



# Service and Maintenance Instructions

## CONTENTS

	Page
<b>SAFETY CONSIDERATIONS</b>	2
<b>UNIT ARRANGEMENT AND ACCESS</b>	4
General	4
Routine Maintenance	5
Filters	5
<b>SUPPLY FAN (BLOWER) SECTION</b>	6
Supply Fan (Direct-Drive)	6
Staged Air Volume	13
<b>COOLING</b>	13
Condenser Coil	14
Condenser Coil Maintenance and Cleaning	
Recommendation	14
Evaporator Coil	16
<b>THERMOSTATIC EXPANSION VALVE (TXV)</b>	16
TXV Operation	16
Replacing TXV	16
Refrigerant System Pressure Access Ports	16
<b>PURON ADVANCE (R-454B) REFRIGERANT</b>	17
Refrigerant Charge	17
<b>COMPRESSOR</b>	24
Lubrication	24
Replacing Compressor	24
Compressor Rotation	24
Filter Drier	24
Condenser-Fan Adjustment	24
Troubleshooting Cooling System	26
<b>CONVENIENCE OUTLETS</b>	27
Convenience Outlets	27
Installing Weatherproof Cover	27
Non-Powered Type	27
Unit-Powered Type	27
Duty Cycle	28
Maintenance	28
Fuse on Powered Type	28
<b>SMOKE DETECTORS</b>	28
System	28
Controller	28
Smoke Detector Sensor	28
Smoke Detector Locations	29
FIOP Smoke Detector Wiring and Response	30
<b>SENSOR AND CONTROLLER TESTS</b>	31
Sensor Alarm Test	31
Controller Alarm Test	31
Dirty Controller Test	31
Dirty Sensor Test	31
Changing the Dirt Sensor Test	32
<b>Remote Station Test</b>	32
<b>SD-TRK4 Remote Alarm Test Procedure</b>	32
<b>Remote Test/Reset Station Dirty Sensor Test</b>	32
<b>Dirty Sensor Test Using an SD-TRK4</b>	32
<b>Detector Cleaning</b>	32
<b>Indicators</b>	33
<b>Troubleshooting</b>	33
<b>PROTECTIVE DEVICES</b>	34
Compressor Protection	34
Refrigerant Leak Protection	34
Relief Device	34
Control Circuit, 24-V	34
<b>GAS HEATING SYSTEM</b>	34
General	34
Fuel Types and Pressures	35
Combustion-Air Blower	35
Burners and Igniters	36
Burner Ignition	38
Orifice Replacement	38
Troubleshooting Heating System	40
<b>SYSTEMVu CONTROL SYSTEM</b>	43
SystemVu Interface	43
Additional SystemVu Installation and Troubleshooting	43
<b>A2L REFRIGERATION INFORMATION</b>	44
Servicing	44
Minimum Conditioned Space Area	44
Detection of Flammable Refrigerants	44
Evacuation, Removal, and Recovery	45
Decommissioning	45
Leak Dissipation System	46
<b>ECONOMIZER SYSTEMS</b>	49
EconoMi\$er® 2	50
EconomizerONE (Field-Installed Accessory)	51
EconomizerONE (Factory Option)	55
PRE-START-UP/START-UP	76
START-UP, GENERAL	76
Unit Preparation	76
Additional Installation/Inspection	76
Gas Piping	76
Return-Air Filters	77
Outdoor-Air Inlet Screens	77
Compressor Mounting	77
Internal Wiring	77
Refrigerant Service Ports	77
Compressor Rotation	77
Cooling	77
Main Burner	78
Heating	78

<b>Ventilation (Continuous Fan)</b> .....	<b>78</b>
<b>FASTENER TORQUE VALUES</b> .....	<b>78</b>
<b>START-UP, SYSTEMVU CONTROLS</b> .....	<b>78</b>
<b>APPENDIX A — MODEL NUMBER NOMENCLATURE</b> .....	<b>79</b>
<b>APPENDIX B — PHYSICAL DATA</b> .....	<b>80</b>
<b>APPENDIX C — FAN PERFORMANCE</b> .....	<b>82</b>
<b>APPENDIX D — WIRING DIAGRAMS</b> .....	<b>107</b>
<b>APPENDIX E — LOW AMBIENT CONTROL SENSOR LOCATION</b> .....	<b>117</b>
<b>START-UP CHECKLIST</b> .....	<b>CL-1</b>

## 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 basic maintenance functions of cleaning coils and filters and replacing filters. All other operations should be performed by trained service personnel. 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, including ANSI (American National Standards Institute) Z223.1. Wear safety glasses and work gloves. Use quenching cloth for unbrazing operations. Have fire extinguisher available for all brazing operations.

It is important to recognize safety information. This is the safety-alert symbol . When you see this symbol on the unit and in instructions or manuals, be alert to the potential for personal injury.

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

### **WARNING**

#### UNIT OPERATION AND SAFETY HAZARD

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

R-454B is an A2L refrigerant. All service equipment or components must be A2L refrigerant rated. Do not use non-A2L rated equipment or components on R-454B refrigerant equipment.

### **WARNING**

#### PERSONAL INJURY AND ENVIRONMENTAL HAZARD

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

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

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

### **WARNING**

Use caution when servicing compressor terminal pins. System or compressor abnormalities can dislodge pins allowing oil and refrigerant to vent under pressure.

### **AVERTISSEMENT**

Soyez prudent lors de l'entretien des bornes du compresseur. Les anomalies du système ou du compresseur peuvent déloger les bornes, permettant à l'huile et au réfrigérant de s'évacuer sous pression.

### **WARNING**

#### FIRE, EXPLOSION HAZARD

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

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

### **CAUTION**

#### UNIT DAMAGE HAZARD

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

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

### **WARNING**

#### ELECTRICAL OPERATION HAZARD

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

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

**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.

The following symbols may be seen on the equipment:

SYMBOL	CODE	MEANING
	GHS02: Flammable	Flammable gas
	ISO 7000-0790 (2004-01)	Read operator's manual.
	ISO 7000-1659 (2004-01)	Service indicator: read technical manual.
	ISO 7000-1641 (2004-01)	Operator's manual: operating instructions

### ⚠ 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).

### ⚠ AVERTISSEMENT

#### RISQUE D'INCENDIE ET D'EXPLOSION

Le non-respect de cet avertissement peut entraîner la mort, des blessures graves et/ou des dommages matériels.

Débranchez la tuyauterie de gaz de l'appareil lors d'un essai de pression à une pression supérieure à 0,5 psig (3450 Pa). Une pression supérieure à 0,5 psig endommagera la valve de gaz et créera une situation dangereuse. Si la valve de gaz est soumise à une pression supérieure à 0,5 psig, elle doit être remplacée avant utilisation. Lors d'un essai de pression sur une tuyauterie de gaz fournie sur site à une pression inférieure ou égale à 0,5 psig, l'appareil raccordé à cette tuyauterie doit être isolé en fermant la ou les valves de gaz manuelles.

### ⚠ DANGER

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

### ⚠ WARNING

#### RISK OF FIRE OR EXPLOSION

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

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

#### WHAT TO DO IF YOU SMELL GAS

- Do not try to light any appliance.
- Do not touch any electrical switch; do not use any phone in your building.
- Leave the building immediately.
- 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.

### ⚠ WARNING

#### CARBON-MONOXIDE POISONING HAZARD

Failure to follow instructions could result in severe personal injury or death due to carbon-monoxide poisoning, if combustion products infiltrate into the building.

Check that all openings in the outside wall around the vent (and air intake) pipe(s) are sealed to prevent infiltration of combustion products into the building.

Check that furnace vent (and air intake) terminal(s) are not obstructed in any way during all seasons.

## ⚠ AVERTISSEMENT

### RISQUE D'INTOXICATION AU MONOXYDE DE CARBONE

Si ces directives ne sont pas suivies, cela peut entraîner des blessures graves ou une intoxication au monoxyde de carbone pouvant causer la mort, si des produits de combustion s'infiltrent dans le bâtiment.

Vérifier que toutes les ouvertures pratiquées dans le mur extérieur autour du ou des tuyaux d'évent (et de la prise d'air) sont scellées de manière à empêcher l'infiltration de produits de combustion dans le bâtiment.

Veiller à ce que la ou les sorties de l'évent de l'appareil de chauffage (et la prise d'air) ne soient, en aucune façon, obstruées, quelle que soit la saison.

## ⚠ WARNING

### ELECTRICAL SHOCK HAZARD

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

Before performing installation, service, or maintenance on this unit, turn off the main power disconnect to the unit and install lock and lockout tag. Some equipment may have multiple power disconnects.

## ⚠ ADVERTISSEMENT

### RISQUE DE CHOC ÉLECTRIQUE

Le non-respect de cet avertissement pourrait entraîner des blessures corporelles, voire la mort.

Avant d'effectuer l'installation, l'entretien ou la maintenance de cet appareil, coupez l'alimentation principale de l'appareil et installez des verrous et des étiquettes de verrouillage. Certains équipements peuvent avoir plusieurs alimentations de courant.

## ⚠ WARNING

This equipment is not intended for use by persons (including children) with reduced physical, sensory, or mental capabilities, or lack of experience and knowledge, unless they have been given supervision or instruction concerning use of the appliance by a person responsible for their safety. Children should be supervised to ensure that they do not play with the appliance.

## ⚠ ADVERTISSEMENT

Cet équipement n'est pas destiné à être utilisé par des personnes (y compris des enfants) ayant des capacités physiques, sensorielles ou mentales réduites, ou un manque d'expérience et de connaissances, à moins qu'elles n'aient reçu une supervision ou des instructions concernant l'utilisation de l'appareil par une personne responsable de leur sécurité. Les enfants doivent être surveillés pour s'assurer qu'ils ne jouent pas avec l'appareil.

## ⚠ CAUTION

### PERSONAL INJURY HAZARD

Failure to follow this caution may result in personal injury.

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

## ⚠ ADVERTISSEMENT

### RISQUE DE BLESSURE CORPORELLE

Le non-respect de cette mise en garde peut entraîner des blessures corporelles.

Les pièces en tôle peuvent présenter des bords tranchants ou des bavures. Soyez prudent et portez des vêtements de protection appropriés, des lunettes de sécurité et des gants lors de la manipulation des pièces et de l'entretien des équipements de climatisation.

## UNIT ARRANGEMENT AND ACCESS

### General

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

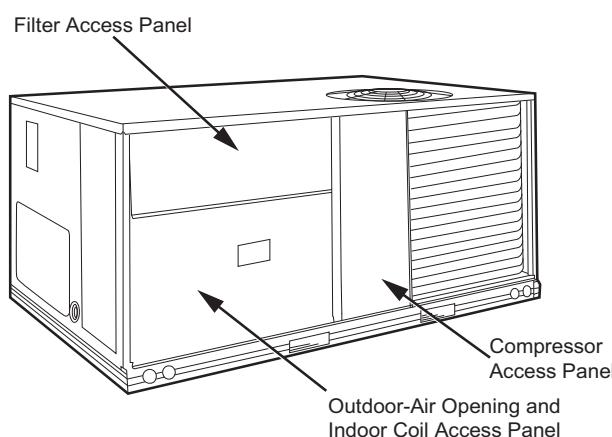


Fig. 1 — Typical Access Panel Locations

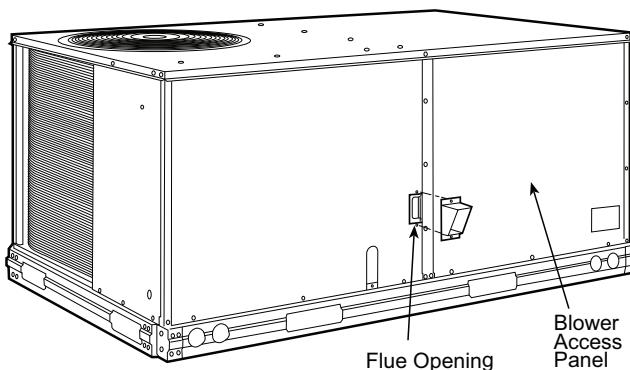


Fig. 2 — Blower Access Panel Location

## 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:

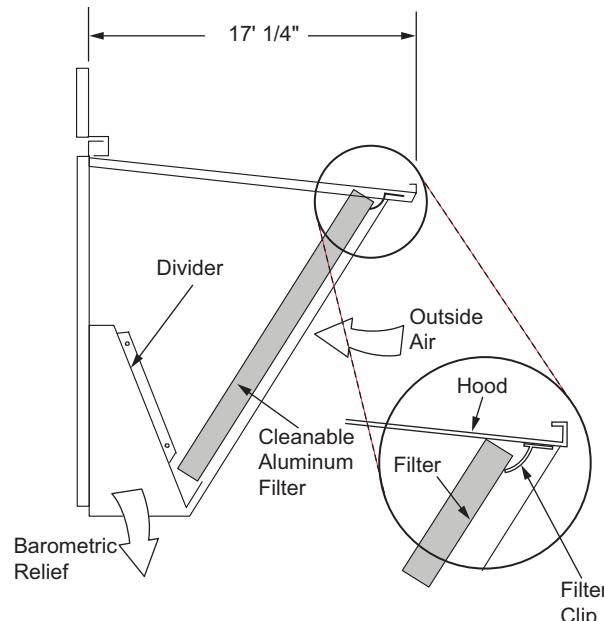
1. Slide the top of the panel up under the unit top panel.
2. Slide the bottom into the side channels.
3. Push the bottom flange down until it contacts the top of the lower panel (or economizer top).

### 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.)

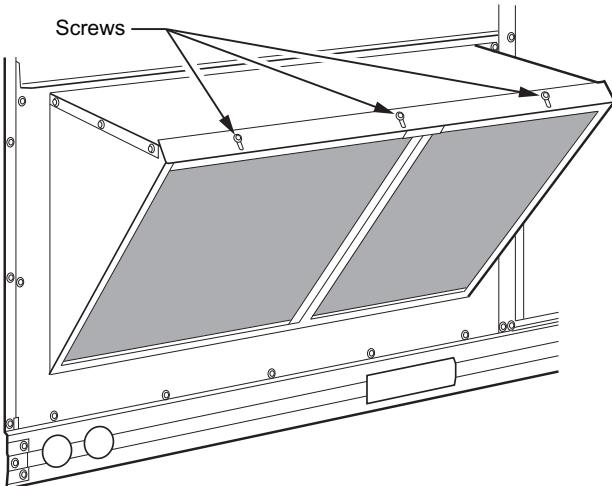


**Fig. 3 — Filter Installation**

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 OPERATION HAZARD

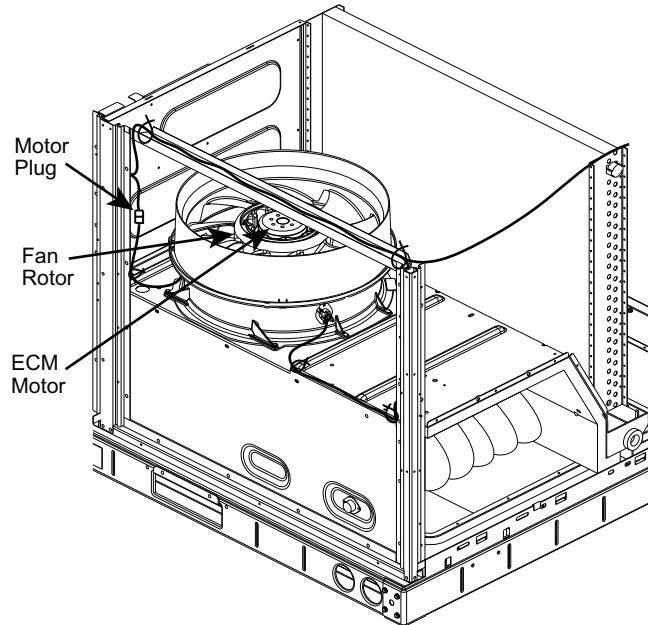
Failure to follow this warning could result in personal injury or death.

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

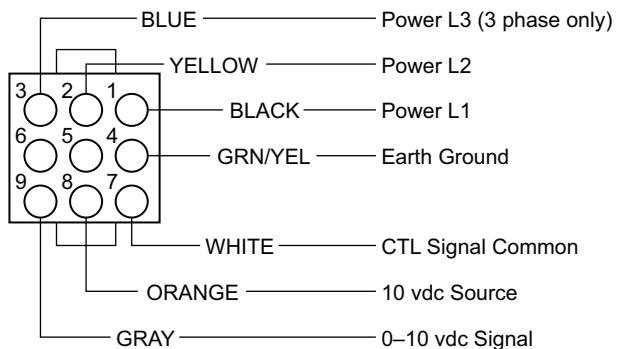
All low-voltage wiring should be routed through the provided raceway built into the corner post of the unit or secured to the unit control box with the electrical conduit in order to provide UL-required clearance between high and low-voltage wiring.

### Supply Fan (Direct-Drive)

All GE 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.

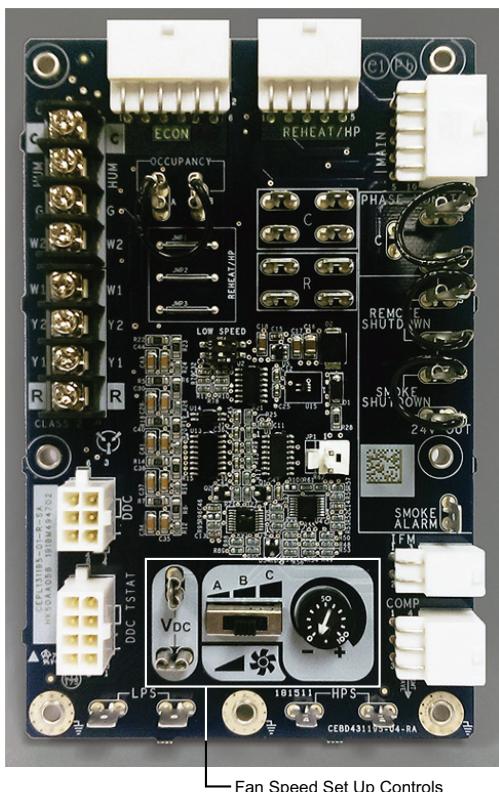
### Units with electromechanical controls

The Fan Speed Set Up controls are located on the lower section of the Unit Control Board (UCB). See Fig. 7 for location on 3 phase voltage units or Fig. 8 for location on single phase voltage units.

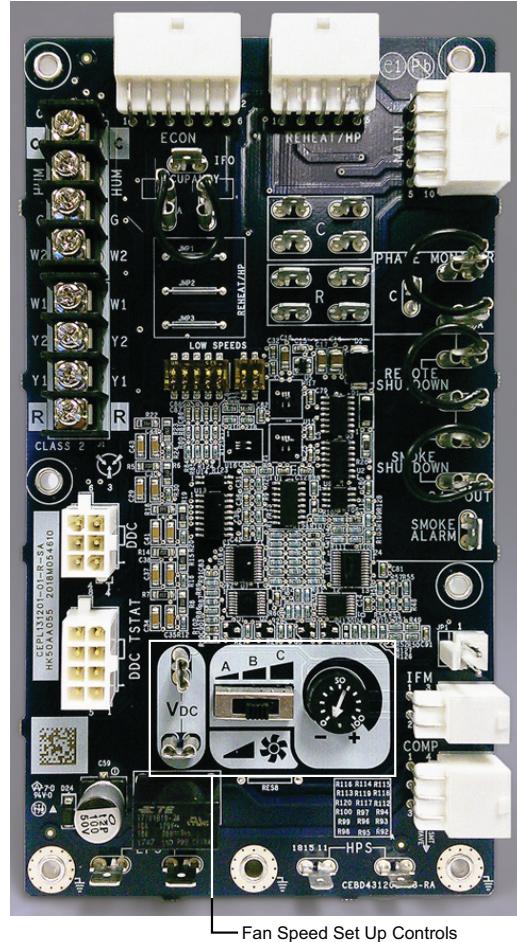
1. Check the job specifications for the cfm (cubic feet per minute) and ESP (external static pressure) required.
2. Using the chart on the Fan Speed Set Up labels (see Fig. 9), calculate the vdc from the cfm and ESP for the base.
3. If installing any accessories listed at the bottom of the Fan Speed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

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

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



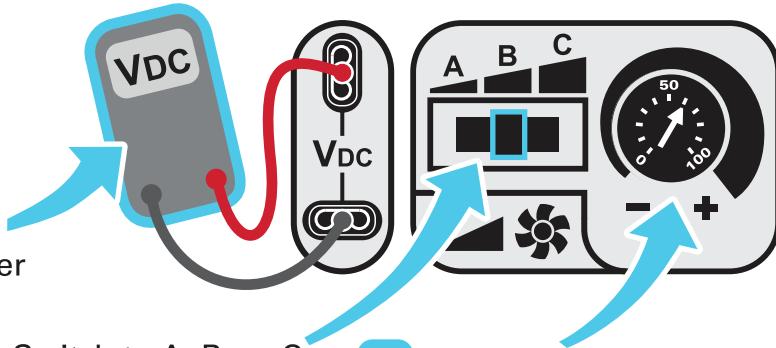
**Fig. 7 – UCB Fan Speed Controls - 3-Phase Units**



**Fig. 8 – UCB Fan Speed Controls - Single Phase Units**

## FAN SPEED SET UP:

- 1 Calculate VDC from CFM and ESP plus field accessories.
- 2 Connect multimeter
- 3 Set Switch to A, B, or C from Switch Range chart below.
- 4 Turn dial to fine tune VDC reading.
- 5 Fill in Field Setting.



Vdc Calculator

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
1500		6.0	6.7	7.4	8.0	8.5	9.0	9.5	9.9		
1625		6.3	7.1	7.7	8.3	8.8	9.3	9.7			
1750		6.7	7.4	8.0	8.6	9.1	9.5	10.0			
1875		7.1	7.7	8.3	8.9	9.4	9.8				
2000		7.5	8.1	8.7	9.2	9.7					
2125		7.9	8.4	9.0	9.5						
2250		8.3	8.8	9.4	9.9						
2375		8.7	9.2	9.7							
2500		9.1	9.5								
Field Accessories:											
Economizer	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1		

Factory Setting:

9.0 VDC

Field Setting:

Record field setting here  
VDC

Switch Range: \*

A B C

A	4.1 - 7.5
B	6.9 - 8.7
C	7.7 - 10.0

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

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

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

## Low speed fan adjustment (Single Phase and 3-Phase units)

### 2-Pin DIP Switch

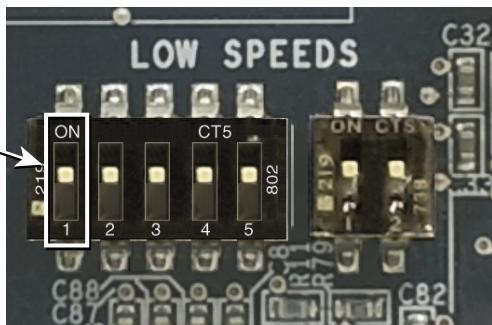
The 2-pin DIP switch is common to both the single and 3 phase unit control boards (see Fig. 7 and 8). When replacing UCB, the board will be shipped as default without a low speed selected. Use the 2-pin LOW SPEED DIP switch to set the low speed. To select correct GE low fan speed, set Dip Switch 1 to the "ON" position (see Table 1). The dip switch positions can also be found on the unit's control label diagram.

**Table 1 — Low Speed 2-Pin DIP Switch Settings**

LOW SPEED		% OF USER SET FAN SPEED
DIP1	DIP2	
0	0	100%
1	0	75%

### 5-Pin DIP Switch (Single Phase units only)

On single phase units, the approximate static pressure of the ductwork must be set for optimal unit efficiency. The unit is factory set for greater than 1.0 in. wg. If the external static pressure is less than 1.0 in. wg, slide switch 1 on the 5-pin DIP to the "ON" position. See Fig. 10. Switches 2 and 3 are used to determine the unit tonnage. Switches 4 and 5 are used to match the motor and drive combination. Table 2 details the various settings for the 5-pin DIP switch.



**Fig. 10 — Detail – 5-Pin DIP Switch**

**Table 2 — Low Speed 5-Pin DIP Switch Reference**

QUICK ENABLE/DISABLE	UNIT TON REFERENCE			UNIT/MOTOR REFERENCE		UNIT APPLICATION REFERENCE
	DIP1	DIP2	DIP3	DIP4	DIP5	
1	0	1		0	1	3 ton with Low static motor option
1	0	1		1	0	3 ton with Medium static motor option
1	0	1		1	1	3 ton with High static motor option
1	1	0		0	1	4 ton with Low static motor option
1	1	0		1	0	4 ton with Medium static motor option
1	1	0		1	1	4 ton with High static motor option
1	1	1		0	1	5 ton with Low static motor option
1	1	1		1	0	5 ton with Medium static motor option
1	1	1		1	1	5 ton with High static motor option

### 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. 11), calculate the RPM from the cfm and ESP for the base unit.
3. If installing any accessories listed at the bottom of the Fan Speed Set Up label, add accessory RPM to base unit RPM in upper portion of the 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. 11). 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 *FE/GE Series Single Package Rooftop Units with SystemVu Controller Controls, Start-up, Operation and Troubleshooting* manual.



MAIN MENU:

## FAN SPEED SETUP (RPM)

SETTINGS

UNIT CONFIGURATIONS

INDOOR FAN

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

↓ DETERMINE RPM FROM BELOW ↓

48TC003136 REV. A

RPM Calculator

UNIT MODEL NUMBER CFM	0.2	0.4	0.6	0.8	ESP in. wg					
					1.0	1.2	1.4	1.6	1.8	2.0
1500	1425	1609	1764	1902	2028	2147	2260	2367		
1625	1512	1688	1839	1974	2097	2212	2322			
1750	1601	1768	1916	2047	2168	2280	2387			
1875	1692	1850	1994	2123	2241	2351				
2000	1784	1933	2073	2200	2316					
2125	1878	2018	2153	2277						
2250	1973	2104	2235	2356						
2375	2069	2192	2317							
2500	2166	2282								
Field Accessories:										
Economizer	65	65	65	65	65	65	65	65		

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

Fig. 11 — 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. For temperature related faults the motor requires a line voltage reset to continue operation. For all others, the motor will resume operation automatically as soon as the fault condition is cleared. See Table 3 for a complete list.

**Table 3 — Fault Condition/Reset Trigger**

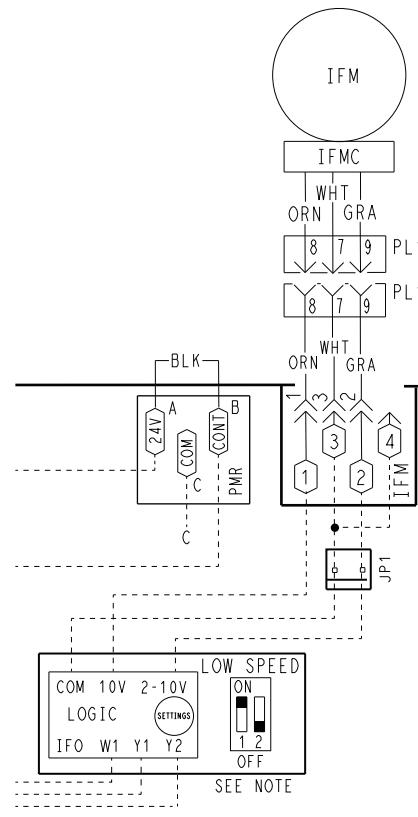
Fault Condition	Reset Trigger	Description
Phase Failure	Automatic	One phase is missing or imbalanced. In this case the motor will come to a stop and then automatically restart when all phases are present.
Locked/ Blocked Rotor	Automatic	The rotor is blocked. Once the locking mechanism has been removed, the motor will automatically restart.
Motor Over Heated	Manual	The motor will stop in the event the motor over heats. In this case there has to be a manual restart.
Power Module Over Heated	Manual	The motor will stop in the event the electronics over heat. In this case there has to be a manual restart.
Line under-voltage	Automatic	Once the line voltage returns within permitted operating range, the fan will automatically restart.
Communication Error	Automatic	Internal communication error of the fan's electronics. The fan will restart automatically, if error is cleared.

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.

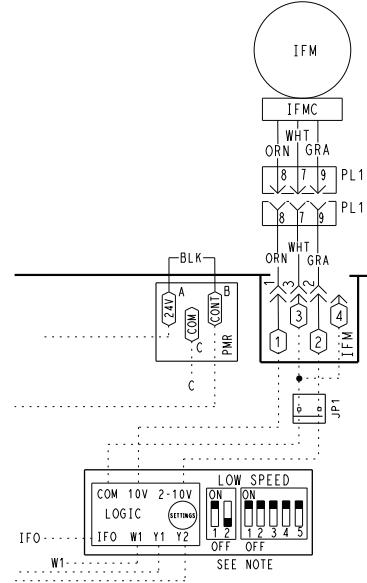
48GE UNIT VOLTAGE	MOTOR VOLTAGE	MIN-MAX VOLTS
208/230	230	187-253
460	460	414-506
575	575	518-633

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. 12 for 3-phase units and see Fig. 13 for 1-phase units.
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.



NOTE: 2-PIN LOW SPEED DIP SWITCH POSITIONS ARE FACTORY SET AS SHOWN.

**Fig. 12 — Supply Fan Control Wiring Diagram (3 Phase Units)**



NOTE: 2-PIN LOW SPEED DIP SWITCH POSITIONS ARE FACTORY SET AS SHOWN. 5-PIN LOW SPEED DIP SWITCH POSITIONS, REFER TO TABLE 1.

TABLE 1 FACTORY SETTINGS						
DIP SWITCH	1	2	3	4	5	IDF OPTION
3-TON	STANDARD	OFF	OFF	ON	OFF	ON
	MEDIUM	OFF	OFF	ON	ON	OFF
	HIGH	OFF	OFF	ON	ON	ON
4-TON	STANDARD	OFF	ON	OFF	OFF	ON
	MEDIUM	OFF	ON	OFF	ON	OFF
	HIGH	OFF	ON	OFF	ON	ON
5-TON	STANDARD	OFF	ON	ON	OFF	ON
	MEDIUM	OFF	ON	ON	ON	OFF
	HIGH	OFF	ON	ON	ON	ON

REFER TO LITERATURE FOR WHEN TO ENABLE DIP #1

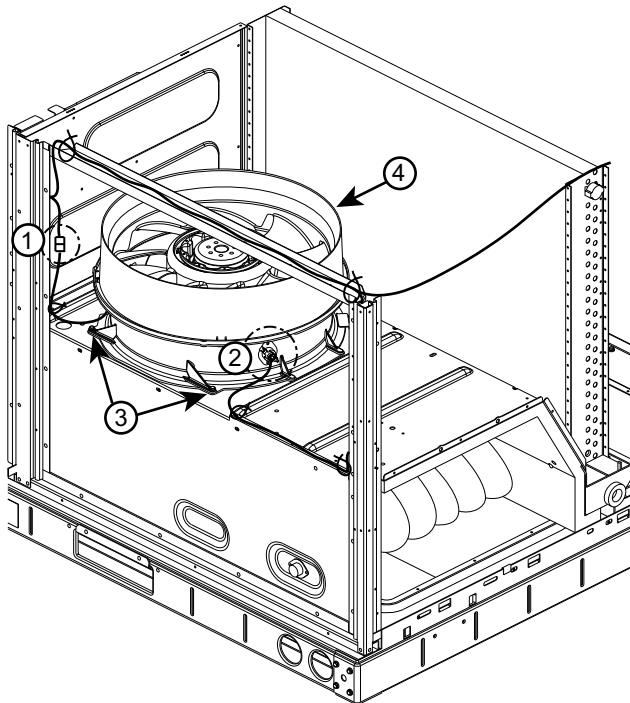
**Fig. 13 — Supply Fan Control Wiring Diagram (Single Phase Units)**

## 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. 14.

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 two screws at front of stator on fan deck.
4. Slide fan assembly forward a couple of inches to clear rear brackets and lift assembly out.

