Carrier

# 48FC**20-30
# Single Package Rooftop Gas Heat/Electric Cooling Unit with Puron® (R-410A) Refrigerant
# 17.5-27.5 Nominal Tons

# Service and Maintenance Instructions

## CONTENTS





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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 contaminates 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.

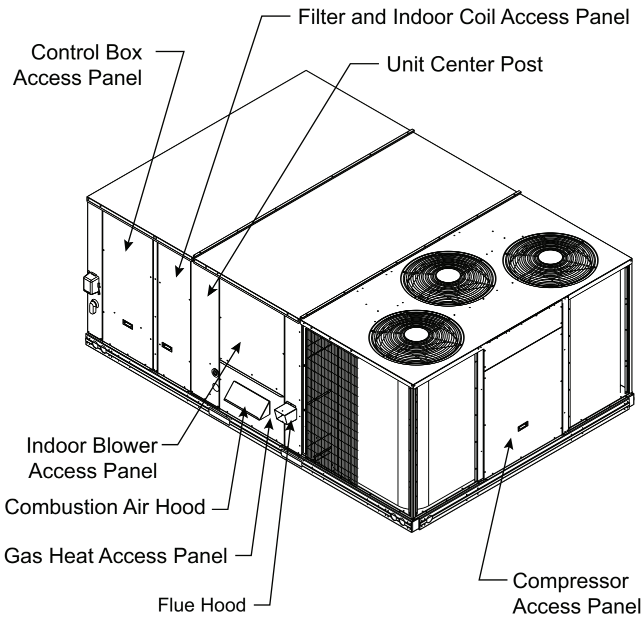



**Fig. 1 — Typical Access Panel Locations (Front)**

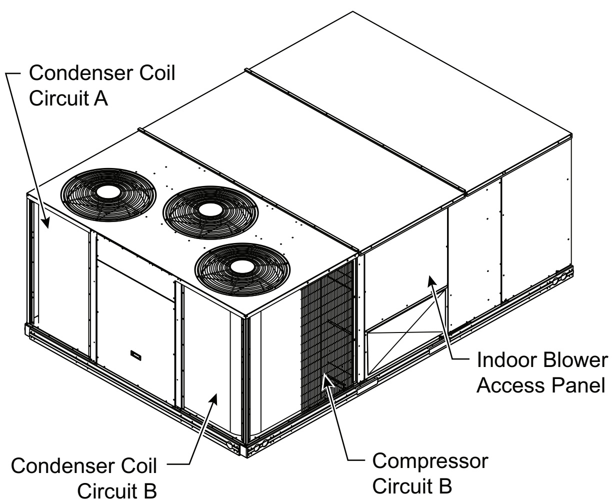



**Fig. 2 — Typical Access Panel Location (Back)**

## 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 small lift-out panel located on the rear side of the unit, above the evaporator/return air access panel. (See Fig. 3.)

To remove the filters:

1. Grasp the bottom flange of the upper panel.
2. Lift up and swing the bottom out until the panel disengages and pulls out.
3. Reach inside and extract the filters from the filter rack.
4. Replace these 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 top of the lower panel (or economizer top).

OUTSIDE AIR HOOD

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 restarting the unit. Observe the flow direction arrows on the side of each filter frame.

ECONOMIZER INLET AIR SCREEN

This air screen is retained by filter clips under the top edge of the hood. (See Fig. 3.)

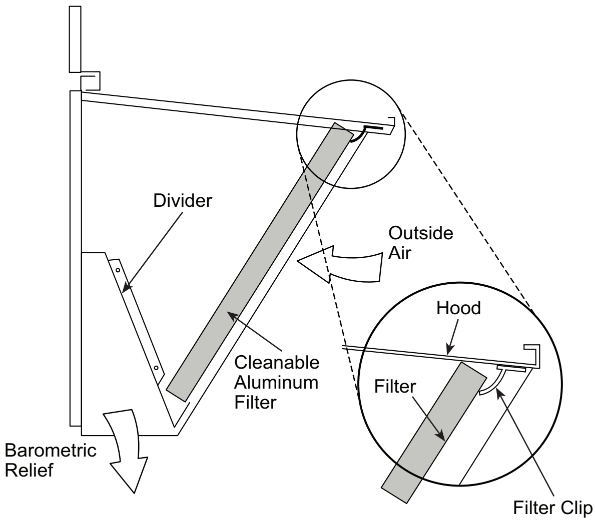



**Fig. 3 — Filter Installation**

To remove the filter, open the filter clips. Re-install the filter by placing the frame in its track, then closing the filter clips.

MANUAL OUTSIDE AIR HOOD SCREEN

This inlet screen is secured by a retainer angle across the top edge of the hood. (See Fig. 4.)

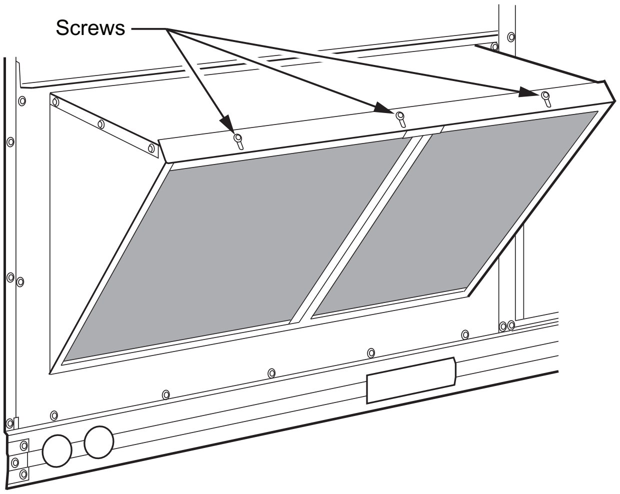



**Fig. 4 — Screens Installed on Outdoor-Air Hood**

To remove the screen, loosen the screws in the top retainer and slip the retainer up until the filter can be removed. Re-install by placing the frame in its track, rotating the retainer back down, and tightening all screws.

## 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. 5 and 6.

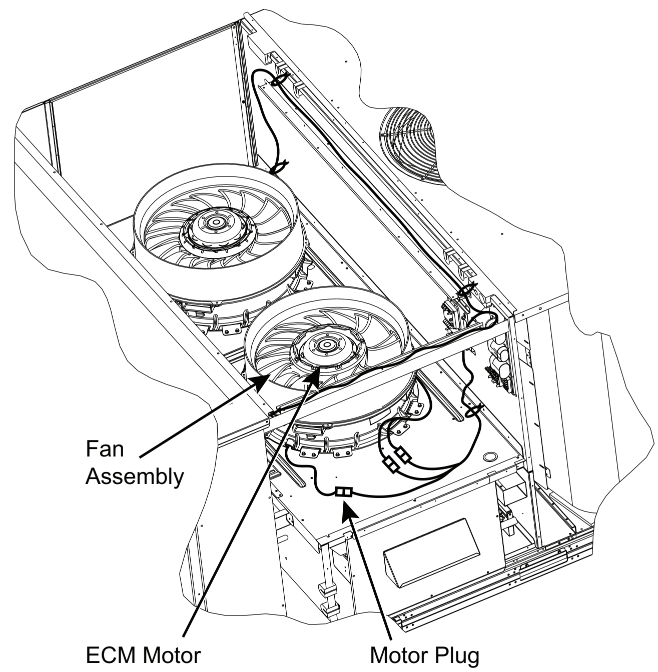



**Fig. 5 — Direct-Drive Supply Fan Assembly**

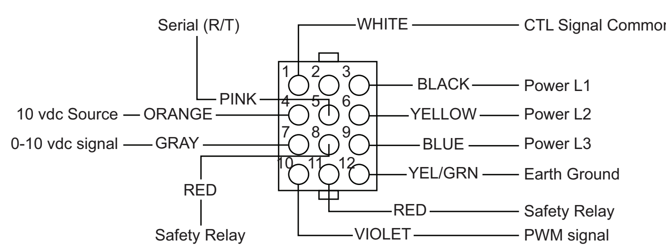



**Fig. 6 — ECM Motor Plug Connectors**

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 Electro-mechanical controls***

The Fan Speed set up controls are located on the lower section of the Unit Control Board (UCB). See Fig. 7 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. 8), calculate the vdc from the cfm and ESP for the base.
3. If installing any accessories listed at the bottom of the 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.

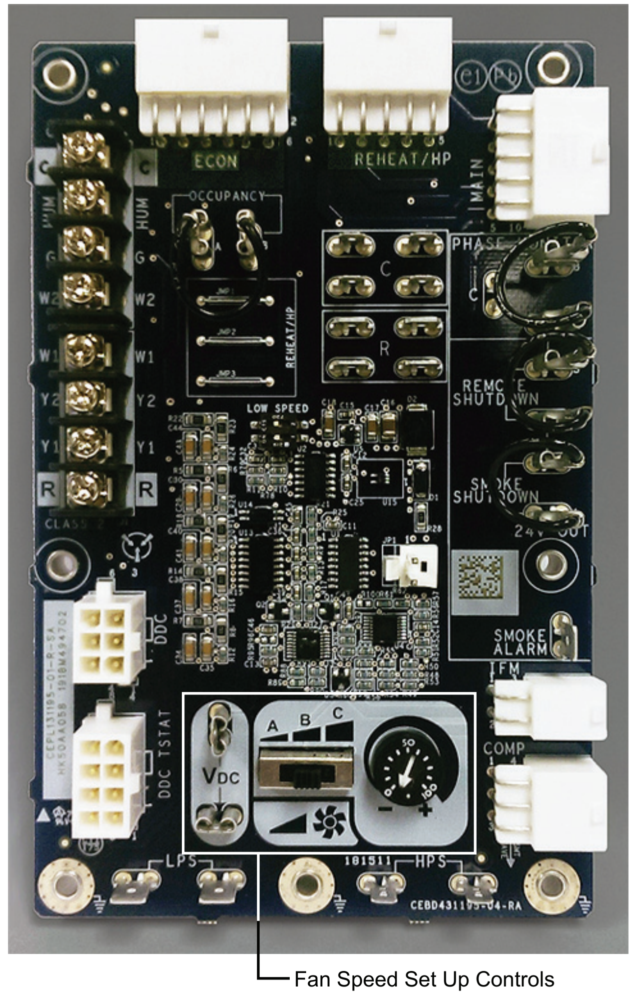
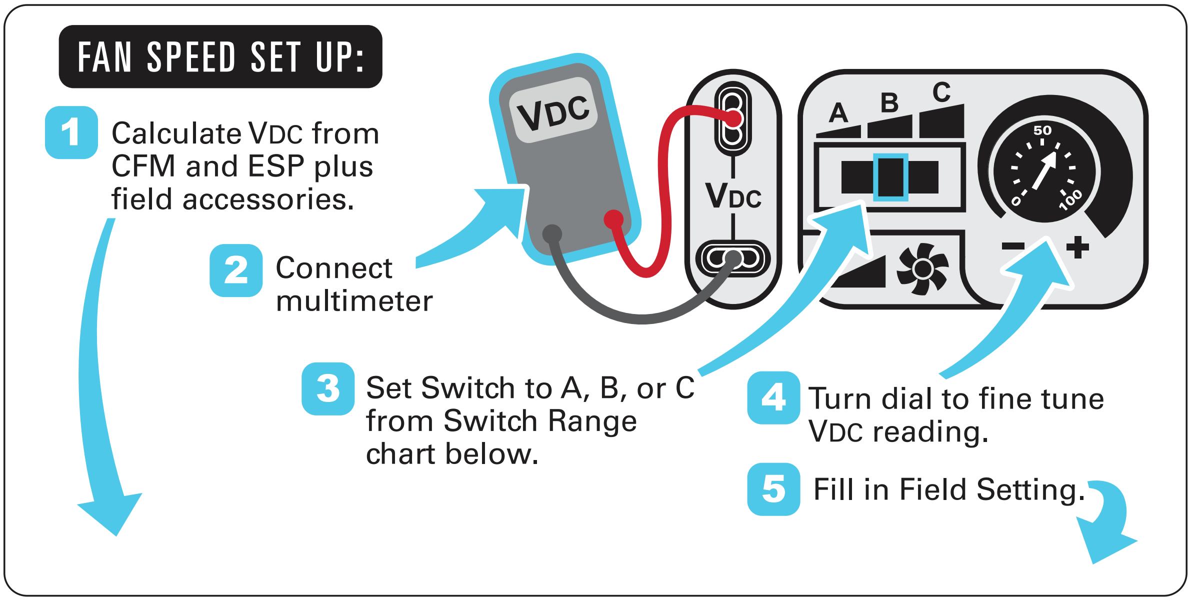



**Fig. 7 — UCB Fan Speed Controls - 3-Phase Units**




VDC Calculator

| UNIT MODEL NUMBER / CFM | ESP in. wg 0.2 | 0.4 | 0.6 | 0.8 | 1.0 | 1.2 | 1.4 | 1.6 | 1.8 | 2.0 |
|---|---|---|---|---|---|---|---|---|---|---|
| 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 | 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. 8 — Example of Fan Speed Set Up Labels for Electro-Mechanical 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. 9), 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. 9). 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.

SystemVu™

# FAN SPEED SETUP (RPM)

MAIN MENU:

**SETTINGS**

→ UNIT CONFIGURATIONS

→ INDOOR FAN

→ IDF VENT SPD -RPM
→ IDF HEAT SPD -RPM
→ IDF HIGH COOL SPD -RPM
→ IDF FREE COOL SPD -RPM

↓ DETERMINE RPM FROM BELOW ↓

48TC003136 REV. B

RPM Calculator

| UNIT MODEL NUMBER CFM | ESP in. wg 0.2 | 0.4 | 0.6 | 0.8 | 1.0 | 1.2 | 1.4 | 1.6 | 1.8 | 2.0 |
|---|---|---|---|---|---|---|---|---|---|---|
| 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. 9 — 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 36 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. 10.
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.

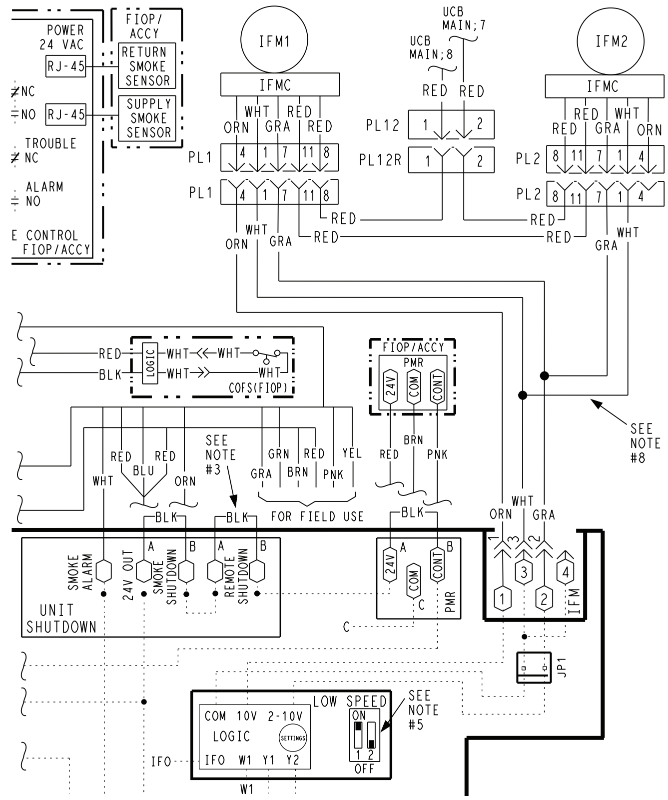



**Fig. 10 — Supply Fan Control Wiring Diagram**

*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. 11.

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.

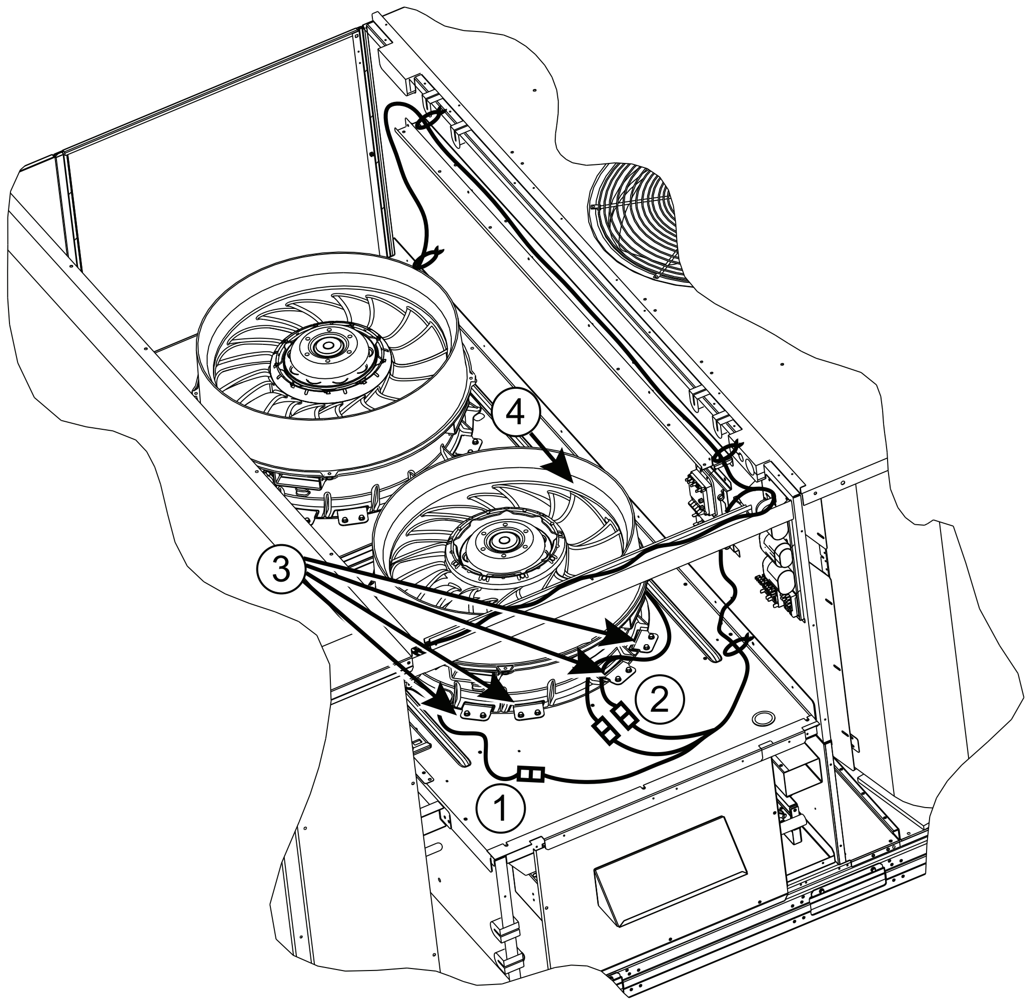



**Fig. 11 — Fan Assembly Removal**

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

See Fig. 12.

NOTE: Refer to "Model Number Nomenclature" on page 70, 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.

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

See Fig. 13.

NOTE: Refer to "Model Number Nomenclature" on page 70, 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.

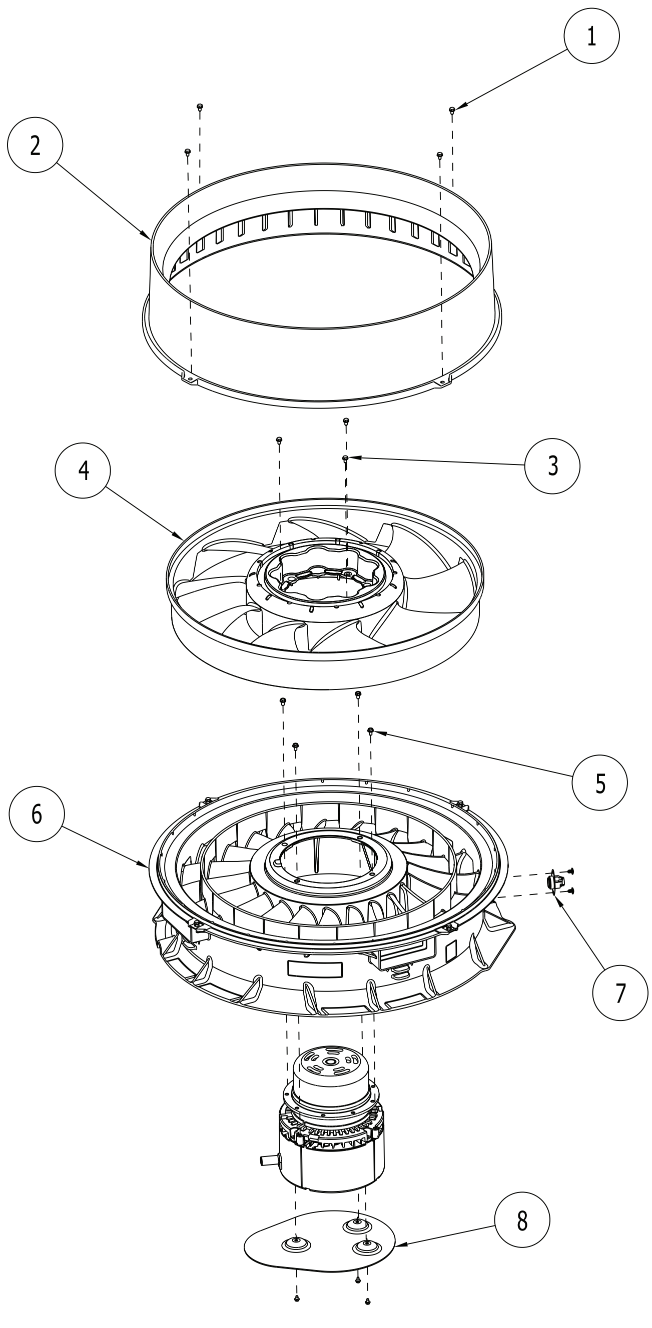



**Fig. 12 — Disassembling Standard or Medium Static Motor and Fan Assembly**

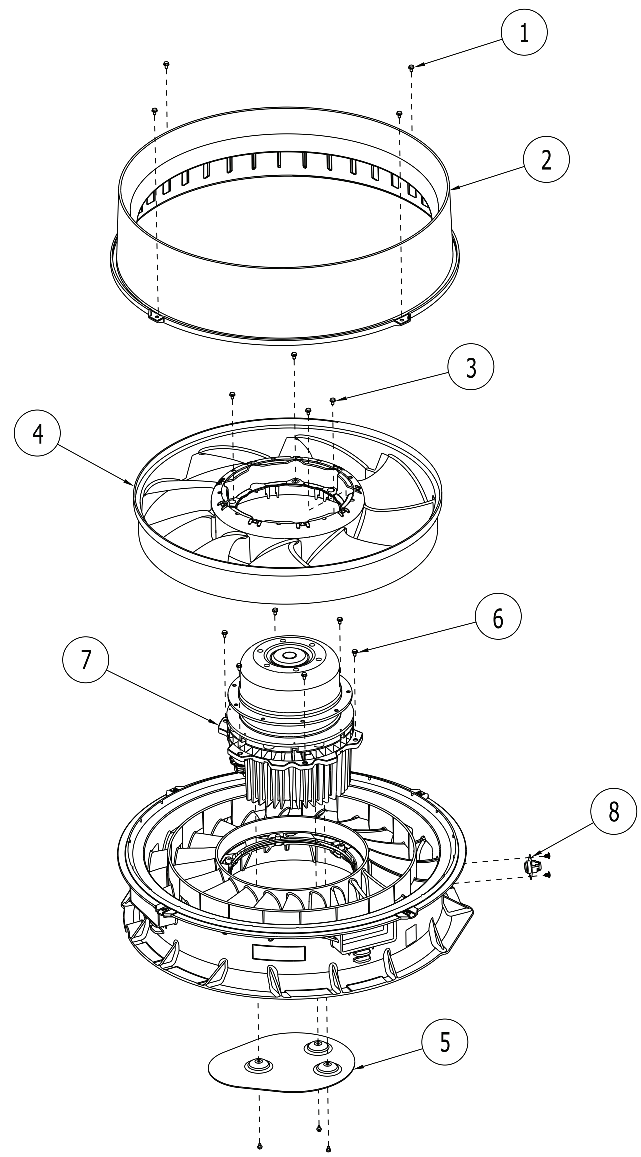



**Fig. 13 — Disassembling High Static Motor and Fan Assembly**

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

See Fig. 14.

NOTE: Refer to “Model Number Nomenclature” on page 70, 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 (48TM005675).
3. Line up keying features on stator and motor and set stator onto motor. Install four 1/4-20 x 1-in. screws (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 (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 (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.

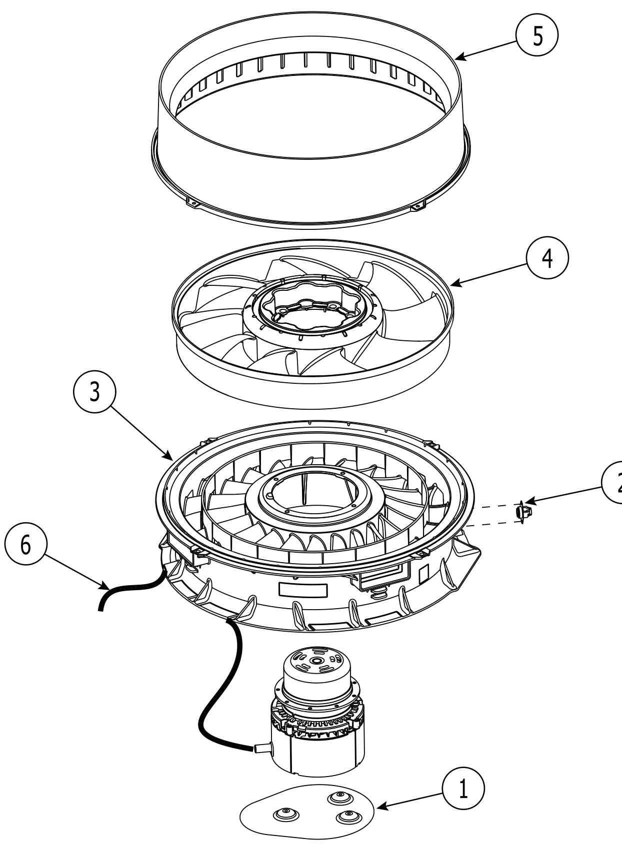



**Fig. 14 — Standard/Medium Fan System Re-Assembly**

***Reassembly of High Static Motor and Fan Assembly***

See Fig. 15.

NOTE: Refer to “Model Number Nomenclature” on page 70, 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 (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 (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 (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 (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.

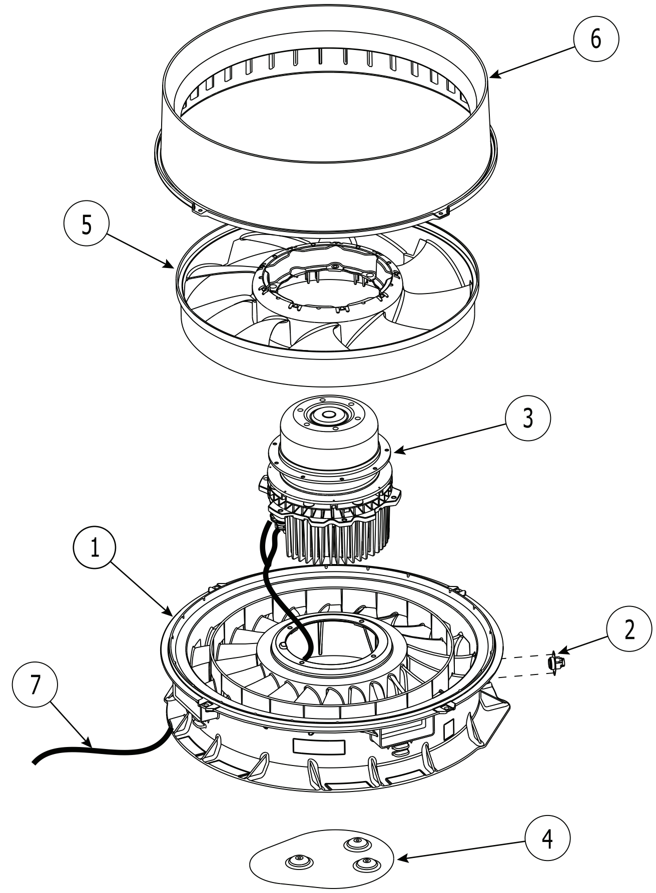



**Fig. 15 — High Static Fan System Re-Assembly**

***Reinstalling Motor and Fan Assembly***

See Fig. 16.

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.

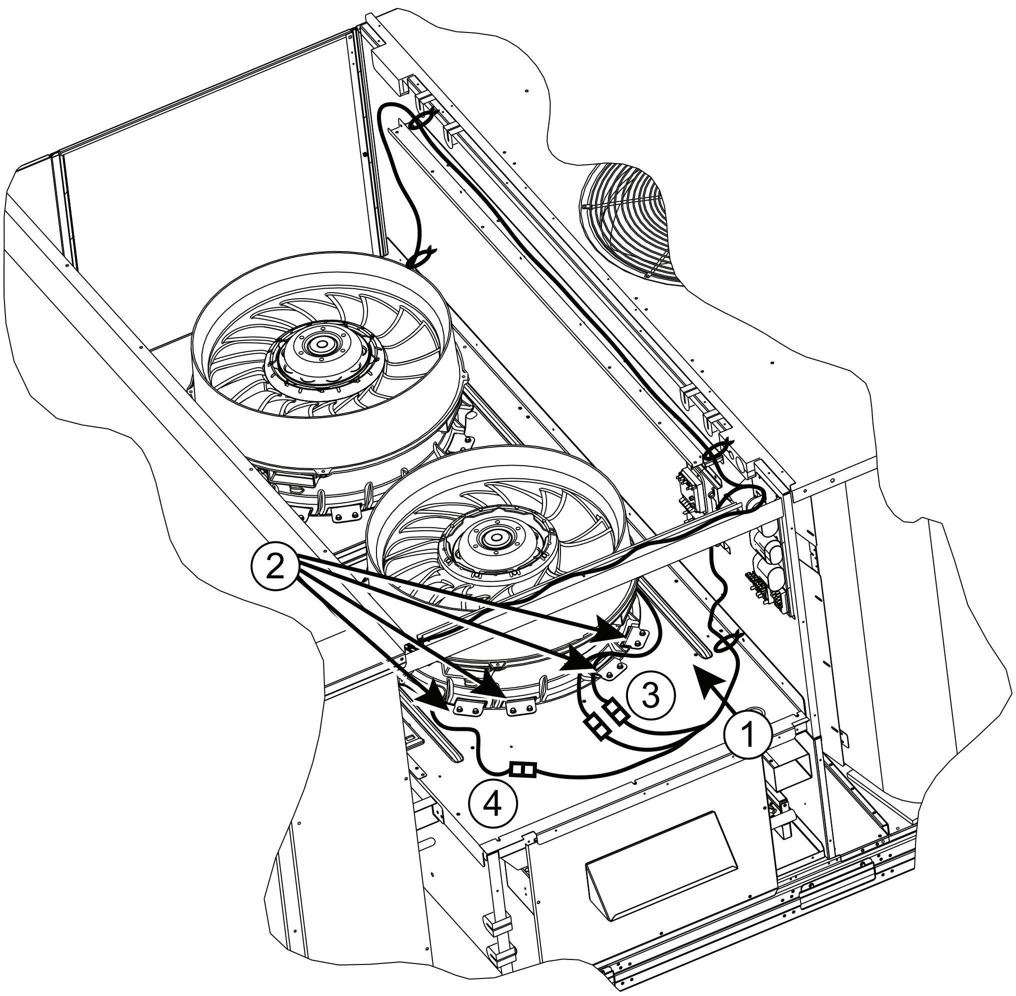



**Fig. 16 — Fan Assembly Installation**

## 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. 17.

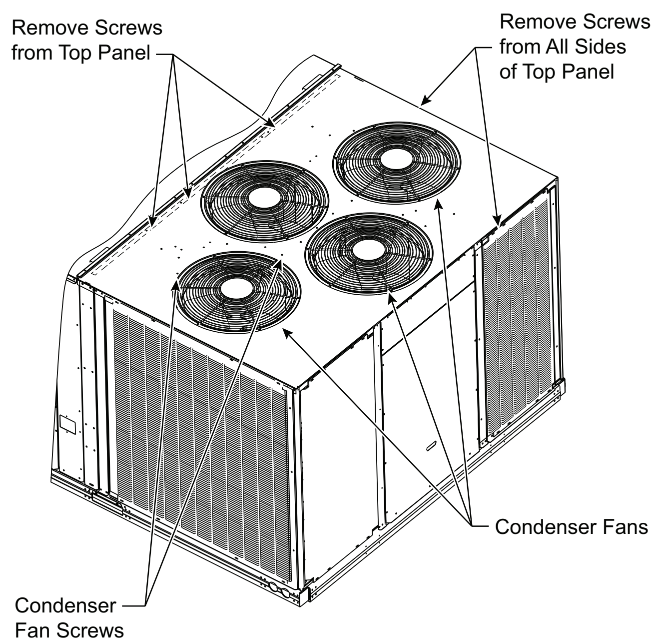



**Fig. 17 — Location of Top Panel Screws and Coil Corner Post**

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. 18.

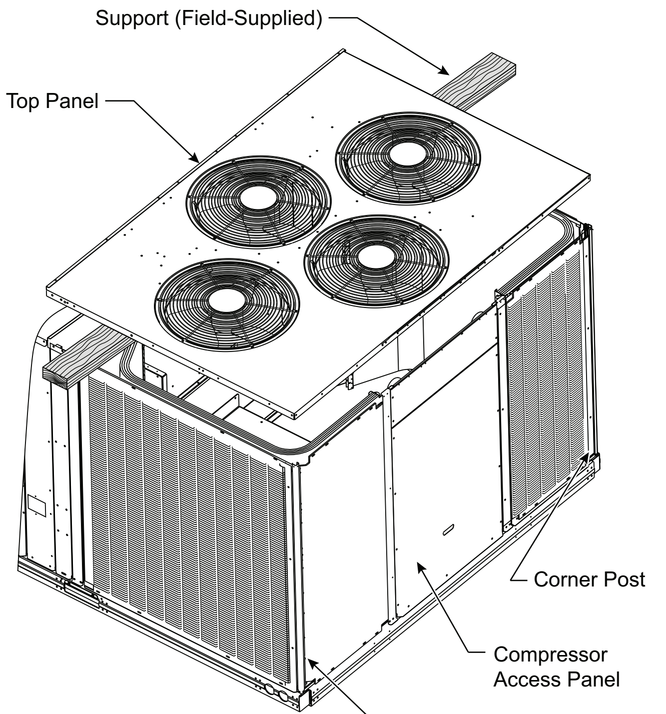



**Fig. 18 — Top Panel Removal**

4. Remove the compressor access panel to access the lower coil clips. The condenser coil corner post may also be removed. See Fig. 18.
5. Remove the screws from both sides of the 4 coil retaining clips on the hairpin end of the coil tube sheets. See Fig. 19.
6. Remove the 4 retaining clips.

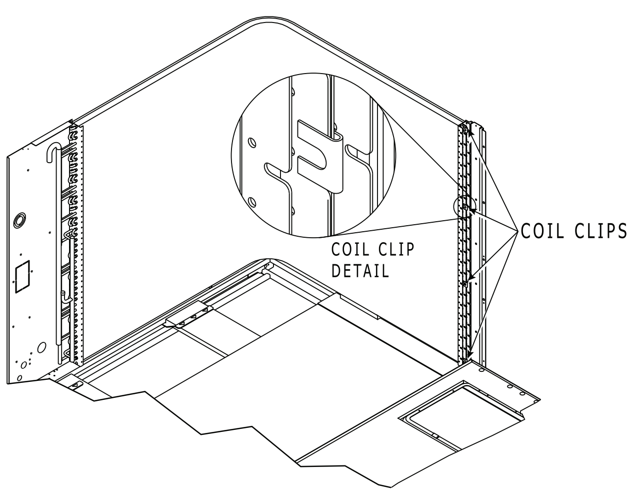



**Fig. 19 — Condenser Coil Clips**

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. 20.
9. Clean the outer coil surface to remove surface loaded fibers or dirt. See “Remove Surface Loaded Fibers” on page 13 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.

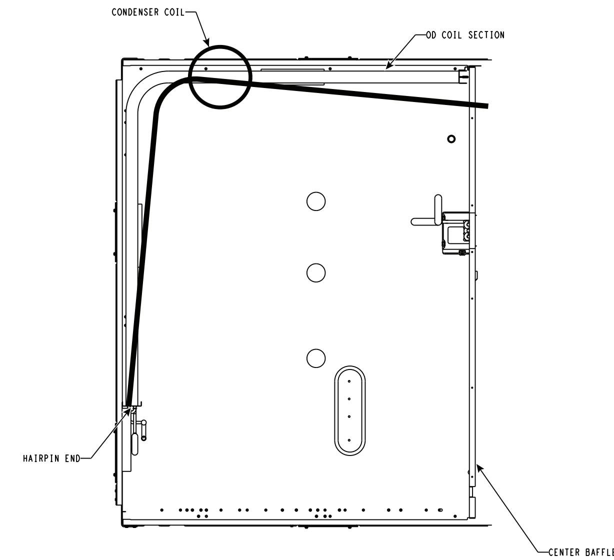



**Fig. 20 — Separating Coil Sections (Top View)**

**⚠ 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®[1] 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, backflush 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-distributer system.

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

# 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® 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/l6-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. 21.
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.

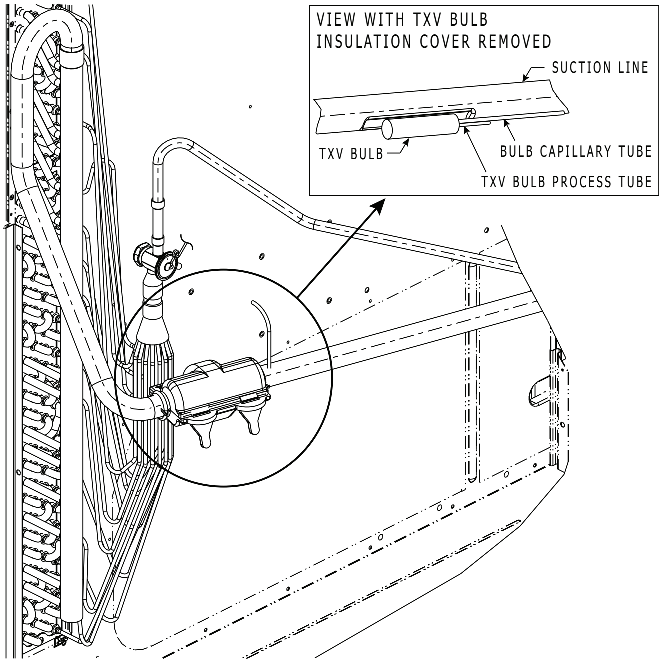



**Fig. 21 — TXV Valve and Sensing Bulb Location**

## 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. 22. 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 ± 10 in.-lb (10.85 ± 1.1 Nm) of torque; do not over-tighten.

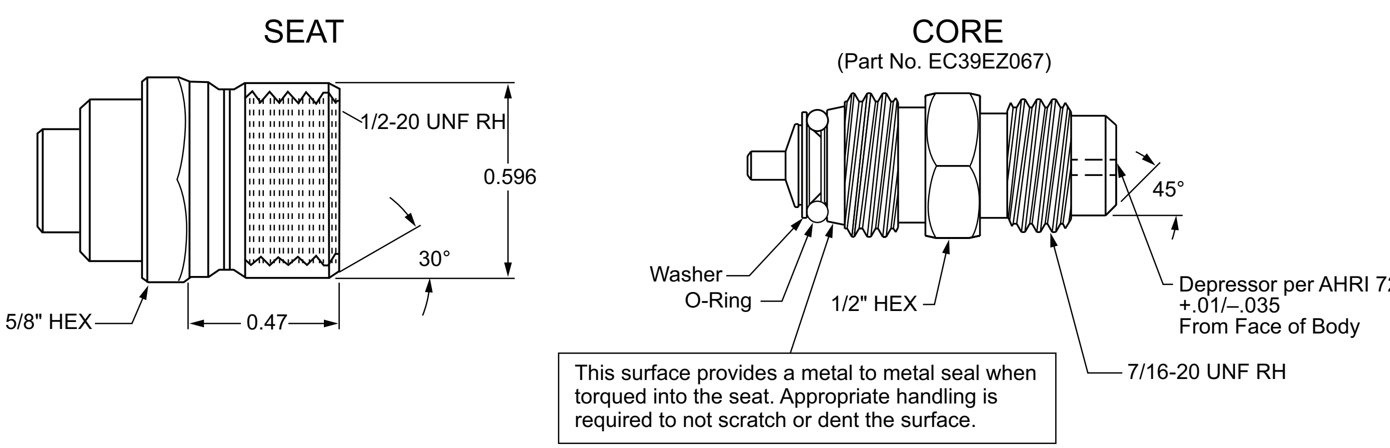



**Fig. 22 — CoreMax™[1] Access Port Assembly**

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. 23-30, 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 (16°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.

