-the-Base Connections  
 N = Phase Monitor/Protection  
 Q = Phase Monitor/Protection and Non-Fused Disconnect  
 R = Phase Monitor/Protection and Thru-the-Base Connections  
 T = Phase Monitor/Protection with Non-Fused Disconnect and Thru-the-Base Connections  
 1 = HSCCR Protection  
 2 = HSCCR Protection and Thru-the-Base Connections

### Service Options

0 = None  
 1 = Unpowered Convenience Outlet  
 2 = Powered Convenience Outlet  
 3 = Hinged Access Panels  
 4 = Hinged Access Panels and Unpowered Convenience Outlet  
 5 = Hinged Access Panels and Powered Convenience Outlet  
 6 = 4" MERV 13 High Efficiency Filter Track  
 7 = Unpowered Convenience Outlet and 4" MERV 13 High Efficiency Filter Track  
 8 = Powered Convenience Outlet and 4" MERV 13 High Efficiency Filter Track  
 9 = Hinged Access Panels and 4" MERV 13 High Efficiency Filter Track  
 A = Hinged Access Panels, Unpowered Convenience Outlet and 4" MERV 13 High Efficiency Filter Track  
 B = Hinged Access Panels, Powered Convenience Outlet and 4" MERV 13 High Efficiency Filter Track

### Intake / Exhaust Options

A = None  
 B = Low Leak Temp Economizer with Baro Relief (Electro-Mechanical Controls Only)  
 D = Low Leak Temp Economizer with PE (cent) Vert Only (EM Only)  
 F = Low Leak Enthalpy Economizer with Baro Relief (EM Only)  
 H = Low Leak Enthalpy Economizer with PE (cent) Vert Only (EM Only)  
 U = ULTRA Low Leak Temp Economizer with Baro Relief  
 V = ULTRA Low Leak Temp Economizer with PE (cent) Vert Only  
 W = ULTRA Low Leak Enthalpy Economizer with Baro Relief  
 X = ULTRA Low Leak Enthalpy Economizer with PE (cent) Vert Only

### Base Unit Controls

0 = Electromechanical Controller (allows for use of field-installed economizers)  
 3 = SystemVu™ Controls  
 8 = Electromechanical Controls with POL224 EconomizerONE (with Fault Detection and Diagnostic)

### Design Revision

- = Factory Design Revision

**Fig. A — Model Number Nomenclature**

## APPENDIX B — PHYSICAL DATA

### 48FC\*(M/N) 20 to 24 — Physical Data

| UNIT                                          | 48FC*M20       | 48FC*N20       | 48FC*M24       | 48FC*N24       |
|-----------------------------------------------|----------------|----------------|----------------|----------------|
| NOMINAL CAPACITY (tons)                       | 17.5           | 17.5           | 20             | 20             |
| BASE UNIT OPERATING WT (lb) 48FC <sup>a</sup> | 1800           | 1800           | 2000           | 2000           |
| <b>REFRIGERATION SYSTEM</b>                   |                |                |                |                |
| Number Circuits / Number Compressors / Type   | 1 / 2 / Scroll | 1 / 2 / Scroll | 1 / 2 / Scroll | 1 / 2 / Scroll |
| Puron® (R-410A) Charge (lb-oz)                | 28-14          | —              | 32-0           | —              |
| Humidi-MiZer® Puron (R-410A) Charge (lb-oz)   | —              | 40-2           | —              | 43-0           |
| Metering Device                               | TXV            | —              | TXV            | —              |
| Humidi-MiZer Metering Device                  | —              | TXV            | —              | TXV            |
| High-Pressure Trip / Reset (psig)             | 630 / 505      | 630 / 505      | 630 / 505      | 630 / 505      |
| Low-Pressure Trip / Reset                     | 54 / 117       | 54 / 117       | 54 / 117       | 54 / 117       |
| <b>EVAPORATOR COIL</b>                        |                |                |                |                |
| Material (Tube / Fin)                         | Cu / Al        | Cu / Al        | Cu / Al        | Cu / Al        |
| Coil Type (RTPF)                              | 3/8 in.        | 3/8 in.        | 3/8 in.        | 3/8 in.        |
| Rows / FPI                                    | 4 / 15         | 4 / 15         | 4 / 15         | 4 / 15         |
| Total Face Area (ft²)                         | 22             | 22             | 22             | 22             |
| Condensate Drain Connection Size              | 3/4 in.        | 3/4 in.        | 3/4 in.        | 3/4 in.        |
| <b>CONDENSER COIL</b>                         |                |                |                |                |
| Material (Tube / Fin)                         | Cu / Al        | Cu / Al        | Cu / Al        | Cu / Al        |
| Coil Type (RTPF)                              | 5/16 in.       | 5/16 in.       | 5/16 in.       | 5/16 in.       |
| Rows / FPI                                    | 2 / 18         | 2 / 18         | 2 / 18         | 2 / 18         |
| Total Face Area (ft²)                         | 19.6           | 19.6           | 23.8           | 23.8           |
| <b>HUMIDI-MIZER COIL</b>                      |                |                |                |                |
| Material                                      | —              | Cu / Al        | —              | Cu / Al        |
| Coil Type (RTPF)                              | —              | 5/16 in.       | —              | 5/16 in.       |
| Rows / FPI                                    | —              | 1 / 18         | —              | 1 / 18         |
| Total Face Area (ft²)                         | —              | 21.4           | —              | 21.4           |
| <b>EVAPORATOR FAN AND MOTOR</b>               |                |                |                |                |
| <b>Vertical Standard Static 3 Phase</b>       |                |                |                |                |
| Motor Qty / Drive Type                        | 2 / Direct     | 2 / Direct     | 2 / Direct     | 2 / Direct     |
| Max Cont bhp (per motor)                      | 2.4            | 2.4            | 2.4            | 2.4            |
| Range (rpm)                                   | 250-2000       | 250-2000       | 250-2000       | 250-2000       |
| Fan Qty / Type                                | 2 / Vane Axial | 2 / Vane Axial | 2 / Vane Axial | 2 / Vane Axial |
| Fan Diameter (in.)                            | 22             | 22             | 22             | 22             |
| <b>Vertical High Static 3 Phase</b>           |                |                |                |                |
| Motor Qty / Drive Type                        | 2 / Direct     | 2 / Direct     | 2 / Direct     | 2 / Direct     |
| Max Cont bhp (per motor)                      | 3              | 5              | 5              | 5              |
| Range (rpm)                                   | 250-2200       | 250-2200       | 250-2200       | 250-2200       |
| Fan Qty / Type                                | 2 / Vane Axial | 2 / Vane Axial | 2 / Vane Axial | 2 / Vane Axial |
| Fan Diameter (in.)                            | 22             | 22             | 22             | 22             |
| <b>Horizontal High Static 3 Phase</b>         |                |                |                |                |
| Motor Qty / Drive Type                        | 2 / Direct     | 2 / Direct     | 2 / Direct     | 2 / Direct     |
| Max Cont bhp (per motor)                      | 5              | 5              | 5              | 5              |
| Range (rpm)                                   | 250-2200       | 250-2200       | 250-2200       | 250-2200       |
| Fan Qty / Type                                | 2 / Vane Axial | 2 / Vane Axial | 2 / Vane Axial | 2 / Vane Axial |
| Fan Diameter (in.)                            | 22             | 22             | 22             | 22             |
| <b>CONDENSER FAN AND MOTOR</b>                |                |                |                |                |
| Qty / Motor Drive Type                        | 3 / direct     | 3 / direct     | 4 / direct     | 4 / direct     |
| Motor hp / rpm                                | 1/4 / 1100     | 1/4 / 1100     | 1/4 / 1100     | 1/4 / 1100     |
| Fan Diameter (in.)                            | 22             | 22             | 22             | 22             |
| <b>Filters</b>                                |                |                |                |                |
| RA Filter Qty / Size (in.)                    | 6 / 20x25x2    | 6 / 20x25x2    | 6 / 20x25x2    | 6 / 20x25x2    |
| OA Inlet Screen Qty / Size (in.)              | 4 / 16x25x1    | 4 / 16x25x1    | 4 / 16x25x1    | 4 / 16x25x1    |

NOTE(S):

a. Base unit operating weight does not include weight of options.

#### LEGEND

**bhp** — Brake Horsepower  
**FPI** — Fins Per Inch  
**OA** — Outdoor Air  
**RA** — Return Air

## APPENDIX B — PHYSICAL DATA (cont)

### 48FC\*(M/N) 28 to 30 — Physical Data

| UNIT                                                | 48FC*M28       | 48FC*N28       | 48FC*M30       | 48FC*N30       |
|-----------------------------------------------------|----------------|----------------|----------------|----------------|
| <b>NOMINAL CAPACITY (tons)</b>                      | 25             | 25             | 27.5           | 27.5           |
| <b>BASE UNIT OPERATING WT (lb) 48FC<sup>a</sup></b> | 2174           | 2174           | 2351           | 2351           |
| <b>REFRIGERATION SYSTEM</b>                         |                |                |                |                |
| Number Circuits / Number Compressors / Type         | 1 / 2 / Scroll | 1 / 2 / Scroll | 1 / 2 / Scroll | 1 / 2 / Scroll |
| Puron® (R-410A) Charge (lb-oz)                      | 37-10          | —              | 46-0           | —              |
| Humidi-MiZer® Puron (R-410A) Charge (lb-oz)         | —              | 43-8           | —              | 55-3           |
| Metering Device                                     | TXV            | —              | TXV            | —              |
| Humidi-MiZer Metering Device                        | —              | TXV            | —              | TXV            |
| High-Pressure Trip / Reset (psig)                   | 630 / 505      | 630 / 505      | 630 / 505      | 630 / 505      |
| Low-Pressure Trip / Reset                           | 54 / 117       | 54 / 117       | 54 / 117       | 54 / 117       |
| <b>EVAPORATOR COIL</b>                              |                |                |                |                |
| Material (Tube / Fin)                               | Cu / Al        | Cu / Al        | Cu / Al        | Cu / Al        |
| Coil Type (RTPF)                                    | 3/8 in.        | 3/8 in.        | 3/8 in.        | 3/8 in.        |
| Rows / FPI                                          | 4 / 15         | 4 / 15         | 4 / 15         | 4 / 15         |
| Total Face Area (ft <sup>2</sup> )                  | 23.1           | 23.1           | 26             | 26             |
| Condensate Drain Connection Size                    | 3/4 in.        | 3/4 in.        | 3/4 in.        | 3/4 in.        |
| <b>CONDENSER COIL</b>                               |                |                |                |                |
| Material (Tube / Fin)                               | Cu / Al        | Cu / Al        | Cu / Al        | Cu / Al        |
| Coil Type (RTPF)                                    | 5/16 in.       | 5/16 in.       | 5/16 in.       | 5/16 in.       |
| Rows / FPI                                          | 2 / 18         | 2 / 18         | 2 / 18         | 2 / 18         |
| Total Face Area (ft <sup>2</sup> )                  | 25.3           | 25.3           | 28.9           | 28.9           |
| <b>HUMIDI-MIZER COIL</b>                            |                |                |                |                |
| Material (Tube / Fin)                               | —              | Cu / Al        | —              | Cu / Al        |
| Coil Type (RTPF)                                    | —              | 5/16 in.       | —              | 5/16 in.       |
| Rows / FPI                                          | —              | 1 / 18         | —              | 1 / 18         |
| Total Face Area (ft <sup>2</sup> )                  | —              | 22.4           | —              | 25.3           |
| <b>EVAPORATOR FAN AND MOTOR</b>                     |                |                |                |                |
| <b>Vertical Standard Static 3 Phase</b>             |                |                |                |                |
| Motor Qty / Drive Type                              | 2 / Direct     | 2 / Direct     | 2 / Direct     | 2 / Direct     |
| Max Continuous bhp (per motor)                      | 3              | 3              | 3              | 3              |
| Range (rpm)                                         | 250-2000       | 250-2000       | 250-2000       | 250-2000       |
| Fan Qty / Type                                      | 2 / Vane Axial | 2 / Vane Axial | 2 / Vane Axial | 2 / Vane Axial |
| Fan Diameter (in.)                                  | 22             | 22             | 22             | 22             |
| <b>Vertical High Static 3 Phase</b>                 |                |                |                |                |
| Motor Qty / Drive Type                              | 2 / Direct     | 2 / Direct     | 2 / Direct     | 2 / Direct     |
| Max Continuous bhp (per motor)                      | 3              | 5              | 5              | 5              |
| Range (rpm)                                         | 250-2200       | 250-2200       | 250-2200       | 250-2200       |
| Fan Qty / Type                                      | 2 / Vane Axial | 2 / Vane Axial | 2 / Vane Axial | 2 / Vane Axial |
| Fan Diameter (in.)                                  | 22             | 22             | 22             | 22             |
| <b>Horizontal High Static 3 Phase</b>               |                |                |                |                |
| Motor Qty / Drive Type                              | 2 / Direct     | 2 / Direct     | 2 / Direct     | 2 / Direct     |
| Max Continuous bhp (per motor)                      | 5              | 5              | 5              | 5              |
| Range (rpm)                                         | 250-2200       | 250-2200       | 250-2200       | 250-2200       |
| Fan Qty / Type                                      | 2 / Vane Axial | 2 / Vane Axial | 2 / Vane Axial | 2 / Vane Axial |
| Fan Diameter (in.)                                  | 22             | 22             | 22             | 22             |
| <b>CONDENSER FAN AND MOTOR</b>                      |                |                |                |                |
| Qty / Motor Drive Type                              | 4 / direct     | 4 / direct     | 6 / direct     | 6 / direct     |
| Motor hp / rpm                                      | 1/4 / 1100     | 1/4 / 1100     | 1/4 / 1100     | 1/4 / 1100     |
| Fan Diameter (in.)                                  | 22             | 22             | 22             | 22             |
| <b>Filters</b>                                      |                |                |                |                |
| RA Filter Qty / Size (in.)                          | 9 / 20x25x2    | 9 / 20x25x2    | 9 / 20x25x2    | 9 / 20x25x2    |
| OA Inlet Screen Qty / Size (in.)                    | 4 / 16x25x1    | 4 / 16x25x1    | 4 / 16x25x1    | 4 / 16x25x1    |

NOTE(S):

a. Base unit operating weight does not include weight of options.

#### LEGEND

**bhp** — Brake Horsepower  
**FPI** — Fins Per Inch  
**OA** — Outdoor Air  
**RA** — Return Air

## APPENDIX C — GAS HEAT DATA

### 48FC 20 to 30 Gas Heat Data

| UNIT                                                | 48FC**20          | 48FC**24          | 48FC**28          | 48FC**30          |
|-----------------------------------------------------|-------------------|-------------------|-------------------|-------------------|
| <b>NOMINAL CAPACITY (tons)</b>                      | 17.5              | 20                | 25                | 27.5              |
| <b>GAS CONNECTION</b>                               |                   |                   |                   |                   |
| Number of Gas Valves                                | 1                 | 1                 | 1                 | 1                 |
| Natural Gas Supply Line Pressure (in. wg)/(psig)    | 5-13 / 0.18-0.47  | 5-13 / 0.18-0.47  | 5-13 / 0.18-0.47  | 5-13 / 0.18-0.47  |
| Liquid Propane Supply Line Pressure (in. wg)/(psig) | 11-13 / 0.40-0.47 | 11-13 / 0.40-0.47 | 11-13 / 0.40-0.47 | 11-13 / 0.40-0.47 |
| <b>HEAT ANTICIPATOR SETTING (AMPS)</b>              |                   |                   |                   |                   |
| First Stage                                         | 0.14              | 0.14              | 0.14              | 0.14              |
| Second Stage                                        | 0.14              | 0.14              | 0.14              | 0.14              |
| <b>NATURAL GAS HEAT</b>                             |                   |                   |                   |                   |
| <b>LOW</b>                                          |                   |                   |                   |                   |
| Number of Stages / Number of Burners (total)        | 2 / 5             | 2 / 5             | 2 / 5             | 2 / 5             |
| Connection Size (NPT)                               | 3/4 in.           | 3/4 in.           | 3/4 in.           | 3/4 in.           |
| Rollout Switch Opens / Closes (°F)                  | 195 / 115         | 195 / 115         | 195 / 115         | 195 / 115         |
| Temperature Rise (°F)                               | 15-45             | 15-45             | 10-45             | 10-45             |
| <b>MEDIUM</b>                                       |                   |                   |                   |                   |
| Number of Stages / Number of Burners (total)        | 2 / 7             | 2 / 7             | 2 / 7             | 2 / 7             |
| Connection Size (NPT)                               | 3/4 in.           | 3/4 in.           | 3/4 in.           | 3/4 in.           |
| Rollout Switch Opens / Closes (°F)                  | 195 / 115         | 195 / 115         | 195 / 115         | 195 / 115         |
| Temperature Rise (°F)                               | 25-55             | 20-55             | 15-55             | 15-55             |
| <b>HIGH</b>                                         |                   |                   |                   |                   |
| Number of Stages / Number of Burners (total)        | 2 / 9             | 2 / 9             | 2 / 9             | 2 / 9             |
| Connection Size (NPT)                               | 3/4 in.           | 3/4 in.           | 3/4 in.           | 3/4 in.           |
| Rollout Switch Opens / Closes (°F)                  | 195 / 115         | 195 / 115         | 195 / 115         | 195 / 115         |
| Temperature Rise (°F)                               | 30-60             | 30-60             | 20-60             | 20-60             |
| <b>LIQUID PROPANE HEAT</b>                          |                   |                   |                   |                   |
| <b>LOW</b>                                          |                   |                   |                   |                   |
| Number of Stages / Number of Burners (total)        | 2 / 5             | 2 / 5             | 2 / 5             | 2 / 5             |
| Connection Size (NPT)                               | 3/4 in.           | 3/4 in.           | 3/4 in.           | 3/4 in.           |
| Rollout Switch Opens / Closes (°F)                  | 195 / 115         | 195 / 115         | 195 / 115         | 195 / 115         |
| Temperature Rise (°F)                               | 15-45             | 15-45             | 10-45             | 10-45             |
| <b>MEDIUM</b>                                       |                   |                   |                   |                   |
| Number of Stages / Number of Burners (total)        | 2 / 7             | 2 / 7             | 2 / 7             | 2 / 7             |
| Connection Size (NPT)                               | 3/4 in.           | 3/4 in.           | 3/4 in.           | 3/4 in.           |
| Rollout Switch Opens / Closes (°F)                  | 195 / 115         | 195 / 115         | 195 / 115         | 195 / 115         |
| Temperature Rise (°F)                               | 25-55             | 20-55             | 15-55             | 15-55             |
| <b>HIGH</b>                                         |                   |                   |                   |                   |
| Number of Stages / Number of Burners (total)        | 2 / 9             | 2 / 9             | 2 / 9             | 2 / 9             |
| Connection Size (NPT)                               | 3/4 in.           | 3/4 in.           | 3/4 in.           | 3/4 in.           |
| Rollout Switch Opens / Closes (°F)                  | 195 / 115         | 195 / 115         | 195 / 115         | 195 / 115         |
| Temperature Rise (°F)                               | 30-60             | 30-60             | 20-60             | 20-60             |

## APPENDIX D — FAN PERFORMANCE

### GENERAL FAN PERFORMANCE NOTES

1. Interpolation is permissible. Do not extrapolate.
2. External static pressure is the static pressure difference between the return duct and the supply duct plus the static pressure caused by any FIOPs or accessories.
3. Tabular data accounts for pressure loss due to clean filters, unit casing, wet coils, and highest gas heat exchanger (when gas heat unit).
4. Factory options and accessories may effect static pressure losses. Gas heat unit fan tables assume highest gas heat models; for fan selections with low or medium heat models, the user must deduct low and medium heat static pressures. Selection software is available, through your salesperson, to help you select the best motor/drive combination for your application.
5. The fan performance tables offer motor/drive recommendations. In cases when two motor/drive combinations would work, the lower horsepower option is recommended.
6. For information on the electrical properties of the fan motors, please see the Electrical information section of the Product Data book.
7. For more information on the performance limits of the fan motors, see the application data section of the Product Data book.
8. The EPACT (Energy Policy Act of 1992) regulates energy requirements for specific types of indoor fan motors. Motors regulated by EPACT include any general purpose, T-frame (three-digit, 143 and larger), single-speed, foot mounted, polyphase, squirrel cage induction motors of NEMA (National Electrical Manufacturers Association) design A and B, manufactured for use in the United States. Ranging from 1 to 200 Hp, these continuous-duty motors operate on 230 and 460 volt, 60 Hz power. If a motor does not fit into these specifications, the motor does not have to be replaced by an EPACT compliant energy-efficient motor. Variable-speed motors are exempt from EPACT compliance requirements.

## APPENDIX D — FAN PERFORMANCE (cont)

### 48FCFM20 — 17.5 Ton Vertical Supply (rpm - bhp)

| CFM  | AVAILABLE EXTERNAL STATIC PRESSURE (in. wg) |      |      |      |      |      |      |      |      |      |
|------|---------------------------------------------|------|------|------|------|------|------|------|------|------|
|      | 0.2                                         |      | 0.4  |      | 0.6  |      | 0.8  |      | 1.0  |      |
|      | rpm                                         | bhp  | rpm  | bhp  | rpm  | bhp  | rpm  | bhp  | rpm  | bhp  |
| 5250 | 1099                                        | 1.00 | 1210 | 1.33 | 1313 | 1.70 | 1408 | 2.10 | 1496 | 2.51 |
| 5690 | 1172                                        | 1.21 | 1276 | 1.56 | 1375 | 1.96 | 1466 | 2.37 | 1551 | 2.81 |
| 6125 | 1247                                        | 1.46 | 1344 | 1.83 | 1438 | 2.24 | 1525 | 2.67 | 1607 | 3.12 |
| 6565 | 1322                                        | 1.73 | 1413 | 2.12 | 1502 | 2.54 | 1587 | 3.00 | 1666 | 3.47 |
| 7000 | 1399                                        | 2.04 | 1484 | 2.43 | 1568 | 2.87 | 1649 | 3.34 | 1726 | 3.83 |
| 7440 | 1477                                        | 2.37 | 1556 | 2.77 | 1637 | 3.23 | 1714 | 3.70 | 1788 | 4.20 |
| 7875 | 1555                                        | 2.72 | 1629 | 3.13 | 1705 | 3.59 | 1779 | 4.07 | 1851 | 4.59 |
| 8315 | 1633                                        | 3.08 | 1703 | 3.50 | 1775 | 3.96 | 1846 | 4.45 | 1916 | 4.98 |
| 8750 | 1712                                        | 3.46 | 1778 | 3.88 | 1847 | 4.35 | 1915 | 4.84 | 1981 | 5.36 |

| CFM  | AVAILABLE EXTERNAL STATIC PRESSURE (in. wg) |      |      |      |      |      |      |      |      |      |
|------|---------------------------------------------|------|------|------|------|------|------|------|------|------|
|      | 1.2                                         |      | 1.4  |      | 1.6  |      | 1.8  |      | 2.0  |      |
|      | rpm                                         | bhp  | rpm  | bhp  | rpm  | bhp  | rpm  | bhp  | rpm  | bhp  |
| 5250 | 1579                                        | 2.96 | 1658 | 3.42 | 1733 | 3.91 | 1805 | 4.42 | 1875 | 4.95 |
| 5690 | 1631                                        | 3.26 | 1707 | 3.74 | 1780 | 4.24 | 1851 | 4.77 | 1919 | 5.32 |
| 6125 | 1685                                        | 3.60 | 1759 | 4.09 | 1830 | 4.61 | 1899 | 5.15 | 1965 | 5.71 |
| 6565 | 1742                                        | 3.96 | 1814 | 4.48 | 1883 | 5.01 | 1949 | 5.55 | 2014 | 6.13 |
| 7000 | 1800                                        | 4.34 | 1870 | 4.87 | 1937 | 5.41 | 2002 | 5.97 | —    | —    |
| 7440 | 1859                                        | 4.73 | 1927 | 5.26 | 1993 | 5.82 | —    | —    | —    | —    |
| 7875 | 1920                                        | 5.12 | 1986 | 5.67 | —    | —    | —    | —    | —    | —    |
| 8315 | 1982                                        | 5.51 | 2047 | 6.07 | —    | —    | —    | —    | —    | —    |
| 8750 | 2046                                        | 5.91 | —    | —    | —    | —    | —    | —    | —    | —    |

Std/Med Static 1099-2000 rpm, 4.8 Max bhp (2.4 Max bhp per fan motor)

High Static 1099-2200 rpm, 6.0 Max bhp (3.0 Max bhp per fan motor)

### 48FCFM20 – Standard/Medium Static — 17.5 Ton Vertical Supply (rpm - vdc)

| CFM  | AVAILABLE EXTERNAL STATIC PRESSURE (in. wg) |     |      |     |      |     |      |     |      |     |
|------|---------------------------------------------|-----|------|-----|------|-----|------|-----|------|-----|
|      | 0.2                                         |     | 0.4  |     | 0.6  |     | 0.8  |     | 1.0  |     |
|      | rpm                                         | vdc | rpm  | vdc | rpm  | vdc | rpm  | vdc | rpm  | vdc |
| 5250 | 1099                                        | 5.4 | 1210 | 5.9 | 1313 | 6.5 | 1408 | 7.0 | 1496 | 7.4 |
| 5690 | 1172                                        | 5.7 | 1276 | 6.3 | 1375 | 6.8 | 1466 | 7.3 | 1551 | 7.7 |
| 6125 | 1247                                        | 6.1 | 1344 | 6.6 | 1438 | 7.1 | 1525 | 7.6 | 1607 | 8.0 |
| 6565 | 1322                                        | 6.5 | 1413 | 7.0 | 1502 | 7.4 | 1587 | 7.9 | 1666 | 8.3 |
| 7000 | 1399                                        | 6.9 | 1484 | 7.3 | 1568 | 7.8 | 1649 | 8.2 | 1726 | 8.6 |
| 7440 | 1477                                        | 7.3 | 1556 | 7.7 | 1637 | 8.1 | 1714 | 8.5 | 1788 | 8.9 |
| 7875 | 1555                                        | 7.7 | 1629 | 8.1 | 1705 | 8.5 | 1779 | 8.9 | 1851 | 9.2 |
| 8315 | 1633                                        | 8.1 | 1703 | 8.5 | 1775 | 8.8 | 1846 | 9.2 | —    | —   |
| 8750 | 1712                                        | 8.5 | 1778 | 8.9 | 1847 | 9.2 | —    | —   | —    | —   |

| CFM  | AVAILABLE EXTERNAL STATIC PRESSURE (in. wg) |     |      |     |      |     |      |     |     |     |
|------|---------------------------------------------|-----|------|-----|------|-----|------|-----|-----|-----|
|      | 1.2                                         |     | 1.4  |     | 1.6  |     | 1.8  |     | 2.0 |     |
|      | rpm                                         | vdc | rpm  | vdc | rpm  | vdc | rpm  | vdc | rpm | vdc |
| 5250 | 1579                                        | 7.8 | 1658 | 8.2 | 1733 | 8.6 | 1805 | 9.0 | —   | —   |
| 5690 | 1631                                        | 8.1 | 1707 | 8.5 | 1780 | 8.9 | 1851 | 9.2 | —   | —   |
| 6125 | 1685                                        | 8.4 | 1759 | 8.8 | 1830 | 9.1 | —    | —   | —   | —   |
| 6565 | 1742                                        | 8.7 | 1814 | 9.0 | —    | —   | —    | —   | —   | —   |
| 7000 | 1800                                        | 9.0 | —    | —   | —    | —   | —    | —   | —   | —   |
| 7440 | 1859                                        | 9.3 | —    | —   | —    | —   | —    | —   | —   | —   |
| 7875 | —                                           | —   | —    | —   | —    | —   | —    | —   | —   | —   |
| 8315 | —                                           | —   | —    | —   | —    | —   | —    | —   | —   | —   |
| 8750 | —                                           | —   | —    | —   | —    | —   | —    | —   | —   | —   |