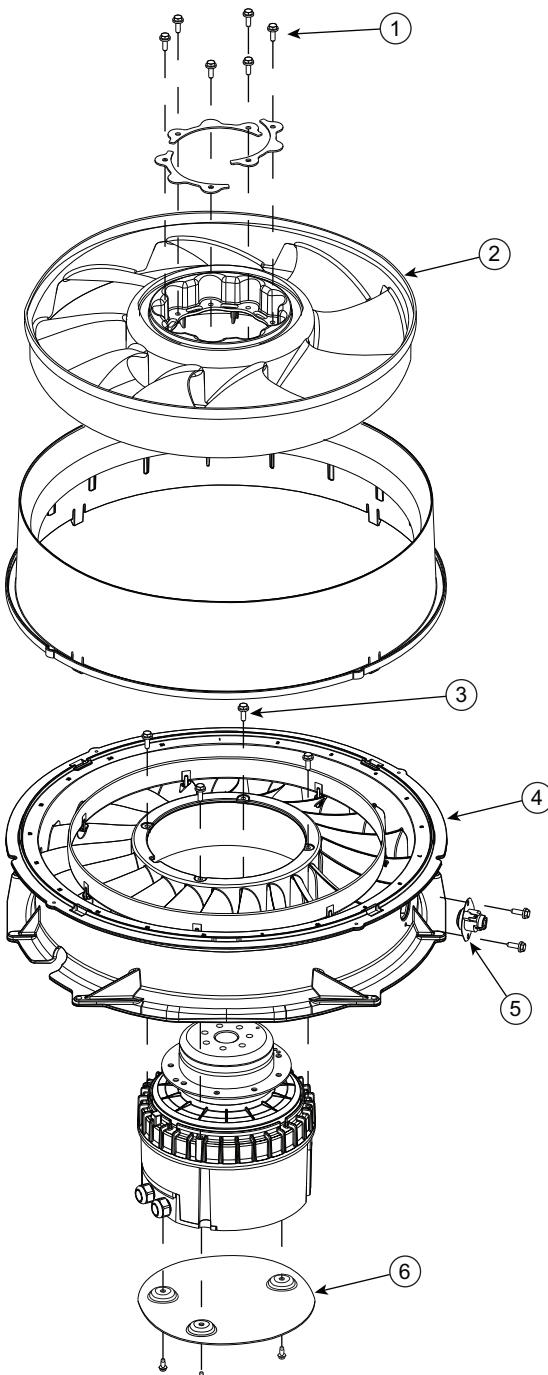


**Fig. 14 — Fan Assembly Removal**

## Disassembling motor and fan assembly

See Fig. 15.

1. Remove six screws from retaining rings in the top of the fan rotor.
2. Remove rotor from motor.
3. Remove four screws connecting motor to stator flange.
4. Remove stator from motor.
5. If required, remove stator limit switch on stator.
6. Remove three screws from the heat shield. Retain the heat shield if a new heat shield has not been ordered.



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

## Reassembly of motor and fan assembly

See Fig. 16.

1. Install heat shield on motor with three #8-32 x 3/8-in. thread cutting screws (P/N: AK92AB100). Tighten to 30 in.-lb (3.39 Nm).
2. Place motor on flat surface.
3. If required, install stator limit switch on stator with two #10 x 5/8-in. hex head screws (P/N: AL48AM217). Tighten to 50 in.-lb (5.65 Nm).
4. If required, insert composite ring into stator where pegs match up with holes.
5. Line up rectangle key way in the center of stator with rectangle feature on motor and set stator onto motor.

6. Install four #10-32 x 1/2-in. hex head machine screws (P/N: AD07AB126) to connect stator to motor. Tighten to 23 in.-lb (2.6 Nm).
7. Fit grommet on motor wire harness into keyhole feature on the side of the stator and pull wire harness out through grommet.
8. Install rotor on motor by lining up one of 9 holes on composite rotor with one of 9 holes on motor flange. This can be done by adjusting motor and the top of the motor hub and aligning using a 3/16-in. Allen key or similar pin. Press fan rotor down until it is flush with the motor flange.
9. Set retaining rings (x3) into composite rotor and install 6 #10-32 x 1/2-in. hex head machine screws (P/N: AD07AB126) through the holes in retaining rings. Tighten to 23 in.-lb (2.6 Nm). It is recommended this screw installation be done in a star pattern.
10. Align tabs of composite casing with rectangular cutouts on top of stator and snap into place.
11. Final assembly should have a small clearance between top of plastic rotor and underside of casing lip. Spin rotor by hand to ensure no contact or rubbing between these two parts.

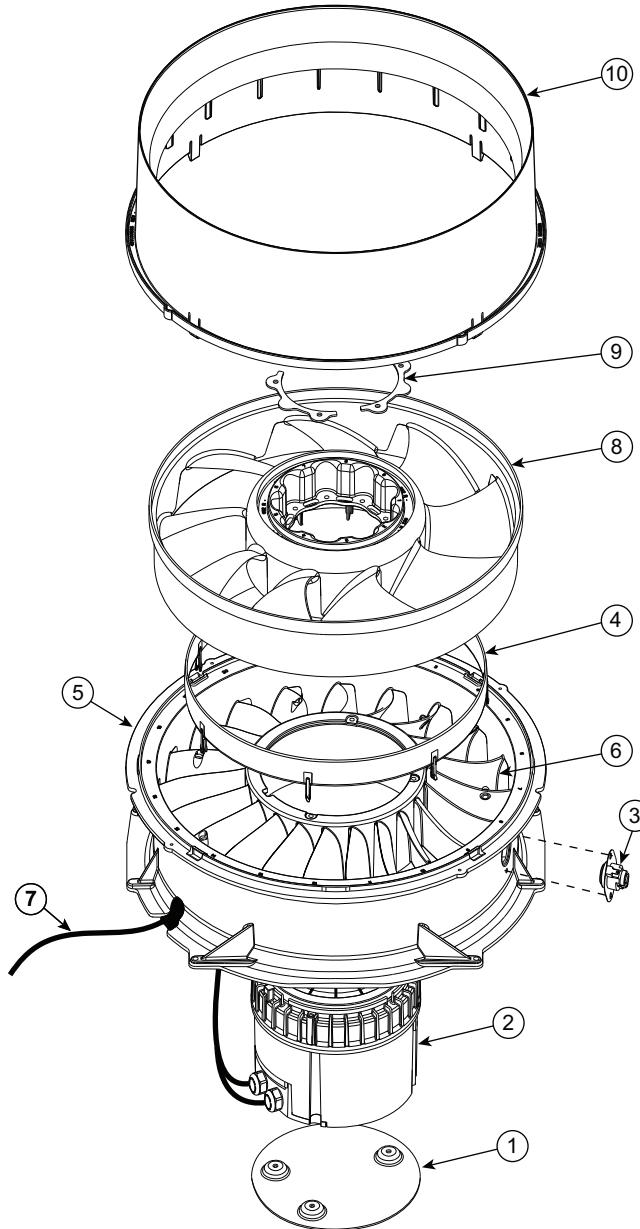


Fig. 16 — Fan System Re-Assembly

### Reinstalling motor and fan assembly

See Fig. 17.

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 stator is under the rear fan deck brackets.
2. Align (if necessary) two front holes and fasten stator to fan deck 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.

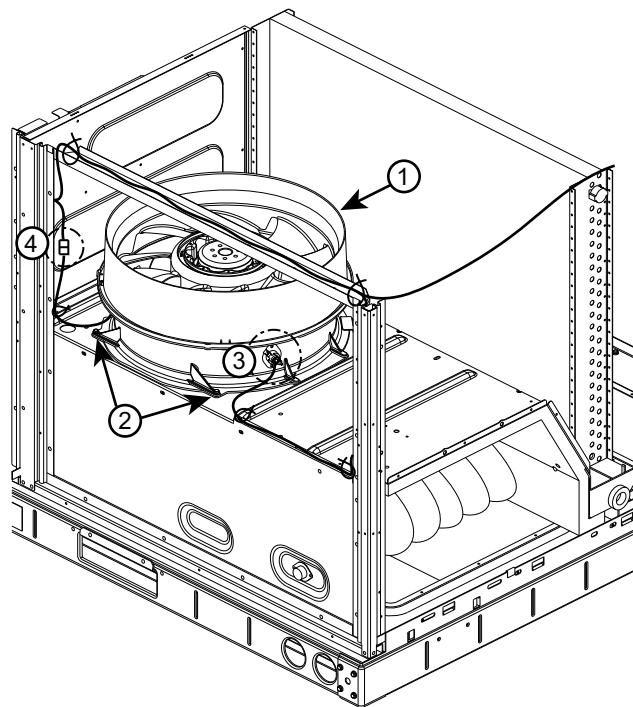


Fig. 17 — Fan Assembly Install

### Staged Air Volume

All 48GEG 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 75% 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 75% speed.

See Table 1 on page 9 for 2-Pin DIP switch settings.

## COOLING

### ⚠ WARNING

#### UNIT OPERATION AND SAFETY HAZARD

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

R-454B is an A2L refrigerant. All service equipment or components must be A2L refrigerant rated. Do not use non-A2L rated equipment or components on R-454B refrigerant equipment.

## 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” on page 79 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® coil cleaner is essential to extend the life of coils. This cleaner is available from Replacement Components as part number P902-0301 for a one gallon container, and part number 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 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:

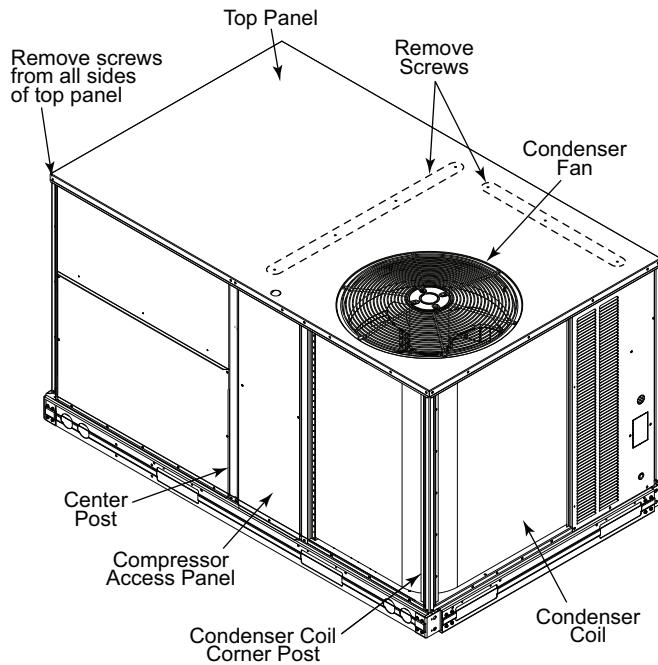
- coil brighteners
- acid cleaning prior to painting
- high pressure washers
- poor quality water for cleaning

Totaline coil cleaner is nonflammable, hypo-allergenic, nonbacterial, 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.

## Two-row condenser coils

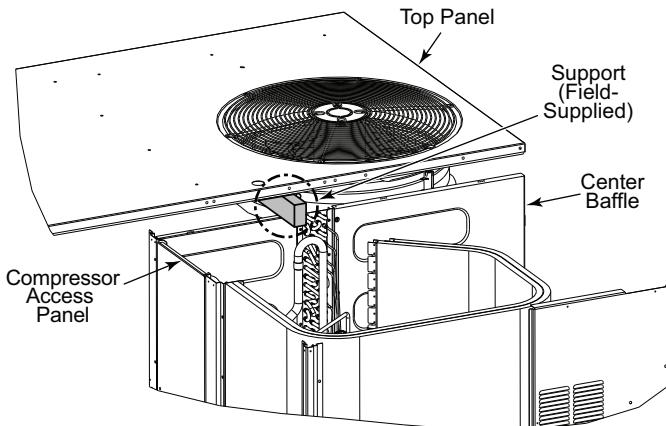
Clean coil as follows:

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. 18).



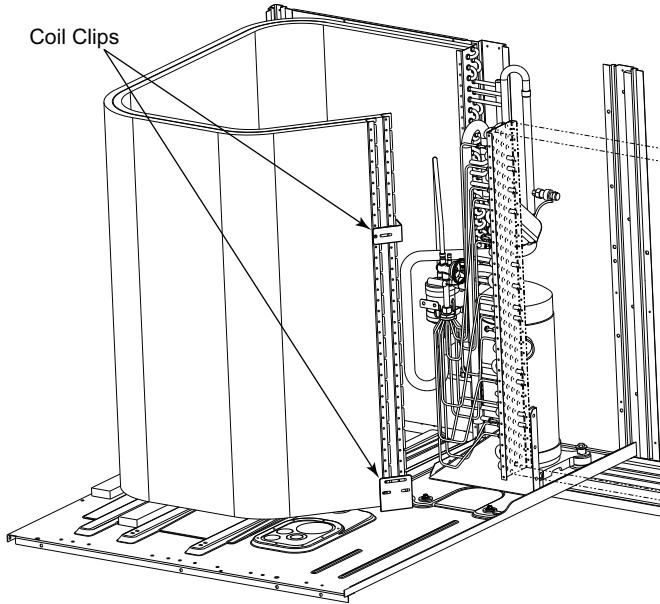
**Fig. 18 — Location of Screws and Coil Corner Post**

3. Lift and rotate the top panel at the condenser fan end and rotate the panel 90 degrees. Support the top panel so it remains level while resting on the condenser fan as shown in Fig. 19.



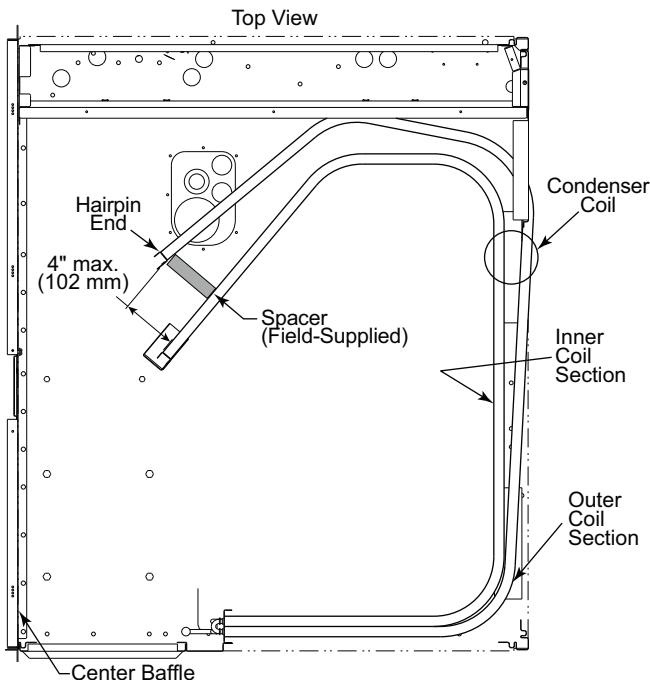
**Fig. 19 — Top Panel Position**

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



**Fig. 20 — 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. 21).
9. Clean the outer coil surface to remove surface loaded fibers or dirt. See "Remove Surface Loaded Fibers" on page 14 for details.
10. Use a water hose or other suitable equipment to flush down between the 2 coil sections to remove dirt and debris. If a coil cleaner is used be sure to rinse the coils completely before reassembly.
11. Move the inner coil back into position. Reinstall the lower and upper coil clips. Reinstall the top panel and replace all screws.



**Fig. 21 — Separating Coil Sections**

## ⚠ 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 air-side 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 coil cleaner.

### Totaline Coil Cleaner Application Equipment

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

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

## Evaporator Coil

### CLEANING THE EVAPORATOR COIL

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

## THERMOSTATIC EXPANSION VALVE (TXV)

All 48GE units include a factory-installed, non-adjustable 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 Advance<sup>TM</sup> (R-454B) refrigerant. Use only factory-authorized TXVs.

### TXV Operation

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

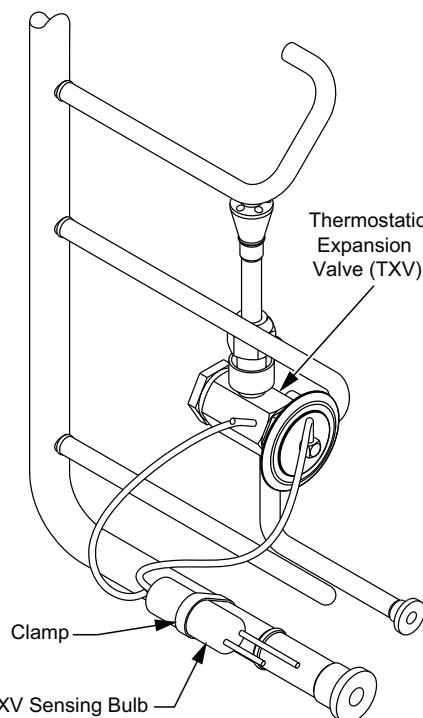
The volume of refrigerant metered through the valve seat is dependent upon the following:

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

### Replacing TXV

1. Recover refrigerant.
2. Remove TXV support clamp using a 5/16-in. nut driver.
3. Remove TXV using a wrench and an additional wrench on connections to prevent damage to tubing.
4. Remove equalizer tube from suction line of coil. Use file or tubing cutter to cut brazed equalizer line approximately 2 inches above suction tube.
5. Remove bulb from vapor tube inside cabinet.

6. Install the new TXV using a wrench and an additional wrench on connections to prevent damage to tubing while attaching TXV to distributor.
7. Attach the equalizer tube to the suction line. If the coil has a mechanical connection, then use a wrench and an additional wrench on connections to prevent damage. If the coil has a brazed connection, use a file or a tubing cutter to remove the mechanical flare nut from the equalizer line. Then use a new coupling to braze the equalizer line to the stub (previous equalizer line) in suction line.
8. Attach TXV bulb in the same location where the original (in the sensing bulb indent) was when it was removed, using the supplied bulb clamps (see Fig. 22).
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.



NOTE: Sensing bulb insulation removed for clarity.

**Fig. 22 — 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. 23). This check valve is permanently assembled into this core body and cannot be serviced separately; replace the entire core body if necessary. Service tools are available from RCD that allow the replacement of the check valve core without having to recover the entire system refrigerant charge. Apply compressor refrigerant oil to the check valve core's bottom o-ring. Install the fitting body with  $96 \pm 10$  in.-lb (10.85  $\pm$  1.10 Nm) of torque; do not over-tighten.

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

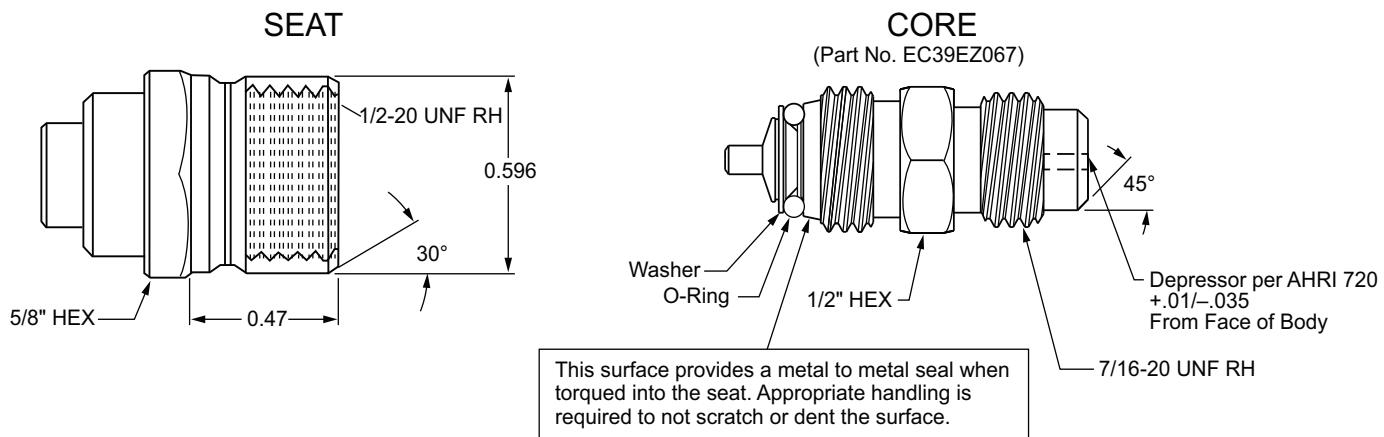


Fig. 23 — CoreMax™1 Access Port Assembly

## PURON ADVANCE (R-454B) REFRIGERANT

This unit is designed for use with Puron Advance™ (R-454B) refrigerant. Do not use any other refrigerant in this system.

Puron Advance (R-454B) refrigerant is provided in gray cylinders with a red band near the top. Pay close attention to the cylinder labels to verify that the cylinder contains the correct refrigerant. 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 Advance (R-454B) refrigerant is a zeotropic 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 Advance (R-454B) 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. 24-29, 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.

48GE(G/H) SIZE DESIGNATION	NOMINAL TONS REFERENCE
04	3
05	4
06	5

### EXAMPLE:

Model ..... 48GEG\*04

Discharge Pressure ..... 400 psig (2758 kPa)

Outdoor Coil Leaving Temperature ..... 105°F (37.7°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.

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

## COOLING CHARGING CHARTS

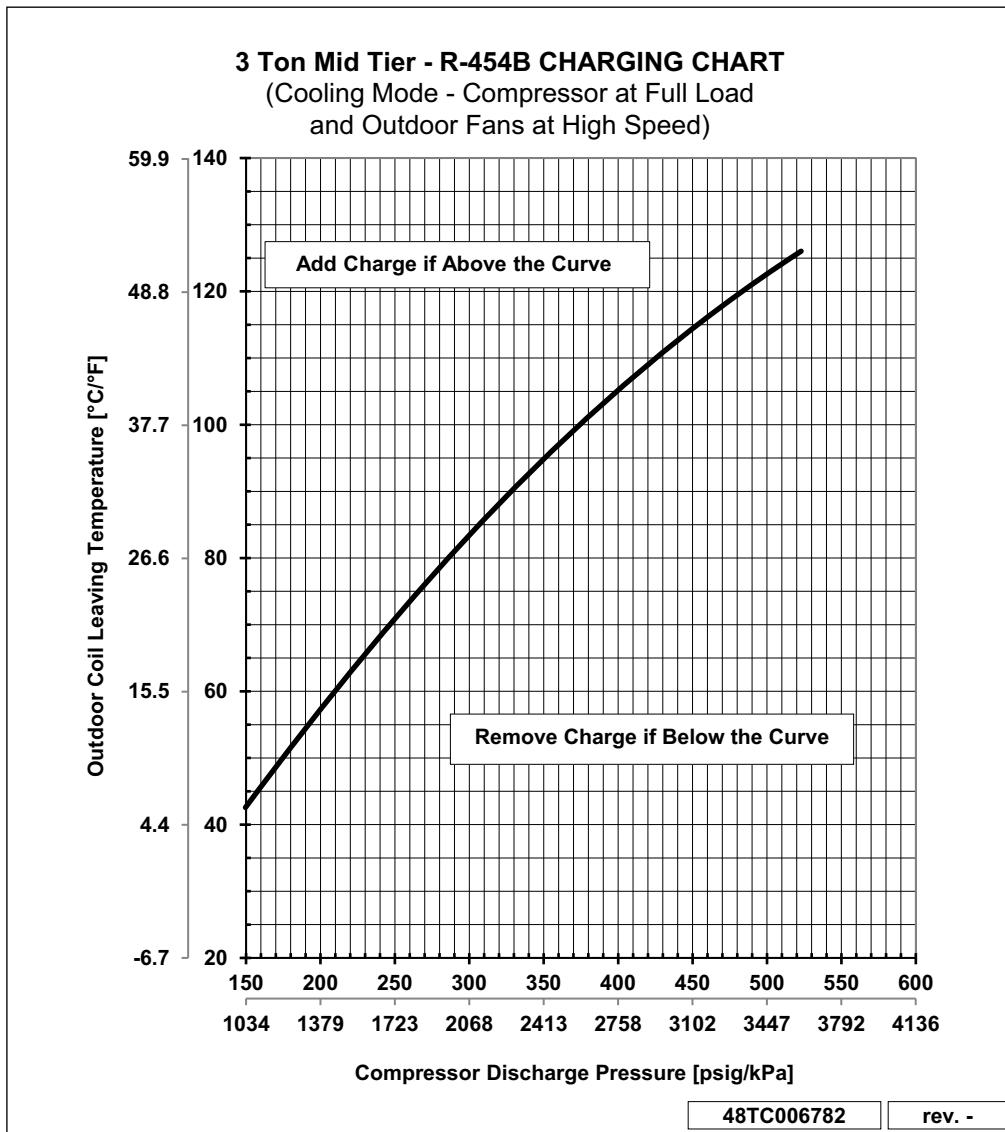
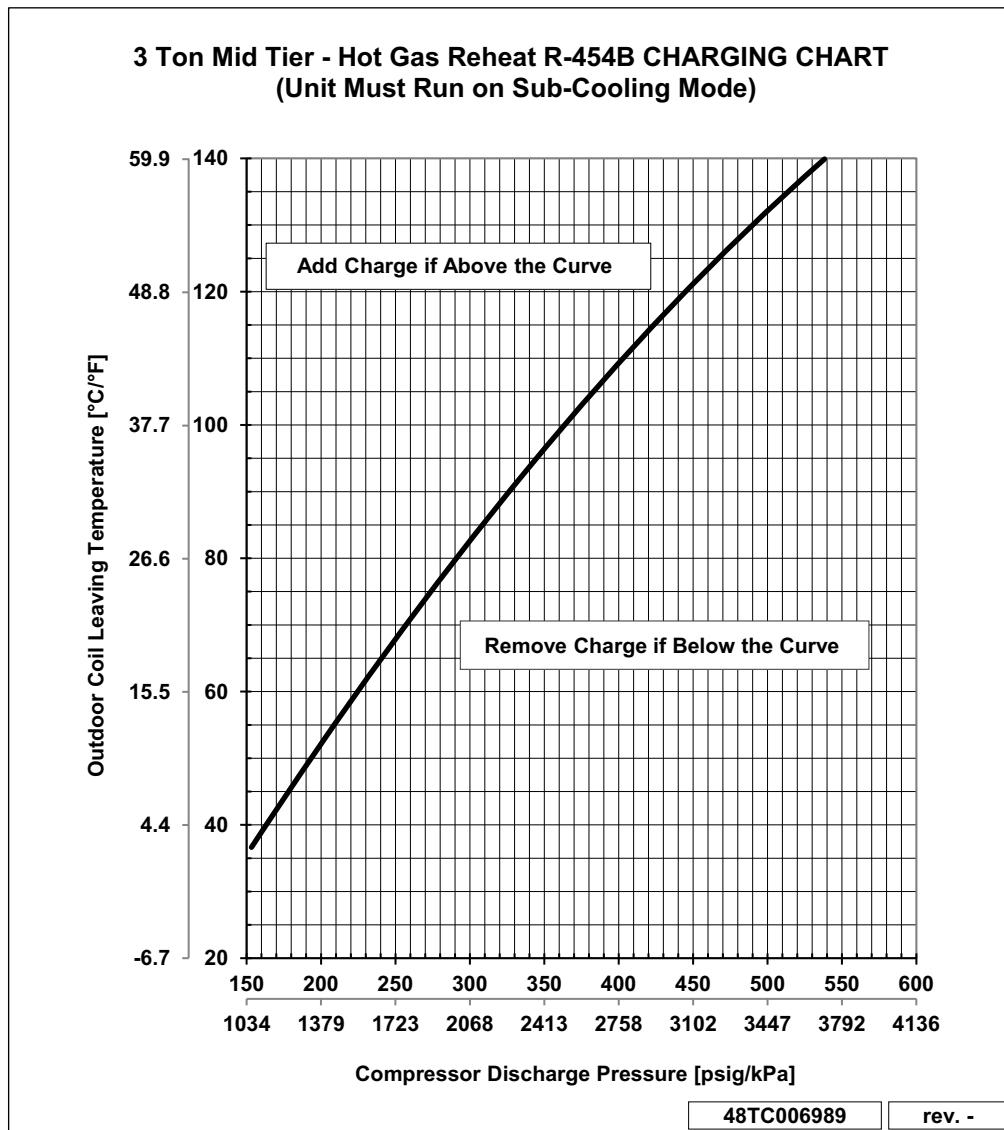


Fig. 24 — Cooling Charging Chart — 3 Ton

## COOLING CHARGING CHARTS



**Fig. 25 — Cooling Charging Chart — 3 Ton  
with Hot Gas Reheat (Humidi-MiZer® System) Option**

## COOLING CHARGING CHARTS

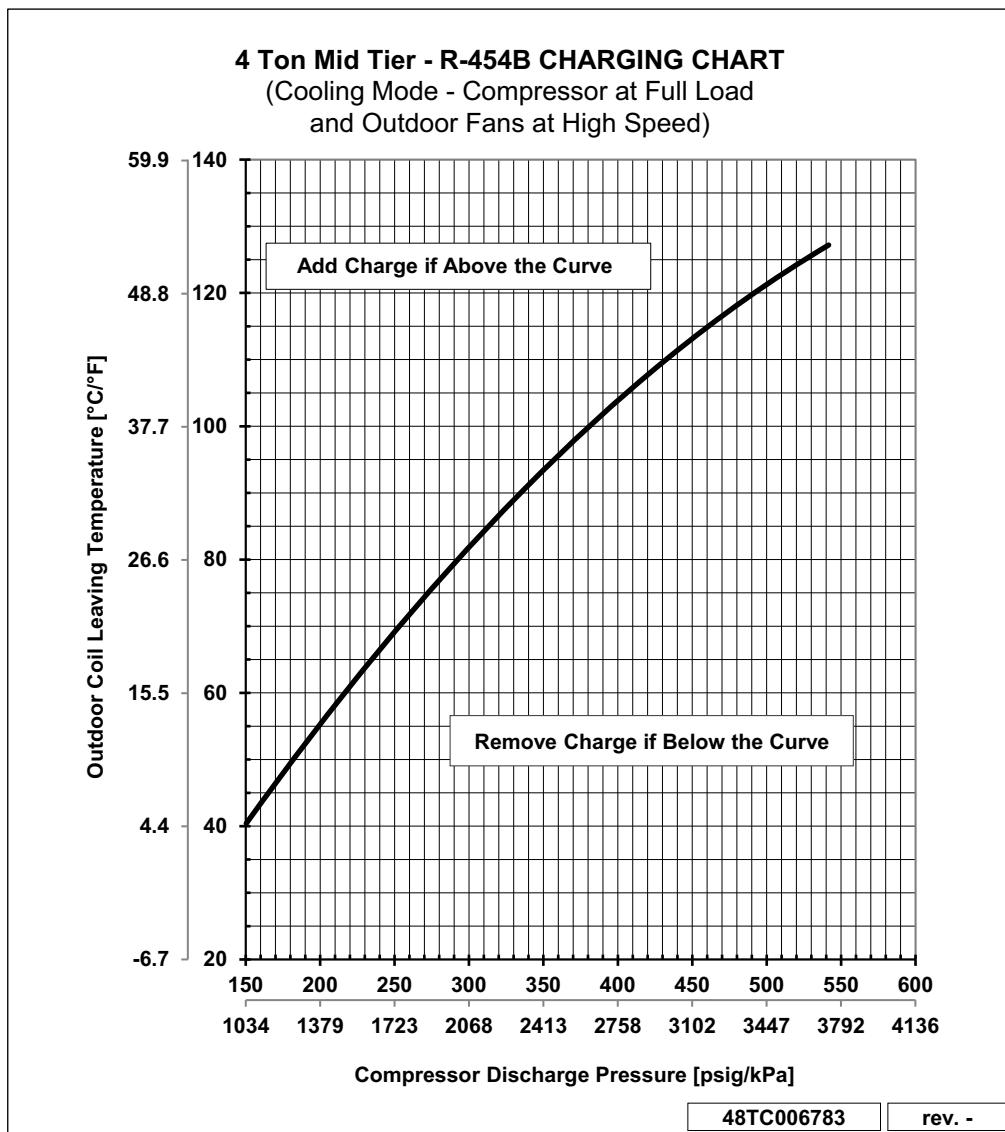
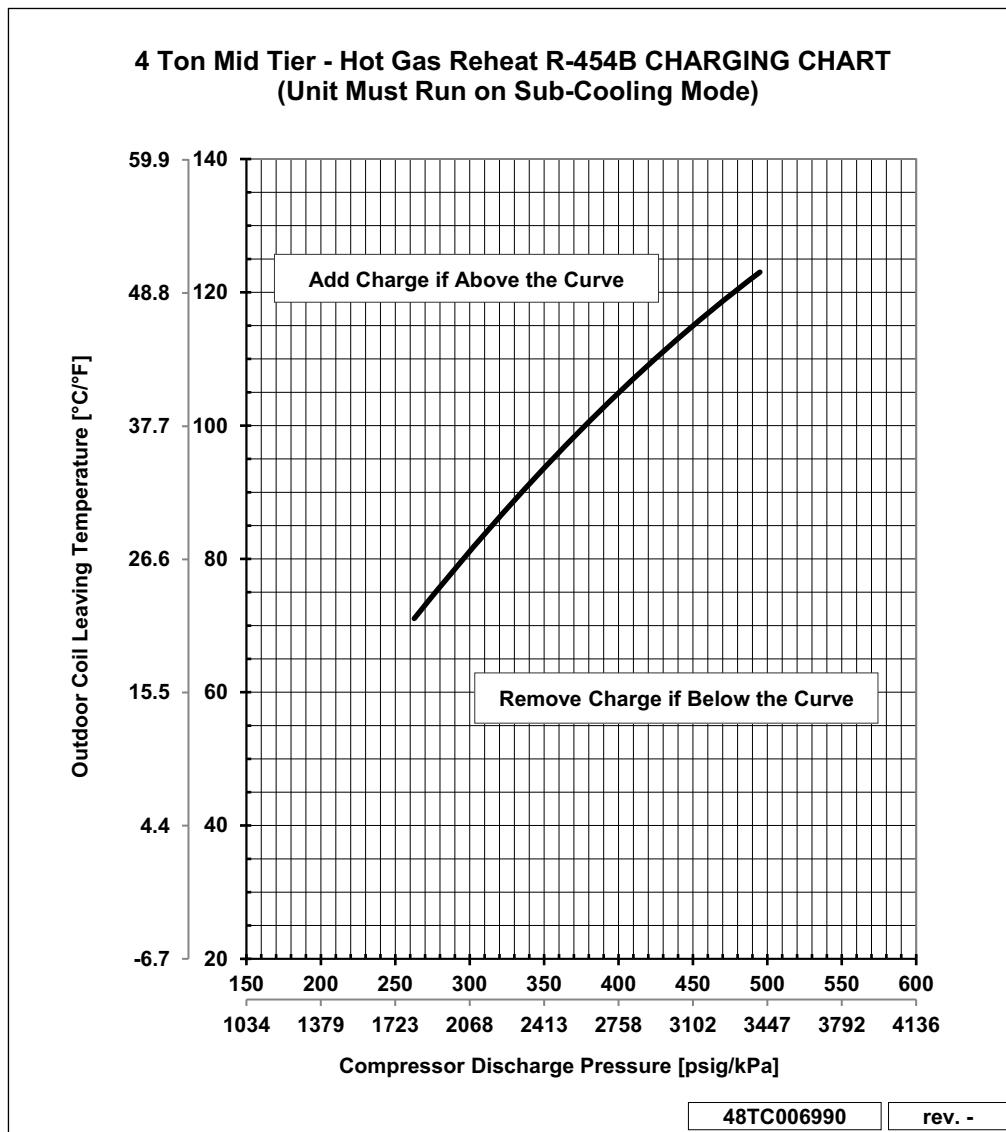