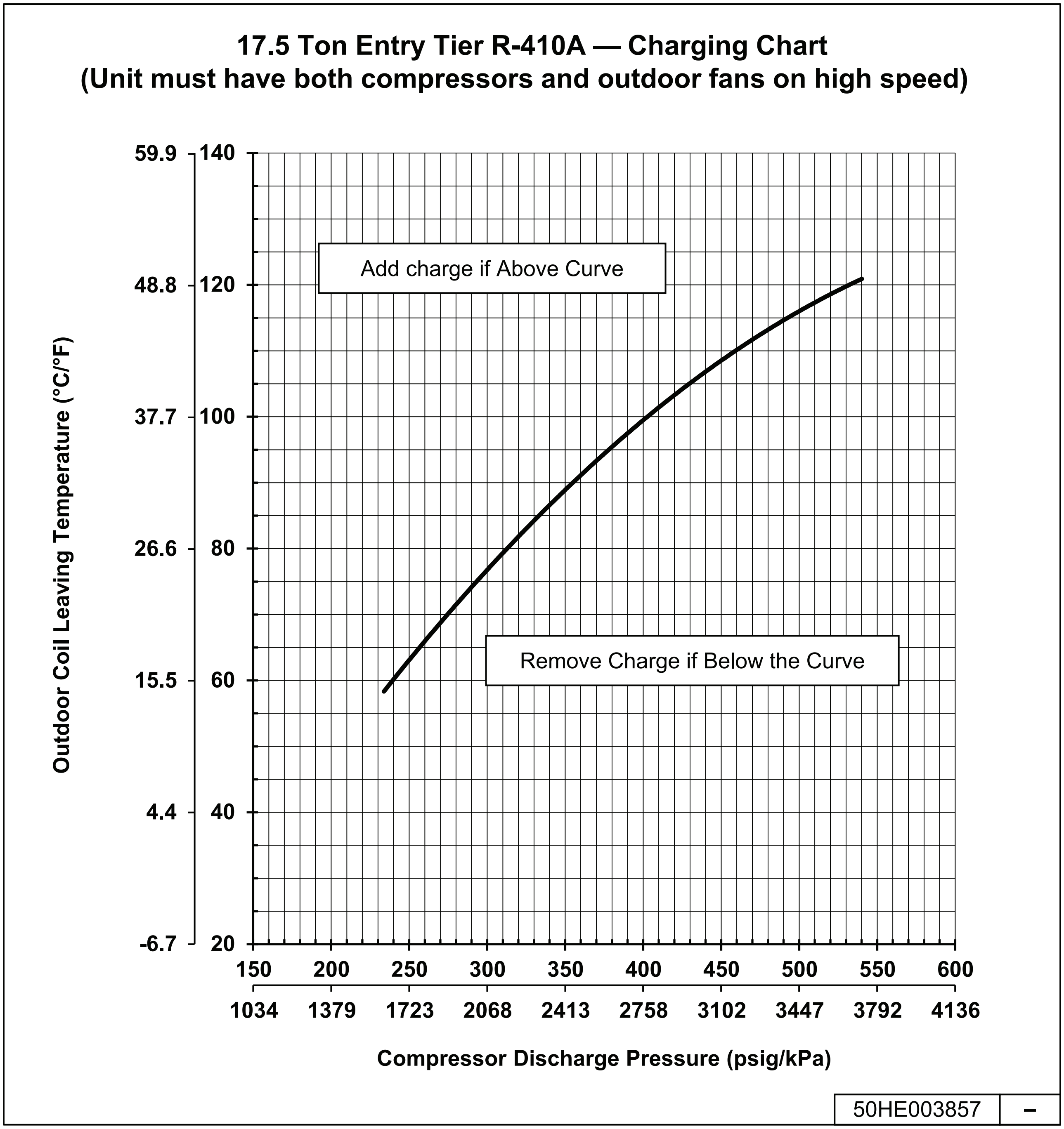



Fig. 23 — Cooling Charging Chart — 17.5 Ton

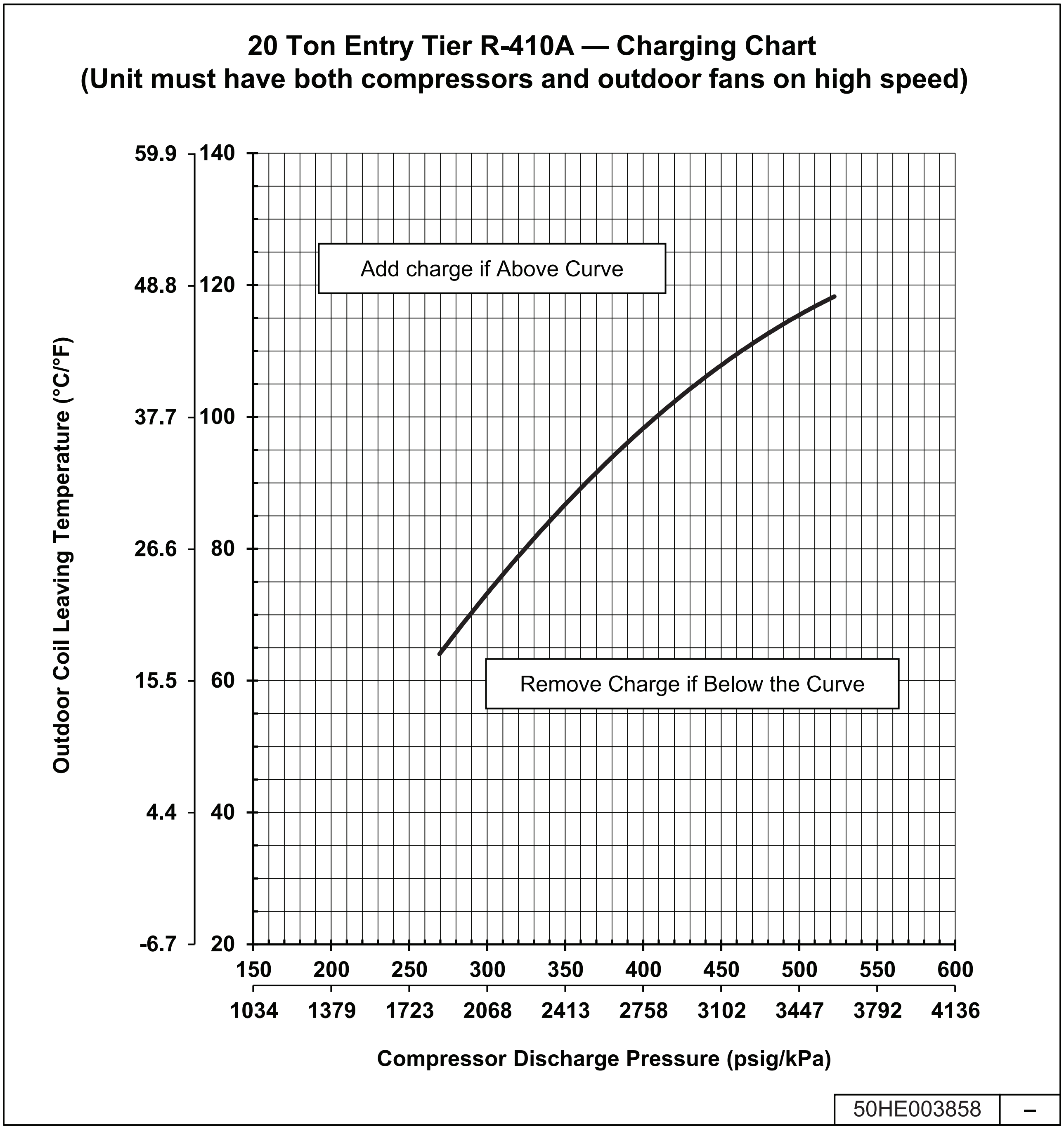



Fig. 24 — Cooling Charging Chart — 20 Ton

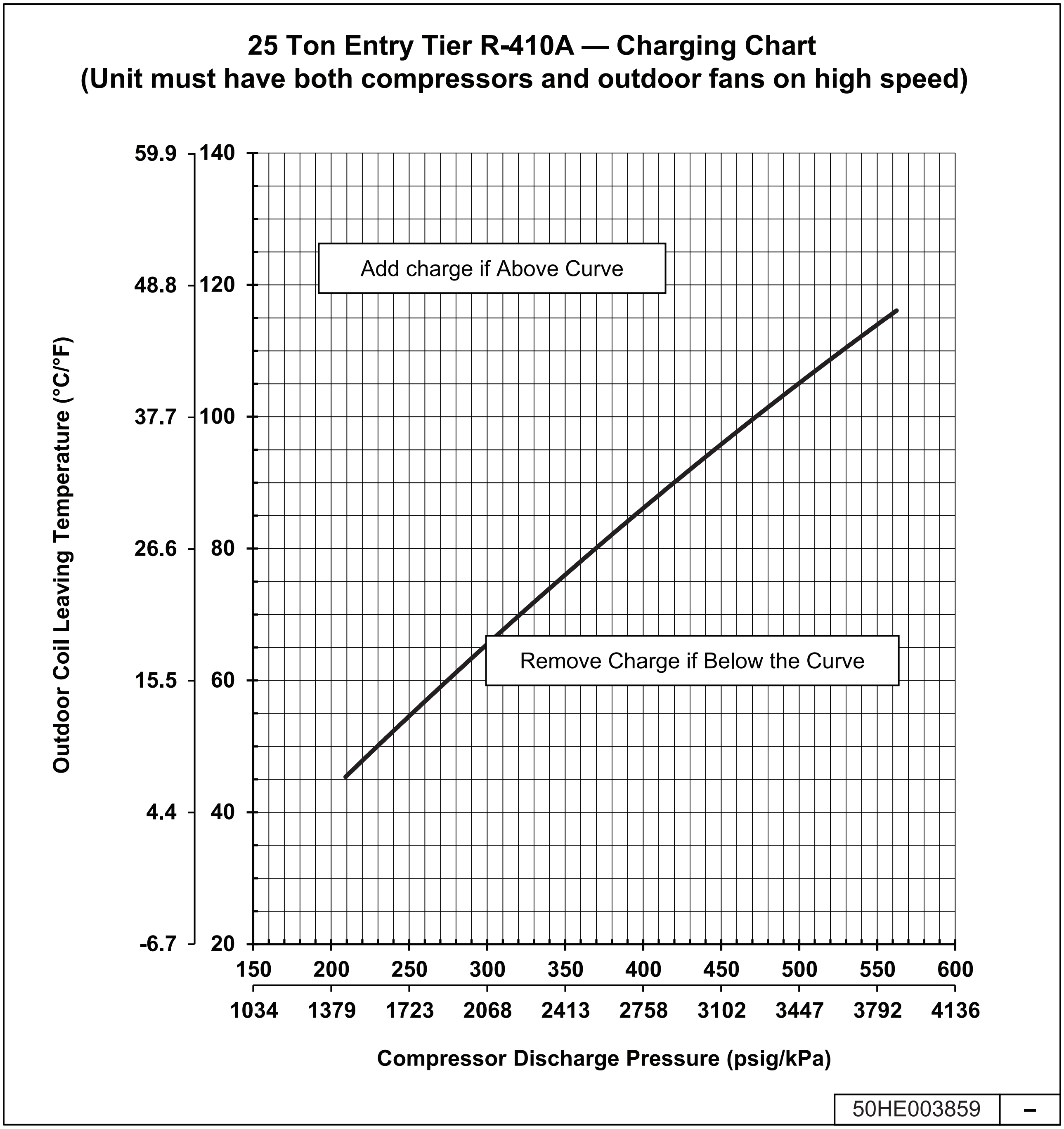



Fig. 25 — Cooling Charging Chart — 25 Ton

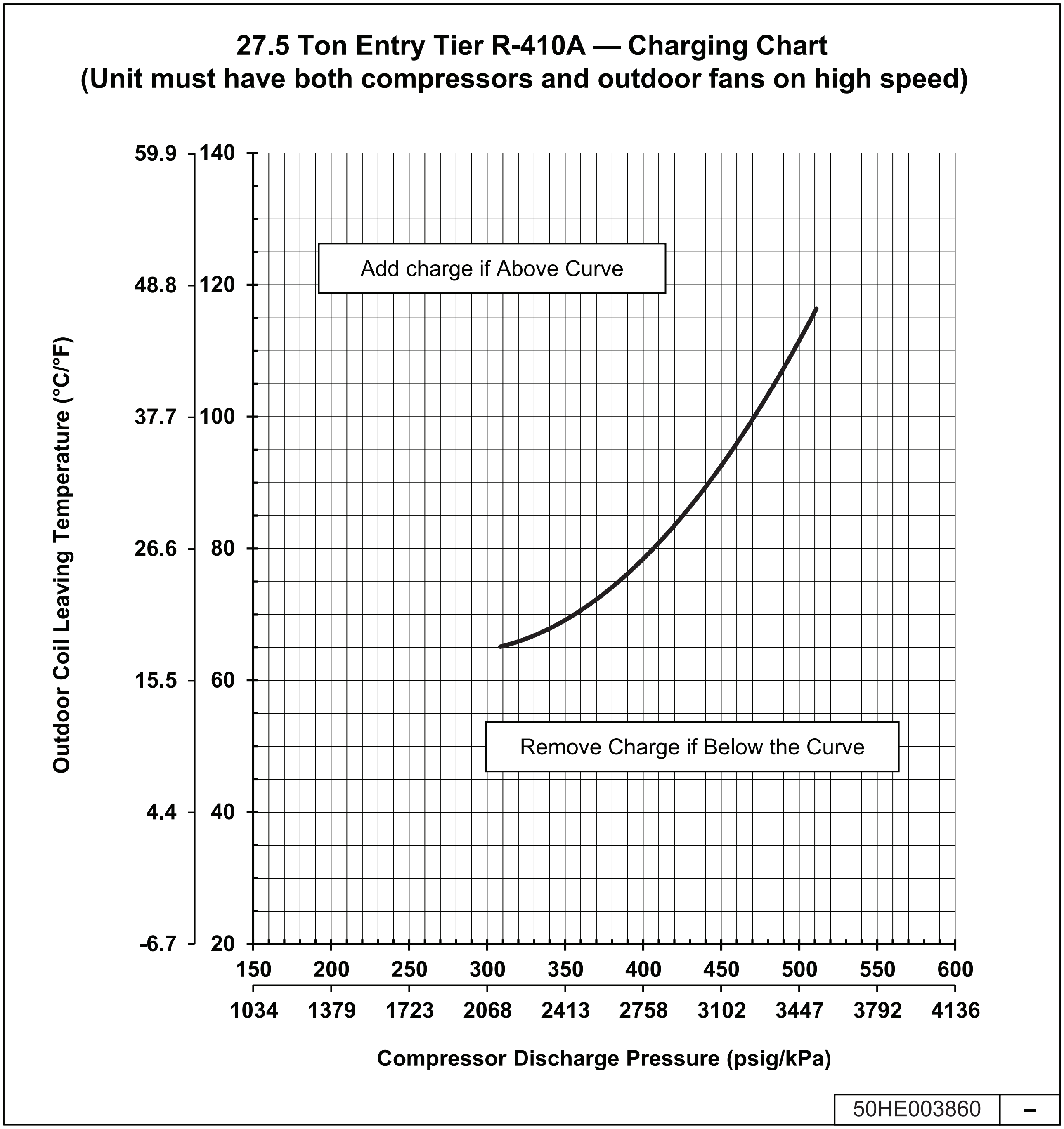



**Fig. 26 — Cooling Charging Chart — 27.5 Ton**

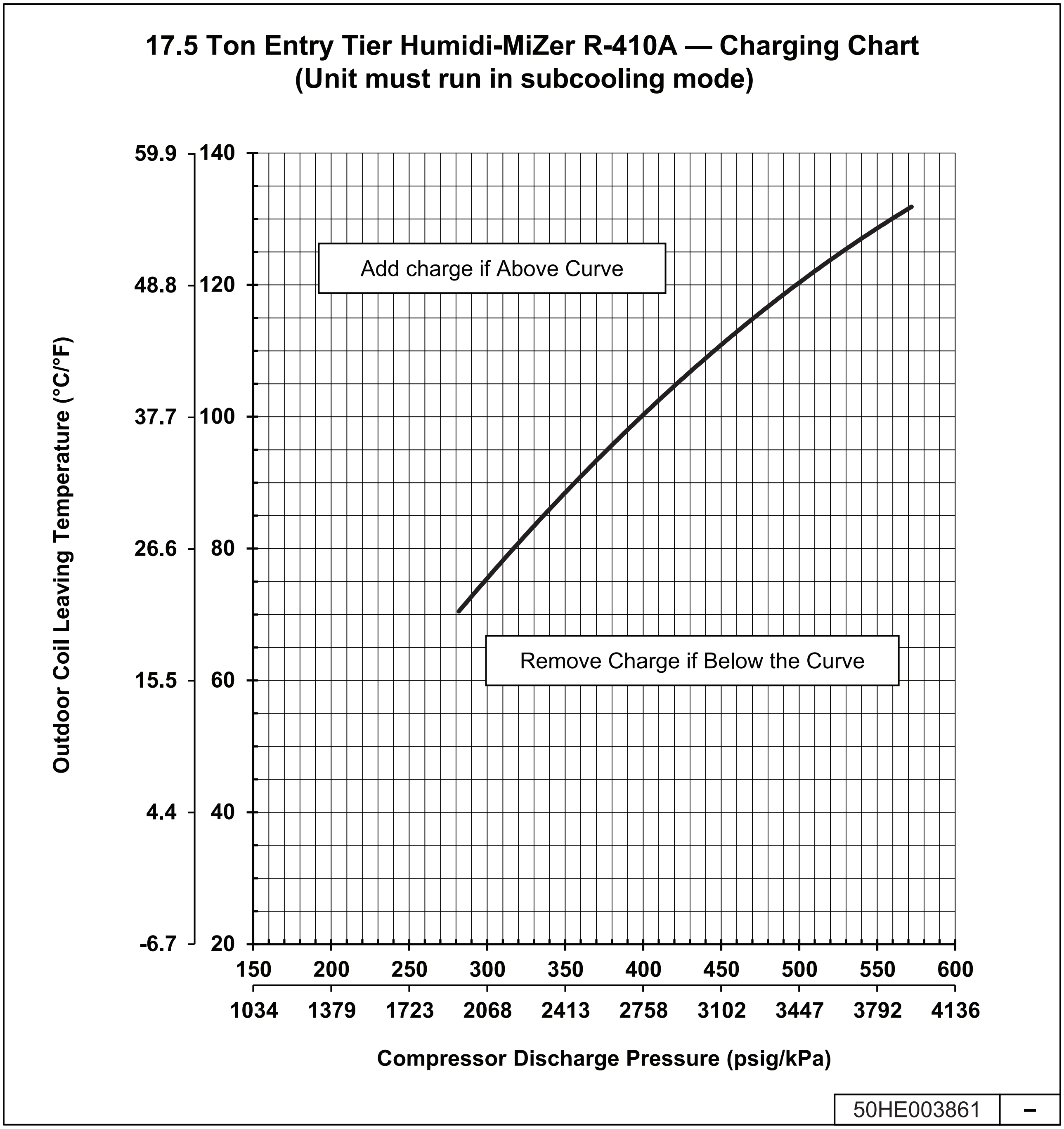



Fig. 27 — Cooling Charging Chart with Humidi-MiZer System — 17.5 Ton

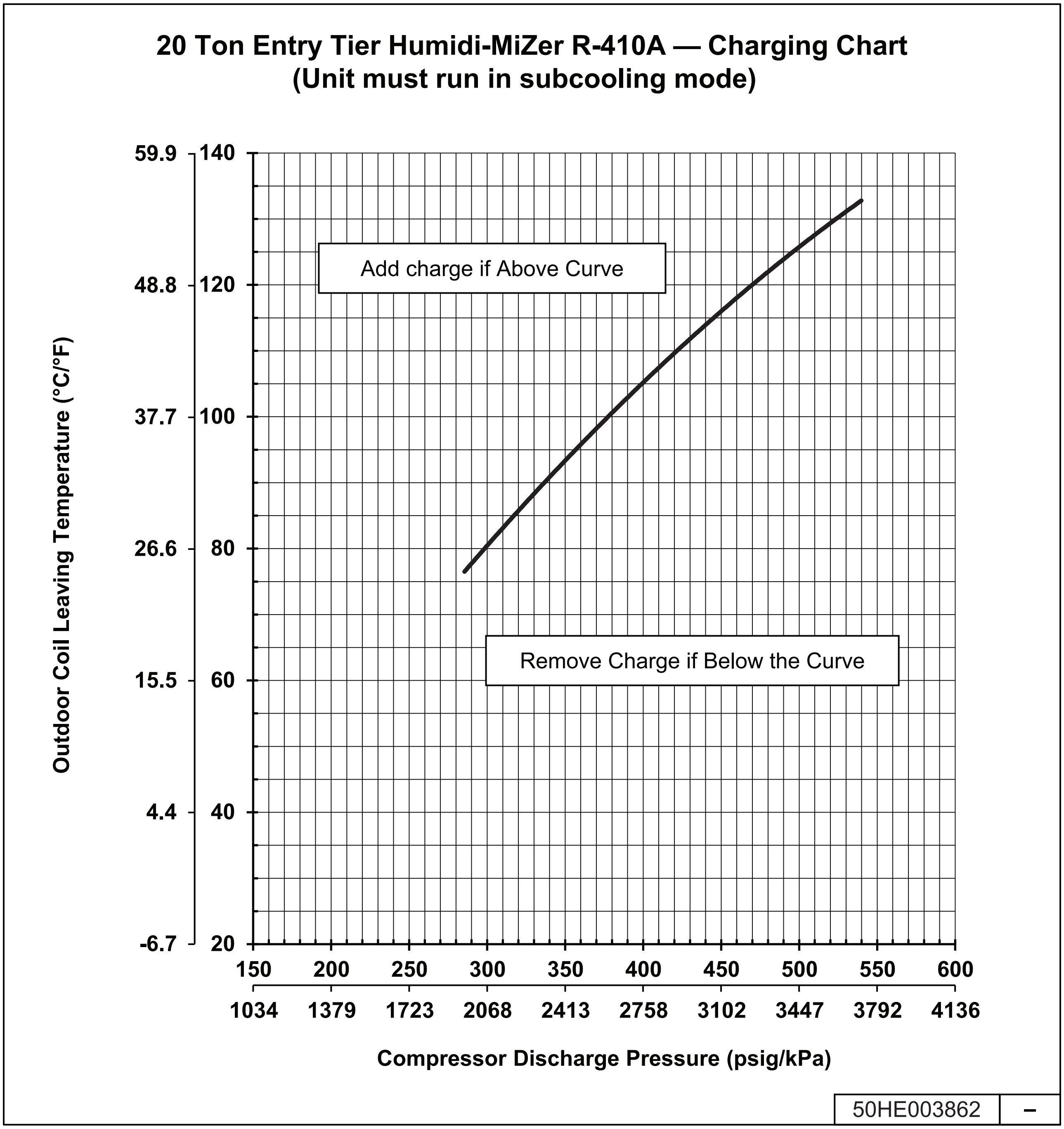



Fig. 28 — Cooling Charging Chart with Humidi-MiZer System — 20 Ton

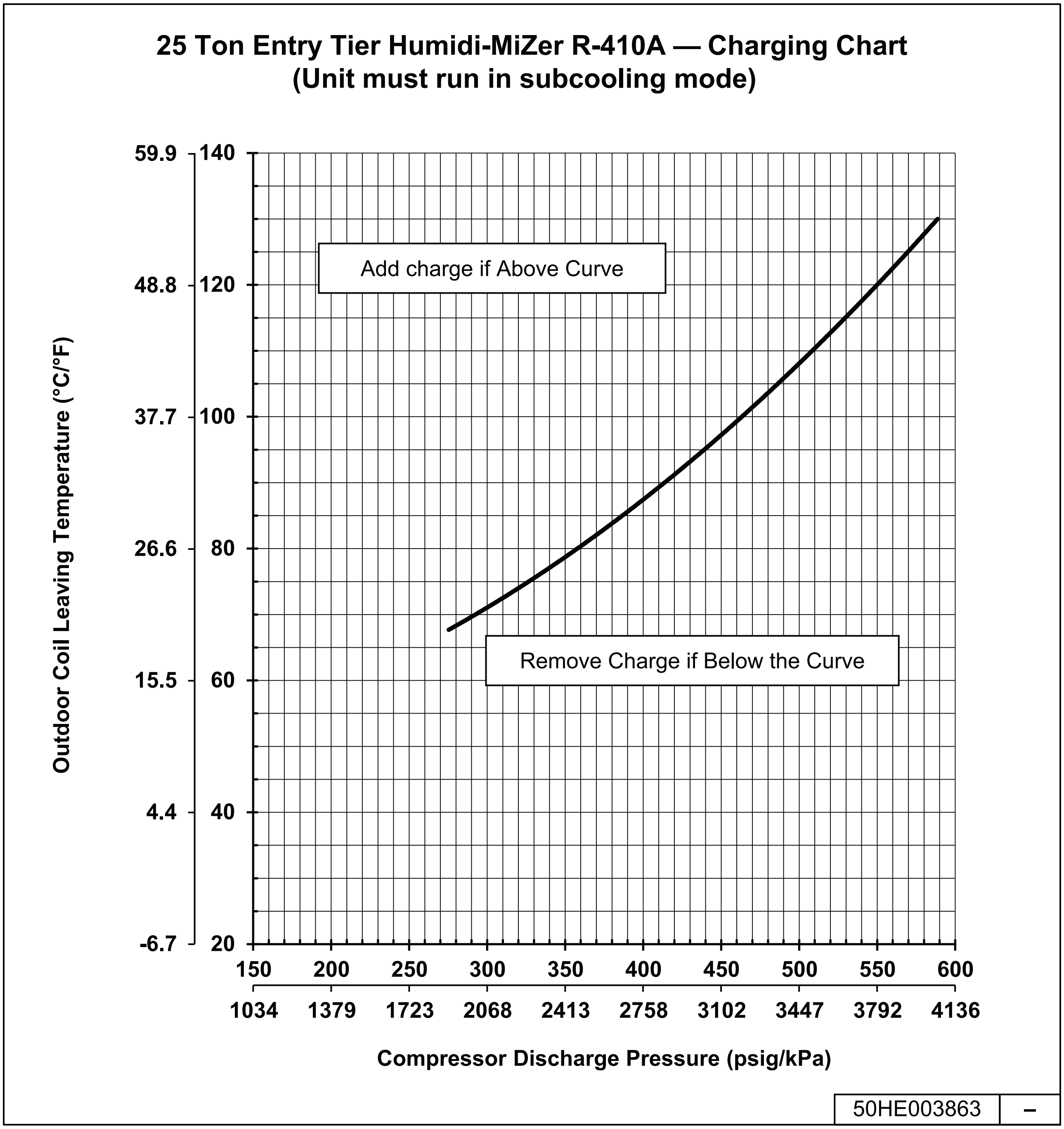



Fig. 29 — Cooling Charging Chart with Humidi-MiZer System — 25 Ton

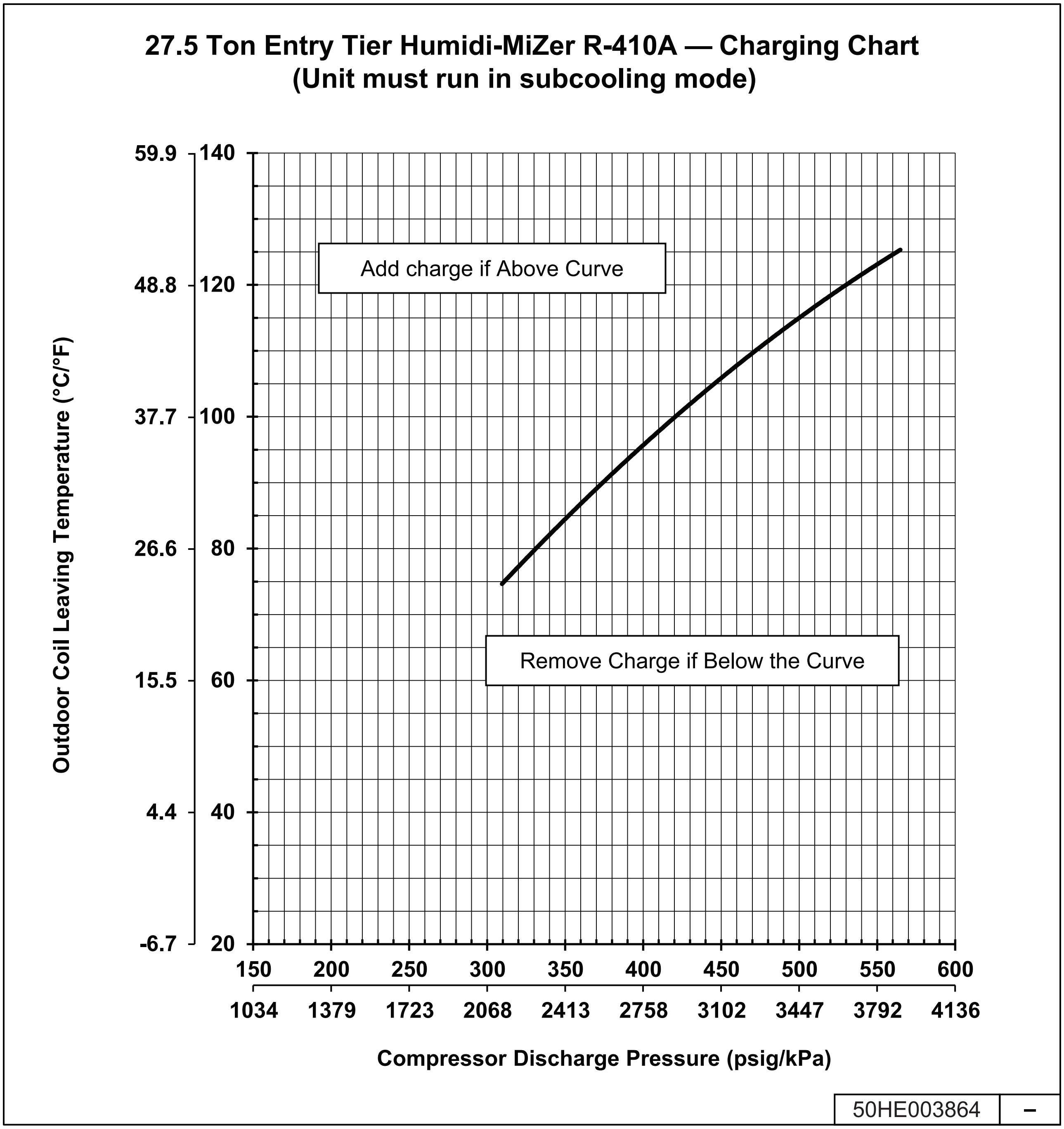



**Fig. 30 — Cooling Charging Chart with Humidi-MiZer System — 27.5 Ton**

## 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 contaminates 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. 31.
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) ± 12 in.-lb (1.5 Nm).
6. Replace condenser-fan assembly.

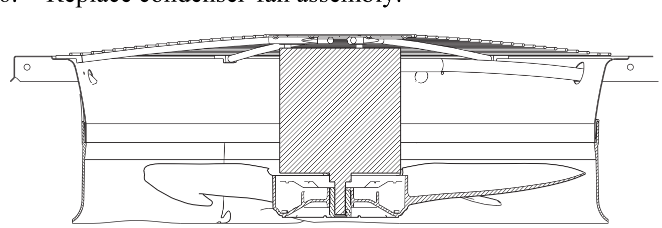


**Fig. 31 — Condenser Fan Adjustment**

## Troubleshooting Cooling System

Refer to Table 1 for additional troubleshooting topics.

**Table 1 — Troubleshooting**

| SYMPTOM | CAUSE | SOLUTION |
|---|---|---|
| **Compressor and Outdoor Fan Will Not Start** | 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.” |
| **Compressor Will Not Start but Outdoor Fan Runs** | 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. |
| **Compressor Cycles (Other Than Normally Satisfying Thermostat)** | 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. |
| **Compressor Operates Continuously** | 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. |
| **Compressor Makes Excessive Noise** | Compressor rotating in the wrong direction. | Reverse the 3-phase power leads as described in Start-Up. |
| **Excessive Head Pressure** | 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. |
| **Head Pressure Too Low** | Low refrigerant charge. | Check for leaks; repair and recharge |
| | Compressor scroll plates defective. | Replace compressor |
| | Restriction in liquid tube. | Remove restriction. |
| **Excessive Suction Pressure** | High heat load. | Check for source and eliminate. |
| | Compressor scroll plates defective. | Replace compressor. |
| | Refrigerant overcharge. | Recover excess refrigerant. |
| **Suction Pressure Too Low** | 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. 32.

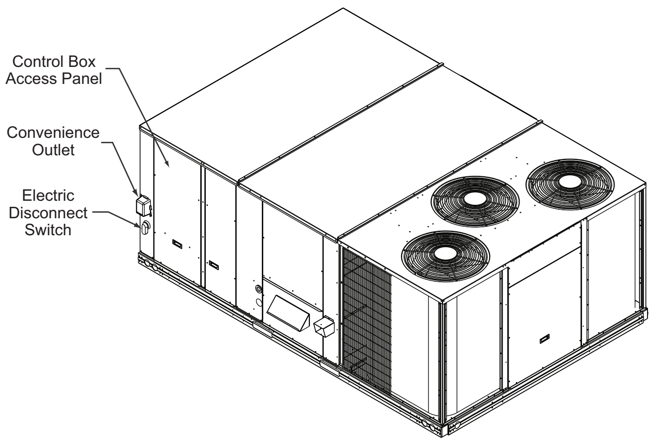



**Fig. 32 — Convenience Outlet Location**

### 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 CONVENIENCE 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. 33.
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.

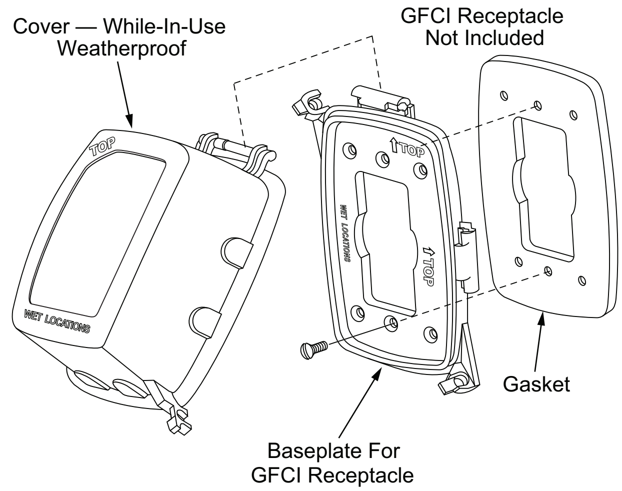



**Fig. 33 — Weatherproof Cover Installation**

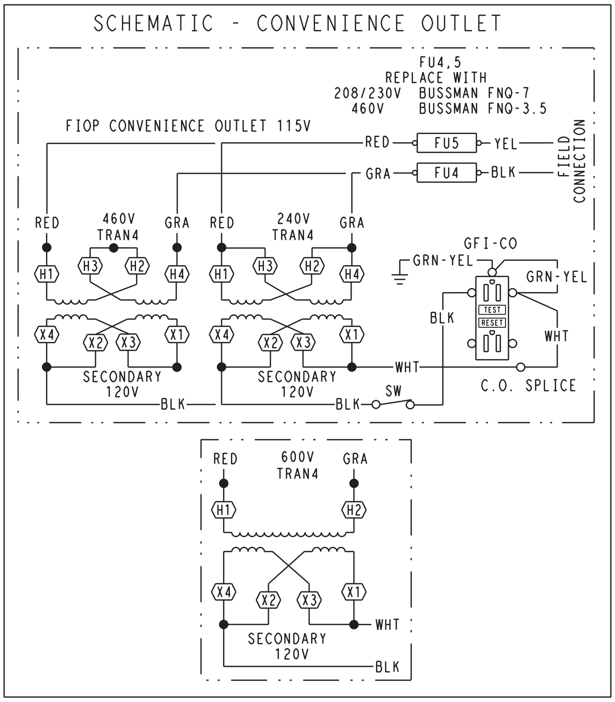
### Non-Powered Type

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. 32.

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. 34.




| UNIT VOLTAGE | CONNECT AS | PRIMARY CONNECTIONS | TRANSFORMER 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. 34 — 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[1] 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. 35) 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. 36) 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).

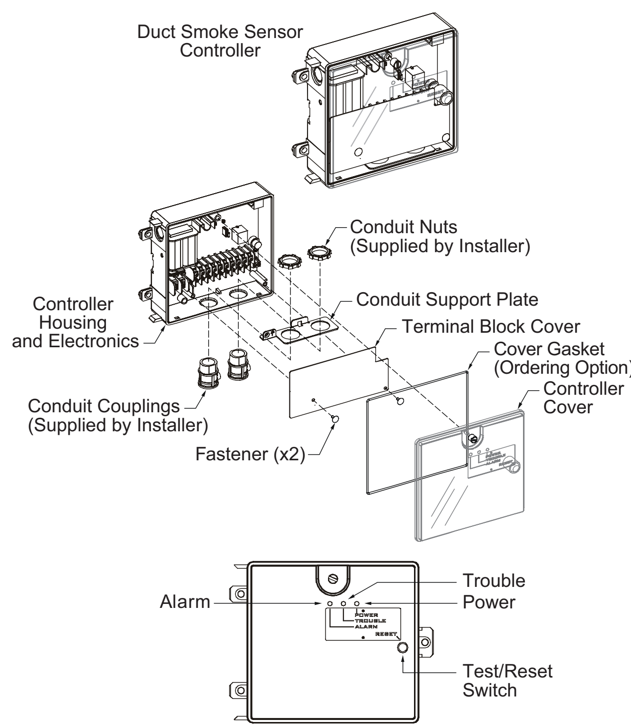



**Fig. 35 — Controller Assembly**

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.

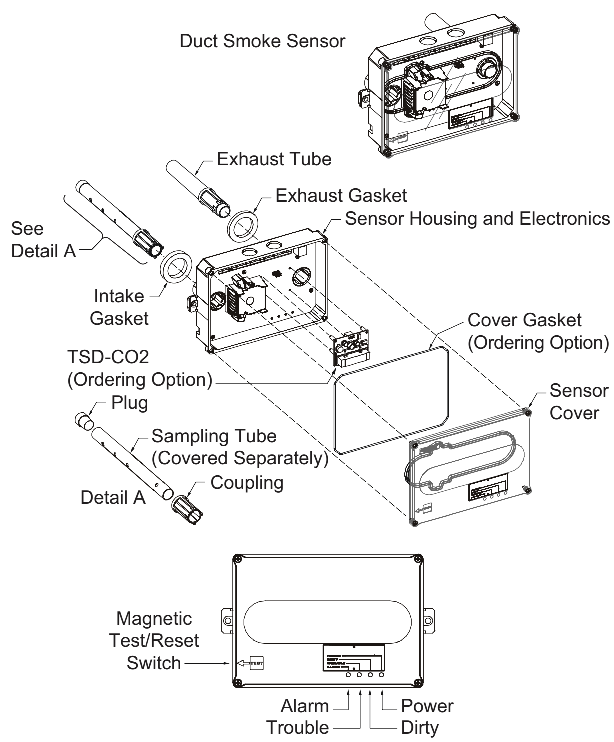



**Fig. 36 — Smoke Detector Sensor**

## 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. 37. 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.

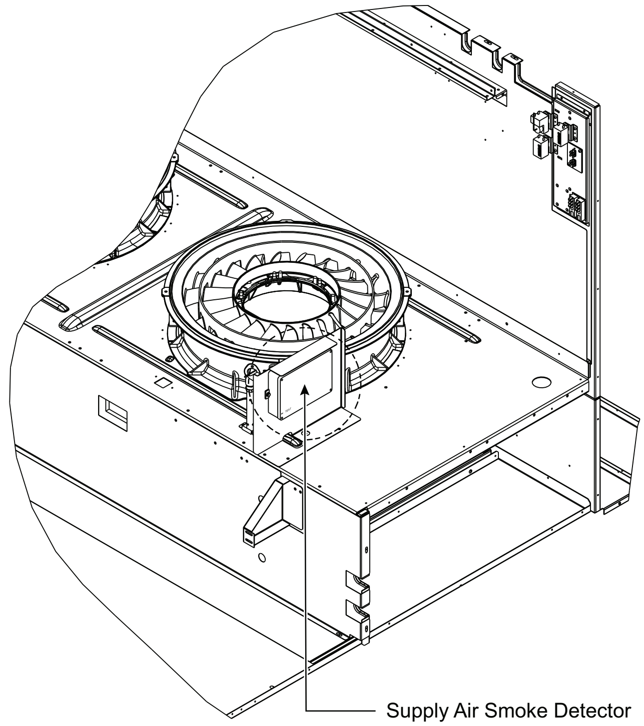



**Fig. 37 — Typical Supply Air Smoke Detector Sensor Location**

RETURN AIR SMOKE DETECTOR SENSOR WITHOUT ECONOMIZER

The sampling tube is located across the return air opening on the unit basepan. See Fig. 38. 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.

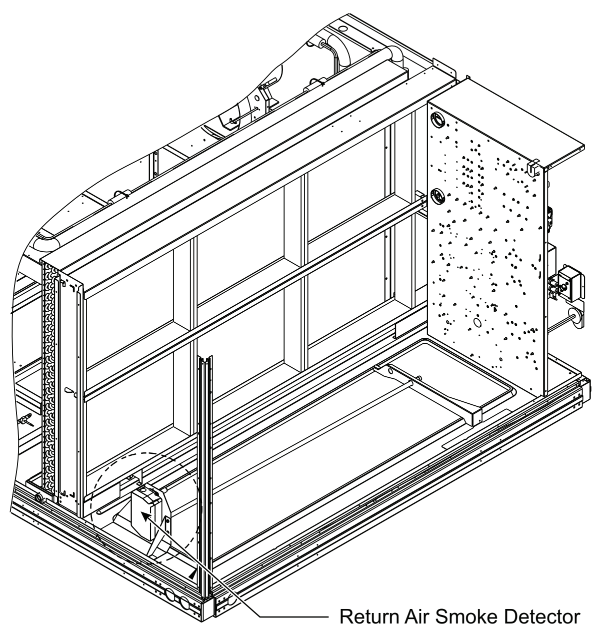



**Fig. 38 — Typical Return Air Smoke Detector Location**

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 39 and 40 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.

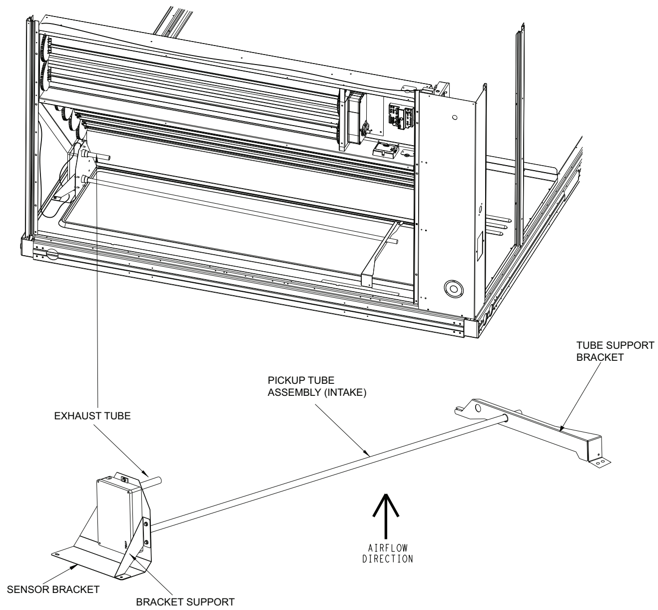



**Fig. 39 — Vertical Return Air Sampling Sensor Assembly and Tube Location (View reoriented to show opposite side for clarity.)**

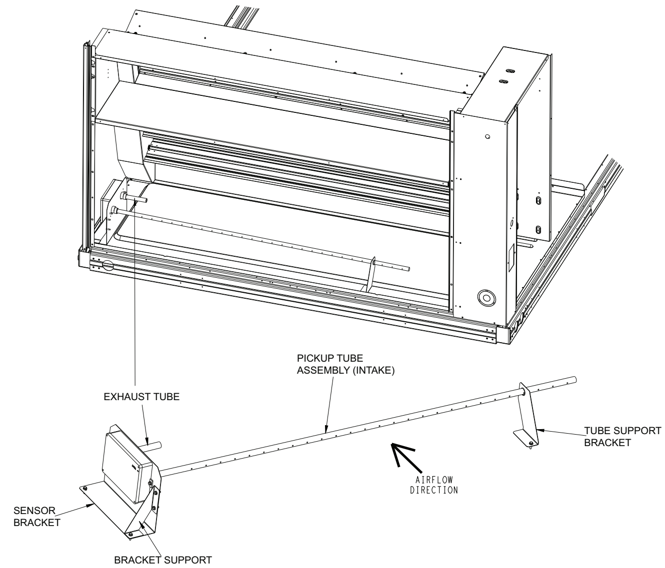



**Fig. 40 — Horizontal Return Air Sampling Sensor Assembly and Tube Location (View reoriented to show opposite side for clarity.)**

## 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. 41, 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.

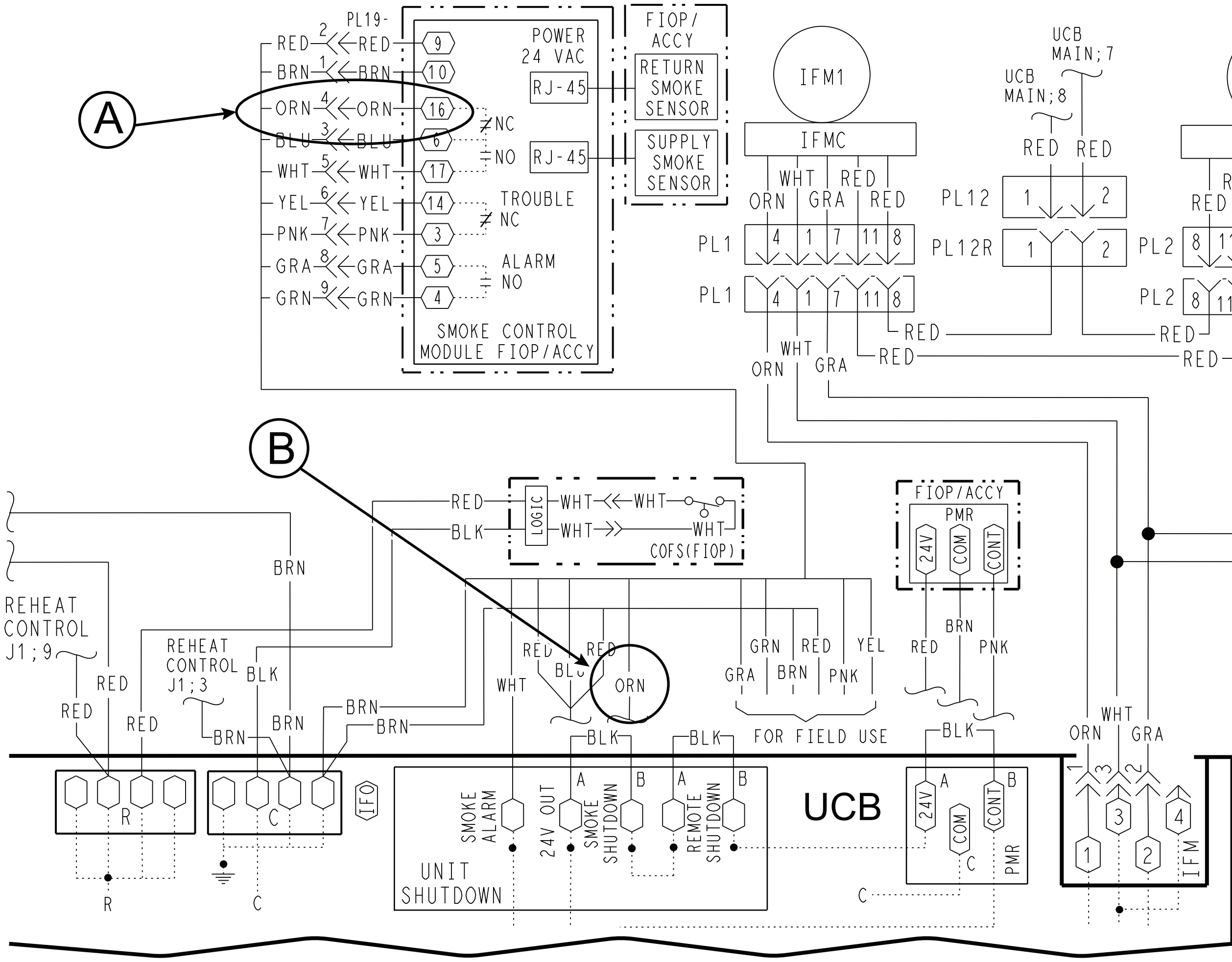



**Fig. 41 — Typical Smoke Detector System Wiring**

## 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. 42 and configured to operate the controller's supervision relay. For more information, see "Dirty Sensor Test" on page 33.

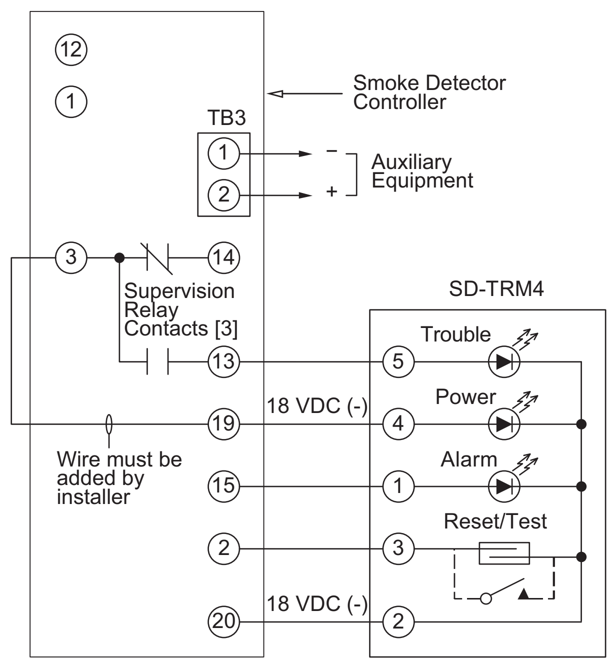



**Fig. 42 — Remote Test/Reset Station Connections**

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. 43.
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.

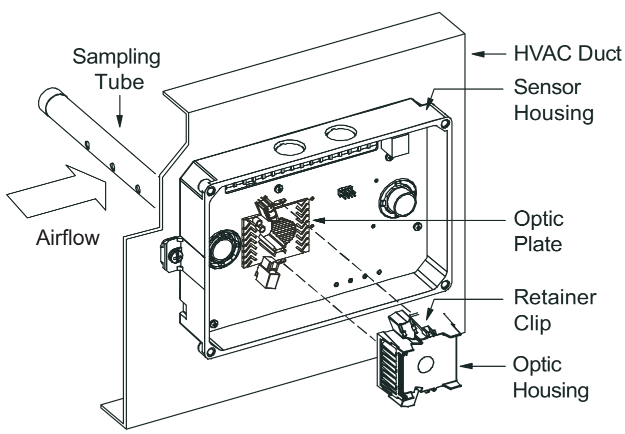



**Fig. 43 — Sensor Cleaning Diagram**

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. 44.)
- 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 |
|---|---|
| **Magnetic test/ reset switch** | Resets the sensor when it is in the alarm or trouble state. Activates or tests the sensor when it is in the normal state. |
| **Alarm LED** | Indicates the sensor is in the alarm state. |
| **Trouble LED** | Indicates the sensor is in the trouble state. |
| **Dirty LED** | Indicates the amount of environmental compensation used by the sensor (flashing continuously = 100%) |
| **Power LED** | Indicates the sensor is energized. |

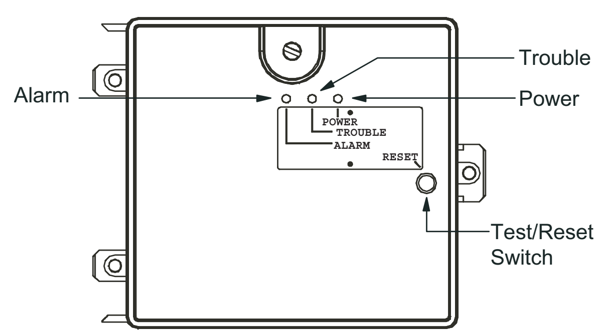



**Fig. 44 — Controller Assembly**

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. 42. 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 33.