Std/Med Static 1099-2000 rpm

## APPENDIX D — FAN PERFORMANCE (cont)

### 48FCFM20 – High Static — 17.5 Ton Vertical Supply (rpm - vdc)

| CFM  | AVAILABLE EXTERNAL STATIC PRESSURE (in. wg) |     |      |     |      |     |      |     |      |     |
|------|---------------------------------------------|-----|------|-----|------|-----|------|-----|------|-----|
|      | 0.2                                         |     | 0.4  |     | 0.6  |     | 0.8  |     | 1.0  |     |
|      | rpm                                         | vdc | rpm  | vdc | rpm  | vdc | rpm  | vdc | rpm  | vdc |
| 5250 | 1099                                        | 4.9 | 1210 | 5.4 | 1313 | 5.9 | 1408 | 6.3 | 1496 | 6.8 |
| 5690 | 1172                                        | 5.3 | 1276 | 5.7 | 1375 | 6.2 | 1466 | 6.6 | 1551 | 7.0 |
| 6125 | 1247                                        | 5.6 | 1344 | 6.0 | 1438 | 6.5 | 1525 | 6.9 | 1607 | 7.3 |
| 6565 | 1322                                        | 5.9 | 1413 | 6.4 | 1502 | 6.8 | 1587 | 7.2 | 1666 | 7.5 |
| 7000 | 1399                                        | 6.3 | 1484 | 6.7 | 1568 | 7.1 | 1649 | 7.5 | 1726 | 7.8 |
| 7440 | 1477                                        | 6.7 | 1556 | 7.0 | 1637 | 7.4 | 1714 | 7.8 | 1788 | 8.1 |
| 7875 | 1555                                        | 7.0 | 1629 | 7.4 | 1705 | 7.7 | 1779 | 8.1 | 1851 | 8.4 |
| 8315 | 1633                                        | 7.4 | 1703 | 7.7 | 1775 | 8.0 | 1846 | 8.4 | 1916 | 8.7 |
| 8750 | 1712                                        | 7.7 | 1778 | 8.1 | 1847 | 8.4 | 1915 | 8.7 | 1981 | 9.0 |

| CFM  | AVAILABLE EXTERNAL STATIC PRESSURE (in. wg) |     |      |     |      |     |      |     |      |     |
|------|---------------------------------------------|-----|------|-----|------|-----|------|-----|------|-----|
|      | 1.2                                         |     | 1.4  |     | 1.6  |     | 1.8  |     | 2.0  |     |
|      | rpm                                         | vdc | rpm  | vdc | rpm  | vdc | rpm  | vdc | rpm  | vdc |
| 5250 | 1579                                        | 7.1 | 1658 | 7.5 | 1733 | 7.8 | 1805 | 8.2 | 1875 | 8.5 |
| 5690 | 1631                                        | 7.4 | 1707 | 7.7 | 1780 | 8.1 | 1851 | 8.4 | 1919 | 8.7 |
| 6125 | 1685                                        | 7.6 | 1759 | 8.0 | 1830 | 8.3 | 1899 | 8.6 | 1965 | 8.9 |
| 6565 | 1742                                        | 7.9 | 1814 | 8.2 | 1883 | 8.5 | 1949 | 8.8 | 2014 | 9.1 |
| 7000 | 1800                                        | 8.2 | 1870 | 8.5 | 1937 | 8.8 | 2002 | 9.1 | —    | —   |
| 7440 | 1859                                        | 8.4 | 1927 | 8.7 | 1993 | 9.0 | —    | —   | —    | —   |
| 7875 | 1920                                        | 8.7 | 1986 | 9.0 | —    | —   | —    | —   | —    | —   |
| 8315 | 1982                                        | 9.0 | 2047 | 9.3 | —    | —   | —    | —   | —    | —   |
| 8750 | 2046                                        | 9.3 | —    | —   | —    | —   | —    | —   | —    | —   |

High Static 1099-2200 rpm

## APPENDIX D — FAN PERFORMANCE (cont)

### 48FCFM24 — 20 Ton Vertical Supply (rpm - bhp)

| CFM   | AVAILABLE EXTERNAL STATIC PRESSURE (in. wg) |      |      |      |      |      |      |      |      |      |
|-------|---------------------------------------------|------|------|------|------|------|------|------|------|------|
|       | 0.2                                         |      | 0.4  |      | 0.6  |      | 0.8  |      | 1.0  |      |
|       | rpm                                         | bhp  | rpm  | bhp  | rpm  | bhp  | rpm  | bhp  | rpm  | bhp  |
| 6000  | 1225                                        | 1.38 | 1325 | 1.75 | 1419 | 2.15 | 1508 | 2.58 | 1591 | 3.03 |
| 6500  | 1312                                        | 1.69 | 1403 | 2.07 | 1493 | 2.50 | 1578 | 2.95 | 1658 | 3.42 |
| 7000  | 1399                                        | 2.04 | 1484 | 2.43 | 1568 | 2.87 | 1649 | 3.34 | 1726 | 3.83 |
| 7500  | 1488                                        | 2.42 | 1566 | 2.82 | 1646 | 3.27 | 1723 | 3.75 | 1797 | 4.26 |
| 8000  | 1577                                        | 2.82 | 1650 | 3.23 | 1725 | 3.69 | 1798 | 4.18 | 1870 | 4.70 |
| 8500  | 1667                                        | 3.25 | 1735 | 3.66 | 1806 | 4.13 | 1875 | 4.62 | 1944 | 5.15 |
| 9000  | 1757                                        | 3.68 | 1822 | 4.10 | 1888 | 4.57 | 1954 | 5.06 | 2019 | 5.58 |
| 9500  | 1848                                        | 4.13 | 1909 | 4.55 | 1971 | 5.01 | 2034 | 5.50 | 2096 | 6.02 |
| 10000 | 1939                                        | 4.58 | 1997 | 5.00 | 2056 | 5.46 | 2115 | 5.94 | 2175 | 6.47 |

| CFM   | AVAILABLE EXTERNAL STATIC PRESSURE (in. wg) |      |      |      |      |      |      |      |      |      |
|-------|---------------------------------------------|------|------|------|------|------|------|------|------|------|
|       | 1.2                                         |      | 1.4  |      | 1.6  |      | 1.8  |      | 2.0  |      |
|       | rpm                                         | bhp  | rpm  | bhp  | rpm  | bhp  | rpm  | bhp  | rpm  | bhp  |
| 6000  | 1670                                        | 3.51 | 1744 | 3.99 | 1816 | 4.51 | 1885 | 5.04 | 1951 | 5.59 |
| 6500  | 1733                                        | 3.91 | 1806 | 4.42 | 1875 | 4.95 | 1942 | 5.50 | 2006 | 6.06 |
| 7000  | 1800                                        | 4.34 | 1870 | 4.87 | 1937 | 5.41 | 2002 | 5.97 | 2064 | 6.55 |
| 7500  | 1868                                        | 4.78 | 1936 | 5.33 | 2001 | 5.88 | 2064 | 6.45 | 2125 | 7.04 |
| 8000  | 1938                                        | 5.24 | 2004 | 5.79 | 2067 | 6.35 | 2128 | 6.93 | 2187 | 7.52 |
| 8500  | 2010                                        | 5.69 | 2073 | 6.24 | 2135 | 6.82 | 2194 | 7.40 | —    | —    |
| 9000  | 2083                                        | 6.13 | 2144 | 6.69 | —    | —    | —    | —    | —    | —    |
| 9500  | 2157                                        | 6.56 | —    | —    | —    | —    | —    | —    | —    | —    |
| 10000 | —                                           | —    | —    | —    | —    | —    | —    | —    | —    | —    |

Std/Med Static 1225-2000 rpm, 4.8 Max bhp (2.4 Max bhp per fan motor)

High Static 1225-2200 rpm, 10.0 Max bhp (5.0 Max bhp per fan motor)

### 48FCFM24 – Standard/Medium Static — 20 Ton Vertical Supply (rpm - vdc)

| CFM   | AVAILABLE EXTERNAL STATIC PRESSURE (in. wg) |     |      |     |      |     |      |     |      |     |
|-------|---------------------------------------------|-----|------|-----|------|-----|------|-----|------|-----|
|       | 0.2                                         |     | 0.4  |     | 0.6  |     | 0.8  |     | 1.0  |     |
|       | rpm                                         | vdc | rpm  | vdc | rpm  | vdc | rpm  | vdc | rpm  | vdc |
| 6000  | 1225                                        | 5.5 | 1325 | 6.0 | 1419 | 6.4 | 1508 | 6.8 | 1591 | 7.2 |
| 6500  | 1312                                        | 5.9 | 1403 | 6.3 | 1493 | 6.7 | 1578 | 7.1 | 1658 | 7.5 |
| 7000  | 1399                                        | 6.3 | 1484 | 6.7 | 1568 | 7.1 | 1649 | 7.5 | 1726 | 7.8 |
| 7500  | 1488                                        | 6.7 | 1566 | 7.1 | 1646 | 7.4 | 1723 | 7.8 | 1797 | 8.1 |
| 8000  | 1577                                        | 7.1 | 1650 | 7.5 | 1725 | 7.8 | 1798 | 8.1 | 1870 | 8.5 |
| 8500  | 1667                                        | 7.5 | 1735 | 7.9 | 1806 | 8.2 | 1875 | 8.5 | —    | —   |
| 9000  | 1757                                        | 8.0 | 1822 | 8.3 | 1888 | 8.6 | —    | —   | —    | —   |
| 9500  | 1848                                        | 8.4 | 1909 | 8.7 | —    | —   | —    | —   | —    | —   |
| 10000 | 1939                                        | 8.8 | —    | —   | —    | —   | —    | —   | —    | —   |

| CFM   | AVAILABLE EXTERNAL STATIC PRESSURE (in. wg) |     |      |     |      |     |     |     |     |     |
|-------|---------------------------------------------|-----|------|-----|------|-----|-----|-----|-----|-----|
|       | 1.2                                         |     | 1.4  |     | 1.6  |     | 1.8 |     | 2.0 |     |
|       | rpm                                         | vdc | rpm  | vdc | rpm  | vdc | rpm | vdc | rpm | vdc |
| 6000  | 1670                                        | 7.6 | 1744 | 7.9 | 1816 | 8.2 | —   | —   | —   | —   |
| 6500  | 1733                                        | 7.8 | 1806 | 8.2 | —    | —   | —   | —   | —   | —   |
| 7000  | 1800                                        | 8.2 | —    | —   | —    | —   | —   | —   | —   | —   |
| 7500  | 1868                                        | 8.5 | —    | —   | —    | —   | —   | —   | —   | —   |
| 8000  | —                                           | —   | —    | —   | —    | —   | —   | —   | —   | —   |
| 8500  | —                                           | —   | —    | —   | —    | —   | —   | —   | —   | —   |
| 9000  | —                                           | —   | —    | —   | —    | —   | —   | —   | —   | —   |
| 9500  | —                                           | —   | —    | —   | —    | —   | —   | —   | —   | —   |
| 10000 | —                                           | —   | —    | —   | —    | —   | —   | —   | —   | —   |

Std/Med Static 1225-2000 rpm

## APPENDIX D — FAN PERFORMANCE (cont)

### 48FCFM24 – High Static — 20 Ton Vertical Supply (rpm - vdc)

| CFM   | AVAILABLE EXTERNAL STATIC PRESSURE (in. wg) |     |      |     |      |     |      |     |      |     |
|-------|---------------------------------------------|-----|------|-----|------|-----|------|-----|------|-----|
|       | 0.2                                         |     | 0.4  |     | 0.6  |     | 0.8  |     | 1.0  |     |
|       | rpm                                         | vdc | rpm  | vdc | rpm  | vdc | rpm  | vdc | rpm  | vdc |
| 6000  | 1225                                        | 5.5 | 1325 | 6.0 | 1419 | 6.4 | 1508 | 6.8 | 1591 | 7.2 |
| 6500  | 1312                                        | 5.9 | 1403 | 6.3 | 1493 | 6.7 | 1578 | 7.1 | 1658 | 7.5 |
| 7000  | 1399                                        | 6.3 | 1484 | 6.7 | 1568 | 7.1 | 1649 | 7.5 | 1726 | 7.8 |
| 7500  | 1488                                        | 6.7 | 1566 | 7.1 | 1646 | 7.4 | 1723 | 7.8 | 1797 | 8.1 |
| 8000  | 1577                                        | 7.1 | 1650 | 7.5 | 1725 | 7.8 | 1798 | 8.1 | 1870 | 8.5 |
| 8500  | 1667                                        | 7.5 | 1735 | 7.9 | 1806 | 8.2 | 1875 | 8.5 | 1944 | 8.8 |
| 9000  | 1757                                        | 8.0 | 1822 | 8.3 | 1888 | 8.6 | 1954 | 8.9 | 2019 | 9.2 |
| 9500  | 1848                                        | 8.4 | 1909 | 8.7 | 1971 | 8.9 | 2034 | 9.2 | 2096 | 9.5 |
| 10000 | 1939                                        | 8.8 | 1997 | 9.1 | 2056 | 9.3 | 2115 | 9.6 | 2175 | 9.9 |

| CFM   | AVAILABLE EXTERNAL STATIC PRESSURE (in. wg) |     |      |     |      |     |      |      |      |     |
|-------|---------------------------------------------|-----|------|-----|------|-----|------|------|------|-----|
|       | 1.2                                         |     | 1.4  |     | 1.6  |     | 1.8  |      | 2.0  |     |
|       | rpm                                         | vdc | rpm  | vdc | rpm  | vdc | rpm  | vdc  | rpm  | vdc |
| 6000  | 1670                                        | 7.6 | 1744 | 7.9 | 1816 | 8.2 | 1885 | 8.5  | 1951 | 8.9 |
| 6500  | 1733                                        | 7.8 | 1806 | 8.2 | 1875 | 8.5 | 1942 | 8.8  | 2006 | 9.1 |
| 7000  | 1800                                        | 8.2 | 1870 | 8.5 | 1937 | 8.8 | 2002 | 9.1  | 2064 | 9.4 |
| 7500  | 1868                                        | 8.5 | 1936 | 8.8 | 2001 | 9.1 | 2064 | 9.4  | 2125 | 9.7 |
| 8000  | 1938                                        | 8.8 | 2004 | 9.1 | 2067 | 9.4 | 2128 | 9.7  | 2187 | 9.9 |
| 8500  | 2010                                        | 9.1 | 2073 | 9.4 | 2135 | 9.7 | 2194 | 10.0 | —    | —   |
| 9000  | 2083                                        | 9.5 | 2144 | 9.7 | —    | —   | —    | —    | —    | —   |
| 9500  | 2157                                        | 9.8 | —    | —   | —    | —   | —    | —    | —    | —   |
| 10000 | —                                           | —   | —    | —   | —    | —   | —    | —    | —    | —   |

High Static 1225-2200 rpm

## APPENDIX D — FAN PERFORMANCE (cont)

### 48FCFM28 — 25 Ton Vertical Supply (rpm - bhp)

| CFM   | AVAILABLE EXTERNAL STATIC PRESSURE (in. wg) |      |      |      |      |      |      |      |      |      |
|-------|---------------------------------------------|------|------|------|------|------|------|------|------|------|
|       | 0.2                                         |      | 0.4  |      | 0.6  |      | 0.8  |      | 1.0  |      |
|       | rpm                                         | bhp  | rpm  | bhp  | rpm  | bhp  | rpm  | bhp  | rpm  | bhp  |
| 7500  | 1184                                        | 1.59 | 1267 | 1.95 | 1355 | 2.39 | 1444 | 2.89 | 1531 | 3.44 |
| 8125  | 1270                                        | 1.98 | 1345 | 2.35 | 1425 | 2.80 | 1507 | 3.31 | 1590 | 3.89 |
| 8750  | 1357                                        | 2.43 | 1425 | 2.81 | 1498 | 3.26 | 1574 | 3.79 | 1651 | 4.37 |
| 9375  | 1444                                        | 2.92 | 1508 | 3.33 | 1575 | 3.79 | 1644 | 4.31 | 1715 | 4.89 |
| 10000 | 1533                                        | 3.46 | 1592 | 3.88 | 1653 | 4.34 | 1718 | 4.88 | 1784 | 5.46 |
| 10625 | 1621                                        | 4.03 | 1676 | 4.45 | 1734 | 4.93 | 1794 | 5.46 | 1855 | 6.04 |
| 11250 | 1711                                        | 4.64 | 1762 | 5.07 | 1816 | 5.55 | 1871 | 6.07 | 1929 | 6.65 |
| 11875 | 1800                                        | 5.30 | 1849 | 5.75 | 1899 | 6.23 | 1951 | 6.75 | 2005 | 7.33 |
| 12500 | 1890                                        | 6.10 | 1936 | 6.56 | 1983 | 7.05 | 2032 | 7.58 | 2083 | 8.17 |

| CFM   | AVAILABLE EXTERNAL STATIC PRESSURE (in. wg) |      |      |      |      |      |      |      |      |      |
|-------|---------------------------------------------|------|------|------|------|------|------|------|------|------|
|       | 1.2                                         |      | 1.4  |      | 1.6  |      | 1.8  |      | 2.0  |      |
|       | rpm                                         | bhp  | rpm  | bhp  | rpm  | bhp  | rpm  | bhp  | rpm  | bhp  |
| 7500  | 1614                                        | 4.04 | 1693 | 4.66 | 1766 | 5.29 | 1837 | 5.95 | 1903 | 6.61 |
| 8125  | 1669                                        | 4.49 | 1746 | 5.15 | 1818 | 5.81 | 1888 | 6.51 | 1954 | 7.21 |
| 8750  | 1727                                        | 5.00 | 1801 | 5.67 | 1872 | 6.37 | 1940 | 7.09 | 2005 | 7.83 |
| 9375  | 1787                                        | 5.53 | 1858 | 6.22 | 1927 | 6.94 | 1994 | 7.69 | 2058 | 8.45 |
| 10000 | 1851                                        | 6.10 | 1918 | 6.78 | 1985 | 7.52 | 2049 | 8.27 | 2112 | 9.06 |
| 10625 | 1918                                        | 6.68 | 1981 | 7.36 | 2044 | 8.08 | 2107 | 8.85 | 2167 | 9.63 |
| 11250 | 1987                                        | 7.27 | 2047 | 7.95 | 2107 | 8.67 | 2166 | 9.42 | —    | —    |
| 11875 | 2060                                        | 7.95 | 2116 | 8.62 | 2172 | 9.32 | —    | —    | —    | —    |
| 12500 | 2134                                        | 8.78 | 2187 | 9.45 | —    | —    | —    | —    | —    | —    |

Std/Med Static 1184-2000 rpm, 6.0 Max bhp (3.0 Max bhp per fan motor)

High Static 1184-2200 rpm, 10.0 Max bhp (5.0 Max bhp per fan motor)

### 48FCFM28 – Standard/Medium Static — 25 Ton Vertical Supply (rpm - vdc)

| CFM   | AVAILABLE EXTERNAL STATIC PRESSURE (in. wg) |     |      |     |      |     |      |     |      |     |
|-------|---------------------------------------------|-----|------|-----|------|-----|------|-----|------|-----|
|       | 0.2                                         |     | 0.4  |     | 0.6  |     | 0.8  |     | 1.0  |     |
|       | rpm                                         | vdc | rpm  | vdc | rpm  | vdc | rpm  | vdc | rpm  | vdc |
| 7500  | 1184                                        | 5.3 | 1267 | 5.7 | 1355 | 6.1 | 1444 | 6.5 | 1531 | 6.9 |
| 8125  | 1270                                        | 5.7 | 1345 | 6.1 | 1425 | 6.4 | 1507 | 6.8 | 1590 | 7.2 |
| 8750  | 1357                                        | 6.1 | 1425 | 6.4 | 1498 | 6.8 | 1574 | 7.1 | 1651 | 7.5 |
| 9375  | 1444                                        | 6.5 | 1508 | 6.8 | 1575 | 7.1 | 1644 | 7.4 | 1715 | 7.8 |
| 10000 | 1533                                        | 6.9 | 1592 | 7.2 | 1653 | 7.5 | 1718 | 7.8 | 1784 | 8.1 |
| 10625 | 1621                                        | 7.3 | 1676 | 7.6 | 1734 | 7.8 | 1794 | 8.1 | —    | —   |
| 11250 | 1711                                        | 7.7 | 1762 | 8.0 | 1816 | 8.2 | —    | —   | —    | —   |
| 11875 | 1800                                        | 8.2 | 1849 | 8.4 | —    | —   | —    | —   | —    | —   |
| 12500 | —                                           | —   | —    | —   | —    | —   | —    | —   | —    | —   |

| CFM   | AVAILABLE EXTERNAL STATIC PRESSURE (in. wg) |     |      |     |      |     |      |     |     |     |
|-------|---------------------------------------------|-----|------|-----|------|-----|------|-----|-----|-----|
|       | 1.2                                         |     | 1.4  |     | 1.6  |     | 1.8  |     | 2.0 |     |
|       | rpm                                         | vdc | rpm  | vdc | rpm  | vdc | rpm  | vdc | rpm | vdc |
| 7500  | 1614                                        | 7.3 | 1693 | 7.7 | 1766 | 8.0 | 1837 | 8.3 | —   | —   |
| 8125  | 1669                                        | 7.5 | 1746 | 7.9 | 1818 | 8.2 | —    | —   | —   | —   |
| 8750  | 1727                                        | 7.8 | 1801 | 8.2 | —    | —   | —    | —   | —   | —   |
| 9375  | 1787                                        | 8.1 | 1858 | 8.4 | —    | —   | —    | —   | —   | —   |
| 10000 | —                                           | —   | —    | —   | —    | —   | —    | —   | —   | —   |
| 10625 | —                                           | —   | —    | —   | —    | —   | —    | —   | —   | —   |
| 11250 | —                                           | —   | —    | —   | —    | —   | —    | —   | —   | —   |
| 11875 | —                                           | —   | —    | —   | —    | —   | —    | —   | —   | —   |
| 12500 | —                                           | —   | —    | —   | —    | —   | —    | —   | —   | —   |

Std/Med Static 1184-2000 rpm

## APPENDIX D — FAN PERFORMANCE (cont)

### 48FCFM28 – High Static — 25 Ton Vertical Supply (rpm - vdc)

| CFM   | AVAILABLE EXTERNAL STATIC PRESSURE (in. wg) |     |      |     |      |     |      |     |      |     |
|-------|---------------------------------------------|-----|------|-----|------|-----|------|-----|------|-----|
|       | 0.2                                         |     | 0.4  |     | 0.6  |     | 0.8  |     | 1.0  |     |
|       | rpm                                         | vdc | rpm  | vdc | rpm  | vdc | rpm  | vdc | rpm  | vdc |
| 7500  | 1184                                        | 5.3 | 1267 | 5.7 | 1355 | 6.1 | 1444 | 6.5 | 1531 | 6.9 |
| 8125  | 1270                                        | 5.7 | 1345 | 6.1 | 1425 | 6.4 | 1507 | 6.8 | 1590 | 7.2 |
| 8750  | 1357                                        | 6.1 | 1425 | 6.4 | 1498 | 6.8 | 1574 | 7.1 | 1651 | 7.5 |
| 9375  | 1444                                        | 6.5 | 1508 | 6.8 | 1575 | 7.1 | 1644 | 7.4 | 1715 | 7.8 |
| 10000 | 1533                                        | 6.9 | 1592 | 7.2 | 1653 | 7.5 | 1718 | 7.8 | 1784 | 8.1 |
| 10625 | 1621                                        | 7.3 | 1676 | 7.6 | 1734 | 7.8 | 1794 | 8.1 | 1855 | 8.4 |
| 11250 | 1711                                        | 7.7 | 1762 | 8.0 | 1816 | 8.2 | 1871 | 8.5 | 1929 | 8.7 |
| 11875 | 1800                                        | 8.2 | 1849 | 8.4 | 1899 | 8.6 | 1951 | 8.9 | 2005 | 9.1 |
| 12500 | 1890                                        | 8.6 | 1936 | 8.8 | 1983 | 9.0 | 2032 | 9.2 | 2083 | 9.5 |

| CFM   | AVAILABLE EXTERNAL STATIC PRESSURE (in. wg) |     |      |     |      |     |      |     |      |     |
|-------|---------------------------------------------|-----|------|-----|------|-----|------|-----|------|-----|
|       | 1.2                                         |     | 1.4  |     | 1.6  |     | 1.8  |     | 2.0  |     |
|       | rpm                                         | vdc | rpm  | vdc | rpm  | vdc | rpm  | vdc | rpm  | vdc |
| 7500  | 1614                                        | 7.3 | 1693 | 7.7 | 1766 | 8.0 | 1837 | 8.3 | 1903 | 8.6 |
| 8125  | 1669                                        | 7.5 | 1746 | 7.9 | 1818 | 8.2 | 1888 | 8.6 | 1954 | 8.9 |
| 8750  | 1727                                        | 7.8 | 1801 | 8.2 | 1872 | 8.5 | 1940 | 8.8 | 2005 | 9.1 |
| 9375  | 1787                                        | 8.1 | 1858 | 8.4 | 1927 | 8.7 | 1994 | 9.0 | 2058 | 9.3 |
| 10000 | 1851                                        | 8.4 | 1918 | 8.7 | 1985 | 9.0 | 2049 | 9.3 | 2112 | 9.6 |
| 10625 | 1918                                        | 8.7 | 1981 | 9.0 | 2044 | 9.3 | 2107 | 9.6 | 2167 | 9.8 |
| 11250 | 1987                                        | 9.0 | 2047 | 9.3 | 2107 | 9.6 | 2166 | 9.8 | —    | —   |
| 11875 | 2060                                        | 9.4 | 2116 | 9.6 | 2172 | 9.9 | —    | —   | —    | —   |
| 12500 | 2134                                        | 9.7 | 2187 | 9.9 | —    | —   | —    | —   | —    | —   |