Fig. 26 – Cooling Charging Chart – 4 Ton

## COOLING CHARGING CHARTS



**Fig. 27 — Cooling Charging Chart — 4 Ton  
with Hot Gas Reheat (Humidi-MiZer® System) Option**

## COOLING CHARGING CHARTS

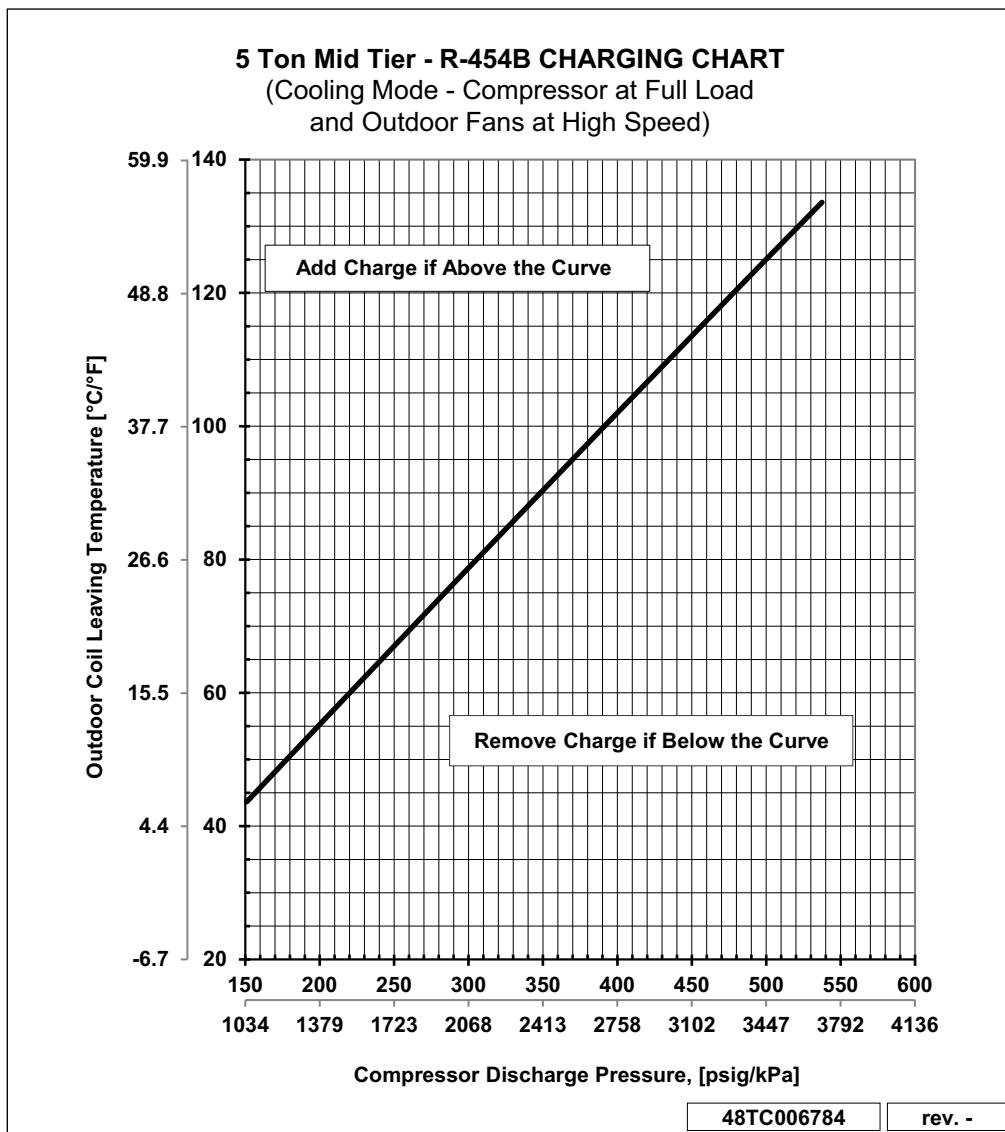


Fig. 28 – Cooling Charging Chart – 5 Ton

## COOLING CHARGING CHARTS

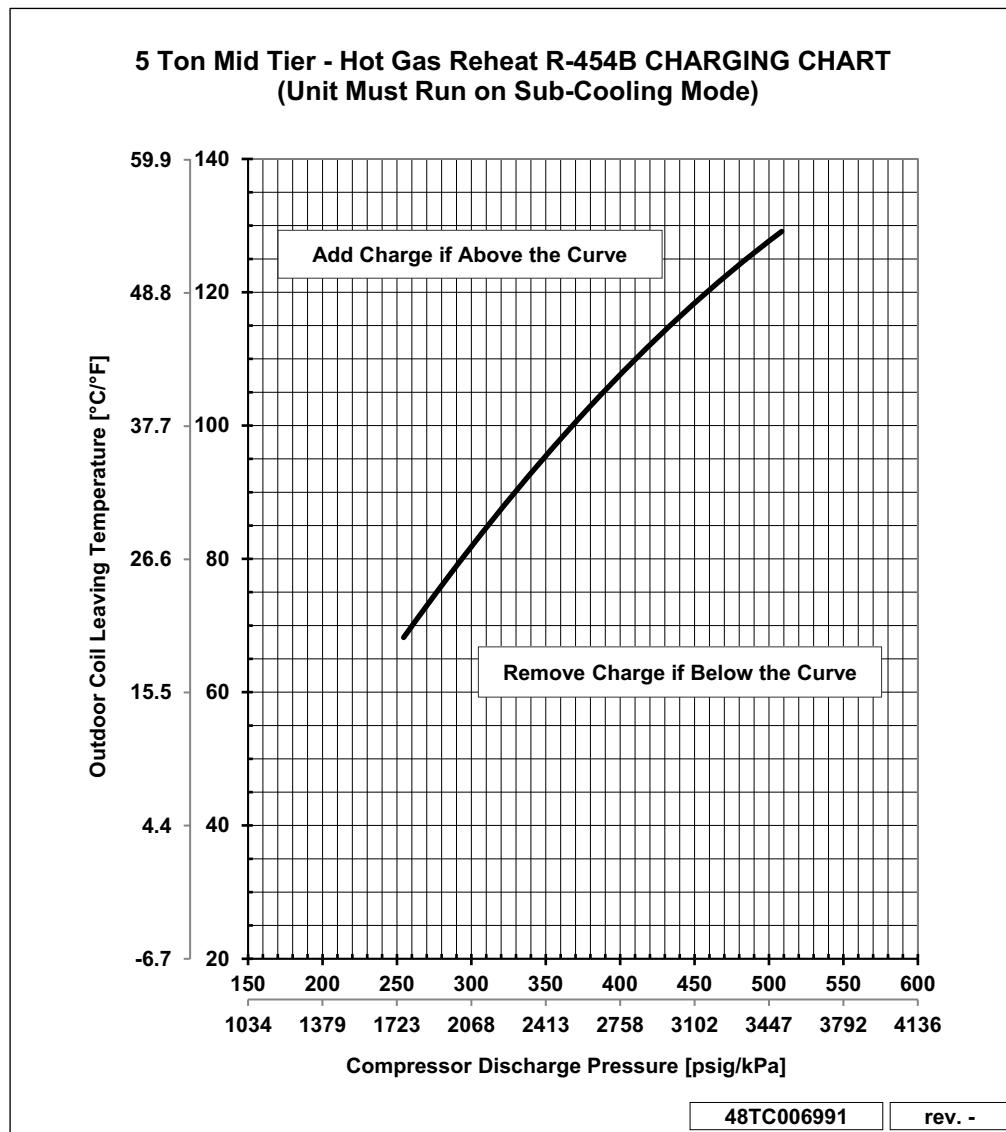


Fig. 29 – Cooling Charging Chart – 5 Ton  
with Hot Gas Reheat (Humidi-MiZer System) Option

## 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 R-454B refrigerant system and uses a polyolester (POE) oil. This oil is extremely hygroscopic, meaning it absorbs water readily. POE oils can absorb 15 times as much water as other oils designed for HCFC and CFC refrigerants. Avoid exposure of the oil to the atmosphere.

#### ⚠ WARNING

##### FIRE, EXPLOSION HAZARD

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

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

#### ⚠ WARNING

##### FIRE, EXPLOSION HAZARD

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

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

### Replacing Compressor

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

#### ⚠ CAUTION

##### INSTALLATION SITE DAMAGE

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

R-454B 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 Advance™ 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. 30).
3. Loosen fan hub setscrews.
4. Adjust fan height by pushing fan until it stops on the fan shaft.
5. Tighten set screw to 60 in.-lb (6.78 Nm).
6. Replace condenser-fan assembly. When replacing the condenser-fan assembly follow the screw pattern sequence shown in Fig. 31. The screws must be replaced in the sequence shown in the figure.

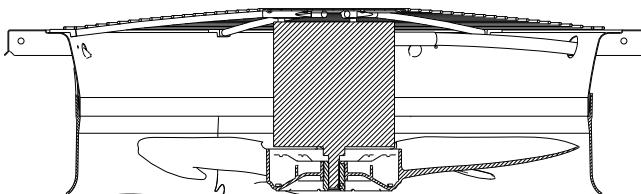
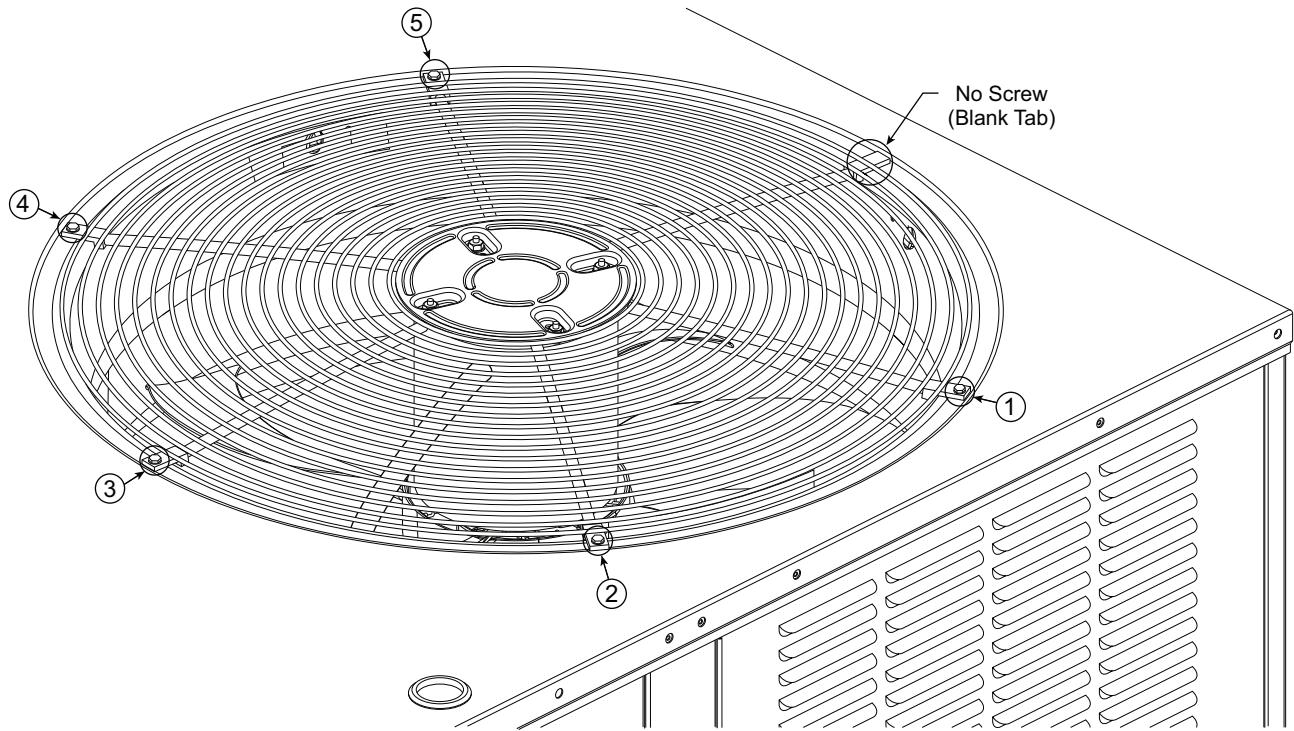


Fig. 30 — Condenser Fan Adjustment



**Fig. 31 — Condenser-Fan Assembly — Screw Pattern Sequence**

## Troubleshooting Cooling System

Refer to Table 4 for additional troubleshooting topics.

**Table 4 — Troubleshooting**

SYMPTOM	CAUSE	SOLUTION
<b>Compressor and Outdoor Fan Will Not Start</b>	Power failure.	Call power company.
	Fuse blown or circuit breaker tripped.	Replace fuse or reset circuit breaker. Determine root cause.
	Defective thermostat, contactor, transformer, control relay, or capacitor.	Replacement component.
	Insufficient line voltage.	Determine cause and correct.
	Incorrect or faulty wiring.	Check wiring diagram and rewire correctly.
	Thermostat setting too high.	Lower thermostat setting below room temperature.
	High pressure switch tripped.	See problem "Excessive head pressure."
	Low pressure switch tripped.	Check system for leaks. Repair as necessary.
	Freeze-up protection thermostat tripped.	See problem "Suction pressure too low."
<b>Compressor Will Not Start but Outdoor Fan Runs</b>	Faulty wiring or loose connections in compressor circuit.	Check wiring and repair or replace.
	Compressor motor burned out, seized, or internal overload open.	Determine cause. Replace compressor or allow enough time for internal overload to cool and reset.
	Defective run/start capacitor, overload, start relay.	Determine cause. Replace compressor or allow enough time for internal overload to cool and reset.
	One leg of 3-phase power dead.	Replace fuse or reset circuit breaker. Determine cause.
<b>Compressor Cycles (Other Than Normally Satisfying Thermostat)</b>	Refrigerant overcharge or undercharge.	Recover refrigerant, evacuate system, and recharge to nameplate.
	Defective compressor.	Replace and determine cause.
	Insufficient line voltage.	Determine cause and correct.
	Blocked outdoor coil or dirty air filter.	Determine cause and correct.
	Defective Run/Start capacitor, overload, start relay.	Determine cause and correct.
	Defective thermostat.	Replace thermostat.
	Faulty outdoor-fan (cooling) or indoor-fan (heating) motor or capacitor.	Replace faulty part.
	Restriction in refrigerant system.	Locate restriction and remove.
	Defective loader plug.	Determine cause and replace.
<b>Compressor Operates Continuously</b>	Dirty air filter.	Replaced filter.
	Unit undersized for load.	Decrease load or increase unit size.
	Thermostat set too low (cooling).	Reset thermostat.
	Low refrigerant charge.	Locate leak; repair and recharge.
	Air in system.	Recover refrigerant, evacuate system, and recharge.
	Outdoor coil dirty or restricted.	Clean coil or remove restriction.
<b>Compressor Makes Excessive Noise</b>	Compressor rotating in the wrong direction.	Reverse the 3-phase power leads as described in Start-Up.
<b>Excessive Head Pressure</b>	Dirty outside.	Replace filter.
	Dirty outdoor coil (cooling).	Clean coil.
	Refrigerant overcharged.	Recover excess refrigerant.
	Air in system.	Recover refrigerant, evacuate system, and recharge.
	Condensing air restricted or air short-cycling.	Determine cause and correct.
<b>Head Pressure Too Low</b>	Low refrigerant charge.	Check for leaks; repair and recharge
	Compressor scroll plates defective.	Replace compressor
	Restriction in liquid tube.	Remove restriction.
<b>Excessive Suction Pressure</b>	High heat load.	Check for source and eliminate.
	Compressor scroll plates defective.	Replace compressor.
	Refrigerant overcharge.	Recover excess refrigerant.
	Dirty air filter (cooling).	Replace filter.
<b>Suction Pressure Too Low</b>	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 40°F (cooling).	Install low-ambient kit.
	Outdoor fan motor(s) not operating (heating).	Check fan motor operation.

## CONVENIENCE OUTLETS

### ⚠️ WARNING

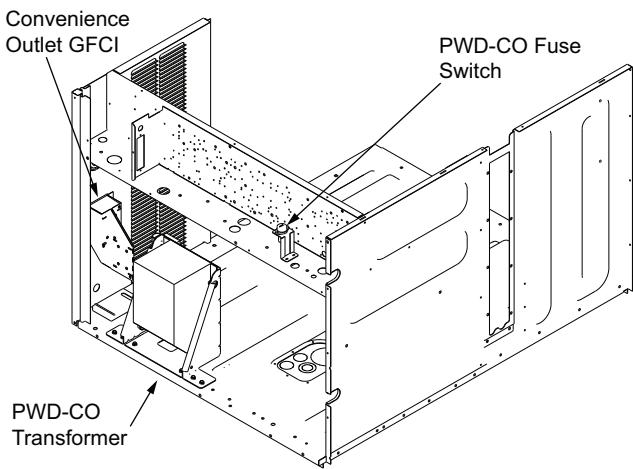
#### ELECTRICAL OPERATION HAZARD

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. Lock-out and tag-out this switch, if necessary.

### Convenience Outlets

Two types of convenience outlets are offered on 48GE 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

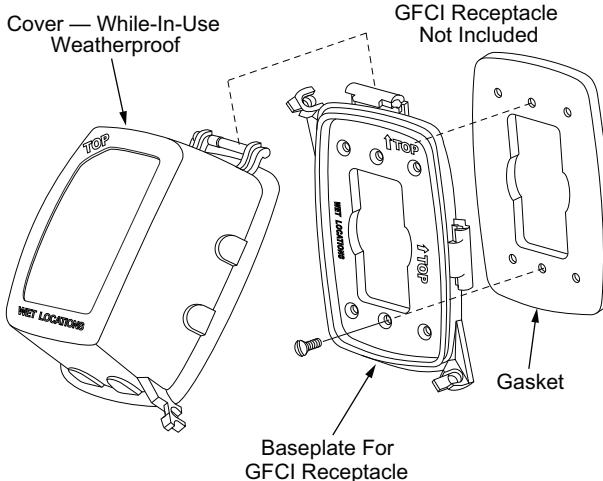
A weatherproof while-in-use cover for the factory installed convenience outlets is now required by UL standards. This cover cannot be factory-mounted due to its depth. The cover must be installed at unit installation. For shipment, the convenience outlet is covered with a blank cover plate.

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 overtighten).
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**

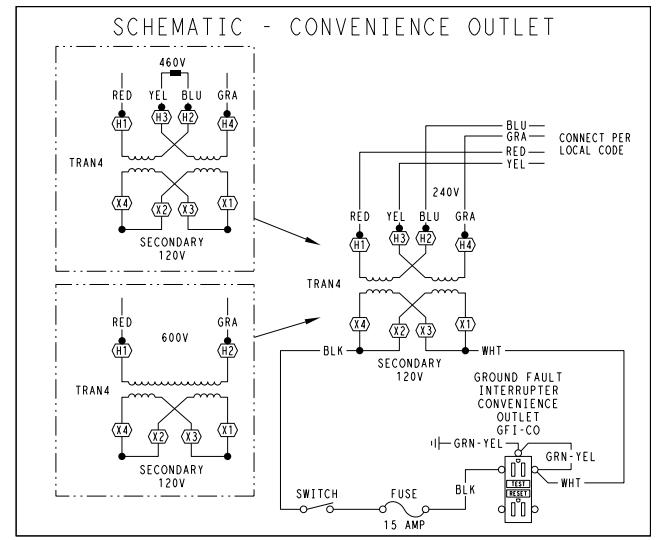
### Non-Powered Type

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 L2: BLU + GRA	H1 + H3 H2 + H4
460	480	L1: RED Splice BLU + YEL L2: GRA	H1 H2 + H3 H4
575	600	L1: RED L2: GRA	H1 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<sup>1</sup> 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 48GE 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

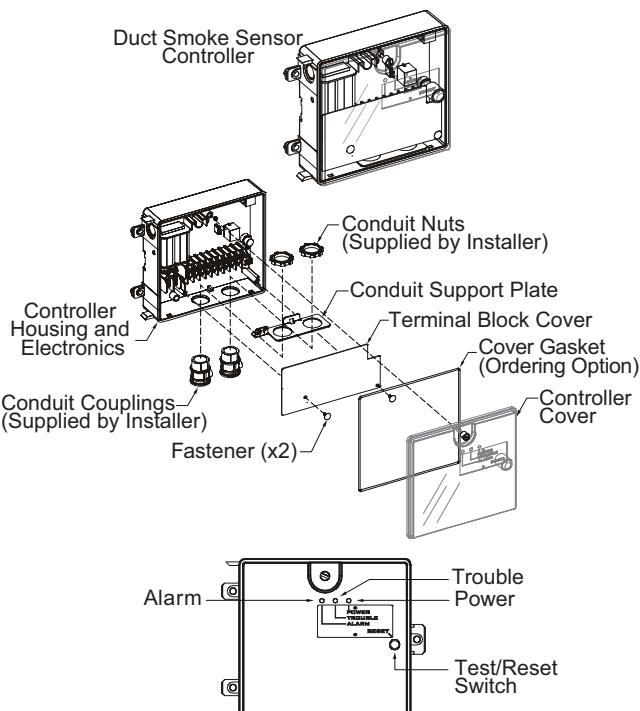
The smoke detector system consists of a four-wire controller and one or two sensors. Its primary function is to shut down the rooftop unit in order to prevent smoke from circulating throughout the building. It is not to be used as a life saving device.

### 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.

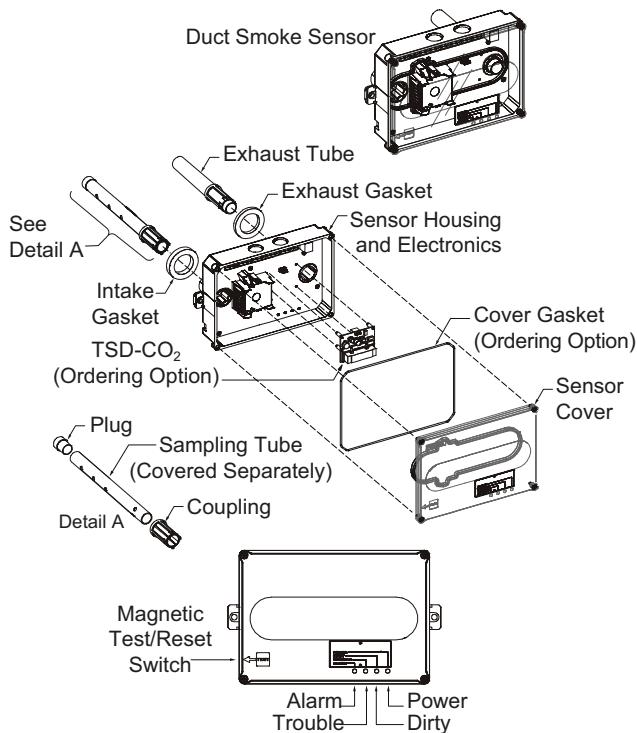
Air is introduced to the duct smoke detector sensor's sensing chamber through a sampling tube that extends into the HVAC duct and is directed back into the ventilation system through a (shorter) exhaust tube.

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.

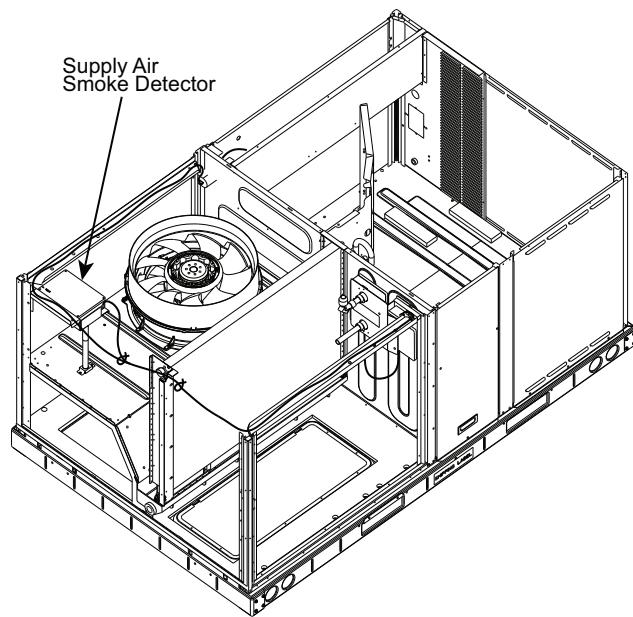


**Fig. 36 – Smoke Detector Sensor**

## Smoke Detector Locations

### SUPPLY AIR

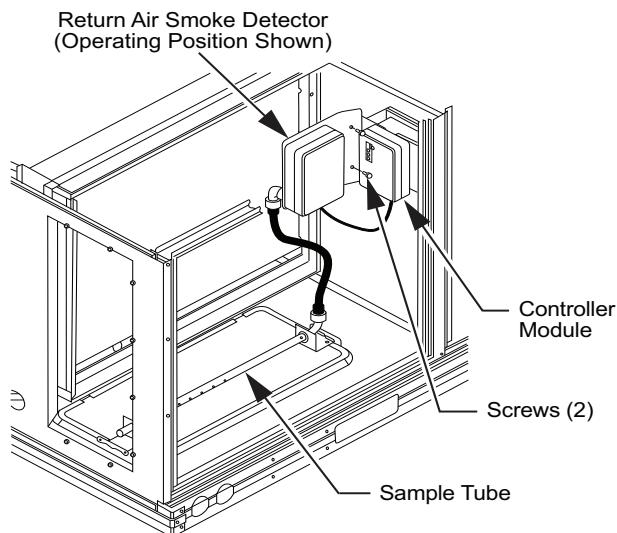
The supply air smoke detector sensor is located to the right of the unit's indoor (supply) fan (see Fig. 37). Access is through the fan access panel. The sampling tube inlet extends through the fan deck (into a high pressure area). The controller is located on a bracket to the right of the return filter, 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 downward, into the return air stream. The sampling tube is connected through tubing to the return air sensor that is mounted on a bracket high on the partition between return filter and controller location. The sensor is shipped in a flat-mounting location. Installation requires that this sensor be relocated to its operating location and the tubing to the sampling tube be connected.



**Fig. 38 – Return Air Smoke Detector Operating Position**

### 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. See Fig. 39. The holes in the sampling tube face downward, into the return air stream. The sampling tube is connected using tubing to the return air sensor mounted on a bracket high on the partition between return filter and controller location.

## 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. 40, 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.

#### Highlight C

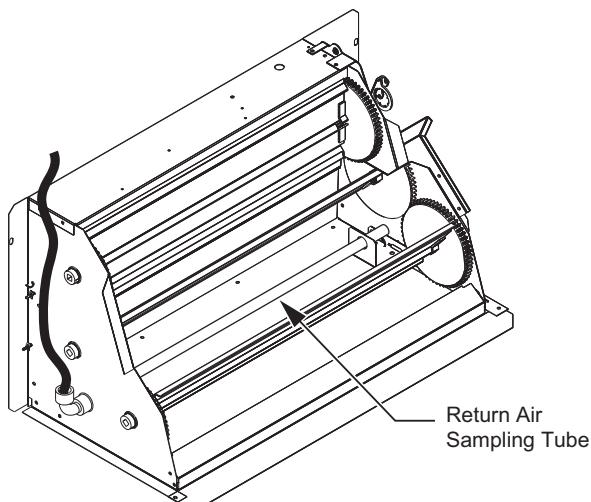
On smoke alarm condition, the smoke detector NO Alarm contact will close, supplying 24-v power to GRA conductor.

#### Highlight D

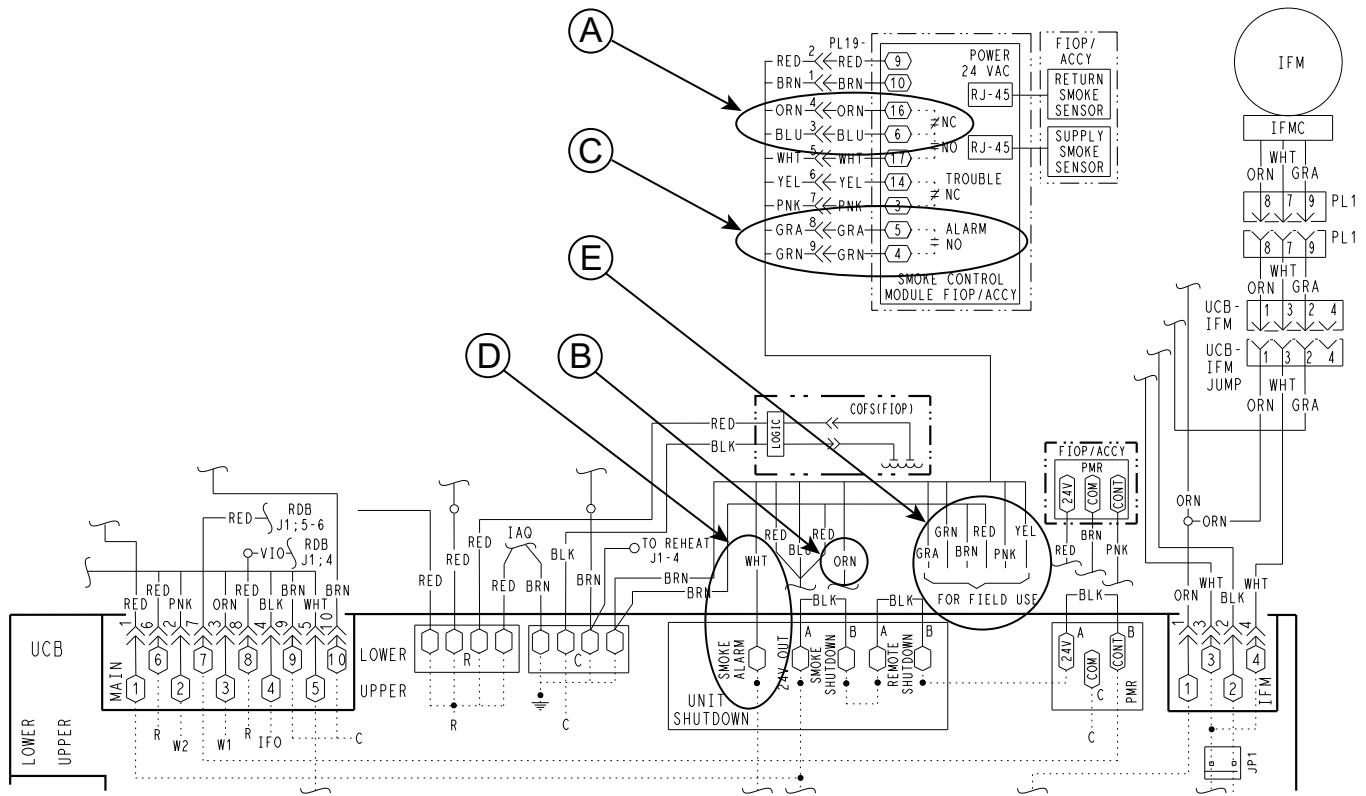
WHT lead at Smoke Alarm input on UCB provides 24-v signal to FIOP DDC control.