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. 45.

The switch opens to prevent mechanical cooling operation at low return temperatures (below 60°F [+/- 1.5°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 (+/-1.5°F) allowing compressor operation to resume.

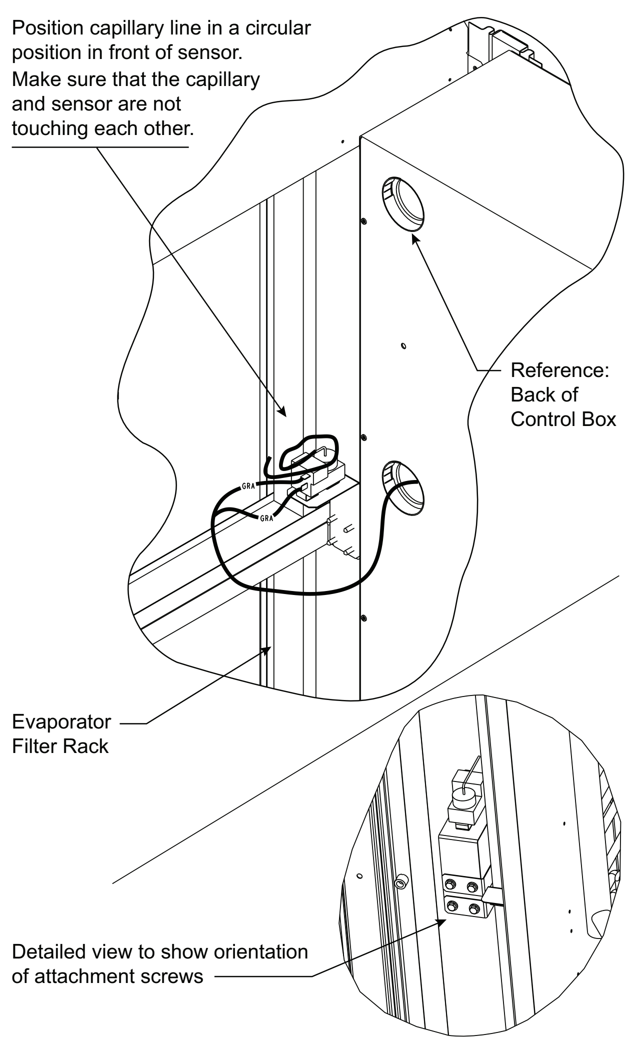



**Fig. 45 — Mixed Temperature Sensor Location**

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 ± 10 psig (4344 ± 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 ± 5 psig (372 ± 34 kPa). Reset is automatic at 117 ± 5 psig (807 ± 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 ± 5°F (–1°C ± 3°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.<br>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.<br>If motor detects 3 consecutive faults, the motor waits 3 minutes and restarts.<br>Cycle starts again after 20 seconds. |
| **Locked Rotor Protection, Running** | |
| **Over/Under Voltage** | Automatic Reset – Motor restarts as soon as input voltage is back within +/-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. |
| | 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. 52) 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. 46.)

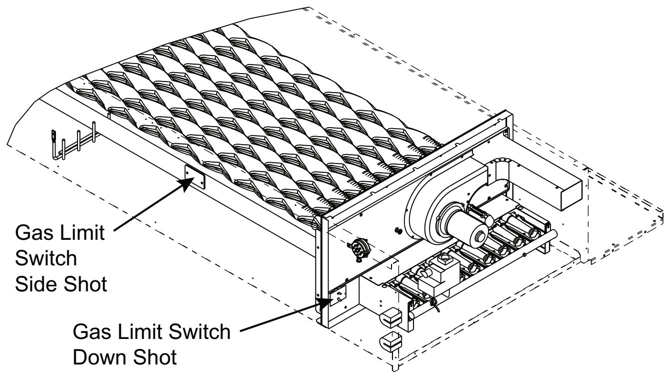



**Fig. 46 — Gas Limit Switch Location**

### 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 (1246 Pa) | 13.0 in. wg (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 (748 Pa) | 2.0 in. wg (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 (2740 Pa) | 13.0 in. wg (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 (2740 Pa) | 7.3 in. wg (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. 47 and 48. 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.

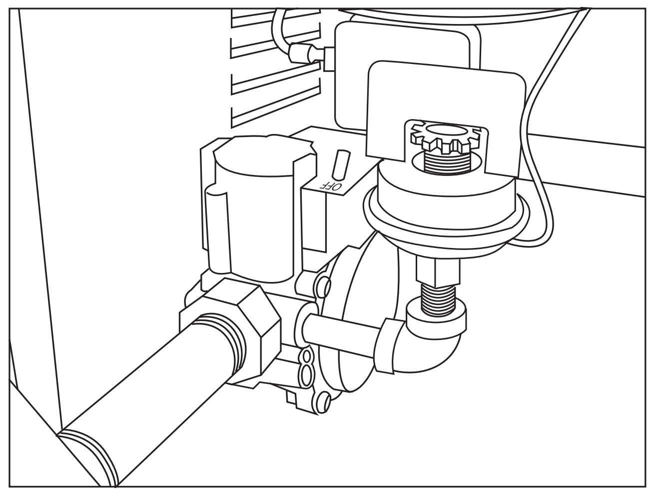



**Fig. 47 — LP Low Pressure Switch (Installed)**

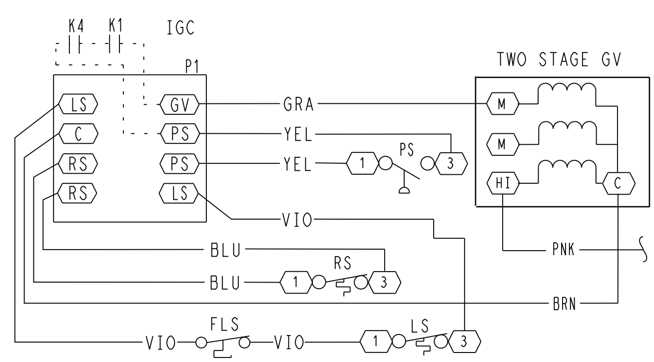



**Fig. 48 — LP Supply Line Low Pressure Switch Wiring**

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. 49.
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. 51) and slide out the panel.
2. Remove the seven screws attaching the induced-draft motor housing to the vestibule plate. (See Fig. 49.)
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.

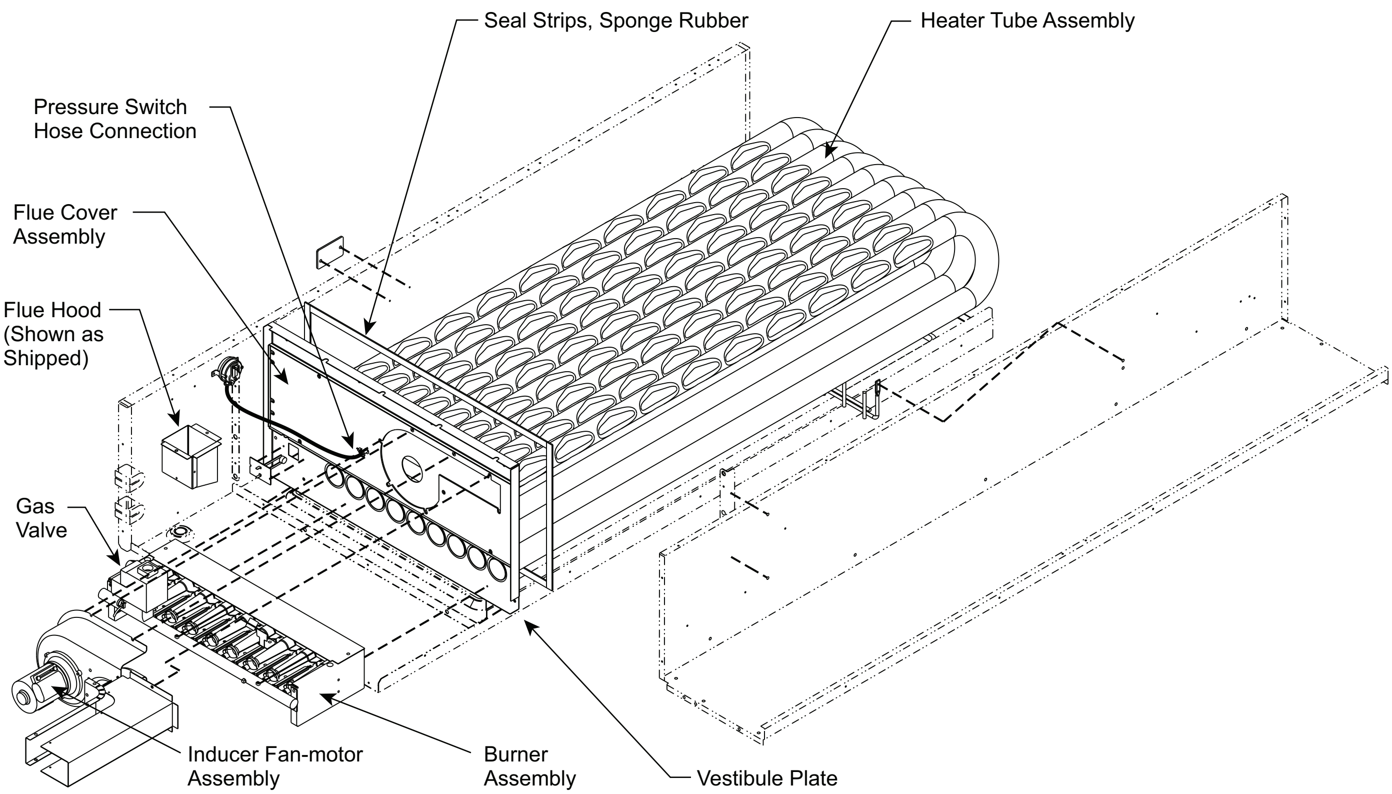



**Fig. 49 — Heat Exchanger Assembly**

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. 50 for maximum projection dimension for orifice face to manifold tube.

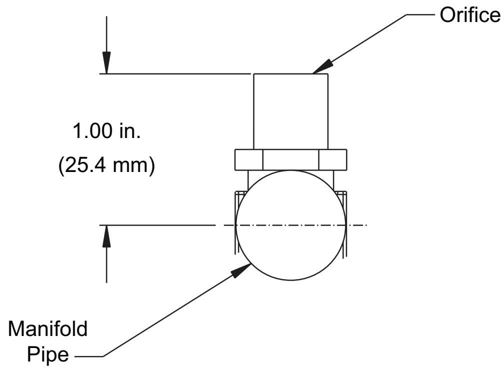



**Fig. 50 — Orifice Projection**

REMOVAL AND REPLACEMENT OF GAS TRAIN

See Fig. 49, 51, 52, 53 and 54.

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. 53) 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. 54.)
9. Remove the two screws attaching the burner rack to the vestibule plate (see Fig. 49).
10. Slide the burner tray out of the unit. (See Fig. 52.)
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. 55.)
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. 50.)
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.

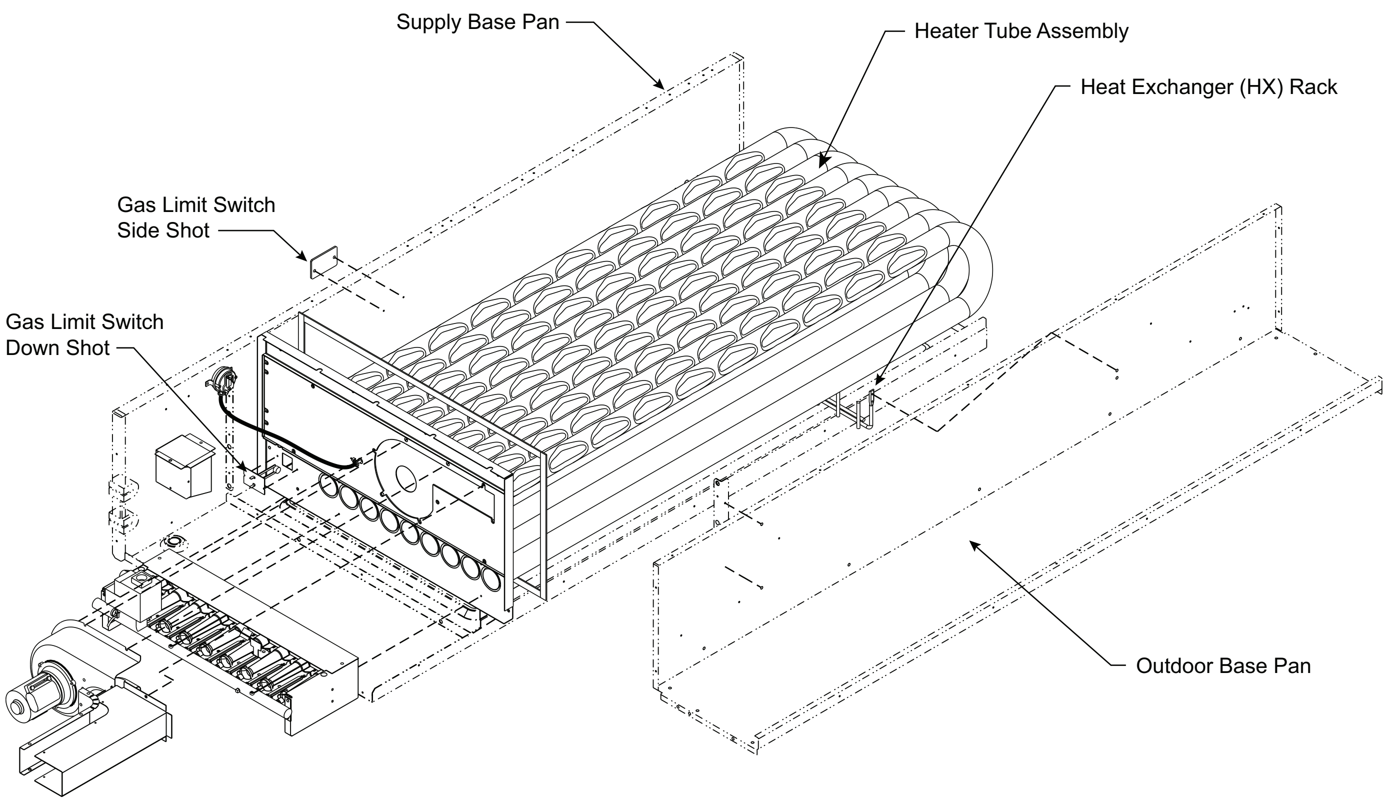



**Fig. 51 — Heat Exchanger Access - Gas Limit Switches and HX Rack Locations**

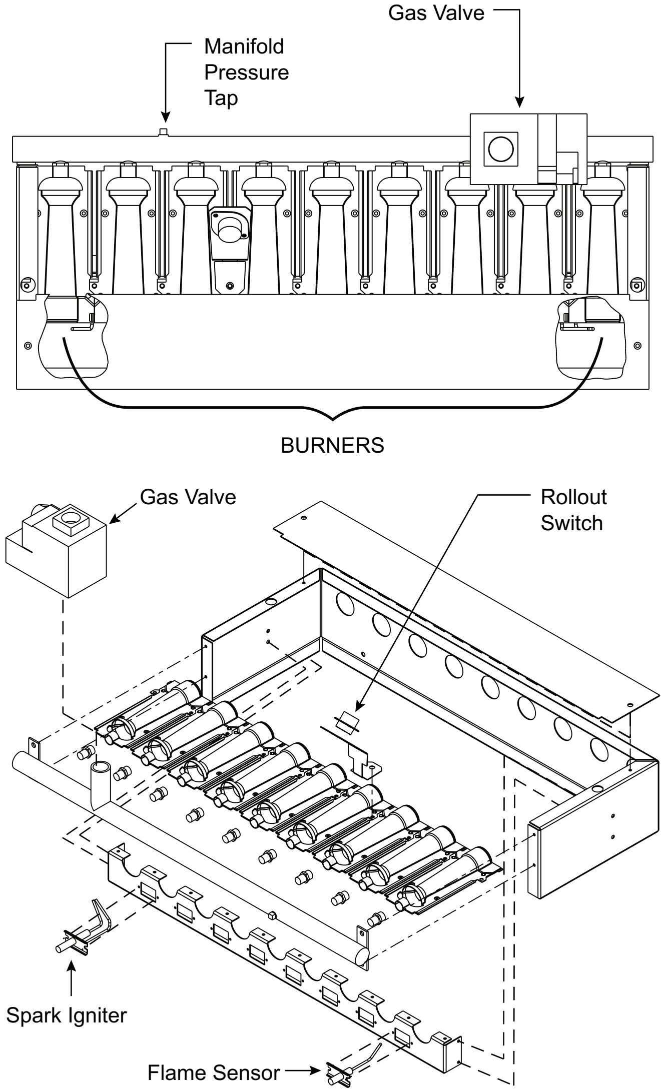



**Fig. 52 — Burner Tray Details**

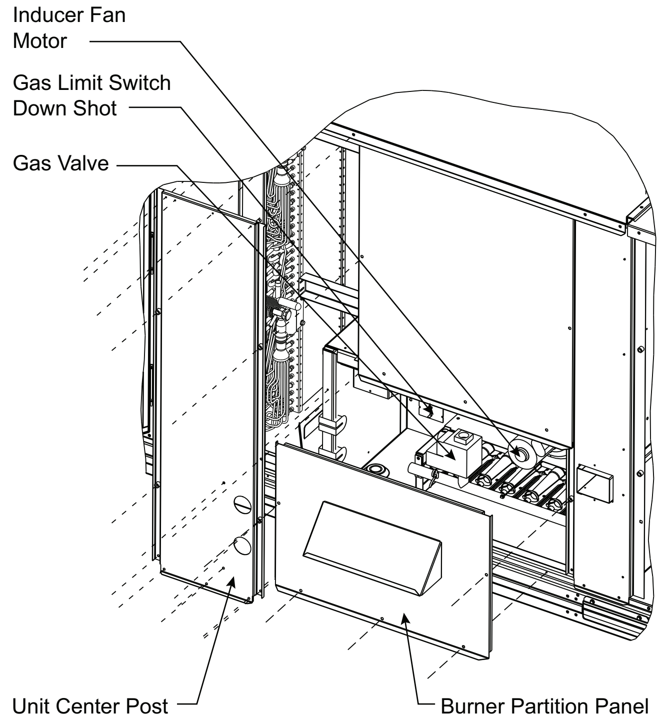



**Fig. 53 — Burner Partition Pane and Unit Center Post**

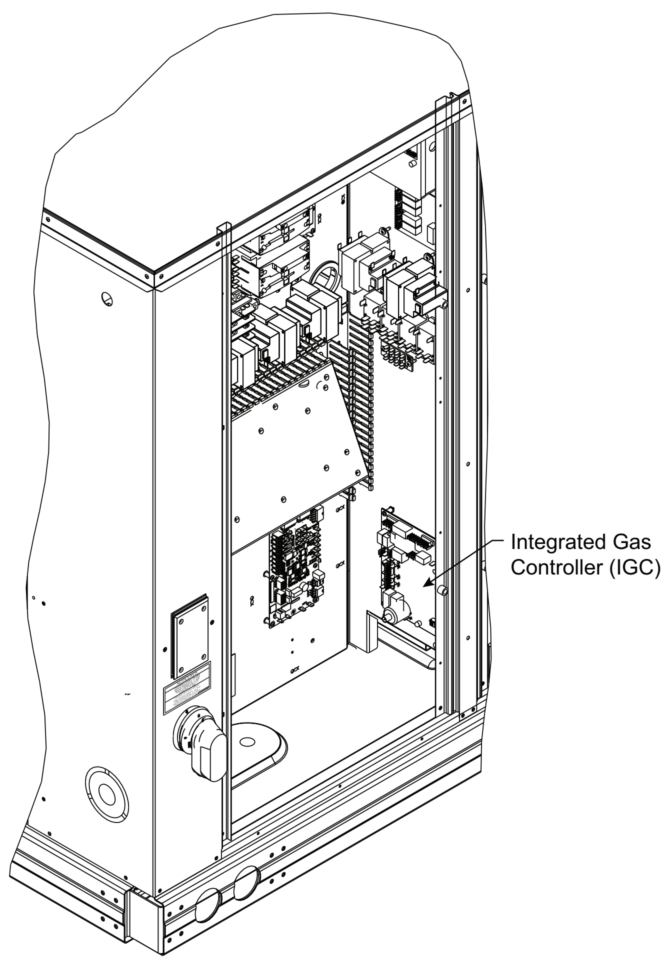



**Fig. 54 — Unit Control Box/IGC Location**

REMOVING THE HEAT EXCHANGER

The following procedure details the steps to remove the heat exchanged 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. 53).
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. 49).
10. Remove the pressure switch hose from the connection on the flue cover assembly (see Fig. 49).
11. Remove the screws around the vestibule plate.
12. Remove the nuts holding the heat exchanger support rack to the fan deck (see Fig. 51).
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.

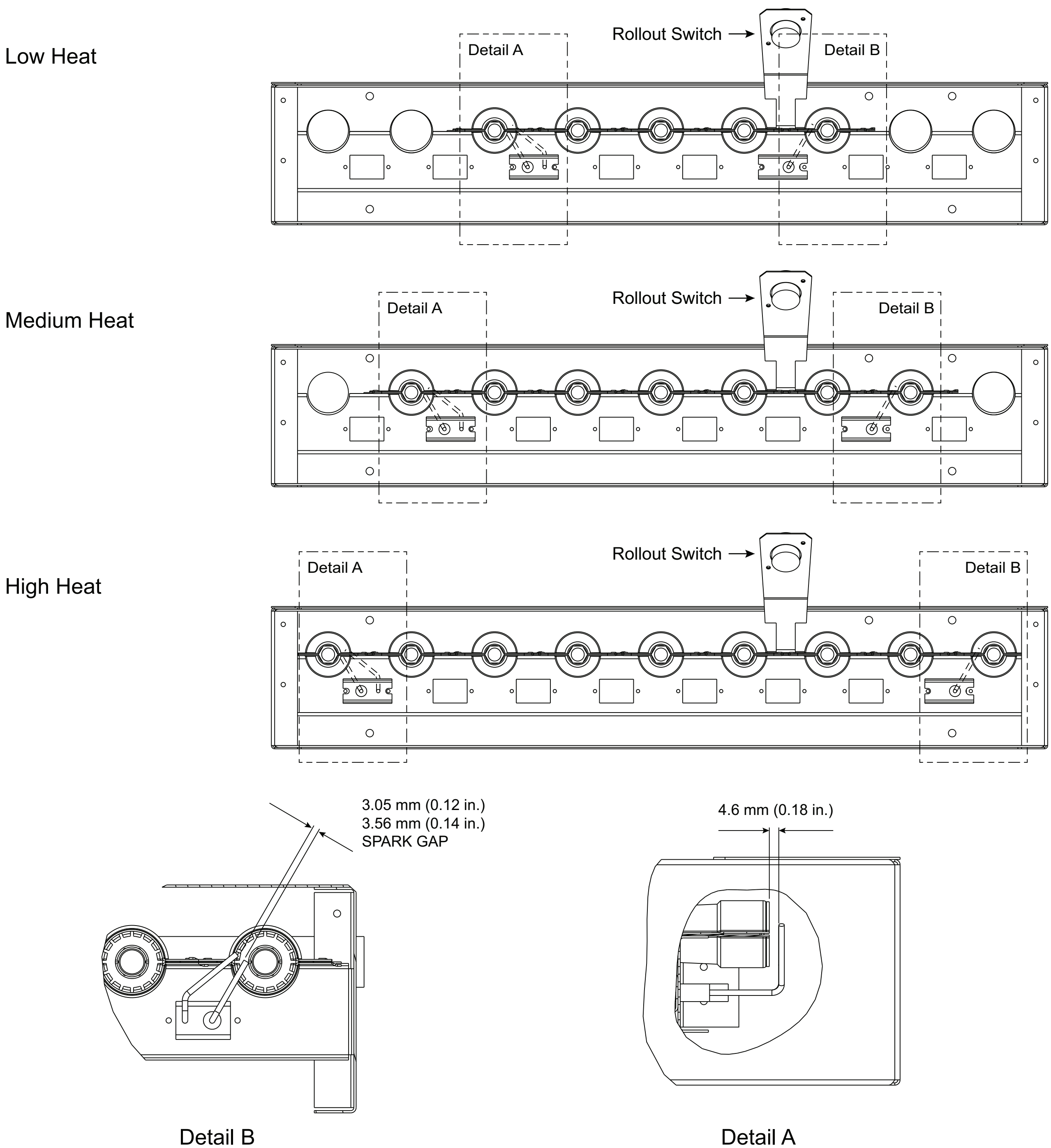



**Fig. 55 — Spark Adjustment**

GAS VALVE

All three-phase models are equipped with 2-stage gas valves. See Fig. 56 for locations of adjustment screws and features on the gas valve.

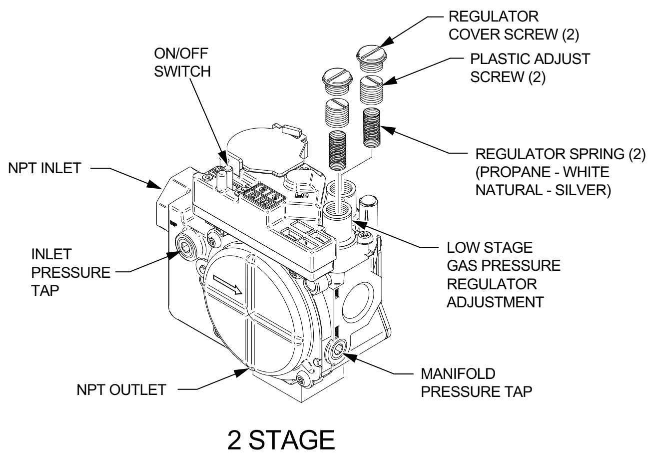



**Fig. 56 — Typical 2 Stage Gas Valve**

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. 52.)
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. 52.)

LIMIT SWITCH

Remove the indoor blower access panel. Limit switch is located on the heat exchanger cover panel. See Fig. 51.

## 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. 54). The IGC contains a self-diagnostic LED (light-emitting diode). A single LED (see Fig. 57) 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[a]**

| LED INDICATION | ERROR CODE DESCRIPTION |
|---|---|
| ON | Normal Operation |
| OFF | Hardware Failure |
| 1 Flash[b] | 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/ 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. 50.

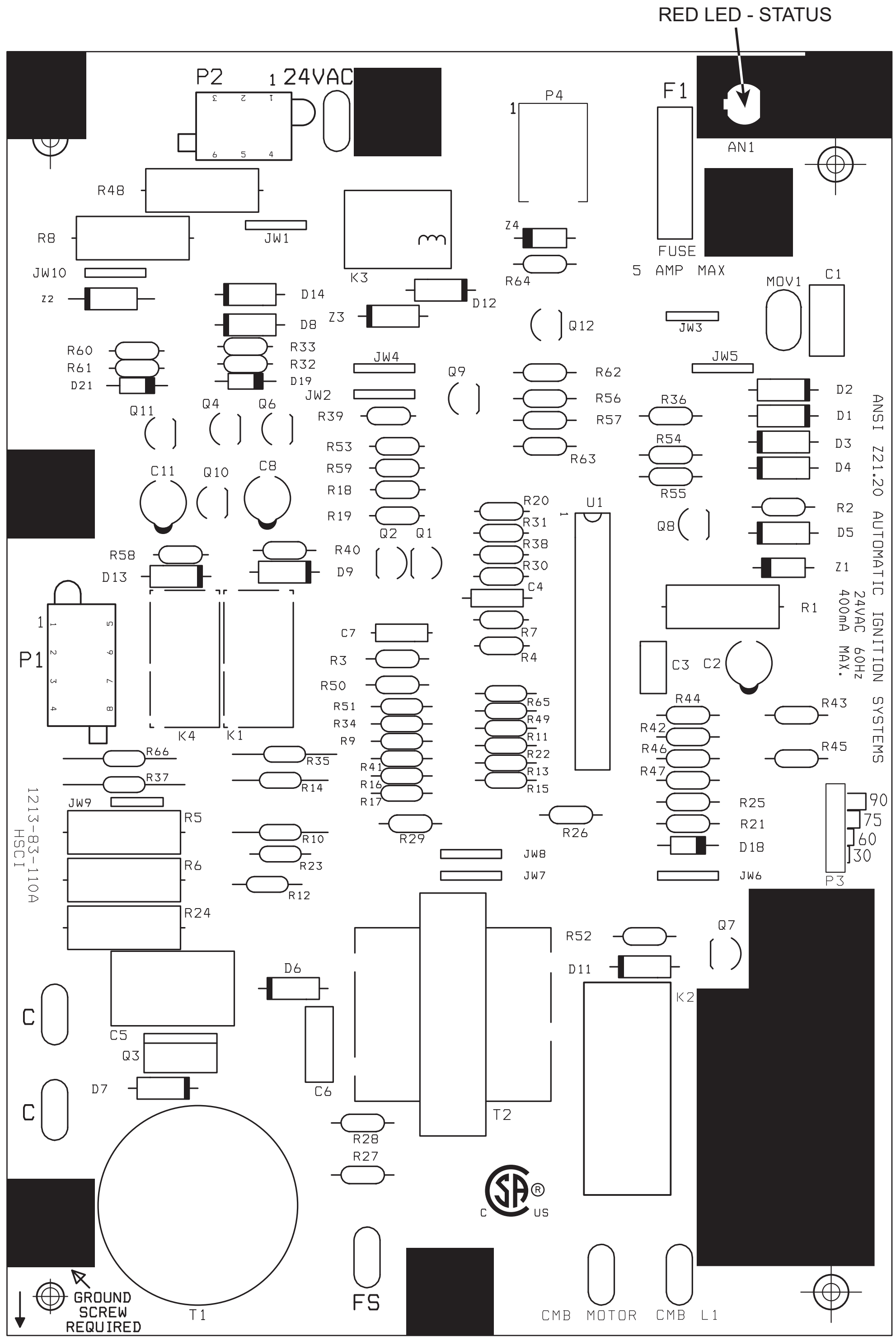



**Fig. 57 — Integrated Gas Control (IGC) Board**

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. 58. 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.

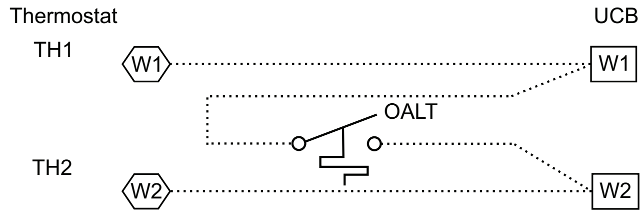



**Fig. 58 — OATL Connections**

## Troubleshooting Heating System

Refer to Tables 10 and 11 for additional troubleshooting topics.

**Table 10 — Heating Service Troubleshooting**

| PROBLEM | CAUSE | REMEDY |
|---|---|---|
| **Burners Will Not Ignite.** | 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. |
| | | 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. |
| **Inadequate Heating.** | 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. |
| | | Check economizer operation. |
| **Poor Flame Characteristics.** | 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. |
| | | Check orifice to burner alignment. |
| **Burners Will Not Turn Off.** | 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 [a,b,c,d]

| LED FLASH CODE | DESCRIPTION | ACTION TAKEN BY CONTROL | RESET METHOD | PROBABLE CAUSE |
|---|---|---|---|---|
| **On** | Normal Operation | — | — | — |
| **Off** | Hardware Failure | No gas heating. | — | Loss of power to the IGC. Check 5 amp fuse on IGC, power to unit, 24V circuit breaker, transformer, and wiring to the IGC. |
| **1 Flash** | Indoor Fan On/Off Delay Modified | 5 seconds subtracted from On delay. | Power reset. | High temperature limit switch opens during heat exchanger warm-up period before fan-on delay expires. |
| **2 Flashes** | 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.<br>Ensure that the supply-air temperature rise is within the range on the unit nameplate. Check wiring and limit switch operation. |
| **3 Flashes** | 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. |
| **4 Flashes** | Four Consecutive Limit Switch Fault | No gas heating. | Heat call (W) Off. Power reset for LED reset. | 4 consecutive limit switch faults within a single call for heat. See Limit Switch Fault. |
| **5 Flashes** | Ignition Fault | No gas heating. | Heat call (W) Off. Power reset for LED reset. | Unit unsuccessfully attempted ignition for 15 minutes.<br>Check igniter and flame sensor electrode spacing, gaps, etc. Check flame sense and igniter wiring. Check gas valve operation and gas supply. |
| **6 Flashes** | Induced Draft Motor Fault/Pressure Switch Fault | If heat off: no gas heating. 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 Pressure Switch. |
| **7 Flashes** | 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. |
| **8 Flashes** | 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. |
| **9 Flashes** | Temporary Software Lockout | No gas heating. | 1 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, 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 inducer pressure switch is stuck closed, then the unit will sit idle and do nothing, with 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[1] 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. 59.

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.”

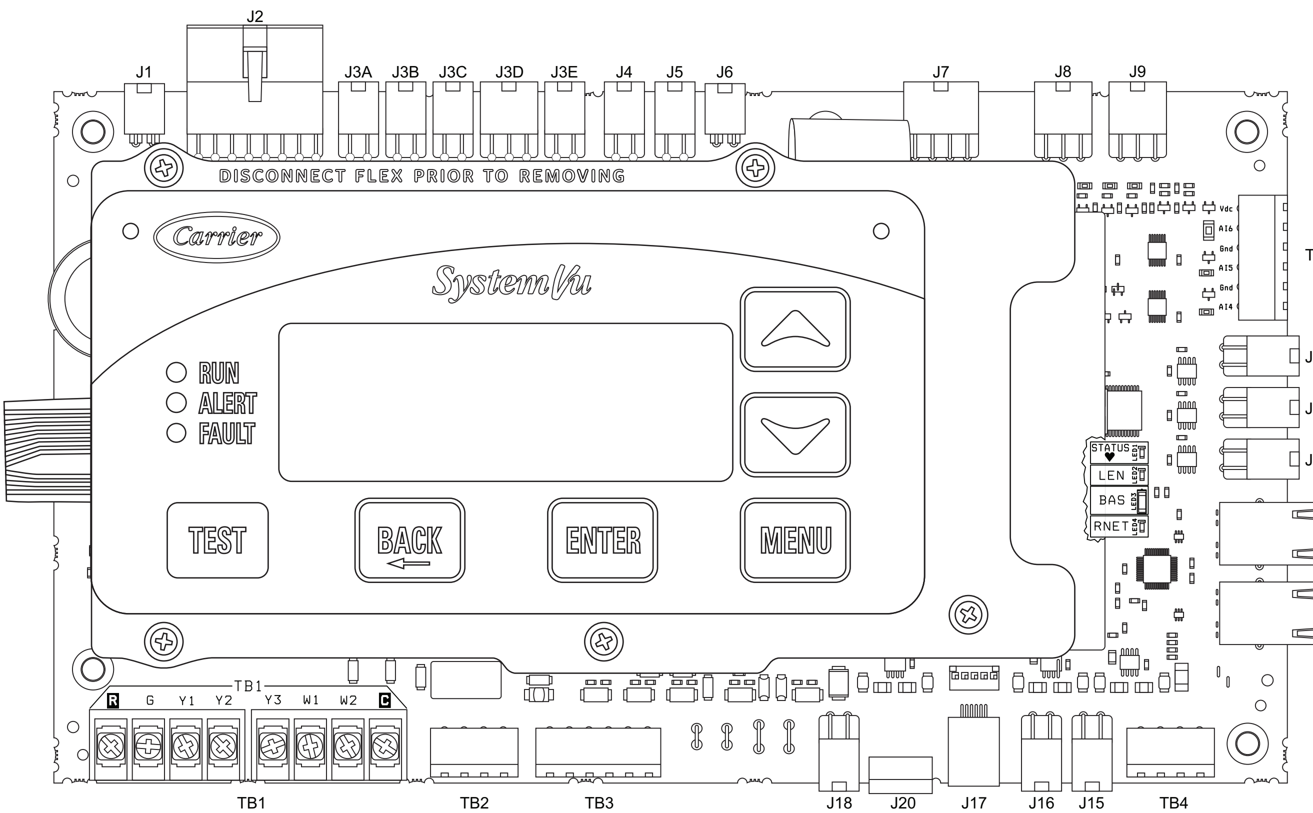



Fig. 59 — SystemVu Control

## ECONOMIZER SYSTEMS

The unit may be equipped with a factory-installed or accessory (field-installed) economizer system. Three types are available: two with logic control systems (EconoMi$er®X and EconoMi$er IV) and one without a control system (EconoMi$er2). See Fig. 60-62 for 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.

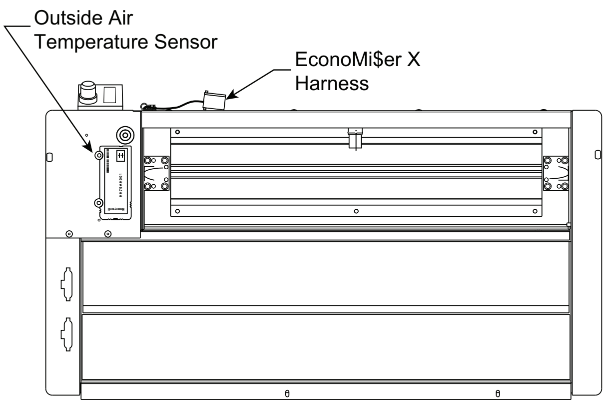



**Fig. 60 — EconoMi$er X Component Locations**

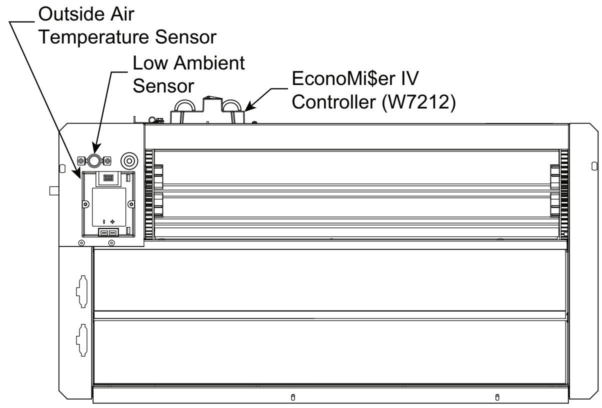



**Fig. 61 — EconoMi$er IV Component Locations**

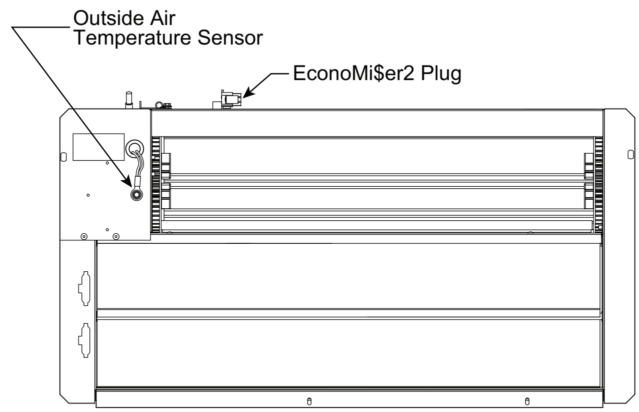



**Fig. 62 — EconoMi$er2 Component Locations**

## 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.

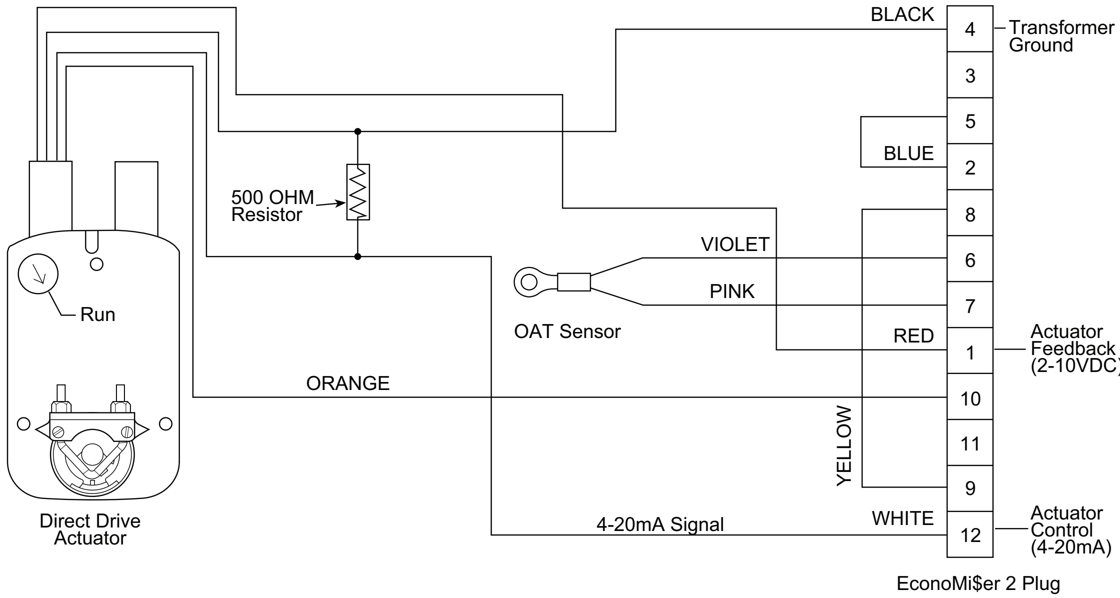



**Fig. 63 — EconoMi$er2 with 4 to 20 mA Control Wiring**

## EconoMi$er IV (Field-Installed Accessory)

> IMPORTANT: For 48FC*20-30 rooftop units EconoMi$er IV is available as a field-installed accessory only.

ECONOMI$ER IV STANDARD SENSORS

Troubleshooting instructions are enclosed. A functional view of the EconoMi$er® IV accessory is shown in Fig. 64. Typical settings, sensor ranges, and jumper positions are also shown. An EconoMi$er IV simulator program is available to help with EconoMi$er IV training and troubleshooting. See Table 12 for further details.

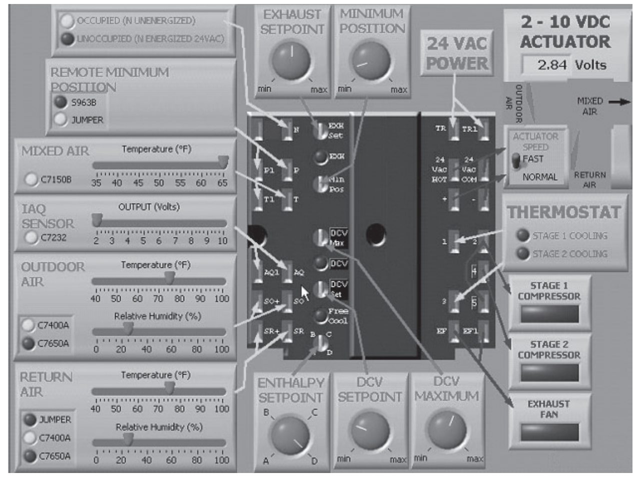



**Fig. 64 — EconoMi$er IV Functional View**

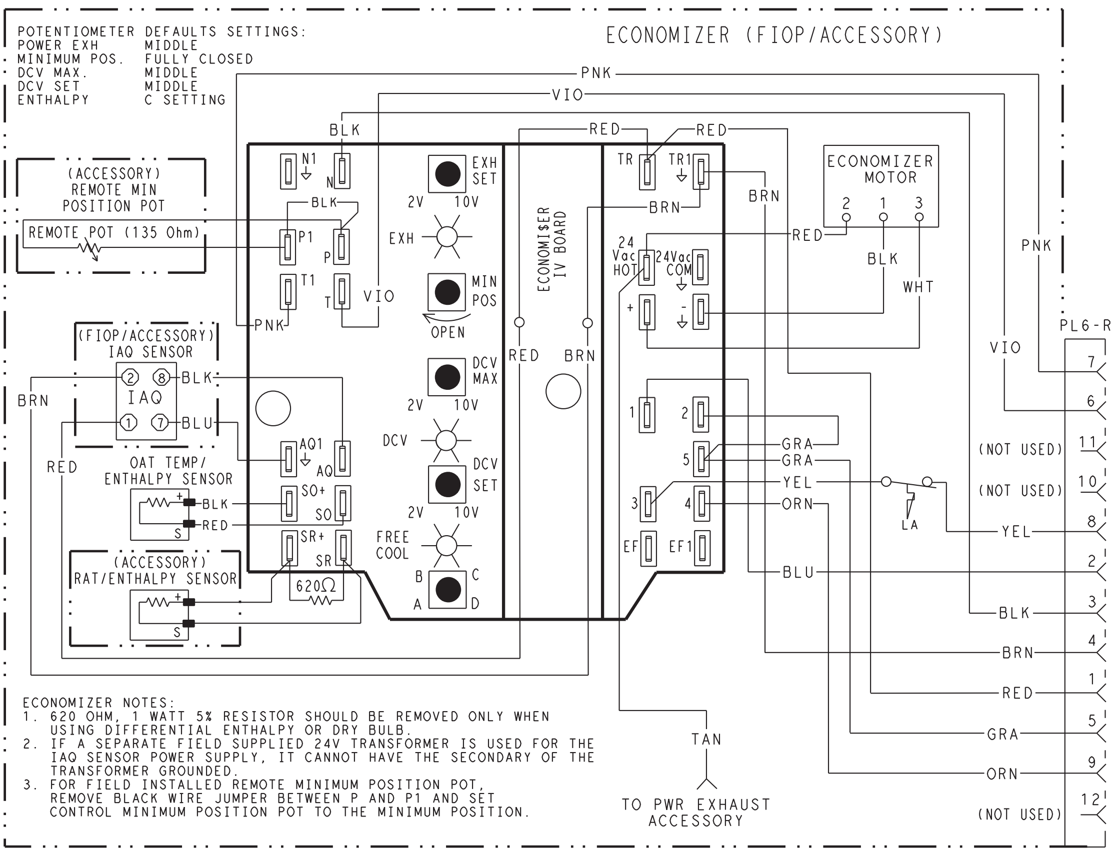



**Fig. 65 — Typical EconoMi$er IV (W7212 Controller) Wiring**

LEGEND

| | | |
|---|---|---|
| **DCV** | — | Demand Controlled Ventilation |
| **IAQ** | — | Indoor Air Quality |
| **LA** | — | Low Ambient Lockout Device |
| **OAT** | — | Outdoor-Air Temperature |
| **POT** | — | Potentiometer |
| **RAT** | — | Return-Air Temperature |

### Table 12 — EconoMi$er IV Input/Output Logic

| INPUTS | | | | | OUTPUTS | | | |
|---|---|---|---|---|---|---|---|---|
| **Demand Controlled Ventilation (DCV)** | **Enthalpy[a]** | | **Y1** | **Y2** | **Compressor** | | **N Terminal[b]** | |
| | **Outdoor** | **Return** | | | **Stage 1** | **Stage 2** | **Occupied** | **Unoccupied** |
| **Below Set (DCV LED Off)** | High (Free Cooling LED Off) | Low | On | On | On | On | Minimum position | Closed |
| | | | On | Off | On | Off | | |
| | | | Off | Off | Off | Off | | |
| | Low (Free Cooling LED On) | High | On | On | On | Off | Modulating[c] (between min. position and full-open) | Modulating[c] (between closed and full-open) |
| | | | On | Off | Off | Off | | |
| | | | Off | Off | Off | Off | Minimum position | Closed |
| **Above Set (DCV LED On)** | High (Free Cooling LED Off) | Low | On | On | On | On | Modulating[d] (between min. position and DCV maximum) | Modulating[d] (between closed and DCV maximum) |
| | | | On | Off | On | Off | | |
| | | | Off | Off | Off | Off | | |
| | Low (Free Cooling LED On) | High | On | On | On | Off | Modulating[e] | Modulating[f] |
| | | | On | Off | Off | Off | | |
| | | | Off | Off | Off | Off | | |

NOTE(S):

a. For single enthalpy control, the module compares outdoor enthalpy to the ABCD set point.
b. Power at N terminal determines Occupied/Unoccupied setting: 24 vac (Occupied), no power (Unoccupied).
c. Modulation is based on the supply-air sensor signal.
d. Modulation is based on the DCV signal.
e. Modulation is based on the greater of DCV and supply-air sensor signals, between minimum position and either maximum position (DCV) or fully open (supply-air signal).
f. Modulation is based on the greater of DCV and supply-air sensor signals, between closed and either maximum position (DCV) or fully open (supply-air signal).