High Static 1184-2200 rpm

## APPENDIX D — FAN PERFORMANCE (cont)

### 48FCFM30 — 27.5 Ton Vertical Supply (rpm - bhp)

| CFM   | AVAILABLE EXTERNAL STATIC PRESSURE (in. wg) |      |      |      |      |      |      |      |      |      |
|-------|---------------------------------------------|------|------|------|------|------|------|------|------|------|
|       | 0.2                                         |      | 0.4  |      | 0.6  |      | 0.8  |      | 1.0  |      |
|       | rpm                                         | bhp  | rpm  | bhp  | rpm  | bhp  | rpm  | bhp  | rpm  | bhp  |
| 8250  | 1280                                        | 2.03 | 1353 | 2.40 | 1431 | 2.84 | 1512 | 3.35 | 1593 | 3.91 |
| 8940  | 1376                                        | 2.53 | 1442 | 2.91 | 1513 | 3.36 | 1586 | 3.88 | 1661 | 4.45 |
| 9625  | 1472                                        | 3.09 | 1533 | 3.49 | 1597 | 3.94 | 1664 | 4.46 | 1733 | 5.03 |
| 10300 | 1569                                        | 3.69 | 1625 | 4.10 | 1684 | 4.56 | 1746 | 5.08 | 1809 | 5.65 |
| 11000 | 1666                                        | 4.32 | 1719 | 4.75 | 1773 | 5.21 | 1830 | 5.73 | 1888 | 6.29 |
| 11700 | 1764                                        | 5.02 | 1813 | 5.45 | 1864 | 5.92 | 1917 | 6.44 | 1971 | 7.00 |
| 12375 | 1863                                        | 5.84 | 1909 | 6.28 | 1956 | 6.76 | 2005 | 7.28 | 2056 | 7.85 |
| 13075 | 1961                                        | 6.94 | 2005 | 7.41 | 2049 | 7.91 | 2095 | 8.46 | 2142 | 9.04 |
| 13750 | 2060                                        | 8.64 | 2101 | 9.17 | 2143 | 9.73 | —    | —    | —    | —    |

| CFM   | AVAILABLE EXTERNAL STATIC PRESSURE (in. wg) |      |      |      |      |      |      |      |      |      |
|-------|---------------------------------------------|------|------|------|------|------|------|------|------|------|
|       | 1.2                                         |      | 1.4  |      | 1.6  |      | 1.8  |      | 2.0  |      |
|       | rpm                                         | bhp  | rpm  | bhp  | rpm  | bhp  | rpm  | bhp  | rpm  | bhp  |
| 8250  | 1672                                        | 4.52 | 1748 | 5.17 | 1821 | 5.84 | 1890 | 6.53 | 1957 | 7.25 |
| 8940  | 1736                                        | 5.08 | 1809 | 5.75 | 1879 | 6.44 | 1947 | 7.17 | 2012 | 7.91 |
| 9625  | 1803                                        | 5.67 | 1872 | 6.35 | 1940 | 7.06 | 2006 | 7.81 | 2070 | 8.58 |
| 10300 | 1874                                        | 6.28 | 1939 | 6.96 | 2004 | 7.68 | 2067 | 8.43 | 2129 | 9.21 |
| 11000 | 1948                                        | 6.91 | 2009 | 7.58 | 2070 | 8.29 | 2131 | 9.05 | 2190 | 9.82 |
| 11700 | 2026                                        | 7.60 | 2083 | 8.26 | 2140 | 8.96 | 2198 | 9.71 | —    | —    |
| 12375 | 2107                                        | 8.45 | 2160 | 9.10 | —    | —    | —    | —    | —    | —    |
| 13075 | 2191                                        | 9.67 | —    | —    | —    | —    | —    | —    | —    | —    |
| 13750 | —                                           | —    | —    | —    | —    | —    | —    | —    | —    | —    |

Std/Med Static 1280-2200 rpm, 6.0 Max bhp (3.0 Max bhp per fan motor)

High Static 1280-2200 rpm, 10.0 Max bhp (5 Max bhp per fan motor)

### 48FCFM30 – Standard/Medium Static — 27.5 Ton Vertical Supply (rpm - vdc)

| CFM   | AVAILABLE EXTERNAL STATIC PRESSURE (in. wg) |     |      |     |      |     |      |     |      |     |
|-------|---------------------------------------------|-----|------|-----|------|-----|------|-----|------|-----|
|       | 0.2                                         |     | 0.4  |     | 0.6  |     | 0.8  |     | 1.0  |     |
|       | rpm                                         | vdc | rpm  | vdc | rpm  | vdc | rpm  | vdc | rpm  | vdc |
| 8250  | 1280                                        | 5.8 | 1353 | 6.1 | 1431 | 6.5 | 1512 | 6.8 | 1593 | 7.2 |
| 8940  | 1376                                        | 6.2 | 1442 | 6.5 | 1513 | 6.8 | 1586 | 7.2 | 1661 | 7.5 |
| 9625  | 1472                                        | 6.6 | 1533 | 6.9 | 1597 | 7.2 | 1664 | 7.5 | 1733 | 7.8 |
| 10300 | 1569                                        | 7.1 | 1625 | 7.3 | 1684 | 7.6 | 1746 | 7.9 | 1809 | 8.2 |
| 11000 | 1666                                        | 7.5 | 1719 | 7.8 | 1773 | 8.0 | 1830 | 8.3 | —    | —   |
| 11700 | 1764                                        | 8.0 | 1813 | 8.2 | 1864 | 8.4 | —    | —   | —    | —   |
| 12375 | 1863                                        | 8.4 | —    | —   | —    | —   | —    | —   | —    | —   |
| 13075 | —                                           | —   | —    | —   | —    | —   | —    | —   | —    | —   |
| 13750 | —                                           | —   | —    | —   | —    | —   | —    | —   | —    | —   |

| CFM   | AVAILABLE EXTERNAL STATIC PRESSURE (in. wg) |     |      |     |      |     |     |     |     |     |
|-------|---------------------------------------------|-----|------|-----|------|-----|-----|-----|-----|-----|
|       | 1.2                                         |     | 1.4  |     | 1.6  |     | 1.8 |     | 2.0 |     |
|       | rpm                                         | vdc | rpm  | vdc | rpm  | vdc | rpm | vdc | rpm | vdc |
| 8250  | 1672                                        | 7.6 | 1748 | 7.9 | 1821 | 8.3 | —   | —   | —   | —   |
| 8940  | 1736                                        | 7.9 | 1809 | 8.2 | —    | —   | —   | —   | —   | —   |
| 9625  | 1803                                        | 8.2 | —    | —   | —    | —   | —   | —   | —   | —   |
| 10300 | —                                           | —   | —    | —   | —    | —   | —   | —   | —   | —   |
| 11000 | —                                           | —   | —    | —   | —    | —   | —   | —   | —   | —   |
| 11700 | —                                           | —   | —    | —   | —    | —   | —   | —   | —   | —   |
| 12375 | —                                           | —   | —    | —   | —    | —   | —   | —   | —   | —   |
| 13075 | —                                           | —   | —    | —   | —    | —   | —   | —   | —   | —   |
| 13750 | —                                           | —   | —    | —   | —    | —   | —   | —   | —   | —   |

Std/Med Static 1280-2200 rpm

## APPENDIX D — FAN PERFORMANCE (cont)

### 48FCFM30 – High Static — 27.5 Ton Vertical Supply (rpm - vdc)

| CFM   | AVAILABLE EXTERNAL STATIC PRESSURE (in. wg) |     |      |     |      |     |      |     |      |     |
|-------|---------------------------------------------|-----|------|-----|------|-----|------|-----|------|-----|
|       | 0.2                                         |     | 0.4  |     | 0.6  |     | 0.8  |     | 1.0  |     |
|       | rpm                                         | vdc | rpm  | vdc | rpm  | vdc | rpm  | vdc | rpm  | vdc |
| 8250  | 1280                                        | 5.8 | 1353 | 6.1 | 1431 | 6.5 | 1512 | 6.8 | 1593 | 7.2 |
| 8940  | 1376                                        | 6.2 | 1442 | 6.5 | 1513 | 6.8 | 1586 | 7.2 | 1661 | 7.5 |
| 9625  | 1472                                        | 6.6 | 1533 | 6.9 | 1597 | 7.2 | 1664 | 7.5 | 1733 | 7.8 |
| 10300 | 1569                                        | 7.1 | 1625 | 7.3 | 1684 | 7.6 | 1746 | 7.9 | 1809 | 8.2 |
| 11000 | 1666                                        | 7.5 | 1719 | 7.8 | 1773 | 8.0 | 1830 | 8.3 | 1888 | 8.6 |
| 11700 | 1764                                        | 8.0 | 1813 | 8.2 | 1864 | 8.4 | 1917 | 8.7 | 1971 | 8.9 |
| 12375 | 1863                                        | 8.4 | 1909 | 8.7 | 1956 | 8.9 | 2005 | 9.1 | 2056 | 9.3 |
| 13075 | 1961                                        | 8.9 | 2005 | 9.1 | 2049 | 9.3 | 2095 | 9.5 | 2142 | 9.7 |
| 13750 | 2060                                        | 9.4 | 2101 | 9.5 | 2143 | 9.7 | 2186 | 9.9 | —    | —   |

| CFM   | AVAILABLE EXTERNAL STATIC PRESSURE (in. wg) |      |      |     |      |     |      |      |      |      |
|-------|---------------------------------------------|------|------|-----|------|-----|------|------|------|------|
|       | 1.2                                         |      | 1.4  |     | 1.6  |     | 1.8  |      | 2.0  |      |
|       | rpm                                         | vdc  | rpm  | vdc | rpm  | vdc | rpm  | vdc  | rpm  | vdc  |
| 8250  | 1672                                        | 7.6  | 1748 | 7.9 | 1821 | 8.3 | 1890 | 8.6  | 1957 | 8.9  |
| 8940  | 1736                                        | 7.9  | 1809 | 8.2 | 1879 | 8.5 | 1947 | 8.8  | 2012 | 9.1  |
| 9625  | 1803                                        | 8.2  | 1872 | 8.5 | 1940 | 8.8 | 2006 | 9.1  | 2070 | 9.4  |
| 10300 | 1874                                        | 8.5  | 1939 | 8.8 | 2004 | 9.1 | 2067 | 9.4  | 2129 | 9.7  |
| 11000 | 1948                                        | 8.8  | 2009 | 9.1 | 2070 | 9.4 | 2131 | 9.7  | 2190 | 10.0 |
| 11700 | 2026                                        | 9.2  | 2083 | 9.5 | 2140 | 9.7 | 2198 | 10.0 | —    | —    |
| 12375 | 2107                                        | 9.6  | 2160 | 9.8 | —    | —   | —    | —    | —    | —    |
| 13075 | 2191                                        | 10.0 | —    | —   | —    | —   | —    | —    | —    | —    |
| 13750 | —                                           | —    | —    | —   | —    | —   | —    | —    | —    | —    |

High Static 1280-2200 rpm

## APPENDIX D — FAN PERFORMANCE (cont)

### 48FCFM20 — 17.5 Ton Horizontal Supply (rpm - bhp)

| CFM  | AVAILABLE EXTERNAL STATIC PRESSURE (in. wg) |      |      |      |      |      |      |      |      |      |
|------|---------------------------------------------|------|------|------|------|------|------|------|------|------|
|      | 0.2                                         |      | 0.4  |      | 0.6  |      | 0.8  |      | 1.0  |      |
|      | rpm                                         | bhp  | rpm  | bhp  | rpm  | bhp  | rpm  | bhp  | rpm  | bhp  |
| 5250 | 1237                                        | 1.14 | 1337 | 1.43 | 1432 | 1.76 | 1522 | 2.11 | 1607 | 2.49 |
| 5690 | 1323                                        | 1.38 | 1417 | 1.69 | 1506 | 2.03 | 1592 | 2.40 | 1673 | 2.79 |
| 6125 | 1411                                        | 1.66 | 1499 | 1.99 | 1583 | 2.34 | 1664 | 2.72 | 1742 | 3.12 |
| 6560 | 1499                                        | 1.96 | 1582 | 2.30 | 1661 | 2.66 | 1738 | 3.05 | 1813 | 3.47 |
| 7000 | 1589                                        | 2.29 | 1666 | 2.64 | 1742 | 3.02 | 1815 | 3.42 | 1886 | 3.84 |
| 7440 | 1678                                        | 2.65 | 1752 | 3.02 | 1823 | 3.40 | 1893 | 3.81 | 1961 | 4.23 |
| 7875 | 1768                                        | 3.04 | 1838 | 3.42 | 1906 | 3.81 | 1973 | 4.23 | 2038 | 4.66 |
| 8310 | 1859                                        | 3.46 | 1925 | 3.85 | 1990 | 4.25 | 2054 | 4.67 | 2116 | 5.11 |
| 8750 | 1950                                        | 3.91 | 2013 | 4.30 | 2075 | 4.71 | 2136 | 5.14 | 2196 | 5.59 |

| CFM  | AVAILABLE EXTERNAL STATIC PRESSURE (in. wg) |      |      |      |      |      |      |      |      |      |
|------|---------------------------------------------|------|------|------|------|------|------|------|------|------|
|      | 1.2                                         |      | 1.4  |      | 1.6  |      | 1.8  |      | 2.0  |      |
|      | rpm                                         | bhp  | rpm  | bhp  | rpm  | bhp  | rpm  | bhp  | rpm  | bhp  |
| 5250 | 1688                                        | 2.88 | 1764 | 3.29 | 1837 | 3.72 | 1908 | 4.17 | 1976 | 4.63 |
| 5690 | 1751                                        | 3.20 | 1825 | 3.62 | 1896 | 4.06 | 1965 | 4.52 | 2031 | 4.99 |
| 6125 | 1817                                        | 3.54 | 1889 | 3.97 | 1958 | 4.43 | 2024 | 4.89 | 2088 | 5.37 |
| 6560 | 1885                                        | 3.89 | 1954 | 4.34 | 2021 | 4.80 | 2086 | 5.28 | 2148 | 5.76 |
| 7000 | 1955                                        | 4.27 | 2022 | 4.73 | 2087 | 5.20 | 2150 | 5.68 | —    | —    |
| 7440 | 2027                                        | 4.67 | 2092 | 5.14 | 2154 | 5.61 | —    | —    | —    | —    |
| 7875 | 2101                                        | 5.10 | 2163 | 5.57 | —    | —    | —    | —    | —    | —    |
| 8310 | 2177                                        | 5.56 | —    | —    | —    | —    | —    | —    | —    | —    |
| 8750 | —                                           | —    | —    | —    | —    | —    | —    | —    | —    | —    |

High Static 1237-2200 rpm, 10.0 Max bhp (5.0 Max bhp per fan motor)

### 48FCFM20 – High Static — 17.5 ton Horizontal Supply (rpm - vdc)

| CFM  | AVAILABLE EXTERNAL STATIC PRESSURE (in. wg) |     |      |     |      |     |      |     |      |      |
|------|---------------------------------------------|-----|------|-----|------|-----|------|-----|------|------|
|      | 0.2                                         |     | 0.4  |     | 0.6  |     | 0.8  |     | 1.0  |      |
|      | rpm                                         | vdc | rpm  | vdc | rpm  | vdc | rpm  | vdc | rpm  | vdc  |
| 5250 | 1237                                        | 5.6 | 1337 | 6.0 | 1432 | 6.5 | 1522 | 6.9 | 1607 | 7.3  |
| 5690 | 1323                                        | 6.0 | 1417 | 6.4 | 1506 | 6.8 | 1592 | 7.2 | 1673 | 7.6  |
| 6125 | 1411                                        | 6.4 | 1499 | 6.8 | 1583 | 7.2 | 1664 | 7.5 | 1742 | 7.9  |
| 6560 | 1499                                        | 6.8 | 1582 | 7.1 | 1661 | 7.5 | 1738 | 7.9 | 1813 | 8.2  |
| 7000 | 1589                                        | 7.2 | 1666 | 7.5 | 1742 | 7.9 | 1815 | 8.2 | 1886 | 8.6  |
| 7440 | 1678                                        | 7.6 | 1752 | 7.9 | 1823 | 8.3 | 1893 | 8.6 | 1961 | 8.9  |
| 7875 | 1768                                        | 8.0 | 1838 | 8.3 | 1906 | 8.6 | 1973 | 9.0 | 2038 | 9.3  |
| 8310 | 1859                                        | 8.4 | 1925 | 8.7 | 1990 | 9.0 | 2054 | 9.3 | 2116 | 9.6  |
| 8750 | 1950                                        | 8.8 | 2013 | 9.1 | 2075 | 9.4 | 2136 | 9.7 | 2196 | 10.0 |

| CFM  | AVAILABLE EXTERNAL STATIC PRESSURE (in. wg) |     |      |     |      |     |      |     |      |     |
|------|---------------------------------------------|-----|------|-----|------|-----|------|-----|------|-----|
|      | 1.2                                         |     | 1.4  |     | 1.6  |     | 1.8  |     | 2.0  |     |
|      | rpm                                         | vdc | rpm  | vdc | rpm  | vdc | rpm  | vdc | rpm  | vdc |
| 5250 | 1688                                        | 7.6 | 1764 | 8.0 | 1837 | 8.3 | 1908 | 8.7 | 1976 | 9.0 |
| 5690 | 1751                                        | 7.9 | 1825 | 8.3 | 1896 | 8.6 | 1965 | 8.9 | 2031 | 9.2 |
| 6125 | 1817                                        | 8.2 | 1889 | 8.6 | 1958 | 8.9 | 2024 | 9.2 | 2088 | 9.5 |
| 6560 | 1885                                        | 8.5 | 1954 | 8.9 | 2021 | 9.2 | 2086 | 9.5 | 2148 | 9.8 |
| 7000 | 1955                                        | 8.9 | 2022 | 9.2 | 2087 | 9.5 | 2150 | 9.8 | —    | —   |
| 7440 | 2027                                        | 9.2 | 2092 | 9.5 | 2154 | 9.8 | —    | —   | —    | —   |
| 7875 | 2101                                        | 9.5 | 2163 | 9.8 | —    | —   | —    | —   | —    | —   |
| 8310 | 2177                                        | 9.9 | —    | —   | —    | —   | —    | —   | —    | —   |
| 8750 | —                                           | —   | —    | —   | —    | —   | —    | —   | —    | —   |

High Static 1237-2200 rpm

## APPENDIX D — FAN PERFORMANCE (cont)

### 48FCFM24 — 20 Ton Horizontal Supply (rpm - bhp)

| CFM   | AVAILABLE EXTERNAL STATIC PRESSURE (in. wg) |      |      |      |      |      |      |      |      |      |
|-------|---------------------------------------------|------|------|------|------|------|------|------|------|------|
|       | 0.2                                         |      | 0.4  |      | 0.6  |      | 0.8  |      | 1.0  |      |
|       | rpm                                         | bhp  | rpm  | bhp  | rpm  | bhp  | rpm  | bhp  | rpm  | bhp  |
| 6000  | 1386                                        | 1.58 | 1475 | 1.90 | 1561 | 2.25 | 1643 | 2.62 | 1722 | 3.02 |
| 6500  | 1487                                        | 1.92 | 1570 | 2.26 | 1650 | 2.62 | 1728 | 3.01 | 1803 | 3.42 |
| 7000  | 1589                                        | 2.29 | 1666 | 2.64 | 1742 | 3.02 | 1815 | 3.42 | 1886 | 3.84 |
| 7500  | 1691                                        | 2.71 | 1764 | 3.07 | 1835 | 3.46 | 1904 | 3.86 | 1972 | 4.29 |
| 8000  | 1794                                        | 3.16 | 1863 | 3.54 | 1930 | 3.93 | 1996 | 4.35 | 2060 | 4.78 |
| 8500  | 1898                                        | 3.65 | 1963 | 4.04 | 2026 | 4.44 | 2089 | 4.87 | 2150 | 5.31 |
| 9000  | 2002                                        | 4.18 | 2064 | 4.58 | 2124 | 4.99 | 2183 | 5.41 | —    | —    |
| 9500  | 2106                                        | 4.70 | 2165 | 5.11 | —    | —    | —    | —    | —    | —    |
| 10000 | —                                           | —    | —    | —    | —    | —    | —    | —    | —    | —    |

| CFM   | AVAILABLE EXTERNAL STATIC PRESSURE (in. wg) |      |      |      |      |      |      |      |      |      |
|-------|---------------------------------------------|------|------|------|------|------|------|------|------|------|
|       | 1.2                                         |      | 1.4  |      | 1.6  |      | 1.8  |      | 2.0  |      |
|       | rpm                                         | bhp  | rpm  | bhp  | rpm  | bhp  | rpm  | bhp  | rpm  | bhp  |
| 6000  | 1798                                        | 3.44 | 1870 | 3.87 | 1940 | 4.32 | 2007 | 4.78 | 2072 | 5.26 |
| 6500  | 1875                                        | 3.84 | 1945 | 4.29 | 2012 | 4.75 | 2077 | 5.22 | 2140 | 5.71 |
| 7000  | 1955                                        | 4.27 | 2022 | 4.73 | 2087 | 5.20 | 2150 | 5.68 | —    | —    |
| 7500  | 2038                                        | 4.74 | 2102 | 5.20 | 2164 | 5.67 | —    | —    | —    | —    |
| 8000  | 2123                                        | 5.23 | 2184 | 5.70 | —    | —    | —    | —    | —    | —    |
| 8500  | —                                           | —    | —    | —    | —    | —    | —    | —    | —    | —    |
| 9000  | —                                           | —    | —    | —    | —    | —    | —    | —    | —    | —    |
| 9500  | —                                           | —    | —    | —    | —    | —    | —    | —    | —    | —    |
| 10000 | —                                           | —    | —    | —    | —    | —    | —    | —    | —    | —    |

High Static 1386-2200 rpm, 10.0 Max bhp (5.0 Max bhp per fan motor)

### 48FCFM24 – High Static — 20 Ton Horizontal Supply (rpm - vdc)

| CFM   | AVAILABLE EXTERNAL STATIC PRESSURE (in. wg) |     |      |     |      |     |      |     |      |     |
|-------|---------------------------------------------|-----|------|-----|------|-----|------|-----|------|-----|
|       | 0.2                                         |     | 0.4  |     | 0.6  |     | 0.8  |     | 1.0  |     |
|       | rpm                                         | vdc | rpm  | vdc | rpm  | vdc | rpm  | vdc | rpm  | vdc |
| 6000  | 1386                                        | 6.2 | 1475 | 6.7 | 1561 | 7.1 | 1643 | 7.4 | 1722 | 7.8 |
| 6500  | 1487                                        | 6.7 | 1570 | 7.1 | 1650 | 7.5 | 1728 | 7.8 | 1803 | 8.2 |
| 7000  | 1589                                        | 7.2 | 1666 | 7.5 | 1742 | 7.9 | 1815 | 8.2 | 1886 | 8.6 |
| 7500  | 1691                                        | 7.7 | 1764 | 8.0 | 1835 | 8.3 | 1904 | 8.6 | 1972 | 8.9 |
| 8000  | 1794                                        | 8.1 | 1863 | 8.4 | 1930 | 8.8 | 1996 | 9.1 | 2060 | 9.4 |
| 8500  | 1898                                        | 8.6 | 1963 | 8.9 | 2026 | 9.2 | 2089 | 9.5 | 2150 | 9.8 |
| 9000  | 2002                                        | 9.1 | 2064 | 9.4 | 2124 | 9.6 | 2183 | 9.9 | —    | —   |
| 9500  | 2106                                        | 9.6 | 2165 | 9.8 | —    | —   | —    | —   | —    | —   |
| 10000 | —                                           | —   | —    | —   | —    | —   | —    | —   | —    | —   |

| CFM   | AVAILABLE EXTERNAL STATIC PRESSURE (in. wg) |     |      |     |      |     |      |     |      |     |
|-------|---------------------------------------------|-----|------|-----|------|-----|------|-----|------|-----|
|       | 1.2                                         |     | 1.4  |     | 1.6  |     | 1.8  |     | 2.0  |     |
|       | rpm                                         | vdc | rpm  | vdc | rpm  | vdc | rpm  | vdc | rpm  | vdc |
| 6000  | 1798                                        | 8.1 | 1870 | 8.5 | 1940 | 8.8 | 2007 | 9.1 | 2072 | 9.4 |
| 6500  | 1875                                        | 8.5 | 1945 | 8.8 | 2012 | 9.1 | 2077 | 9.4 | 2140 | 9.7 |
| 7000  | 1955                                        | 8.9 | 2022 | 9.2 | 2087 | 9.5 | 2150 | 9.8 | —    | —   |
| 7500  | 2038                                        | 9.3 | 2102 | 9.5 | 2164 | 9.8 | —    | —   | —    | —   |
| 8000  | 2123                                        | 9.6 | 2184 | 9.9 | —    | —   | —    | —   | —    | —   |
| 8500  | —                                           | —   | —    | —   | —    | —   | —    | —   | —    | —   |
| 9000  | —                                           | —   | —    | —   | —    | —   | —    | —   | —    | —   |
| 9500  | —                                           | —   | —    | —   | —    | —   | —    | —   | —    | —   |
| 10000 | —                                           | —   | —    | —   | —    | —   | —    | —   | —    | —   |

High Static 1386-2200 rpm

## APPENDIX D — FAN PERFORMANCE (cont)

### 48FCFM28 — 25 Ton Horizontal Supply (rpm - bhp)

| CFM   | AVAILABLE EXTERNAL STATIC PRESSURE (in. wg) |      |      |      |      |      |      |      |      |      |
|-------|---------------------------------------------|------|------|------|------|------|------|------|------|------|
|       | 0.2                                         |      | 0.4  |      | 0.6  |      | 0.8  |      | 1.0  |      |
|       | rpm                                         | bhp  | rpm  | bhp  | rpm  | bhp  | rpm  | bhp  | rpm  | bhp  |
| 7500  | 1494                                        | 2.53 | 1571 | 2.94 | 1648 | 3.39 | 1722 | 3.87 | 1795 | 4.38 |
| 8125  | 1606                                        | 3.13 | 1678 | 3.57 | 1748 | 4.04 | 1818 | 4.54 | 1886 | 5.07 |
| 8750  | 1719                                        | 3.82 | 1786 | 4.28 | 1852 | 4.77 | 1917 | 5.29 | 1981 | 5.84 |
| 9375  | 1833                                        | 4.58 | 1895 | 5.06 | 1957 | 5.57 | 2018 | 6.11 | 2078 | 6.67 |
| 10000 | 1947                                        | 5.41 | 2005 | 5.90 | 2063 | 6.43 | 2121 | 6.99 | 2178 | 7.57 |
| 10625 | 2062                                        | 6.29 | 2117 | 6.81 | 2171 | 7.35 | —    | —    | —    | —    |
| 11250 | 2177                                        | 7.22 | —    | —    | —    | —    | —    | —    | —    | —    |
| 11875 | —                                           | —    | —    | —    | —    | —    | —    | —    | —    | —    |
| 12500 | —                                           | —    | —    | —    | —    | —    | —    | —    | —    | —    |

| CFM   | AVAILABLE EXTERNAL STATIC PRESSURE (in. wg) |      |      |      |      |      |      |      |      |      |
|-------|---------------------------------------------|------|------|------|------|------|------|------|------|------|
|       | 1.2                                         |      | 1.4  |      | 1.6  |      | 1.8  |      | 2.0  |      |
|       | rpm                                         | bhp  | rpm  | bhp  | rpm  | bhp  | rpm  | bhp  | rpm  | bhp  |
| 7500  | 1864                                        | 4.91 | 1931 | 5.46 | 1996 | 6.03 | 2058 | 6.61 | 2117 | 7.19 |
| 8125  | 1953                                        | 5.63 | 2017 | 6.20 | 2079 | 6.79 | 2139 | 7.40 | 2197 | 8.02 |
| 8750  | 2044                                        | 6.41 | 2105 | 7.01 | 2165 | 7.62 | —    | —    | —    | —    |
| 9375  | 2138                                        | 7.26 | 2197 | 7.88 | —    | —    | —    | —    | —    | —    |
| 10000 | —                                           | —    | —    | —    | —    | —    | —    | —    | —    | —    |
| 10625 | —                                           | —    | —    | —    | —    | —    | —    | —    | —    | —    |
| 11250 | —                                           | —    | —    | —    | —    | —    | —    | —    | —    | —    |
| 11875 | —                                           | —    | —    | —    | —    | —    | —    | —    | —    | —    |
| 12500 | —                                           | —    | —    | —    | —    | —    | —    | —    | —    | —    |