#### Using Remote Logic

Six conductors are provided for field use (see Highlight E) for additional annunciation functions.



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



**Fig. 40 — Typical Smoke Detector System Wiring**

## SYSTEMVUTM UNITS

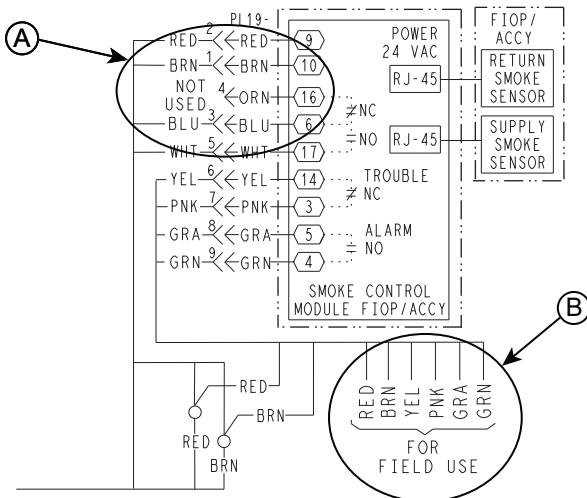
See Fig. 41 for typical SystemVu controller smoke detector wiring

### Highlight A

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

### Highlight B – using Remote Logic (SystemVu controller)

Six conductors are provided for field use (see Highlight B) for additional annunciation functions.



**Fig. 41 – Typical Smoke Detector System Wiring, SystemVu Control Units.**

## ADDITIONAL APPLICATION DATA

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

## 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 5.

**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 5 – 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.

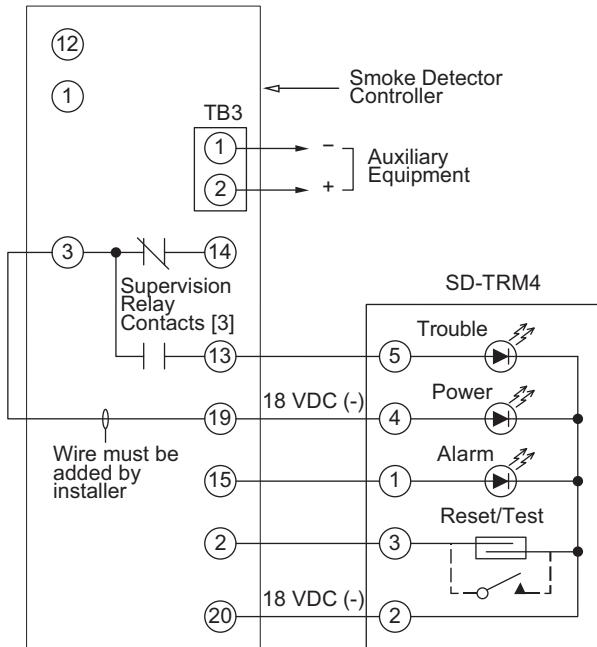
**IMPORTANT:** Failure to follow this ALERT can result in an unnecessary evacuation of the facility. This test places the duct detector into the alarm state. Unless part of the test, disconnect all auxiliary equipment from the controller before performing the test. If the duct detector is connected to 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 31.



**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.

Hold 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

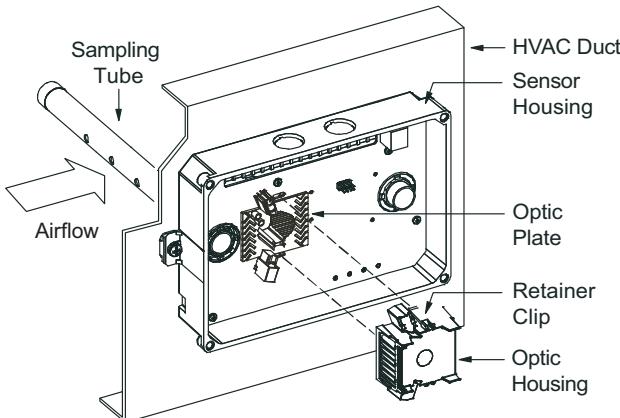
Clean the duct smoke sensor when the Dirty LED is flashing continuously or sooner, if conditions warrant.

IMPORTANT: OPERATIONAL TEST ALERT

**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 6).

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™<sup>1</sup> 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.

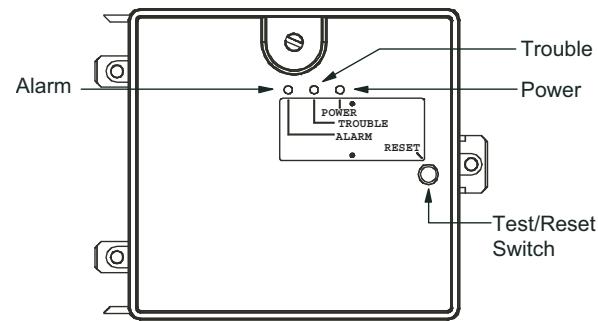
An internal sensor fault is detected upon entering the trouble state:

- 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 6 – 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.

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

## 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 31.

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

Remove JP1 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.

#### 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  $630 \text{ psig} \pm 10 \text{ psig}$  ( $4344 \pm 69 \text{ kPa}$ ) when hot. Reset is automatic at  $505 \text{ psig}$  ( $3482 \text{ kPa}$ ).

#### 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  $54 \pm 5 \text{ psig}$  ( $372 \pm 34 \text{ kPa}$ ). Reset is automatic at  $117 \pm 5 \text{ psig}$  ( $807 \pm 34 \text{ kPa}$ ).

#### 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  $30^\circ\text{F} \pm 5^\circ\text{F}$  ( $-1^\circ\text{C} \pm 3^\circ\text{C}$ ). Reset is automatic at  $45^\circ\text{F}$  ( $7^\circ\text{C}$ ).

#### SUPPLY (INDOOR) FAN MOTOR PROTECTION

Disconnect and lockout power when servicing fan motor.

The standard supply fan motor is equipped with internal overcurrent and over-temperature protection. Protection devices reset automatically.

The high static option supply fan motor is equipped with a pilot-circuit Thermix combination over-temperature/over-current protection device. This device resets automatically. Do not bypass this switch to correct trouble. Determine the cause and correct it.

## CONDENSER FAN MOTOR PROTECTION

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

## Refrigerant Leak Protection

These units are equipped with a factory installed R-454B leak dissipation system to ensure safe operation in the event of a refrigerant leak. See Leak Dissipation System on starting on page 46 for details.

## 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 overcurrent conditions by a circuit breaker mounted on control transformer TRAN. Reset is manual.

## 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 (at the top of the burner compartment; see Fig. 45) and a limit switch (mounted through the heat exchanger cover panel, over the tubes) (see Fig. 46).

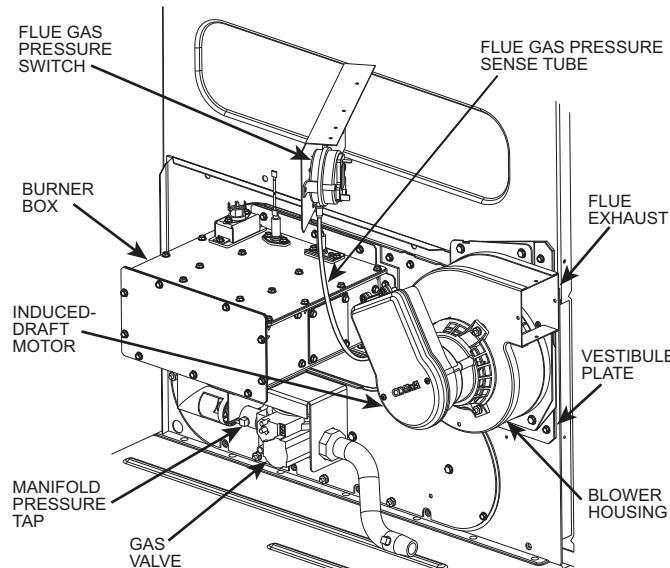
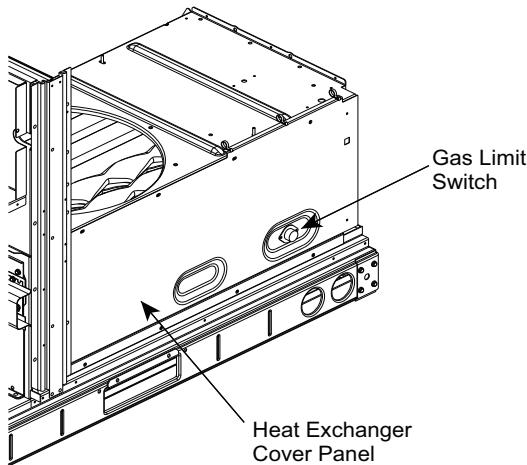


Fig. 45 — Burner Section Details



**Fig. 46 — Limit Switch Location**

## Fuel Types and Pressures

### NATURAL GAS

The 48GE unit is factory-equipped for use with natural gas (NG) fuel at elevation under 2000 ft (610 m).

#### **CAUTION**

Units can not be operated at altitudes greater than 2,000 feet under any circumstances.

Gas line pressure entering the unit's main gas valve must be within specified ranges (see Table 7). Adjust unit gas regulator valve as required or consult local gas utility.

**Table 7 — Natural Gas Supply Line Pressure Ranges**

UNIT MODEL	UNIT SIZE	MIN	MAX
48GE(G/H)	04, 05, 06	5.0 in. wg (1.24 kPa)	13.0 in. wg (3.23 kPa)

Manifold pressure is factory-adjusted for NG fuel use. Adjust as required to obtain best flame characteristic (see Table 8).

**Table 8 — Natural Gas Manifold Pressure**

UNIT MODEL	UNIT SIZE	MANIFOLD PRESSURE
48GE(G/H)	04, 05, 06	3.2 in. wg (796 Pa)

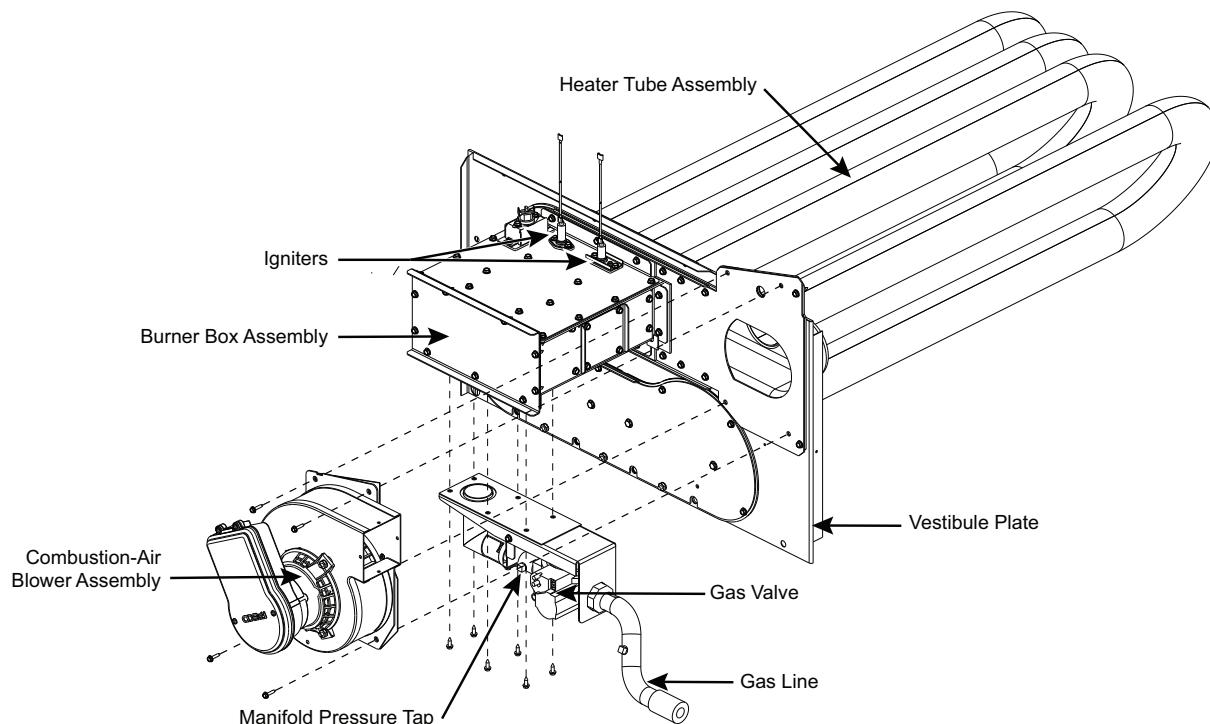
## Combustion-Air Blower

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 and slide out the panel (see Fig. 50).
2. Remove the four screws attaching the induced-draft motor housing to the vestibule plate (see Fig. 47).
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.



**Fig. 47 — Heat Exchanger Assembly**

## Burners and Igniters

### CAUTION

#### EQUIPMENT DAMAGE HAZARD

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

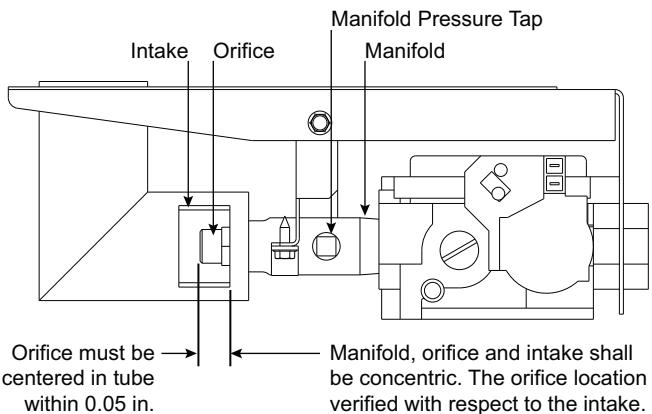
When working on gas train, do not hit or plug orifice spuds.

### BURNERS BOX/HEAT EXCHANGER ASSEMBLY

The main burners are not accessible on any Ultra Low NO<sub>x</sub> units (low heat/medium heat). No serviceable parts. Replace with new burner box/heat exchanger assembly. This assembly is a single unit and if replacement is required, the entire assembly must be replaced.

#### Orifice projection and placement

Refer to Fig. 48 for maximum projection and placement dimension for orifice face to manifold tube. The manifold, orifice and intake shall be concentric. The orifice must be centered in the intake tube.



**Fig. 48 — Orifice Projection**

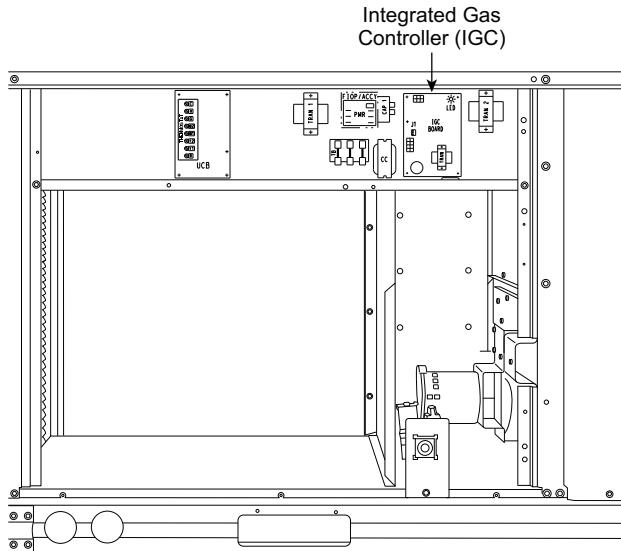
### REMOVAL AND REPLACEMENT OF GAS TRAIN

See Fig. 45, 47, 50, and 49.

1. Shut off manual gas valve.
2. Shut off power to unit.
3. Remove the control box access panel.
4. Remove the control box high voltage cover.
5. Remove the screw at the base of the burner partition panel and slide out the panel (see Fig. 50).
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. 49).
9. Remove the six screws attaching the gas valve assembly to the burner box assembly (see Fig. 47).
10. Reverse the procedures outlined above to reinstall the gas valve assembly.

### CLEANING AND ADJUSTMENT

1. Remove gas valve assembly from unit as described in the previous section "Removal and Replacement of Gas Train".
2. 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. 48).
3. Reinstall gas valve assembly as described in the previous section "Removal and Replacement of Gas Train".
4. Remove igniter modules from the top of the burner box assembly. Inspect and adjust the spark gap, if necessary (see Fig. 51).

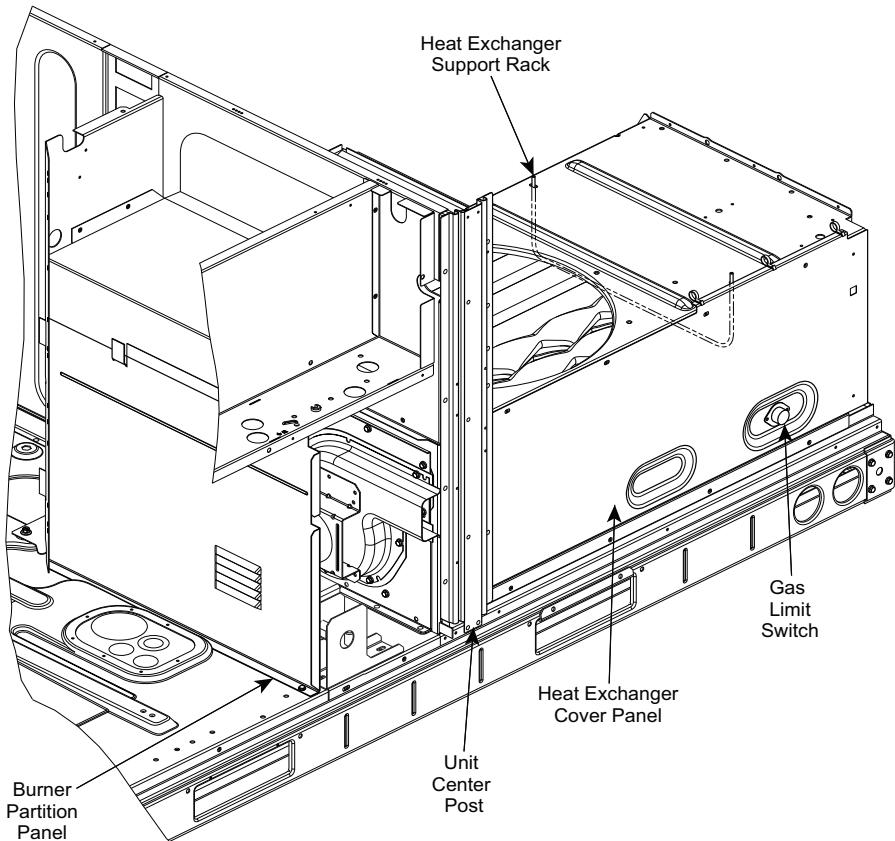


**Fig. 49 — Unit Control Box/IGC Location**

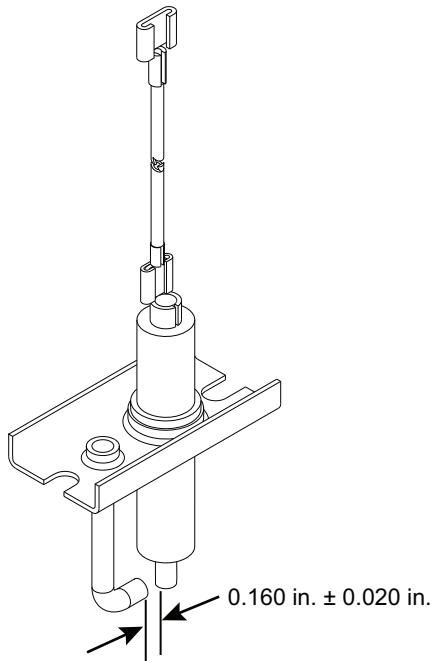
### REMOVING THE HEAT EXCHANGER

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

1. Turn off electric power to the unit and shut off the unit's gas supply.
2. Remove the two exterior panels: control box access panel and indoor blower access panel.
3. Remove the unit center post (see Fig. 50).
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 six screws attaching the gas valve assembly to the burner box assembly (see Fig. 47).
10. Remove the pressure switch hose from the connection on the flue cover assembly (see Fig. 47).
11. Remove the screws around the vestibule plate.
12. Remove the nuts holding the heat exchanger support rack to the fan deck.
13. Remove the heat exchanger from the unit.



**Fig. 50 — Heat Exchanger Access - Internal Panels, Center Post and HX Rack Locations**



**Fig. 51 — Spark Adjustment (Size 04-06)**

#### GAS VALVE

All Ultra-Low NO<sub>x</sub> models are equipped with a single-stage gas valve. See Fig. 52 for locations of adjustment screws and features on the gas valve.

**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 (see Tables 7 and 8).

1. Slide out burner partition panel.
2. Remove manifold pressure tap plug from manifold and connect pressure gauge or manometer (see Fig. 48).
3. Turn on electrical supply.
4. Turn on unit main gas valve.
5. Set room thermostat to call for heat.
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. Replace regulator cover screw(s) when finished.
9. Observe unit heating operation. Verify that the burner flames are blue in appearance, and that the flames are approximately the same for each burner.
10. Turn off unit, remove pressure manometer and replace the manifold pressure tap plug (see Fig. 48).

#### LIMIT SWITCH

Remove blower access panel. Limit switch is located on the fan deck (see Fig. 46).

## 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. 49). The IGC contains a self-diagnostic LED (light-emitting diode). A single LED on the IGC provides a visual display of operational or sequential problems when the power supply is uninterrupted (see Fig. 53). When a break in power occurs, the IGC will be reset (resulting in a loss of fault history) and the indoor (evaporator) fan ON/OFF times will be reset. The LED error code can be observed through the viewport. During servicing, refer to the label on the control box cover or Table 9 for an explanation of LED error code descriptions.

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

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

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

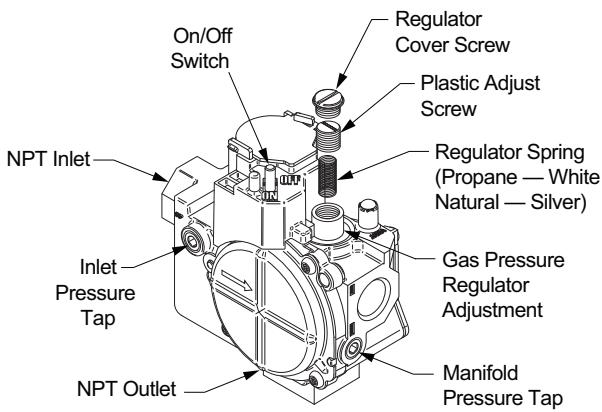
**LED** — Light Emitting Diode

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

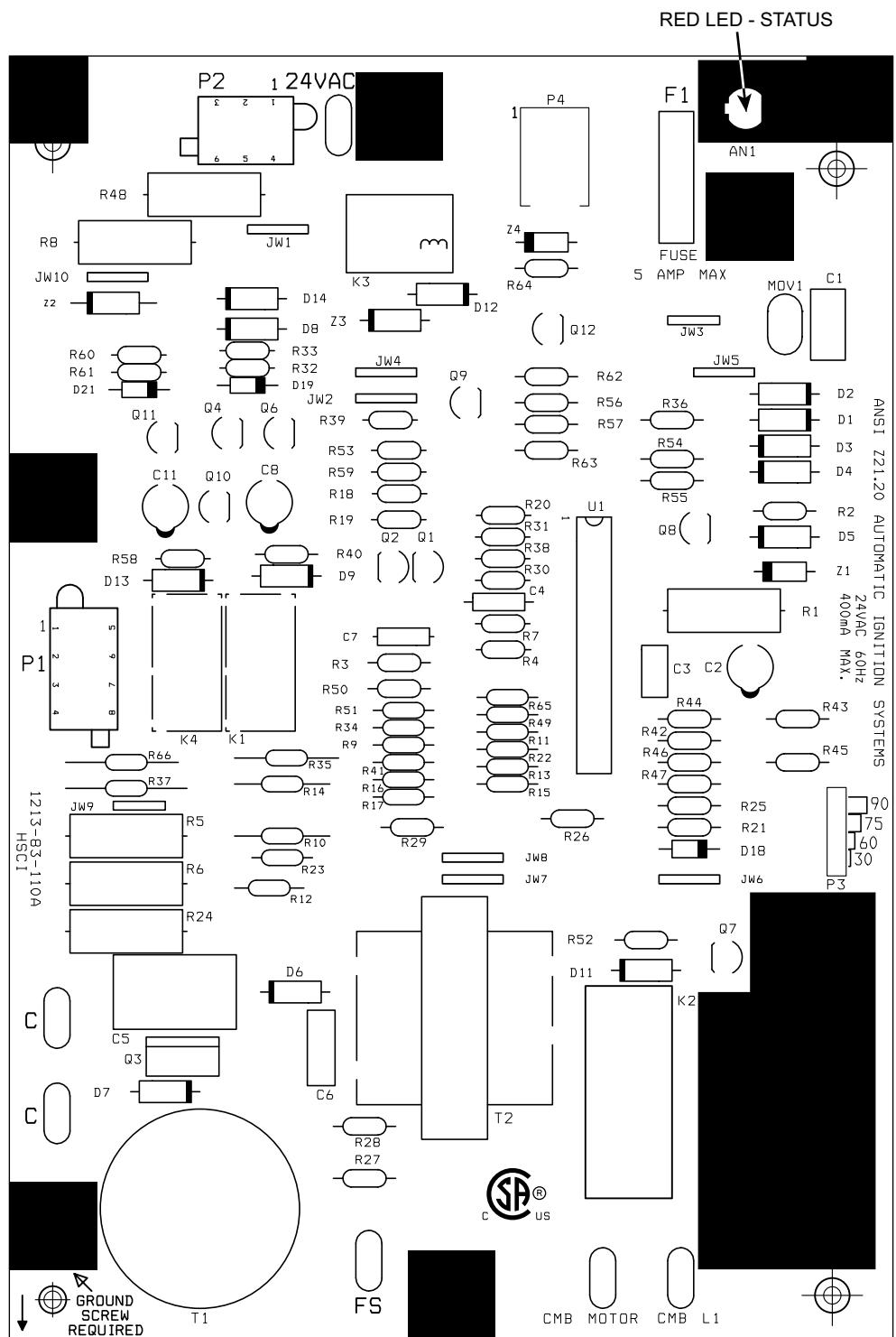
## Orifice Replacement

This unit uses orifice type LH32RFnnn (where “nnn” indicates orifice reference size). When replacing unit orifices, order the necessary parts through RCD.

Ensure each replacement orifice is tight as its threads into the manifold pipe, and the orifice projection does not exceed maximum value (see Fig. 48).



**Fig. 52 — Typical Gas Valves**



**Fig. 53 — 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 (part no. HH22AG106) in series with the second stage gas valve (see Fig. 54). 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.

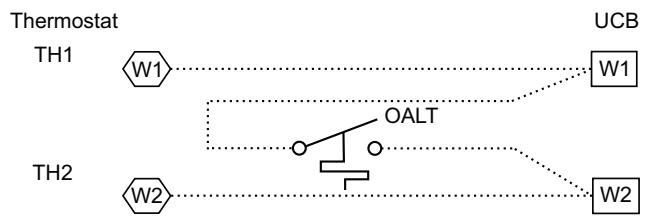


Fig. 54 — OALT Connections

## Troubleshooting Heating System

See Fig. 55 for the IGC service analysis logic. Figure 56 shows a typical IGC control wiring diagram. 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.
	Water in gas line.	Check gas valve.
	No power to furnace.	Drain water and install drip leg to trap water.
	No 24-v power supply to control circuit.	Check power supply, fuses, wiring, and circuit breaker.
	Miswired or loose connections.	Check transformer. Transformers with internal overcurrent protection require a cool down period before resetting.
	Burned-out heat anticipator in thermostat.	Check all wiring and wire nut connections.
	Broken thermostat wires.	Replace thermostat.
Inadequate Heating.	Dirty air filter.	Run continuity check. Replace wires, if necessary.
	Gas input to unit too low.	Clean or replace filter as necessary.
	Unit undersized for application.	Check gas pressure at manifold. Clock gas meter for input. If too low, increase manifold pressure, or replace with correct orifices.
	Restricted airflow.	Replace with proper unit or add additional unit.
	Blower speed too low.	Clean filter, replace filter, or remove any restrictions.
	Limit switch cycles main burners.	Use high speed tap, increase fan speed, or install optional blower, as suitable for individual units.
	Too much outdoor air.	Check rotation of blower, thermostat heat anticipator settings, and temperature rise of unit. Adjust as needed.
		Adjust minimum position.
Poor Flame Characteristics.	Incomplete combustion (lack of combustion air) results in: Aldehyde odors, CO, sooting flame, or floating flame.	Check economizer operation.
		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.
Burners Will Not Turn Off.	Unit is locked into Heating mode for a one minute minimum.	Check orifice to burner alignment.
		Wait until mandatory one-minute time period has elapsed or reset power to unit.