*Outdoor Air Temperature (OAT) Sensor*

The outdoor air temperature sensor (HH57AC074) is a 10 to 20 mA device used to measure the outdoor-air temperature. The outdoor-air temperature is used to determine when the EconoMi$er IV can be used for free cooling. The sensor has 8 selectable temperature changeover setpoints, ranging from 48°F to 78°F. The temperature changeover is set using the 3 dip switches on the sensor See Fig. 66.

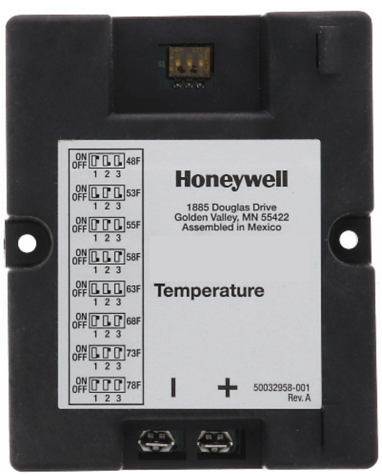



**Fig. 66 — C7660 Temperature Sensor**

*Supply Air Temperature (SAT) Sensor*

The supply air temperature sensor is a field-installed 3 K thermistor and is installed through the heat section partition extending into the supply airstream. See Fig. 67. The operating range of temperature measurement is 0°F to 158°F (–18°C to 70°C). See Table 13 for sensor temperature/resistance values.

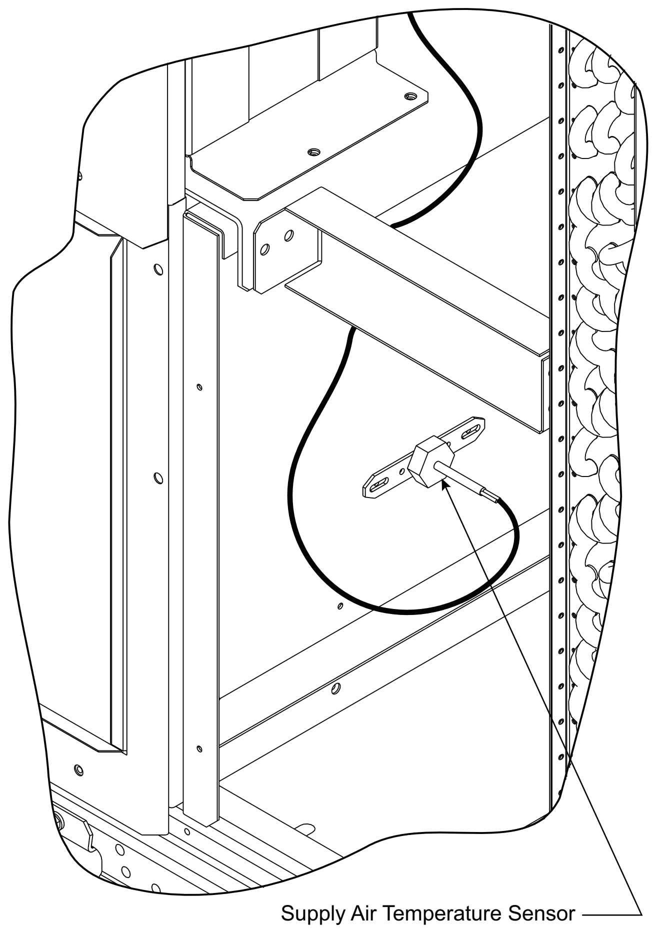



**Fig. 67 — Supply Air Temperature Sensor Location**

The temperature sensor looks like an eyelet terminal with wires running to it. The sensor is located in the "crimp end" and is sealed from moisture.

*Outdoor Air Lockout Sensor*

The EconoMi$er IV is equipped with an ambient temperature lockout switch located in the outdoor airstream which is used to lock out the compressors below a 42°F (6°C) ambient temperature. See Fig. 61 on page 47.

**Table 13 — Supply Air Sensor Temperature/Resistance Values**

| TEMPERATURE (F) | RESISTANCE (ohms) |
|---|---|
| **–58** | 220,250 |
| **–40** | 100,000 |
| **–22** | 53,010 |
| **–4** | 29,091 |
| **14** | 16,500 |
| **32** | 9,795 |
| **50** | 5,970 |
| **68** | 3,747 |
| **77** | 3,000 |
| **86** | 2,416 |
| **104** | 1,597 |
| **122** | 1,080 |
| **140** | 746 |
| **158** | 525 |
| **176** | 376 |
| **185** | 321 |
| **194** | 274 |
| **212** | 203 |
| **230** | 153 |
| **248** | 116 |
| **257** | 102 |
| **266** | 89 |
| **284** | 70 |
| **302** | 55 |

ECONOMI$ER IV CONTROL MODES

Determine the EconoMi$er® IV control mode before set up of the control. Some modes of operation may require different sensors. The EconoMi$er IV accessory is supplied from the factory with a supply-air temperature sensor and an outdoor-air temperature sensor. This allows for operation of the EconoMi$er IV with outdoor air dry bulb changeover control. Additional accessories can be added to allow for different types of changeover control and operation of the EconoMi$er IV and unit.

*Outdoor Dry Bulb Changeover*

The standard controller is shipped from the factory configured for outdoor dry bulb changeover control. For this control mode, the outdoor temperature is compared to a selectable set point on the OAT sensor. If the outdoor air temperature is above the set point, the EconoMi$er IV will adjust the outdoor air dampers to minimum position. If the outdoor air temperature is below the set point, the position of the outdoor air dampers will be controlled to provide free cooling using outdoor air. When in this mode, the Free Cool LED next to the outdoor enthalpy set point (ABCD) potentiometer will be on. The changeover temperature set point is controlled by the dip switches on the sensor. See Fig. 68 for the switch positions corresponding to the temperature changeover values. The ABCD potentiometer on the controller should be turned fully clockwise (CW) to the "D" position. See Fig. 69 for damper leakage.

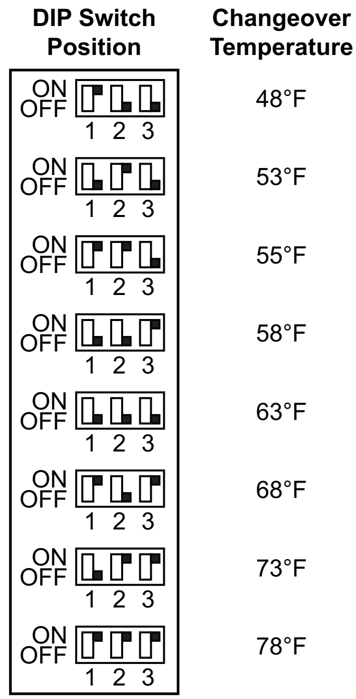



**Fig. 68 — Outdoor Air Temperature Changeover Set Points**

*Outdoor Enthalpy Changeover*

For enthalpy control, accessory enthalpy sensor (P/N: HH57AC078) is required. Replace the standard outdoor dry bulb temperature sensor with the accessory enthalpy sensor in the same mounting location. See Fig. 70. When the outdoor air enthalpy rises above the outdoor enthalpy changeover set point, the outdoor-air damper moves to its minimum position. The outdoor enthalpy changeover set point is set with the outdoor enthalpy set point potentiometer on the EconoMi$er IV controller. The set points are A, B, C, and D. See Fig. 71 and 72. The factory-installed 620-ohm jumper must be in place across terminals $S_R$ and SR+ on the EconoMi$er IV controller.

*Differential Enthalpy Control*

For differential enthalpy control, the EconoMi$er IV controller uses two enthalpy sensors (HH57AC078 and CRENTDIF004A00), one in the outside air and one in the return air duct. The EconoMi$er IV controller compares the outdoor air enthalpy to the return air enthalpy to determine EconoMi$er IV use. The controller selects the lower enthalpy air (return or outdoor) for cooling. For example, when the outdoor air has a lower enthalpy than the return air, the EconoMi$er IV opens to bring in outdoor air for free cooling.

Replace the standard outside air dry bulb temperature sensor with the accessory enthalpy sensor in the same mounting location. See Fig. 61 on page 47. Mount the return air enthalpy sensor in the return air duct. See Fig. 70. Wiring is provided in the EconoMi$er IV wiring harness. See Fig. 65 on page 49. The outdoor enthalpy changeover set point is set with the outdoor enthalpy set point potentiometer on the EconoMi$er IV controller. When using this mode of changeover control, turn the enthalpy set point potentiometer fully clockwise to the D setting. See Fig. 71 and 72.

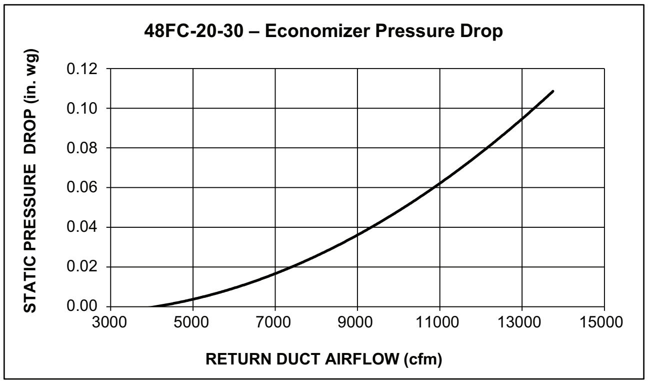



**Fig. 69 — Economizer Static Pressure Drop**

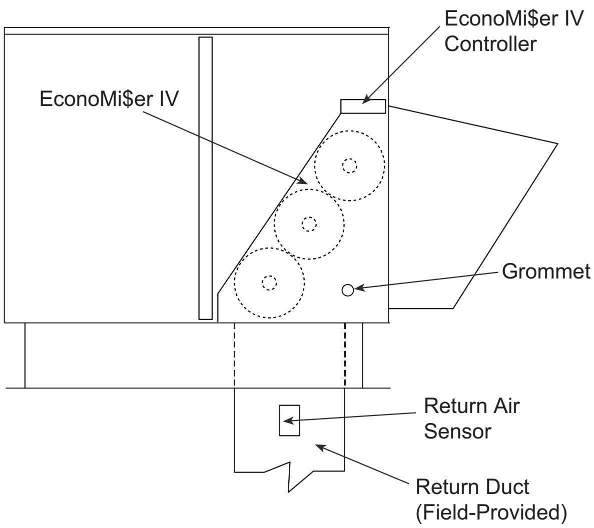



**Fig. 70 — Return Air Temperature or Enthalpy Sensor Mounting Location**

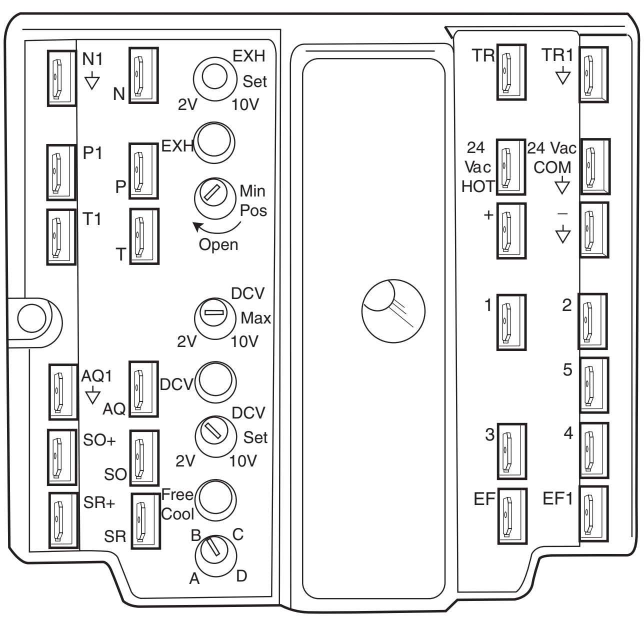



**Fig. 71 — EconoMi$er® IV W7212 Control**

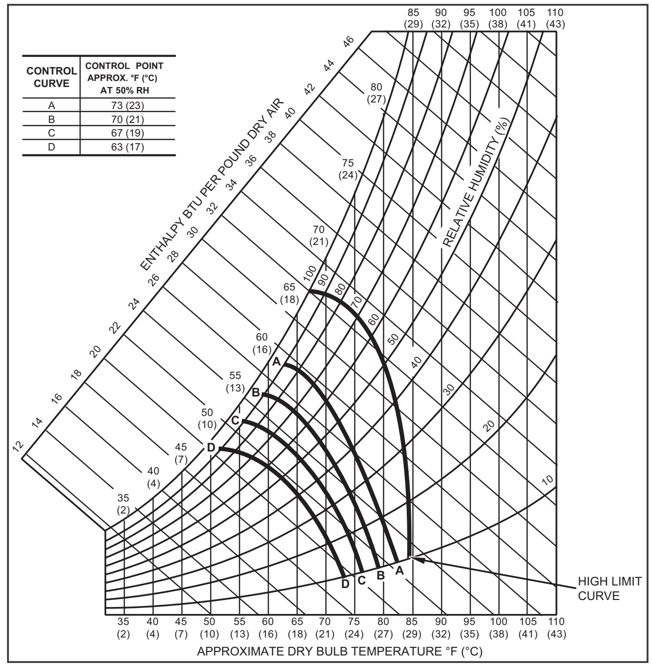



**Fig. 72 — Enthalpy Changeover Set Points**

### *Indoor Air Quality (IAQ) Sensor Input*

The IAQ input can be used for demand controlled ventilation control based on the level of $CO_2$ measured in the space or return air duct.

Mount the accessory IAQ sensor according to manufacturer specifications. The IAQ sensor should be wired to the AQ and AQ1 terminals of the controller. Adjust the DCV potentiometers to correspond to the DCV voltage output of the indoor air quality sensor at the user-determined set point. See Fig. 73.

If a separate field-supplied transformer is used to power the IAQ sensor, the sensor must not be grounded or the EconoMi$er® IV control board will be damaged.

When using demand controlled ventilation, the minimum damper position represents the minimum ventilation position for VOC (volatile organic compounds) ventilation requirements. The maximum demand ventilation position is used for fully occupied ventilation.

When demand controlled ventilation is not being used, the minimum position potentiometer should be used to set the occupied ventilation position. The maximum demand ventilation position should be turned fully clockwise.

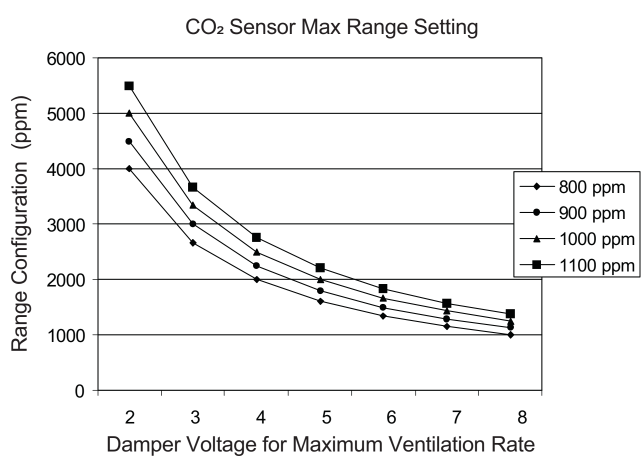



**Fig. 73 — $CO_2$ Sensor Maximum Range Settings**

*Exhaust Set Point Adjustment*

The exhaust set point will determine when the exhaust fan runs based on damper position (if accessory power exhaust is installed). The set point is modified with the Exhaust Fan set point (EXH SET) potentiometer. See Fig. 71. The set point represents the damper position above which the exhaust fans will be turned on. When there is a call for exhaust, the EconoMi$er IV controller provides a 45 ± 15 second delay before exhaust fan activation to allow the dampers to open. This delay allows the damper to reach the appropriate position to avoid unnecessary fan overload.

*Minimum Position Control*

There is a minimum damper position potentiometer on the EconoMi$er IV controller. See Fig. 71. The minimum damper position maintains the minimum airflow into the building during the occupied period.

When using demand controlled ventilation, the minimum damper position represents the minimum ventilation position for Volatile Organic Compound (VOC) ventilation requirements. The maximum demand ventilation position is used for fully occupied ventilation.

When demand controlled ventilation is not being used, the minimum position potentiometer should be used to set the occupied ventilation position. The maximum demand ventilation position should be turned fully clockwise.

Adjust the minimum position potentiometer to allow the minimum amount of outdoor air, as required by local codes, to enter the building. Make minimum position adjustments with at least 10°F temperature difference between the outdoor and return-air temperatures.

To determine the minimum position setting, perform the following procedure:

1. Calculate the appropriate mixed air temperature using the following formula:

$$(T_O \times \frac{OA}{100}) + (T_R \times \frac{RA}{100}) = T_M$$

$T_O$ = Outdoor-Air Temperature

OA= Percent of Outdoor Air

$T_R$ = Return-Air Temperature

RA= Percent of Return Air

$T_M$ = Mixed-Air Temperature

As an example, if local codes require 10% outdoor air during occupied conditions, outdoor-air temperature is 60°F, and return-air temperature is 75°F.

(60 x 0.10) + (75 x 0.90) = 73.5°F

2. Disconnect the supply air sensor from terminals T and T1.
3. Ensure that the factory-installed jumper is in place across terminals P and P1. If remote damper positioning is being used, make sure that the terminals are wired according to Fig. 66 and that the minimum position potentiometer is turned fully clockwise.
4. Connect 24 vac across terminals TR and TR1.
5. Carefully adjust the minimum position potentiometer until the measured mixed air temperature matches the calculated value.
6. Reconnect the supply air sensor to terminals T and T1.

Remote control of the EconoMi$er IV damper is desirable when requiring additional temporary ventilation. If a field-supplied remote potentiometer (Honeywell P/N: S963B1128) is wired to the EconoMi$er IV controller, the minimum position of the damper can be controlled from a remote location.

To control the minimum damper position remotely, remove the factory-installed jumper on the P and P1 terminals on the EconoMi$er IV controller. Wire the field-supplied potentiometer to the P and P1 terminals on the EconoMi$er IV controller. (See Fig. 71.)

*Damper Movement*

Damper movement from full open to full closed (or vice versa) takes 2-1/2 minutes.

*Thermostats*

The EconoMi$er® IV control works with conventional thermostats that have a Y1 (cool stage 1), Y2 (cool stage 2), W1 (heat stage 1), W2 (heat stage 2), and G (fan). The EconoMi$er® IV control does not support space temperature sensors. Connections are made at the thermostat terminal connection board located in the main control box.

*Occupancy Control*

The factory default configuration for the EconoMi$er IV control is occupied mode. Occupied status is provided by the black jumper from terminal TR to terminal N. When unoccupied mode is desired, install a field-supplied timeclock function in place of the jumper between TR and N. When the timeclock contacts are closed, the EconoMi$er IV control will be in occupied mode. When the timeclock contacts are open (removing the 24-v signal from terminal N), the EconoMi$er IV will be in unoccupied mode.

*Demand Controlled Ventilation (DCV)*

When using the EconoMi$er IV for demand controlled ventilation, there are some equipment selection criteria which should be considered. When selecting the heat capacity and cool capacity of the equipment, the maximum ventilation rate must be evaluated for design conditions. The maximum damper position must be calculated to provide the desired fresh air.

Typically the maximum ventilation rate will be about 5 to 10% more than the typical cfm required per person, using normal outside air design criteria.

A proportional anticipatory strategy should be taken with the following conditions: a zone with a large area, varied occupancy, and equipment that cannot exceed the required ventilation rate at design conditions. Exceeding the required ventilation rate means the equipment can condition air at a maximum ventilation rate that is greater than the required ventilation rate for maximum occupancy. A proportional-anticipatory strategy will cause the fresh air supplied to increase as the room $CO_2$ level increases even though the $CO_2$ set point has not been reached. By the time the $CO_2$ level reaches the set point, the damper will be at maximum ventilation and should maintain the set point.

In order to have the $CO_2$ sensor control the economizer damper in this manner, first determine the damper voltage output for minimum or base ventilation. Base ventilation is the ventilation required to remove contaminants during unoccupied periods. The following equation may be used to determine the percent of outside air entering the building for a given damper position. For best results, there should be at least a 10 degree difference in outside and return-air temperatures.

$$(T_O \times \frac{OA}{100}) + (T_R \times \frac{RA}{100}) = T_M$$

$T_O$ = Outdoor-Air Temperature

OA= Percent of Outdoor Air

$T_R$ = Return-Air Temperature

RA= Percent of Return Air

$T_M$ = Mixed-Air Temperature

Once base ventilation has been determined, set the minimum damper position potentiometer to the correct position.

The same equation can be used to determine the occupied or maximum ventilation rate to the building. For example, an output of 3.6 volts to the actuator provides a base ventilation rate of 5% and an output of 6.7 volts provides the maximum ventilation rate of 20% (or base plus 15 cfm per person). Use Fig. 73 to determine the maximum setting of the $CO_2$ sensor. For example, an 1100 ppm set point relates to a 15 cfm per person design. Use the 1100 ppm curve on Fig. 73 to find the point when the $CO_2$ sensor output will be 6.7 volts. Line up the point on the graph with the left side of the chart to determine that the range configuration for the $CO_2$ sensor should be 1800 ppm. The EconoMi$er IV controller will output the 6.7 volts from the $CO_2$ sensor to the actuator when the $CO_2$ concentration in the space is at 1100 ppm. The DCV set point may be left at 2 volts since the $CO_2$ sensor voltage will be ignored by the EconoMi$er IV controller until it rises above the 3.6 volt setting of the minimum position potentiometer.

Once the fully occupied damper position has been determined, set the maximum damper demand controlled ventilation potentiometer to this position. Do not set to the maximum position as this can result in over-ventilation to the space and potential high humidity levels.

***$CO_2$ Sensor Configuration***

The $CO_2$ sensor has preset standard voltage settings that can be selected anytime after the sensor is powered up.

Use setting 1 or 2 for Carrier equipment

1. Press Clear and Mode buttons. Hold at least 5 seconds until the sensor enters the Edit mode.
2. Press Mode twice. The STDSET Menu will appear.
3. Use the Up/Down button to select the preset number.
4. Press Enter to lock in the selection.
5. Press Mode to exit and resume normal operation.

The custom settings of the $CO_2$ sensor can be changed anytime after the sensor is energized. Follow the steps below to change the non-standard settings:

1. Press Clear and Mode buttons. Hold at least 5 seconds until the sensor enters the Edit mode.
2. Press Mode twice. The STDSET Menu will appear.
3. Use the Up/Down button to toggle to the NONSTD menu and press Enter.
4. Use the Up/Down button to toggle through each of the nine variables, starting with Altitude, until the desired setting is reached.
5. Press Mode to move through the variables.
6. Press Enter to lock in the selection, then press Mode to continue to the next variable.

***Dehumidification of Fresh Air with DCV (Demand Controlled Ventilation) Control***

If normal rooftop heating and cooling operation is not adequate for the outdoor humidity level, an energy recovery unit and/or a dehumidification option should be considered.

ECONOMI$ER IV PREPARATION

This procedure is used to prepare the EconoMi$er IV for troubleshooting. No troubleshooting or testing is done by performing the following procedure.

NOTE: This procedure requires a 9-v battery, 1.2 kilo-ohm resistor, and a 5.6 kilo-ohm resistor which are not supplied with the EconoMi$er IV.

| |
|---|
| IMPORTANT: Be sure to record the positions of all potentiometers before starting troubleshooting. |

1. Disconnect power at TR and TR1. All LEDs should be off. Exhaust fan contacts should be open.
2. Disconnect device at P and P1.
3. Jumper P to P1.
4. Disconnect wires at T and T1. Place 5.6 kilo-ohm resistor across T and T1.
5. Jumper TR to 1.
6. Jumper TR to N.
7. If connected, remove sensor from terminals SO and +. Connect 1.2 kilo-ohm 4074EJM checkout resistor across terminals SO and +.
8. Put 620-ohm resistor across terminals SR and +.
9. Set minimum position, DCV set point, and exhaust potentiometers fully CCW (counterclockwise).
10. Set DCV maximum position potentiometer fully CW (clockwise).
11. Set enthalpy potentiometer to D.
12. Apply power (24 vac) to terminals TR and TR1.

DIFFERENTIAL ENTHALPY

To check differential enthalpy:

1. Make sure EconoMi$er® IV preparation procedure has been performed.
2. Place 620-ohm resistor across SO and +.
3. Place 1.2 kilo-ohm resistor across SR and +. The Free Cool LED should be lit.
4. Remove 620-ohm resistor across SO and +. The Free Cool LED should turn off.
5. Return EconoMi$er IV settings and wiring to normal after completing troubleshooting.

SINGLE ENTHALPY

To check single enthalpy:

1. Make sure EconoMi$er IV preparation procedure has been performed.
2. Set the enthalpy potentiometer to A (fully CCW). The Free Cool LED should be lit.
3. Set the enthalpy potentiometer to D (fully CW). The Free Cool LED should turn off.
4. Return EconoMi$er IV settings and wiring to normal after completing troubleshooting.

DCV (DEMAND CONTROLLED VENTILATION) AND POWER EXHAUST

To check DCV and Power Exhaust:

1. Make sure EconoMi$er IV preparation procedure has been performed.
2. Ensure terminals AQ and AQ1 are open. The LED for both DCV and Exhaust should be off. The actuator should be fully closed.
3. Connect a 9-v battery to AQ (positive node) and AQ1 (negative node). The LED for both DCV and Exhaust should turn on. The actuator should drive to between 90 and 95% open.
4. Turn the Exhaust potentiometer CW until the Exhaust LED turns off. The LED should turn off when the potentiometer is approximately 90%. The actuator should remain in position.
5. Turn the DCV set point potentiometer CW until the DCV LED turns off. The DCV LED should turn off when the potentiometer is approximately 9-v. The actuator should drive fully closed.
6. Turn the DCV and Exhaust potentiometers CCW until the Exhaust LED turns on. The exhaust contacts will close 30 to 120 seconds after the Exhaust LED turns on.
7. Return EconoMi$er IV settings and wiring to normal after completing troubleshooting.

DCV MINIMUM AND MAXIMUM POSITION

To check the DCV minimum and maximum position:

1. Make sure EconoMi$er IV preparation procedure has been performed.
2. Connect a 9-v battery to AQ (positive node) and AQ1 (negative node). The DCV LED should turn on. The actuator should drive to between 90 and 95% open.
3. Turn the DCV Maximum Position potentiometer to midpoint. The actuator should drive to between 20 and 80% open.
4. Turn the DCV Maximum Position potentiometer to fully CCW. The actuator should drive fully closed.
5. Turn the Minimum Position potentiometer to mid-point. The actuator should drive to between 20 and 80% open.
6. Turn the Minimum Position Potentiometer fully CW. The actuator should drive fully open.
7. Remove the jumper from TR and N. The actuator should drive fully closed.
8. Return EconoMi$er IV settings and wiring to normal after completing troubleshooting.

SUPPLY-AIR SENSOR INPUT

To check supply-air sensor input:

1. Make sure EconoMi$er IV preparation procedure has been performed.
2. Set the Enthalpy potentiometer to A. The Free Cool LED turns on. The actuator should drive to between 20 and 80% open.
3. Remove the 5.6 kilo-ohm resistor and jumper T to T1. The actuator should drive fully open.
4. Remove the jumper across T and T1. The actuator should drive fully closed.
5. Return EconoMi$er IV settings and wiring to normal after completing troubleshooting.

ECONOMI$ER IV TROUBLESHOOTING COMPLETION

This procedure is used to return the EconoMi$er IV to operation. No troubleshooting or testing is done by performing the following procedure.

1. Disconnect power at TR and TR1.
2. Set enthalpy potentiometer to previous setting.
3. Set DCV maximum position potentiometer to previous setting.
4. Set minimum position, DCV set point, and exhaust potentiometers to previous settings.
5. Remove 620-ohm resistor from terminals SR and +.
6. Remove 1.2 kilo-ohm checkout resistor from terminals SO and +. If used, reconnect sensor from terminals SO and +.
7. Remove jumper from TR to N.
8. Remove jumper from TR to 1.
9. Remove 5.6 kilo-ohm resistor from T and T1. Reconnect wires at T and T1.
10. Remove jumper from P to P1. Reconnect device at P and P1.
11. Apply power (24 vac) to terminals TR and TR1.

## EconoMi$er X (Factory-Installed Option)

PRODUCT DESCRIPTION

The EconoMi$er® X system is an expandable economizer control system, which includes a W7220 economizer module (controller) with an LCD and keypad (see Fig. 74). The W7220 module can be configured with optional sensors.


**Fig. 74 — W7220 Economizer Module**

The W7220 economizer module can be used as a stand-alone economizer module wired directly to a commercial set-back space thermostat and sensors to provide outside air dry-bulb economizer control.

The W7220 economizer module can be connected to optional sensors for single or differential enthalpy control. The W7220 economizer module provides power and communications for the sensors.

The W7220 economizer module automatically detects sensors by polling to determine which sensors are present. If a sensor loses communications after it has been detected, the W7220 economizer controller indicates a device fail error on its LCD.

SYSTEM COMPONENTS

The EconoMi$er X system includes an economizer module, 20k mixed air sensor, damper actuator, and either a 20k outdoor air temperature sensor or S-Bus enthalpy sensors.

***Economizer Module***

The module is the core of the EconoMi$er X system. The module is mounted in the unit's control box, and includes the user interface for the system. The W7220 economizer module provides the basic inputs and outputs to provide simple economizer control. When used with the optional sensors, the economizer module provides more advanced economizer functionality.

***S-Bus Enthalpy Control Sensors***

The sensor is a combination temperature and humidity sensor which is powered by and communicates on the S-Bus. Up to three sensors may be configured with the W7220 economizer module.

***$CO_2$ Sensor (optional)***

The sensor can be added for Demand Controlled Ventilation (DCV).

## SPECIFICATIONS

### *W7220 Economizer Module*

The module is designed for use with 2 to 10 vdc or bus communicating actuator. The module includes terminals for $CO_2$ sensor, Mixed Air sensor, and an Outdoor Dry Bulb sensor. Enthalpy and other options are available with bus sensors.

### *User Interface*

Provides status for normal operation, setup parameters, checkout tests, and alarm and error conditions with a 2-line 16 character LCD display and four button keypad.

### *Electrical*

Rated Voltage — 20 to 30 vac RMS, 50/60 Hz

Transformer — 100 va maximum system input

Nominal Power Consumption (at 24 vac, 60 Hz) — 11.5 VA without sensors or actuators

Relay Digital Output Rating at 30 vac (maximum power from Class 2 input only) — 1.5A run:

- 3.5A inrush at 0.45PF (200,000 cycles) or
- 7.5A inrush at 0.45PF (100,000 cycles)

External Sensors Power Output — 21 vdc ± 5% at 48mA

| IMPORTANT: All inputs and outputs must be Class 2 wiring. |
|---|

## INPUTS

### *Sensors*

NOTE: A Mixed Air (MA) analog sensor is required on all W7220 units; either an Outdoor Air (OA) sensor for dry bulb change over or an OA bus sensor for outdoor enthalpy change over is required in addition to the MA sensor. An additional Return Air (RA) bus sensor can be added to the system for differential enthalpy or dry bulb changeover. For differential dry bulb changeover, a 20k ohm sensor is required in the OA and a bus sensor in the RA. DIP switch on RA bus sensor must be set in the RA position.

<u>Dry Bulb Temperature (optional) and Mixed Air (required), 20k NTC</u>

2-wire (18 to 22 AWG);

Temperature range –40°F to 150°F (–40°C to 65°C)

Temperature accuracy –0°F/+2°F

<u>Temperature and Humidity, C7400S1000 (optional)</u>

S-Bus; 2-wire (18 to 22 AWG)

Temperature: range –40°F to 150°F (–40°C to 65°C)

Temperature accuracy –0°F/+2°F

Humidity: range 0 to 100% RH with 5% accuracy.

NOTE: Up to three (3) S-Bus sensors may be connected to the W7220 economizer module. For outdoor air (OA), return air (RA) and discharge (supply) air (DA).

<u>4 Binary Inputs</u>

1-wire 24 vac + common GND (see page 58 for wiring details).

<u>24 vac power supply</u>

20 to 30 vac 50/60Hz; 100 VA Class 2 transformer.

## OUTPUTS

### *Actuator Signal:*

2-10 vdc; minimum actuator impedance is 2k ohm; bus two-wire output for bus communicating actuators.

### *Exhaust fan, Y1, Y2 and AUX1 O:*

All Relay Outputs (at 30 vac):

Running: 1.5A maximum

Inrush: 7.5A maximum

## ENVIRONMENTAL

### *Operating Temperature:*

–40°F to 150°F (–40°C to 65°C)

Exception of display operation down to –4°F (–20°C) with full recovery at –4°F (–20°C) from exposure to –40°F (–40°C)

### *Storage Temperature:*

–40°F to 150°F (–40°C to 65°C)

### *Shipping Temperature:*

–40°F to 150°F (–40°C to 65°C)

### *Relative Humidity:*

5% to 95% RH non-condensing

## ECONOMIZER MODULE WIRING DETAILS

Use Fig. 75 and Tables 14 and 15 to locate the wiring terminals for the Economizer module.

NOTE: The four terminal blocks are removable. You can slide out each terminal block, wire it, and then slide it back into place.

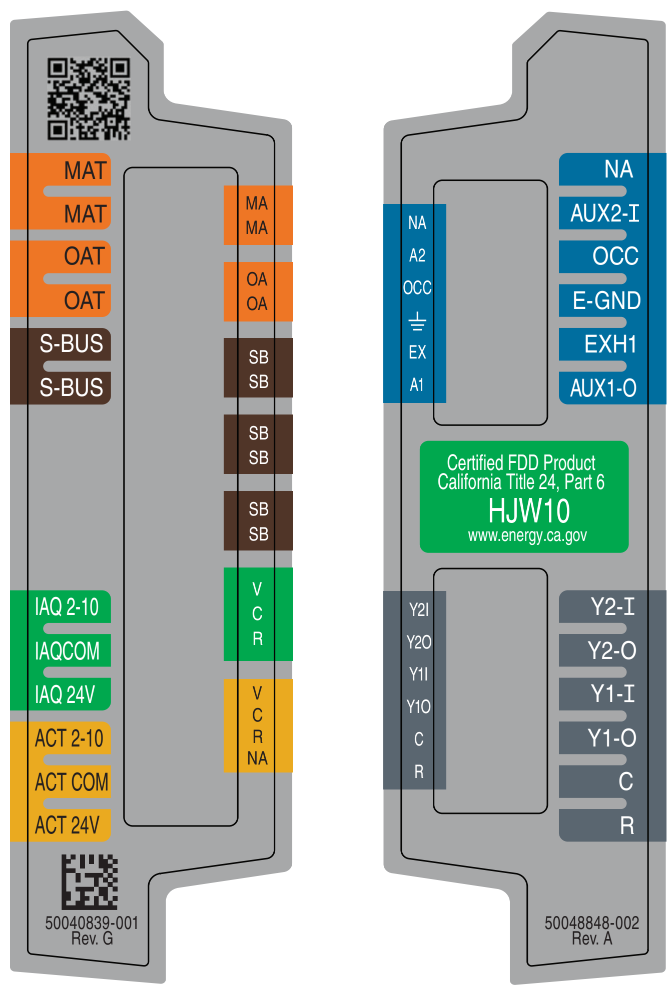



**Fig. 75 — W7220 Wiring Terminals**

### Table 14 — Economizer Module — Left Hand Terminal Blocks

| LABEL | TYPE | DESCRIPTION |
|---|---|---|
| **Top Left Terminal Block** | | |
| **MAT**<br>**MAT** | 20k NTC and COM | Mixed Air Temperature Sensor (Polarity Insensitive Connection) |
| **OAT**<br>**OAT** | 20k NTC and COM | Outdoor Air Temperature Sensor (Polarity Insensitive Connection) |
| **S-BUS**<br>**S-BUS** | S-BUS (Sylk™[a] Bus) | Enthalpy Control Sensor (Polarity Insensitive Connection) |
| **Bottom Left Terminal Block** | | |
| **IAQ 2-10** | 2-10 vdc | Air Quality Sensor Input (e.g., $CO_2$ sensor) |
| **IAQ COM** | COM | Air Quality Sensor Common |
| **IAQ 24V** | 24 vac | Air Quality Sensor 24 vac Source |
| **ACT 2-10** | 2-10 vdc | Damper Actuator Output (2-10 vdc) |
| **ACT COM** | COM | Damper Actuator Output Common |
| **ACT 24-v** | 24 vac | Damper Actuator 24 vac Source |

NOTE(S):

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

### Table 15 — Economizer Module — Right Hand Terminal Blocks

| LABEL | TYPE | DESCRIPTION |
|---|---|---|
| **Top Right Terminal Blocks** | | |
| **AUX2 I** | 24 vac IN | The first terminal is not used. |
| **OCC** | 24 vac IN | Shut Down (SD) or HEAT (W) Conventional only<br>and<br>Heat Pump Changeover (O-B) in Heat Pump mode. |
| **E-GND** | E-GND | Occupied/Unoccupied Input |
| **EXH1** | 24 vac OUT | Exhaust Fan 1 Output |
| **AUX1 O** | 24 vac OUT | Programmable:<br>Exhaust fan 2 output<br>or<br>ERV<br>or<br>System alarm output |
| **Bottom Right Terminal Blocks** | | |
| **Y2-I** | 24 vac IN | Y2 in - Cooling Stage 2 Input from space thermostat |
| **Y2-O** | 24 vac OUT | Y2 out - Cooling Stage 2 Output to stage 2 mechanical cooling |
| **Y1-I** | 24 vac IN | Y1 in - Cooling Stage 2 Input from space thermostat |
| **Y1-O** | 24 vac OUT | Y1 out - Cooling Stage 2 Output to stage 2 mechanical cooling |
| **C** | COM | 24 vac Common |
| **R** | 24 vac | 24 vac Power (hot) |

S-BUS SENSOR WIRING

The labels on the sensors and controller are color coded for ease of installation. Orange labeled sensors can only be wired to orange terminals on the controller. Brown labeled sensors can only be wired to S-bus (brown) terminals. Use Fig. 76 and Table 16 to locate the wiring terminals for each S-Bus sensor.

Use Fig. 76 and Table 16 to locate the wiring terminals for each enthalpy control sensor.

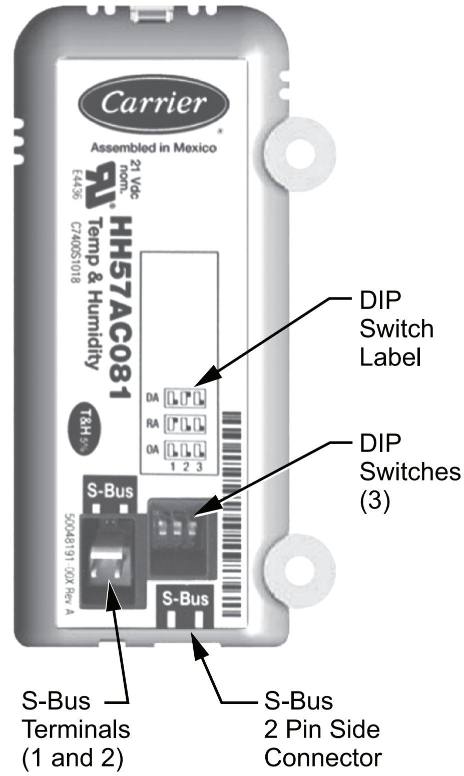



**Fig. 76 — S-Bus Sensor DIP Switches**

### Table 16 — HH57AC081 Sensor Wiring Terminations

| TERMINAL | | TYPE | DESCRIPTION |
|---|---|---|---|
| **NUMBER** | **LABEL** | | |
| 1 | S-BUS | S-BUS | S-BUS Communications (Enthalpy Control Sensor Bus) |
| 2 | S-BUS | S-BUS | S-BUS Communications (Enthalpy Control Sensor Bus) |

Use Fig. 76 and Table 17 to set the DIP switches for the desired use of the sensor.

### Table 17 — HH57AC081 Sensor DIP Switch

| USE | DIP SWITCH POSITIONS FOR SWITCHES 1, 2, AND 3 | | |
|---|---|---|---|
| | **1** | **2** | **3** |
| **DA** | OFF | ON | OFF |
| **RA** | ON | OFF | OFF |
| **OA** | OFF | OFF | OFF |

NOTE: When a S-Bus sensor is connected to an existing network, it will take 60 minutes for the network to recognize and auto-configure itself to use the new sensor.

During the 60 minute setup period, no alarms for sensor failures (except SAT) will be issued and no economizing function will be available.

$CO_2$ SENSOR WIRING

When using a $CO_2$ sensor, the black and brown common wires are internally connected and only one is connected to "IAQ COM" on the W7220. Use the power from the W7220 to power the $CO_2$ sensor OR make sure the ground for the power supplies are common. See Fig. 77 for $CO_2$ sensor wiring.

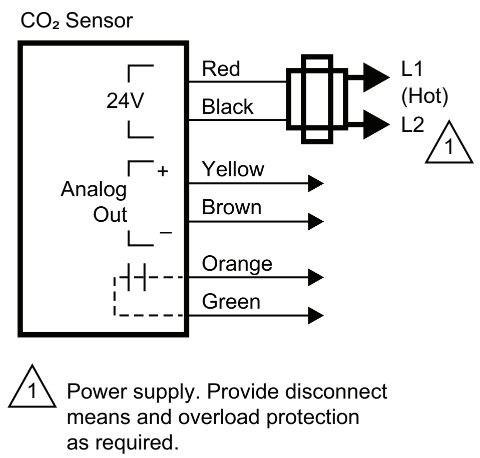



**Fig. 77 — $CO_2$ Sensor Wiring**

INTERFACE OVERVIEW

This section describes how to use the EconoMi$er® X user interface for:

- Keypad and menu navigation
- Settings and parameter changes
- Menu structure and selection

USER INTERFACE

The user interface consists of a 2-line LCD display and a 4-button keypad on the front of the economizer controller.

KEYPAD

The four navigation buttons (see Fig. 78) are used to scroll through the menus and menu items, select menu items, and to change parameter and configuration settings.

To use the keypad when working with menus:

- Press the ▲ (Up arrow) button to move to the previous menu.
- Press the ▼ (Down arrow) button to move to the next menu.
- Press the ↵ (Enter) button to display the first item in the currently displayed menu.
- Press the ⓘ (Menu Up/Exit) button to exit a menu's item and return to the list of menus.

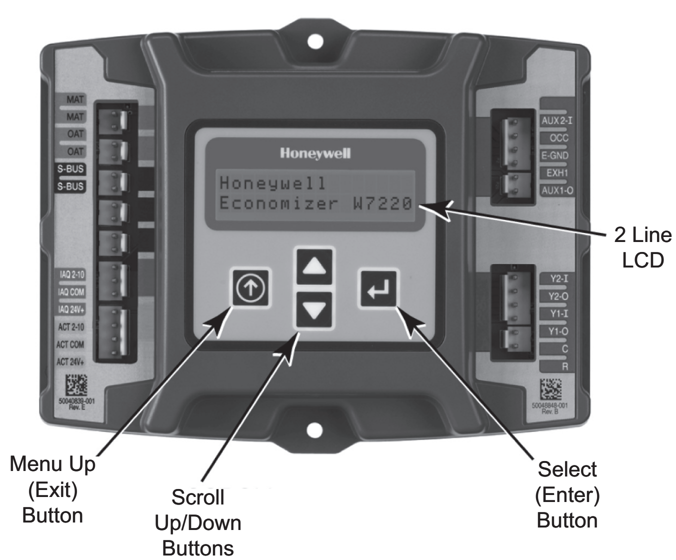



**Fig. 78 — W7220 Controller Navigation Buttons**

To use the keypad when working with Set Points, System and Advanced Settings, Checkout tests and Alarms:

1. Navigate to the desired menu.
2. Press the ↵ (Enter) button to display the first item in the currently displayed menu.
3. Use the ▲ and ▼ buttons to scroll to the desired parameter.
4. Press the ↵ (Enter) button to display the value of the currently displayed item.
5. Press the ▲ button to increase (change) the displayed parameter value.
6. Press the ▼ button to decrease (change) the displayed parameter value.

   NOTE: When values are displayed, pressing and holding the ▲ or ▼ button causes the display to automatically increment.
7. Press the ↵ (Enter) button to accept the displayed value and store it in nonvolatile RAM.
8. "CHANGE STORED" displays.
9. Press the ↵ (Enter) button to return to the current menu parameter.
10. Press the ⓘ (Menu Up/Exit) button to return to the previous menu.