High Static 1494-2200 rpm, 10.0 Max bhp (5.0 Max bhp per fan motor)

### 48FCFM28 – High Static — 25 Ton Horizontal Supply (rpm - vdc)

| CFM   | AVAILABLE EXTERNAL STATIC PRESSURE (in. wg) |     |      |     |      |     |      |     |      |     |
|-------|---------------------------------------------|-----|------|-----|------|-----|------|-----|------|-----|
|       | 0.2                                         |     | 0.4  |     | 0.6  |     | 0.8  |     | 1.0  |     |
|       | rpm                                         | vdc | rpm  | vdc | rpm  | vdc | rpm  | vdc | rpm  | vdc |
| 7500  | 1494                                        | 6.7 | 1571 | 7.1 | 1648 | 7.5 | 1722 | 7.8 | 1795 | 8.1 |
| 8125  | 1606                                        | 7.3 | 1678 | 7.6 | 1748 | 7.9 | 1818 | 8.2 | 1886 | 8.6 |
| 8750  | 1719                                        | 7.8 | 1786 | 8.1 | 1852 | 8.4 | 1917 | 8.7 | 1981 | 9.0 |
| 9375  | 1833                                        | 8.3 | 1895 | 8.6 | 1957 | 8.9 | 2018 | 9.2 | 2078 | 9.4 |
| 10000 | 1947                                        | 8.8 | 2005 | 9.1 | 2063 | 9.4 | 2121 | 9.6 | 2178 | 9.9 |
| 10625 | 2062                                        | 9.4 | 2117 | 9.6 | 2171 | 9.9 | —    | —   | —    | —   |
| 11250 | 2177                                        | 9.9 | —    | —   | —    | —   | —    | —   | —    | —   |
| 11875 | —                                           | —   | —    | —   | —    | —   | —    | —   | —    | —   |
| 12500 | —                                           | —   | —    | —   | —    | —   | —    | —   | —    | —   |

| CFM   | AVAILABLE EXTERNAL STATIC PRESSURE (in. wg) |     |      |      |      |     |      |     |      |      |
|-------|---------------------------------------------|-----|------|------|------|-----|------|-----|------|------|
|       | 1.2                                         |     | 1.4  |      | 1.6  |     | 1.8  |     | 2.0  |      |
|       | rpm                                         | vdc | rpm  | vdc  | rpm  | vdc | rpm  | vdc | rpm  | vdc  |
| 7500  | 1864                                        | 8.4 | 1931 | 8.8  | 1996 | 9.1 | 2058 | 9.3 | 2117 | 9.6  |
| 8125  | 1953                                        | 8.9 | 2017 | 9.2  | 2079 | 9.4 | 2139 | 9.7 | 2197 | 10.0 |
| 8750  | 2044                                        | 9.3 | 2105 | 9.6  | 2165 | 9.8 | —    | —   | —    | —    |
| 9375  | 2138                                        | 9.7 | 2197 | 10.0 | —    | —   | —    | —   | —    | —    |
| 10000 | —                                           | —   | —    | —    | —    | —   | —    | —   | —    | —    |
| 10625 | —                                           | —   | —    | —    | —    | —   | —    | —   | —    | —    |
| 11250 | —                                           | —   | —    | —    | —    | —   | —    | —   | —    | —    |
| 11875 | —                                           | —   | —    | —    | —    | —   | —    | —   | —    | —    |
| 12500 | —                                           | —   | —    | —    | —    | —   | —    | —   | —    | —    |

High Static 1494-2200 rpm

## APPENDIX D — FAN PERFORMANCE (cont)

### 48FCFM30 — 27.5 Ton Horizontal Supply (rpm - bhp)

| CFM   | AVAILABLE EXTERNAL STATIC PRESSURE (in. wg) |      |      |      |      |      |      |      |      |      |
|-------|---------------------------------------------|------|------|------|------|------|------|------|------|------|
|       | 0.2                                         |      | 0.4  |      | 0.6  |      | 0.8  |      | 1.0  |      |
|       | rpm                                         | bhp  | rpm  | bhp  | rpm  | bhp  | rpm  | bhp  | rpm  | bhp  |
| 8250  | 1619                                        | 3.20 | 1689 | 3.64 | 1759 | 4.11 | 1828 | 4.61 | 1896 | 5.15 |
| 8940  | 1743                                        | 3.97 | 1808 | 4.43 | 1872 | 4.91 | 1936 | 5.44 | 2000 | 5.99 |
| 9625  | 1868                                        | 4.82 | 1928 | 5.30 | 1987 | 5.80 | 2048 | 6.35 | 2107 | 6.92 |
| 10300 | 1993                                        | 5.74 | 2049 | 6.24 | 2105 | 6.77 | 2161 | 7.32 | —    | —    |
| 11000 | 2119                                        | 6.73 | 2171 | 7.24 | —    | —    | —    | —    | —    | —    |
| 11690 | —                                           | —    | —    | —    | —    | —    | —    | —    | —    | —    |
| 12375 | —                                           | —    | —    | —    | —    | —    | —    | —    | —    | —    |
| 13060 | —                                           | —    | —    | —    | —    | —    | —    | —    | —    | —    |
| 13750 | —                                           | —    | —    | —    | —    | —    | —    | —    | —    | —    |

| CFM   | AVAILABLE EXTERNAL STATIC PRESSURE (in. wg) |      |      |      |      |      |      |      |     |     |
|-------|---------------------------------------------|------|------|------|------|------|------|------|-----|-----|
|       | 1.2                                         |      | 1.4  |      | 1.6  |      | 1.8  |      | 2.0 |     |
|       | rpm                                         | bhp  | rpm  | bhp  | rpm  | bhp  | rpm  | bhp  | rpm | bhp |
| 8250  | 1961                                        | 5.70 | 2025 | 6.27 | 2087 | 6.86 | 2147 | 7.47 | —   | —   |
| 8940  | 2062                                        | 6.57 | 2122 | 7.16 | 2182 | 7.78 | —    | —    | —   | —   |
| 9625  | 2165                                        | 7.50 | —    | —    | —    | —    | —    | —    | —   | —   |
| 10300 | —                                           | —    | —    | —    | —    | —    | —    | —    | —   | —   |
| 11000 | —                                           | —    | —    | —    | —    | —    | —    | —    | —   | —   |
| 11690 | —                                           | —    | —    | —    | —    | —    | —    | —    | —   | —   |
| 12375 | —                                           | —    | —    | —    | —    | —    | —    | —    | —   | —   |
| 13060 | —                                           | —    | —    | —    | —    | —    | —    | —    | —   | —   |
| 13750 | —                                           | —    | —    | —    | —    | —    | —    | —    | —   | —   |

High Static 1619-2200 rpm, 10.0 Max bhp (Max bhp 5.0 per fan motor)

### 48FCFM30 – High Static — 27.5 Ton Horizontal Supply (rpm - vdc)

| CFM   | AVAILABLE EXTERNAL STATIC PRESSURE (in. wg) |     |      |     |      |     |      |     |      |     |
|-------|---------------------------------------------|-----|------|-----|------|-----|------|-----|------|-----|
|       | 0.2                                         |     | 0.4  |     | 0.6  |     | 0.8  |     | 1.0  |     |
|       | rpm                                         | vdc | rpm  | vdc | rpm  | vdc | rpm  | vdc | rpm  | vdc |
| 8250  | 1619                                        | 7.3 | 1689 | 7.6 | 1759 | 8.0 | 1828 | 8.3 | 1896 | 8.6 |
| 8940  | 1743                                        | 7.9 | 1808 | 8.2 | 1872 | 8.5 | 1936 | 8.8 | 2000 | 9.1 |
| 9625  | 1868                                        | 8.5 | 1928 | 8.7 | 1987 | 9.0 | 2048 | 9.3 | 2107 | 9.6 |
| 10300 | 1993                                        | 9.0 | 2049 | 9.3 | 2105 | 9.6 | 2161 | 9.8 | —    | —   |
| 11000 | 2119                                        | 9.6 | 2171 | 9.9 | —    | —   | —    | —   | —    | —   |
| 11690 | —                                           | —   | —    | —   | —    | —   | —    | —   | —    | —   |
| 12375 | —                                           | —   | —    | —   | —    | —   | —    | —   | —    | —   |
| 13060 | —                                           | —   | —    | —   | —    | —   | —    | —   | —    | —   |
| 13750 | —                                           | —   | —    | —   | —    | —   | —    | —   | —    | —   |

| CFM   | AVAILABLE EXTERNAL STATIC PRESSURE (in. wg) |     |      |     |      |     |      |     |     |     |
|-------|---------------------------------------------|-----|------|-----|------|-----|------|-----|-----|-----|
|       | 1.2                                         |     | 1.4  |     | 1.6  |     | 1.8  |     | 2.0 |     |
|       | rpm                                         | vdc | rpm  | vdc | rpm  | vdc | rpm  | vdc | rpm | vdc |
| 8250  | 1961                                        | 8.9 | 2025 | 9.2 | 2087 | 9.5 | 2147 | 9.8 | —   | —   |
| 8940  | 2062                                        | 9.4 | 2122 | 9.6 | 2182 | 9.9 | —    | —   | —   | —   |
| 9625  | 2165                                        | 9.8 | —    | —   | —    | —   | —    | —   | —   | —   |
| 10300 | —                                           | —   | —    | —   | —    | —   | —    | —   | —   | —   |
| 11000 | —                                           | —   | —    | —   | —    | —   | —    | —   | —   | —   |
| 11690 | —                                           | —   | —    | —   | —    | —   | —    | —   | —   | —   |
| 12375 | —                                           | —   | —    | —   | —    | —   | —    | —   | —   | —   |
| 13060 | —                                           | —   | —    | —   | —    | —   | —    | —   | —   | —   |
| 13750 | —                                           | —   | —    | —   | —    | —   | —    | —   | —   | —   |

High Static 1619-2200 rpm

## APPENDIX E — WIRING DIAGRAMS

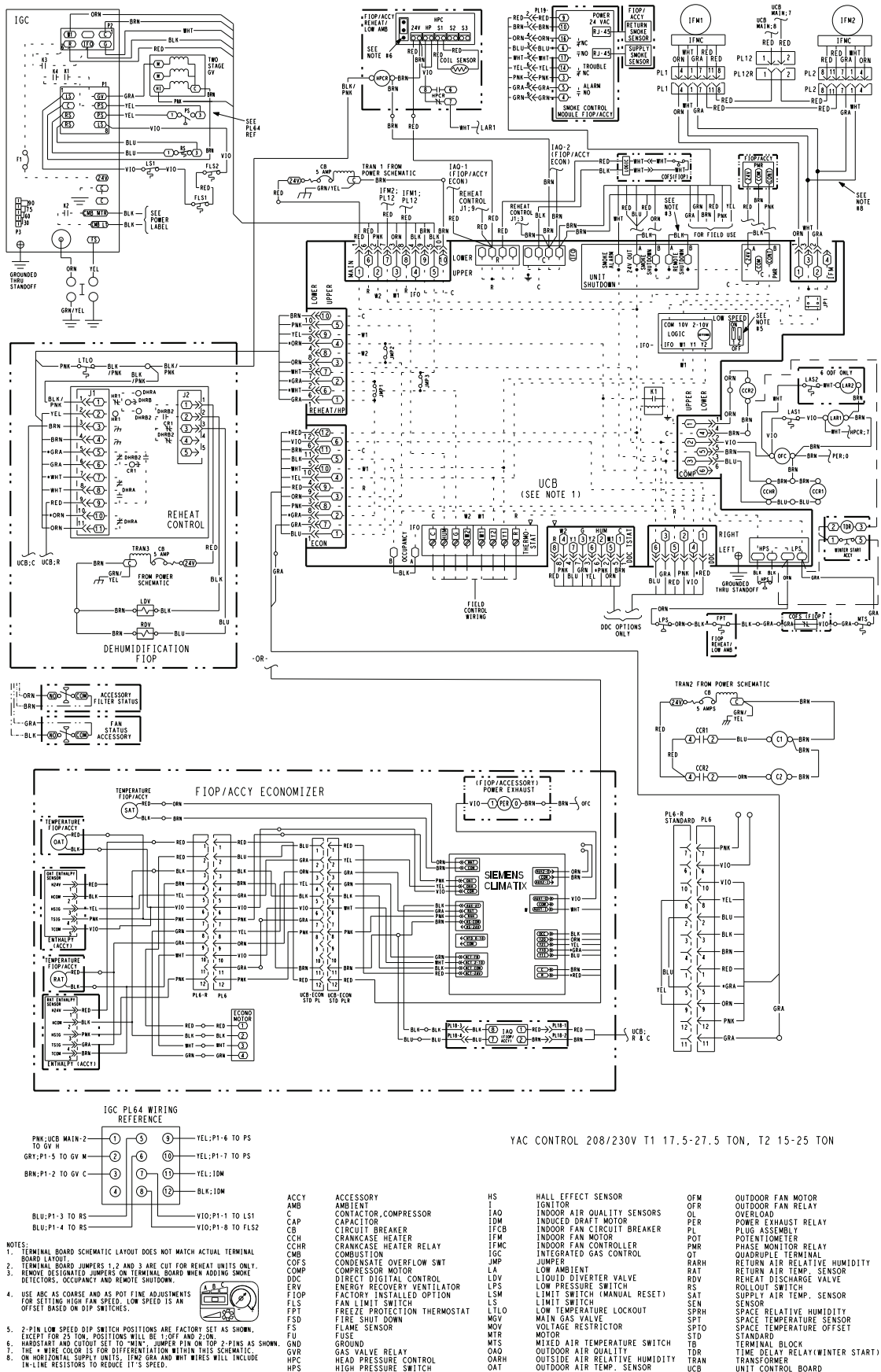
### 48FC\*20-30 — Wiring Diagrams — Standard SCCR

| SIZE                                                                 | VOLTAGE | CONTROL<br>(OVERLAY) | PAGE | POWER      | PAGE |
|----------------------------------------------------------------------|---------|----------------------|------|------------|------|
| <b>48FC**20-28<br/>Electromechanical<br/>POL224 Controller</b>       | 208/230 | 50HE006332           | 97   | 50HE003743 | 101  |
|                                                                      | 460     | 50HE006333           | 98   | 50HE003762 | 102  |
|                                                                      | 575     |                      |      | 50HE003763 | 103  |
| <b>48FC**30<br/>Electromechanical<br/>POL224 Controller</b>          | 208/230 | 50HE006332           | 97   | 50HE003744 | 104  |
|                                                                      | 460     | 50HE006333           | 98   | 50HE003764 | 105  |
|                                                                      | 575     |                      |      | 50HE003765 | 106  |
| <b>48FC**20-28<br/>SystemVu™<br/>Controller<br/>(Factory Option)</b> | 208/230 | 50HE004108           | 99   | 50HE004092 | 107  |
|                                                                      | 460     | 50HE004109           | 100  | 50HE004100 | 108  |
|                                                                      | 575     |                      |      | 50HE004101 | 109  |
| <b>48FC**30<br/>SystemVu™<br/>Controller<br/>(Factory Option)</b>    | 208/230 | 50HE004108           | 99   | 50HE004093 | 110  |
|                                                                      | 460     | 50HE004109           | 100  | 50HE004102 | 111  |
|                                                                      | 575     |                      |      | 50HE004103 | 112  |

### 48FC\*20-30 — Wiring Diagrams — High SCCR

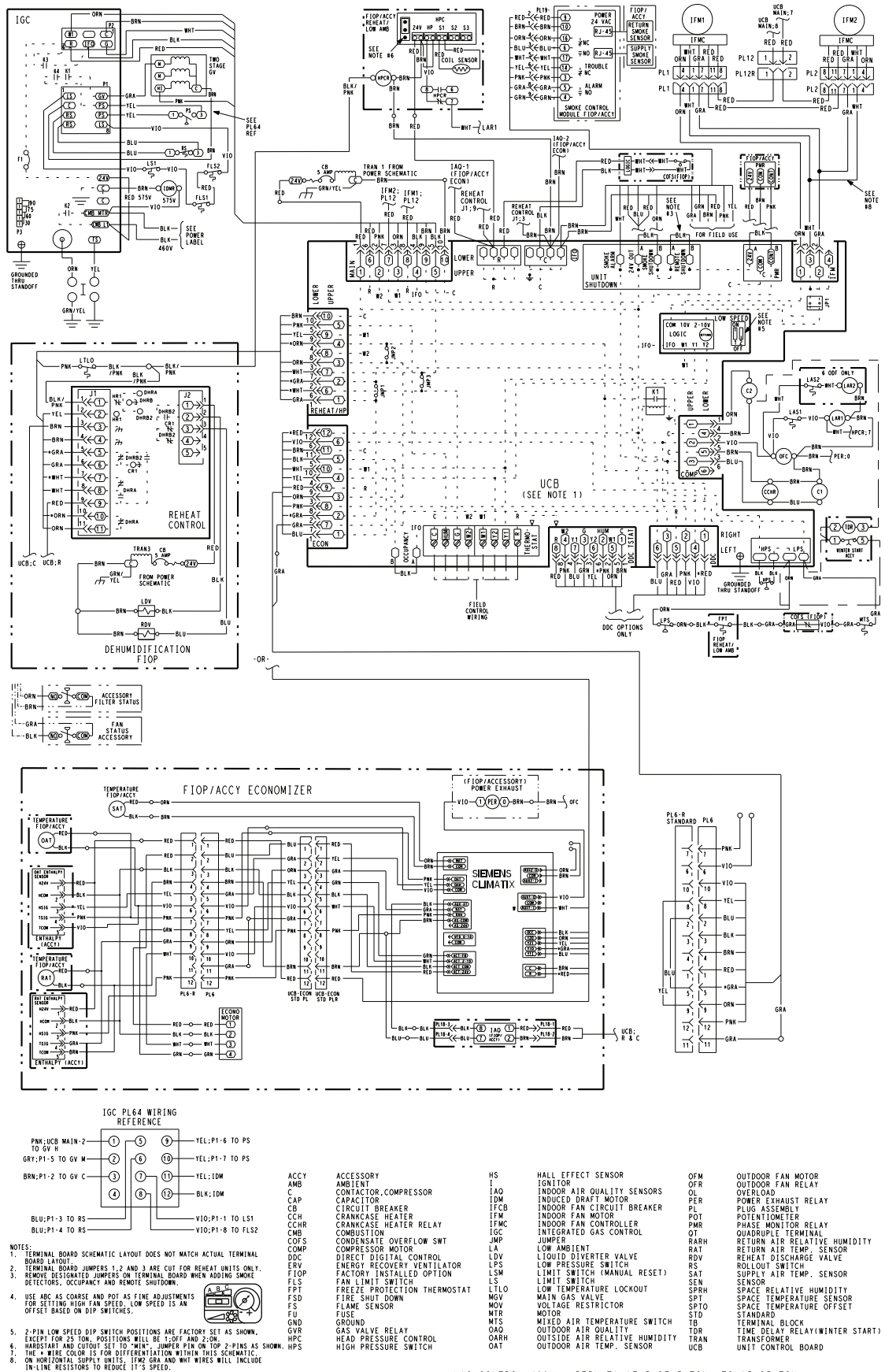
| SIZE                                                                 | VOLTAGE | CONTROL<br>(OVERLAY) | PAGE | POWER      | PAGE |
|----------------------------------------------------------------------|---------|----------------------|------|------------|------|
| <b>48FC**20-28<br/>Electromechanical<br/>POL224 Controller</b>       | 208/230 | 50HE006525           | 113  | 50HE006161 | 117  |
|                                                                      | 460     | 50HE006526           | 114  | 50HE006165 | 118  |
| <b>48FC**30<br/>Electromechanical<br/>POL224 Controller</b>          | 208/230 | 50HE006525           | 113  | 50HE006162 | 119  |
|                                                                      | 460     | 50HE006526           | 114  | 50HE006167 | 120  |
| <b>48FC**20-28<br/>SystemVu™<br/>Controller<br/>(Factory Option)</b> | 208/230 | 50HE006357           | 115  | 50HE006170 | 121  |
|                                                                      | 460     | 50HE006358           | 116  | 50HE006174 | 122  |
| <b>48FC**30<br/>SystemVu™<br/>Controller<br/>(Factory Option)</b>    | 208/230 | 50HE006357           | 115  | 50HE006171 | 123  |
|                                                                      | 460     | 50HE006358           | 116  | 50HE006175 | 124  |

# APPENDIX E — WIRING DIAGRAMS (cont)



**Fig. B — 48FC\*\*20-30 — 208/230-3-60 — Control Wiring Diagram Electromechanical with POL224 Controller**

## APPENDIX E — WIRING DIAGRAMS (cont)

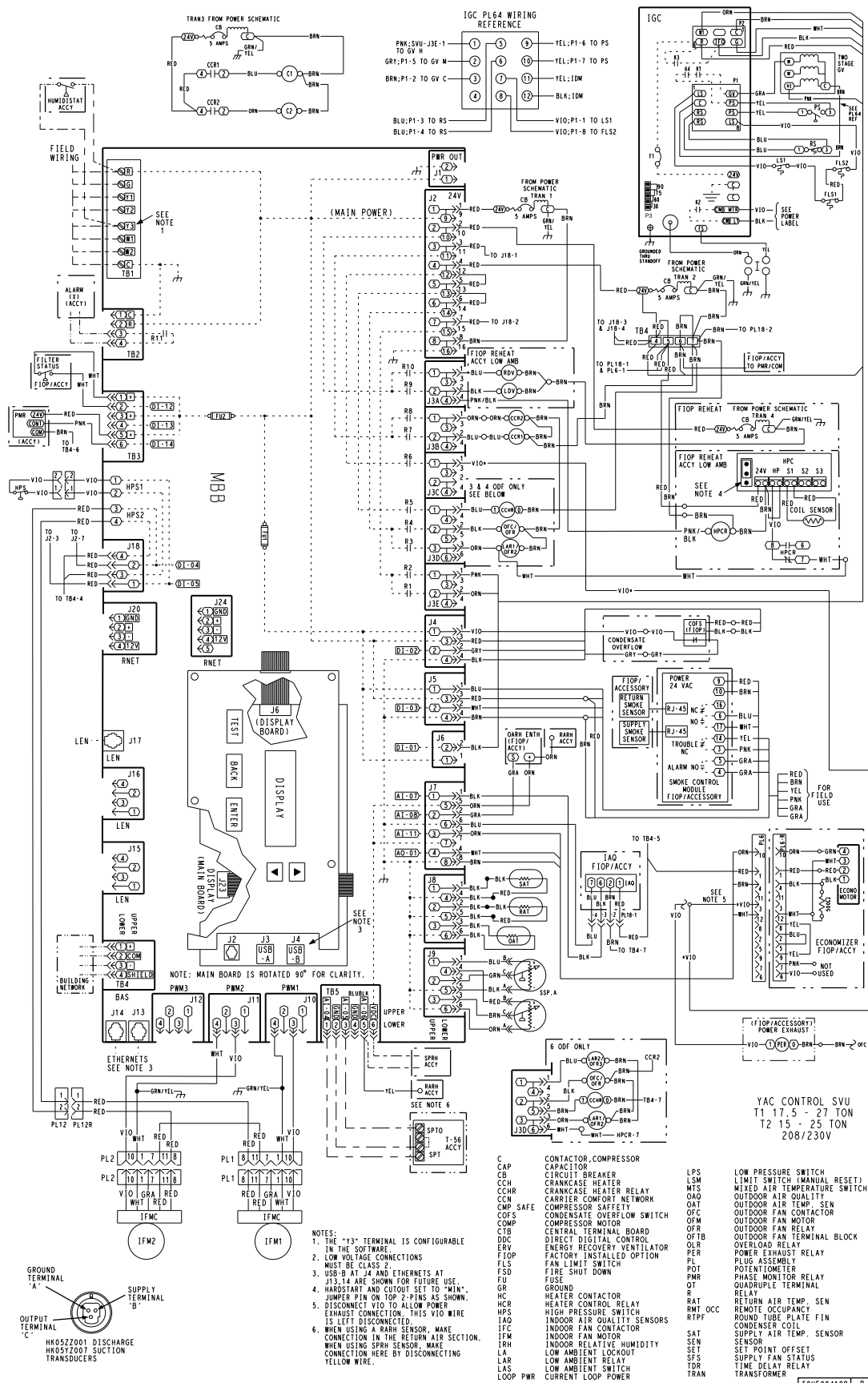


YAC CONTROL 460V , 575V T1 17.5-27.5 TON, T2 15-25 TON

50HE006333

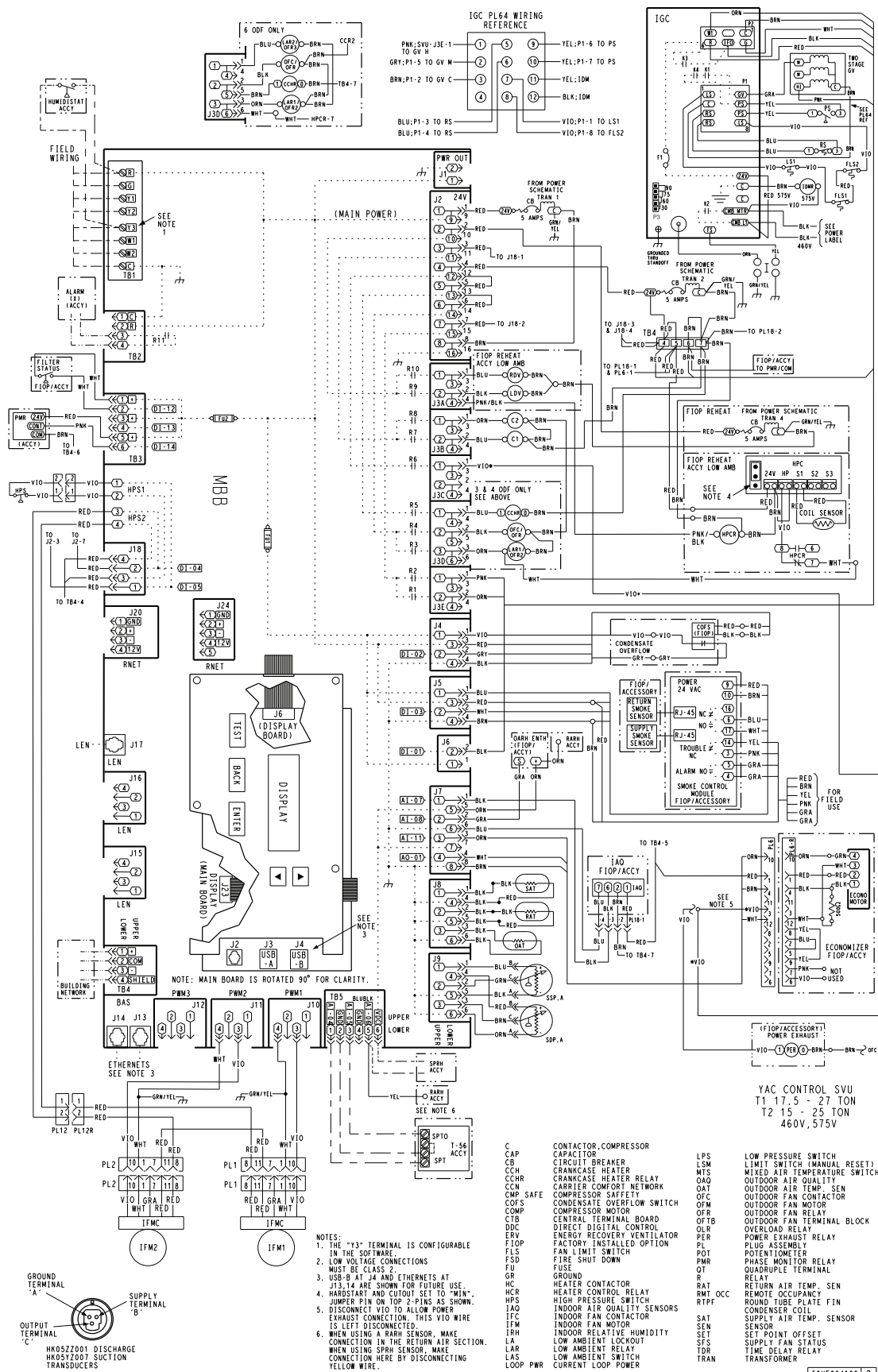
**Fig. C — 48FC\*\*20-30 — 460/575-3-60 — Control Wiring Diagram  
Electromechanical with POL224 Controller**