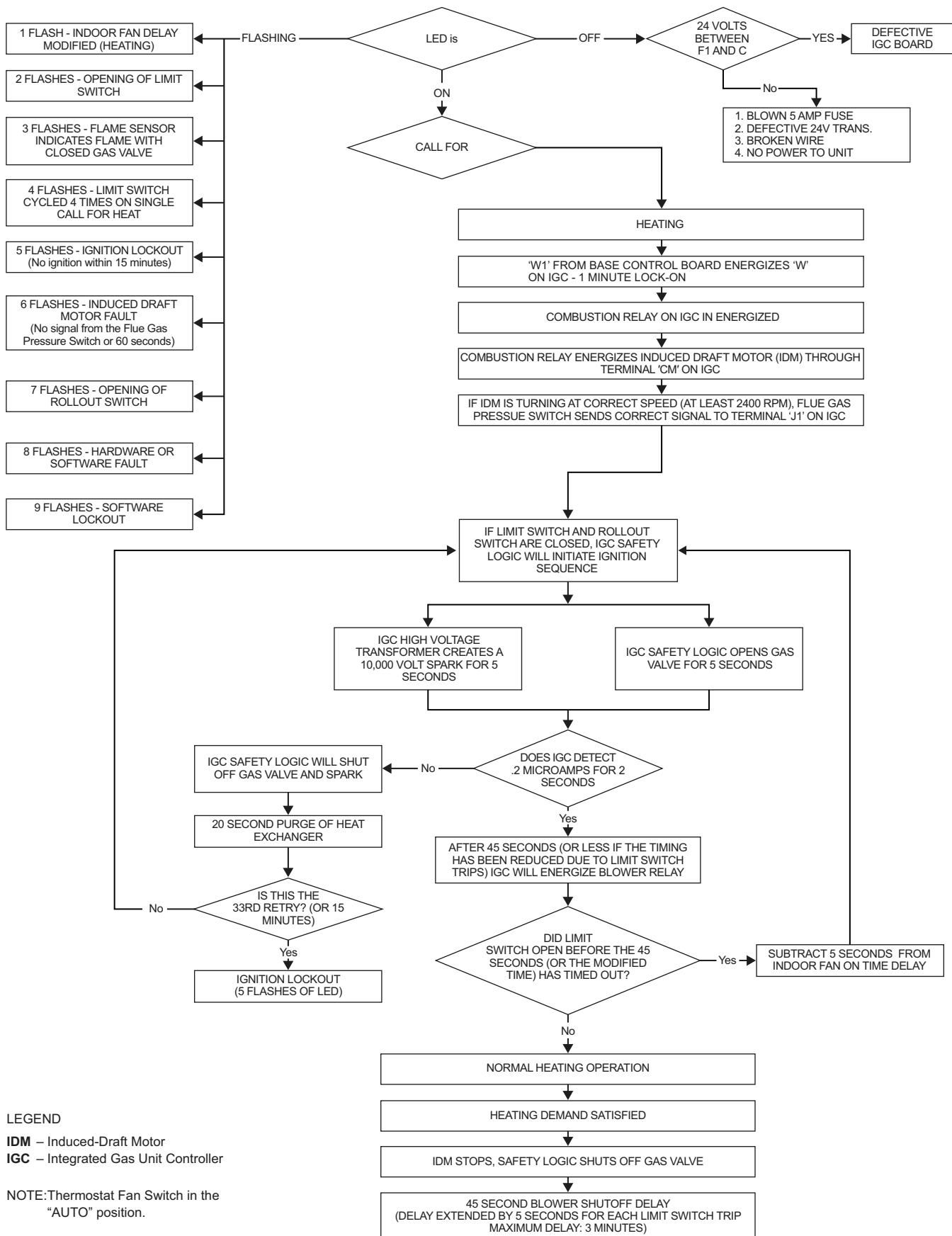


Fig. 55 – IGC Service Analysis Logic

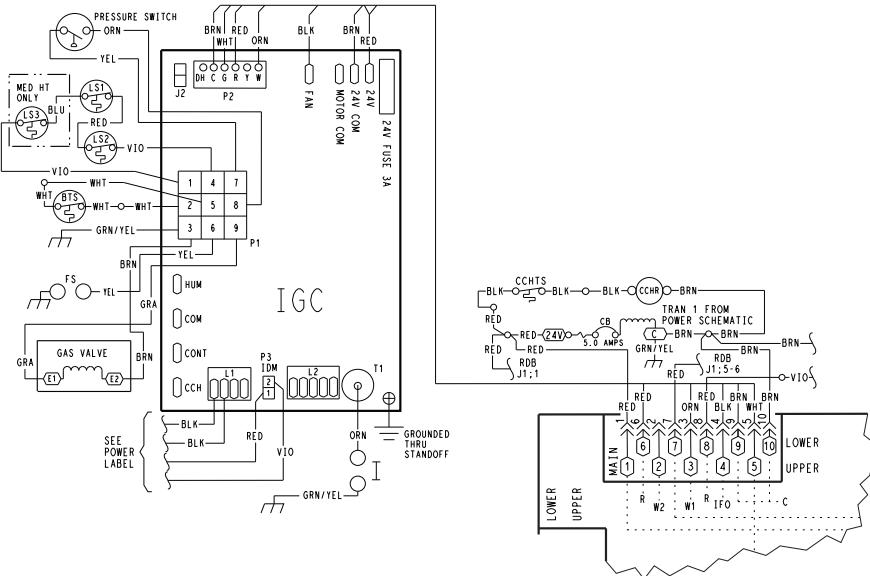


Fig. 56 — Typical IGC Control Wiring Diagram

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

LED FLASH CODE	DESCRIPTION	ACTION TAKEN BY CONTROL	RESET METHOD	PROBABLE CAUSE
On	Normal Operation	—	—	—
Off	Hardware Failure	No gas heating.	—	Loss of power to the IGC. Check 5 amp fuse on IGC, power to unit, 24-v circuit breaker, transformer, and wiring to the IGC.
1 Flash	Indoor Fan On/Off Delay Modified	5 seconds subtracted from On delay. 5 seconds added to Off delay (3 minute maximum).	Power reset.	High temperature limit switch opens during heat exchanger warm-up period before fan-on delay expires. High temperature limit switch opens within 10 minutes of heat call (W) Off. See Limit Switch Fault.
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. 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.	Four 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. 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/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 motor and flue gas 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, check for bad gas valve, replace the IGC.
9 Flashes	Temporary Software Lockout	No gas heating.	One hour auto reset or power reset.	Electrical interference is disrupting the IGC software.

NOTE(S):

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

LEGEND

IGC — Integrated Gas Unit Control

LED — Light-Emitting Diode

## SYSTEMVU CONTROL SYSTEM

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

The SystemVu control system is fully communicating and cable-ready for connection to the Carrier Comfort Network® (CCN), Carrier i-Vu®, and Third Party BACnet® 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. 57).

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 current version of the following manual: “48/50FE 04-30, 48/50GE 04-28 Single Package Rooftop Units with SystemVu™ Controls Version X.X Controls, Start-up, Operation and Troubleshooting.”

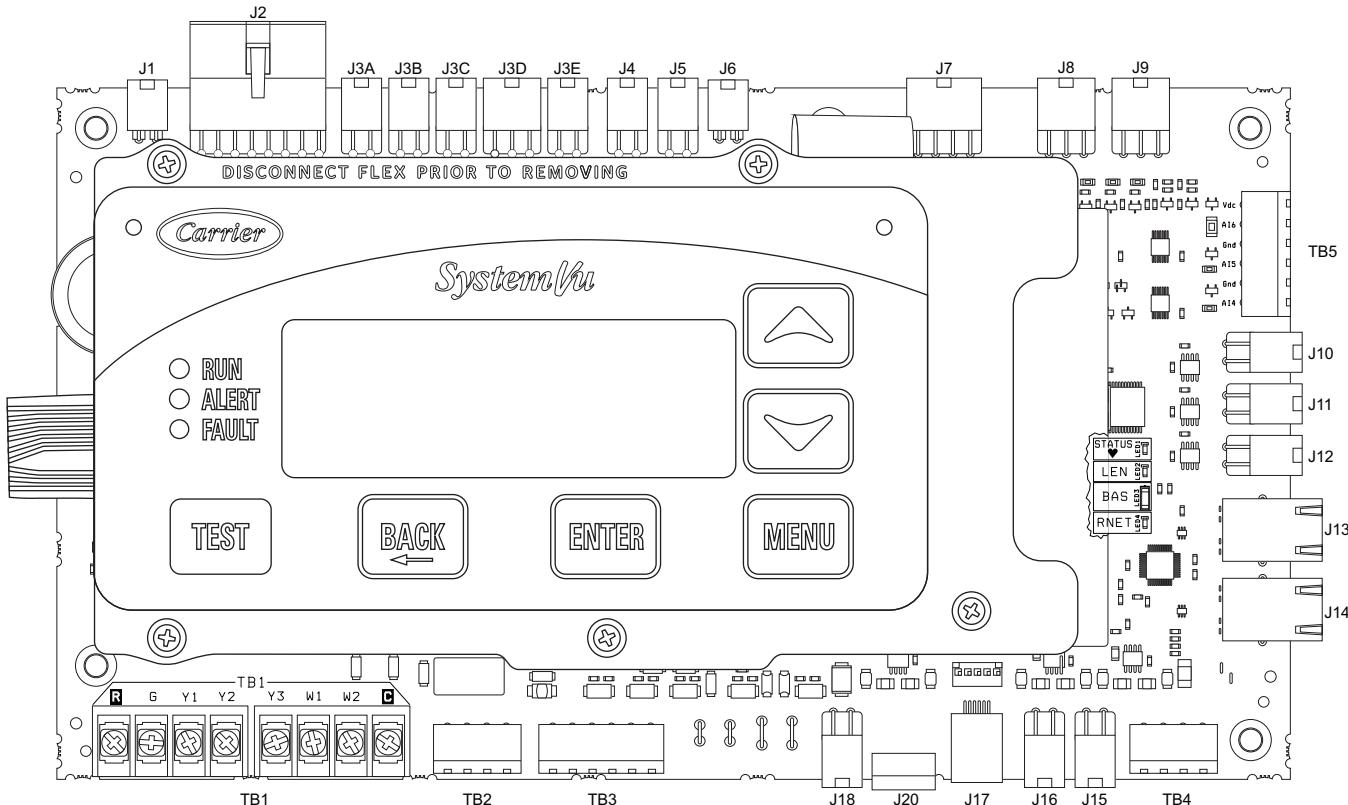


Fig. 57 — SystemVu Control

## A2L REFRIGERATION INFORMATION

This equipment contains R-454B, a mildly flammable refrigerant classified as A2L (see Fig. 58). Read all instructions prior to transporting, storing, installing, or servicing this equipment.



Fig. 58 — A2L Refrigerant Safety Group Warning Label



### Servicing

Prior to, and during the work being performed on a unit containing A2L refrigerant, the area must be checked with an appropriate refrigerant detector to ensure that the person or persons performing work are aware of a potentially toxic or flammable atmosphere. The area must also be surveyed to ensure there are no flammable hazards or ignition risks. "No Smoking" signs shall be displayed.

Should any hot work need to be performed on the refrigerant system, or associated parts, appropriate fire extinguishing equipment shall be available nearby. Have a dry powder or CO<sub>2</sub> fire extinguisher adjacent to the charging area.

All maintenance staff and others working in the local area shall also be instructed on the nature of work being carried out. Work in confined spaces shall be avoided wherever possible.

### Minimum Conditioned Space Area

The space area served by ducted equipment with A2L refrigerant is restricted by building code based on refrigerant volume that the refrigerant is released to the conditioned space served by the duct system.

Determine the conditioned space area by calculating the floor area (room length x room width) of all spaces served by a common duct system and adding them all together to get the total conditioned space area.

Compare the calculated total conditioned space area to the minimum conditioned space area (TA<sub>min</sub>) listed in Table 12, based on the unit size and configuration (with or without Humidi-MiZer).

**Table 12 — Minimum Conditioned Space Area (MCSA or TA<sub>min</sub>)**

UNIT	(TA <sub>MIN</sub> ) <sup>a</sup>	
	Sq Ft	Sq Meter
48GE(G/H)M04	250	24
48GE(G/H)M05	235	22
48GE(G/H)M06	303	29
48GE(G/H)N04	338	32
48GE(G/H)N05	400	38
48GE(G/H)N06	508	48

NOTE(S):

a. TA<sub>min</sub> is based on a minimum ceiling height of 7.2 ft (2.2 m) and the worst-case unit refrigerant charge.

If the space area is above the minimum conditioned space area listed in Table 12 based on unit size and configuration, no action is needed.

If the conditioned space area is below the minimum conditioned space area listed in Table 12 based on unit size and configuration, then additional ventilation may be required. Refer to local code, UL-60335-2-40, or ASHRAE<sup>®</sup>1 standard 15.

### CAUTION

Do not install an ignition source or potential ignition source in a space where the total conditioned area is below the minimum total conditioned area (TA<sub>min</sub>), unless a flame arresting device has been installed.

### ADVERTISSEMENT

N'installez pas de source d'inflammation ou de source d'inflammation potentielle dans un espace où la surface totale conditionnée est inférieure à la surface totale conditionnée minimale (TA<sub>min</sub>), à moins qu'un dispositif pare-flamme n'ait été installé.

### Detection of Flammable Refrigerants

Under no circumstances shall potential sources of ignition be used in the searching for or detection of refrigerant leaks. A halide torch (or any other detector utilizing a naked flame) shall not be used.

The following leak detection methods are deemed acceptable for all refrigerant systems.

- Electronic leak detectors may be used to detect refrigerant leaks, but in the case of flammable refrigerants the sensitivity may not be adequate, or may need recalibration. (Detection equipment shall be calibrated in a refrigerant-free area.) Ensure that the detector is not a potential source of ignition and is suitable for the refrigerant used. Leak detection equipment shall be set at a percentage of the LFL of the refrigerant and shall be calibrated to the refrigerant employed, and the appropriate percentage of gas (25% max.) is confirmed.
- Leak detection fluids are also suitable for use with most refrigerants but the use of detergents containing chlorine shall be avoided as the chlorine may react with the refrigerant and corrode the copper pipe-work.  
Examples of leak detection fluids:
  - Bubble method.
  - Fluorescent method agents.

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

If a leak is suspected, all naked flames shall be removed/extinguished.

If a leakage of refrigerant is found which requires brazing, all of the refrigerant shall be recovered from the system, or isolated (by means of shut off valves) in a part of the system remote from the leak. Removal of refrigerant shall be according to the following section.

## **Evacuation, Removal, and Recovery**

When breaking into the refrigerant circuit to make repairs, or for any other purpose, conventional procedures shall be used. However, for flammable refrigerants it is important that best practice be followed, since flammability is a consideration.

The following procedure shall be adhered to:

- Safely remove refrigerant following local and national regulations
  - Evacuate refrigerant.
  - Purge the circuit with inert gas (optional for A2L refrigerants).
  - Continuously flush or purge with inert gas when using flame to open circuit.
  - Open the circuit.

For appliances containing flammable refrigerants, purging shall be achieved by breaking the vacuum in the system with oxygen-free nitrogen and continuing to fill until the working pressure is achieved, then venting to atmosphere, and finally pulling down to a vacuum. This process may need to be repeated several times until the system is free from refrigerant. When the final oxygen-free nitrogen charge is used, the system shall be vented down to atmospheric pressure to enable work to take place.

The refrigerant charge shall be recovered into the correct recovery cylinders if venting is not allowed by local and national codes. Ensure that the correct number of cylinders for holding the total system charge is available. All cylinders to be used are designated for the recovered refrigerant and labeled for that refrigerant. Cylinders shall be complete with pressure-relief valve and associated shut-off valves in good working order. Empty recovery cylinders are evacuated and, if possible cooled before recovery occurs.

The recovery equipment shall be in good working order with a set of instructions concerning the equipment that is at hand and shall be suitable for the recovery of the flammable refrigerant. If in doubt, the manufacturer should be consulted. In addition, a set of calibrated weighing scales shall be available and in good working order. Hoses shall be complete with leak-free disconnect coupling and in good condition.

The recovered refrigerant shall be processed according to local legislation in the correct recovery cylinder, and the relevant waste transfer not arranged.

**IMPORTANT:** Do not mix refrigerants in recovery units, and especially not in cylinders.

If compressors or compressor oils are to be removed, ensure that they have been evacuated to an acceptable level to make certain that flammable refrigerant does not remain within the lubricant. The compressor body shall not be heated by an open flame or other ignition sources to accelerate this process. When oil is drained from a system, it shall be carried out safely.

**IMPORTANT:** At no point during this process should the outlet for the vacuum pump be close to any potential ignition sources, and ventilation shall be available.

## **Decommissioning**

Before carrying out this procedure, it is essential that the technician is completely familiar with the equipment and all its detail. It is recommended good practice that all refrigerants are recovered safely. Prior to the task being carried out, an oil and refrigerant sample shall be taken in case analysis is required prior to re-use of recovered refrigerant. It is essential that electrical power is available before the task is commenced.

1. Become familiar with the equipment and its operation.
2. Isolate the system electrically.
3. Before attempting the procedure, ensure that:
  - a. Mechanical handling equipment is available, if required for handling refrigerant cylinders.
  - b. All personal protective equipment is available and being used correctly.
  - c. The recovery process is supervised at all times by a competent person.
  - d. Recovery equipment and cylinders conform to the appropriate standards.
4. Pump down refrigerant system, if possible.
5. If a vacuum is not possible, make a manifold so that refrigerant can be removed from various parts of the system.
6. Make sure that the cylinder is situated on the scales before recovery takes place.
7. Start the recovery machine and operate in accordance with instructions.
8. Do not overfill cylinders (no more than 80% of volume liquid charge).
9. Do not exceed the maximum working pressure of the cylinder, even temporarily.
10. When the cylinders have been filled correctly and the process completed, make sure that the cylinders and the equipment are removed from the site promptly and all isolation valves on the equipment are closed off.
11. Recovered refrigerant shall not be charged into another refrigerating system unless it has been cleaned and checked.

Equipment shall be labeled that it has been de-commissioned and emptied of refrigerant. The label shall be dated and signed. For units containing flammable refrigerants, affix labels on the equipment stating the equipment contains flammable refrigerant.

## Leak Dissipation System

48GEG/H units use R-454B refrigerant. These units are equipped with a factory installed R-454B leak dissipation system to ensure safe operation in the event of a refrigerant leak. This system consists of an A2L sensor (Fig. 59) and the dissipation control board (see Fig. 60) which are located in the indoor coil section of the unit (see the Control Box Access Panel section of the unit, Fig. 1 on page 4). The A2L sensor is located between the indoor coil and the air filters.

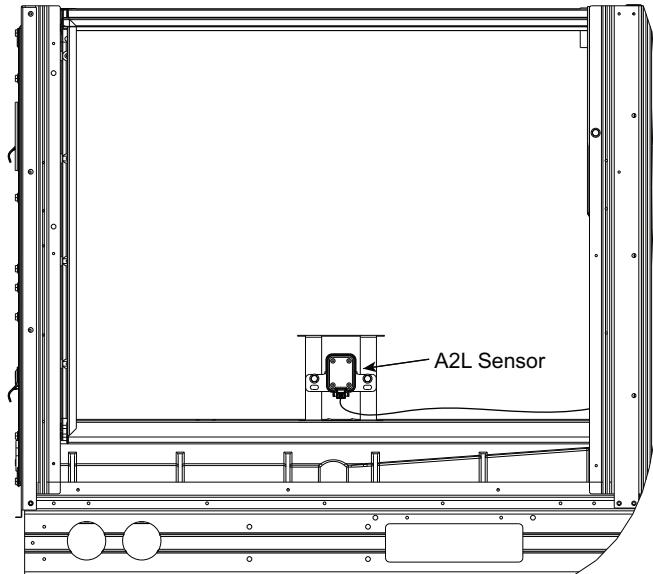


Fig. 59 — Location of AL2 Sensor

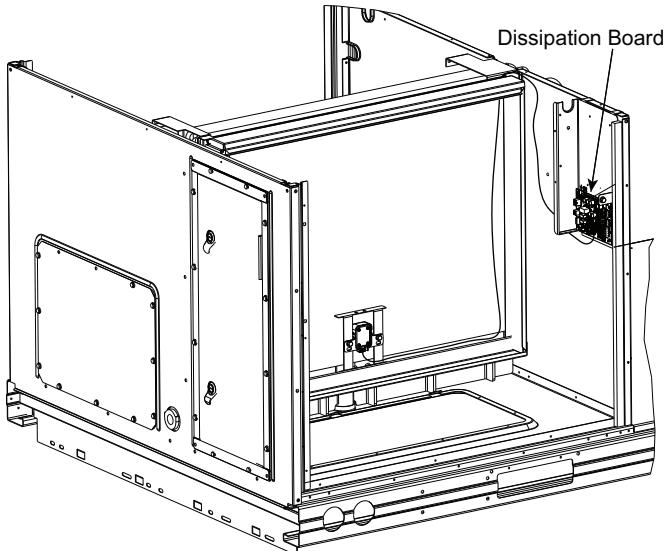


Fig. 60 — Location of Dissipation Control Board  
(shown with dust cover removed)

The A2L detection sensor communicates via a wiring harness to the dissipation board. The sensor harness is routed on the bottom of the filter rack towards the unit bulkhead and secured with wire ties. The sensor harness then runs through the pass-through at the bottom of the control box and connects to the dissipation board.

NOTE: The drain wire must be properly connected to the ground lug on the dissipation board via the quick connect and ground harness. Failure of proper sensor harness grounding can lead to false dissipation events.

## SEQUENCE OF OPERATION

The control functions as an R-454B refrigerant dissipation system. If the refrigerant detection sensor sends a signal indicating a refrigerant leak, the control board will prevent heating and cooling operation and begin dissipating the sensed refrigerant with a blower request. The refrigerant dissipation board will display a flash code from the yellow status LED (see Fig. 61) indicating the sensor that detected the refrigerant. See Fig. 63 — on page 48 for the full text on the Dissipation Control Status label.

When the sensor signal indicates the refrigerant has dissipated, the dissipation board yellow status LED will display a flash code 3 and return to its normal state and allow unit operations after a 5 minute delay.

## LEAK DISSIPATION SYSTEM SELF-TEST

Power on the unit and verify proper functioning of equipment. The yellow Status LED on the dissipation board should be steady (see Fig. 61). If flash codes are present, see Troubleshooting on page 48.

NOTE: Operation of the Test Mode is only possible if no faults exist on the dissipation board.

Remove the control box access panel to access the dissipation board and Test button (see Fig. 62). The Test button is located above the COMM LED.

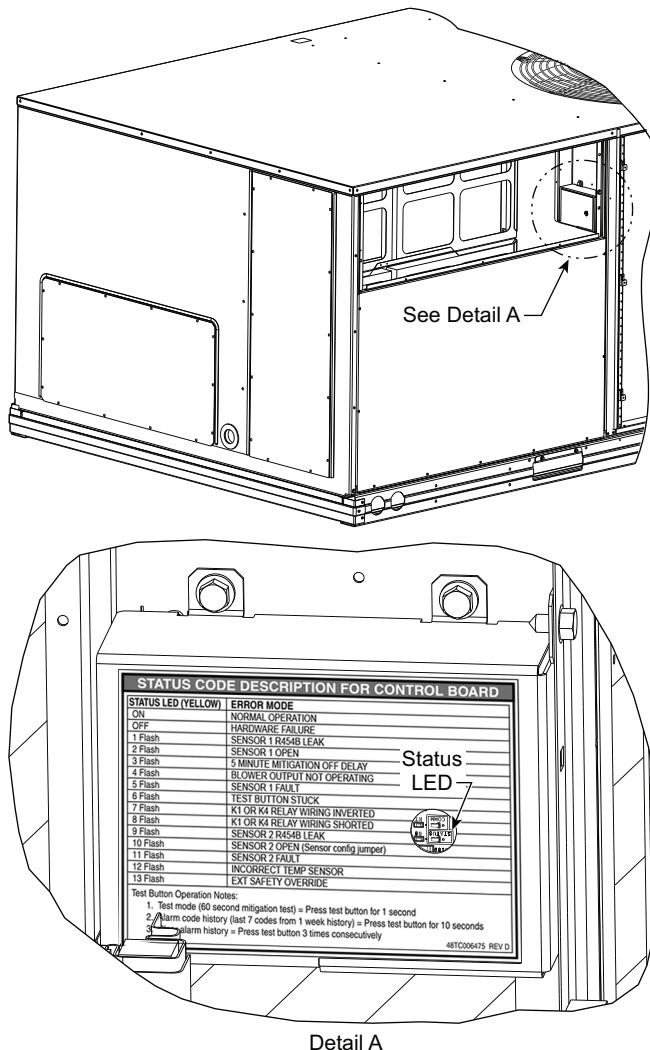
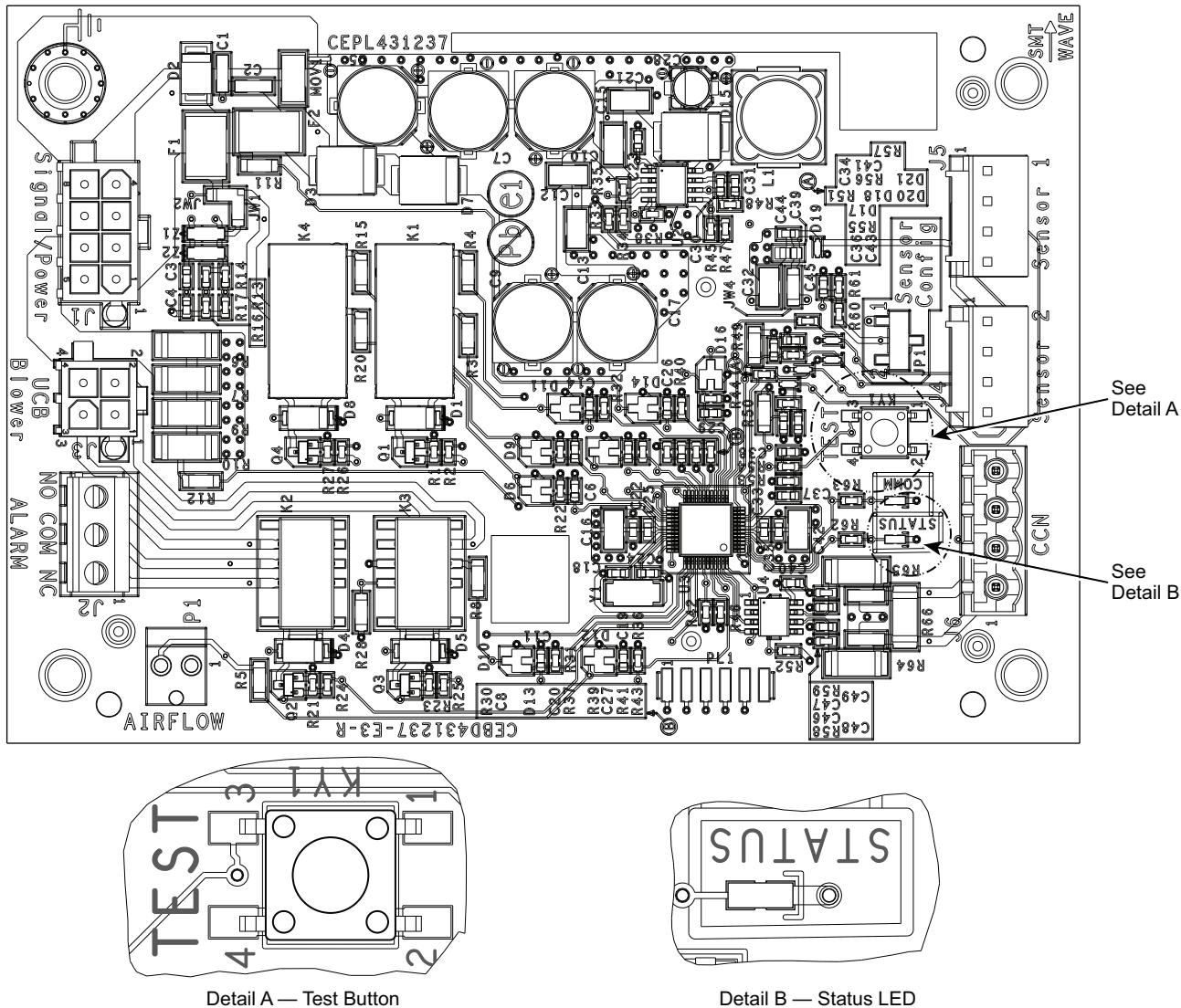


Fig. 61 — Yellow STATUS LED



**Fig. 62 – Dissipation Control Board – shown without dust cover**

Press the Test button on the dissipation system control board to ensure proper dissipation system operation under each test condition listed below. After pressing the Test button, system will enter Dissipation Mode for 60 seconds to help verify correct operation.

Ensure that the unit is able to meet the minimum required dissipation mode airflows. These required minimum airflow rates during Dissipation Mode are listed in Table 14. They are based on the total system refrigerant charge quantity.

**IMPORTANT:** Press the Test button for roughly ONE SECOND to enter Test Mode. Pressing the Test button for a longer periods enables different functions (see Table 13).

**Table 13 – Dissipation Board Test Button Functions**

HOLD BUTTON TIME (SEC)	FUNCTION
1-4	Dissipation Mode for 60 seconds
5-29	Display flash code history
30+	Flash code 6
<b>3 Rapid Presses</b>	Clear flash code history

Table 14 – Minimum Dissipation Air Flows

MINIMUM DISSIPATION AIR FLOW (cfm)	
UNIT	cfm
48GE(G/H)M04	230
48GE(G/H)M05	220
48GE(G/H)M06	280
48GE(G/H)N04	310
48GE(G/H)N05	370
48GE(G/H)N06	470

Table 15 details the required operational checks to ensure proper dissipation system function.

**Table 15 — Dissipation System Required Operational Checks**

NORMAL OPERATION				
TEST NO.	UNIT DEMAND	COMPRESSOR	INDOOR FAN	ELECTRIC/GAS HEAT
1	None	Off	Off	Off
2	Cool	On	On	Off
3	Heat	On	On	On
DISSIPATION ACTIVATED				
4	None	Off	On	Off
5	Cool	Off	On	Off
6	Heat	Off	On	Off

Figure 63 shows the flash codes displayed on the Dissipation control board.

#### TROUBLESHOOTING

For all flash codes, first try power cycling the system to remove the code.

##### No Power

Verify the wiring to/from pins 1 and 8 on the power harness plug. Check the 24V system wiring from the transformer.

**Table 16 — Status LED Troubleshooting Table**

STATUS LED	REASON	CONTROL VERBAGE	MODE
<b>1 Flash</b>	Sensor 1 $\geq$ 20% LFL.	REFRIG DISSIPATION ACTIVE	Dissipation in Process
<b>2 Flash</b>	Sensor 1 Open.	REFRIG SENSOR OPEN	Dissipation in Process
<b>3 Flash</b>	5 Minute Blower Operating, Sensor $<$ 20% LFL and sensors are not opened (done after fault 1, 2, 9 and 10).	DISSIPATION OFF DELAY ACTIVE	Dissipation in Process
<b>4 Flash</b>	0 VAC sensed on G output.	BLOWER OUTPUT NOT OPERATING	Dissipation in Process
<b>5 Flash</b>	Fault with the A2L digital sensor.	REFRIG SENSOR FAULT	Dissipation in Process
<b>6 Flash</b>	If KY1 is stuck pressed for more than 30 seconds.	TEST BUTTON STUCK	To prevent a shorted KY1 to keep the dissipation running continuously.
<b>7 Flash</b>	Y out switched with Y in or W out switched with W in.	Y (K4) OR W (K1) WIRING INVERTED	Normal mode
<b>8 Flash</b>	Y or W shorted (relay detects both sides are high).	Y (K4) OR W (K1) OUTPUT SHORTED TO Y (K4) OR W (K1) INPUT	Normal mode
<b>9 Flash<sup>a</sup></b>	Sensor 2 $\geq$ 20% LFL.	SENSOR 2 DISSIPATION ACTIVE	Dissipation in Process
<b>10 Flash<sup>a</sup></b>	Sensor 2 Open.	SENSOR 2 OPEN	Dissipation in Process
<b>11 Flash<sup>a</sup></b>	Fault with the second A2L digital sensor.	SENSOR 2 FAULT	Dissipation in Process
<b>12 Flash</b>	High temperature sensor attached on commercial.	OVERCURRENT INCORRECT SENSOR	Normal mode
<b>13 Flash<sup>b</sup></b>	G input signal is lost. Indicates another unit safety will override dissipation.	EXT SAFETY OVERRIDE	Normal mode

NOTE(S):

- There is only one sensor mounted in these units. This table represents the standard label being put on all commercial equipment. The hardware changes only allow one sensor to be connected to the board; the software remains the same for a one or two sensor board. Although unlikely these flash codes may appear if the board malfunctions.
- External Safety Override (flashing 13) can be caused by the following unit safeties: Phase Monitor Relay fault, Remote Shutdown, Smoke Shutdown, Fan Limit Switch (CH1-2 rooftop units, air handler units), or Fan Safety Relay (CH3-8 rooftop units, splits, air handler units).

#### LEGEND

**LFL** — Lower Flammable Limit

STATUS CODE DESCRIPTION FOR CONTROL BOARD	
STATUS LED (YELLOW)	ERROR MODE
ON	NORMAL OPERATION
OFF	HARDWARE FAILURE
1 Flash	SENSOR 1 R454B LEAK
2 Flash	SENSOR 1 OPEN
3 Flash	5 MINUTE MITIGATION OFF DELAY
4 Flash	BLOWER OUTPUT NOT OPERATING
5 Flash	SENSOR 1 FAULT
6 Flash	TEST BUTTON STUCK
7 Flash	K1 OR K4 RELAY WIRING INVERTED
8 Flash	K1 OR K4 RELAY WIRING SHORTED
9 Flash	SENSOR 2 R454B LEAK
10 Flash	SENSOR 2 OPEN (Sensor config jumper)
11 Flash	SENSOR 2 FAULT
12 Flash	INCORRECT TEMP SENSOR
13 Flash	EXT SAFETY OVERRIDE

Test Button Operation Notes:

- Test mode (60 second mitigation test) = Press test button for 1 second
- Alarm code history (last 7 codes from 1 week history) = Press test button for 10 seconds
- Clear alarm history = Press test button 3 times consecutively

48TC006475 REV D

**Fig. 63 — Dissipation Control Status Label**

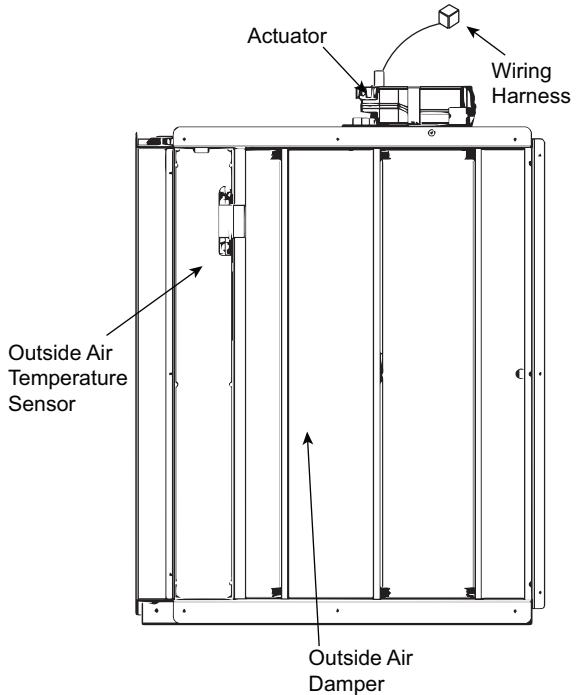
See Table 16 for details on the operating status and troubleshooting of the Dissipation system for the various flash codes.