MENU STRUCTURE

Table 18 illustrates the complete hierarchy of menus and parameters for the EconoMi$er® X system.

The Menus in display order are:

- STATUS
- SET POINTS
- SYSTEM SETUP
- ADVANCED SETUP
- CHECKOUT
- ALARMS

> IMPORTANT: Table 18 illustrates the complete hierarchy. Your menu parameters may be different depending on your configuration.
>
> For example, if you do not have a DCV ($CO_2$) sensor, then none of the DCV parameters appear and only MIN POS will display. If you have a $CO_2$ sensor, the DCV MIN and DCV MAX will appear AND if you have 2 speed fan DCV MIN (high and low speed) and DCV MAX (high and low speed will appear).

NOTE: Some parameters in the menus use the letters MA or MAT, indicating a mixed air temperature sensor location before the cooling coil. This unit application has the control sensor located after the cooling coil, in the fan section, where it is designated as (Cooling) Supply Air Temperature or SAT sensor.

SETUP AND CONFIGURATION

Before being placed into service, the W7220 economizer module must be setup and configured for the installed system.

> IMPORTANT: During setup, the economizer module is live at all times.

The setup process uses a hierarchical menu structure that is easy to use. Press the ▲ and ▼ arrow buttons to move forward and backward through the menus and press the button to select and confirm setup item changes.

TIME-OUT AND SCREENSAVER

When no buttons have been pressed for 10 minutes, the LCD displays a screen saver, which cycles through the Status items. Each Status items displays in turn and cycles to the next item after 5 seconds.

## Table 18 — W7220 Menu Structure[a]

| MENU | PARAMETER | PARAMETER DEFAULT VALUE | PARAMETER RANGE AND INCREMENT[b] | NOTES |
|---|---|---|---|---|
| STATUS | ECONO AVAIL | NO | YES/NO | FIRST STAGE COOLING DEMAND (Y1–IN)<br>YES = economizing available; the system can use outside air for free cooling when required. |
| | ECONOMIZING | NO | YES/NO | FIRST STAGE COOLING RELAY OUTPUT<br>YES = outside air being used for 1 stage cooling |
| | OCCUPIED[c] | NO | YES/NO | OCCUPIED<br>YES = OCC signal received from space thermostat or unitary controller<br>YES = 24 vac on terminal OCC<br>NO = 0 vac on terminal OCC |
| | HEAT PUMP | N/A | COOL<br>HEAT | HEAT PUMP MODE<br>Displays COOL or HEAT when system is set to heat pump (Non-conventional). |
| | COOL Y1—IN | OFF | ON/OFF | FIRST STAGE COOLING DEMAND (Y1-IN)<br>Y1–I signal from space thermostat or unitary controller for cooling stage 1.<br>ON = 24 vac on terminal Y1–I<br>OFF = 0 vac on terminal Y1–I |
| | COOL Y1—OUT | OFF | ON/OFF | FIRST STAGE COOLING RELAY OUTPUT<br>Cool stage 1 Relay Output to stage 1 mechanical cooling (Y1–OUT terminal). |
| | COOL Y2—IN | OFF | ON/OFF | SECOND STAGE COOLING DEMAND (Y2–IN)<br>Y2–I signal from space thermostat our unitary controller for second stage cooling.<br>ON = 24 vac on terminal Y2–I<br>OFF = 0 vac on terminal Y2–I |
| | COOL Y2—OUT | OFF | ON/OFF | SECOND STAGE COOLING RELAY OUTPUT<br>Cool Stage 2 Relay Output to mechanical cooling (Y2–OUT terminal). |
| | MA TEMP[d] | _ _ . _ F | 0°F to 140°F<br>(–17°C to 60°C) | SUPPLY AIR TEMPERATURE, Cooling Mode<br>displays value of measured mixed air from MAT sensor.<br>Displays _ _ . _ F if not connected, short or out-of-range. |
| | DA TEMP | _ _ . _ F | 0°F to 140°F<br>(–17°C to 60°C) | DISCHARGE AIR TEMPERATURE, after Heating section<br>displays when Discharge Air sensor is connected and displays measured discharge temperature.<br>Displays _ _ . _F if sensor sends invalid value, if not connected, short or out-of-range. |
| | OA TEMP | _ _ . _ F | –40°F to 140°F<br>(–40°C to 60°C) | OUTSIDE AIR TEMP<br>Displays measured value of outdoor air temperature.<br>Displays _ _ . _F if sensor sends invalid value, short or out-of-range. |
| | OA HUM | _ _ % | 0 to 100% | OUTSIDE AIR RELATIVE HUMIDITY<br>Displays measured value of outdoor humidity from OA sensor.<br>Displays _ _% if not connected short, or out-of-range. |
| | RA TEMP | _ _ . _ F | 0°F to 140°F<br>(–17°C to 60°C) | RETURN AIR TEMPERATURE<br>Displays measured value of return air temperature from RAT sensor.<br>Displays _ _ . _ F if sensor sends invalid value, if not connected, short or out-of-range. |
| | RA HUM | _ _ % | 0 to 100% | RETURN AIR RELATIVE HUMIDITY<br>Displays measured value of return air humidity from RA sensor.<br>Displays _ _% if sensor sends invalid value, if not connected, short or out-of-range. |
| | IN CO2 | _ _ _ ppm | 0 to 2000 ppm | SPACE/RETURN AIR $CO_2$<br>Displays value of measured $CO_2$ from $CO_2$ sensor. Invalid if not connected, short or out-of-range. |
| | DCV STATUS | N/A | ON/OFF | DEMAND CONTROLLED VENTILATION STATUS<br>Displays ON if above setpoint and OFF if below setpoint, and ONLY if a $CO_2$ sensor is connected. |
| | DAMPER OUT | 2.0v | 2.0 to 10.0v | Displays voltage output to the damper actuator. |
| | ACT POS | N/A | 0 to 100% | Displays actual position of outdoor air damper actuator. |
| | ACT COUNT | N/A | 1 to 65535 | Displays number of times actuator has cycled.<br>1 cycle equals 180 deg. of actuator movement in any direction. |
| | ACTUATOR | N/A | OK/Alarm (on Alarm menu) | Displays ERROR if voltage or torque is below actuator range. |
| | EXH1 OUT | OFF | ON/OFF | EXHAUST STAGE 1 RELAY OUTPUT<br>Output of EXH1 terminal:<br>ON = relay closed<br>OFF = relay open |
| | EXH2 OUT | OFF | ON/OFF | EXHAUST STAGE 2 RELAY OUTPUT<br>Output of AUX terminal; displays only if AUX = EXH2 |
| | ERV | OFF | ON/OFF | ENERGY RECOVERY VENTILATOR<br>Output of AUX terminal; displays only if AUX = ERV |

## Table 18 — W7220 Menu Structure[a] (cont)

| MENU | PARAMETER | PARAMETER DEFAULT VALUE | PARAMETER RANGE AND INCREMENT[b] | NOTES |
|---|---|---|---|---|
| **STATUS (cont)** | MECH COOL ON or HEAT STAGES ON | 0 | 0, 1, or 2 | Displays stage of mechanical cooling that is active.<br><br>Displays the stage of heat pump heating that is active. |
| | FAN SPEED | N/A | LOW or HIGH | SUPPLY FAN SPEED<br>Displays speed setting of fan on a 2-speed fan unit. |
| | W (HEAT ON) | N/A | ON/OFF | HEAT DEMAND STATUS<br>Displays status of heat demand on a 2-speed fan unit. |
| **SETPOINTS** | MAT SET[d] | 53°F | 38°F to 70°F (3°C to 21°C); increment by 1°F | MIXED AIR SETPOINT<br>Setpoint determines where the economizer will modulate the OA damper to maintain the mixed air temperature. |
| | LOW T LOCK | 32°F | –45°F to 80°F (–43°C to 27°C); increment by 1°F | COMPRESSOR LOW TEMPERATURE LOCKOUT<br>Setpoint determines outdoor temperature when the mechanical cooling cannot be turned on. Commonly referred to as the Compressor lockout. |
| | DRYBLB SET[e] | 63°F | 48°F to 80°F (9°C to 27°C); increment by 1°F | OA DRY BULB TEMPERATURE CHANGEOVER SETPOINT<br>Setpoint determines where the economizer will assume outdoor air temperature is good for free cooling; e.g.; at 63°F unit will economize at 62°F and below and not economize at 64°F and above. There is a 2°F deadband.<br>DRYBULB SET is only displayed if the economizer has a single dry bulb sensor. |
| | DRYBLB DIFF | 0°F | 0°F to 6°F Increment by 2°F | Drybulb Differential will only show if using dual drybulb - i.e., when an outdoor air temperature sensor C7250 is attached to OAT terminals and C7400S sensor is wired to S-Bus and configured for RAT (return air). Free cooling will be assumed whenever OA temp is at or below RAT minus this drybulb setting. |
| | ENTH CURVE | ES3 | ES1,ES2,ES3, ES4, or ES5 | ENTHALPY CHANGEOVER CURVE<br>(Requires enthalpy sensor option)<br>Enthalpy boundary “curves” for economizing using single enthalpy. |
| | DCV SET | 1100ppm | 500 to 2000 ppm; increment by 100 | DEMAND CONTROLLED VENTILATION SETPOINT<br>Displays only if $CO_2$ sensor is connected. Setpoint for Demand Controlled Ventilation of space. Above the setpoint, the OA dampers will modulate open to bring in additional OA to maintain a space ppm level below the setpoint. |
| | MIN POS | 4.4-v | 2 to 10 vdc | VENTILATION MINIMUM POSITION<br>Only displayed if controller is set for single speed unit under FAN TYPE, and if DCV is NOT used. |
| | MIN POS L | 6.0-v | 2 to 10 vdc | VENTILATION MINIMUM POSITION AT LOW SPEED<br>Only displays if unit is set for 2 or 3 speed and $CO_2$ is not used. If using 2 speed with 1 heat and 1 cool then set for HEATING ventilation. If using 3 speed with 1 heat and 2 cool then set for LOW SPEED COOLING ventilation. |
| | MIN POS M | 5.4-v | 2 to 10 vdc | VENTILATION MINIMUM POSITION AT MEDIUM SPEED<br>Only displays if unit is set for 3 speed with 1 heat and 2 cool, and $CO_2$ is not used. Set for HEATING ventilation. |
| | MIN POS H | 4.4-v | 2 to 10 vdc | VENTILATION MINIMUM POSITION AT HIGH SPEED<br>Only displays if unit is set for 2 or 3 speed and $CO_2$ is not used. IF using 2 speed with 1 heat and 1 cool then set for COOLING ventilation. If using 3 speed with 1 heat and 2 cool then set for HIGH SPEED COOLING ventilation. |
| | VENTMAX L | 6.0-v | 2 to 10 vdc | DCV MAXIMUM DAMPER POSITION AT LOW SPEED<br>Only displays if unit is set for 2 speed or 3 speed with 1 heat and 2 cool. IF using 2 speed with 1 heat and 1 cool then set for HEATING ventilation. If using 3 speed with 1 heat and 2 cool then set for LOW SPEED COOLING. |
| | VENTMAX M | 5.4-v | 2 to 10 vdc | DCV MAXIMUM DAMPER POSITION AT MEDIUM SPEED<br>Only displays if unit is set for 3 speed with 1 heat and 2 cool. Set for HEATING ventilation. |
| | VENTMAX H | 4.4-v | 2 to 10 vdc | DCV MAXIMUM DAMPER POSITION AT HIGH SPEED<br>Only displays if unit is set for 2 speed or 3 speed with 1 heat and 2 cool. IF using 2 speed with 1 heat and 1 cool then set for COOLING ventilation. If using 3 speed with 1 heat and 2 cool then set for HIGH SPEED COOLING ventilation. |
| | VENTMIN L | 3.7-v | 2 to 10 vdc | DCV MINIMUM DAMPER POSITION AT LOW SPEED<br>Only displays if unit is set for 2 speed or 3 speed with 1 heat and 2 cool. IF using 2 speed with 1 heat and 1 cool then set for HEATING ventilation. If using 3 speed with 1 heat and 2 cool then set for LOW SPEED COOLING. |
| | VENTMIN M | 3.4-v | 2 to 10 vdc | DCV MINIMUM DAMPER POSITION AT MEDIUM SPEED<br>Only displays if unit is set for 3 speed with 1 heat and 2 cool. Set for HEATING ventilation. |
| | VENTMIN H | 2.8-v | 2 to 10 vdc | DCV MINIMUM DAMPER POSITION AT HIGH SPEED<br>Only displays if unit is set for 2 speed or 3 speed with 1 heat and 2 cool. IF using 2 speed with 1 heat and 1 cool then set for COOLING ventilation. If using 3 speed with 1 heat and 2 cool then set for HIGH SPEED COOLING ventilation. |

## Table 18 — W7220 Menu Structure[a] (cont)

| MENU | PARAMETER | PARAMETER DEFAULT VALUE | PARAMETER RANGE AND INCREMENT[b] | NOTES |
|---|---|---|---|---|
| SETPOINTS (cont) | ERV OAT SP[f] | 32°F | 0°F to 50°F (–18°C to 10°C); increment by 1°F | ENERGY RECOVERY VENTILATOR UNIT OUTDOOR AIR TEMPERATURE SETPOINT<br>Only displayed when AUX1 O = ERV. |
| | EXH1 SET | 50% | 0 to 100% | Exhaust fan set point for single speed units. Based on OA Damper position to activate power exhaust. |
| | EXH1 L SET | 65% | 0 to 100% | EXHAUST FAN 1 SETPOINT AT LOW SPEED on 2 speed or 3 speed with 1 heat and 2 cool. Based on economizer OA damper position to activate power exhaust. |
| | EXH1 M SET | 60% | 0 to 100% | EXHAUST POINT 1 SETPOINT AT MEDIUM SPEED. Only displays if unit is set for 3 speed with 1 heat and 2 cool. Based on economizer OA damper position to activate power exhaust. |
| | EXH1 H SET | 50% | 0 to 100% | EXHAUST FAN 1 SETPOINT AT HIGH SPEED on 2 speed or 3 speed with 1 heat and 2 cool. Based on economizer OA damper position to activate power exhaust. |
| | EXH2 L SET | 80% | 0 to 100% | EXHAUST FAN 2 SETPOINT AT LOW SPEED on 2 speed or 3 speed with 1 heat and 2 cool. Based on economizer OA damper position to activate power exhaust. |
| | EXH2 M SET | 77% | 0 to 100% | EXHAUST FAN 2 SETPOINT AT MEDIUM SPEED. Only displays if unit is set for 3 speed with 1 heat and 2 cool. Based on economizer OA damper position to activate power exhaust. |
| | EXH2 H SET | 75% | 0 to 100% | EXHAUST FAN 2 SETPOINT AT HIGH SPEED on 2 speed or 3 speed with 1 heat and 2 cool. Based on economizer OA damper position to activate power exhaust. |
| SYSTEM SETUP | INSTALL | 01/01/17 | N/A | Display order = MM/DD/YY.<br>Setting order = DD, MM, then YY. |
| | UNITS DEG | °F | °F or °C | Sets economizer controller in degrees Fahrenheit or Celsius. |
| | EQUIPMENT | CONV | Conventional or HP | CONV = conventional;<br>HP O/B = Enable Heat Pump mode. Use AUX2 I for Heat Pump input from thermostat or controller.[g] |
| | AUX2 IN | W | SD/W or HP(O)/HP(B) | In CONV mode:<br>SD + Enables configuration of shutdown (default);<br>W = Informs controller that system is in heating mode.<br>NOTE: If using 2-speed fan mode, you must program CONV mode for W. Shutdown is not available in 2-speed fan mode.[g]<br>In HP O/B mode:<br>HP(O) = energize heat pump on Cool (default);<br>HP(B) = energize heat pump on Heat. |
| | FAN SPEED | 2 speed | 1 speed<br>2 speed<br>2SP H/C<br>3 speed | Sets the economizer controller operation based on 1 speed, 2 speed, 2 speed heat/cool (2SP H/C), or 3 speed supply fan.<br>NOTE: Multi-speed fan options also need Heat (W1) programmed in AUX 2 In.[g] |
| | FAN CFM | 5000 cfm | 100 to 15000 cfm; increment by 100 | UNIT DESIGN AIRFLOW (CFM)<br>Enter only if using DCVAL ENA = AUTO<br>The value is found on the nameplate label for the specific unit. |
| | AUX1 OUT | NONE | NONE<br>ERV<br>EXH2<br>SYS | Select OUTPUT for AUX1 O relay<br>• NONE = not configured (output is not used)<br>• ERV = Energy Recovery Ventilator[f]<br>• EXH2 = second damper position relay closure for second exhaust fan<br>• SYS = use output as an alarm signal |
| | OCC | INPUT | INPUT or ALWAYS | OCCUPIED MODE BY EXTERNAL SIGNAL<br>When using a setback thermostat with occupancy out (24 vac), the 24 vac is input “INPUT” to the OCC terminal. If no occupancy output from the thermostat then change program to “ALWAYS” OR add a jumper from terminal R to OCC terminal. |
| | FACTORY DEFAULT | NO | NO or YES | Resets all set points to factory defaults when set to YES. LCD will briefly flash YES and change to NO but all parameters will change to the factory default values.<br>NOTE: RECHECK AUX2 IN and FANTYPE for required 2-speed values. |
| ADVANCED SETUP | MA LO SET | 45°F | 35°F to 55°F (2°C to 13°C); Incremented by 10°F | SUPPLY AIR TEMPERATURE LOW LIMIT<br>Temperature to achieve Freeze Protection (close damper and alarm if temperature falls below setup value). |
| | FREEZE POS | CLO | CLO or MIN | FREEZE PROTECTION DAMPER POSITION<br>Damper position when freeze protection is active (closed or MIN POS). |
| | CO2 ZERO | 0 ppm | 0 to 500 ppm; Increment by 10 | $CO_2$ ppm level to match $CO_2$ sensor start level. |
| | CO2 SPAN | 2000 ppm | 1000 to 3000 ppm; Increment by 10 | $CO_2$ ppm span to match $CO_2$ sensor. |

## Table 18 — W7220 Menu Structure[a] (cont)

| MENU | PARAMETER | PARAMETER DEFAULT VALUE | PARAMETER RANGE AND INCREMENT[b] | NOTES |
|---|---|---|---|---|
| ADVANCED SETUP (cont) | STG3 DLY | 2.0h | 0 min, 5 min, 15 min, then 15 min intervals. Up to 4 hrs or OFF | COOLING STAGE 3 DELAY<br>Delay after stage 2 cool has been active. Turns on second stage of cooling when economizer is first stage and mechanical cooling is second stage. Allows three stages of cooling, 1 economizer and 2 mechanical.<br>OFF = no Stage 3 cooling. |
| | SD DMPR POS | CLO | CLO or OPN | Indicates shutdown signal from space thermostat or unitary controller. When controller receives 24 vac input on the SD terminal in conventional mode, the OA damper will open if programmed for OPN and OA damper will close if programmed for CLO. All other controls, e.g., fans, etc. will shut off. |
| | DA LO ALM | 45°F (7°C) | 35°F to 65°F (2°C to 18°C); Incremented by 5°F. | Used for alarm for when the DA air temperature is too low. Set lower range of alarm, below this temperature the alarm will show on the display. |
| | DA HI ALM | 80°F (27°C) | 70°F to 180°F (21°C to 82°C); Incremented by 5°F | Used for alarm for when the DA air temperature is too high. Set upper range of alarm, above this temperature the alarm will show on the display. |
| | DCVCAL ENA | MAN | MAN (manual) AUTO | Turns on the DCV automatic control of the dampers. Resets ventilation based on the RA, OA, and MA sensor conditions. Requires all 3 RA, OA, and MA sensors. |
| | MAT T CAL | 0.0°F | ±2.5°F | SUPPLY AIR TEMPERATURE CALIBRATION<br>Allows for the operator to adjust for an out of calibration temperature sensor. |
| | OAS T CAL | 0.0°F | ±2.5°F | OUTSIDE AIR TEMPERATURE CALIBRATION<br>Allows for the operator to adjust for an out of calibration temperature sensor. |
| | OA H CAL | 0% RH | ±10% RH | OUTSIDE AIR HUMIDITY CALIBRATION<br>Allows for operator to adjust for an out of calibration humidity sensor. |
| | RA T CAL | 0.0°F | ±2.5°F | RETURN AIR TEMPERATURE CALIBRATION<br>Allows for the operator to adjust for an out of calibration temperature sensor. |
| | RA H CAL | 0% RH | ±10% RH | RETURN AIR HUMIDITY CALIBRATION<br>Allows for operator to adjust for an out of calibration humidity sensor. |
| | DA T CAL | 0.0°F | ±2.5°F | DISCHARGE AIR TEMPERATURE CALIBRATION<br>Allows for the operator to adjust for an out of calibration temperature sensor. |
| | 2SP FAN DELAY | 5 Minutes | 0 to 20 minutes in 1 minute increments | TIME DELAY ON SECOND STAGE ECONOMIZING<br>When in economizing mode this is the delay for the high speed fan to try to satisfy the call for second stage cooling before the first stage mechanical cooling is enabled. |
| CHECKOUT | DAMPER MINIMUM POSITION | N/A | N/A | The checkout for the damper minimum position is based on the system. |
| | DAMPER OPEN | N/A | N/A | Position damper to the full open position.<br>Exhaust fan contacts enable during the DAMPER OPEN test. Make sure you pause in the mode to allow exhaust contacts to energize due to the delay in the system. |
| | DAMPER CLOSE | N/A | N/A | Positions damper to the fully closed position. |
| | CONNECT Y1–O | N/A | N/A | Closes the Y1-O relay (Y1-O). |
| | CONNECT Y2–O | N/A | N/A | Closes the Y2-O relay (Y2-O). |
| | CONNECT AUX1-O | N/A | N/A | Energizes the AUX output. If Aux setting is:<br>• NONE — not action taken<br>• ERV — 24 vac out. Turns on or signals an ERV that the conditions are not good for economizing but are for ERV operation.[f]<br>• SYS — 24 vac out. Issues a system alarm. |
| | CONNECT EXH1 | N/A | N/A | Closes the power exhaust fan 2 relay (EXH1). |
| ALARMS | Alarms display only when they are active. The menu title “ALARMS(#)” includes the number of active alarms in parenthesis ( ). When using SYLK bus sensors, “SYLK” will appear on the screen, and when using 20k OA temperature sensors, “SENS T” will appear on the screen. | | | |
| | MA T SENS ERR | N/A | N/A | SUPPLY AIR TEMPERATURE SENSOR ERROR<br>Mixed air sensor has failed or become disconnected - check wiring then replace sensor if the alarm continues. |
| | CO2 SENS ERR | N/A | N/A | $CO_2$ SENSOR ERROR<br>$CO_2$ sensor has failed, gone out of range or become disconnected - check wiring then replace sensor if the alarm continues. |
| | OA SYLK T ERR | N/A | N/A | OUTSIDE AIR S-BUS SENSOR ERROR<br>Outdoor air enthalpy sensor has failed or become disconnected - check wiring then replace sensor if the alarm continues. |
| | OA SYLK H ERR | N/A | N/A | |
| | RA SYLK T ERR | N/A | N/A | RETURN AIR S-BUS SENSOR ERROR<br>Return air enthalpy sensor has failed or become disconnected - check wiring then replace sensor if the alarm continues. |
| | RA SYLK H ERR | N/A | N/A | |

## Table 18 — W7220 Menu Structure[a] (cont)

| MENU | PARAMETER | PARAMETER DEFAULT VALUE | PARAMETER RANGE AND INCREMENT[b] | NOTES |
|---|---|---|---|---|
| ALARMS (cont) | DA SYLK T ERR | N/A | N/A | DISCHARGE AIR S-BUS SENSOR ERROR<br>Discharge air sensor has failed or become disconnected - check wiring then replace sensor if the alarm continues. |
| | OA SENS T ERR | N/A | N/A | OUTSIDE AIR TEMPERATURE SENSOR ERROR<br>Outdoor air temperature sensor has failed or become disconnected - check wiring then replace if the alarm continues. |
| | ACT ERROR | N/A | N/A | ACTUATOR ERROR<br>Actuator has failed or become disconnected - check for stall, over voltage, under voltage, and actuator count. Replace actuator if damper is movable and supply voltage is between 21.6-v and 26.4-v. Check actuator count on STATUS menu. |
| | FREEZE ALARM | N/A | N/A | Check if outdoor temperature is below the LOW Temp Lockout on setpoint menu. Check if Mixed air temperature on STATUS menu is below the Lo Setpoint on Advanced menu. When conditions are back in normal range then the alarm will go away. |
| | SHUTDOWN ACTIVE | N/A | N/A | AUX2 IN is programmed for SHUTDOWN and 24-v has been applied to AUX2 IN terminal. |
| | DMP CAL RUNNING | N/A | N/A | DAMPER CALIBRATION ROUTINE RUNNING<br>If DCV Auto enable has been programmed, when the W7220 is completing a calibration on the dampers, this alarm will display. Wait until the calibration is completed and the alarm will go away. Must have OA, MA, and RA sensors for DCV calibration; set up in the Advanced setup menu. |
| | DA SENS ALM | N/A | N/A | DISCHARGE AIR TEMPERATURE SENSOR ALARM<br>Discharge air temperature is out of the range set in the ADVANCED SETUP Menu. Check the temperature of the discharge air. |
| | SYS ALARM | N/A | N/A | When AUX1-O is set to SYS and there is any alarm (e.g., failed sensors, etc.), the AUX1-O terminal has 24 vac out. |
| | ACT UNDER V | N/A | N/A | ACTUATOR VOLTAGE LOW<br>Voltage received by actuator is above expected range. |
| | ACT OVER V | N/A | N/A | ACTUATOR VOLTAGE HIGH<br>Voltage received by actuator is below expected range. |
| | ACT STALLED | N/A | N/A | ACTUATOR STALLED<br>Actuator stopped before achieving commanded position. |

NOTE(S):

a. Table 18 illustrates the complete hierarchy. Your menu parameters may be different depending on your configuration. For example if you do not have a DCV ($CO_2$) sensor, then none of the DCV parameters appear.
b. When values are displayed, pressing and holding the ▲ or ▼ button causes the display to automatically increment.
c. STATUS —> OCCUPIED — The factory-standard Occupancy signal originates with a thermostat or other controller call for indoor fan operation at UCB terminal G. This signal passes through the Unit Control Board’s OCCUPIED jumper JMP1 to the ECONO connector and to the W7220’s OCC input terminal. An external timeclock or relay is required to implement an Occupancy schedule on the economizer damper position.
d. STATUS —> MA TEMP, SETPOINTS —> MAT SET — The W7220 menu parameters and labels include designations MA, MAT, and Mixed Air for the economizer cooling control sensor. On these rooftop units, the economizer control sensor is located downstream of the evaporator/indoor coil in the supply fan section where this sensor is designated as Supply Air Temperature (SAT) sensor.
e. SETPOINTS —> DRYBLB SET — This point is not displayed if a Return Air (differential) temperature sensor or an Outdoor Air enthalpy sensor is connected.
f. ERV Operation: When in cooling mode AND the conditions are NOT OK for economizing - the ERV terminal will be energized. In the Heating mode, the ERV terminal will be energized when the OA is below the ERV OAT set point in the set point menu.
g. SYSTEM SETUP parameters must be configured as noted for Multi-Speed unit operation:
EQUIPMENT = CONV
AUX2 IN = W
FAN SPEED = 2SPEED

LEGEND

**CLO** — Compressor Lockout
**ERV** — Energy Recovery Ventilator
**LCD** — Liquid Crystal Display
**MA** — Mixed Air
**MAT** — Mixed Air Temperature
**N/A** — Not Applicable
**OA** — Outdoor Air
**OAT** — Outdoor Air Temperature
**OCC** — Occupied
**RA** — Return Air
**RAT** — Return Air Temperature
**RTU** — Rooftop Unit
**SYS** — System

## 2 SPEED FAN OPERATION

The W7220 controller has the capability to work with a system using a 2-speed supply fan. The W7220 does not control the supply directly but uses the following input status to determine the speed of the supply fan and controls the OA damper to the required position, see Table 19.

**Table 19 — Fan Speed**

| STATE | FAN SPEED |
|---|---|
| **OCC** | Low |
| **Y1** | Low |
| **Y2** | High |
| **W** | High |

The W (heating mode) is not controlled by the W7220 but it requires the status to know where to position the OA damper for minimum position for the fan speed.

The 2 speed fan delay is available when the system is programmed for 2 speed fan (in the System Setup menu item). The 2 speed fan delay is defaulted to 5 minutes and can be changed in the Advanced Setup menu item. When the unit has a call for Y1 In and in the free cooling mode and there is a call for Y2 In, the 2-speed fan delay starts and the OA damper will modulate 100% open, the supply fan should be set to high speed by the unit controller.

After the delay, one of two actions will happen:

- The Y2 In call will be satisfied with the damper 100% open and fan on high speed and the call will turn off

OR

- If the call for additional cooling in the space has not been satisfied then the first stage of mechanical cooling will be enabled through Y1 Out or Y2 Out.

Refer to Table 20 for economizer operation.

**Table 20 — Economizer Operation - FAN TYPE = 2SPEED**

| INPUTS | | | | | OUTPUTS | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **DEMAND CONTROLLED VENTILATION (DCV)** | **OUTSIDE AIR GOOD TO ECONOMIZE** | **W (HEAT ON)** | **COOL Y1-IN** | **COOL Y2-IN** | **COOL Y1-OUT** | **COOL Y2-OUT** | **FAN SPEED (reference only)** | **DAMPER POSITION** | |
| | | | | | | | | **OCCUPIED** | **UNOCCUPIED** |
| **NONE** | NO | ON | N/A | N/A | OFF | OFF | HIGH | MIN POS H | Closed |
| | | OFF | OFF | OFF | OFF | OFF | LOW | MIN POS L | Closed |
| | | OFF | ON | OFF | ON | OFF | LOW | MIN POS L | Closed |
| | | OFF | ON | ON | ON | ON | HIGH | MIN POS H | Closed |
| | YES | ON | N/A | N/A | OFF | OFF | HIGH | MIN POS H | Closed |
| | | OFF | OFF | OFF | OFF | OFF | LOW | MIN POS L | Closed |
| | | OFF | ON | OFF | OFF | OFF | LOW | MIN POS L to Full Open | Closed to Full Open |
| | | OFF | ON | ON | ON | OFF[a] | HIGH | MIN POS H to Full Open | Closed to Full Open |
| **Below $CO_2$ Set** | NO | ON | N/A | N/A | OFF | OFF | HIGH | VENTMIN H | Closed |
| | | OFF | OFF | OFF | OFF | OFF | LOW | VENTMIN L | Closed |
| | | OFF | ON | OFF | ON | OFF | LOW | VENTMIN L | Closed |
| | | OFF | ON | ON | ON | ON | HIGH | VENTMIN H | Closed |
| | YES | ON | N/A | N/A | OFF | OFF | HIGH | VENTMIN H | Closed |
| | | OFF | OFF | OFF | OFF | OFF | LOW | VENTMIN L | Closed |
| | | OFF | ON | OFF | OFF | OFF | LOW | VENTMIN L to Full Open | Closed to Full Open |
| | | OFF | ON | ON | ON | OFF[a] | HIGH | VENTMIN H to Full Open | Closed to Full Open |
| **Above $CO_2$ Set** | NO | ON | N/A | N/A | OFF | OFF | HIGH | VENTMIN H to VENTMAX H | Closed |
| | | OFF | OFF | OFF | OFF | OFF | LOW | VENTMIN L to VENTMAX L | Closed |
| | | OFF | ON | OFF | ON | OFF | LOW | VENTMIN L to VENTMAX L | Closed |
| | | OFF | ON | ON | ON | ON | HIGH | VENTMAX H to VENTMAX H | Closed |
| | YES | ON | N/A | N/A | OFF | OFF | HIGH | VENTMIN H to VENTMAX H | Closed |
| | | OFF | OFF | OFF | OFF | OFF | LOW | VENTMIN L to VENTMAX L | Closed |
| | | OFF | ON | OFF | OFF | OFF[a] | LOW | VENTMIN L to Full Open | Closed to Full Open |
| | | OFF | ON | ON | ON | OFF[a] | HIGH | VENTMIN H to Full Open | Closed to Full Open |

NOTE(S):

a. With stage 3 delay (STG3 DLY) in Advanced setup, COOL Y2-OUT will be turned ON after the delay time specified.

LEGEND

**N/A** — Not Applicable

ENTHALPY SETTINGS

When the OA temperature, enthalpy and dew point are below the respective set points, the Outdoor Air can be used for economizing. Figure 79 shows the new single enthalpy boundaries in the W7220. There are 5 boundaries (set points ES1 through ES5), which are defined by dry bulb temperature, enthalpy and dew point.

Refer to Table 21 for ENTH CURVE set point values.

The W7220 calculates the enthalpy and dew point using the OA temperature and humidity input from the OA enthalpy sensor. When the OA temperature, OA humidity and OA dew point are all below the selected boundary, the economizer sets the economizing mode to YES, economizing is available.

When all of the OA conditions are above the selected boundary, the conditions are not good to economize and the mode is set to NO.

Figure 79 shows the 5 current boundaries. There is also a high limit boundary for differential enthalpy. The high limit boundary is ES1 when there are no stages of mechanical cooling energized and HL (high limit) when a compressor stage is energized.

Table 21 provides the values for each boundary limit.

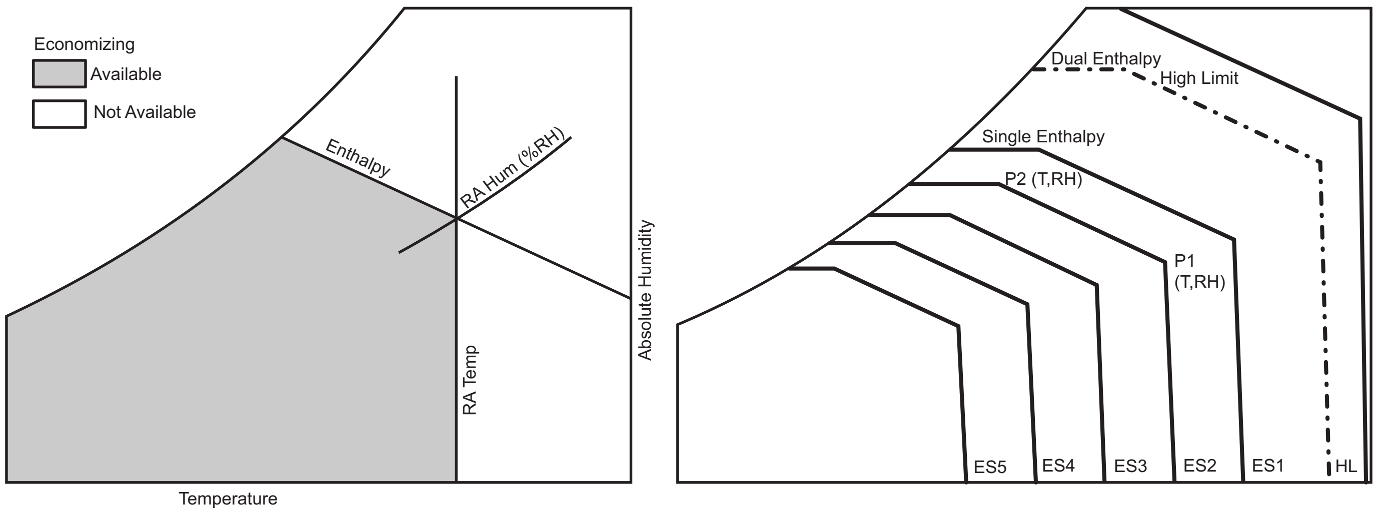



**Fig. 79 — Single Enthalpy Curve Boundaries**

**Table 21 — Single Enthalpy and Dual Enthalpy High Limit Curves**

| ENTHALPY CURVE | TEMP. DRY BULB (°F) | TEMP. DEWPOINT (°F) | ENTHALPY (BTU/LB/DA) | POINT P1 | | POINT P2 | |
|---|---|---|---|---|---|---|---|
| | | | | TEMP. (°F) | HUMIDITY (%RH) | TEMP. (°F) | HUMIDITY (%RH) |
| **ES1** | 80 | 60 | 28.0 | 80 | 36.8 | 66.3 | 80.1 |
| **ES2** | 75 | 57 | 26.0 | 75 | 39.6 | 63.3 | 80.0 |
| **ES3** | 70 | 54 | 24.0 | 70 | 42.3 | 59.7 | 81.4 |
| **ES4** | 65 | 51 | 22.0 | 65 | 44.8 | 55.7 | 84.2 |
| **ES5** | 60 | 48 | 20.0 | 60 | 46.9 | 51.3 | 88.5 |
| **HL** | 86 | 66 | 32.4 | 86 | 38.9 | 72.4 | 80.3 |

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 Checkout tests.

NOTE: For information about menu navigation and use of the keypad see Interface Overview on page 58.

**⚠ WARNING**

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 an 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 W7220 module is mounted and wired, apply power.

***Initial Menu Display***

On initial start up, Honeywell displays on the first line and economizer W7220 on the second line. After a brief pause, the revision of the software appears on the first line and the second line will be blank.

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

All setpoints 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 (see Table 18) 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 58.

***Checkout Tests***

Use the Checkout menu (see page 62) to test the damper operation and any configured outputs. Only items that are configured are shown in the Checkout menu.

NOTE: For information about menu navigation and use of the keypad see Interface Overview on page 58.

To perform a Checkout test:

1. Scroll to the desired test in the Checkout menu using the ▲ and ▼ 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 the Ⓘ (Menu Up/Exit) button 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**

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

***Alarms***

The economizer module provides alarm messages that display on the 2-line LCD.

NOTE: Upon power up, the module waits 60 minutes before checking for alarms. This allows time for all the configured devices (e.g., sensors, actuator) to become operational. The exception is the SAT sensor which will alarm immediately.

If one or more alarms are present and there has been no keypad activity for at least 5 minutes, the Alarms menu displays and cycles through the active alarms.

You can also navigate to the Alarms menu at any time.

***Clearing Alarms***

Once the alarm has been identified and the cause has been removed (e.g., replaced faulty sensor) the alarm can be cleared from the display.

To clear an alarm, perform the following:

1. Navigate to the desired alarm.
2. Press the ↵ (Enter) button. ERASE? displays.
3. Press the ↵ (Enter) button. ALARM ERASED displays.
4. Press the Ⓘ (Menu Up/Exit) button to complete the action and return to the previous menu.

NOTE: If the alarm still exists after clearing it, it is redisplayed within 5 seconds.

## 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 electro-mechanical 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**

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 17.

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 3-15 Ton Small Rooftop Units Accessory LP (Liquid Propane) 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

### Table 22 — Torque Values

| | |
|---|---|
| **Stator Motor Mounting Screws** | 50 in.-lb (5.7 Nm) ± 5 in.-lb (0.6 Nm) |
| **Fan Rotor Mounting Screws (2.4 HP)** | 50 in.-lb (5.7 Nm) ± 5 in.-lb (0.6 Nm) |
| **Fan Rotor Mounting Screws (3 and 5 HP)** | 30 in.-lb (3.4 Nm) ± 2 in.-lb (0.2 Nm) |
| **Fan Deck Bracket Screws** | 50 in.-lb (5.7 Nm) ± 5 in.-lb (0.6 Nm) |
| **Fan Casing Screws** | 10 in.-lb (1.1 Nm) ± 1 in.-lb (0.1 Nm) |
| **Heat Shield Screws** | 30 in.-lb (3.4 Nm) ± 2 in.-lb (0.2 Nm) |
| **Condenser Motor Mounting Screws** | 30 in.-lb (3.4 Nm) ± 2 in.-lb (0.2 Nm) |
| **Condenser Hub Set Screw** | 84 in.-lb (9.5 Nm) ± 12 in.-lb (1.5 Nm) |
| **Compressor Mounting Bolts** | 12 ft-lb (16.2 Nm) ± 2 ft-lb (2.7 Nm) |
| **Tandem Rail Mounting Bolts** | 8 ft-lb (10.8 Nm) ± 0.5 ft-lb (0.6 Nm) |
| **Crankcase Heater** | 22.5 in.-lb (2.5 Nm) ± 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** (Positions 1–2)
48 — Gas Heat Packaged Rooftop

**Model Series - WeatherMaker®** (Positions 3–4)
FC — Standard Efficiency (EcoBlue™ Technology)

**Heat Options** (Position 5)
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** (Position 6)
M = Two Stage Cooling/Single Circuit Models
N = Two Stage Cooling/Single Circuit Models with Humidi-MiZer® System

**Cooling Tons** (Positions 7–8)
20 = 17.5 tons
24 = 20.0 tons
28 = 25.0 tons
30 = 27.5 tons

**Sensor Options** (Position 9)
A = None
B = Return Air Smoke Detector (RA)
C = Supply Air Smoke Detector (SA)
D = RA + SA Smoke Detector
E = $CO_2$ Sensor
F = RA Smoke Detector and $CO_2$
G = SA Smoke Detector and $CO_2$
H = RA + SA Smoke Detector and $CO_2$
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 + $CO_2$
P = Condensate Overflow Switch + RA Smoke Detector and $CO_2$
Q = Condensate Overflow Switch + SA Smoke Detector and $CO_2$
R = Condensate Overflow Switch + RA and SA Smoke Detector and $CO_2$

**Indoor Fan Options - Vane Axial EcoBlue Fan System** (Position 10)
2 = Standard/Medium Static Motor - Vertical Supply
3 = High Static 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 Static Motor - Horizontal Supply
L = High Static Motor - Horizontal Supply and Filter Status Switch

**Coil Options – RTPF (Outdoor – Indoor – Hail Guard)** (Position 11)
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** (Position 12)
1 = 575-3-60
5 = 208/230-3-60
6 = 460-3-60

**Design Revision** (Position 13)
- = Factory Design Revision

**Base Unit Controls** (Position 14)
0 = Electro-mechanical Controller (allows for use of field-installed economizers)
3 = SystemVu™ Controls
8 = Electromechanical Controls — can be used with POL224 EconomizerONE (with Fault Detection and Diagnostic)

**Intake / Exhaust Options** (Position 15)
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 wtih Baro Relief
X = ULTRA Low Leak Enthalpy Economizer with PE (cent) Vert Only

**Service Options** (Position 16)
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

**Electrical Options** (Position 17)
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

**Packaging Compliance** (Position 18)
0 = Standard

**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[a]** | 1800 | 1800 | 2000 | 2000 |
| **REFRIGERATION SYSTEM** | | | | |
| 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 |
| **EVAPORATOR COIL** | | | | |
| 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 ($ft^2$) | 22 | 22 | 22 | 22 |
| Condensate Drain Connection Size | 3/4 in. | 3/4 in. | 3/4 in. | 3/4 in. |
| **CONDENSER COIL** | | | | |
| 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 ($ft^2$) | 19.6 | 19.6 | 23.8 | 23.8 |
| **HUMIDI-MIZER COIL** | | | | |
| Material | — | Cu / Al | — | Cu / Al |
| Coil Type (RTPF) | — | 5/16 in. | — | 5/16 in. |
| Rows / FPI | — | 1 / 18 | — | 1 / 18 |
| Total Face Area ($ft^2$) | — | 21.4 | — | 21.4 |
| **EVAPORATOR FAN AND MOTOR** | | | | |
| Vertical Standard Static 3 Phase | | | | |
| 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 |
| Vertical High Static 3 Phase | | | | |
| 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 |
| Horizontal High Static 3 Phase | | | | |
| 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 |
| **CONDENSER FAN AND MOTOR** | | | | |
| 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 |
| **Filters** | | | | |
| 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 |
|---|---|---|---|---|
| **NOMINAL CAPACITY (tons)** | 25 | 25 | 27.5 | 27.5 |
| **BASE UNIT OPERATING WT (lb) 48FC[a]** | 2174 | 2174 | 2351 | 2351 |
| **REFRIGERATION SYSTEM** | | | | |
| 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 |
| **EVAPORATOR COIL** | | | | |
| 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 ($ft^2$) | 23.1 | 23.1 | 26 | 26 |
| Condensate Drain Connection Size | 3/4 in. | 3/4 in. | 3/4 in. | 3/4 in. |
| **CONDENSER COIL** | | | | |
| 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 ($ft^2$) | 25.3 | 25.3 | 28.9 | 28.9 |
| **HUMIDI-MIZER COIL** | | | | |
| 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 ($ft^2$) | — | 22.4 | — | 25.3 |
| **EVAPORATOR FAN AND MOTOR** | | | | |
| Vertical Standard Static 3 Phase | | | | |
| 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 |
| Vertical High Static 3 Phase | | | | |
| 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 |
| Horizontal High Static 3 Phase | | | | |
| 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 |
| **CONDENSER FAN AND MOTOR** | | | | |
| 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 |
| **Filters** | | | | |
| 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 |
|---|---|---|---|---|
| NOMINAL CAPACITY (tons) | 17.5 | 20 | 25 | 27.5 |
| **GAS CONNECTION** | | | | |
| 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 |
| **HEAT ANTICIPATOR SETTING (AMPS)** | | | | |
| First Stage | 0.14 | 0.14 | 0.14 | 0.14 |
| Second Stage | 0.14 | 0.14 | 0.14 | 0.14 |
| **NATURAL GAS HEAT** | | | | |
| LOW | | | | |
| 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 |
| MEDIUM | | | | |
| 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 |
| HIGH | | | | |
| 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 |
| **LIQUID PROPANE HEAT** | | | | |
| LOW | | | | |
| 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 |
| MEDIUM | | | | |
| 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 |
| HIGH | | | | |
| 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 |

## 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 this book.
7. For more information on the performance limits of the fan motors, see the application data section of this 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.