## APPENDIX E – WIRING DIAGRAMS (cont)



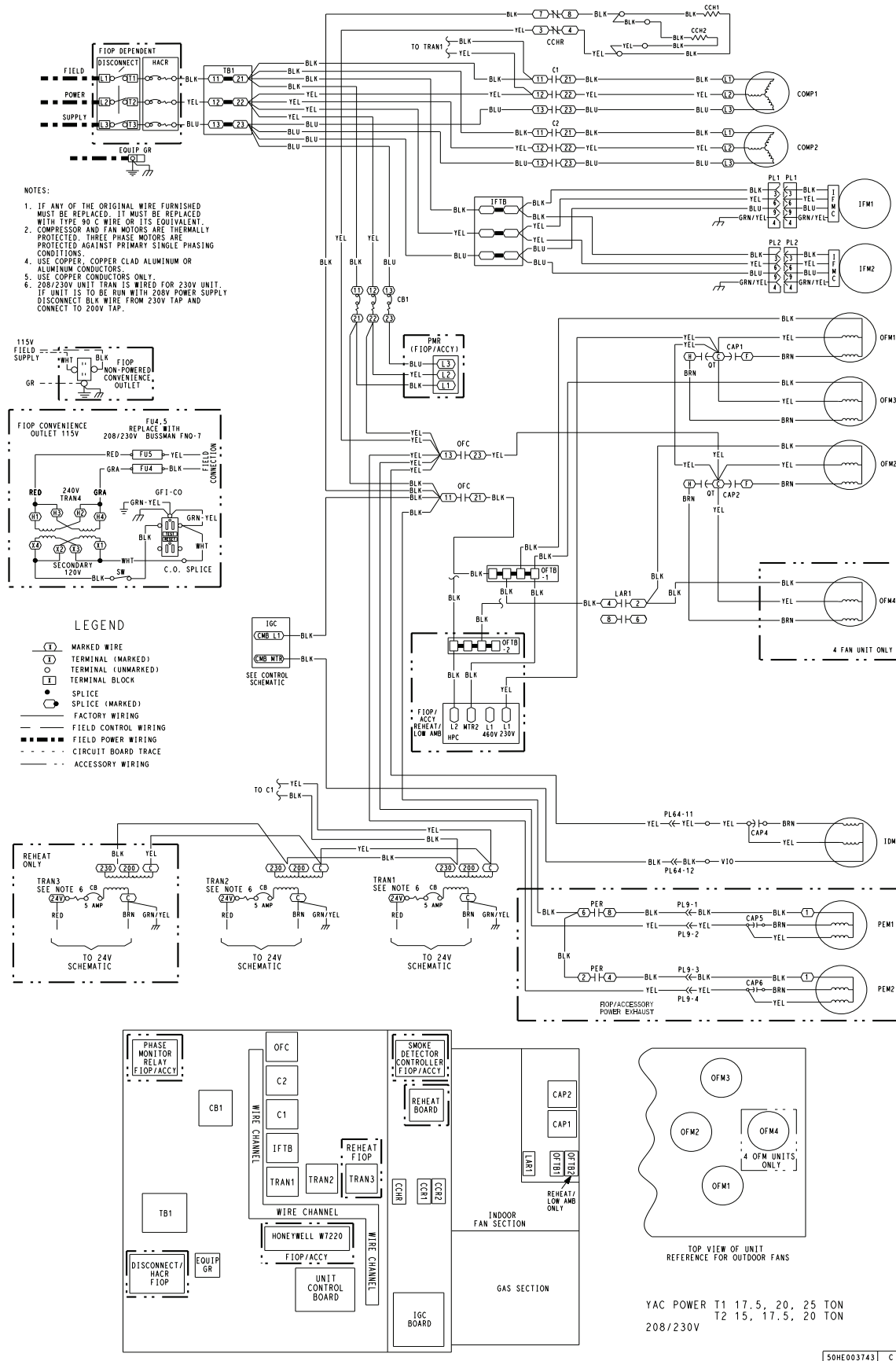
**Fig. D — 48FC\*\*20-30 — 208/230-3-60 — Control Wiring Diagram  
with SystemVu™ Controller**

## APPENDIX E — WIRING DIAGRAMS (cont)



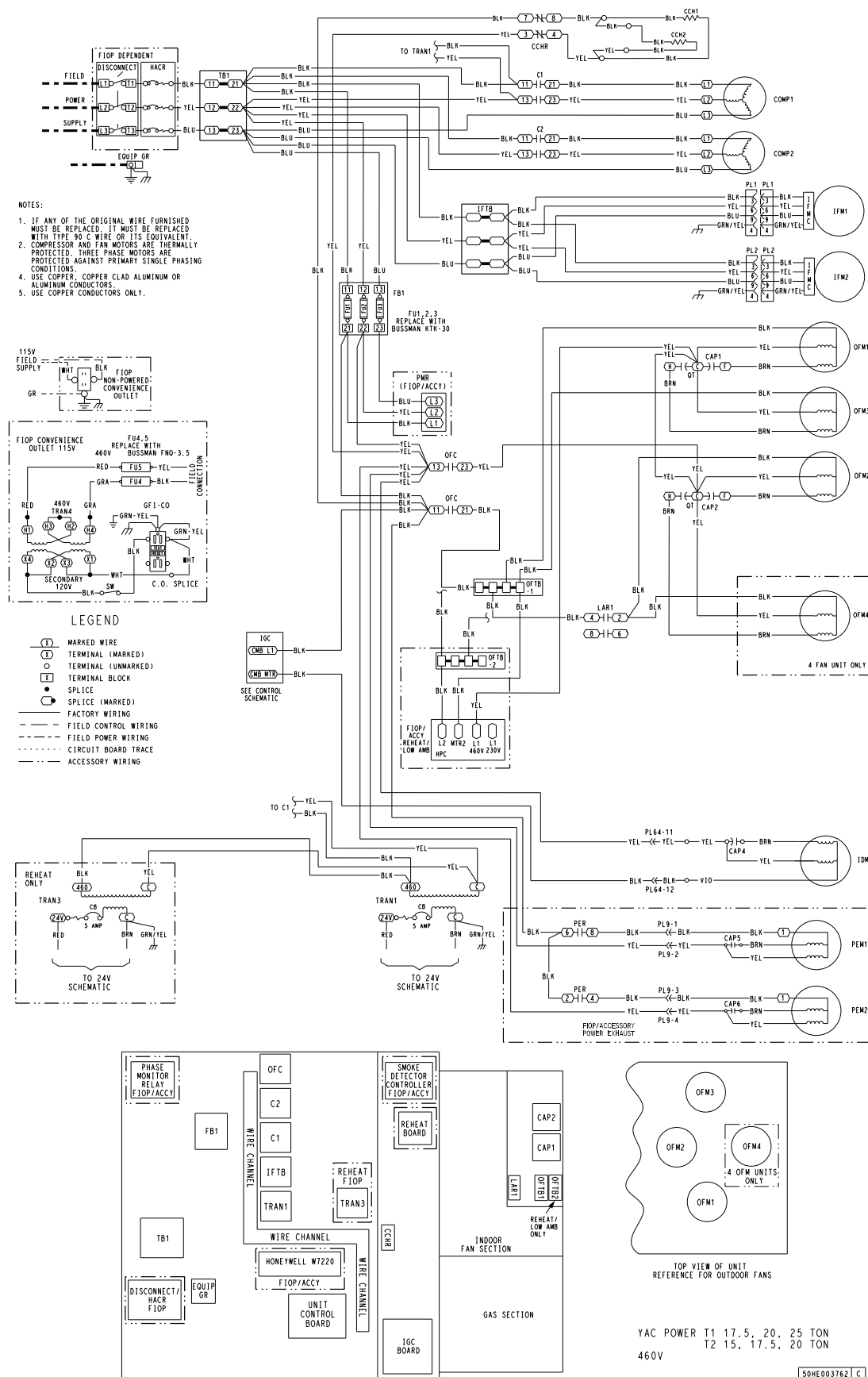
**Fig. E — 48FC\*\*20-30 — 460/575-3-60 — Control Wiring Diagram  
with SystemVu™ Controller**

## APPENDIX E — WIRING DIAGRAMS (cont)



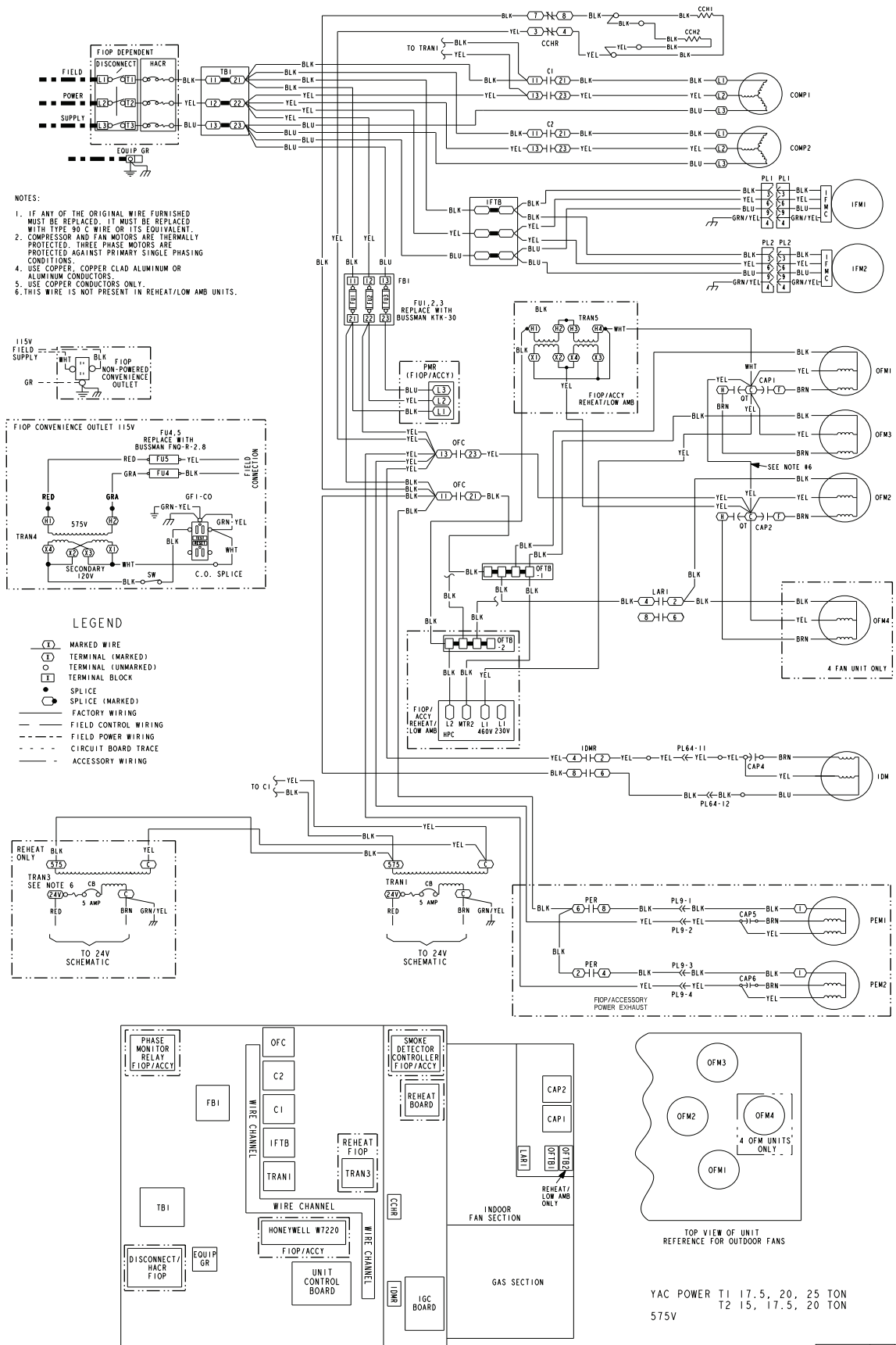
**Fig. F — 48FC\*\*20-28 — 208/230-3-60 — Power Wiring Diagram  
Electromechanical with POL224 Controller**

## APPENDIX E — WIRING DIAGRAMS (cont)



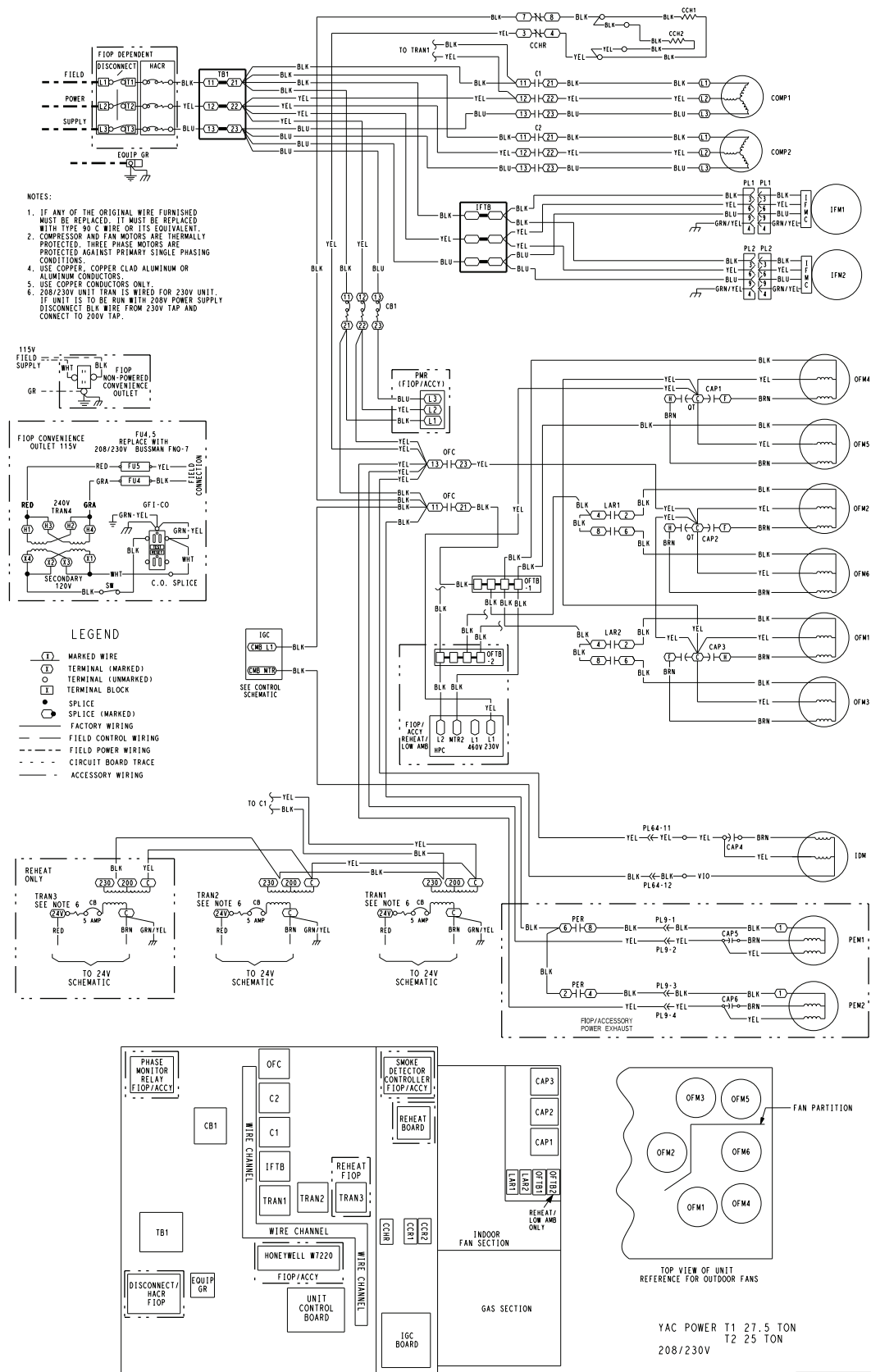
**Fig. G — 48FC\*\*20-28 — 460-3-60 — Power Wiring Diagram  
Electromechanical with POL224 Controller**

## APPENDIX E — WIRING DIAGRAMS (cont)



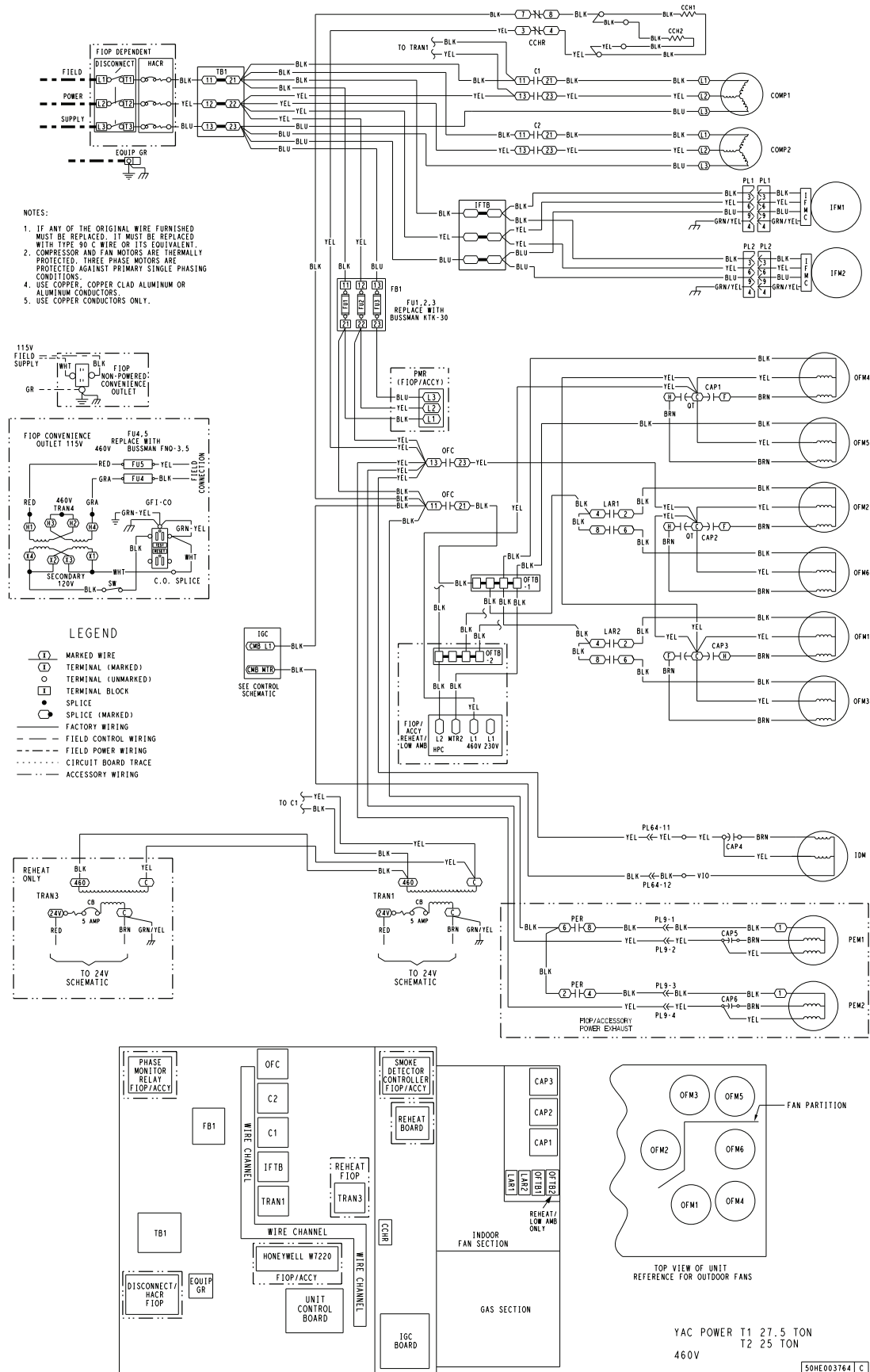
**Fig. H — 48FC\*\*20-28 — 575-3-60 — Power Wiring Diagram  
Electromechanical with POL224 Controller**

## APPENDIX E — WIRING DIAGRAMS (cont)



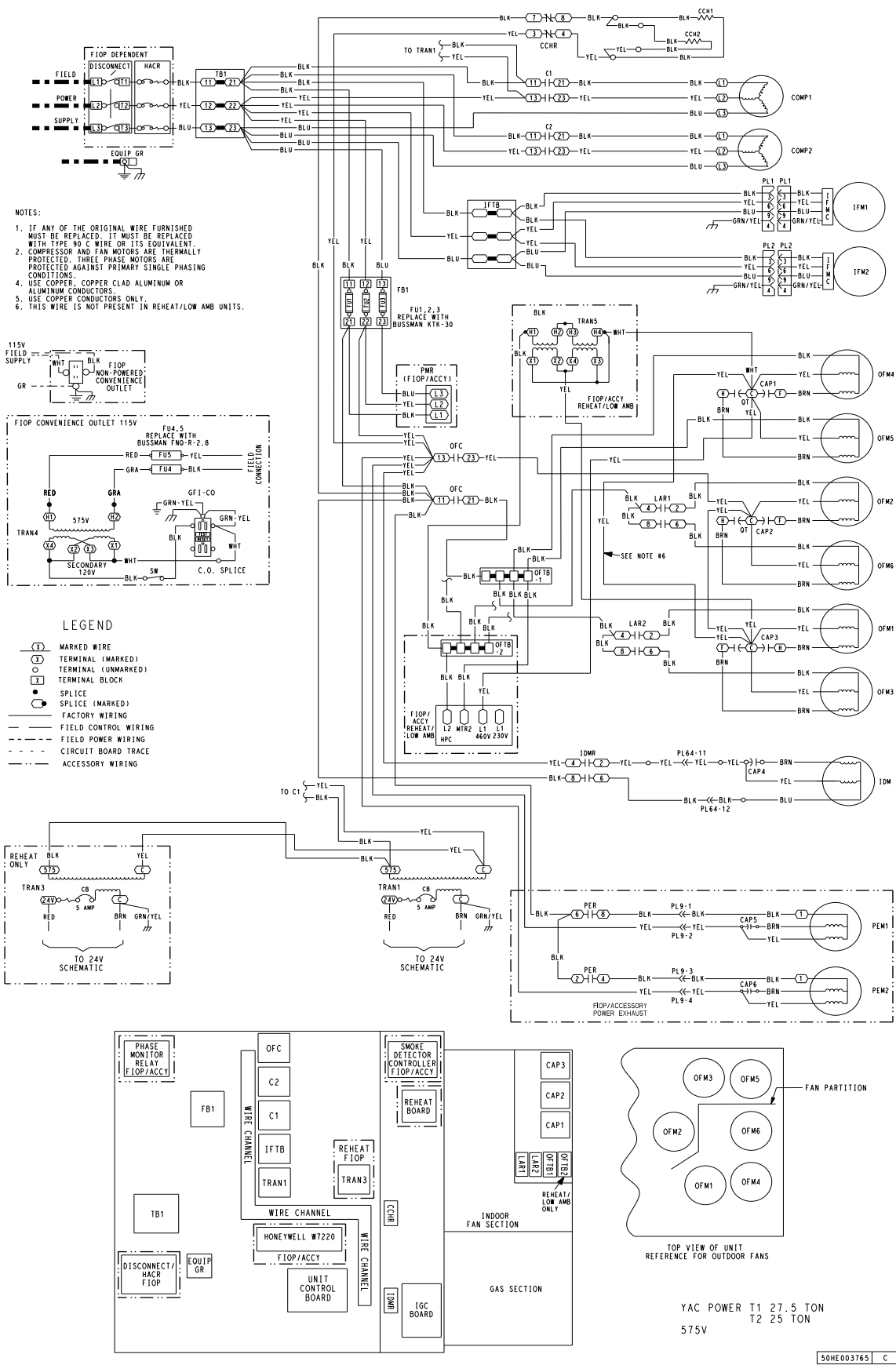
**Fig. I — 48FC\*\*30 — 208/230-3-60 — Power Wiring Diagram  
Electromechanical with POL224 Controller**