## ECONOMIZER SYSTEMS

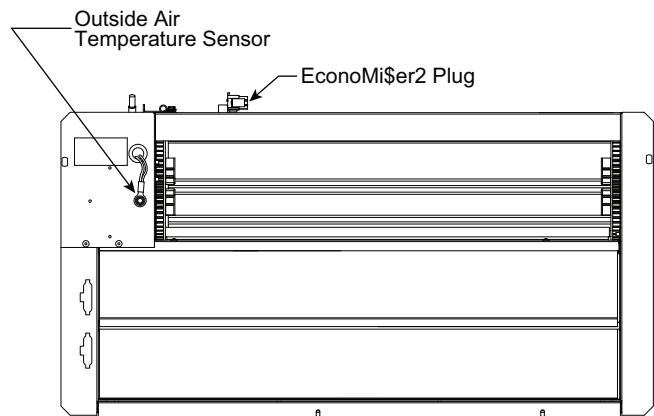
The unit may be equipped with a factory-installed or accessory (field-installed) economizer system. Two types are available: one with a logic control system (EconomizerONE) and one without a control system (EconoMi\$er® 2). See Fig. 64-65 for component locations on each type.

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. 64 — EconomizerONE Component Locations (CRECOMZR108A00 Shown)**



**Fig. 65 — EconoMi\$er2 Component Locations**

## EconoMi\$er® 2

IMPORTANT: The optional EconoMi\$er 2 does not include a controller. The EconoMi\$er 2 is operated by a 4 mA to 20 mA signal from an existing field-supplied controller. See Fig. 66 for wiring information.

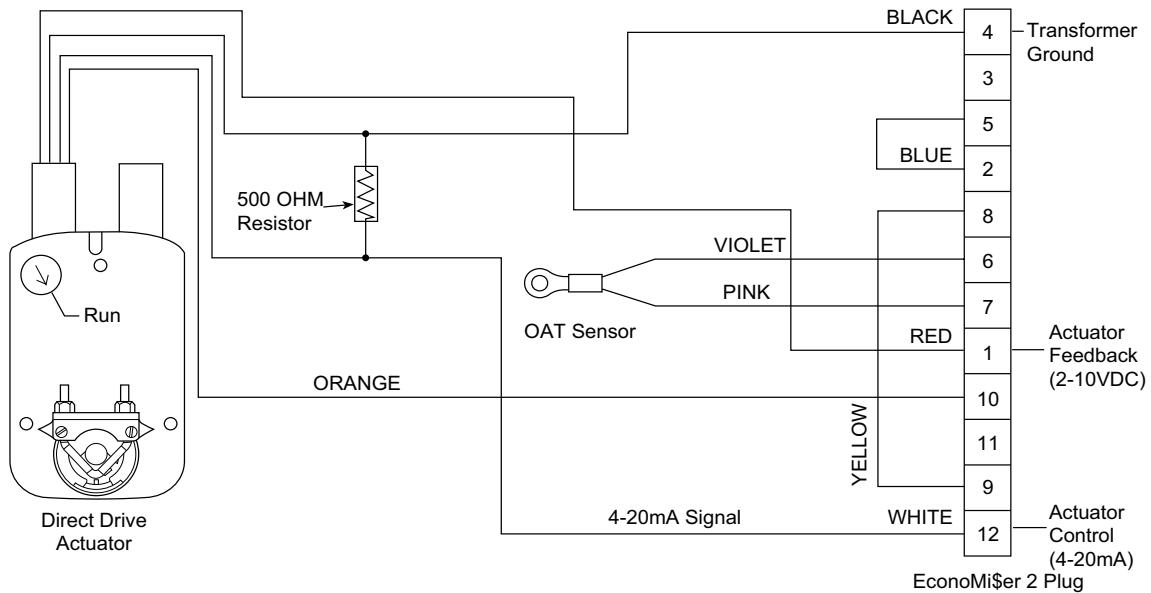


Fig. 66 — EconoMi\$er 2 with 4 mA to 20 mA Control Wiring

## EconomizerONE (Field-Installed Accessory)

### MOUNTING, INSTALLATION, AND WIRING

#### **WARNING**

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

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

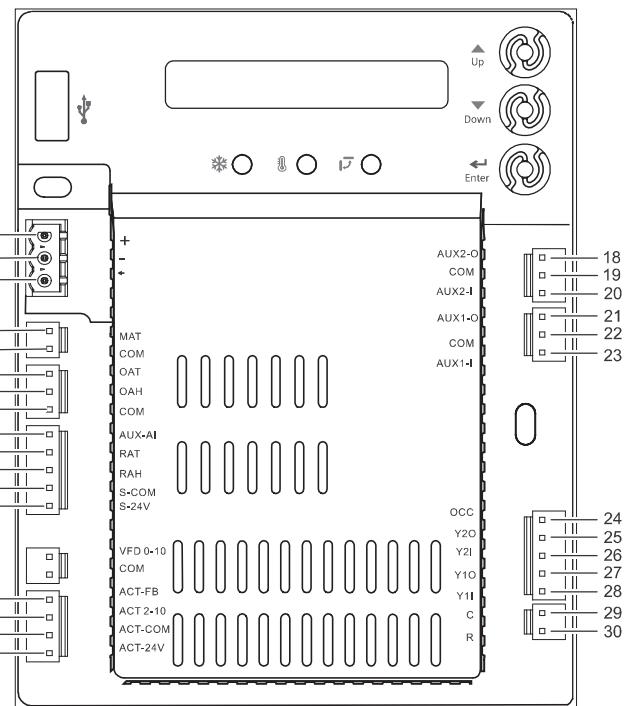
Before mounting, leave specific mounting clearances so that there is space for mounting, wiring, and servicing. See Fig. 67 and Table 17 for economizer controller wiring details.

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

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

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

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



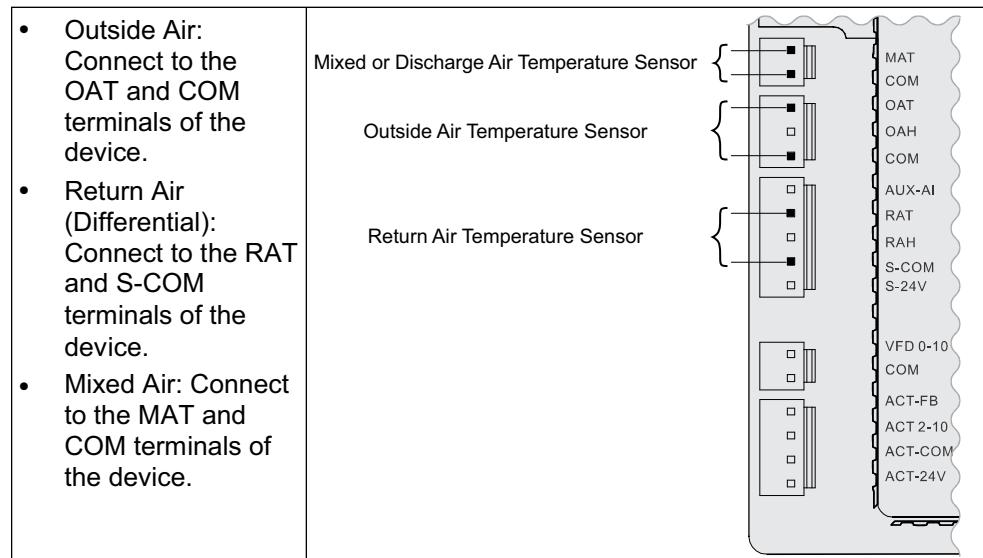
**Fig. 67 — Economizer Control Wiring**

**Table 17 — Economizer Control Wiring Settings**

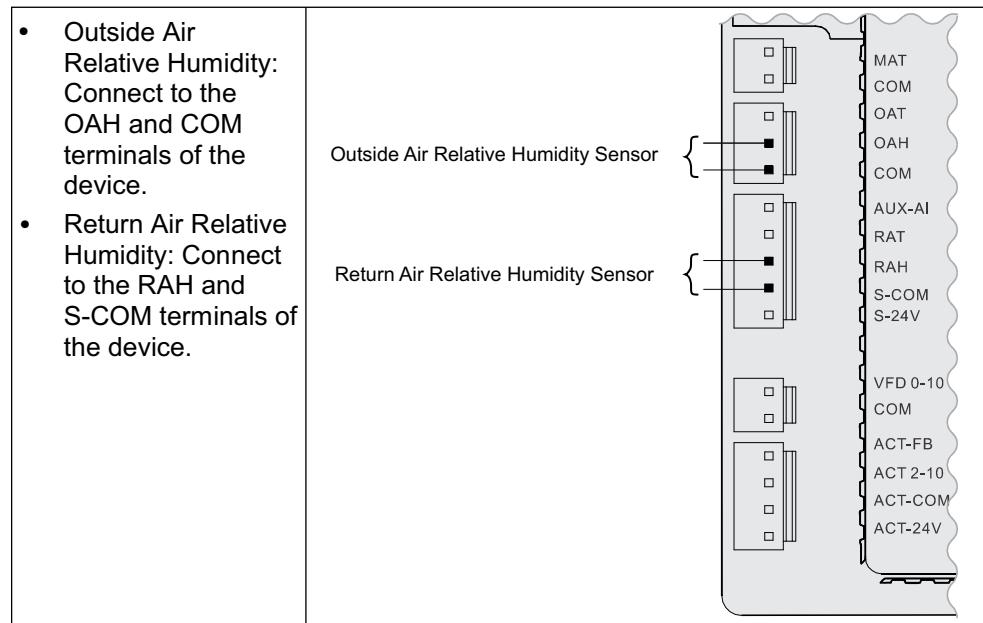
NO.	LABEL	TYPE	DESCRIPTION
1	+	RS485 Modbus A	Line A
2	-	RS485 Modbus B	Line B
3	¬	GND_ISO	Earth Ground
4	MAT	Type II NTC 10K or 0-10 vdc	Mixed or Discharge Air Temperature Sensor
5	COM	COM	Mixed or Discharge Air Temperature Sensor Common
6	OAT	Type II NTC 10K or 0-10 vdc	Outside Air Temperature Sensor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

## CONNECTING PERIPHERAL DEVICES TO THE ECONOMIZER CONTROLLER

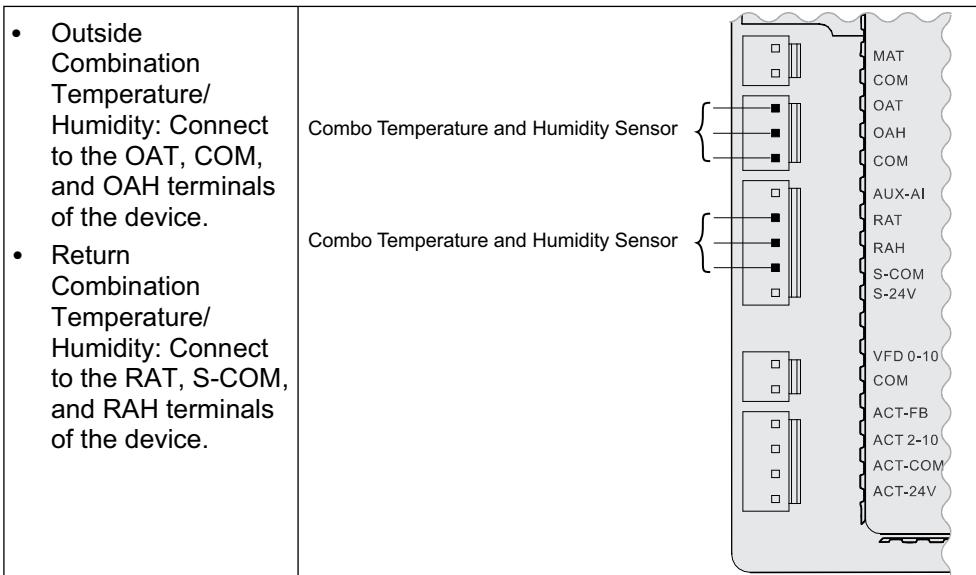
See Fig. 68-72 for wiring details.



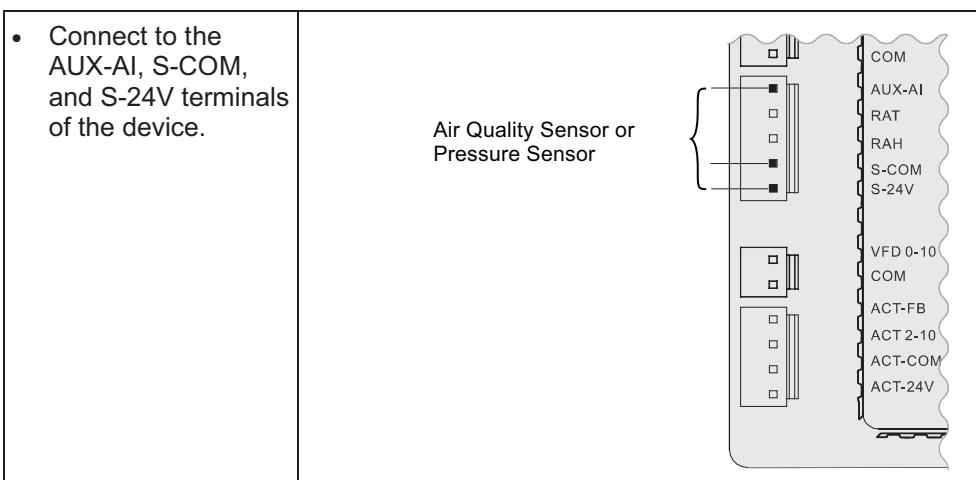
**Fig. 68 — Temperature Sensor Connection**



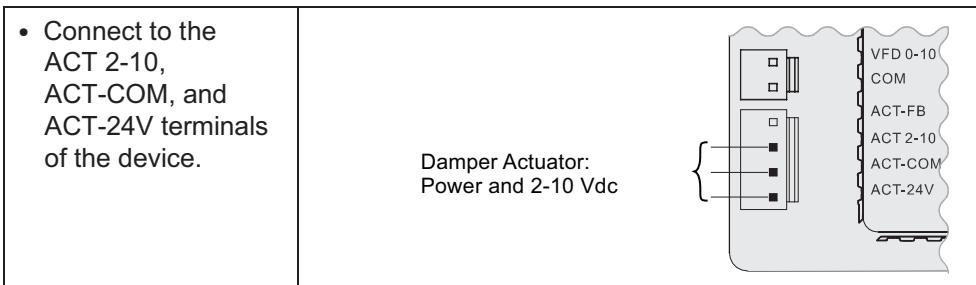
**Fig. 69 — Relative Humidity Sensor Connection**



**Fig. 70 — Combination Temperature/Humidity Sensor Connection**



**Fig. 71 — CO<sub>2</sub>/Pressure Sensor Connection**



**Fig. 72 — Damper Actuator Connection**

## EconomizerONE (Factory Option)

### ECONOMIZER SETTINGS

#### Interface Overview

##### EconomizerONE

This option consists of the following:

- Low Leak Economizer Assembly
- HH79NZ039 OA (Outdoor Air) Dry Bulb Sensor
- HH79NZ039 Mixed Air Sensor
- POL224 Controller
- 48TC005897 Harness

##### POL224 Economizer Module Wiring

The economizer controller used on electromechanical units is a Siemens POL224, which is to be located in the RTU base unit's control box. See Fig. 73 for button description of the POL224 controller. Refer to the unit dimensional drawing for the location of the control box access panel.

The POL224 controller provides the following:

1. One-line LCD (Liquid Crystal Display) — After a period of inactivity, the controller displays the default HMI (Human Machine Interface) screen (free cooling status, 1FREE-COOL YES or 1FREE COOL NO). See Fig. 73-77.
2. Operation button (Up button) — Move to the previous value, step, or category.
3. Operation button (Down Button) — Move to the next value, step, or category.
4. Operation Button (Enter Button):
  - a. Press Enter to edit the current value or option.
  - b. Press Enter to confirm a newly selected value or option.
  - c. Press Enter + Up to jump up one entire category.
  - d. Press Enter + Down to jump down one entire category.

##### User Interface and Keypad

The controller user interface consists of an LCD display and a 3-button keypad for input. The LCD is a 16 character by 1-line dot matrix display. The keypad is used to navigate and change the desired menu items on the display. See Fig. 73.

The Climatix™ mobile application allows for installation, commissioning, and servicing. Scanning a QR code on the controller allows users to download the mobile application on Android™ or Apple iOS®, but a Wi-Fi/WLAN stick is needed. See Fig. 73 and 74. Plug Wi-Fi/WLAN stick into controller USB port for temporary connection for mobile application set-up. The Wi-Fi/WLAN stick can be used for multiple units.

##### Menu Structure

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

At the end of the line, the LCD displays the value of the current submenu (if any). If the value is editable, pressing Enter will put the terminal in Edit mode. The value is then highlighted for change. After making a change by pressing Up or Down, press Enter to confirm the change and exit the Edit mode. See Fig. 76.

##### Powering the Economizer Controller

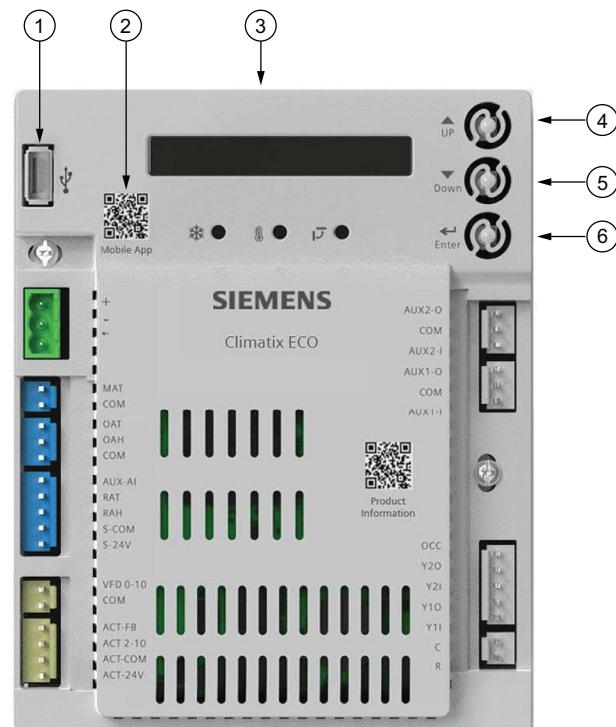
The POL224 controller power connections are made through the economizer harness (P/N 48TC005897). Connections from

the harness are made to the C (24 vac common) and R (24 vac power) terminals of the economizer controller. See Fig. 75.

##### LED Indication

NOTE: If different faulty events occur at the same time, then sensor/DAC LED lights up following the priority below: Red → Yellow → Off. For example, if there is a humidity sensor error and air temperature failure at the same time, then the sensor LED turns red rather than yellow. See Fig. 77 and Table 18.

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



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

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

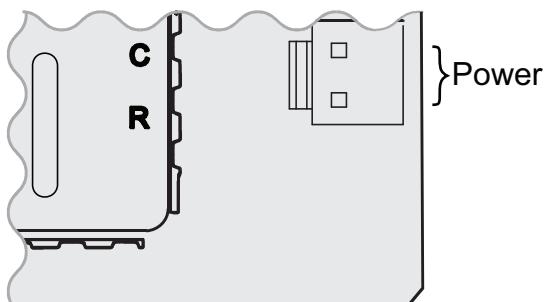
**Fig. 73 – POL224 Controller**

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

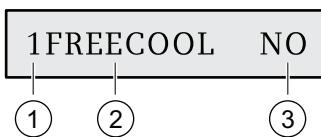


NOTE: QR code in this image is for reference only.

**Fig. 74 — Wi-Fi/WLAN Stick**



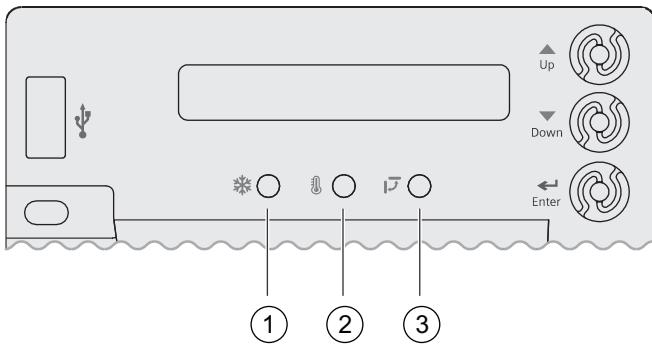
**Fig. 75 — Powering the EconomizerONE Controller**



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

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

**Fig. 76 — Menu Structure Descriptions**



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

**Fig. 77 — LED Indication**

**Table 18 — LED Indication**

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

#### Functions

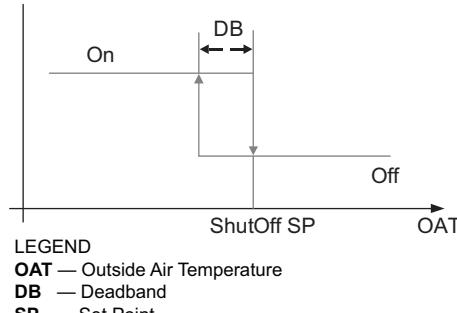
##### Free Cooling Economizing

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

Depending on the sensors that are used, there are four different control modes. In different control modes, the assessed conditions are different. See Table 19.

##### Default Hysteresis Setting

Hysteresis setting (DB) defaults to 2°F (−17°C). See Fig. 78.



**Fig. 78 — Hysteresis Settings**

**Table 19 — Free Cooling Functions**

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

#### Damper Modulation During Free Cooling

Once outside air is suitable for free cooling, the controller modulates the damper based on MAT (mixed air temperature, default) or OAT (outside air temperature). Refer to Table 19.

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

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

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

1. If outside air is higher than 50°F but lower than the temperature shutoff setpoint, then the damper is fully open.
2. If outside air is higher than OAT lockout setpoint but lower than 50°F, then linear modulation is applied when only

Cooling Stage 1 input (Y1I) is ON. Result of the following formula indicates the damper’s open position:

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

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

#### Location-Based Shutoff Setpoints

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

#### Cooling Stage Operation

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

The operation of the cooling stages is determined by the availability of Free Cooling provided by the economizer operation mode. See Cooling Stage I/O Logic Tables 20-21. Based on the use of Free Cooling, the operating modes are as follows:

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

**Table 20 — 1 and 2-Stage Cooling Stage I/O Logic**

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

NOTE(S):

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

**Table 21 — 2-Stage Cooling Stage I/O Logic**

ECONOMIZER CONDITION MET	Y1	Y2	COOLING STAGE 1	COOLING STAGE 2
NO	On	On	On	On
NO	On	On	On	On
NO	On	Off	On	Off
NO	Off	Off	Off	Off
YES	On	On	On	On
YES	On	On	On	On/Off
YES	On	Off	Off	Off
YES	Off	Off	Off	Off

**IMPORTANT:** The economizer controller can tolerate thermostat wiring mismatch, e.g. Thermostat Y1  $\rightarrow$  Economizer Y2-In, Thermostat Y2  $\rightarrow$  Economizer Y1-In. The handling logic is Stage = Y1I + Y2I. For example, Y1O = 1 if Stage  $>=$  1, Y2O = 1 if Stage  $>=$  2.

#### Multi-Speed Fan Support

The economizer controller supports connection to 2-speed fans. When the unit is equipped with a multi-speed fan, the damper responds to multiple fan speeds via multiple minimum positions (**MIN POS**) to keep minimum airflow. See Tables 22-24.

**Table 22 — Damper MIN POS for 2-Speed Fan<sup>a</sup>**

Y1	Y2	W1 OR O/B	SPD L	SPD H	POS L	POS H
X	—	—	X	—	X	—
X	X	—	—	X	—	X
—	—	X	—	X	—	X

NOTE(S):

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

LEGEND

**POS L** — Damper MIN POS for Low-Speed Fan

**POS H** — Damper MIN POS for High-Speed Fan

**SPD L** — Low-Speed (Fan)

**SPD H** — High-Speed (Fan)

**Table 23 — Different Fan Speeds with Different Configured Outputs<sup>a</sup>**

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

NOTE(S):

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

LEGEND

**Spd L** — Low Speed (Fan)

**Spd H** — High Speed (Fan)

**Table 24 — Different Damper Minimum Positions with Different Configured Outputs**

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

NOTE(S):

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

LEGEND

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

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

If DCV (demand controlled ventilation) is enabled, each fan speed corresponds to two damper position ventilation setpoints (VENT MIN, VENT MAX), e.g., Pos L corresponds to 2VENTMIN L... 2VENTMAX L. See Table 25 for Different Damper Position Setting with Different Configured Outputs with DCV enabled.

If CO<sub>2</sub> sensor is connected but DCV is disabled, then each fan speed corresponds to one minimum damper position ventilation setpoint. See Table 26 for Different Damper Position Setting with Different Configured Outputs with DCV disabled.

**Table 25 — Different Damper Position Settings with Different Configured Outputs (DCV is Enabled)**

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

NOTE(S):

a. Configured by Y1O or Y2O.

b. Configured by 6FAN.

**Table 26 — Different Damper Position Settings with Different Configured Outputs (DCV is Disabled, CO<sub>2</sub> sensor is connected)**

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

NOTE(S):

a. Configured by Y1O or Y2O.

b. Configured by 6FAN.

**Cooling Delay via Increasing Fan Speed**

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

Typical field application:

1. Prerequisites:
  - Outside air is suitable for economizing and free cooling is ON.
  - Fan connected to the controller supports multiple speeds. Cooling delay function does not work if only a one-speed fan is connected to the controller.
2. If it is a 2-speed fan and there are two cooling demand inputs/outputs and Y1-Input is called, then the controller sets fan speed to Speed Low. Damper is fully open (100%).

If Y2-Input is also called, then the controller increases fan speed to Speed High and starts fan delay (2FAN DLY) time. After the delay time runs out, the controller starts Y1-Output.

**Demand Controlled Ventilation (DCV)**

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

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

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

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

**High Humidity Limitation**

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

**Anti-Freeze Protection**

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

**MAT-Based Anti-Freeze Protection**

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

**OAT-Based Anti-Freeze Protection**

If OAT temperature falls below the OAT lockout setpoint (3OAT LOCK):

1. The controller stops the compressor from running if unit type is conventional unit and cooling/heating conventional operation mode is enabled.
2. The controller compressor is bypassed if unit type is heat pump and heat pump operation mode is enabled.

## Exhaust Fan Operation

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

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

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

## Occupancy Input

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

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

## Pre-occupancy Purge

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

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

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

## Airflow Commissioning

Airflow measurement station (differential pressure signal) can connect to the controller temporarily to run airflow commissioning to calculate, calibrate, and store 4 fan speed characteristic curves automatically at damper positions 40%, 60%, 80%, and 100%. The controller places the damper to a proper position to meet minimum or any other airflow requests in cfm.

Users can enable this function only from the Climatix™ mobile application if the related function is available in the current mobile application version.

## Fault Detection and Diagnostics

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

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

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

## Firmware Update

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

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

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

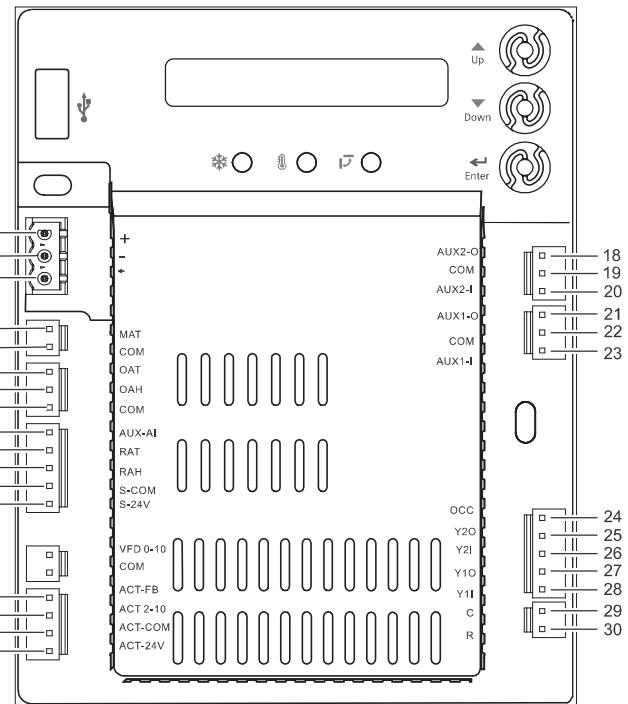
## WIRING

### ⚠️ WARNING

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

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

Devices like damper actuators, sensors (temperature sensor, humidity sensor, combination temperature and humidity sensor, CO<sub>2</sub> sensor), thermostats, and exhaust fans can be connected to the economizer controller. For information on how to mount the devices, see the device's installation instructions. See Fig. 79 and Table 27 for economizer controller wiring details.



**Fig. 79 — EconomizerONE Control Wiring**

**Table 27 — EconomizerONE Control Wiring Settings**

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

## Connecting Peripheral Devices to the Economizer Controller

See Fig. 80-84 for wiring details.