## 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

## 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

## 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

## 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

## 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

### 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

## 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

## 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

## 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

## 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

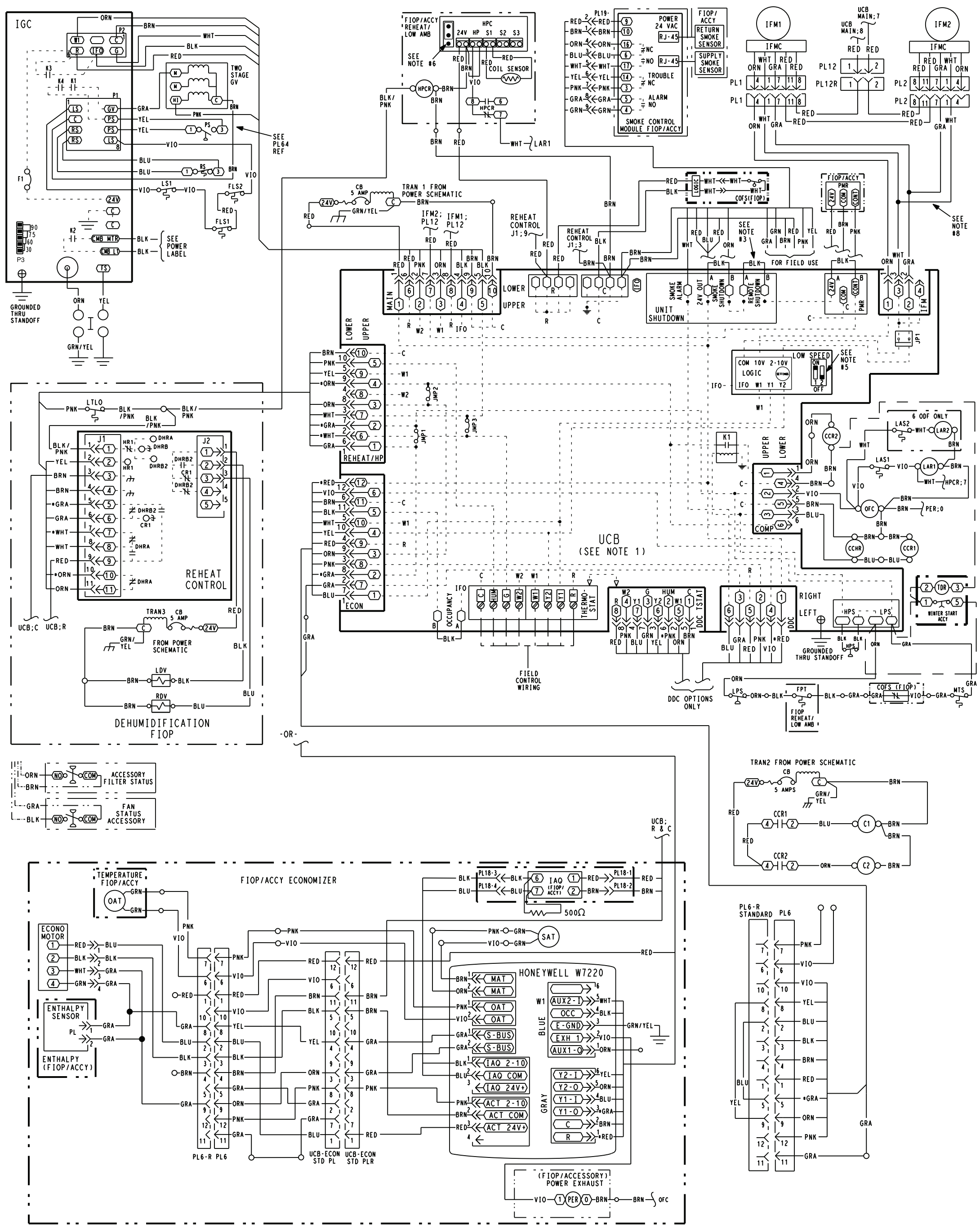
# APPENDIX E — WIRING DIAGRAMS

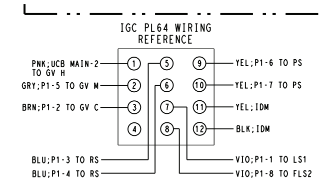
## 48FC*20-30 — Wiring Diagrams — Standard SCCR

| SIZE | VOLTAGE | CONTROL (OVERLAY) | PAGE | POWER | PAGE |
|---|---|---|---|---|---|
| **48FC*20-28 Electro-Mechanical W7220 Controller** | 208/230 | 50HE003741 | 88 | 50HE003743 | 92 |
| | 460 | 50HE003742 | 89 | 50HE003762 | 93 |
| | 575 | | | 50HE003763 | 94 |
| **48FC*30 Electro-Mechanical W7220 Controller** | 208/230 | 50HE003741 | 88 | 50HE003744 | 95 |
| | 460 | 50HE003742 | 89 | 50HE003764 | 96 |
| | 575 | | | 50HE003765 | 97 |
| **48FC*20-28 SystemVu™ Controller (Factory Option)** | 208/230 | 50HE004108 | 90 | 50HE004092 | 98 |
| | 460 | 50HE004109 | 91 | 50HE004100 | 99 |
| | 575 | | | 50HE004101 | 100 |
| **48FC*30 SystemVu™ Controller (Factory Option)** | 208/230 | 50HE004108 | 89 | 50HE004093 | 101 |
| | 460 | 50HE004109 | 91 | 50HE004102 | 102 |
| | 575 | | | 50HE004103 | 103 |

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

| SIZE | VOLTAGE | CONTROL (OVERLAY) | PAGE | POWER | PAGE |
|---|---|---|---|---|---|
| **48FC*20-28 Electro-Mechanical W7220 Controller** | 208/230 | 50HE006351 | 104 | 50HE006161 | 108 |
| | 460 | 50HE006352 | 105 | 50HE006165 | 109 |
| **48FC*30 Electro-Mechanical W7220 Controller** | 208/230 | 50HE006351 | 104 | 50HE006162 | 110 |
| | 460 | 50HE006352 | 105 | 50HE006167 | 111 |
| **48FC*20-28 SystemVu™ Controller (Factory Option)** | 208/230 | 50HE006357 | 106 | 50HE006170 | 112 |
| | 460 | 50HE006358 | 107 | 50HE006174 | 113 |
| **48FC*30 SystemVu™ Controller (Factory Option)** | 208/230 | 50HE006357 | 106 | 50HE006171 | 114 |
| | 460 | 50HE006358 | 107 | 50HE006175 | 115 |






| | | | | | |
|---|---|---|---|---|---|
| ACCY | ACCESSORY | HS | HALL EFFECT SENSOR | OFM | OUTDOOR FAN MOTOR |
| AMB | AMBIENT | I | IGNITOR | OFR | OUTDOOR FAN RELAY |
| C | CONTACTOR,COMPRESSOR | IAQ | INDOOR AIR QUALITY SENSORS | OL | OVERLOAD |
| CAP | CAPACITOR | IDM | INDUCED DRAFT MOTOR | PL | PLUG ASSEMBLY |
| CB | CIRCUIT BREAKER | IFCB | INDOOR FAN CIRCUIT BREAKER | POT | POTENTIOMETER |
| CCH | CRANKCASE HEATER | IFM | INDOOR FAN MOTOR | PMR | PHASE MONITOR RELAY |
| CCHR | CRANKCASE HEATER RELAY | IFMC | INDOOR FAN CONTROLLER | QT | QUADRUPLE TERMINAL |
| CMB | COMBUSTION | IGC | INTEGRATED GAS CONTROL | RARH | RETURN AIR RELATIVE HUMIDITY |
| COFS | CONDENSATE OVERFLOW SWT | JMP | JUMPER | RAT | RETURN AIR TEMP. SENSOR |
| COMP | COMPRESSOR MOTOR | LA | LOW AMBIENT | RDV | REHEAT DISCHARGE VALVE |
| DDC | DIRECT DIGITAL CONTROL | LDV | LIQUID DIVERTER VALVE | RS | ROLLOUT SWITCH |
| ERV | ENERGY RECOVERY VENTILATOR | LPS | LOW PRESSURE SWITCH | SAT | SUPPLY AIR TEMP. SENSOR |
| FIOP | FACTORY INSTALLED OPTION | LSM | LIMIT SWITCH (MANUAL RESET) | SEN | SENSOR |
| FLS | FAN LIMIT SWITCH | LS | LIMIT SWITCH | SPRH | SPACE RELATIVE HUMIDITY |
| FPT | FREEZE PROTECTION THERMOSTAT | LTLO | LOW TEMPERATURE LOCKOUT | SPT | SPACE TEMPERATURE SENSOR |
| FSD | FIRE SHUT DOWN | MGV | MAIN GAS VALVE | SPTO | SPACE TEMPERATURE OFFSET |
| FS | FLAME SENSOR | MOV | VOLTAGE RESTRICTOR | STD | STANDARD |
| FU | FUSE | MTR | MOTOR | TB | TERMINAL BLOCK |
| GND | GROUND | MTS | MIXED AIR TEMPERATURE SWITCH | TDR | TIME DELAY RELAY(WINTER START) |
| GVR | GAS VALVE RELAY | OAQ | OUTDOOR AIR QUALITY | TRAN | TRANSFORMER |
| HPC | HEAD PRESSURE CONTROL | OARH | OUTSIDE AIR RELATIVE HUMIDITY | UCB | UNIT CONTROL BOARD |
| HPS | HIGH PRESSURE SWITCH | OAT | OUTDOOR AIR TEMP. SENSOR | | |

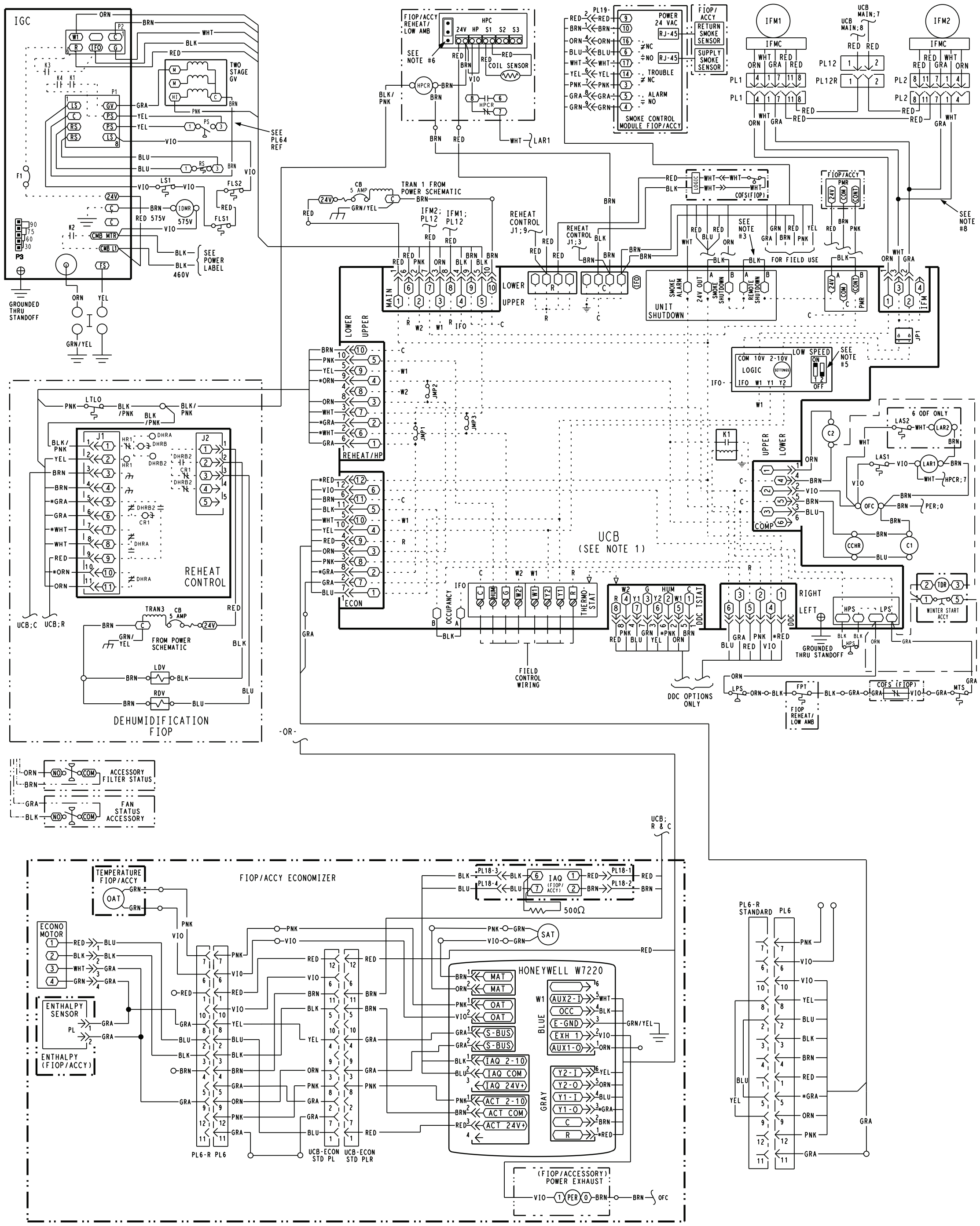
NOTES:
1. TERMINAL BOARD SCHEMATIC LAYOUT DOES NOT MATCH ACTUAL TERMINAL BOARD LAYOUT.
2. TERMINAL BOARD JUMPERS 1,2 AND 3 ARE CUT FOR REHEAT UNITS ONLY.
3. REMOVE DESIGNATED JUMPERS ON TERMINAL BOARD WHEN ADDING SMOKE DETECTORS, OCCUPANCY AND REMOTE SHUTDOWN.
4. USE ABC AS COARSE AND AS POT FINE ADJUSTMENTS FOR SETTING HIGH FAN SPEED. LOW SPEED IS AN OFFSET BASED ON DIP SWITCHES.

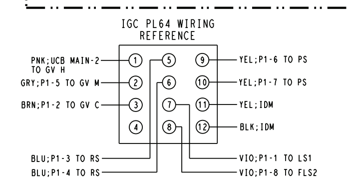

5. 2-PIN LOW SPEED DIP SWITCH POSITIONS ARE FACTORY SET AS SHOWN, EXCEPT FOR 25 TON, POSITIONS WILL BE 1;OFF AND 2;ON.
6. HARDSTART AND CUTOUT SET TO "MIN", JUMPER PIN ON TOP 2-PINS AS SHOWN.
7. THE * WIRE COLOR IS FOR DIFFERENTIATION WITHIN THIS SCHEMATIC.
8. ON HORIZONTAL SUPPLY UNITS, IFM2 GRA AND WHT WIRES WILL INCLUDE IN-LINE RESISTORS TO REDUCE IT'S SPEED.

YAC CONTROL
T1 17.5 - 27.5 TON
T2 15 -25 TON
208/230V

50HE003741 C

**Fig. B — 48FC**20-30 — 208/230-3-60 — Control Wiring Diagram Electro-Mechanical with W7220 Controller — SCCR**




| | |
|---|---|
| ACCY | ACCESSORY |
| AMB | AMBIENT |
| C | CONTACTOR,COMPRESSOR |
| CAP | CAPACITOR |
| CB | CIRCUIT BREAKER |
| CCH | CRANKCASE HEATER |
| CCHR | CRANKCASE HEATER RELAY |
| CMB | COMBUSTION |
| COFS | CONDENSATE OVERFLOW SWT |
| COMP | COMPRESSOR MOTOR |
| DDC | DIRECT DIGITAL CONTROL |
| ERV | ENERGY RECOVERY VENTILATOR |
| FIOP | FACTORY INSTALLED OPTION |
| FLS | FAN LIMIT SWITCH |
| FPT | FREEZE PROTECTION THERMOSTAT |
| FSD | FIRE SHUT DOWN |
| FS | FLAME SENSOR |
| FU | FUSE |
| GND | GROUND |
| GVR | GAS VALVE RELAY |
| HPC | HEAD PRESSURE CONTROL |
| HPS | HIGH PRESSURE SWITCH |
| HS | HALL EFFECT SENSOR |
| I | IGNITOR |
| IAQ | INDOOR AIR QUALITY SENSORS |
| IDM | INDUCED DRAFT MOTOR |
| IFCB | INDOOR FAN CIRCUIT BREAKER |
| IFM | INDOOR FAN MOTOR |
| IFMC | INDOOR FAN CONTROLLER |
| IGC | INTEGRATED GAS CONTROL |
| JMP | JUMPER |
| LA | LOW AMBIENT |
| LDV | LIQUID DIVERTER VALVE |
| LPS | LOW PRESSURE SWITCH |
| LSM | LIMIT SWITCH (MANUAL RESET) |
| LS | LIMIT SWITCH |
| LTLO | LOW TEMPERATURE LOCKOUT |
| MGV | MAIN GAS VALVE |
| MOV | VOLTAGE RESTRICTOR |
| MTR | MOTOR |
| MTS | MIXED AIR TEMPERATURE SWITCH |
| OAQ | OUTDOOR AIR QUALITY |
| OARH | OUTSIDE AIR RELATIVE HUMIDITY |
| OAT | OUTDOOR AIR TEMP. SENSOR |
| OFM | OUTDOOR FAN MOTOR |
| OFR | OUTDOOR FAN RELAY |
| OL | OVERLOAD |
| PL | PLUG ASSEMBLY |
| POT | POTENTIOMETER |
| PMR | PHASE MONITOR RELAY |
| QT | QUADRUPLE TERMINAL |
| RARH | RETURN AIR RELATIVE HUMIDITY |
| RAT | RETURN AIR TEMP. SENSOR |
| RDV | REHEAT DISCHARGE VALVE |
| RS | ROLLOUT SWITCH |
| SAT | SUPPLY AIR TEMP. SENSOR |
| SEN | SENSOR |
| SPRH | SPACE RELATIVE HUMIDITY |
| SPT | SPACE TEMPERATURE SENSOR |
| SPTO | SPACE TEMPERATURE OFFSET |
| STD | STANDARD |
| TB | TERMINAL BLOCK |
| TDR | TIME DELAY RELAY (WINTER START) |
| TRAN | TRANSFORMER |
| UCB | UNIT CONTROL BOARD |

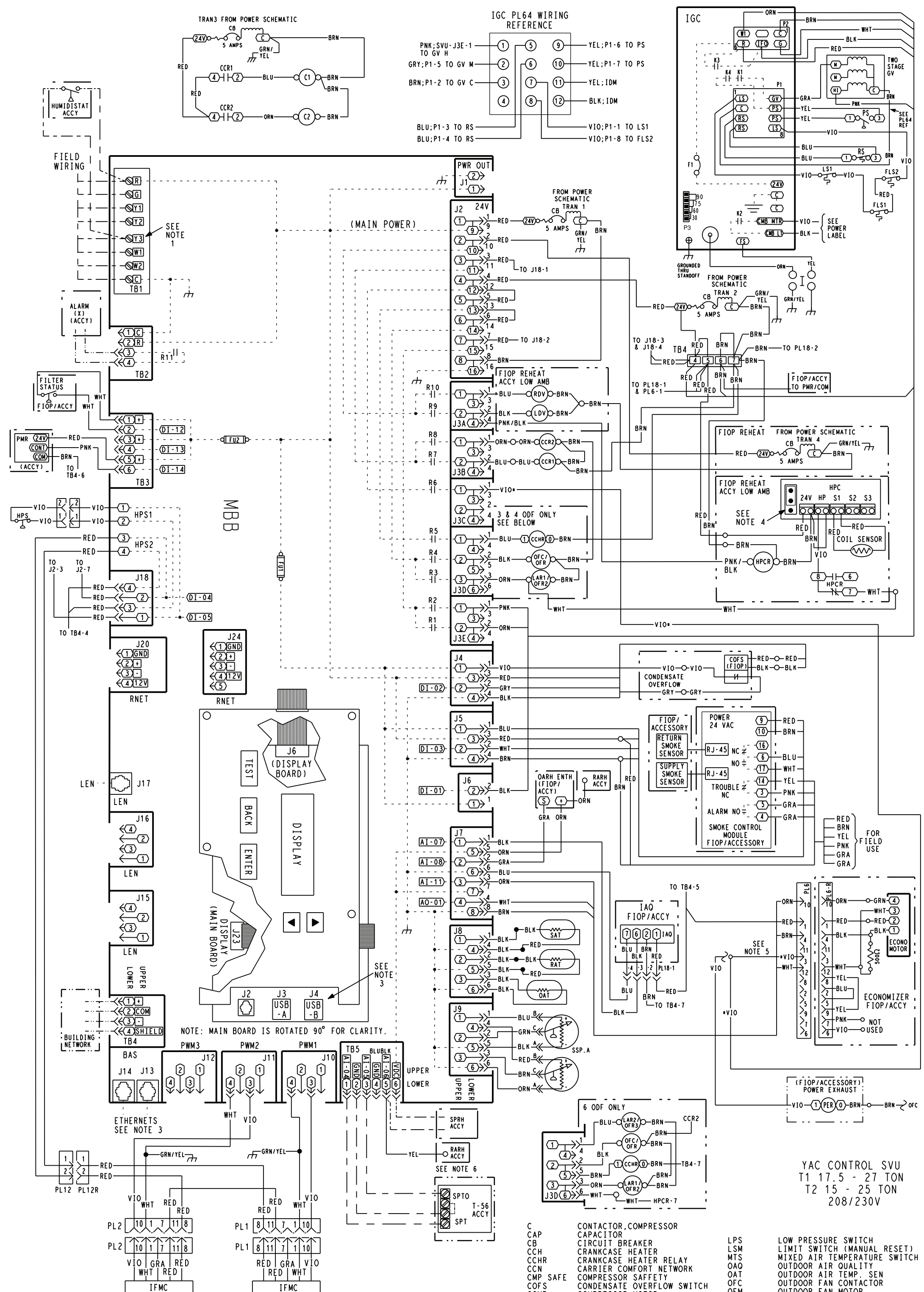
NOTES:

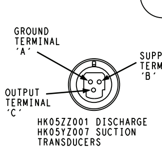
1. TERMINAL BOARD SCHEMATIC LAYOUT DOES NOT MATCH ACTUAL TERMINAL BOARD LAYOUT.
2. TERMINAL BOARD JUMPERS 1,2 AND 3 ARE CUT FOR REHEAT UNITS ONLY.
3. REMOVE DESIGNATED JUMPERS ON TERMINAL BOARD WHEN ADDING SMOKE DETECTORS, OCCUPANCY AND REMOTE SHUTDOWN.
4. USE ABC AS COARSE AND POT AS FINE ADJUSTMENTS FOR SETTING HIGH FAN SPEED. LOW SPEED IS AN OFFSET BASED ON DIP SWITCHES.
5. 2-PIN LOW SPEED DIP SWITCH POSITIONS ARE FACTORY SET AS SHOWN, EXCEPT FOR 25 TON, POSITIONS WILL BE 1;OFF AND 2;ON.
6. HARDSTART AND CUTOUT SET TO "MIN", JUMPER PIN ON TOP 2-PINS AS SHOWN.
7. THE * WIRE COLOR IS FOR DIFFERENTIATION WITHIN THIS SCHEMATIC.
8. ON HORIZONTAL SUPPLY UNITS, IFM2 GRA AND WHT WIRES WILL INCLUDE IN-LINE RESISTORS TO REDUCE IT'S SPEED.

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

50HE003742 C

**Fig. C — 48FC**20-30 — 460/575-3-60 — Control Wiring Diagram Electro-Mechanical with W7220 Controller — SCCR**




NOTES:
1. THE "Y3" TERMINAL IS CONFIGURABLE IN THE SOFTWARE.
2. LOW VOLTAGE CONNECTIONS MUST BE CLASS 2.
3. USB-B AT J4 AND ETHERNETS AT J13,14 ARE SHOWN FOR FUTURE USE.
4. HARDSTART AND CUTOUT SET TO "MIN", JUMPER PIN ON TOP 2-PINS AS SHOWN.
5. DISCONNECT VIO TO ALLOW POWER EXHAUST CONNECTION. THIS VIO WIRE IS LEFT DISCONNECTED.
6. WHEN USING A RARH SENSOR, MAKE CONNECTION IN THE RETURN AIR SECTION. WHEN USING SPRH SENSOR, MAKE CONNECTION HERE BY DISCONNECTING YELLOW WIRE.

| | |
|---|---|
| C | CONTACTOR,COMPRESSOR |
| CAP | CAPACITOR |
| CB | CIRCUIT BREAKER |
| CCH | CRANKCASE HEATER |
| CCHR | CRANKCASE HEATER RELAY |
| CCN | CARRIER COMFORT NETWORK |
| CMP SAFE | COMPRESSOR SAFFETY |
| COFS | CONDENSATE OVERFLOW SWITCH |
| COMP | COMPRESSOR MOTOR |
| CTB | CENTRAL TERMINAL BOARD |
| DDC | DIRECT DIGITAL CONTROL |
| ERV | ENERGY RECOVERY VENTILATOR |
| FIOP | FACTORY INSTALLED OPTION |
| FLS | FAN LIMIT SWITCH |
| FSD | FIRE SHUT DOWN |
| FU | FUSE |
| GR | GROUND |
| HC | HEATER CONTACTOR |
| HCR | HEATER CONTROL RELAY |
| HPS | HIGH PRESSURE SWITCH |
| IAQ | INDOOR AIR QUALITY SENSORS |
| IFC | INDOOR FAN CONTACTOR |
| IFM | INDOOR FAN MOTOR |
| IRH | INDOOR RELATIVE HUMIDITY |
| LA | LOW AMBIENT LOCKOUT |
| LAR | LOW AMBIENT RELAY |
| LAS | LOW AMBIENT SWITCH |
| LOOP PWR | CURRENT LOOP POWER |
| LPS | LOW PRESSURE SWITCH |
| LSM | LIMIT SWITCH (MANUAL RESET) |
| MTS | MIXED AIR TEMPERATURE SWITCH |
| OAQ | OUTDOOR AIR QUALITY |
| OAT | OUTDOOR AIR TEMP. SEN |
| OFC | OUTDOOR FAN CONTACTOR |
| OFM | OUTDOOR FAN MOTOR |
| OFR | OUTDOOR FAN RELAY |
| OFTB | OUTDOOR FAN TERMINAL BLOCK |
| OLR | OVERLOAD RELAY |
| PER | POWER EXHAUST RELAY |
| PL | PLUG ASSEMBLY |
| POT | POTENTIOMETER |
| PMR | PHASE MONITOR RELAY |
| QT | QUADRUPLE TERMINAL |
| R | RELAY |
| RAT | RETURN AIR TEMP. SEN |
| RMT OCC | REMOTE OCCUPANCY |
| RTPF | ROUND TUBE PLATE FIN CONDENSER COIL |
| SAT | SUPPLY AIR TEMP. SENSOR |
| SEN | SENSOR |
| SET | SET POINT OFFSET |
| SFS | SUPPLY FAN STATUS |
| TDR | TIME DELAY RELAY |
| TRAN | TRANSFORMER |

50HE004108 B

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

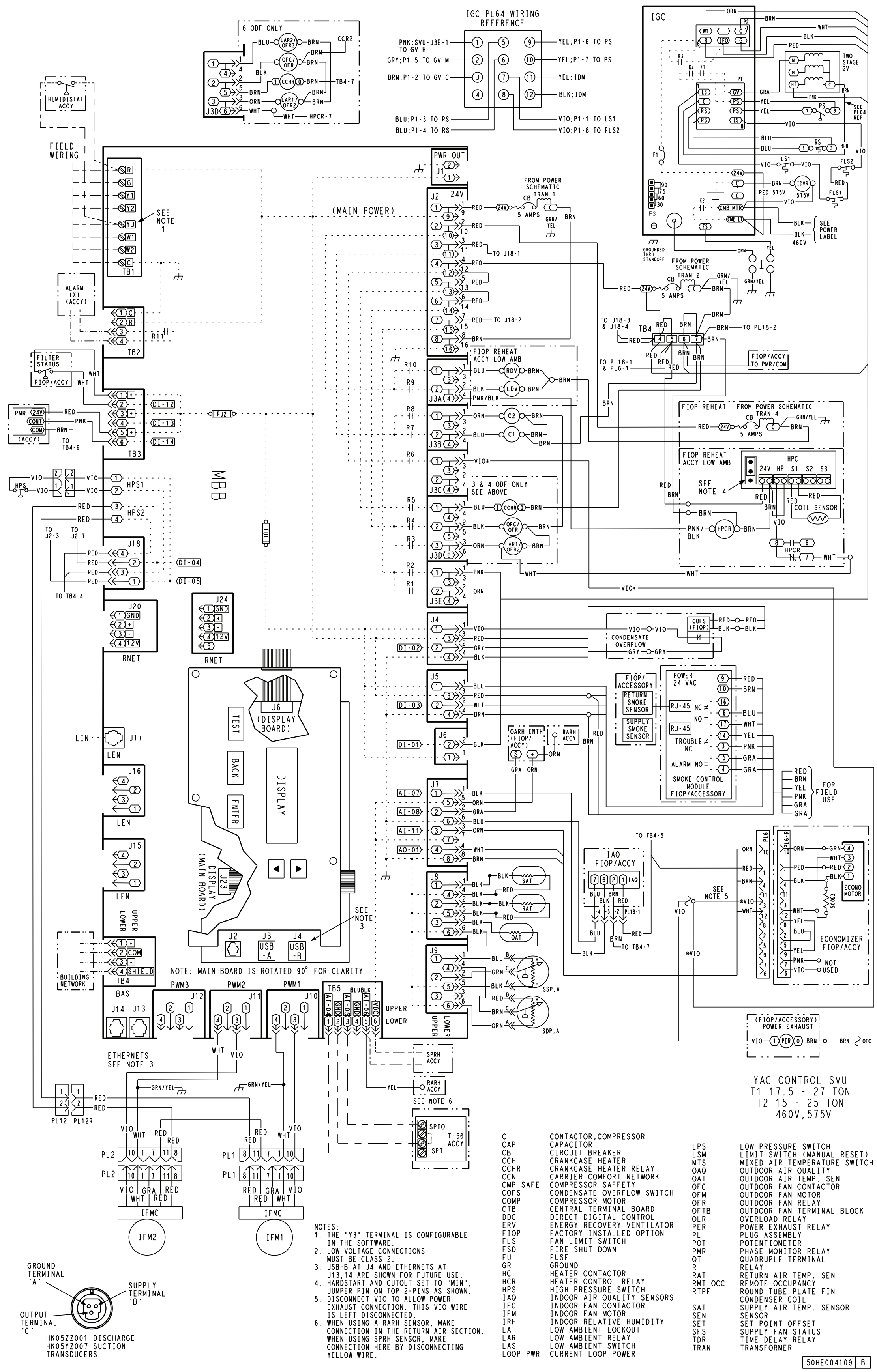



**Fig. E — 48FC**20-30 — 460/575-3-60 — Control Wiring Diagram with SystemVu™ Controller — SCCR**

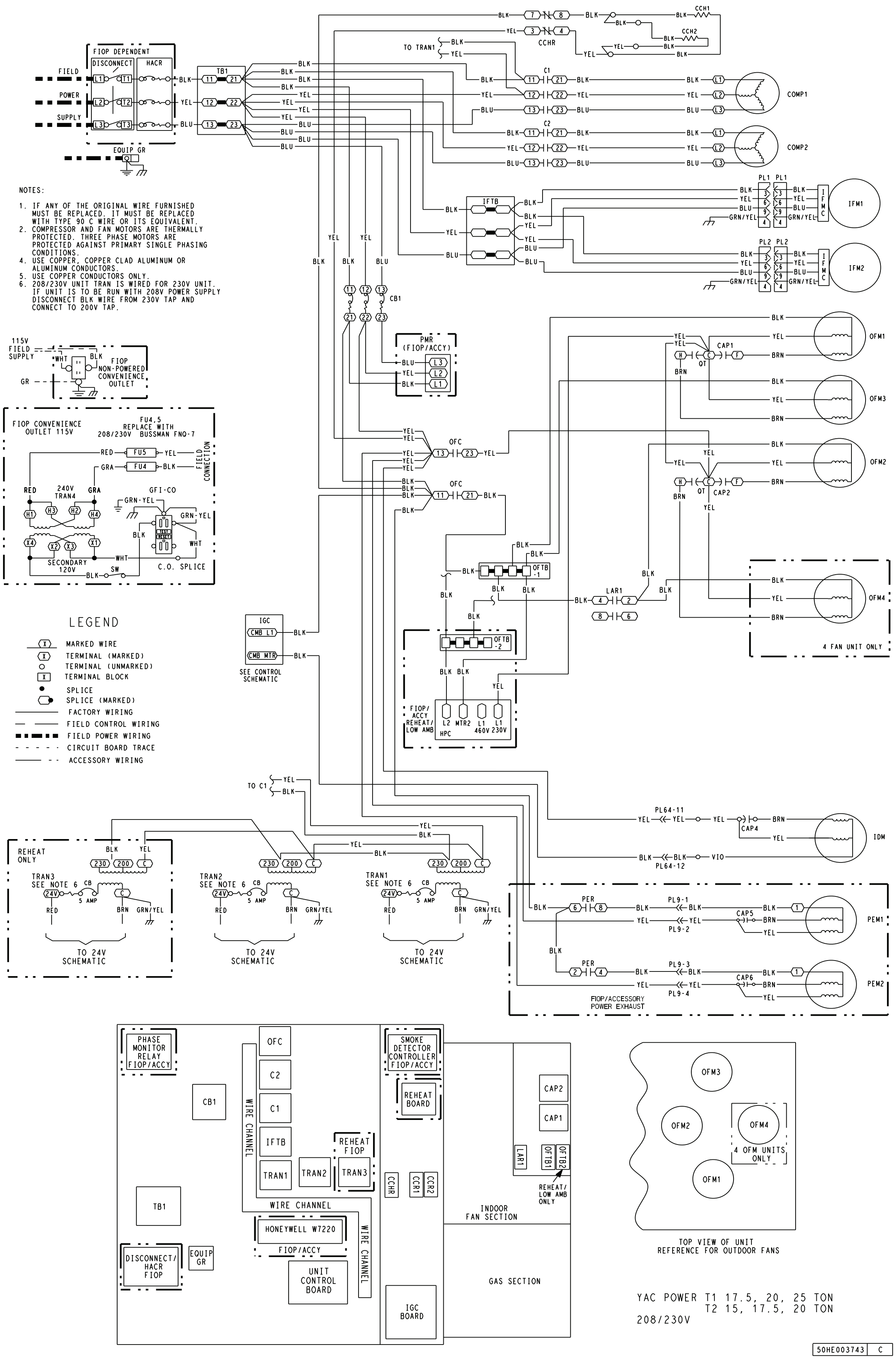



**Fig. F — 48FC**20-28 — 208/230-3-60 — Power Wiring Diagram Electro-Mechanical with W7220 Controller — SCCR**

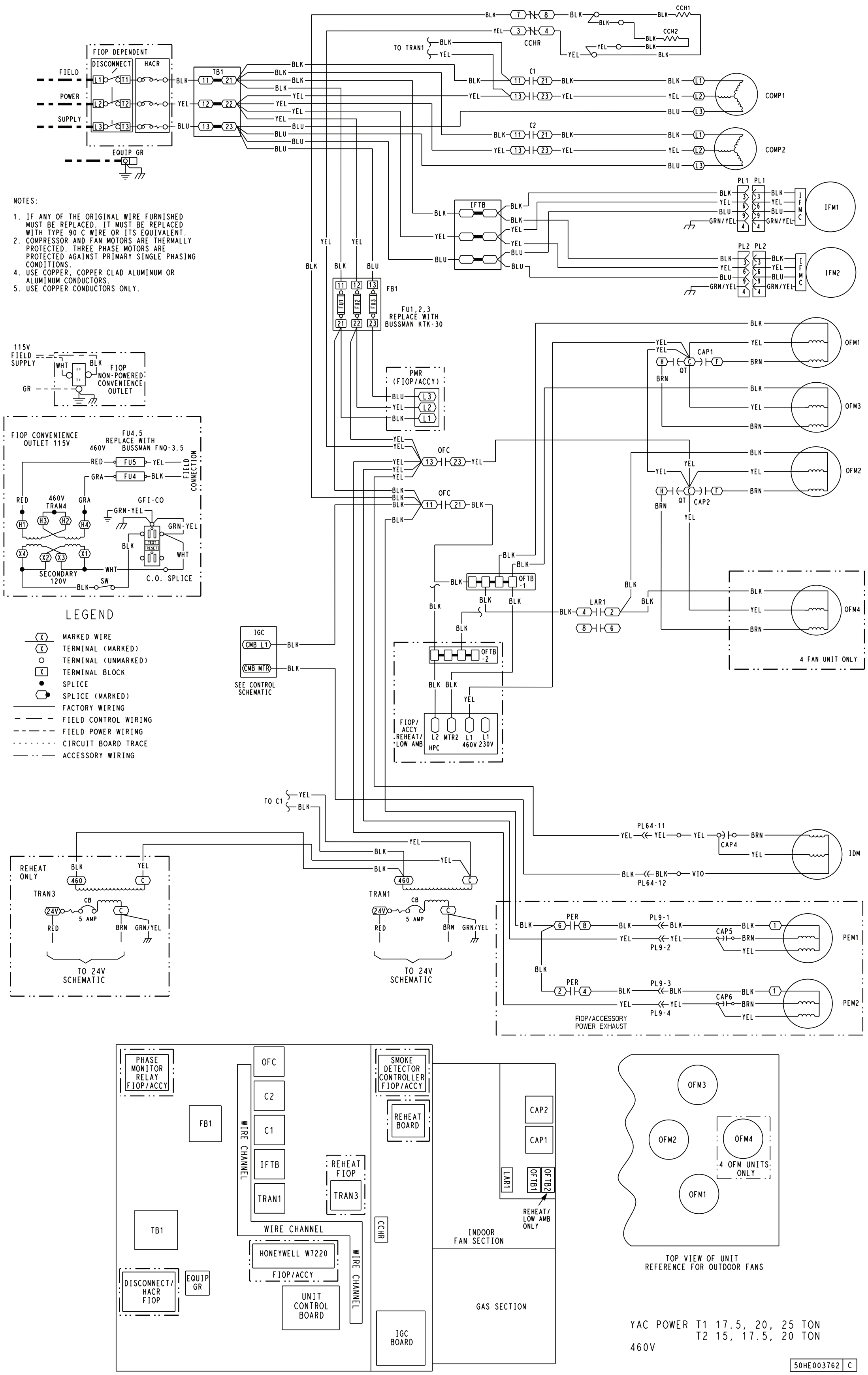



Fig. G — 48FC**20-28 — 460-3-60 — Power Wiring Diagram
Electro-Mechanical with W7220 Controller — SCCR

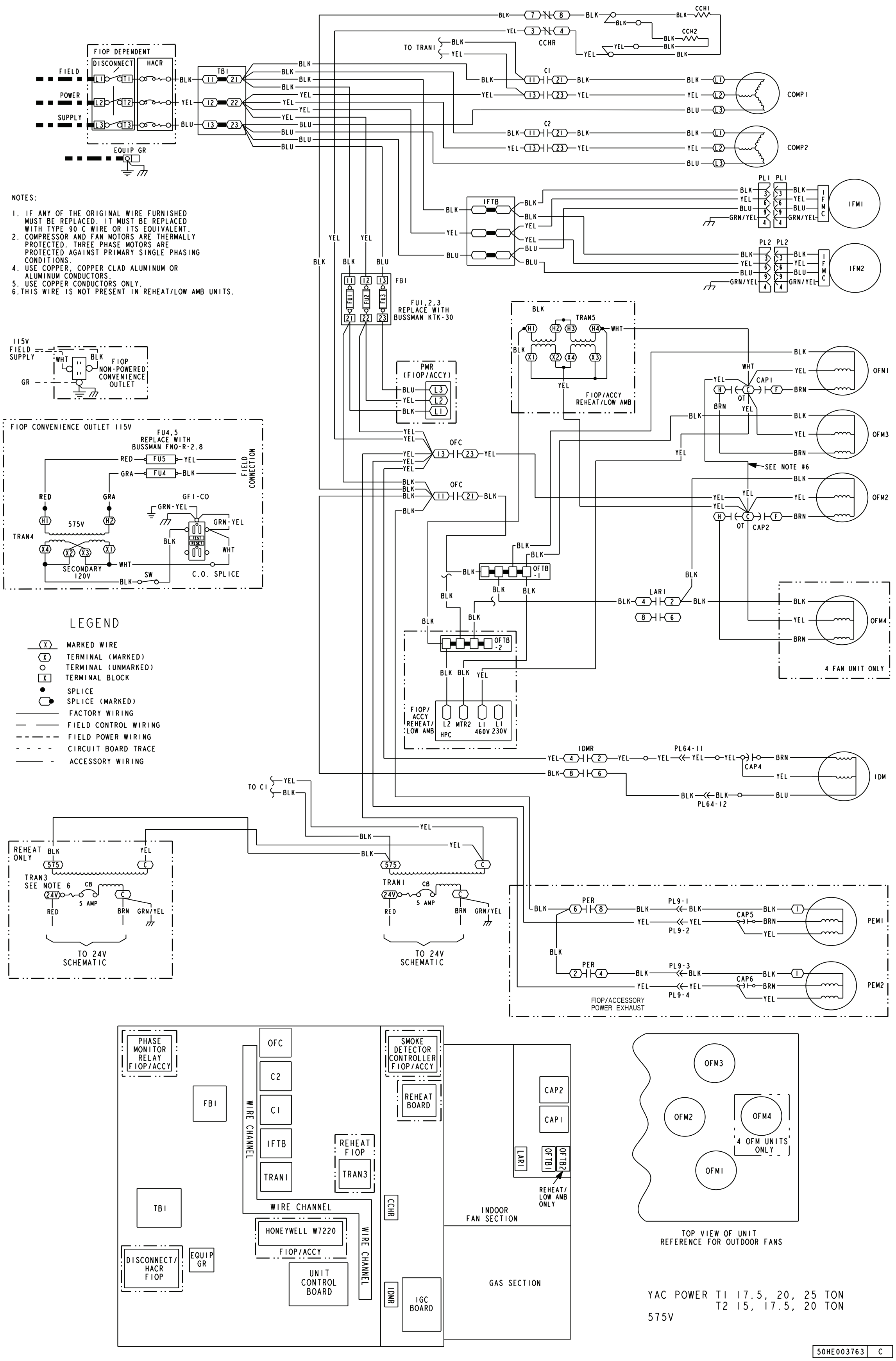


**Fig. H — 48FC**20-28 — 575-3-60 — Power Wiring Diagram Electro-Mechanical with W7220 Controller — SCCR**

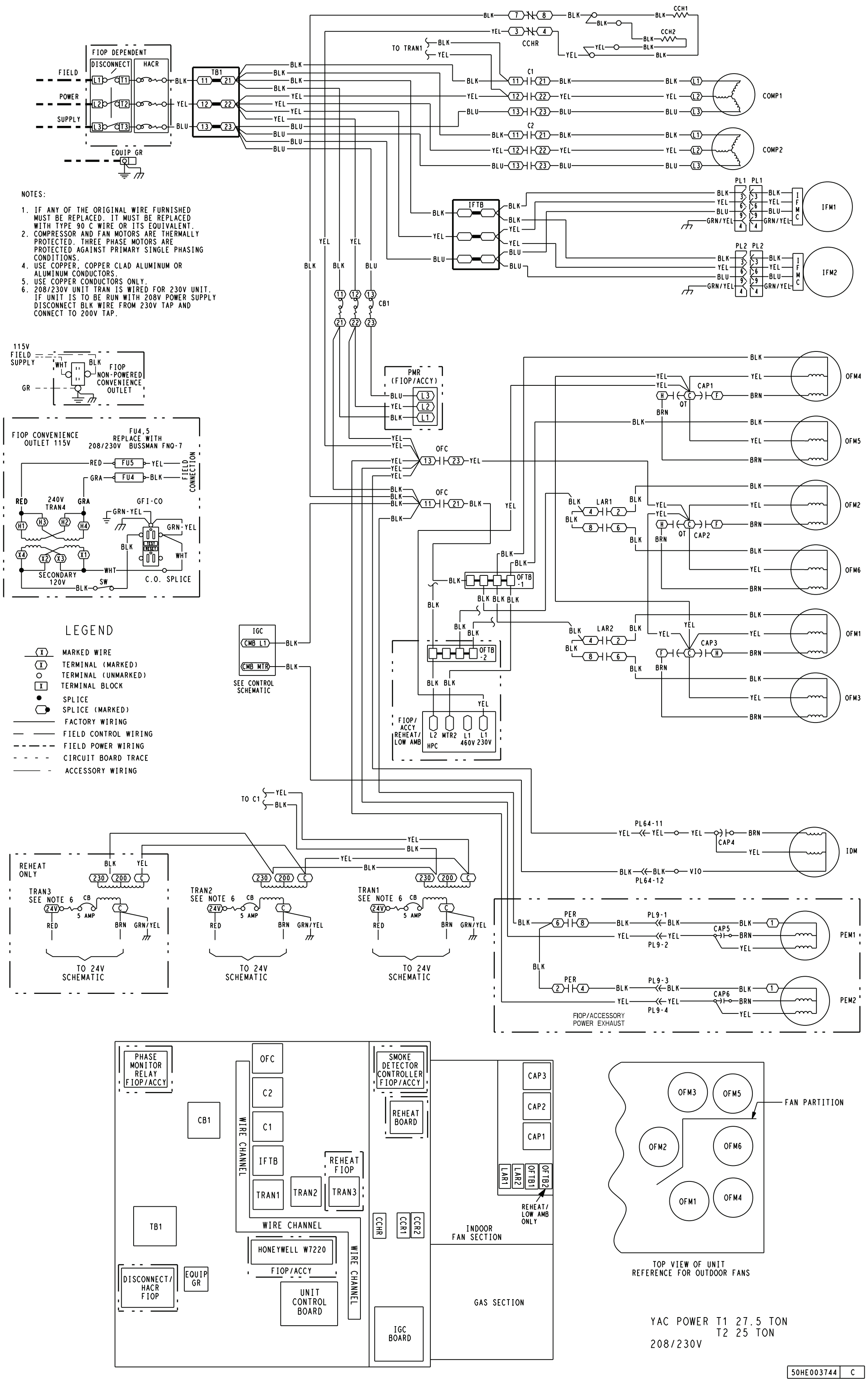


**Fig. I — 48FC**30 — 208/230-3-60 — Power Wiring Diagram Electro-Mechanical with W7220 Controller — SCCR**

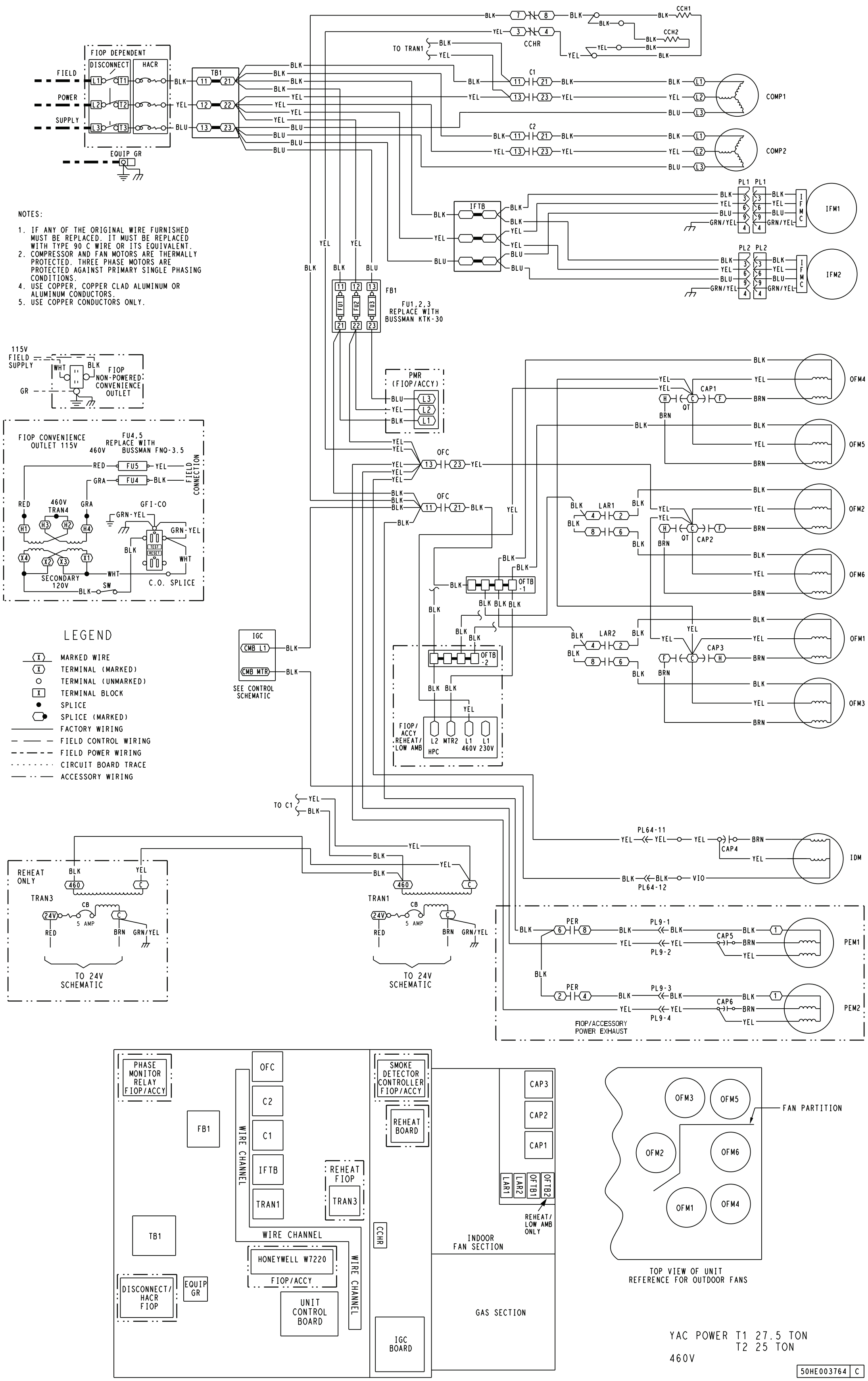


Fig. J — 48FC**30 — 460-3-60 — Power Wiring Diagram
Electro-Mechanical with W7220 Controller — SCCR