## APPENDIX E — WIRING DIAGRAMS (cont)



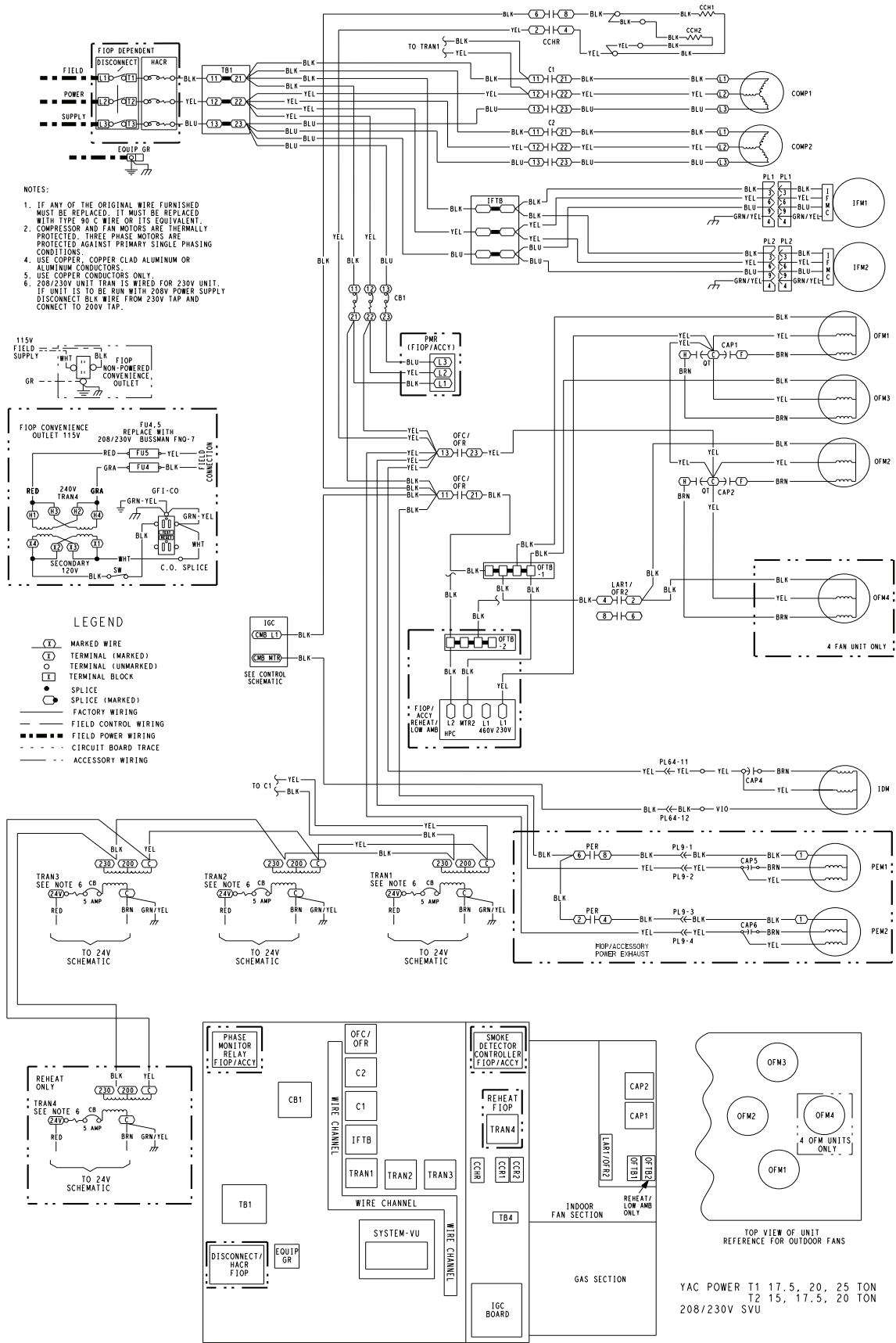
**Fig. J — 48FC\*\*30 — 460-3-60 — Power Wiring Diagram  
Electromechanical with POL224 Controller**

## APPENDIX E – WIRING DIAGRAMS (cont)



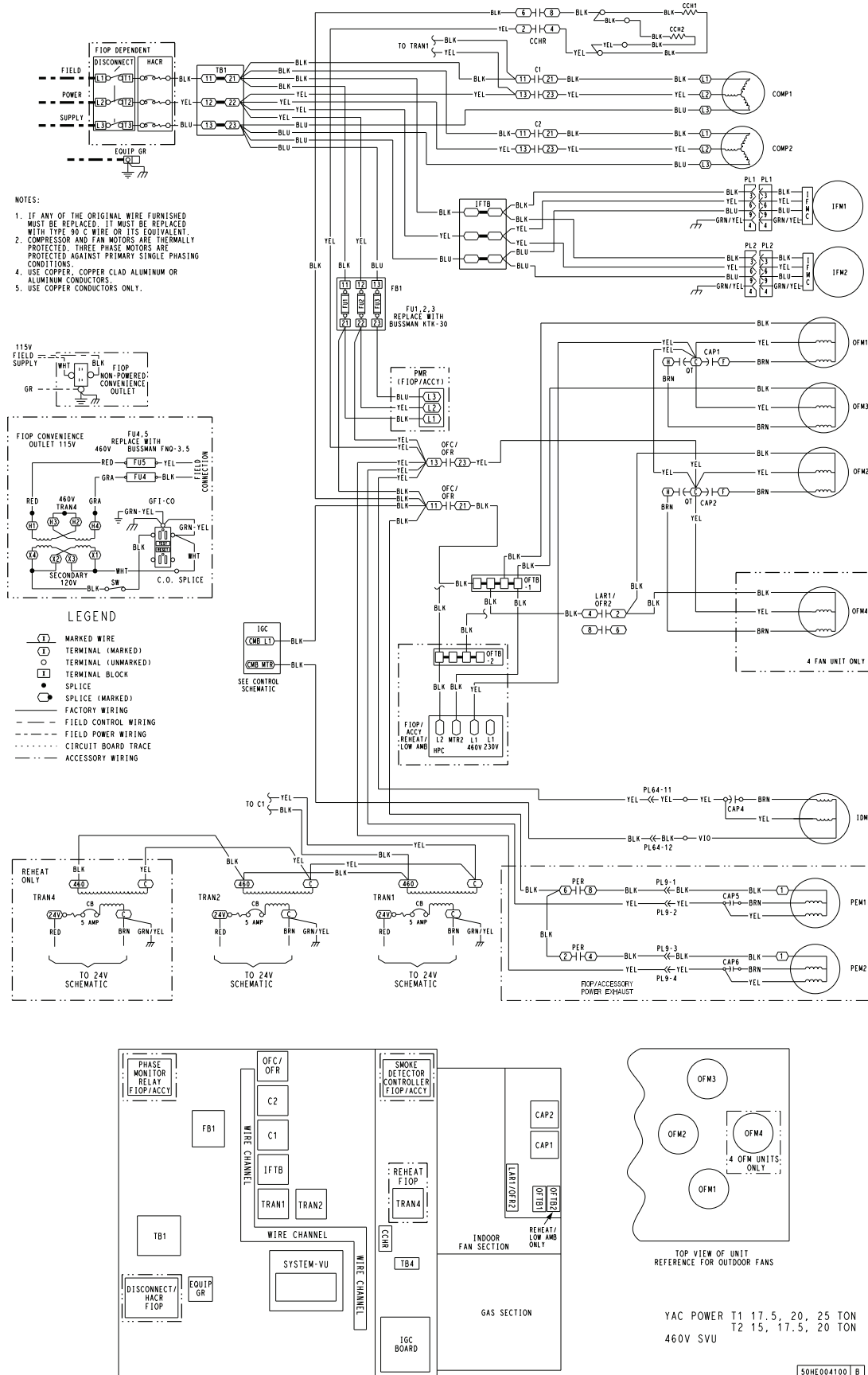
**Fig. K — 48FC\*\*30 — 575-3-60 — Power Wiring Diagram  
Electromechanical with POL224 Controller**

## APPENDIX E — WIRING DIAGRAMS (cont)



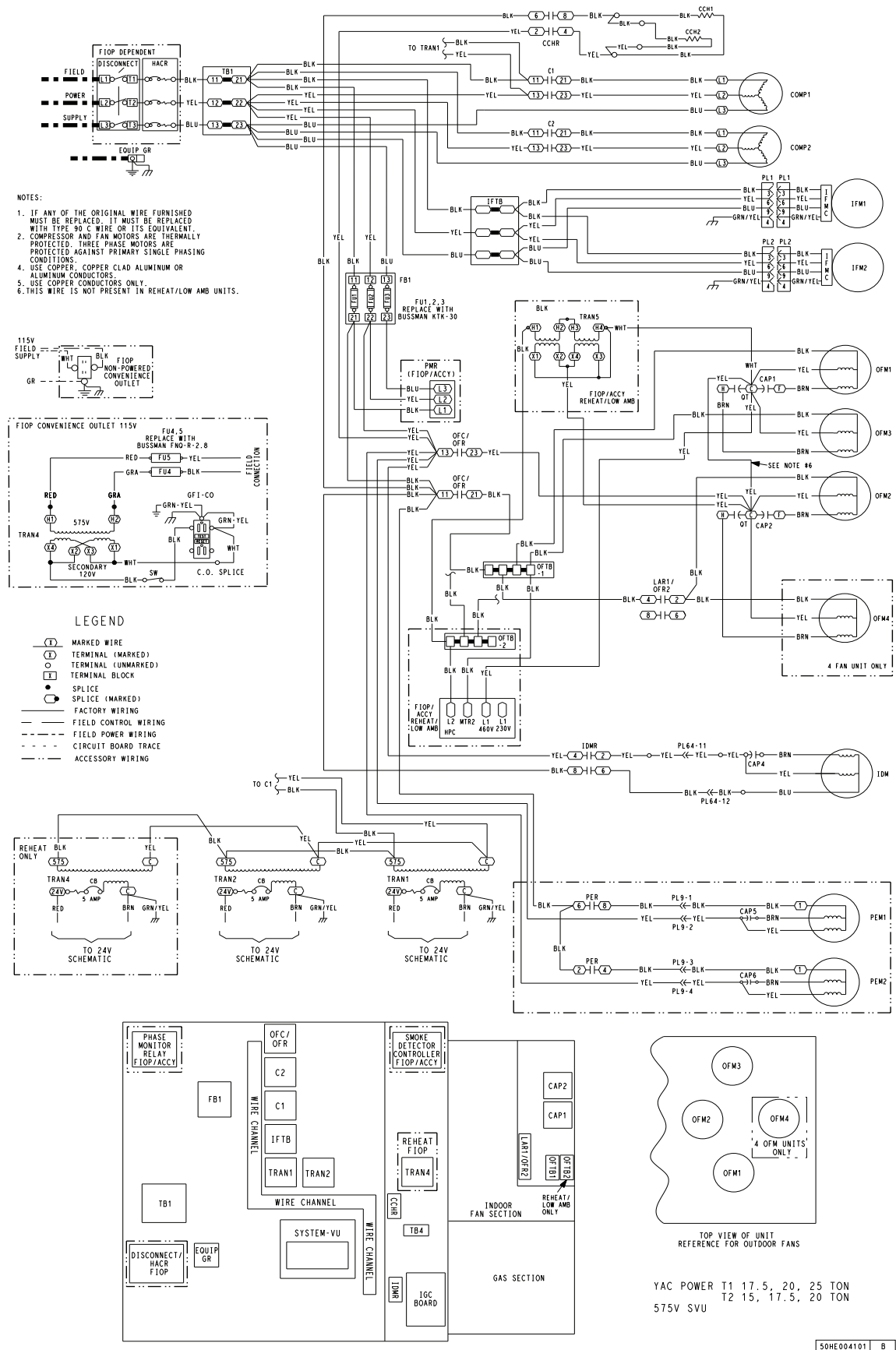
**Fig. L — 48FC\*\*20-28 — 208/230-3-60 — Power Wiring Diagram  
with SystemVu™ Controller**

## APPENDIX E — WIRING DIAGRAMS (cont)

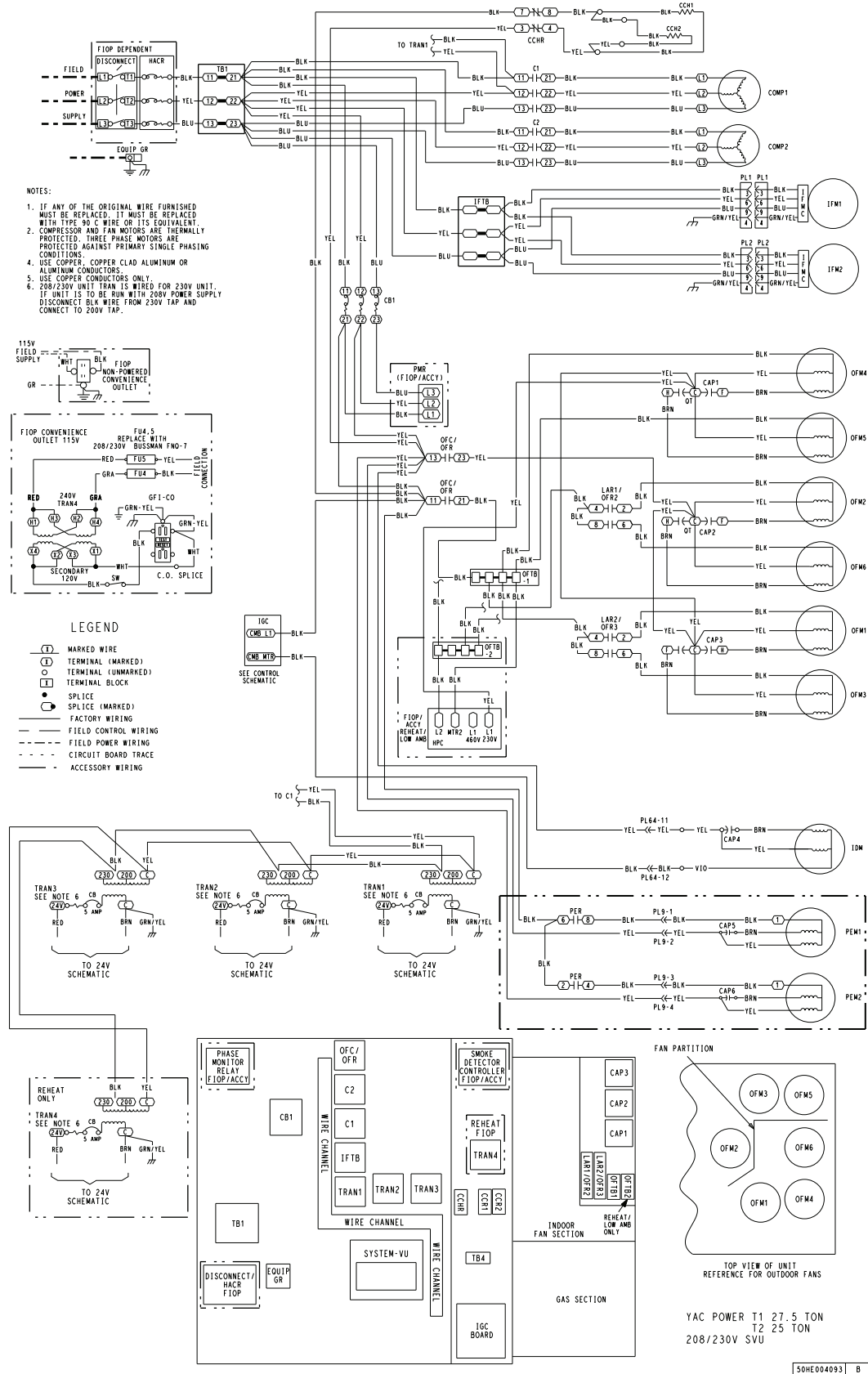


**Fig. M — 48FC\*\*20-28 — 460-3-60 — Power Wiring Diagram with SystemVu™ Controller**

## APPENDIX E — WIRING DIAGRAMS (cont)

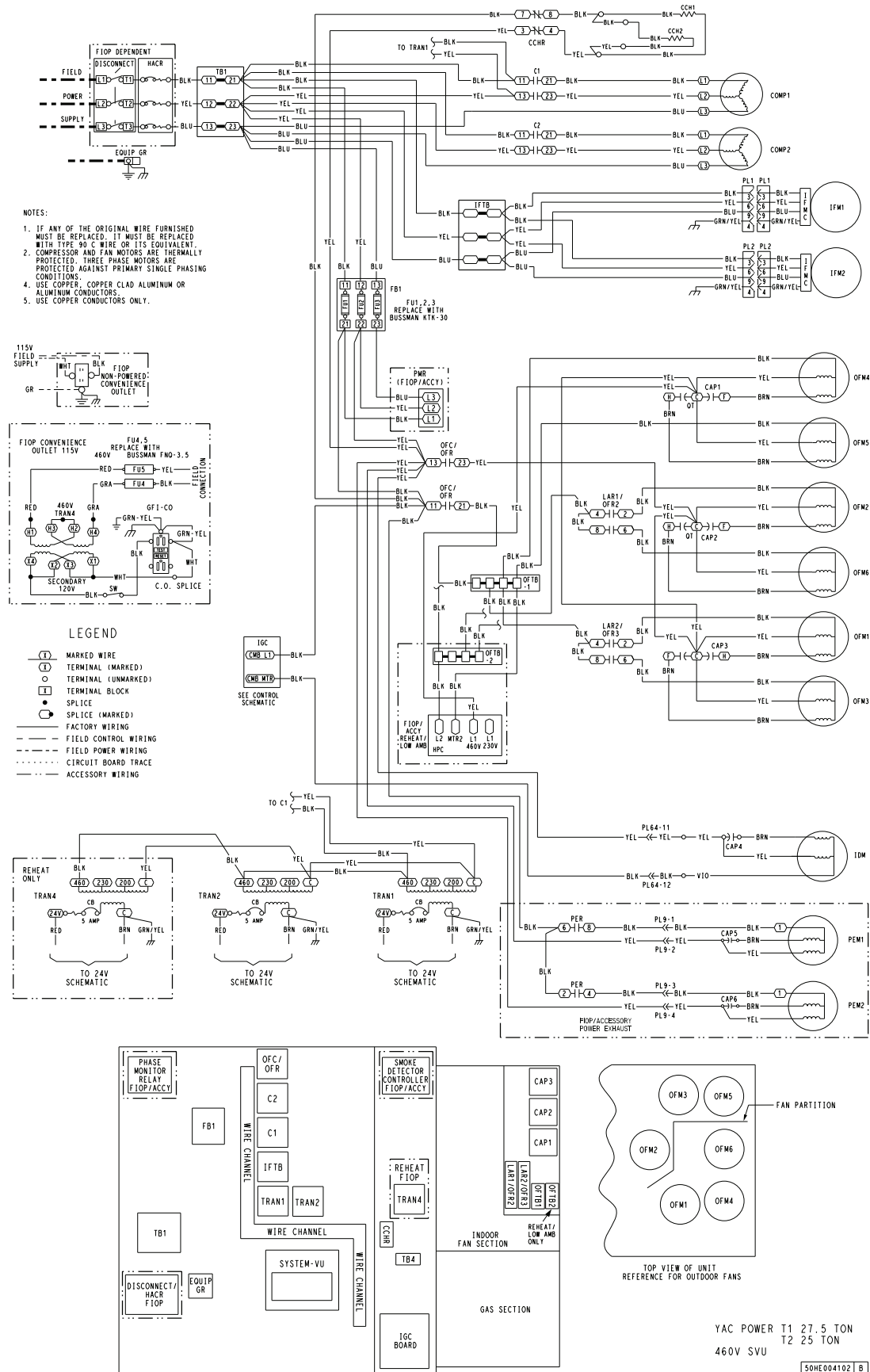


## APPENDIX E — WIRING DIAGRAMS (cont)



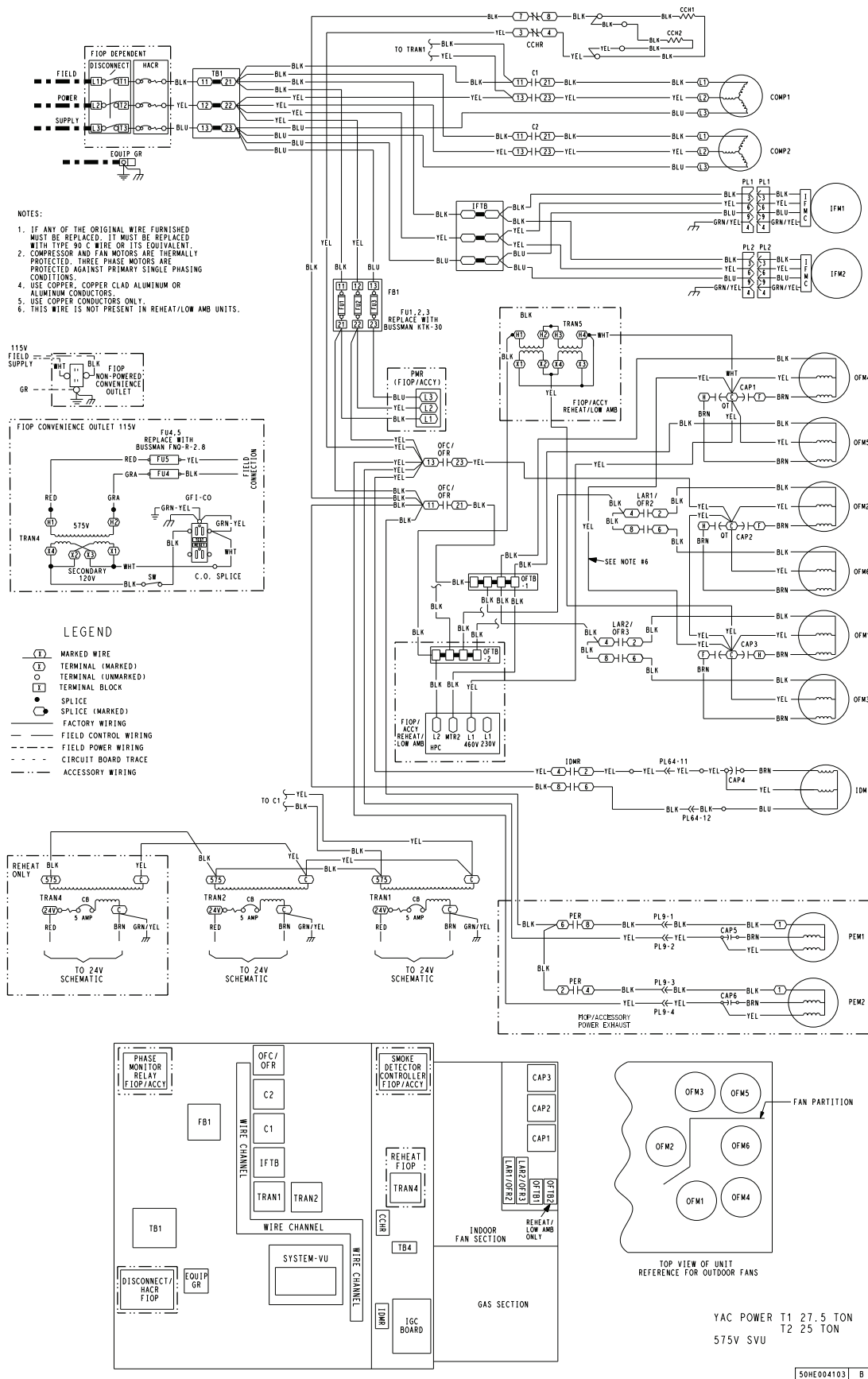
**Fig. O — 48FC\*\*30 — 208/230-3-60 — Power Wiring Diagram with SystemVu™ Controller**