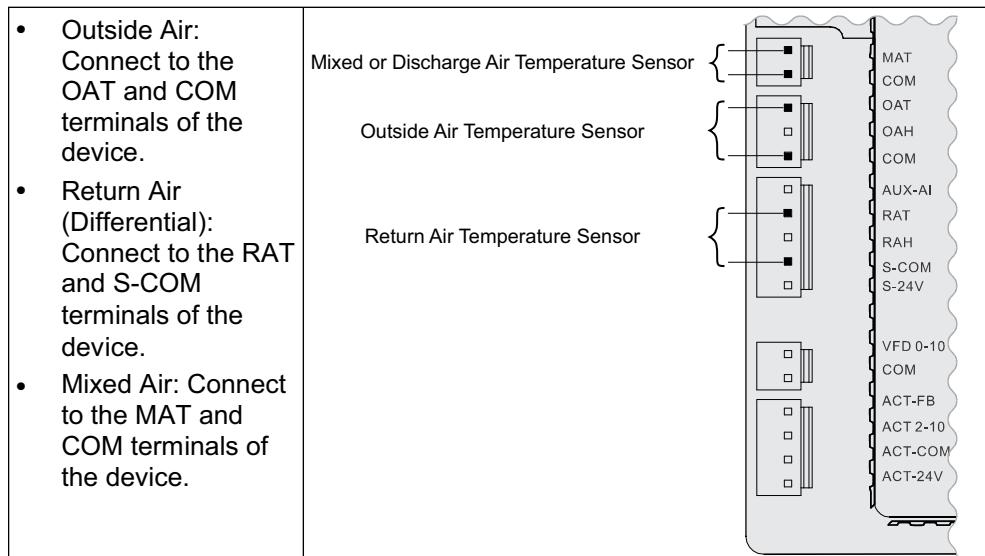


Fig. 80 – Temperature Sensor Connection

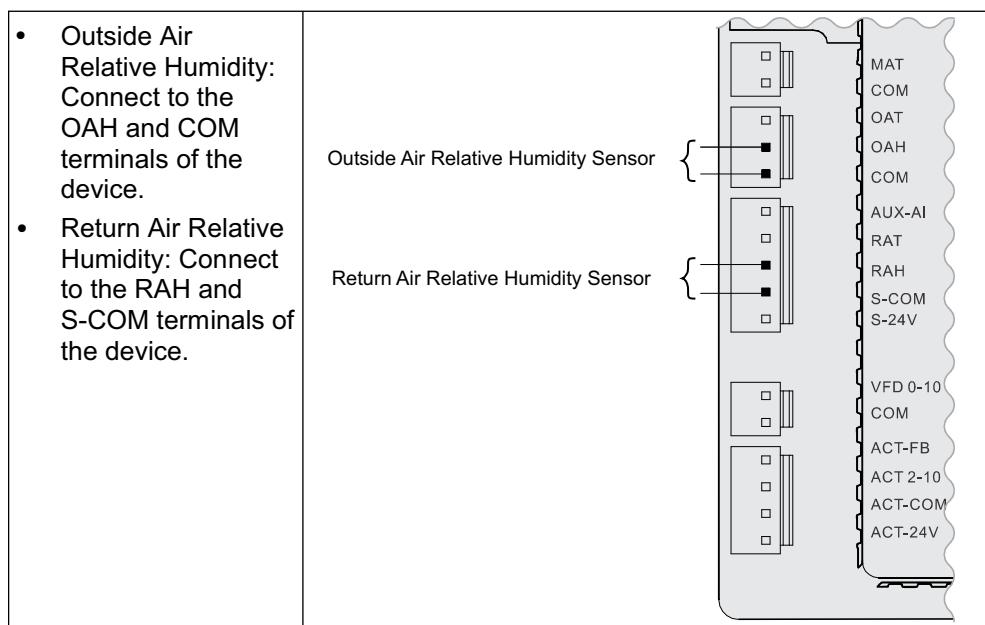
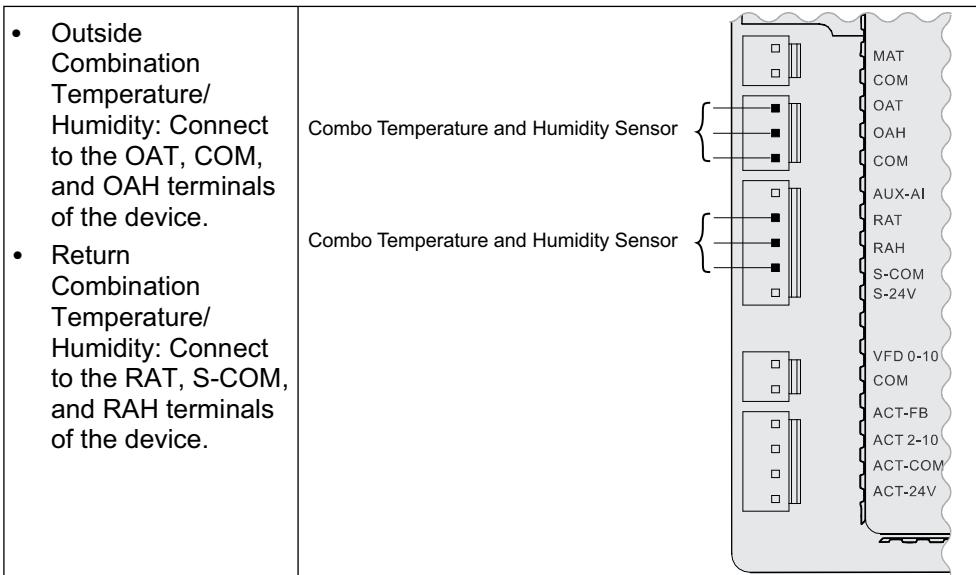
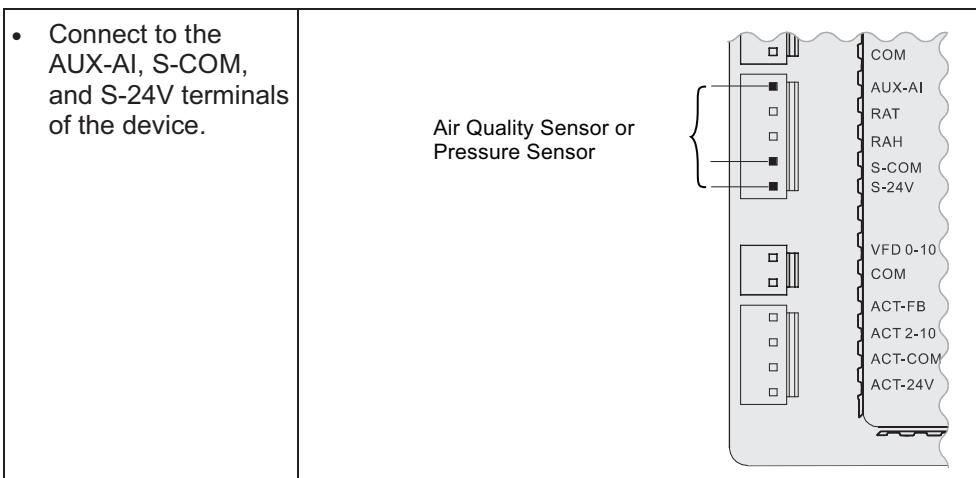


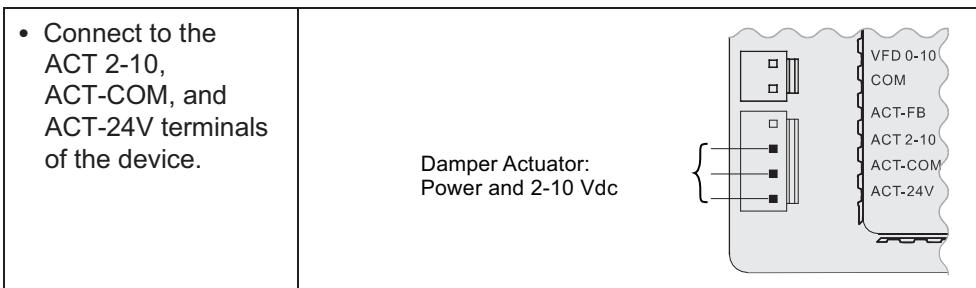
Fig. 81 – Relative Humidity Sensor Connection



**Fig. 82 — Combination Temperature/Humidity Sensor Connection**



**Fig. 83 — CO<sub>2</sub>/Pressure Sensor Connection**



**Fig. 84 — Damper Actuator Connection**

## SETUP AND CONFIGURATION

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

Set up and configure the economizer controller before putting it into usage. This can be accomplished by using the Climatix™ mobile application or the inbuilt display. After sensor, compressor, thermostat, or actuator is connected to the economizer controller, values/statuses are displayed in the Operating section of the mobile application and on the LCD. Users can manually change basic and advanced settings, configure I/Os, and test the damper operation and any configured outputs by modifying the corresponding parameter values in the local device or mobile application. See Tables 28-35 for complete list of all parameters available on the LCD display. Refer to it during the setup and configuration process.

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

**NOTE:** Parameters and display menus may display differently/dynamically if different applications are configured. See Tables 28-35.

**IMPORTANT:** Not all operations are available on the local POL224. For example, users can only obtain shutoff setpoints and perform cfm commissioning via the Climatix™ mobile application. Setup and configuration on the local device are only recommended if operations from the mobile application are unavailable. Check the mobile application for all operations that can be performed from the mobile application end.

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

**NOTE(S):**

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

**Table 28 — Status Display**

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

**Table 29 — Parameter Settings — Basic**

PARAMETER	DESCRIPTION	RANGE	DEFAULT
<b>2 TEMP OFF</b>	Temperature shutoff setpoint can be obtained automatically if a smartphone or tablet with the mobile application installed on it is connected to the network provided by a Wi-Fi/WLAN stick plugged into the economizer controller. This can also be a manually defined setpoint.	48...80°F; increment by 1	63°F
<b>2ENTH OFF</b>	Enthalpy shutoff setpoint can be obtained automatically if a smartphone or tablet with the mobile application installed on it is connected to the network provided by a Wi-Fi/WLAN stick plugged into the economizer controller. This can also be a manually defined setpoint. <b>Dynamic item:</b> Appears only if an OAH sensor is configured.	22...30 Btu/lbm; increment by 1	28 Btu/lbm
<b>2DVC</b>	Demand controlled ventilation setpoint can be obtained automatically if a smartphone or tablet with the mobile application installed on it is connected to the network provided by a Wi-Fi/WLAN stick plugged into the economizer controller. This can also be a manually defined setpoint. <b>Dynamic item:</b> Appears only if a CO <sub>2</sub> sensor is configured.	300...2000PPM; increment by 100	1100PPM
<b>2FAN L ACT</b>	Damper minimum position when fan runs at a low speed. <b>Dynamic item:</b> Appears only if "6FAN" is configured as "2SPEED" under Parameter Settings — I/O Configurations on page 68.	2...10V; increment by 0.1	3.6V
<b>2FAN H ACT</b>	Damper minimum position when fan runs at a high speed. <b>Dynamic item:</b> Appears only if "6FAN" is configured as "1SPEED" or "2SPEED".	2...10V; increment by 0.1	2.8V
<b>2VENTMAX L</b>	DCV maximum position when fan runs at a low speed. <b>Dynamic item:</b> Appears only if a CO <sub>2</sub> sensor is configured and "6FAN" is configured as "2SPEED".	2...10V; increment by 0.1	3.6V
<b>2VENTMAX H</b>	DCV maximum position when fan runs at a high speed. <b>Dynamic item:</b> Appears only if a CO <sub>2</sub> sensor is configured and "6FAN" is configured as "1SPEED" or "2SPEED".	2...10V; increment by 0.1	3.6V
<b>2VENTMIN L</b>	DCV minimum position when fan runs at a low speed. <b>Dynamic item:</b> Appears only if a CO <sub>2</sub> sensor is configured and "6FAN" is configured as "2SPEED".	2...10V; increment by 0.1	3.1V
<b>2VENTMIN H</b>	DCV minimum position when fan runs at a high speed. <b>Dynamic item:</b> Appears only if a CO <sub>2</sub> sensor is configured and "6FAN" is configured as "1SPEED" or "2SPEED".	2...10V; increment by 0.1	2.3V
<b>CFM COMM</b>	Air Flow Chart: <b>CFM commissioning</b> can only be initiated from the mobile application. When <b>CFM commissioning</b> is in progress, the local device reads " <b>CFM COMM</b> ".	—	—
<b>2DEGREES</b>	Temperature unit (°F or °C).	—	°F
<b>2FAN</b>	Fan cfm.	100...50,000cfm; increment by 100	5000cfm
<b>2EX1 L</b>	Exhaust Fan 1 low-speed parameter setting. <b>Dynamic item:</b> Appears only if: <ul style="list-style-type: none"><li>• Exhaust Fan 1 is configured.</li><li>• "6FAN" is configured as "2SPEED".</li></ul>	0...100%; increment by 1	65%
<b>2EX1 H</b>	Exhaust Fan 1 high-speed parameter setting. <b>Dynamic item:</b> Appears only if: <ul style="list-style-type: none"><li>• Exhaust Fan 1 is configured.</li><li>• "6FAN" is configured as "1SPEED" or "2SPEED".</li></ul>	0...100%; increment by 1	50%
<b>2EX2 L</b>	Exhaust Fan 2 low-speed parameter setting. <b>Dynamic item:</b> Appears only if: <ul style="list-style-type: none"><li>• Exhaust Fan 2 is configured.</li><li>• "6FAN" is configured as "2SPEED".</li></ul>	0...100%	80%
<b>2EX2 H</b>	Exhaust Fan 2 high-speed parameter setting. <b>Dynamic item:</b> Appears only if: <ul style="list-style-type: none"><li>• Exhaust Fan 2 is configured.</li><li>• "6FAN" is configured as "1SPEED" or "2SPEED".</li></ul>	0...100%; increment by 1	75%
<b>2THL</b>	Temperature high limitation. <b>Dynamic item:</b> Appears only if an RAT sensor is configured.	0...100%; increment by 1	83%
<b>2EHL</b>	Enthalpy high limitation. <b>Dynamic item:</b> Appears only if an RAH sensor is configured.	30...50 Btu/lbm; increment by 1	33 Btu/lbm
<b>2FAN DLY</b>	Cooling delay via increasing fan speed.	0...30 min; increment by 1	5 min.

**Table 30 — Parameter Settings — Advanced**

PARAMETER	DESCRIPTION	VALUE/RANGE	DEFAULT
<b>3FREEZE POS</b>	Anti-freeze protection damper position (closed or minimum).	CLO MIN	CLO
<b>3SD ACT POS</b>	Damper position during shutdown (open or closed).	CLO OPN	CLO
<b>3DIF T LOC</b>	MAT sensor location: • Choose <b>MAT</b> if the sensor is installed before the DX (Direct Expansion) coil. • Choose <b>LAT</b> if the sensor is installed after the DX coil. • Choose <b>AUTO</b> to let the economizer controller automatically detect the location.	MAT LAT AUTO	LAT
<b>3LAT LOW</b>	Low limit of leaving air temperature. <b>Dynamic item:</b> Appears only if <b>LAT</b> or <b>AUTO</b> is selected for <b>3DIF T LOC</b> .	35...65°F; increment by 1	45°F
<b>3LAT HIGH</b>	High limit of leaving air temperature. <b>Dynamic item:</b> Appears only if <b>LAT</b> or <b>AUTO</b> is selected for <b>3DIF T LOC</b> .	70...180°F; increment by 1	80°F
<b>3OAT CAL</b>	OAT sensor calibration.	-2.5...2.5°F; increment by 0.5	0°F
<b>3RAT CAL</b>	RAT sensor calibration. <b>Dynamic item:</b> Appears only if an RAT sensor is configured.	-2.5...2.5°F; increment by 0.5	—
<b>3OAH CAL</b>	OAH sensor calibration. <b>Dynamic item:</b> Appears only if an OAH sensor is configured.	-10...10%; increment by 0.5	0%
<b>3RAH CAL</b>	RAH sensor calibration. <b>Dynamic item:</b> Appears only if an RAH sensor is configured.		
<b>3MAT CAL</b>	MAT or LAT sensor calibration.	-2.5...2.5°F; increment by 0.5	0°F
<b>3MAT SET</b>	Setpoint of MAT or LAT sensor.	38...70°F; increment by 1	53°F
<b>3FRZ PROT</b>	Anti-freeze protection setpoint of MAT sensor.	35...55°F; increment by 1	45°F
<b>3ACT TOLR</b>	Actuator tolerance setpoint between output (in percent) and feedback (in percent).	0...15%; increment by 1	8%
<b>3OAT LOCK</b>	OAT lockout set point for anti-freeze protection.	-45...80°F; increment by 1	32°F
<b>3OAT LCKOVRD</b>	When OAT LOCKOUT is enabled, choose to override the cooling lockout function or not.	YES NO	NO
<b>3OAT LOCKDOLY</b>	Indicates the overridden time if "YES" is selected for "3OAT LCKOVRD".	0...300 min; increment by 1	45 min.

**Table 31 — Parameter Settings — I/O Configurations**

PARAMETER	DESCRIPTION	VALUE	DEFAULT
<b>6OCC</b>	Configures whether occupancy status receives signal from the connected thermostat or is displayed as <b>ALWAYS</b> in the economizer controller.	T-STAT ALWAYS	T-STAT
<b>6AUX1-I</b>	Auxiliary DI-1. Configurable as: • None • Heat Conventional (W1) from thermostat • Heat pump (reversing valve O) • Heat pump (reversing valve B) • Pre-occupancy signal from thermostat • Shutdown signal from unit	NONE HP(O) HP(B) PREOCC SHUTDWN	W1
<b>6AUX2-I</b>	Auxiliary DI-2. Configurable as: • None • Heat stage 1 (W1) from thermostat • Heat pump (reversing valve O) • Heat pump (reversing valve B) • Pre-occupancy signal from thermostat • Shutdown signal from unit <b>NOTE:</b> Whichever is chosen for 6AUX1-I does not appear in the list of 6AUX2-I.	NONE W1 HP(O) HP(B) PREOCC SHUTDWN	NONE
<b>6OAT SIG</b>	Configures signal type of OAT sensor.	0-10V NTC10K	NTC10K
<b>6RAT SIG</b>	Configures signal type of RAT sensor.	0-10V NTC10K NONE	NONE
<b>6OAH SIG</b>	Configures signal type of OAH sensor.	0-10V 4-20mA NONE	NONE
<b>6RAH SIG</b>	Configures signal type of RAH sensor.		
<b>6MAT SIG</b>	Configures signal type of MAT or LAT sensor.	0-10V NTC10K	NTC10K
<b>6AUX-AI1</b>	Auxiliary AI-1. Configurable as: • CO <sub>2</sub> sensor • Static pressure (temporarily for cfm commissioning) sensor • None	PRESSURE CO <sub>2</sub> NONE	NONE
<b>6X-AI1 SIG</b>	Configures CO <sub>2</sub> sensor type. <b>Dynamic item:</b> Appears only if "CO <sub>2</sub> " is selected for "6AUX-AI1".	0-10V 2-10V 0-5V	0-10V
<b>6CO2 Rng L</b>	Configures the low limit of CO <sub>2</sub> measuring range. <b>Dynamic item:</b> Appears only if "CO <sub>2</sub> " is selected for "6AUX-AI1".	0...500; increment by 10	0
<b>6CO2 Rng H</b>	Configures the high limit of CO <sub>2</sub> measuring range. <b>Dynamic item:</b> Appears only if "CO <sub>2</sub> " is selected for "6AUX-AI1".	1000...3000; increment by 50	2000
<b>6AUX-AI2</b>	Choose <b>ACT FB</b> if feedback signal is available from the connected damper actuator. Otherwise, choose <b>NONE</b> .	ACT FB NONE	ACT FB

**Table 31 — Parameter Settings — I/O Configurations (cont)**

PARAMETER	DESCRIPTION	VALUE	DEFAULT
<b>6Y2O</b>	Choose “COOL 2” if Cooling Stage 2 is available (another compressor is connected to the Economizer). Otherwise, choose “NONE”.	COOL 2 NONE	COOL 2
<b>6AUX1-O</b>	Auxiliary DO-1. Configurable as: • None. • Exhaust fan (1 or 2). • Alarm output to thermostat (Title 24).	NONE ALARM EXHAUST	EXHAUST
<b>6AUX2-O</b>	Auxiliary DO-2. Configurable as: • None. • Exhaust fan (1 or 2). • Alarm output to thermostat (Title 24). <b>NOTE:</b> Except for Exhaust Fan, whichever is chosen for 6AUX1-O does not appear in the list of 6AUX2-O.	NONE ALARM EXHAUST	ALARM
<b>6RS485</b>	Switch between MSTP and Modbus.	MSTP MODBUSSLV	MSTP

**Table 32 — Alarm Parameters<sup>a,b</sup>**

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

NOTE(S):

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

**Table 33 — Test Commands**

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

**Table 34 — Enter Running State**

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

**Table 35 — Enter Configuration State and Restart**

PARAMETER	DESCRIPTION
5CONFIG STATE	Change to Configuration State. Press Enter to confirm the change.
5ENTER CONFIG?	Confirm the change to Configuration State.
5RESTART	Restart the economizer controller. Press Enter to confirm the restart.
5CONF RESTART	Confirm the restart.

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

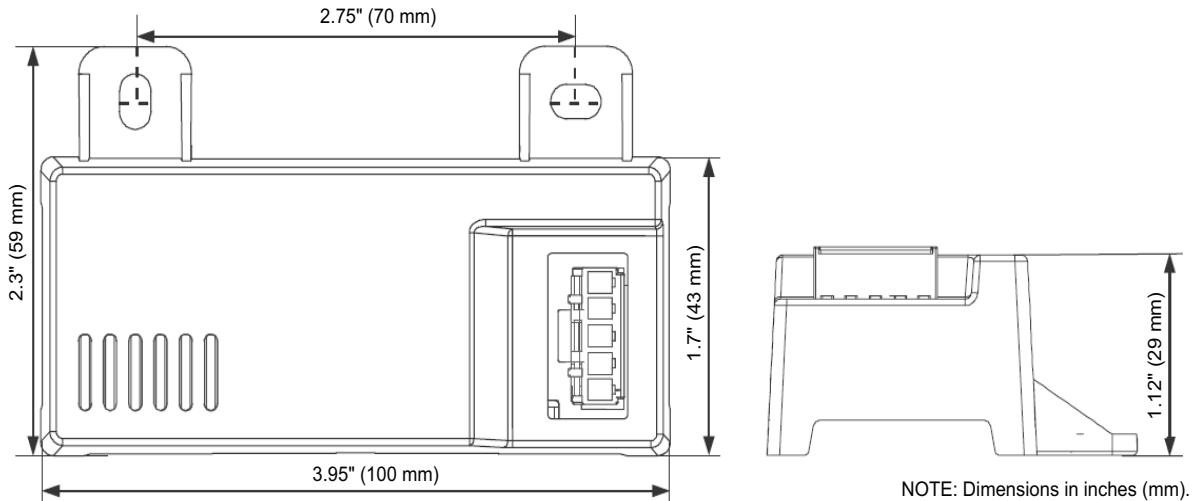
When using the HH57LW001 enthalpy sensor (see Fig. 85) for outside air changeover, the existing HH79NZ039 dry bulb sensor (see Fig. 86) must be removed. The enthalpy sensor will be mounted in the same location as the dry bulb sensor (see Fig. 87). When the enthalpy sensor's OA (Outside Air) temperature, enthalpy, and dew point are below their respective setpoints, the outside air can be used for free cooling. When any of these are above the setpoint, free cooling will not be available. Enthalpy setpoints are configurable and create an enthalpy boundary according to the user's input. For additional details, see Fig. 88-89 and Table 36.

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

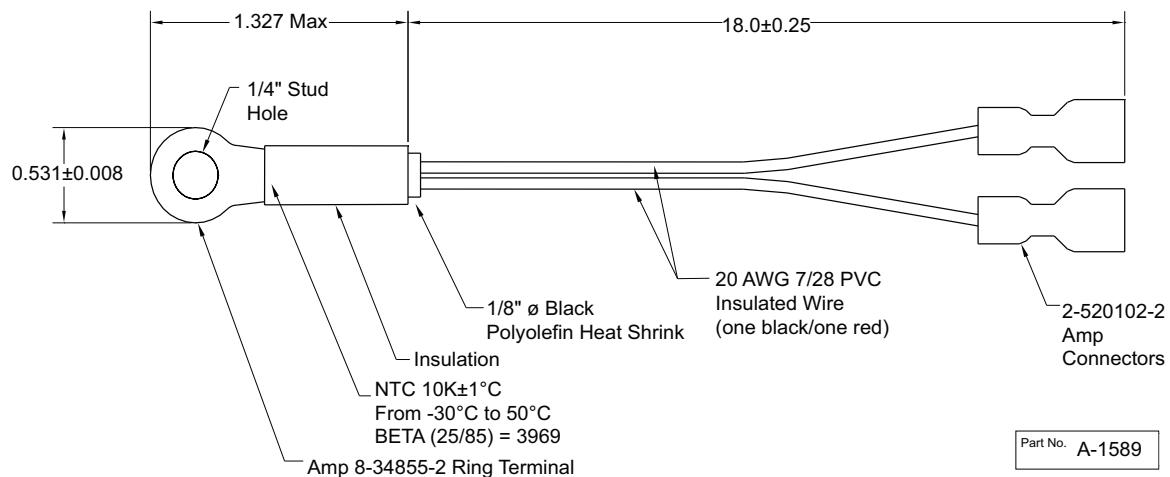
48TC005213 has a 5-pin plug that connects directly to the HH57LW001 enthalpy sensor. The CRENTSEN001A00 accessory kit includes enthalpy sensor (HH57LW001) and associated 5-pin plug (48TC005213) and may be ordered as a finished good.

#### ***Enthalpy Control Sensor Configuration***

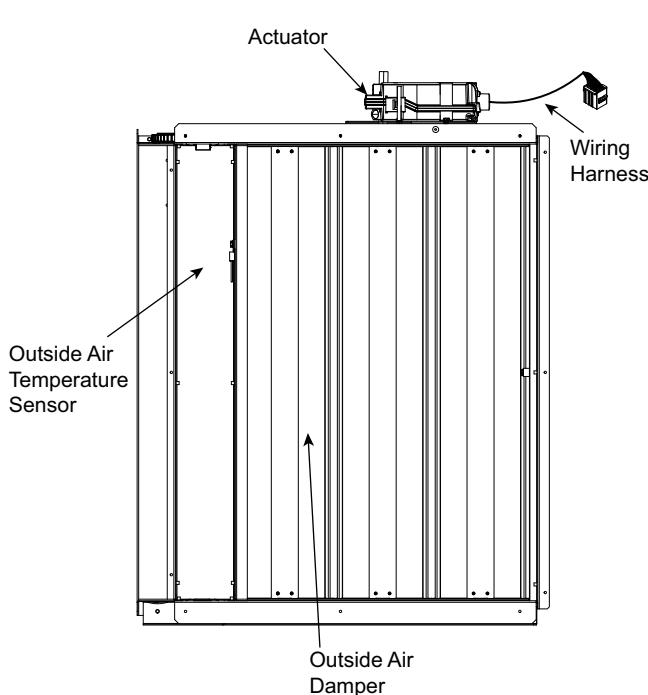
The optional enthalpy control sensor (P/N: HH57LW001) communicates with the POL224 economizer controller using the 5-wire harness, 48TC005213. The HH57LW001 sensor can be used as a single outside air enthalpy, a differential return enthalpy, or a differential return temperature sensor. Refer to the base unit control wiring diagrams found earlier in this book to wire the HH57LW001 enthalpy sensor for each option. Use Fig. 85 and Table 38 on page 73 to locate the wiring terminals for each enthalpy control sensor.



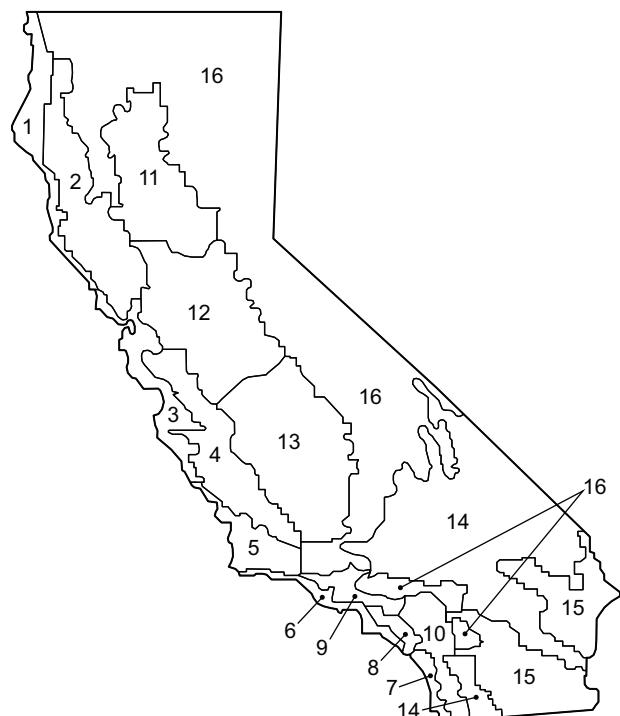
**Fig. 85 — HH57LW001 Dimensional, Connection and Switching Information**



**Fig. 86 — HH79NZ039 Dry Bulb and Mixed Air Sensor Wiring**



**Fig. 87 — EconomizerONE Component Locations (CRECOMZR108A00 Shown)**



**Fig. 88 — California Title 24 Zones**

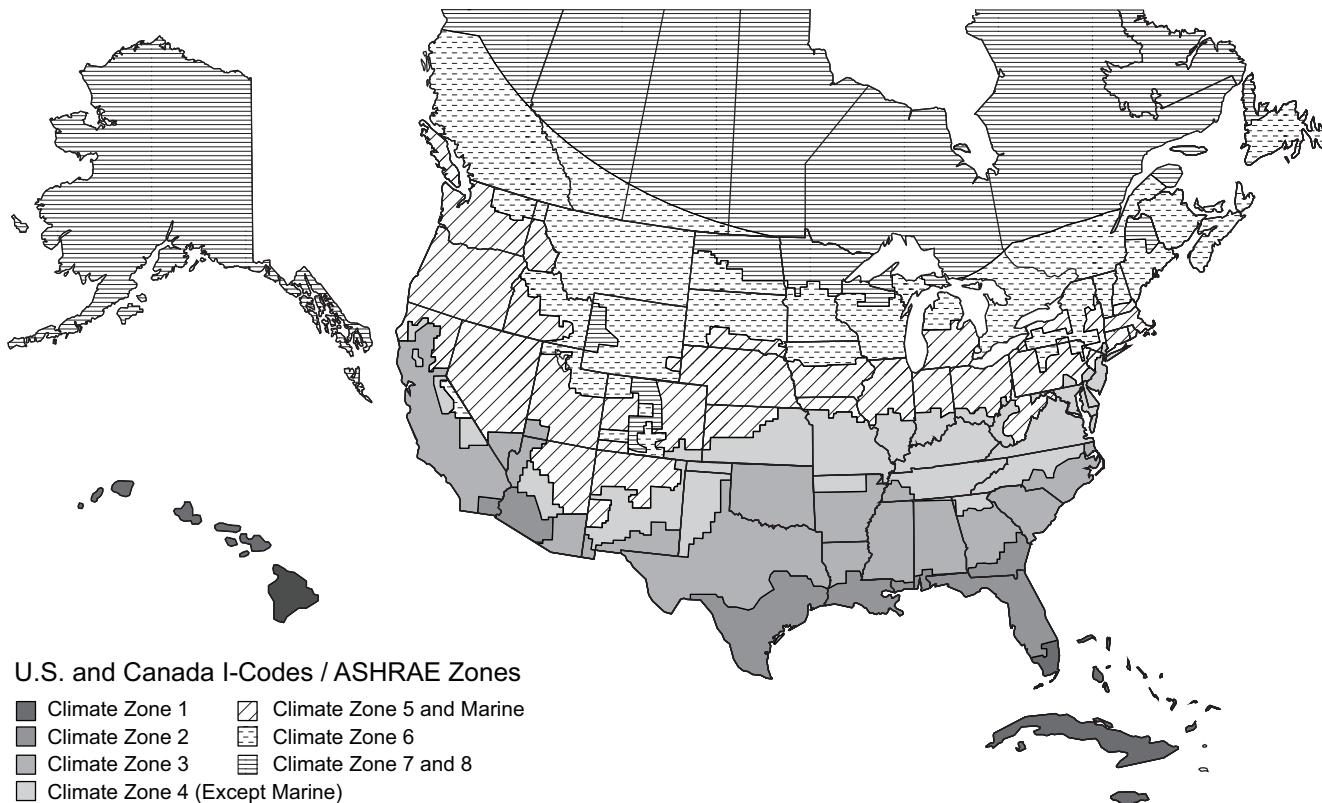


Fig. 89 — U.S. and Canada Climate Zones

Table 36 — Enthalpy Manual Entry Setpoints for EconomizerONE Per Climate Zone

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

NOTE(S):

- a. See Fig. 89 for map of U.S. and Canada climate zones.
- b. See Fig. 88 for map of California Title 24 zones.

Economizers are shipped standard with an HH79NZ039 outside air dry bulb sensor (see Fig. 86). System default setting (high temp limit) is 63°F (17°C) and has a range of 48°F to 80°F (9°C to 27°C). Sensor is factory installed on economizer.

NOTE: A second HH79NZ039 sensor is provided for mixed air temperature.

NOTE: California high temperature setting requirements by region are shown in Table 37.

#### Enthalpy Settings (Enthalpy Option)

If installing the optional HH57LW001 enthalpy sensor, the HH79NZ039 dry bulb outside air sensor must first be removed. Wire sensor to harness 48TC005213 and the (5) wires from the harness to the EconomizerONE harness in the return air chamber. Harness 48TC005213 has a 5-pin plug that connects directly to the HH57LW001 enthalpy sensor. Refer to the base unit control wiring diagrams earlier in this book for wiring connections. Refer to Fig. 85 and Table 38.

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

California's Title 24 code requires a high temperature limit setting for all dry bulb outside air economizer changeover. The temperatures vary by the region within California. See Table 37 for high limit settings.

**Table 37 — California Title 24 Regional High Limit Dry Bulb Temperature Settings<sup>a</sup>**

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

NOTE(S):

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

#### LEGEND

OAT — Outdoor-air Thermostat

RA — Return Air

**Table 38 — HH57LW001 Sensor Wiring Terminations**

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

## CHECKOUT

Inspect all wiring connections at the economizer module's terminals, and verify compliance with the installation wiring diagrams. For checkout, review the Status of each configured parameter and perform the Test Commands tests (refer to Table 33).

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

### **WARNING**

#### ELECTRIC SHOCK HAZARD

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

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

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

## **Power Up**

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

## Initial Menu Display

On initial start up, "Welcome" displays on the economizer HMI screen. After a brief pause, the Parameter Settings — I/O Configuration (refer to Table 31) of the software appears, allowing the user to check that presets and default values are configured correctly.

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

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

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

## **Status**

Use the Status menu (refer to Table 28) to check the parameter values for the various devices and sensors configured.

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

## **Checkout Tests**

Use the Test Commands menu (refer to Table 33) to test the damper operation and any configured outputs. Only items that are configured are shown in the Test Commands menu.

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

To perform a Test Command test:

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

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

### **CAUTION**

#### EQUIPMENT DAMAGE HAZARD

Failure to follow this caution may result in equipment damage.

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

## TROUBLESHOOTING

For EconomizerONE troubleshooting issues see Table 39.