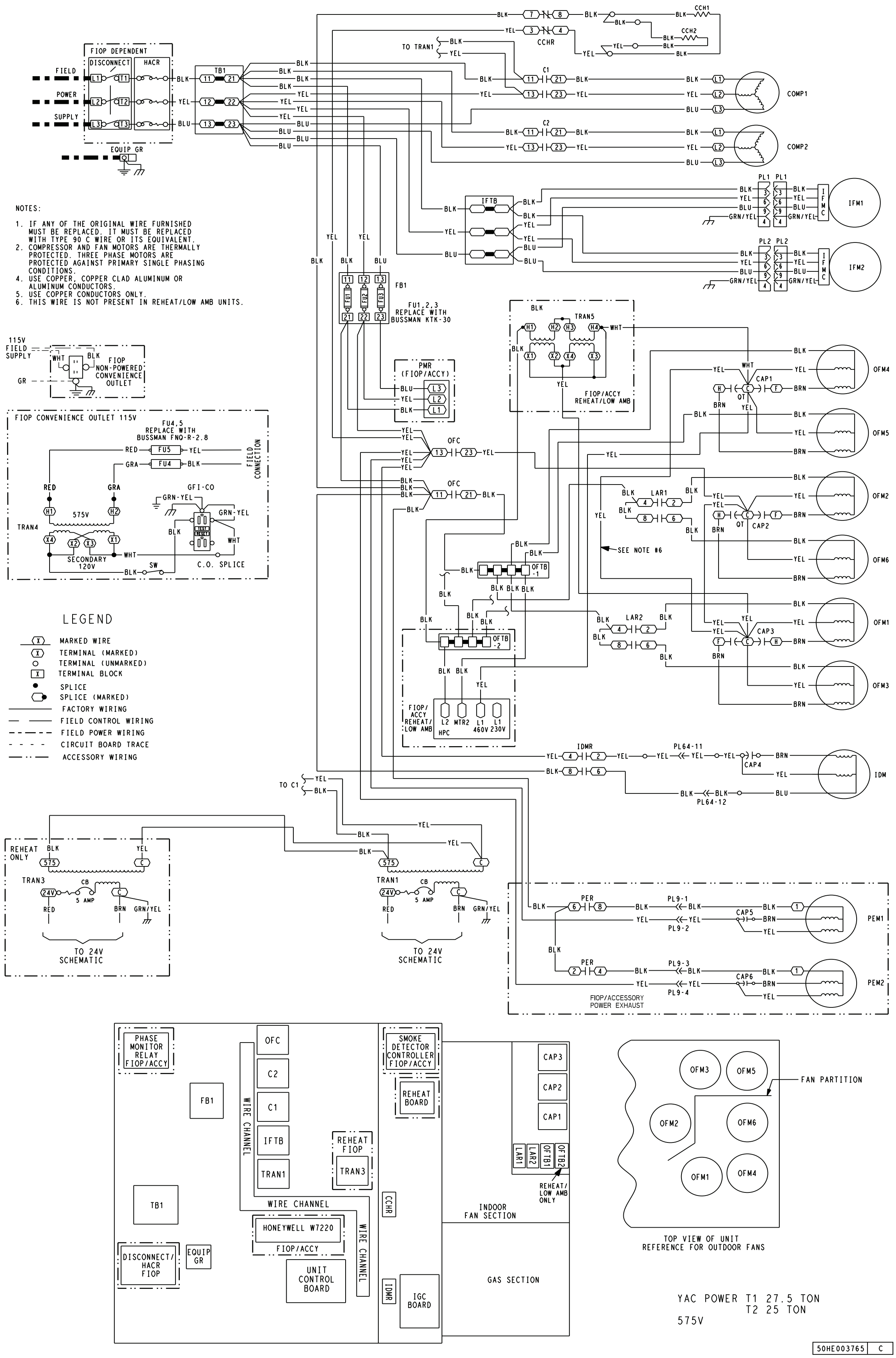



**Fig. K — 48FC**30 — 575-3-60 — Power Wiring Diagram**
**Electro-Mechanical with W7220 Controller — SCCR**

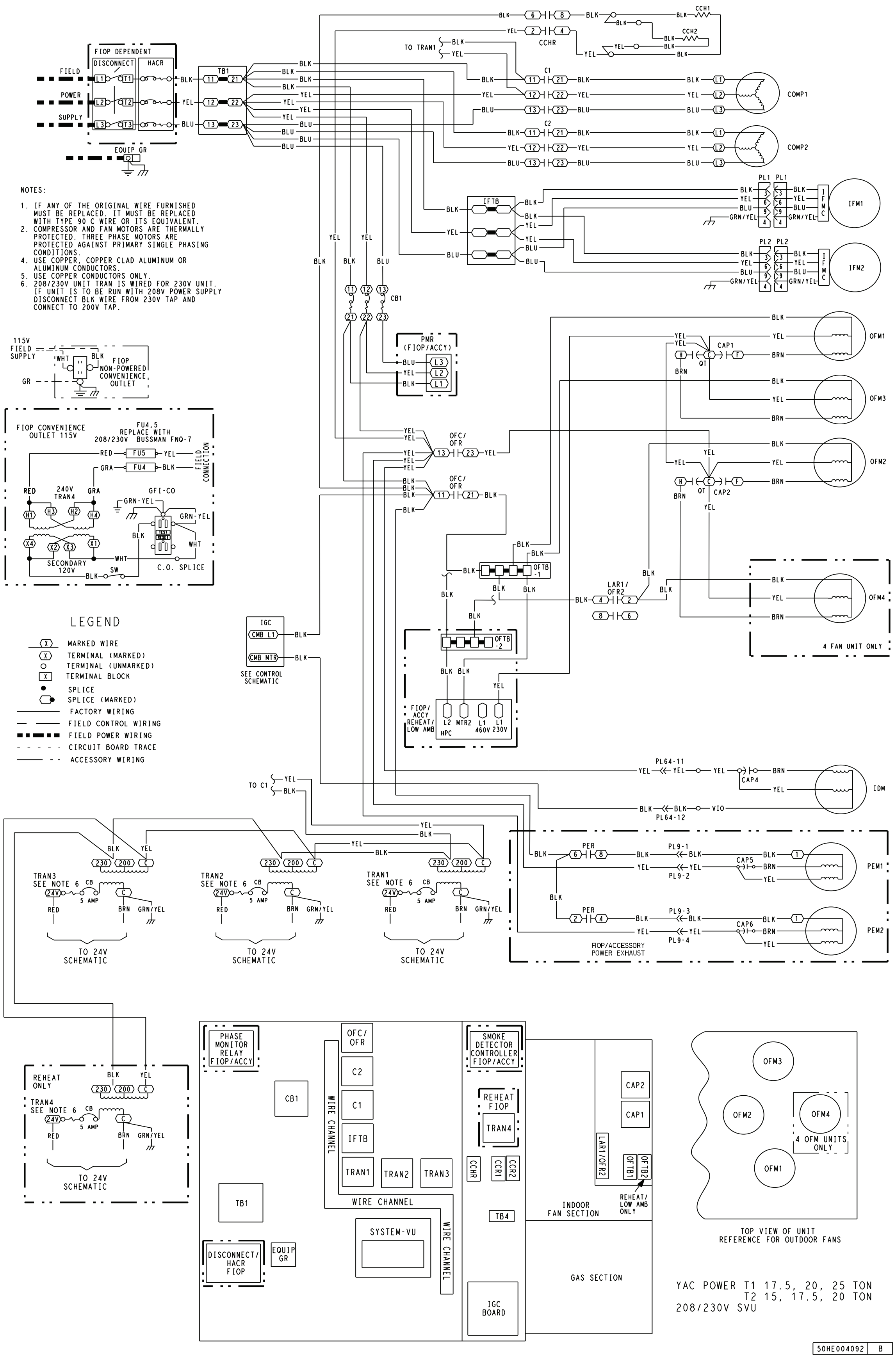
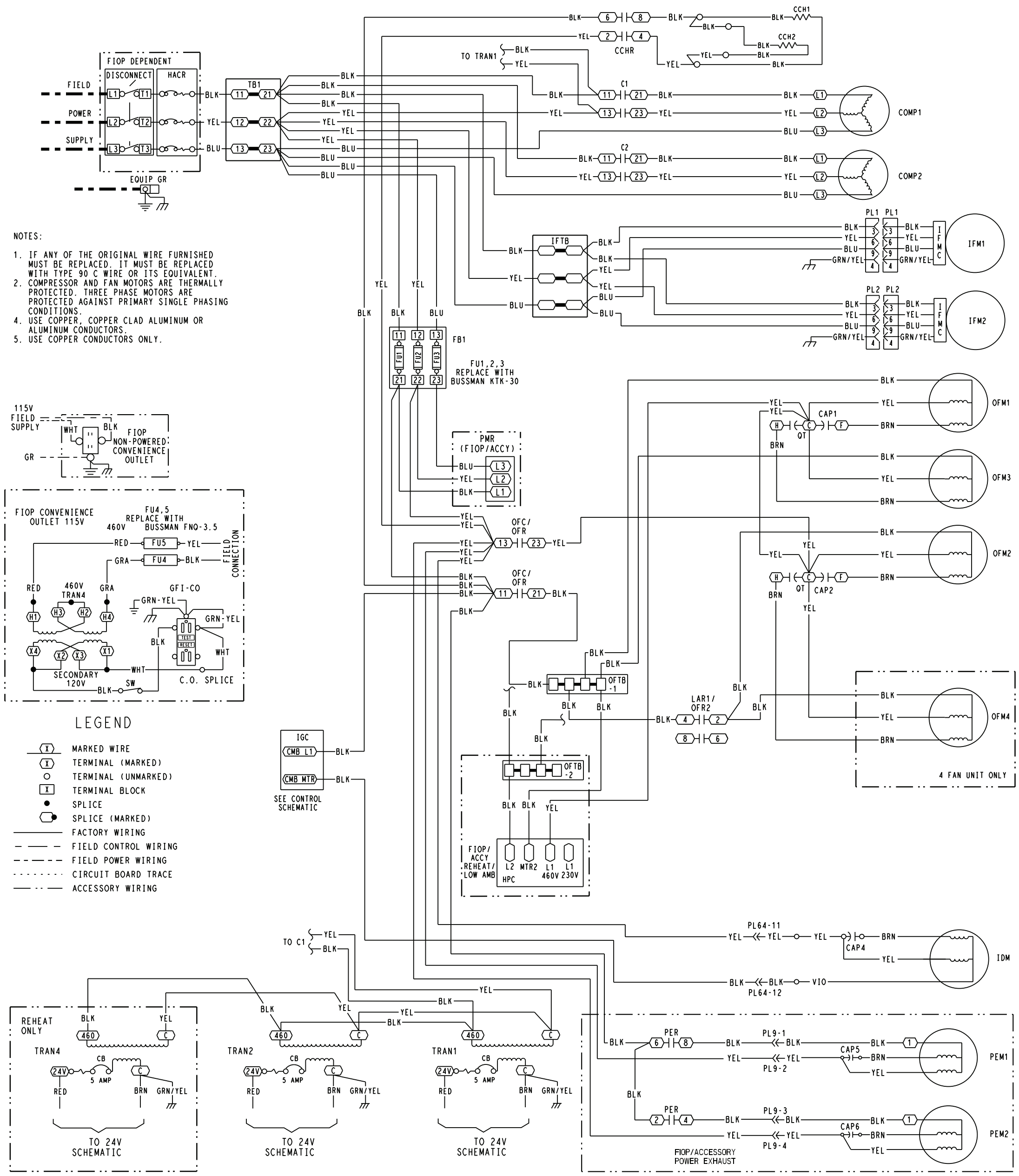



**Fig. L — 48FC**20-28 — 208/230-3-60 — Power Wiring Diagram with SystemVu™ Controller — SCCR**



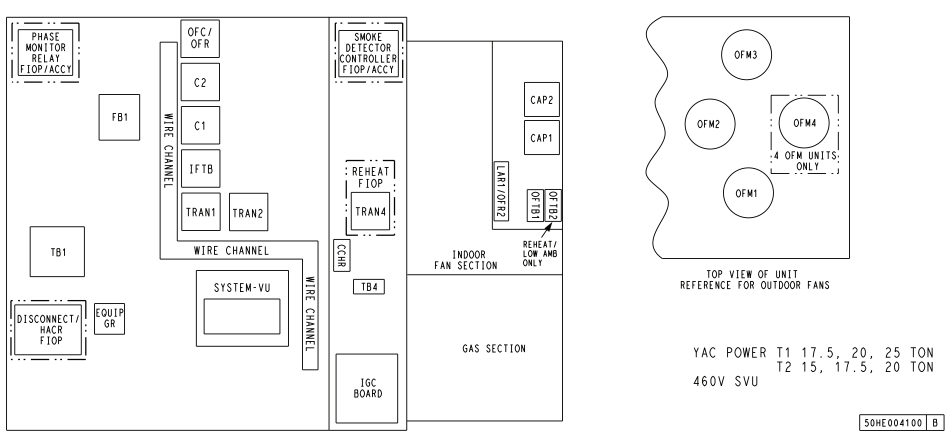



**Fig. M — 48FC**20-28 — 460-3-60 — Power Wiring Diagram with SystemVu™ Controller — SCCR**

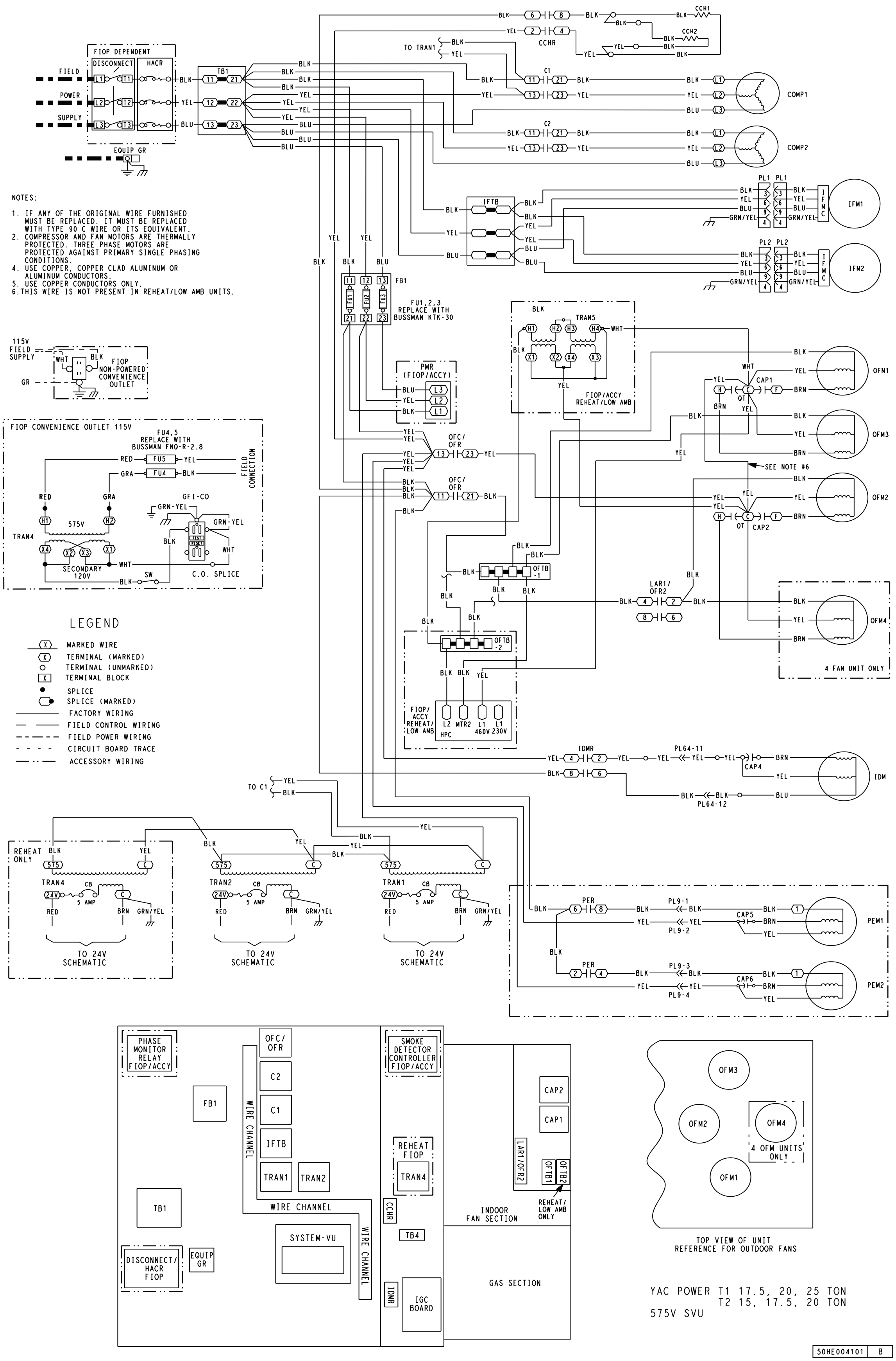



Fig. N — 48FC**20-28 — 575-3-60 — Power Wiring Diagram with SystemVu™ Controller — SCCR

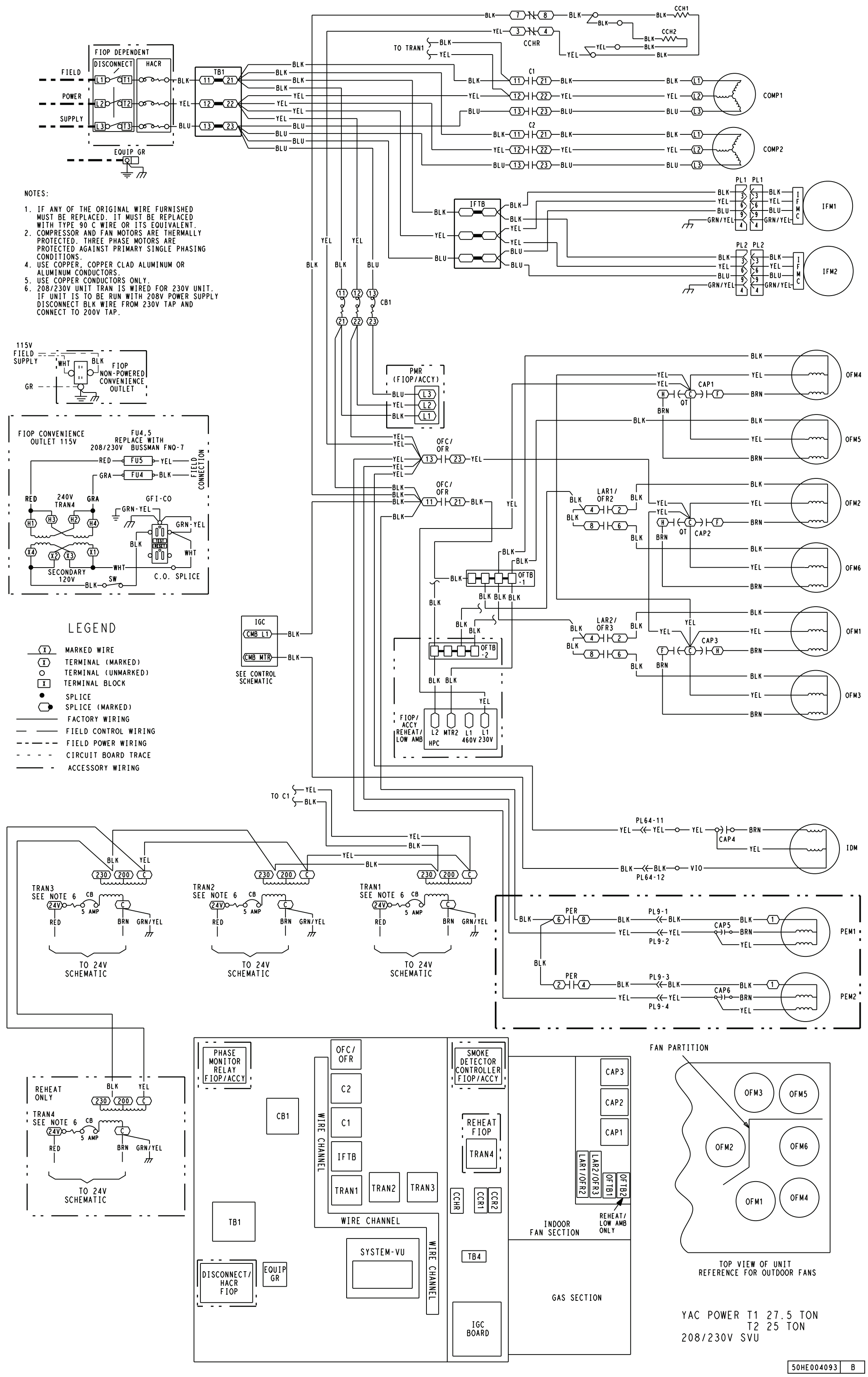



Fig. O — 48FC**30 — 208/230-3-60 — Power Wiring Diagram with SystemVu™ Controller — SCCR

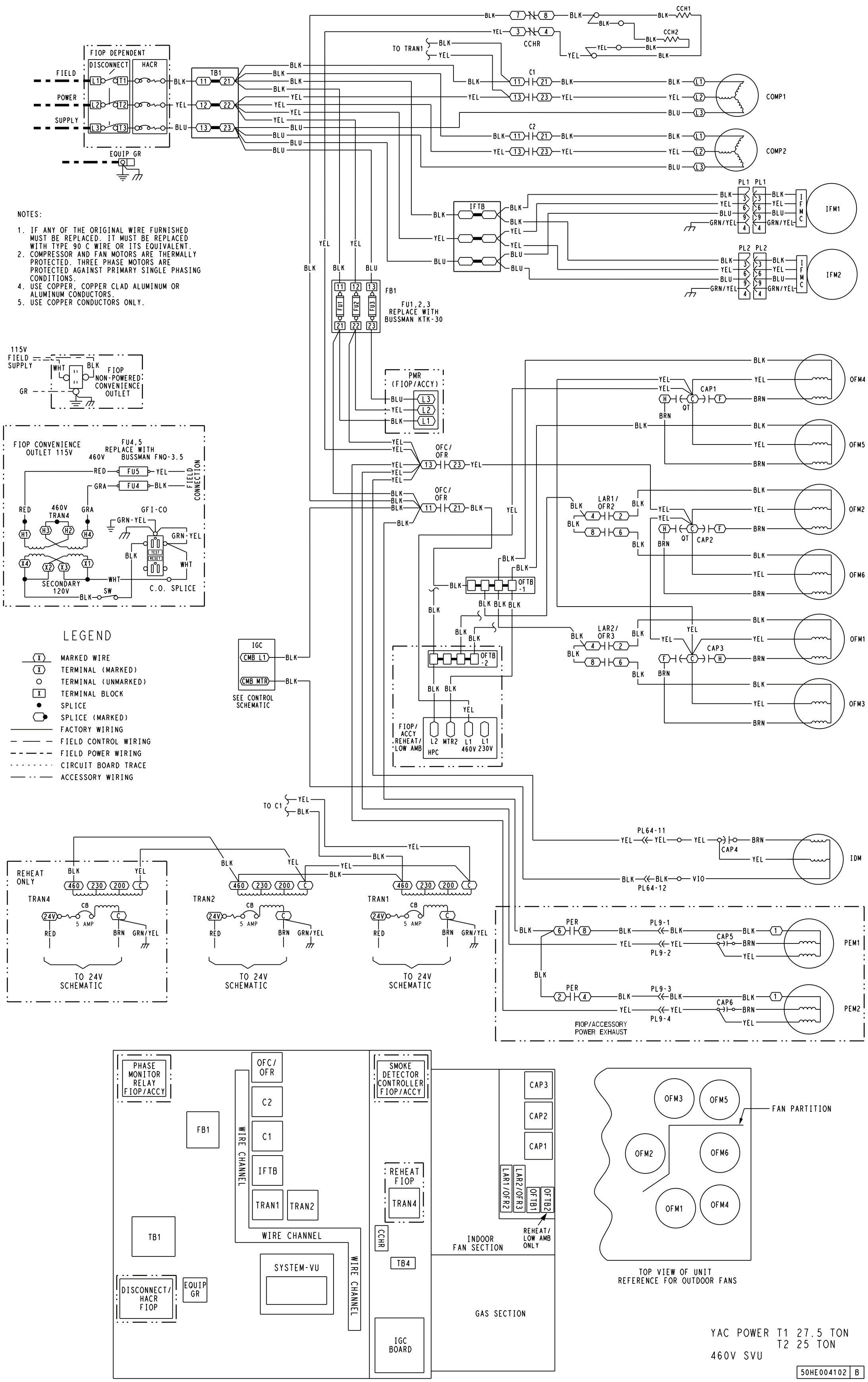



**Fig. P — 48FC**30 — 460-3-60 — Power Wiring Diagram with SystemVu™ Controller — SCCR**

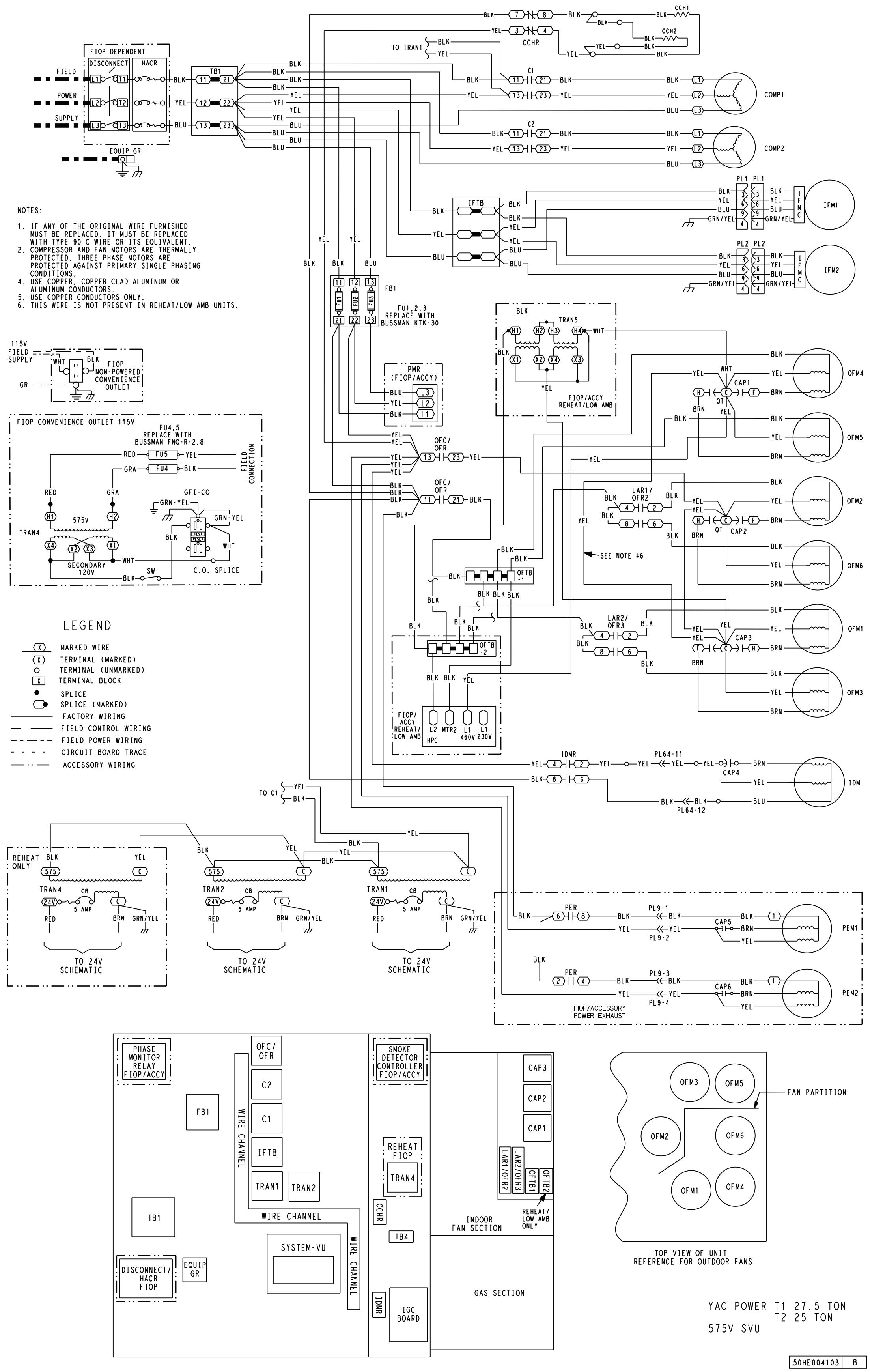



**Fig. Q — 48FC**30 — 575-3-60 — Power Wiring Diagram with SystemVu™ Controller — SCCR**

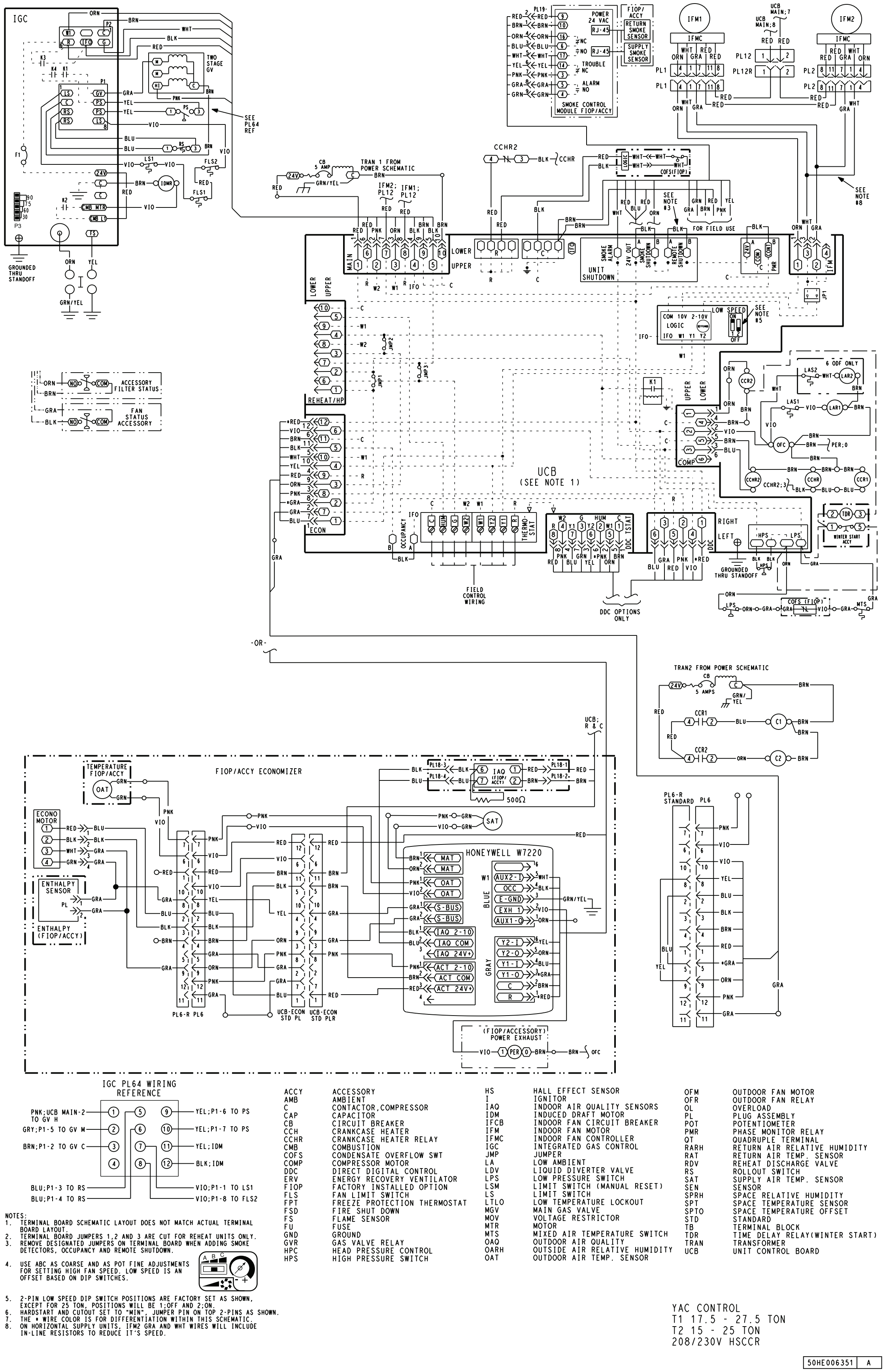
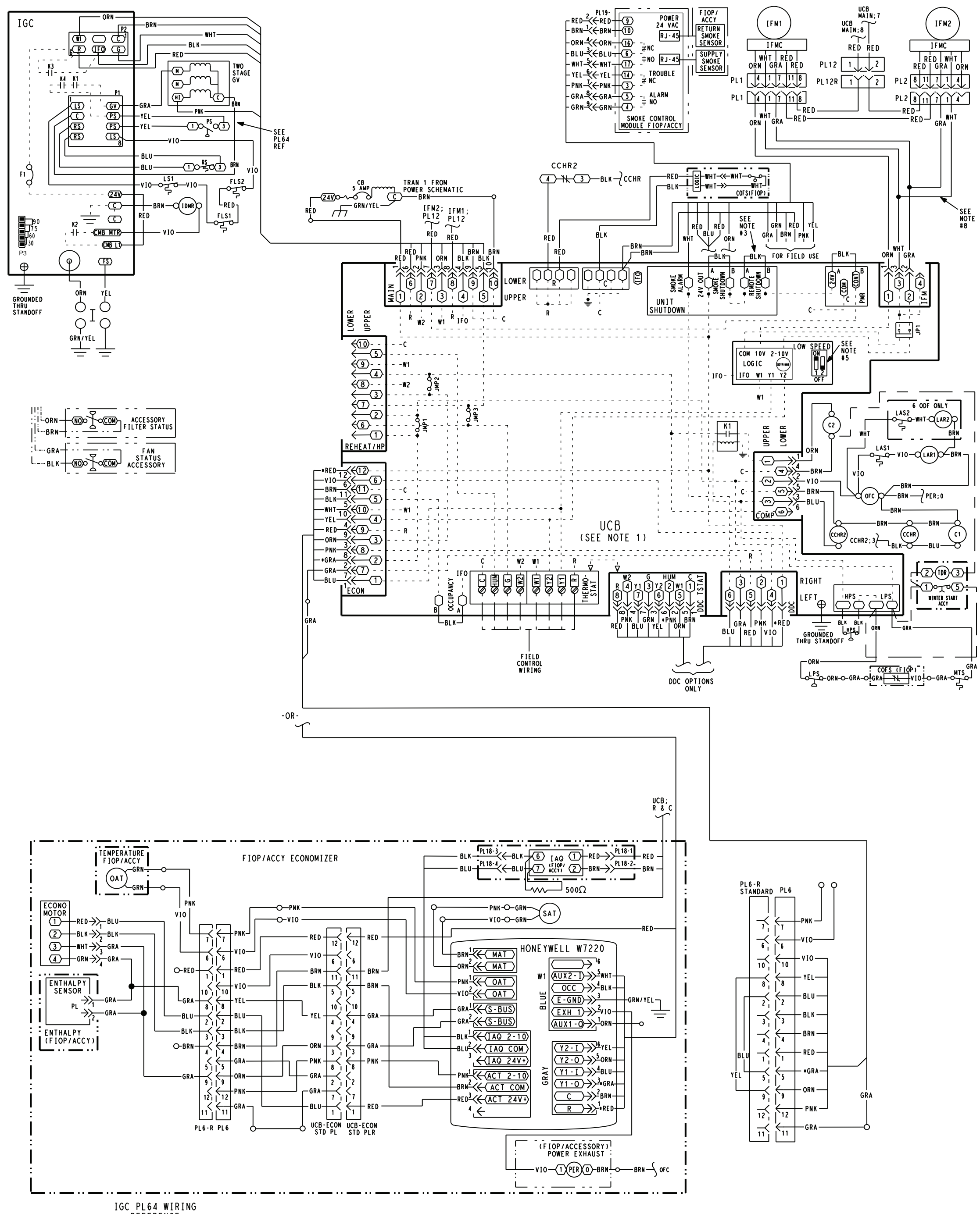
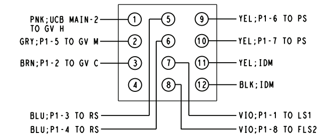



**Fig. R — 48FC**20-30 — 208/230-3-60 — Control Wiring Diagram
Electro-Mechanical with W7220 Controller — HSCCR**




IGC PL64 WIRING REFERENCE




| | | | | | |
|---|---|---|---|---|---|
| ACCY | ACCESSORY | HS | HALL EFFECT SENSOR | OFM | OUTDOOR FAN MOTOR |
| AMB | AMBIENT | I | IGNITOR | OFR | OUTDOOR FAN RELAY |
| C | CONTACTOR,COMPRESSOR | IAQ | INDOOR AIR QUALITY SENSORS | OL | OVERLOAD |
| CAP | CAPACITOR | IDM | INDUCED DRAFT MOTOR | PL | PLUG ASSEMBLY |
| CB | CIRCUIT BREAKER | IFCB | INDOOR FAN CIRCUIT BREAKER | POT | POTENTIOMETER |
| CCH | CRANKCASE HEATER | IFM | INDOOR FAN MOTOR | PMR | PHASE MONITOR RELAY |
| CCHR | CRANKCASE HEATER RELAY | IFMC | INDOOR FAN CONTROLLER | QT | QUADRUPLE TERMINAL |
| CMB | COMBUSTION | IGC | INTEGRATED GAS CONTROL | RARH | RETURN AIR RELATIVE HUMIDITY |
| COFS | CONDENSATE OVERFLOW SWT | JMP | JUMPER | RAT | RETURN AIR TEMP. SENSOR |
| COMP | COMPRESSOR MOTOR | LA | LOW AMBIENT | RDV | REHEAT DISCHARGE VALVE |
| DDC | DIRECT DIGITAL CONTROL | LDV | LIQUID DIVERTER VALVE | RS | ROLLOUT SWITCH |
| ERV | ENERGY RECOVERY VENTILATOR | LPS | LOW PRESSURE SWITCH | SAT | SUPPLY AIR TEMP. SENSOR |
| FIOP | FACTORY INSTALLED OPTION | LSM | LIMIT SWITCH (MANUAL RESET) | SEN | SENSOR |
| FLS | FAN LIMIT SWITCH | LS | LIMIT SWITCH | SPRH | SPACE RELATIVE HUMIDITY |
| FPT | FREEZE PROTECTION THERMOSTAT | LTLO | LOW TEMPERATURE LOCKOUT | SPT | SPACE TEMPERATURE SENSOR |
| FSD | FIRE SHUT DOWN | MGV | MAIN GAS VALVE | SPTO | SPACE TEMPERATURE OFFSET |
| FS | FLAME SENSOR | MOV | VOLTAGE RESTRICTOR | STD | STANDARD |
| FU | FUSE | MTR | MOTOR | TB | TERMINAL BLOCK |
| GND | GROUND | MTS | MIXED AIR TEMPERATURE SWITCH | TDR | TIME DELAY RELAY(WINTER START) |
| GVR | GAS VALVE RELAY | OAQ | OUTDOOR AIR QUALITY | TRAN | TRANSFORMER |
| HPC | HEAD PRESSURE CONTROL | OARH | OUTSIDE AIR RELATIVE HUMIDITY | UCB | UNIT CONTROL BOARD |
| HPS | HIGH PRESSURE SWITCH | OAT | OUTDOOR AIR TEMP. SENSOR | | |

NOTES:
1. TERMINAL BOARD SCHEMATIC LAYOUT DOES NOT MATCH ACTUAL TERMINAL BOARD LAYOUT.
2. TERMINAL BOARD JUMPERS 1,2 AND 3 ARE CUT FOR REHEAT UNITS ONLY.
3. REMOVE DESIGNATED JUMPERS ON TERMINAL BOARD WHEN ADDING SMOKE DETECTORS, OCCUPANCY AND REMOTE SHUTDOWN.
4. USE ABC AS COARSE AND AS POT FINE ADJUSTMENTS FOR SETTING HIGH FAN SPEED. LOW SPEED IS AN OFFSET BASED ON DIP SWITCHES.


5. 2-PIN LOW SPEED DIP SWITCH POSITIONS ARE FACTORY SET AS SHOWN, EXCEPT FOR 25 TON, POSITIONS WILL BE 1;OFF AND 2;ON.
6. HARDSTART AND CUTOUT SET TO "MIN", JUMPER PIN ON TOP 2-PINS AS SHOWN.
7. THE * WIRE COLOR IS FOR DIFFERENTIATION WITHIN THIS SCHEMATIC.
8. ON HORIZONTAL SUPPLY UNITS, IFM2 GRA AND WHT WIRES WILL INCLUDE IN-LINE RESISTORS TO REDUCE IT'S SPEED.