## APPENDIX E — WIRING DIAGRAMS (cont)



**Fig. P — 48FC\*\*30 — 460-3-60 — Power Wiring Diagram with SystemVu™ Controller**

## APPENDIX E — WIRING DIAGRAMS (cont)



## APPENDIX E — WIRING DIAGRAMS (cont)

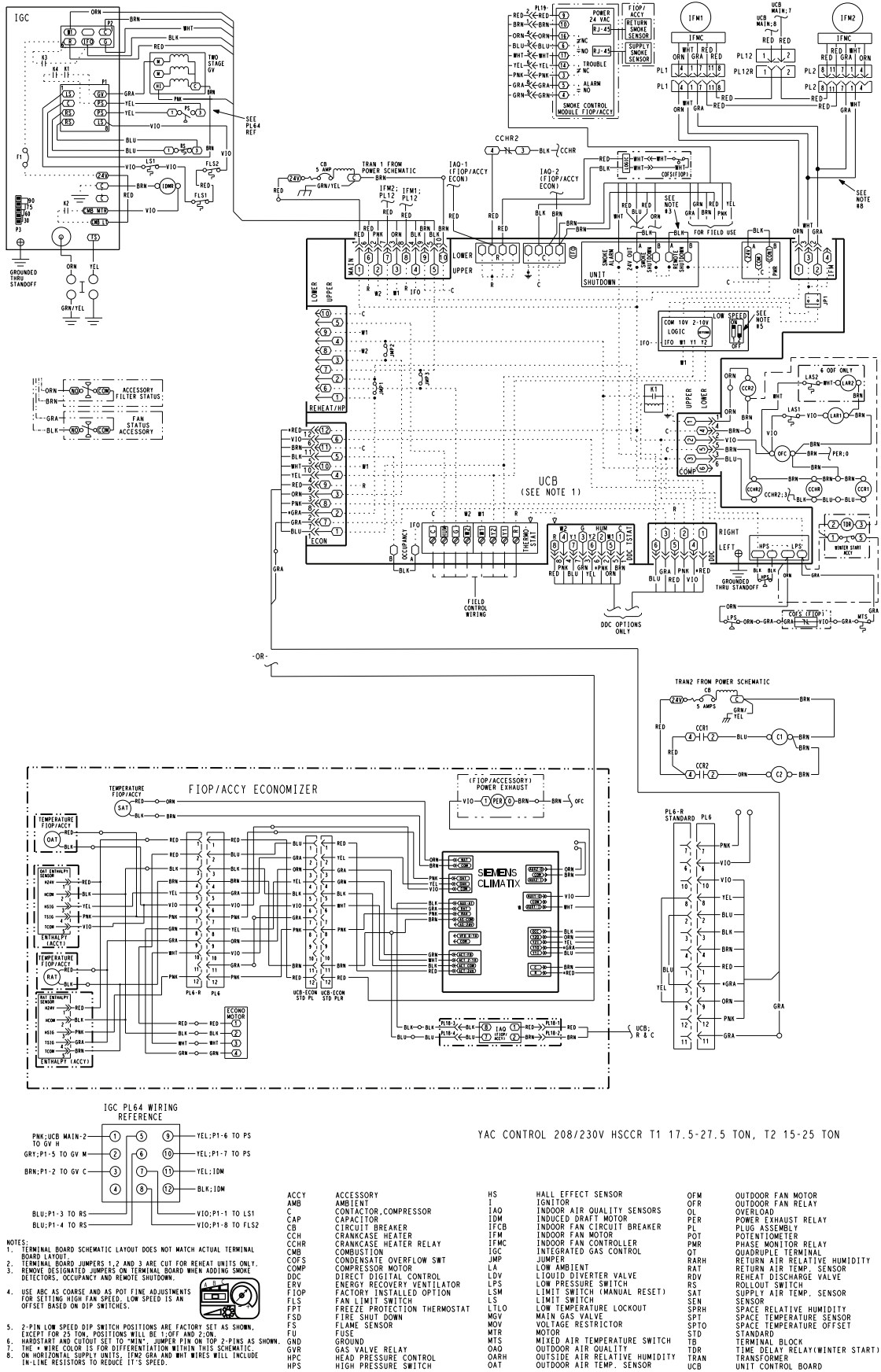
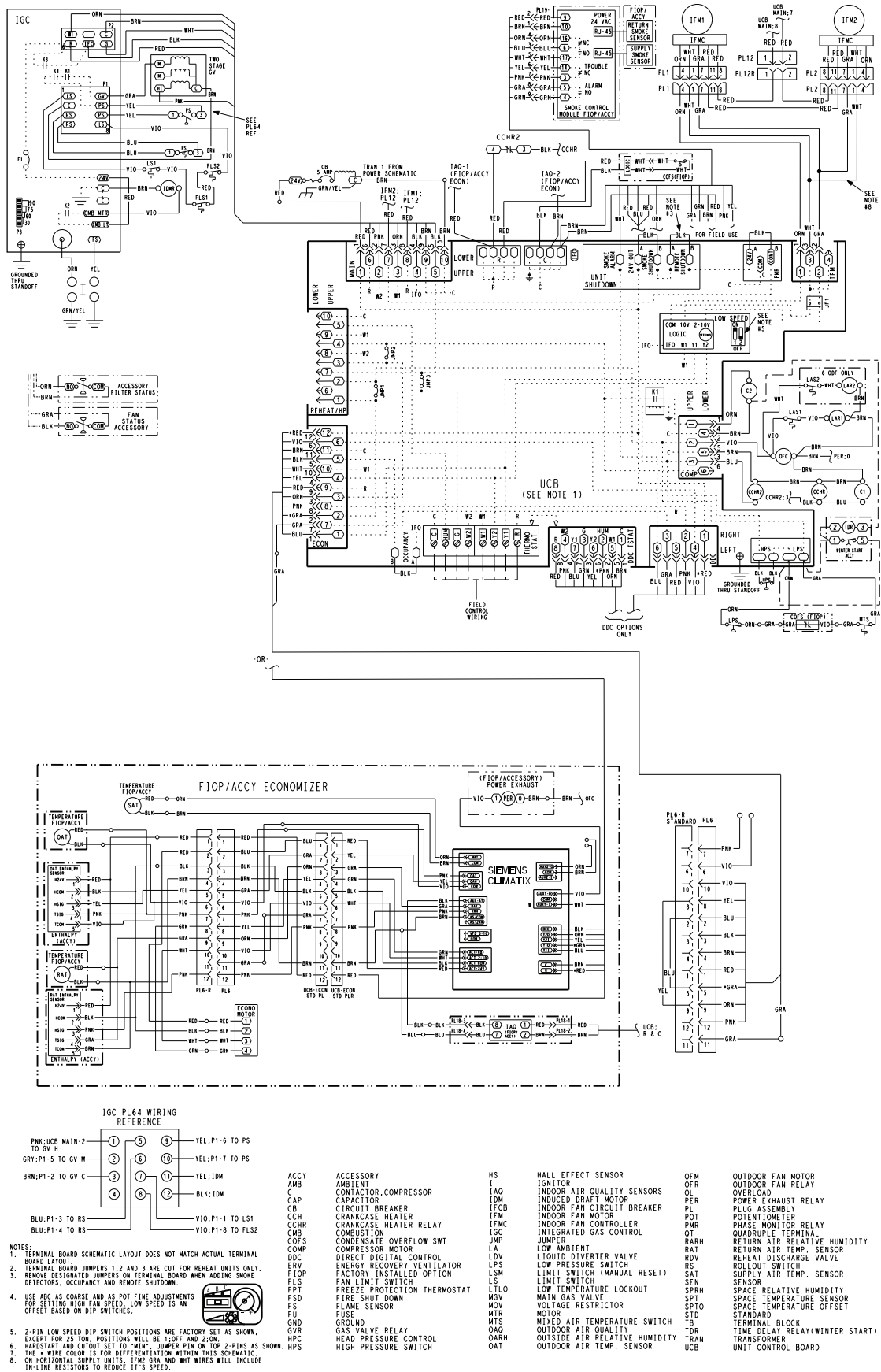


Fig. R — 48FC\*\*20-30 — 208/230-3-60 — Control Wiring Diagram  
Electromechanical with POL224 Controller — HSCCR

## APPENDIX E — WIRING DIAGRAMS (cont)

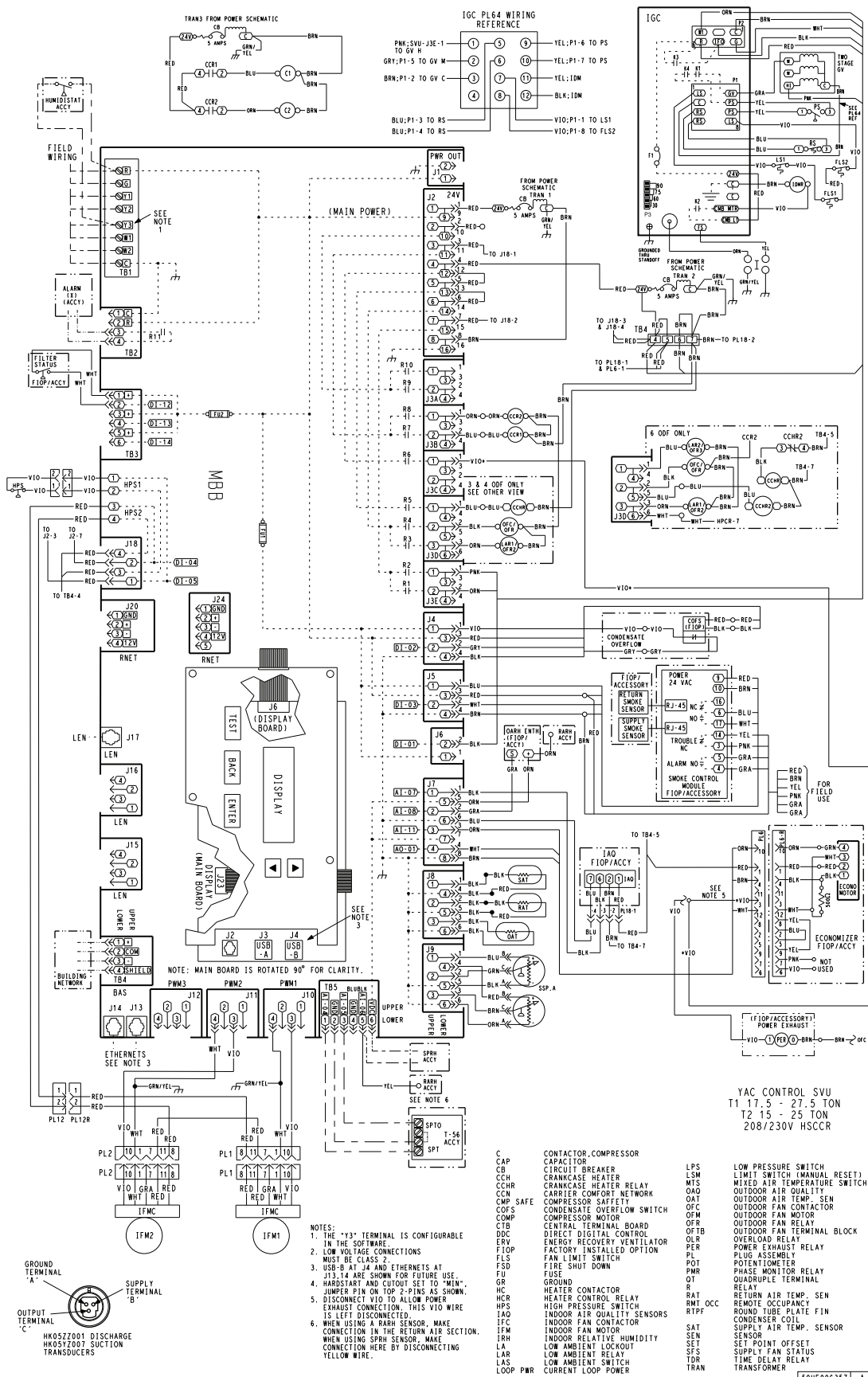


YAC CONTROL 460V HSCCR T1 17.5-27.5 TON, T2 15-25 TON

50HE006526 A

**Fig. S — 48FC\*\*20-30 — 460/575-3-60 — Control Wiring Diagram  
Electromechanical with POL224 Controller — HSCCR**

## APPENDIX E — WIRING DIAGRAMS (cont)



**Fig. T – 48FC\*\*20-30 – 208/230-3-60 – Control Wiring Diagram  
with SystemVu™ Controller – HSCCR**

## APPENDIX E — WIRING DIAGRAMS (cont)

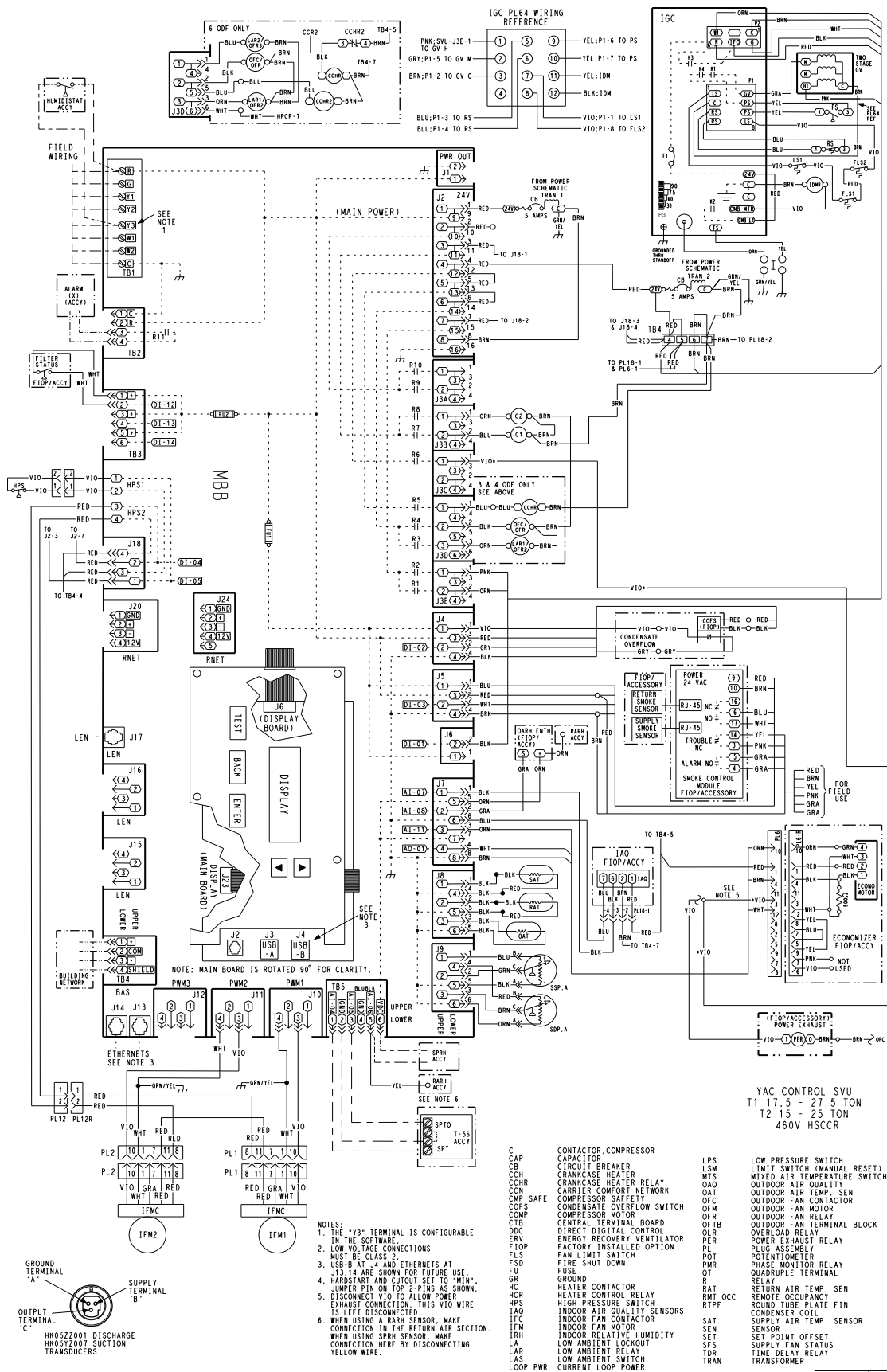
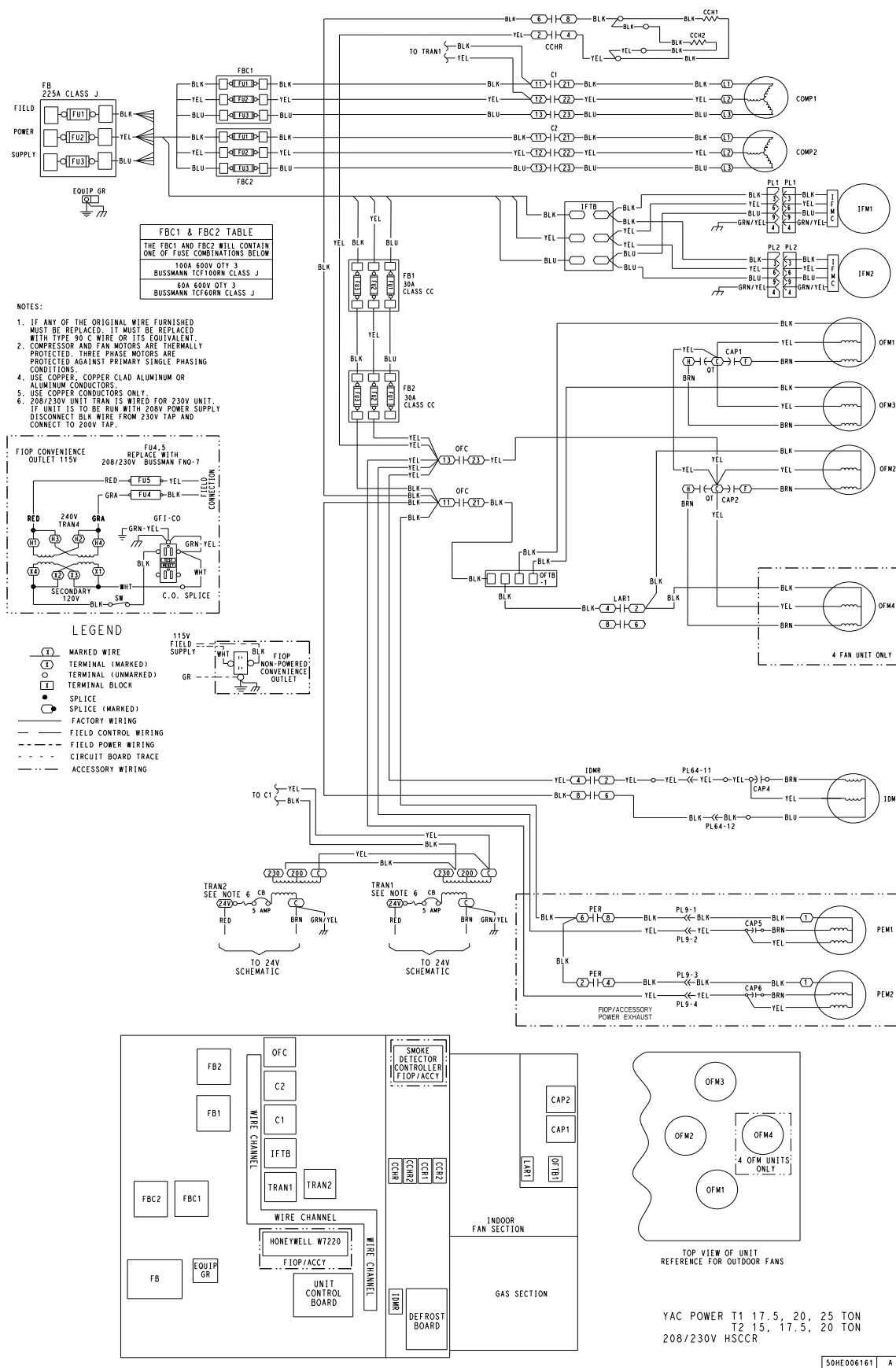


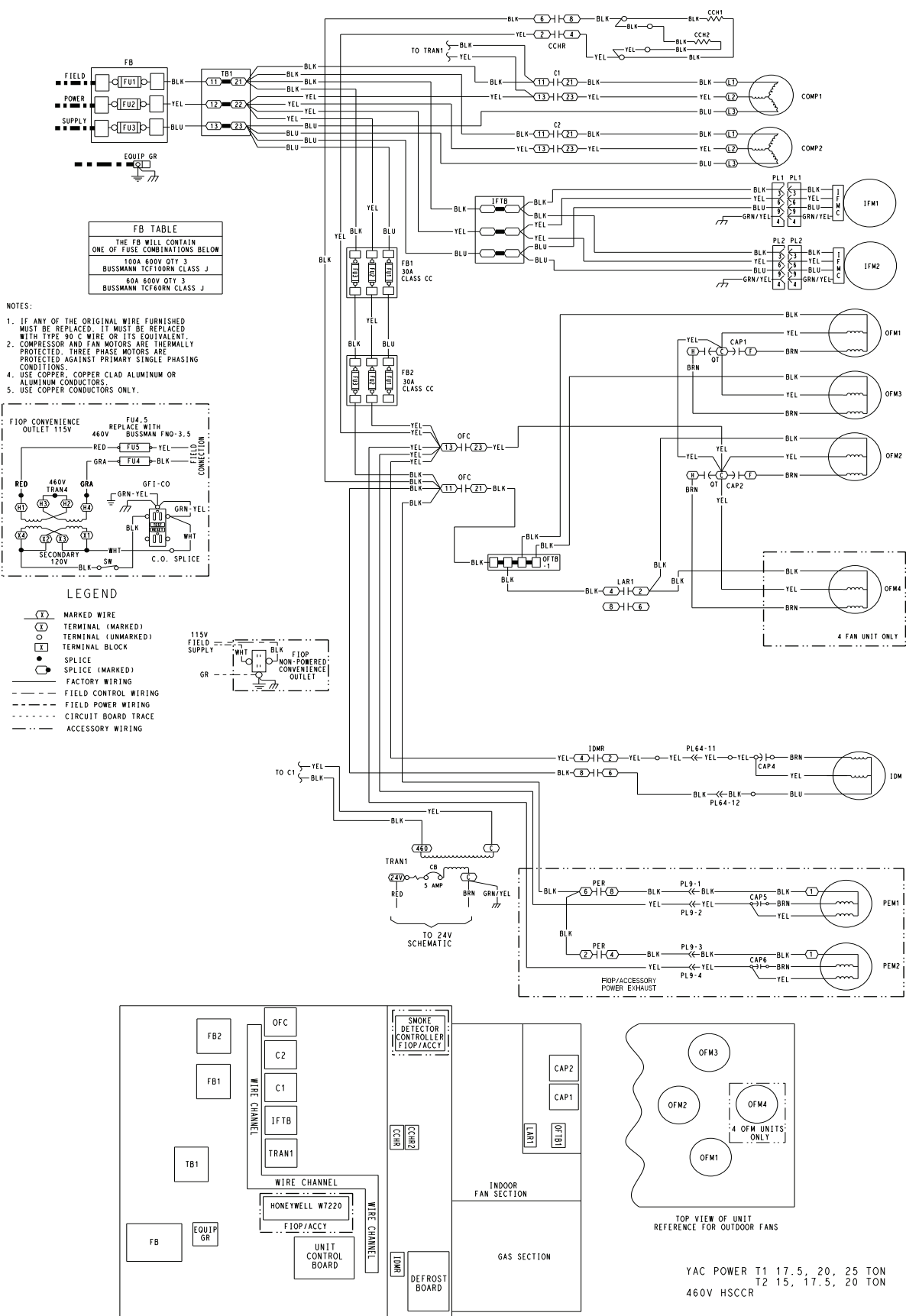
Fig. U — 48FC\*\*20-30 — 460/575-3-60 — Control Wiring Diagram with SystemVu™ Controller — HSCCR

## APPENDIX E – WIRING DIAGRAMS (cont)



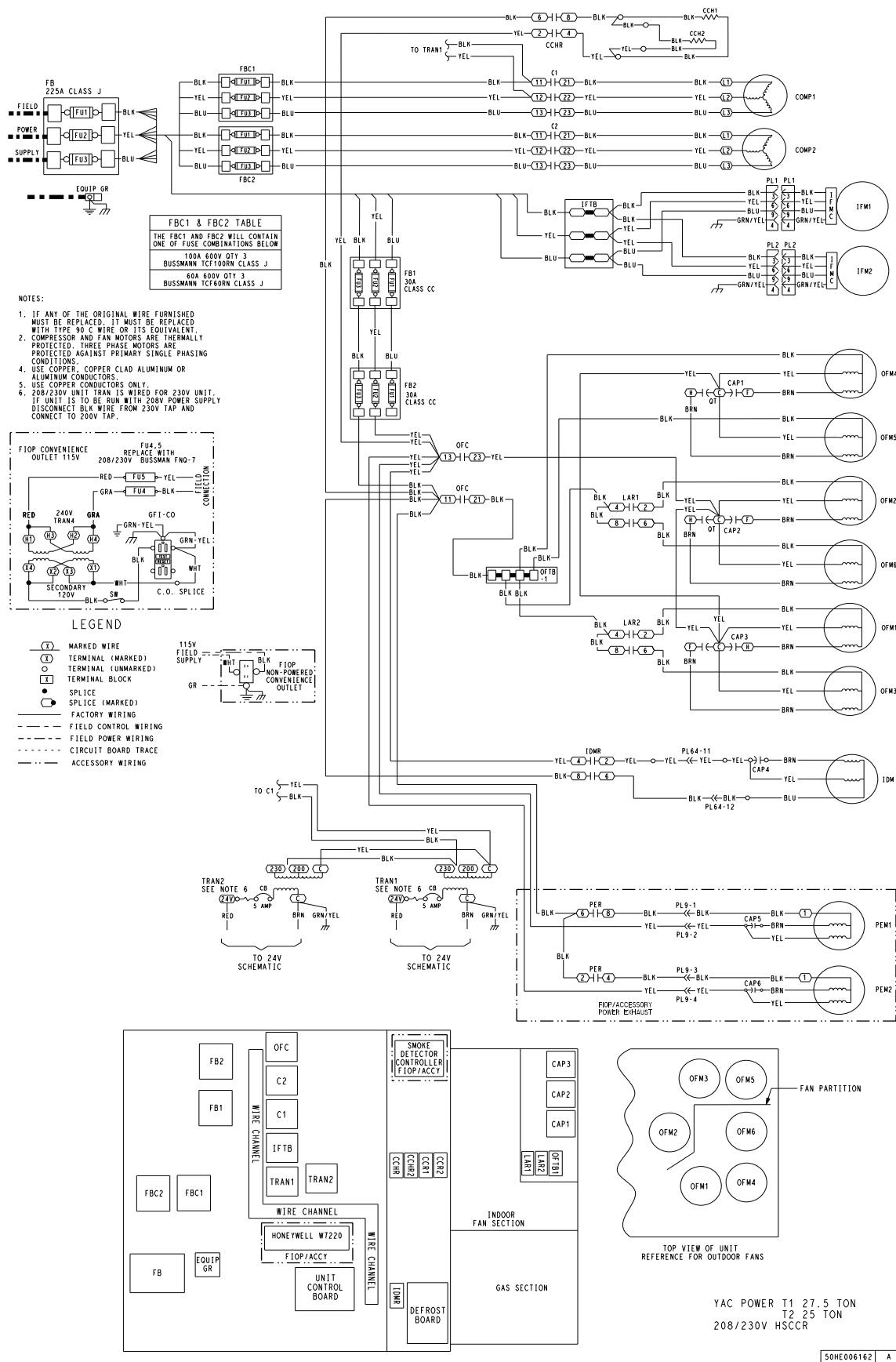
**Fig. V — 48FC\*\*20-28 — 208/230-3-60 — Power Wiring Diagram  
Electromechanical with POL224 Controller — HSCCR**

## APPENDIX E – WIRING DIAGRAMS (cont)



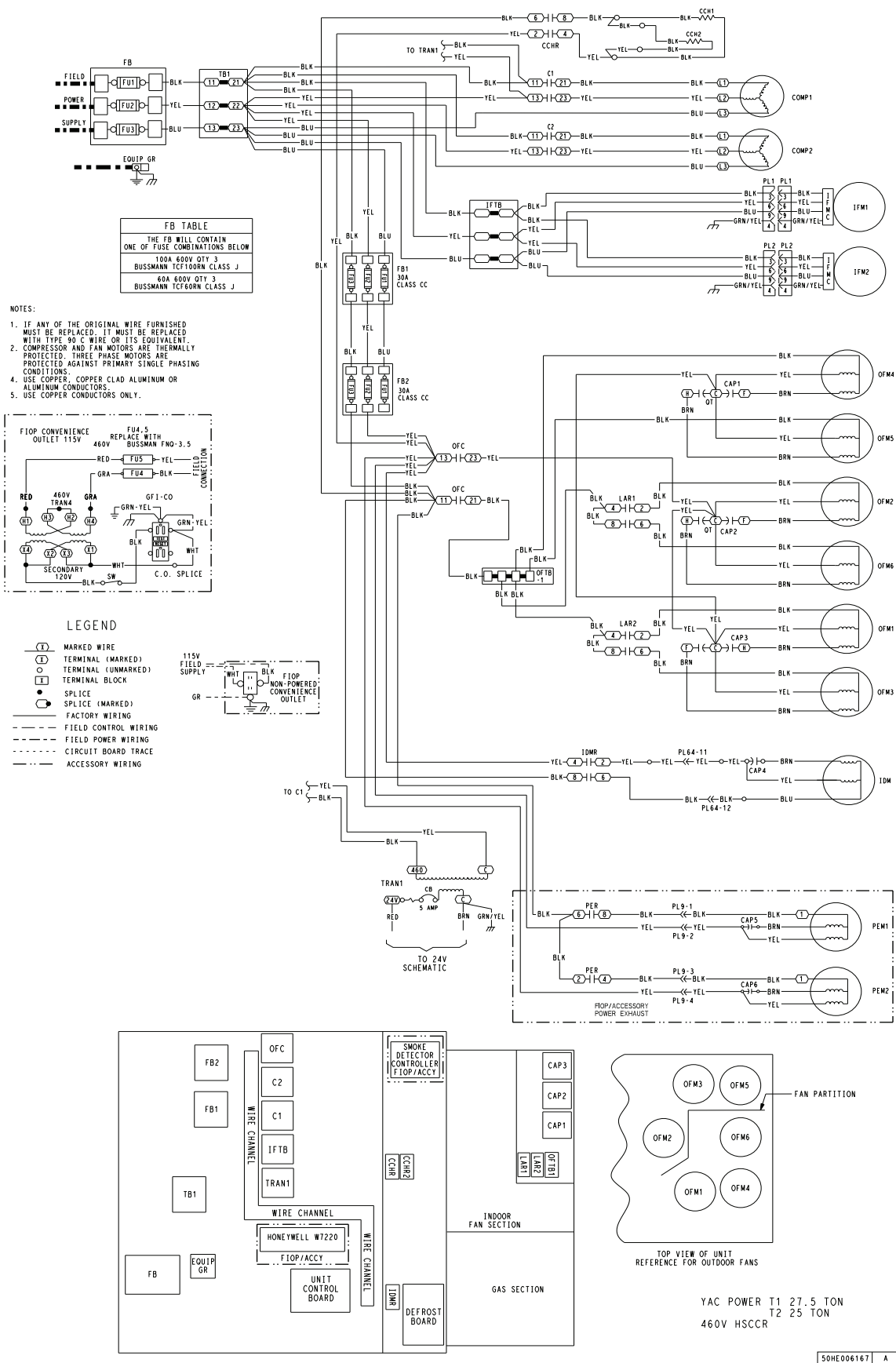
**Fig. W — 48FC\*\*20-28 — 460-3-60 — Power Wiring Diagram  
Electromechanical with POL224 Controller — HSCCR**