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

50HE006352 A

**Fig. S — 48FC**20-30 — 460/575-3-60 — Control Wiring Diagram Electro-Mechanical with W7220 Controller — HSCCR**

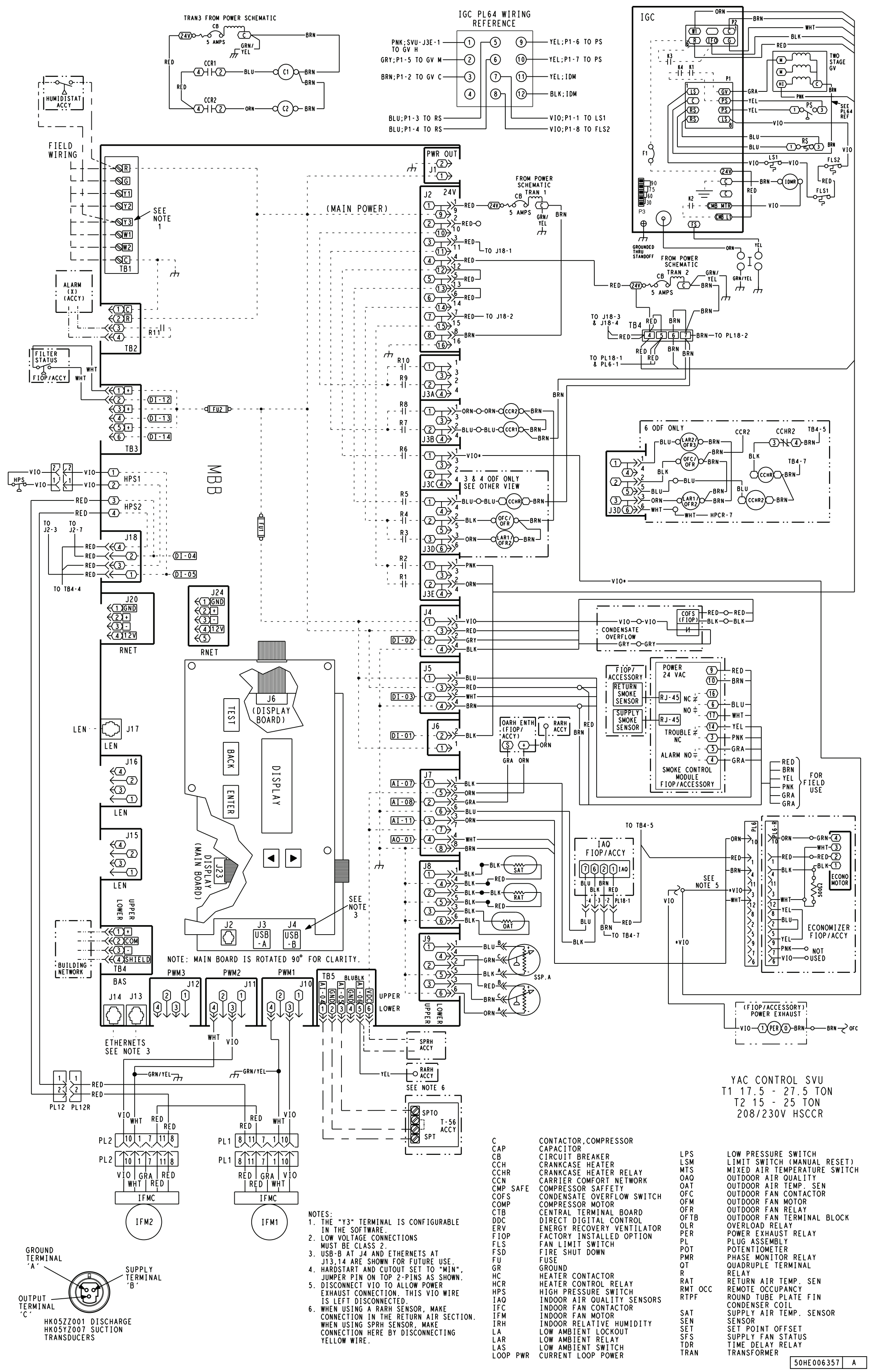
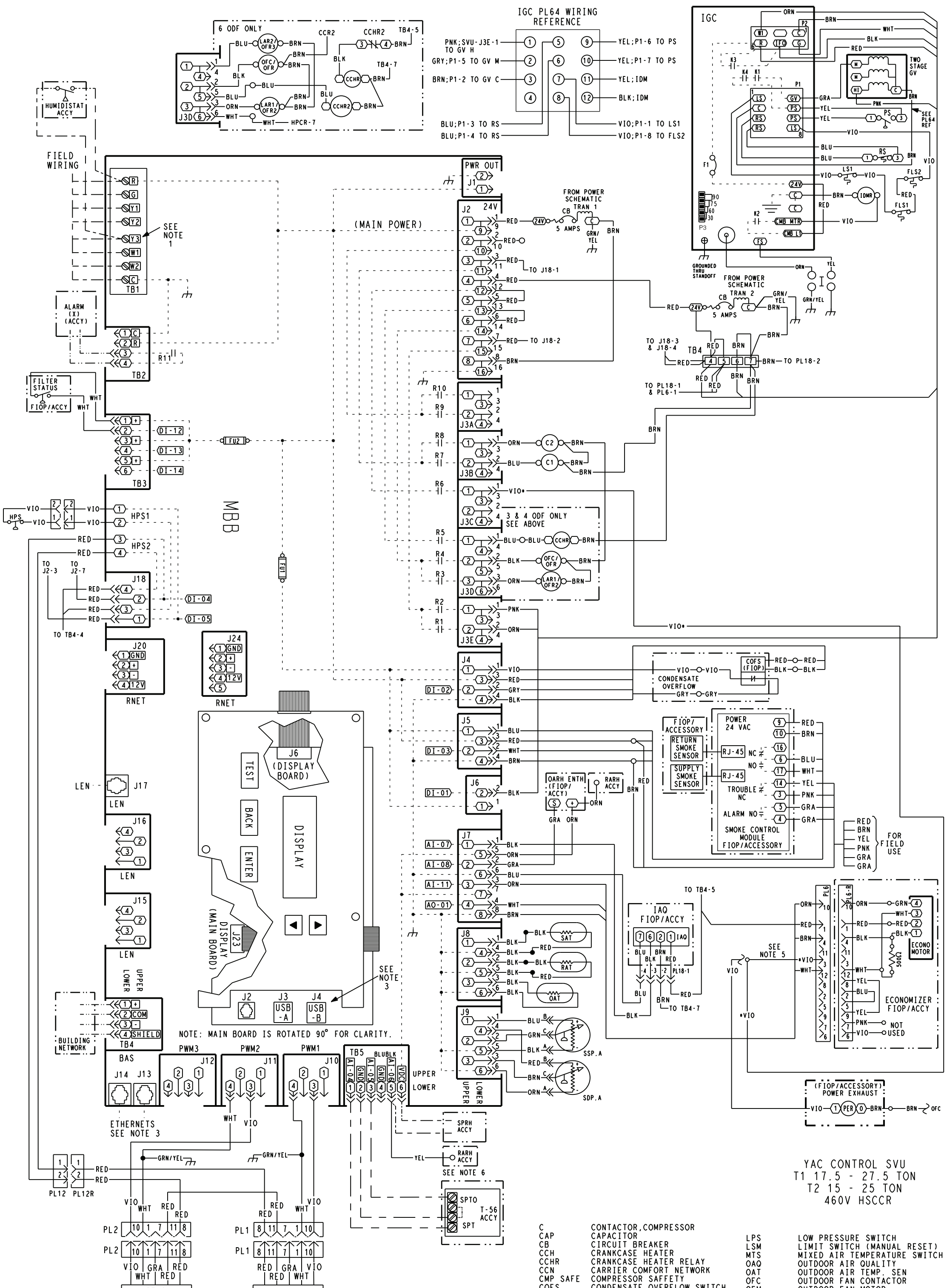
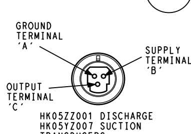



**Fig. T — 48FC**20-30 — 208/230-3-60 — Control Wiring Diagram with SystemVu™ Controller — HSCCR**




NOTES:
1. THE "Y3" TERMINAL IS CONFIGURABLE IN THE SOFTWARE.
2. LOW VOLTAGE CONNECTIONS MUST BE CLASS 2.
3. USB-B AT J4 AND ETHERNETS AT J13,14 ARE SHOWN FOR FUTURE USE.
4. HARDSTART AND CUTOUT SET TO "MIN", JUMPER PIN ON TOP 2-PINS AS SHOWN.
5. DISCONNECT VIO TO ALLOW POWER EXHAUST CONNECTION. THIS VIO WIRE IS LEFT DISCONNECTED.
6. WHEN USING A RARH SENSOR, MAKE CONNECTION IN THE RETURN AIR SECTION. WHEN USING SPRH SENSOR, MAKE CONNECTION HERE BY DISCONNECTING YELLOW WIRE.

| | |
|---|---|
| C | CONTACTOR,COMPRESSOR |
| CAP | CAPACITOR |
| CB | CIRCUIT BREAKER |
| CCH | CRANKCASE HEATER |
| CCHR | CRANKCASE HEATER RELAY |
| CCN | CARRIER COMFORT NETWORK |
| CMP SAFE | COMPRESSOR SAFFETY |
| COFS | CONDENSATE OVERFLOW SWITCH |
| COMP | COMPRESSOR MOTOR |
| CTB | CENTRAL TERMINAL BOARD |
| DDC | DIRECT DIGITAL CONTROL |
| ERV | ENERGY RECOVERY VENTILATOR |
| FIOP | FACTORY INSTALLED OPTION |
| FLS | FAN LIMIT SWITCH |
| FSD | FIRE SHUT DOWN |
| FU | FUSE |
| GR | GROUND |
| HC | HEATER CONTACTOR |
| HCR | HEATER CONTROL RELAY |
| HPS | HIGH PRESSURE SWITCH |
| IAQ | INDOOR AIR QUALITY SENSORS |
| IFC | INDOOR FAN CONTACTOR |
| IFM | INDOOR FAN MOTOR |
| IRH | INDOOR RELATIVE HUMIDITY |
| LA | LOW AMBIENT LOCKOUT |
| LAR | LOW AMBIENT RELAY |
| LAS | LOW AMBIENT SWITCH |
| LOOP PWR | CURRENT LOOP POWER |
| LPS | LOW PRESSURE SWITCH |
| LSM | LIMIT SWITCH (MANUAL RESET) |
| MTS | MIXED AIR TEMPERATURE SWITCH |
| OAQ | OUTDOOR AIR QUALITY |
| OAT | OUTDOOR AIR TEMP. SEN |
| OFC | OUTDOOR FAN CONTACTOR |
| OFM | OUTDOOR FAN MOTOR |
| OFR | OUTDOOR FAN RELAY |
| OFTB | OUTDOOR FAN TERMINAL BLOCK |
| OLR | OVERLOAD RELAY |
| PER | POWER EXHAUST RELAY |
| PL | PLUG ASSEMBLY |
| POT | POTENTIOMETER |
| PMR | PHASE MONITOR RELAY |
| QT | QUADRUPLE TERMINAL |
| R | RELAY |
| RAT | RETURN AIR TEMP. SEN |
| RMT OCC | REMOTE OCCUPANCY |
| RTPF | ROUND TUBE PLATE FIN CONDENSER COIL |
| SAT | SUPPLY AIR TEMP. SENSOR |
| SEN | SENSOR |
| SET | SET POINT OFFSET |
| SFS | SUPPLY FAN STATUS |
| TDR | TIME DELAY RELAY |
| TRAN | TRANSFORMER |

50HE006358 A

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

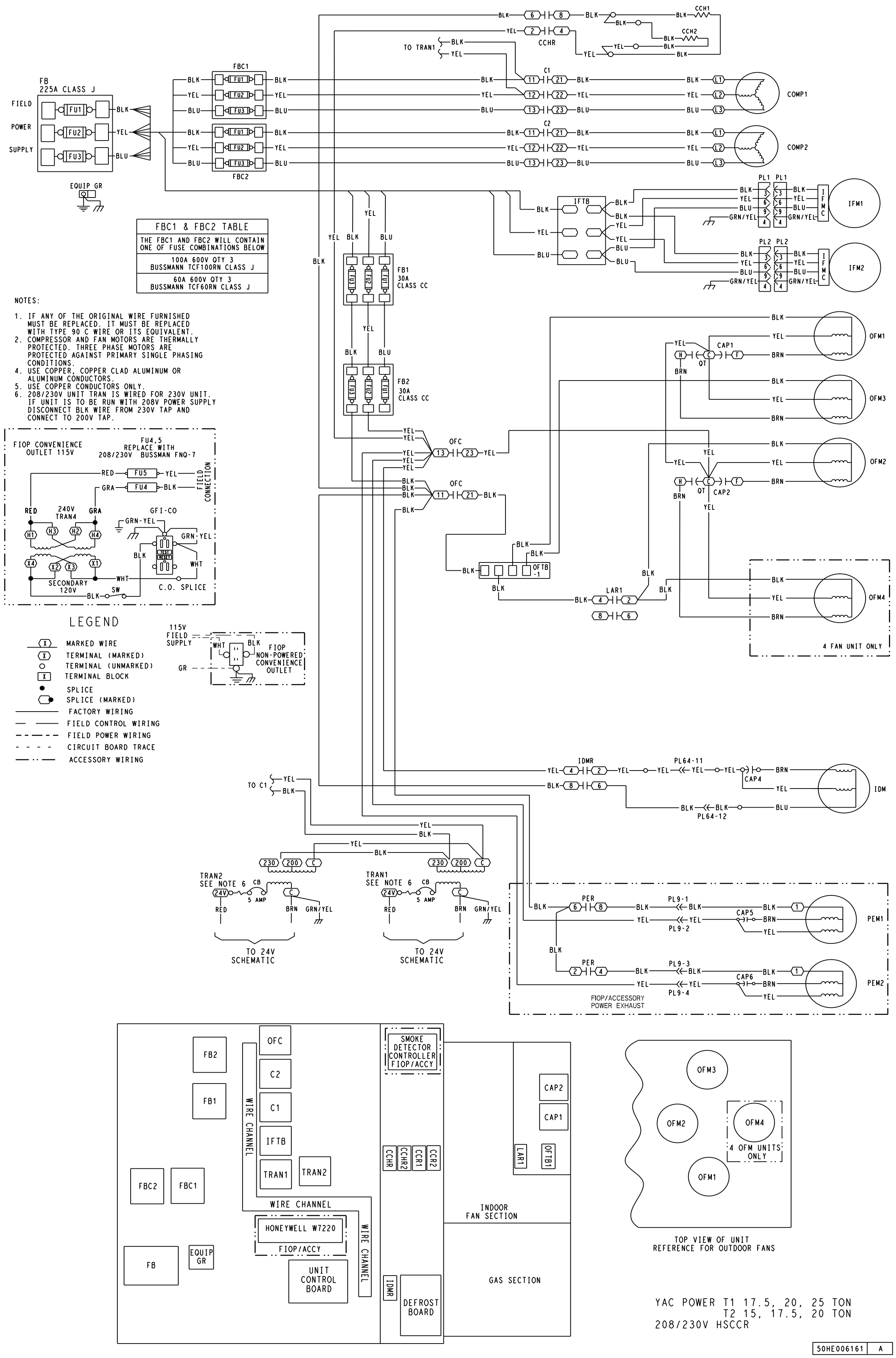
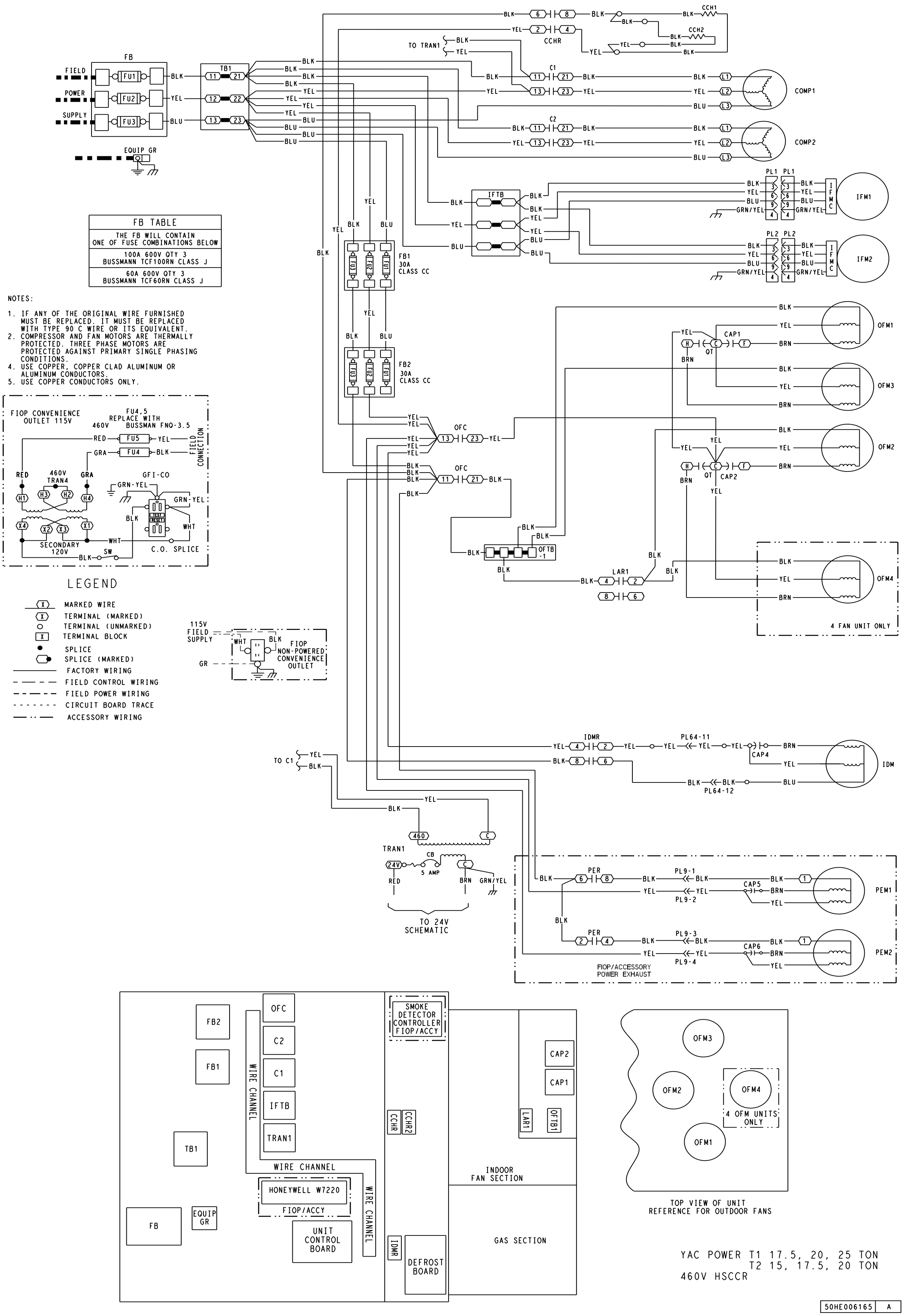



**Fig. V — 48FC**20-28 — 208/230-3-60 — Power Wiring Diagram Electro-Mechanical with W7220 Controller — HSCCR**




| FB TABLE |
|---|
| THE FB WILL CONTAIN ONE OF FUSE COMBINATIONS BELOW |
| 100A 600V QTY 3 BUSSMANN TCF100RN CLASS J |
| 60A 600V QTY 3 BUSSMANN TCF60RN CLASS J |

NOTES:

1. IF ANY OF THE ORIGINAL WIRE FURNISHED MUST BE REPLACED, IT MUST BE REPLACED WITH TYPE 90 C WIRE OR ITS EQUIVALENT.
2. COMPRESSOR AND FAN MOTORS ARE THERMALLY PROTECTED. THREE PHASE MOTORS ARE PROTECTED AGAINST PRIMARY SINGLE PHASING CONDITIONS.
4. USE COPPER, COPPER CLAD ALUMINUM OR ALUMINUM CONDUCTORS.
5. USE COPPER CONDUCTORS ONLY.

LEGEND

- MARKED WIRE
- TERMINAL (MARKED)
- TERMINAL (UNMARKED)
- TERMINAL BLOCK
- SPLICE
- SPLICE (MARKED)
- FACTORY WIRING
- FIELD CONTROL WIRING
- FIELD POWER WIRING
- CIRCUIT BOARD TRACE
- ACCESSORY WIRING

**Fig. W — 48FC**20-28 — 460-3-60 — Power Wiring Diagram Electro-Mechanical with W7220 Controller — HSCCR**

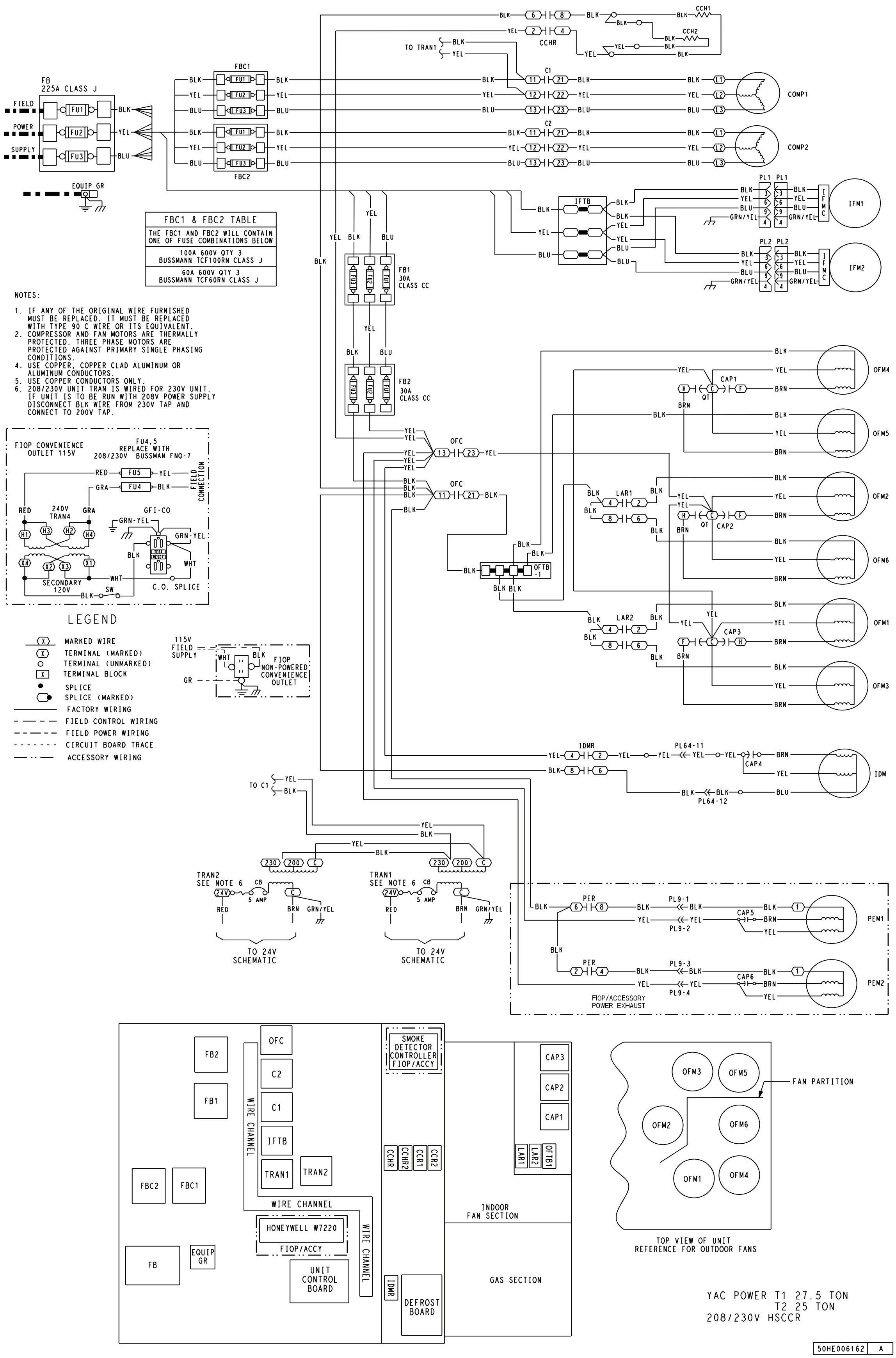



**Fig. X — 48FC**30 — 208/230-3-60 — Power Wiring Diagram**
**Electro-Mechanical with W7220 Controller — HSCCR**

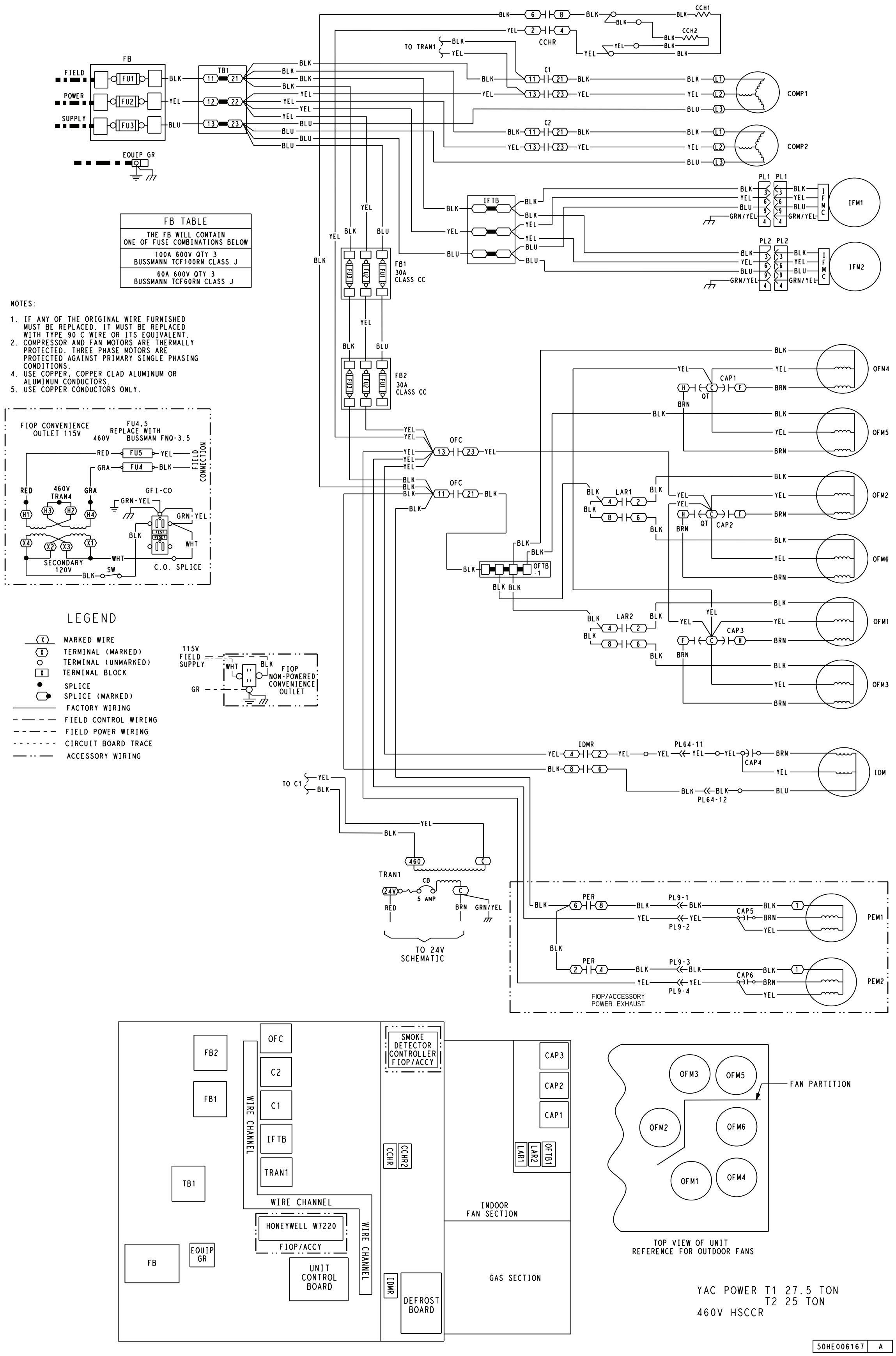



**Fig. Y — 48FC**30— 460-3-60 — Power Wiring Diagram Electro-Mechanical with W7220 Controller — HSCCR**

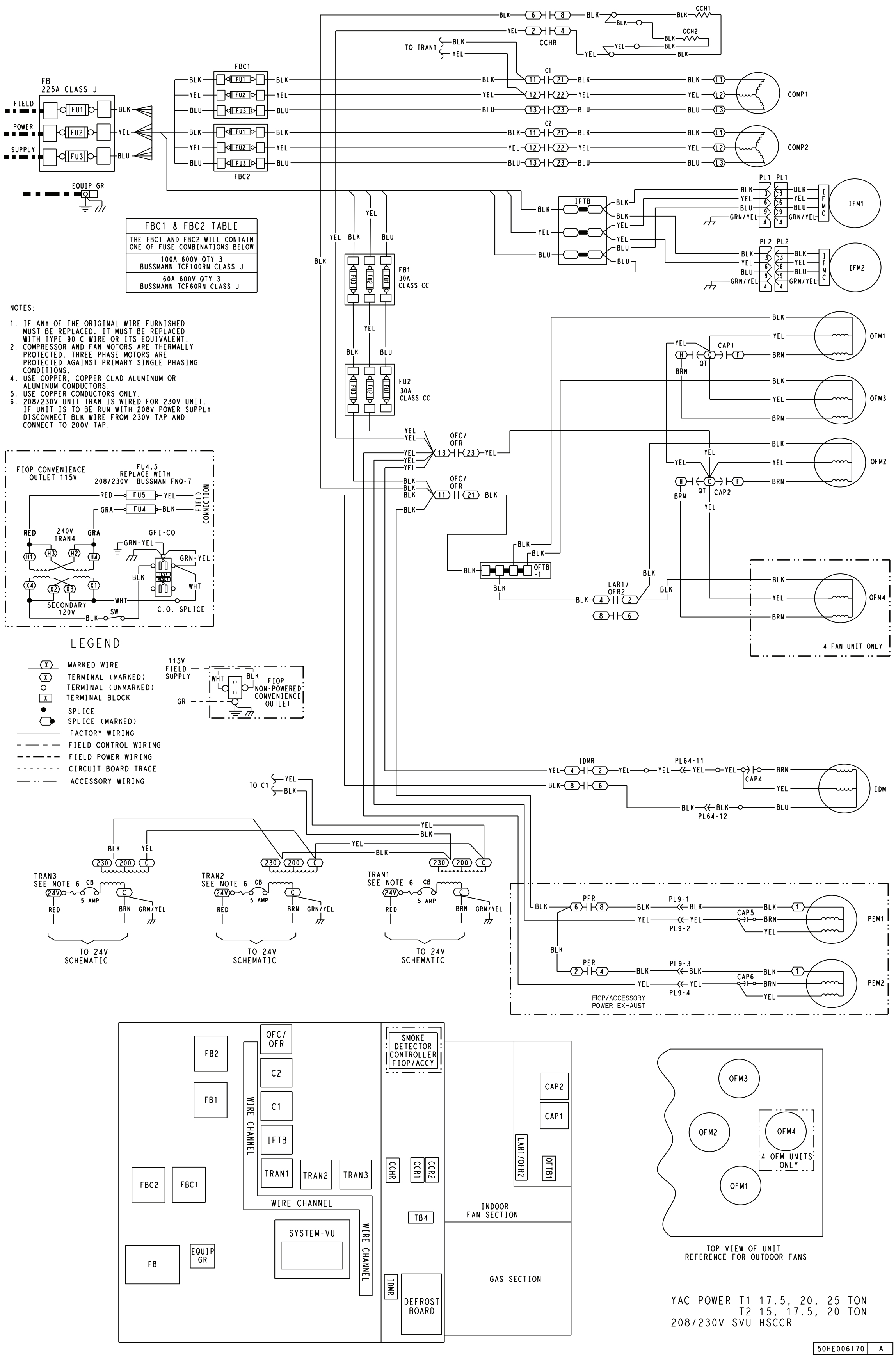



**Fig. Z — 48FC**20-28 — 208/230-3-60 — Power Wiring Diagram with SystemVu™ Controller — HSCCR**

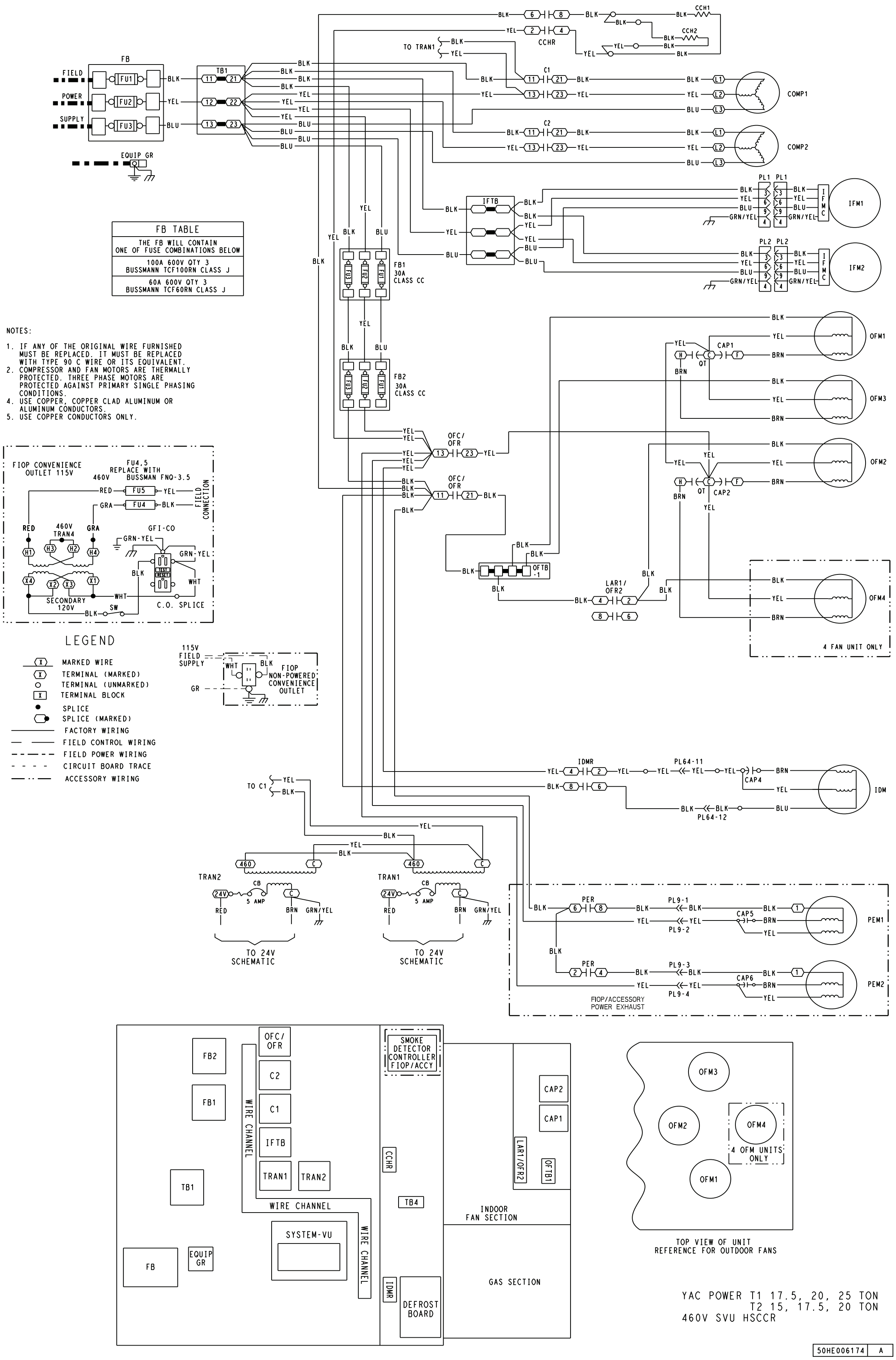



**Fig. AA — 48FC**20-28 — 460-3-60 — Power Wiring Diagram with SystemVu™ Controller — HSCCR**

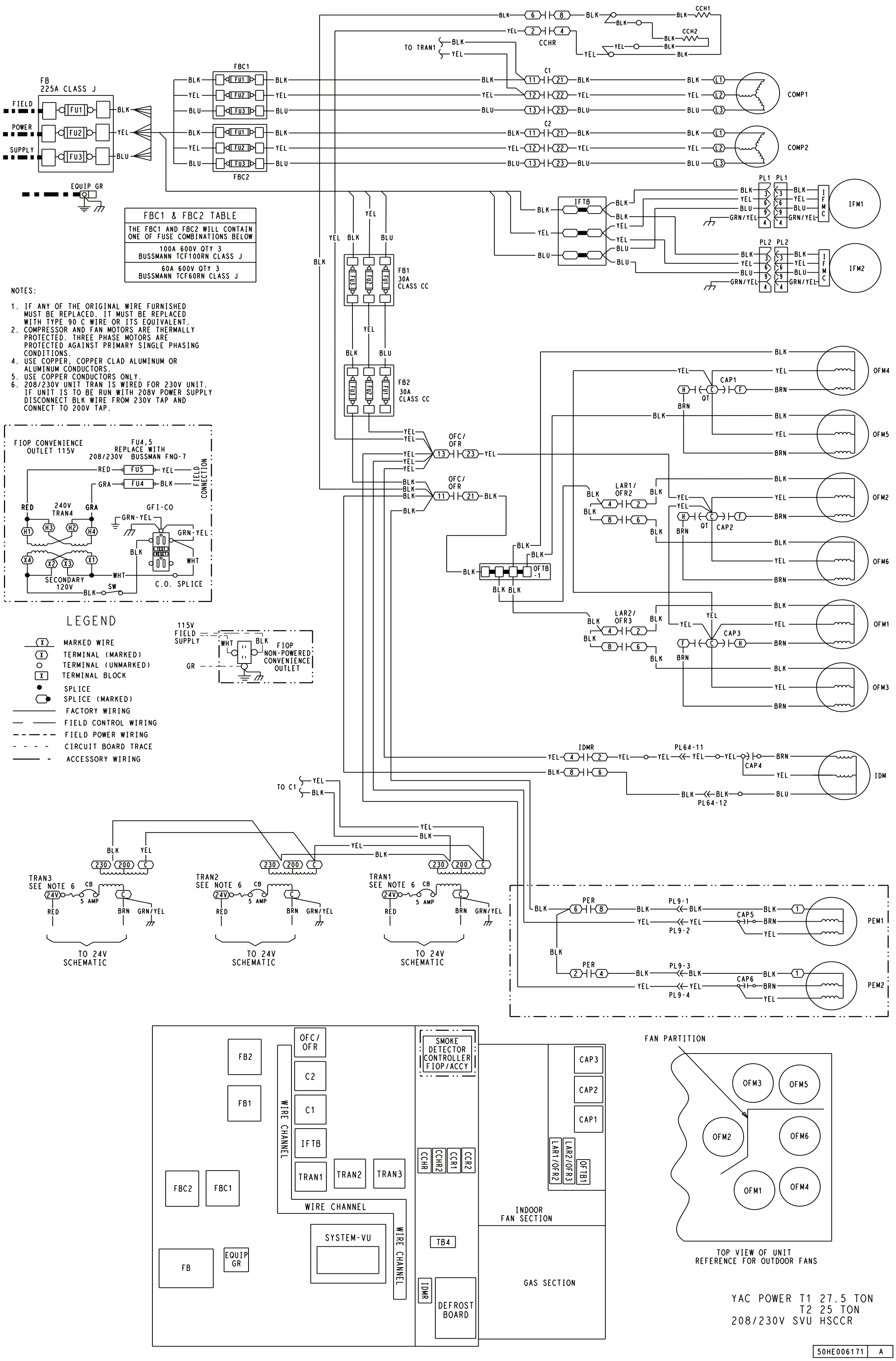



Fig. AB — 48FC**30 — 208/230-3-60 — Power Wiring Diagram with SystemVu™ Controller — HSCCR

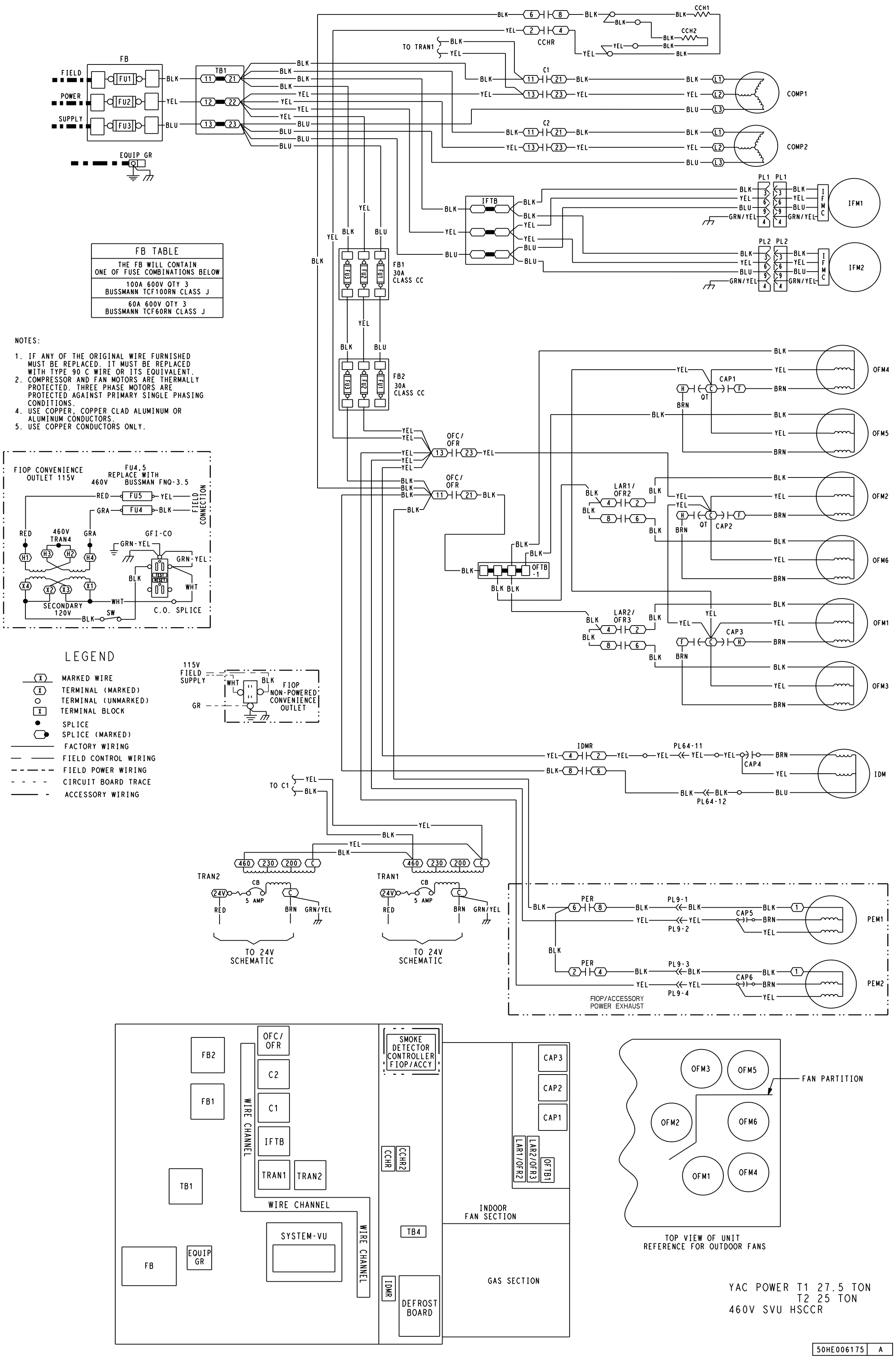
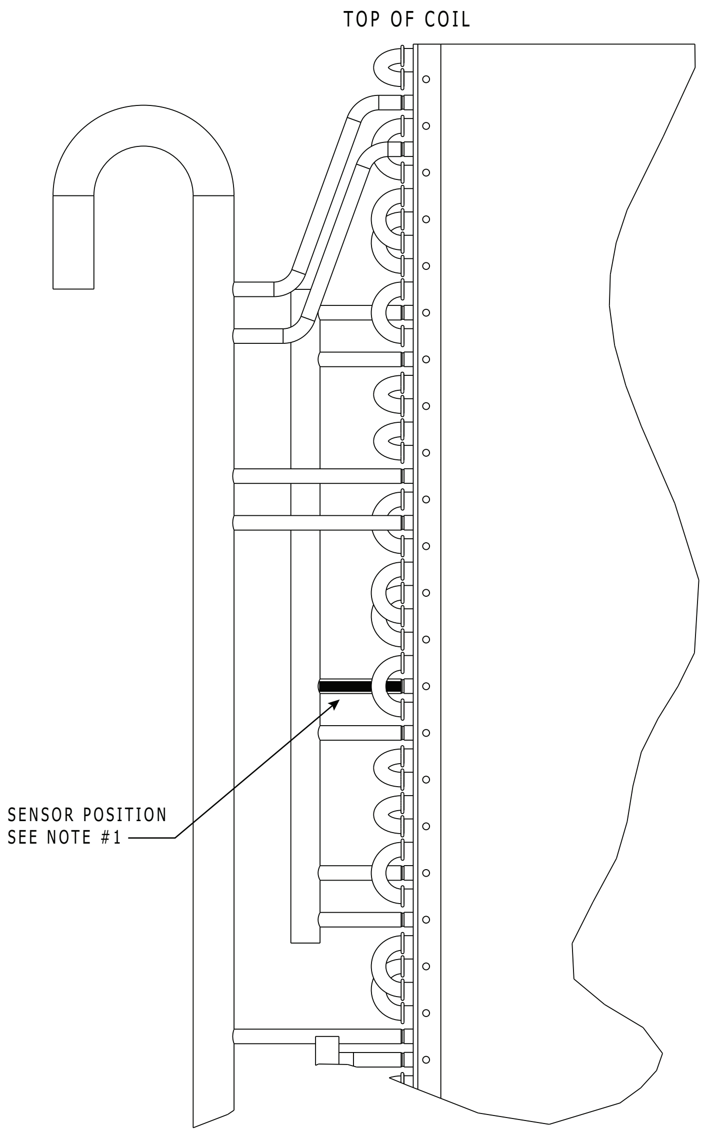
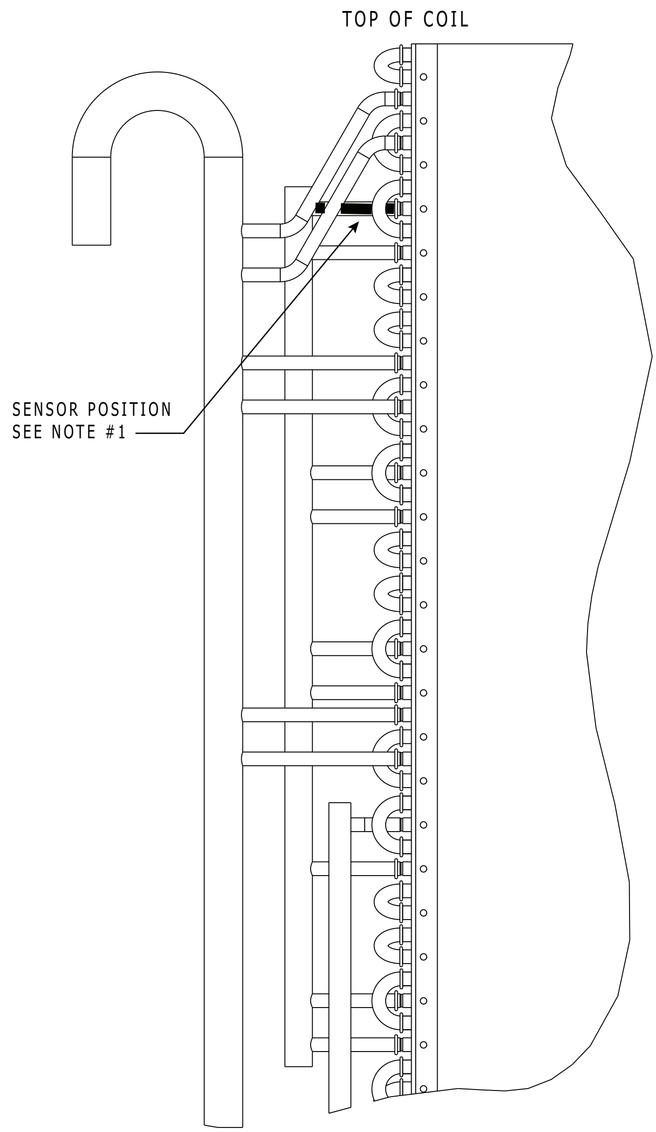



**Fig. AC — 48FC**30 — 460-3-60 — Power Wiring Diagram with SystemVu™ Controller — HSCCR**

## APPENDIX F — LOW AMBIENT CONTROL SENSOR LOCATION




**17.5 Ton to 20.0 Ton**
**Left Hand Outdoor Circuiting**
**(when facing the unit)**




**25.0 Ton to 27.5 Ton**
**Left Hand Outdoor Circuiting**
**(when facing the unit)**

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