## APPENDIX E – WIRING DIAGRAMS (cont)



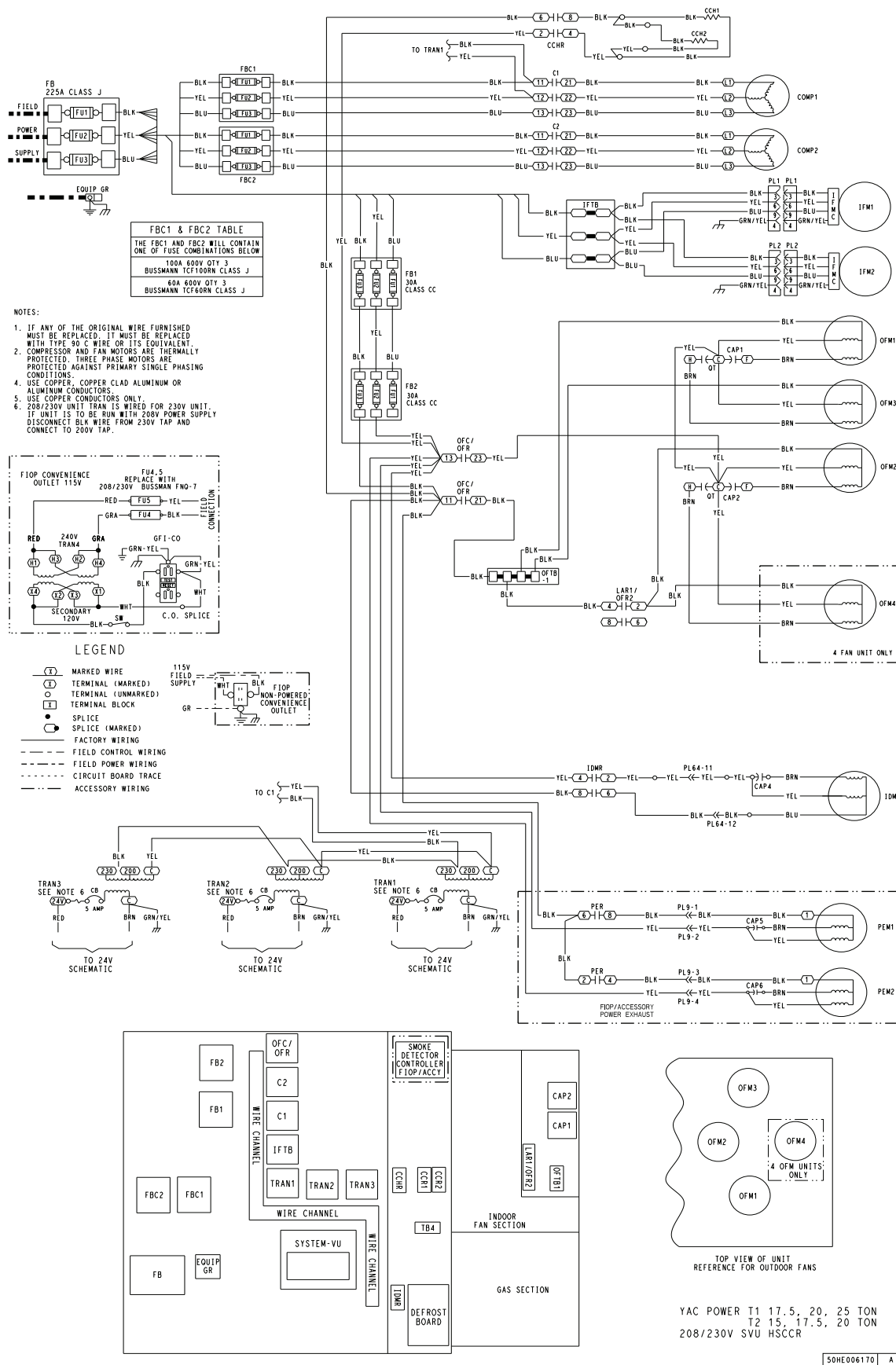
**Fig. X — 48FC\*\*30 — 208/230-3-60 — Power Wiring Diagram  
Electromechanical with POL224 Controller — HSCCR**

## APPENDIX E – WIRING DIAGRAMS (cont)



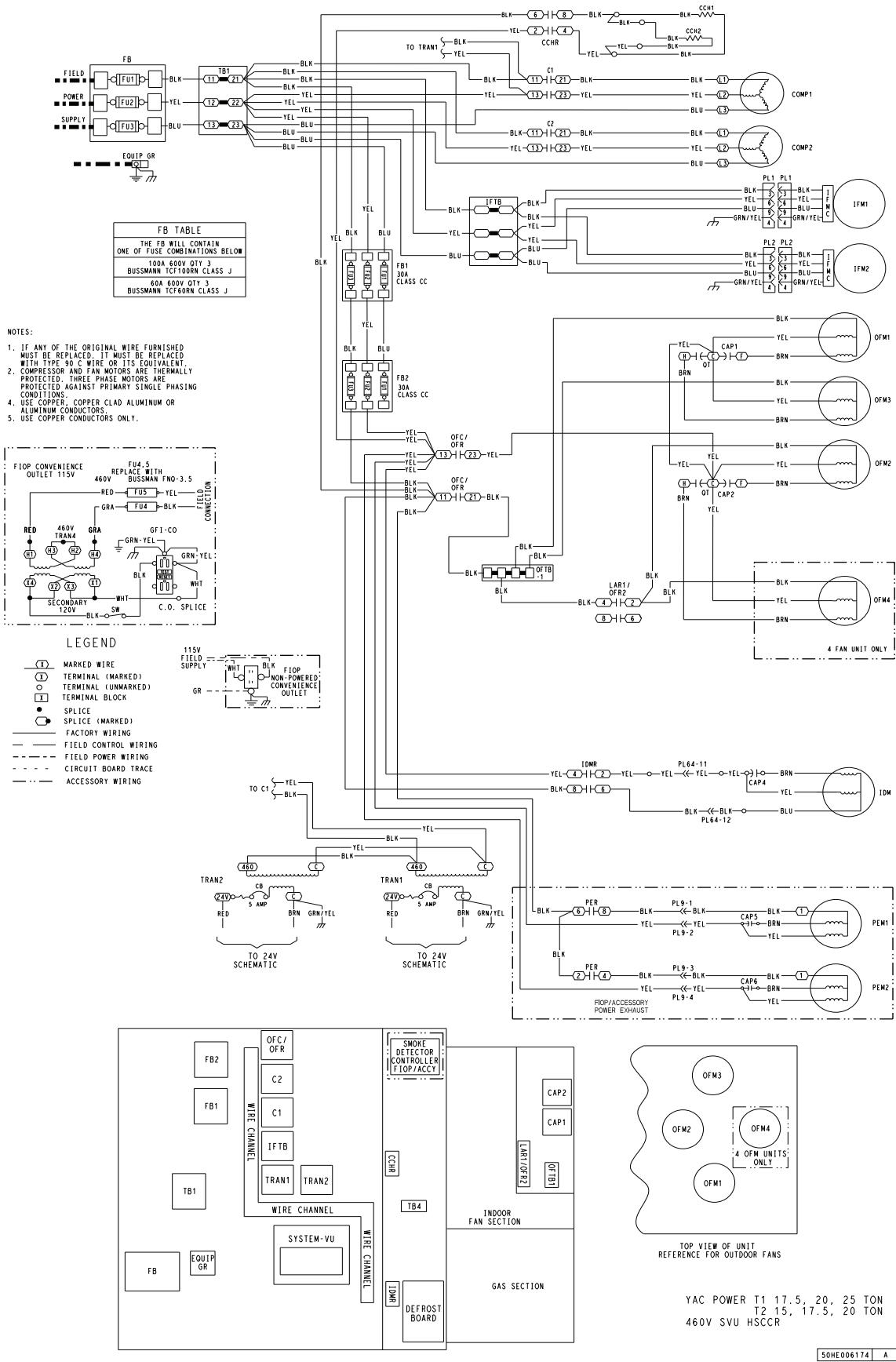
**Fig. Y — 48FC\*\*30— 460-3-60 — Power Wiring Diagram  
Electromechanical with POL224 Controller — HSCCR**

## APPENDIX E – WIRING DIAGRAMS (cont)



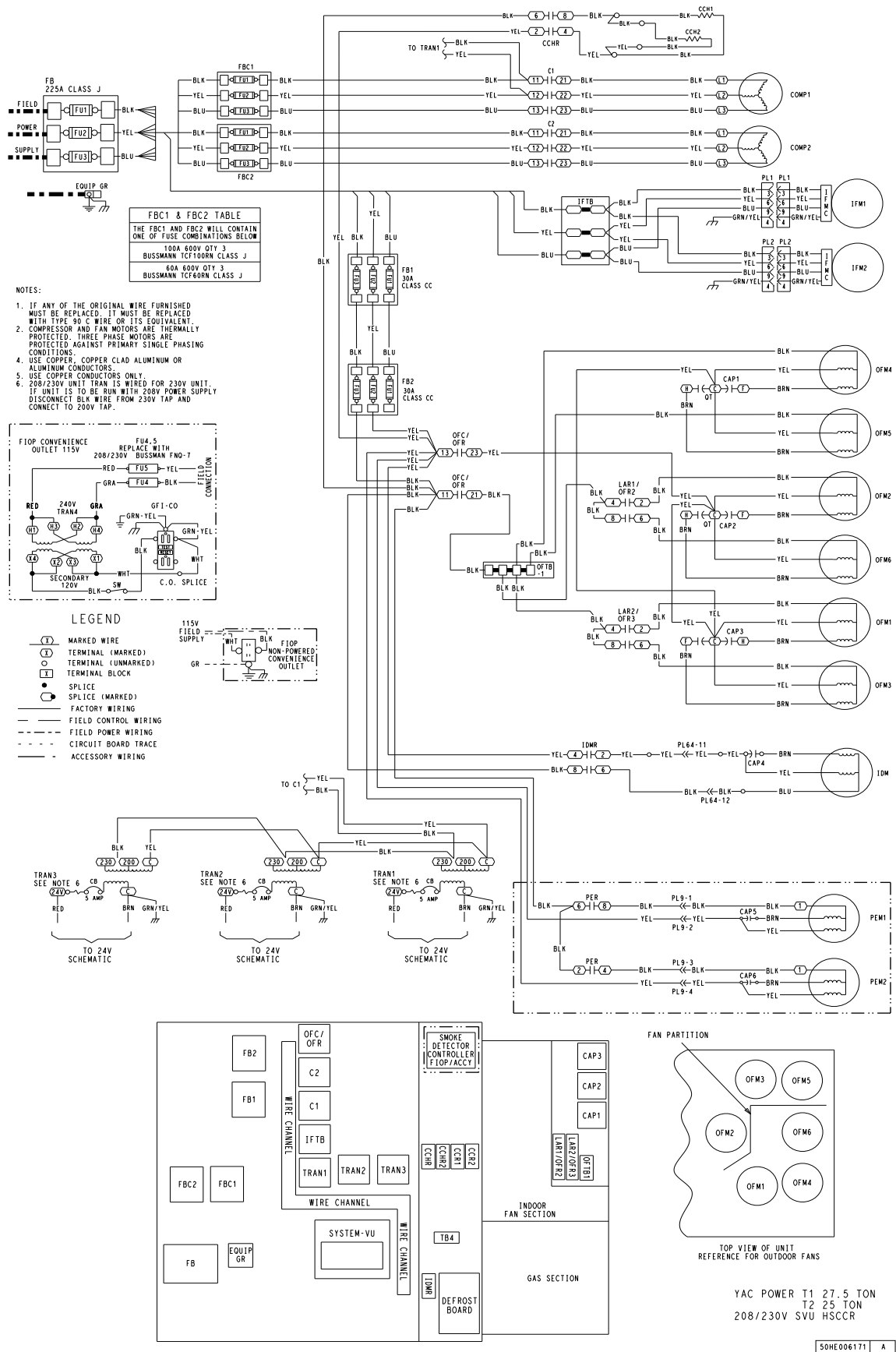
**Fig. Z — 48FC\*\*20-28 — 208/230-3-60 — Power Wiring Diagram  
with SystemVu™ Controller — HSCCR**

## APPENDIX E – WIRING DIAGRAMS (cont)



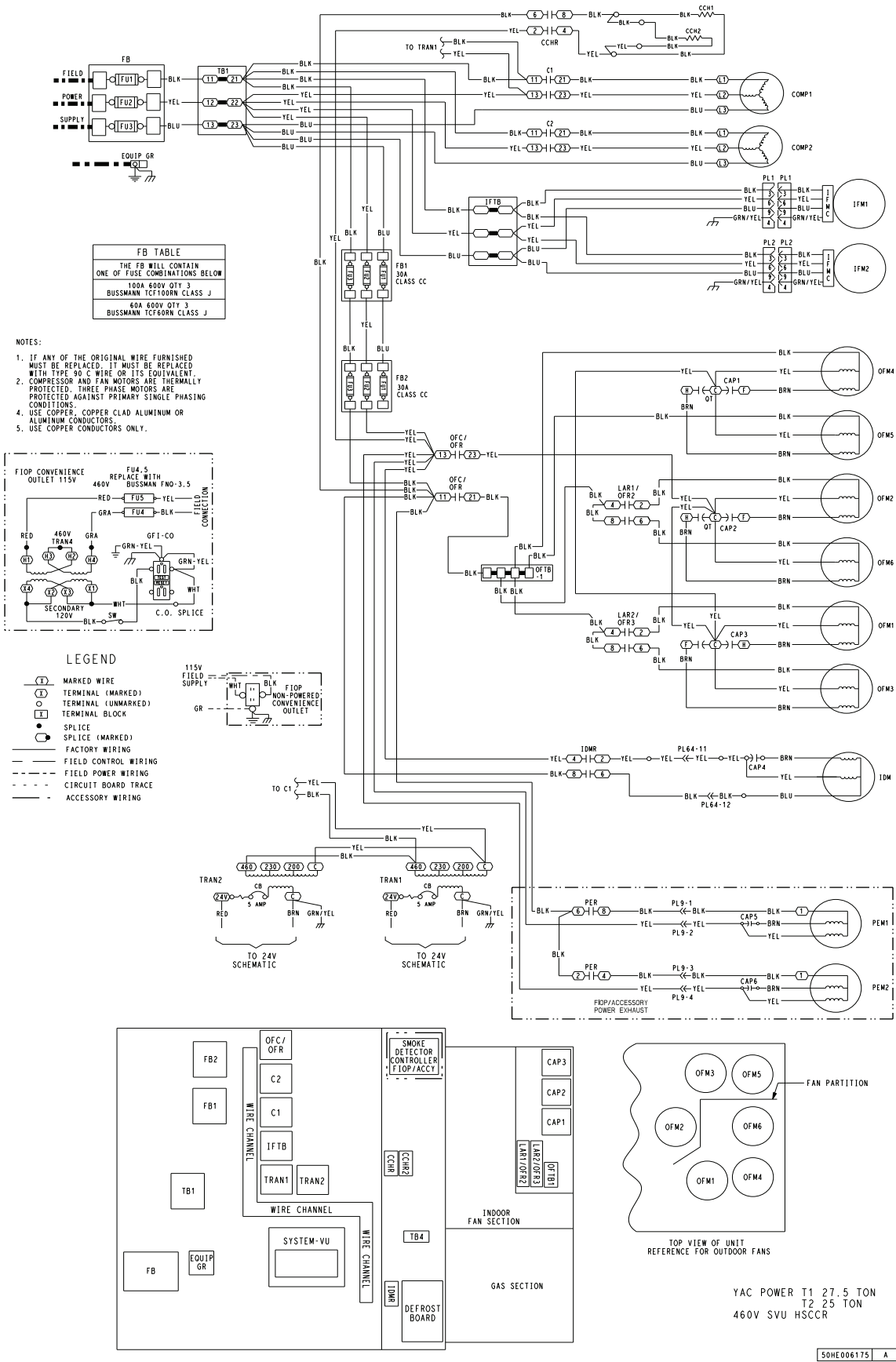
**Fig. AA — 48FC\*\*20-28 — 460-3-60 — Power Wiring Diagram  
with SystemVu™ Controller — HSCCR**

## APPENDIX E — WIRING DIAGRAMS (cont)



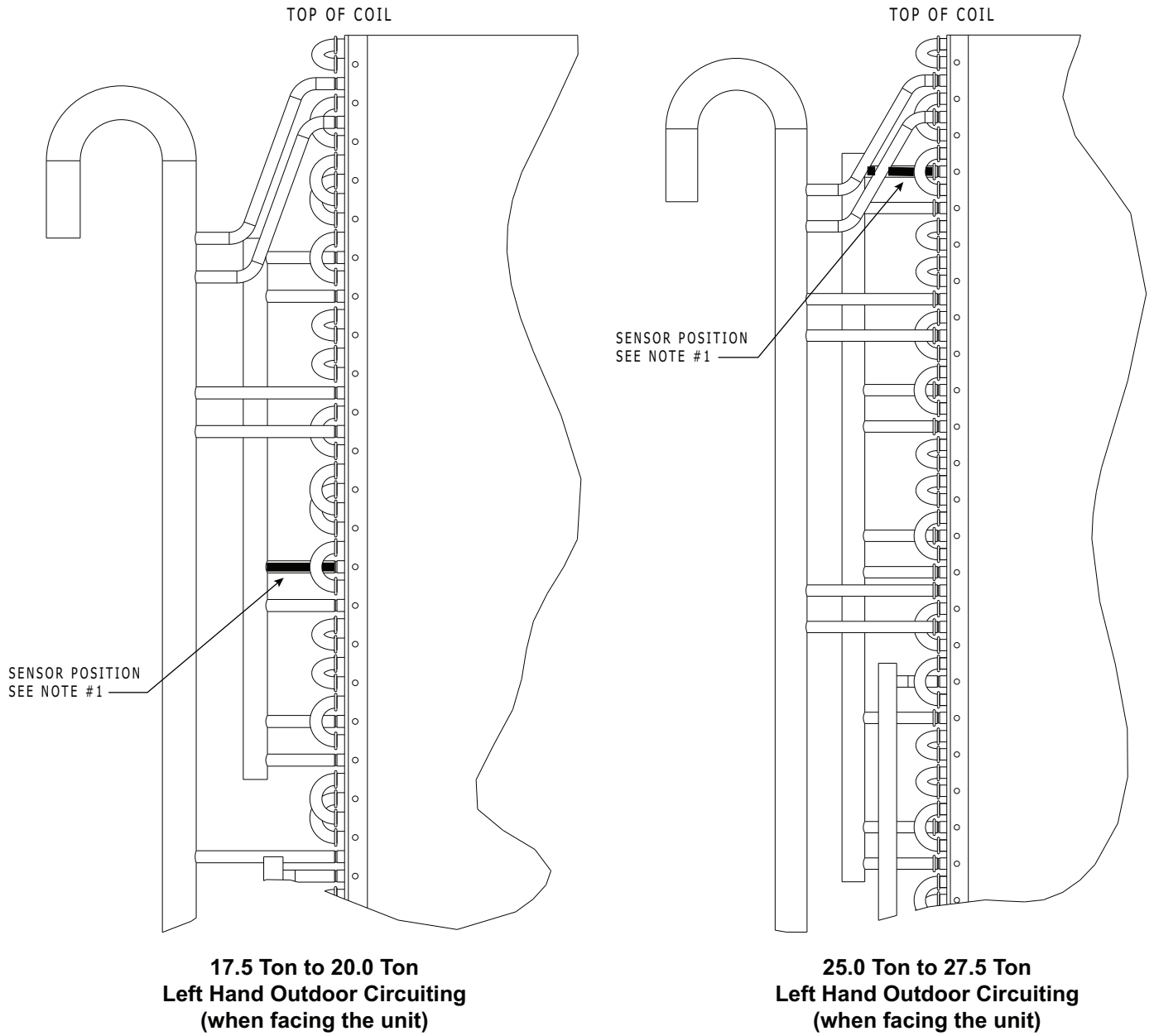
**Fig. AB — 48FC\*\*30 — 208/230-3-60 — Power Wiring Diagram with SystemVu™ Controller — HSCCR**

## APPENDIX E – WIRING DIAGRAMS (cont)



**Fig. AC — 48FC\*\*30 — 460-3-60 — Power Wiring Diagram  
with SystemVu™ Controller — HSCCR**

## APPENDIX F — LOW AMBIENT CONTROL SENSOR LOCATION



### NOTE(S):

1. Apply conductive grease supplied with coil sensor (item #1) on specified leg before attaching sensor to location with wire tie (item #5).

**Fig. AD — 48FC\*\*20-24 and 48FC\*\*28-30 Outdoor Circuiting**



## START-UP CHECKLIST

### 48FC\*\*20-30 Single Package Rooftop Gas Heat/Electric Cooling Unit

(Remove and use for job file)

**NOTE: To avoid injury to personnel and damage to equipment or property when completing the procedures listed in this start-up checklist, use good judgment, follow safe practices, and adhere to the safety considerations/information as outlined in preceding sections of this Service and Maintenance Instruction document.**

#### I. PRELIMINARY INFORMATION

MODEL NO. \_\_\_\_\_

JOB NAME \_\_\_\_\_

SERIAL NO. \_\_\_\_\_

ADDRESS \_\_\_\_\_

START-UP DATE \_\_\_\_\_

TECHNICIAN NAME \_\_\_\_\_

ADDITIONAL ACCESSORIES \_\_\_\_\_

#### II. PRE-START-UP

|                                                                         |             |
|-------------------------------------------------------------------------|-------------|
| Verify that all packaging materials have been removed from unit         | (Y/N) _____ |
| Verify installation of outdoor air hood                                 | (Y/N) _____ |
| Verify installation of flue exhaust and inlet hood                      | (Y/N) _____ |
| Verify that condensate connection is installed per instructions         | (Y/N) _____ |
| Verify that all electrical connections and terminals are tight          | (Y/N) _____ |
| Verify gas pressure to unit gas valve is within specified range         | (Y/N) _____ |
| Check gas piping for leaks                                              | (Y/N) _____ |
| Check that indoor-air filters are clean and in place                    | (Y/N) _____ |
| Check that outdoor air inlet screens are in place                       | (Y/N) _____ |
| Verify that unit is level                                               | (Y/N) _____ |
| Verify that fan assembly is free of obstructions and rotor spins freely | (Y/N) _____ |
| Verify that scroll compressors are rotating in the correct direction    | (Y/N) _____ |
| Verify installation of thermostat                                       | (Y/N) _____ |
| Verify that crankcase heaters have been energized for at least 24 hours | (Y/N) _____ |

#### III. START-UP

##### ELECTRICAL

|                                  |             |             |             |
|----------------------------------|-------------|-------------|-------------|
| Supply Voltage                   | L1-L2 _____ | L2-L3 _____ | L3-L1 _____ |
| Compressor 1Amps                 | L1 _____    | L2 _____    | L3 _____    |
| Compressor 2 Amps / Stage 2 Amps | L1 _____    | L2 _____    | L3 _____    |
| Supply Fan Amps                  | L1 _____    | L2 _____    | L3 _____    |
| Outdoor Fan Amps                 | L1 _____    | L2 _____    |             |

##### TEMPERATURES

|                                |                        |                        |
|--------------------------------|------------------------|------------------------|
| Outdoor-air Temperature        | _____ °F DB (Dry Bulb) |                        |
| Return-air Temperature         | _____ °F DB            | _____ °F WB (Wet Bulb) |
| Cooling Supply Air Temperature | _____ °F               |                        |
| Gas Heat Supply Air            | _____ °F               |                        |

PRESSURES

Gas Inlet Pressure

\_\_\_\_\_

in. wg

Gas Manifold Pressure

STAGE 1

\_\_\_\_\_

in. wg

STAGE 2

\_\_\_\_\_

in. wg

Refrigerant Suction

\_\_\_\_\_

PSIG

Refrigerant Discharge

\_\_\_\_\_

PSIG

Verify Refrigerant Charge using Charging Charts

(Y/N) \_\_\_\_\_

GENERAL

Economizer minimum vent and changeover settings to job requirements (if equipped)

(Y/N) \_\_\_\_\_

Verify smoke detector unit shutdown by utilizing magnet test

(Y/N) \_\_\_\_\_

Verify outdoor fan operation. On units with head pressure controls, verify outdoor fan ramps up

(Y/N) \_\_\_\_\_

IV. HUMIDI-MIZER® SYSTEM START-UP

STEPS

1. Start unit In cooling (Close Y1)

(Y/N) \_\_\_\_\_

OBSERVE AND RECORD

a. Suction pressure

\_\_\_\_\_

PSIG

b. Discharge pressure

\_\_\_\_\_

PSIG

c. Entering air temperature

\_\_\_\_\_

° F

d. Leaving air temperature

\_\_\_\_\_

° F

2. Switch unit to mixed cool and reheat mode (subcool)

(Y/N) \_\_\_\_\_

OBSERVE

a. Reduction in suction pressure (5-7 psi expected)

(Y/N) \_\_\_\_\_

b. Discharge pressure unchanged

(Y/N) \_\_\_\_\_

c. Delta temperature decreases, close to neutral air

(Y/N) \_\_\_\_\_

3. Switch unit to hot gas reheat mode.

OBSERVE

a. Suction pressure increases to normal cooling level

b. Discharge pressure decreases (35-50 psi) (Limited by head pressure control)

c. Liquid temperature returns to normal cooling level

4. With unit in dehumid mode switch to heating and verify compressor and outdoor fan stop

(Y/N) \_\_\_\_\_

5. Turn off heating, cooling, and reheat, restore set points for thermostat and humidistat

(Y/N) \_\_\_\_\_

CUT ALONG DOTTED LINE

CUT ALONG DOTTED LINE