**Table 39 — Operating Issues and Concerns**

SYMPTOM	REASON	SOLUTION
<b>An alarm is displayed on the LCD</b>	Sensor, damper, or the whole working system may not work properly	Check sensor, damper, or the whole working system following the detailed alarm information.
<b>DAC LED is blinking RED</b>	Damper slippage	Check whether the damper works properly.
<b>DAC LED is blinking RED quickly</b>	Damper unplugged	Check whether the damper is connected.
<b>DAC LED is OFF</b>	Terminal ACT-FB is configured but there is no available feedback signal	Check whether the feedback signal is connected; check if ACT-FB is faulty.
<b>Economizer controller has no alarm, but the Free Cooling LED will not turn on when the OA seems to be suitable for Free Cooling</b>	Shutoff SP setting error	Shutoff temperature and/or enthalpy set point is incorrectly set up. Consult an HVAC professional to set up the shutoff set point correctly.
	OA temp is too low	The OA temperature is too low; therefore, there is no cooling demand. This could possibly enable anti-freeze protection.
	OA temp is too high or too humid	In DIFF mode, even though OA temperature is lower than RA temperature, if both OA and RA temperatures exceed the high limit, then Free Cooling turns off. In Differential Enthalpy control mode, even though OA enthalpy is lower than RA enthalpy, if both OA and RA enthalpy exceed the high limit, then Free Cooling turns off.
<b>Economizer controller/mechanical cooling is not operating</b>	No input power	Use a multi-meter to check whether there is 24 vac ± 25% (18-30 vac) at the POWER terminals. If there is no voltage or if the voltage is significantly low, then check the transformer output voltage at the RTU. If 24-v is not present at the transformer secondary side, then check the primary line voltage to the transformer. If the line voltage is not present at the transformer primary side, then check the primary power to the RTU, fuses, circuit breaker, and so on.
	Brownout	If voltage is below 17-v, then the economizer controller may be in Brownout Protection mode. This mode disables all of the relay outputs. When the power is 19 vac or higher, the economizer controller and RTU operate normally.
	Y1/Y2 signal is missing from the thermostat	Mechanical cooling does not run until there is cooling demand (Y1/Y2 Active). Check the wiring from Y11 and Y21 terminals to the commercial thermostat. 24-v should be present between Y1/Y21 and Y1O/Y2O respectively.
	24 vac~ and 24 vac ⊥ are incorrectly wired	24 vac power supply has polarity when all devices are powered by the same 24 vac transformer; reversing polarity may cause a short circuit that can damage the system. Follow the transformer polarity mark, check the wiring of 24-v~ (or G or 24-v+), and ensure that they are tied to the same polar of 24 vac power supply; while checking the wiring of ⊥ (or G0 or 24-v or COM), ensure that they are all tied to another polar of 24 vac power supply.
<b>Firmware update failure</b>	Application file is damaged, operation is incorrect, and/or USB flash disk does not work properly	Reload a BIN file, restart the controller, update firmware <sup>a</sup> , or change a USB flash disk. Contact service provider if failure still exists.
<b>Free Cooling LED is solid RED</b>	Sensor, damper, or whole working system may not work properly	Check sensor, damper, or the whole working system following the detailed alarm information.
<b>Free Cooling LED is blinking RED</b>	Not economizing when it should	Check the whole economizer working system, such as the sensor, damper, and thermostat.
<b>Incorrect controller password error on mobile application</b>	For CO <sub>2</sub> and single enthalpy (control mode 3) configurations from the factory, the password has changed	For units coming from the factory with CO <sub>2</sub> configuration or single enthalpy (control mode 3), use the controller password OneBT2.1. For all other units, use the controller password OneBT. Performing a factory reset on the controller will also reset the password to OneBT.
<b>RS485 communication failure</b>	RS485 signal or configuration error	Check wiring, configuration, Baud Rate (using mobile application), and other network communication parameters.
<b>Sensor LED is blinking RED</b>	Excess outdoor air	Check the whole economizer working system, such as the sensor, damper, and thermostat.
<b>Sensor LED is solid RED</b>	Mixed Air (MA) sensor error	Check the MA sensor. It must be either a Type II NTC 10K or 0-10 vdc sensor.
	Outside Air (OA)/Return Air (RA) sensor error	Check the wiring and signal of the OA sensor. If in Differential (DIFF) mode, also check the RA sensor. The following sensor signals are valid: Type II NTC 10K or 0-10 vdc temperature. 0-10 vdc or 4-20 mA humidity.
	Air temperature failure/fault	Check the air temperature sensor signal. The valid signal must be Type II NTC 10K or 0-10 vdc.
<b>Sensor LED is OFF</b>	CO <sub>2</sub> sensor error	Check CO <sub>2</sub> sensor connection, sensor signal (under range or over range), and sensor signal type.
<b>Sensor LED is YELLOW</b>	Humidity sensor error	Check humidity sensor connection, sensor signal (under range or over range), and sensor signal type.
<b>Wi-Fi connection failure</b>	Wi-Fi/WLAN stick error or wrong user name and password	Unplug and re-plug in the Wi-Fi/WLAN stick, enter a correct user name and password, restart the controller, or replace the Wi-Fi/WLAN stick. If the Wi-Fi/WLAN stick is POL903.00/100, then the default user name and password are Siemens-WLAN-Stick and SIBPAdmin. DNS name is siemens.wlanstick. Contact Application Engineering for information on this accessory.

NOTE(S):

- Back up configurations before firmware update. All the previous configuration data is erased after firmware update. Contact Application Engineering for more information on support for firmware.

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

## PRE-START-UP/START-UP

### ⚠ WARNING

#### PERSONAL INJURY HAZARD

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

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

### ⚠ WARNING

#### ELECTRICAL OPERATION HAZARD

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

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

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

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

- c. Inspect all field-wiring and factory-wiring connections. Be sure that connections are completed and tight. Be sure that wires are not in contact with refrigerant tubing or sharp edges.
- d. Inspect coil fins. If damaged during shipping and handling, carefully straighten fins with a fin comb.

4. Verify the following conditions:

- a. Make sure that condenser-fan blade are correctly positioned in fan orifice. See "Condenser-Fan Adjustment" section for more details.
- b. Make sure that air filter(s) is in place.
- c. Make sure that condensate drain trap is filled with water to ensure proper drainage.
- d. Make sure that all tools and miscellaneous loose parts have been removed.

## START-UP, GENERAL

### Unit Preparation

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

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

### Additional Installation/Inspection

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

### Gas Piping

Check gas piping for leaks.

### ⚠ WARNING

#### FIRE, EXPLOSION HAZARD

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

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

## ⚠ WARNING

### RISK OF FIRE OR EXPLOSION

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

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

### WHAT TO DO IF YOU SMELL GAS

- Do not try to light any appliance.
- Do not touch any electrical switch; do not use any phone in your building.
- Leave the building immediately.
- 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 "Physical Data" on page 80. 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.

## Heating

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

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

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

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

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

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

## Ventilation (Continuous Fan)

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

## FASTENER TORQUE VALUES

<b>Heat shield screws</b>	30 in.-lb (3.4 Nm) $\pm 2$ in.-lb (0.2 Nm)
<b>Stator motor mounting screws</b>	23 in.-lb (2.6 Nm) $\pm 2$ in.-lb (0.2 Nm)
<b>Fan rotor mounting screws</b>	23 in.-lb (2.6 Nm) $\pm 2$ in.-lb (0.2 Nm)
<b>Limit switch screws</b>	50 in.-lb (5.7 Nm) $\pm 5$ in.-lb (0.6 Nm)
<b>Fan Deck bracket screws</b>	50 in.-lb (5.7 Nm) $\pm 5$ in.-lb (0.6 Nm)
<b>Condenser fan motor mounting screws</b>	30 in.-lb (3.4 Nm) $\pm 3$ in.-lb (0.3 Nm)
<b>Condenser fan hub set screw</b>	60 in.-lb (6.8 Nm) $\pm 5$ in.-lb (0.6 Nm)
<b>Compressor mounting bolts</b>	65 in.-lb (7.3 Nm) $\pm 10$ in.-lb (1.2 Nm)

## START-UP, SYSTEMVU CONTROLS

### IMPORTANT: SET-UP INSTRUCTIONS

Installation, wiring and troubleshooting information for the SystemVu™ Controller: "48/50FE 04-30, 48/50GE 04-28 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	G	E	G	M	0	4	A	2	A	6	-	0	A	0	A	0

### Unit Heat Type

48 = Gas Heat Packaged Rooftop

### Model Series — WeatherMaster®

GE = Mid Tier Puron Advance™

### Heat Size

G = Ultra Low NOx - Low Heat<sup>a</sup>

H = Ultra Low NOx - Medium Heat<sup>a</sup>

### Refrig. Systems Options

M = Two-Stage Cooling, Single Circuit

N = Two-Stage Cooling, Single Circuit with  
Humidi-MiZer® System<sup>b</sup>

P = Two-Stage Cooling, Single Circuit with  
Head Pressure Control

### Cooling Tons

04 = 3 tons

05 = 4 tons

06 = 5 tons

### Sensor Options

A = None

B = Return Air Smoke Detector (RA)

C = Supply Air Smoke Detector (SA)

D = RA + SA Smoke Detector

J = Condensate Overflow Switch (COFS)

K = Condensate Overflow Switch + RA Smoke Detector

L = Condensate Overflow Switch + RA + SA Smoke Detectors

M = Condensate Overflow Switch + SA Smoke Detector

### Fan Options

2 = Standard/Medium Static — EcoBlue™ Vane Axial Fan

3 = High Static — EcoBlue Vane Axial Fan

5 = Standard/Medium Static — EcoBlue Vane Axial Fan and  
Filter Status Switch

6 = High Static — EcoBlue Vane Axial Fan and Filter Status Switch

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

A = Al/Cu — Al/Cu

B = Precoat Al/Cu — Al/Cu

C = E-coat Al/Cu — Al/Cu

D = E-coat Al/Cu — E-coat Al/Cu

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

3 = 208/230-1-60<sup>c</sup>

5 = 208/230-3-60

6 = 460-3-60

### Design Revision

- = Factory Design Revision

### Packaging

0 = Standard

### Electrical Options

A = None

B = HACR Breaker

C = Non-Fused Disconnect (NFDC)

D = Thru-the-Base Connections (TTB)

E = HACR + TTB

F = NFDC + TTB

N = Phase Monitor Protection (PMR)

P = PMR + HACR

Q = PMR + NFDC

R = PMR + TTB

S = PMR + HACR + TTB

T = PMR + NFDC + TTB

### Service Options

0 = None

1 = Unpowered Convenience Outlet (NPCO)

2 = Powered Convenience Outlet (PCO)

3 = Hinged Panels (HP)

4 = Hinged Panels + NPCO

5 = Hinged Access Panels + PCO

6 = MERV-13 Filters (M13)

7 = NPCO + MERV-13 Filters

8 = PCO + MERV-13 Filters

9 = Hinged Panels + MERV-13 Filters

A = HP + NPCO + MERV-13 Filters

B = HP + PCO + MERV-13 Filters

C = Foil Faced Insulation (FF)

D = Foil Faced Insulation + NPCO

E = Foil Faced Insulation + PCO

F = Foil Faced Insulation + Hinged Panels

G = FF + HP + NPCO

H = FF + HP + PCO

J = Foil Faced Insulation + MERV-13 Filters

K = FF + NPCO + MERV-13 Filters

L = FF + PCO + MERV-13 Filters

M = FF + HP + MERV-13 Filters

N = FF + HP + NPCO + MERV-13 Filters

P = FF + HP + PCO + MERV-13 Filters

### Intake / Exhaust Options

A = None

B = Standard Leak Economizer with Barometric Relief

F = Standard Leak Enthalpy Economizer with  
Barometric Relief

L = ULL (Ultra Low Leak) Temperature Economizer  
with Barometric Relief and CO<sub>2</sub> Sensor

M = ULL Enthalpy Economizer with Barometric  
Relief and CO<sub>2</sub> Sensor

U = ULL Temperature Economizer with Barometric Relief

W = ULL Enthalpy Economizer with Barometric Relief

### Base Unit Controls

0 = Electromechanical Controller

3 = SystemVu™ Controller

8 = Electromechanical Controls with POL224  
EconomizerONE (with Fault Detection and Diagnostic)

### NOTE(S):

<sup>a</sup> Includes Stainless Steel Heat Exchanger.

<sup>b</sup> Includes Low Ambient controller.

<sup>c</sup> Not available as a factory-installed options for models with this voltage code: Humidi-MiZer System, Coated Coils or Cu Fin Coils, Louvered Hail Guards, Economizer, Powered Convenience Outlet or Upgraded MERV filters.

Fig. A — Model Number Nomenclature

## APPENDIX B — PHYSICAL DATA

### 48GE 3 to 5 Ton Physical Data

48GE UNIT	48GE*M04	48GE*N04	48GE*M05	48GE*N05	48GE*M06	48GE*N06
<b>NOMINAL TONS</b>	3	3	4	4	5	5
<b>BASE UNIT OPERATING WT (lb) 48GE<sup>a</sup></b>	535	535	555	555	600	600
<b>REFRIGERATION SYSTEM</b>						
No. Circuits / No. Compressors / Type	1 / 1 / 2-Stage Scroll					
Puron Advance™ (R-454B) Charge A/B (lb-oz)	8-8	—	8-0	—	10-5	—
Humidi-MiZer® Puron Advance (R-454B) Charge A/B (lb-oz)	—	11-8	—	13-9	—	17-5
Metering Device	TXV	—	TXV	—	TXV	—
Humidi-MiZer Metering Device	—	TXV	—	TXV	—	TXV
High-Pressure Trip/Reset (psig)	630 / 505	630 / 505	630 / 505	630 / 505	630 / 505	630 / 505
Low-Pressure Trip/Reset (psig)	54 / 117	27 / 44	54 / 117	27 / 44	54 / 117	27 / 44
<b>EVAPORATOR COIL</b>						
Material (Tube / Fin)	Cu / Al					
Coil Type	3/8 in. RTPF					
Rows / FPI	2 / 15	2 / 15	4 / 15	4 / 15	4 / 15	4 / 15
Total Face Area (ft <sup>2</sup> )	5.5	5.5	5.5	5.5	7.3	7.3
Condensate Drain Connection Size	3/4 in.					
<b>CONDENSER COIL</b>						
Material (Tube / Fin)	Cu / Al					
Coil Type	5/16 in. RTPF					
Rows / FPI	2 / 18	2 / 18	2 / 18	2 / 18	2 / 18	2 / 18
Total Face Area (ft <sup>2</sup> )	15.9	15.9	15.9	15.9	18.8	18.8
<b>HUMIDI-MIZER COIL</b>						
Material (Tube / Fin)	—	Cu / Al	—	Cu / Al	—	Cu / Al
Coil Type	—	3/8 in. RTPF	—	3/8 in. RTPF	—	3/8 in. RTPF
Rows / FPI	—	1 / 17	—	2 / 17	—	2 / 17
Total Face Area (ft <sup>2</sup> )	—	4.1	—	4.1	—	5.5
<b>EVAPORATOR FAN AND MOTOR</b>						
<b>Standard/Medium Static 1 Phase</b>						
Motor Qty / Drive Type	1 / Direct	—	1 / Direct	—	1 / Direct	—
Maximum Cont Bhp	0.71	—	1.06	—	1.44	—
Rpm Range	219-2190	—	217-2170	—	239-2390	—
Fan Qty/Type	1 / Vane Axial	—	1 / Vane Axial	—	1 / Vane Axial	—
Fan Diameter (in.)	16.6 in.	—	16.6 in.	—	16.6 in.	—
<b>High Static 1 Phase</b>						
Motor Qty/Drive Type	1 / Direct	—	1 / Direct	—	1 / Direct	—
Maximum Cont Bhp	1.07	—	1.53	—	1.96	—
Rpm Range	249-2490	—	246-2460	—	266-2660	—
Fan Qty/Type	1 / Vane Axial	—	1 / Vane Axial	—	1 / Vane Axial	—
Fan Diameter (in.)	16.6 in.	—	16.6 in.	—	16.6 in.	—
<b>Standard/Medium Static 3 Phase</b>						
Motor Qty/Drive Type	1 / Direct					
Maximum Cont Bhp	0.71	0.71	1.06	1.06	1.44	1.44
Rpm Range	219-2190	219-2190	217-2170	217-2170	239-2390	239-2390
Fan Qty/Type	1 / Vane Axial					
Fan Diameter (in.)	16.6 in.					
<b>High Static 3 Phase</b>						
Motor Qty/Drive Type	1 / Direct					
Maximum Cont Bhp	1.07	1.07	1.96	1.96	2.43	2.43
Rpm Range	249-2490	249-2490	266-2660	266-2660	284-2836	284-2836
Fan Qty/Type	1 / Vane Axial					
Fan Diameter (in.)	16.6 in.					

## APPENDIX B — PHYSICAL DATA (cont)

### 48GE 3 to 5 Ton Physical Data (cont)

48GE UNIT	48GE*M04	48GE*N04	48GE*M05	48GE*N05	48GE*M06	48GE*N06
<b>CONDENSER FAN AND MOTOR</b>						
Qty / Motor Drive Type	1 / Direct					
Motor HP / Rpm	1/3 / 1000/800	1/3 / 1000/800	1/3 / 1000/800	1/3 / 1000/800	1/3 / 1200/1100	1/3 / 1200/1100
Fan Diameter (in.)	23 in.					
<b>FILTERS</b>						
RA Filter Qty / Size (in.)	2 / 16 x 25 x 2	4 / 16 x 16 x 2	4 / 16 x 16 x 2			
OA Inlet Screen Qty / Size (in.)	1 / 20 x 24 x 1					

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

### 48GE 3 to 5 Ton Ultra Low NOx Gas Heat Data — 1 and 3-Phase Units

48GE UNIT	48GE**04	48GE**05	48GE**06
<b>GAS CONNECTION</b>			
No. of Gas Valves	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
<b>HEAT ANTICIPATOR SETTING (AMPS)</b>			
<b>NATURAL GAS HEAT</b>			
LOW			
No. of Stages / No. of Burners (total)	1 / 1	1 / 1	1 / 1
Connection Size	1/2 in. NPT	1/2 in. NPT	1/2 in. NPT
Burner Thermal Switch Opens / Closes (°F)	350 / 301	350 / 301	350 / 301
Temperature Rise (°F)	20-50	20-50	15-45
<b>MEDIUM</b>			
No. of Stages / No. of Burners (total)	1 / 1	1 / 1	1 / 1
Connection Size	1/2 in. NPT	1/2 in. NPT	1/2 in. NPT
Burner Thermal Switch Opens / Closes (°F)	350 / 301	350 / 301	350 / 301
Temperature Rise (°F)	20-60	20-60	20-60

## APPENDIX C – FAN PERFORMANCE

### GENERAL FAN PERFORMANCE NOTES

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

## APPENDIX C — FAN PERFORMANCE (cont)

### 48GEGM04 Single Phase — 3 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
900	1129	0.10	1356	0.17	1544	0.26	1708	0.35	1857	0.45
975	1182	0.11	1402	0.19	1586	0.28	1748	0.37	1894	0.47
1050	1236	0.13	1449	0.21	1630	0.30	1789	0.40	1933	0.50
1125	1290	0.15	1498	0.23	1675	0.33	1831	0.43	1973	0.53
1200	1346	0.17	1547	0.26	1721	0.35	1874	0.46	2014	0.57
1275	1403	0.19	1598	0.28	1768	0.38	1919	0.49	2057	0.61
1350	1460	0.22	1651	0.31	1816	0.42	1965	0.53	2100	0.64
1425	1519	0.24	1703	0.34	1865	0.45	2012	0.57	2145	0.69
1500	1579	0.27	1757	0.38	1916	0.49	2059	0.61	2191	0.73

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
900	1994	0.55	2121	0.66	2241	0.78	2354	0.91	2461	1.04
975	2029	0.58	2155	0.70	2274	0.82	2386	0.95	—	—
1050	2066	0.61	2190	0.73	2307	0.86	2419	0.99	—	—
1125	2104	0.65	2227	0.77	2343	0.90	2453	1.03	—	—
1200	2144	0.69	2265	0.81	2379	0.94	2488	1.07	—	—
1275	2184	0.73	2304	0.85	2417	0.98	—	—	—	—
1350	2226	0.77	2345	0.90	2456	1.03	—	—	—	—
1425	2269	0.81	2386	0.95	—	—	—	—	—	—
1500	2313	0.86	2429	1.00	—	—	—	—	—	—

Standard/Medium Static 1129-2190 rpm, 0.71 max bhp

High Static 1129-2490 rpm, 1.07 max bhp

### 48GEGM04 Single Phase — Standard/Medium Static — 3 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
900	1129	5.2	1356	6.2	1544	7.1	1708	7.8	1857	8.5
975	1182	5.4	1402	6.4	1586	7.2	1748	8.0	1894	8.6
1050	1236	5.6	1449	6.6	1630	7.4	1789	8.2	1933	8.8
1125	1290	5.9	1498	6.8	1675	7.6	1831	8.4	1973	9.0
1200	1346	6.1	1547	7.1	1721	7.9	1874	8.6	2014	9.2
1275	1403	6.4	1598	7.3	1768	8.1	1919	8.8	2057	9.4
1350	1460	6.7	1651	7.5	1816	8.3	1965	9.0	2100	9.6
1425	1519	6.9	1703	7.8	1865	8.5	2012	9.2	2145	9.8
1500	1579	7.2	1757	8.0	1916	8.7	2059	9.4	—	—

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
900	1994	9.1	2121	9.7	—	—	—	—	—	—
975	2029	9.3	2155	9.8	—	—	—	—	—	—
1050	2066	9.4	—	—	—	—	—	—	—	—
1125	2104	9.6	—	—	—	—	—	—	—	—
1200	2144	9.8	—	—	—	—	—	—	—	—
1275	—	—	—	—	—	—	—	—	—	—
1350	—	—	—	—	—	—	—	—	—	—
1425	—	—	—	—	—	—	—	—	—	—
1500	—	—	—	—	—	—	—	—	—	—

Standard/Medium Static 1129-2190 rpm

## APPENDIX C — FAN PERFORMANCE (cont)

### 48GEGM04 Single Phase — High Static — 3 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
900	1129	4.5	1356	5.4	1544	6.2	1708	6.9	1857	7.5
975	1182	4.7	1402	5.6	1586	6.4	1748	7.0	1894	7.6
1050	1236	5.0	1449	5.8	1630	6.5	1789	7.2	1933	7.8
1125	1290	5.2	1498	6.0	1675	6.7	1831	7.4	1973	7.9
1200	1346	5.4	1547	6.2	1721	6.9	1874	7.5	2014	8.1
1275	1403	5.6	1598	6.4	1768	7.1	1919	7.7	2057	8.3
1350	1460	5.9	1651	6.6	1816	7.3	1965	7.9	2100	8.4
1425	1519	6.1	1703	6.8	1865	7.5	2012	8.1	2145	8.6
1500	1579	6.3	1757	7.1	1916	7.7	2059	8.3	2191	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
900	1994	8.0	2121	8.5	2241	9.0	2354	9.5	2461	9.9
975	2029	8.1	2155	8.7	2274	9.1	2386	9.6	—	—
1050	2066	8.3	2190	8.8	2307	9.3	2419	9.7	—	—
1125	2104	8.4	2227	8.9	2343	9.4	2453	9.9	—	—
1200	2144	8.6	2265	9.1	2379	9.6	2488	10.0	—	—
1275	2184	8.8	2304	9.3	2417	9.7	—	—	—	—
1350	2226	8.9	2345	9.4	2456	9.9	—	—	—	—
1425	2269	9.1	2386	9.6	—	—	—	—	—	—
1500	2313	9.3	2429	9.8	—	—	—	—	—	—

High Static 1129-2490 rpm

## APPENDIX C — FAN PERFORMANCE (cont)

### 48GEGM04 Three Phase — 3 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
900	1129	0.10	1356	0.17	1544	0.26	1708	0.35	1857	0.45
975	1182	0.11	1402	0.19	1586	0.28	1748	0.37	1894	0.47
1050	1236	0.13	1449	0.21	1630	0.30	1789	0.40	1933	0.50
1125	1290	0.15	1498	0.23	1675	0.33	1831	0.43	1973	0.53
1200	1346	0.17	1547	0.26	1721	0.35	1874	0.46	2014	0.57
1275	1403	0.19	1598	0.28	1768	0.38	1919	0.49	2057	0.61
1350	1460	0.22	1651	0.31	1816	0.42	1965	0.53	2100	0.64
1425	1519	0.24	1703	0.34	1865	0.45	2012	0.57	2145	0.69
1500	1579	0.27	1757	0.38	1916	0.49	2059	0.61	2191	0.73

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
900	1994	0.55	2121	0.66	2241	0.78	2354	0.91	2461	1.04
975	2029	0.58	2155	0.70	2274	0.82	2386	0.95	—	—
1050	2066	0.61	2190	0.73	2307	0.86	2419	0.99	—	—
1125	2104	0.65	2227	0.77	2343	0.90	2453	1.03	—	—
1200	2144	0.69	2265	0.81	2379	0.94	2488	1.07	—	—
1275	2184	0.73	2304	0.85	2417	0.98	—	—	—	—
1350	2226	0.77	2345	0.90	2456	1.03	—	—	—	—
1425	2269	0.81	2386	0.95	—	—	—	—	—	—
1500	2313	0.86	2429	1.00	—	—	—	—	—	—

Standard/Medium Static 1129-2190 rpm, 0.71 max bhp

High Static 1129-2490 rpm, 1.07 max bhp

### 48GEGM04 Three Phase — Standard/Medium Static — 3 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
900	1129	5.2	1356	6.2	1544	7.1	1708	7.8	1857	8.5
975	1182	5.4	1402	6.4	1586	7.2	1748	8.0	1894	8.6
1050	1236	5.6	1449	6.6	1630	7.4	1789	8.2	1933	8.8
1125	1290	5.9	1498	6.8	1675	7.6	1831	8.4	1973	9.0
1200	1346	6.1	1547	7.1	1721	7.9	1874	8.6	2014	9.2
1275	1403	6.4	1598	7.3	1768	8.1	1919	8.8	2057	9.4
1350	1460	6.7	1651	7.5	1816	8.3	1965	9.0	2100	9.6
1425	1519	6.9	1703	7.8	1865	8.5	2012	9.2	2145	9.8
1500	1579	7.2	1757	8.0	1916	8.7	2059	9.4	—	—

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
900	1994	9.1	2121	9.7	—	—	—	—	—	—
975	2029	9.3	2155	9.8	—	—	—	—	—	—
1050	2066	9.4	—	—	—	—	—	—	—	—
1125	2104	9.6	—	—	—	—	—	—	—	—
1200	2144	9.8	—	—	—	—	—	—	—	—
1275	—	—	—	—	—	—	—	—	—	—
1350	—	—	—	—	—	—	—	—	—	—
1425	—	—	—	—	—	—	—	—	—	—
1500	—	—	—	—	—	—	—	—	—	—

Standard/Medium Static 1129-2190 rpm

## APPENDIX C — FAN PERFORMANCE (cont)

### 48GEGM04 Three Phase — High Static — 3 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
900	1129	4.5	1356	5.4	1544	6.2	1708	6.9	1857	7.5
975	1182	4.7	1402	5.6	1586	6.4	1748	7.0	1894	7.6
1050	1236	5.0	1449	5.8	1630	6.5	1789	7.2	1933	7.8
1125	1290	5.2	1498	6.0	1675	6.7	1831	7.4	1973	7.9
1200	1346	5.4	1547	6.2	1721	6.9	1874	7.5	2014	8.1
1275	1403	5.6	1598	6.4	1768	7.1	1919	7.7	2057	8.3
1350	1460	5.9	1651	6.6	1816	7.3	1965	7.9	2100	8.4
1425	1519	6.1	1703	6.8	1865	7.5	2012	8.1	2145	8.6
1500	1579	6.3	1757	7.1	1916	7.7	2059	8.3	2191	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
900	1994	8.0	2121	8.5	2241	9.0	2354	9.5	2461	9.9
975	2029	8.1	2155	8.7	2274	9.1	2386	9.6	—	—
1050	2066	8.3	2190	8.8	2307	9.3	2419	9.7	—	—
1125	2104	8.4	2227	8.9	2343	9.4	2453	9.9	—	—
1200	2144	8.6	2265	9.1	2379	9.6	2488	10.0	—	—
1275	2184	8.8	2304	9.3	2417	9.7	—	—	—	—
1350	2226	8.9	2345	9.4	2456	9.9	—	—	—	—
1425	2269	9.1	2386	9.6	—	—	—	—	—	—
1500	2313	9.3	2429	9.8	—	—	—	—	—	—

High Static 1129-2490 rpm

## APPENDIX C — FAN PERFORMANCE (cont)

### 48GEHM05 Single Phase — 4 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
1200	1262	0.21	1453	0.33	1614	0.45	1757	0.58	1888	0.72
1300	1333	0.25	1517	0.37	1674	0.50	1813	0.63	1942	0.78
1400	1405	0.29	1583	0.42	1735	0.55	1872	0.70	1997	0.84
1500	1478	0.34	1650	0.48	1799	0.62	1932	0.76	2055	0.92
1600	1552	0.40	1718	0.54	1863	0.68	1994	0.84	2114	1.00
1700	1627	0.46	1787	0.60	1929	0.76	2057	0.92	2174	1.09
1800	1704	0.52	1857	0.68	1995	0.84	2121	1.01	2236	1.18
1900	1781	0.60	1929	0.76	2063	0.93	2186	1.10	2299	1.28
2000	1859	0.68	2001	0.85	2132	1.02	2252	1.21	2363	1.39

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
1200	2011	0.87	2126	1.02	2236	1.19	2341	1.37	—	—
1300	2061	0.93	2174	1.09	2281	1.26	2383	1.44	—	—
1400	2114	1.00	2224	1.17	2329	1.34	2429	1.52	—	—
1500	2169	1.08	2277	1.25	2379	1.43	—	—	—	—
1600	2226	1.17	2331	1.34	2432	1.52	—	—	—	—
1700	2284	1.26	2388	1.44	—	—	—	—	—	—
1800	2344	1.36	2446	1.55	—	—	—	—	—	—
1900	2405	1.47	—	—	—	—	—	—	—	—
2000	—	—	—	—	—	—	—	—	—	—

Standard/Medium Static 1262-2170 rpm, 1.06 max bhp

High Static 1262-2460 rpm, 1.53 max bhp

### 48GEHM05 Single Phase — Standard/Medium Static — 4 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
1200	1262	5.8	1453	6.7	1614	7.4	1757	8.1	1888	8.7
1300	1333	6.1	1517	7.0	1674	7.7	1813	8.4	1942	8.9
1400	1405	6.5	1583	7.3	1735	8.0	1872	8.6	1997	9.2
1500	1478	6.8	1650	7.6	1799	8.3	1932	8.9	2055	9.5
1600	1552	7.2	1718	7.9	1863	8.6	1994	9.2	2114	9.7
1700	1627	7.5	1787	8.2	1929	8.9	2057	9.5	—	—
1800	1704	7.9	1857	8.6	1995	9.2	2121	9.8	—	—
1900	1781	8.2	1929	8.9	2063	9.5	—	—	—	—
2000	1859	8.6	2001	9.2	2132	9.8	—	—	—	—

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
1200	2011	9.3	2126	9.8	—	—	—	—	—	—
1300	2061	9.5	—	—	—	—	—	—	—	—
1400	2114	9.7	—	—	—	—	—	—	—	—
1500	—	—	—	—	—	—	—	—	—	—
1600	—	—	—	—	—	—	—	—	—	—
1700	—	—	—	—	—	—	—	—	—	—
1800	—	—	—	—	—	—	—	—	—	—
1900	—	—	—	—	—	—	—	—	—	—
2000	—	—	—	—	—	—	—	—	—	—

Standard/Medium Static 1262-2170 rpm

## APPENDIX C — FAN PERFORMANCE (cont)

### 48GEHM05 Single Phase — High Static — 4 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
1200	1262	5.1	1453	5.9	1614	6.6	1757	7.1	1888	7.7
1300	1333	5.4	1517	6.2	1674	6.8	1813	7.4	1942	7.9
1400	1405	5.7	1583	6.4	1735	7.1	1872	7.6	1997	8.1
1500	1478	6.0	1650	6.7	1799	7.3	1932	7.9	2055	8.4
1600	1552	6.3	1718	7.0	1863	7.6	1994	8.1	2114	8.6
1700	1627	6.6	1787	7.3	1929	7.8	2057	8.4	2174	8.8
1800	1704	6.9	1857	7.5	1995	8.1	2121	8.6	2236	9.1
1900	1781	7.2	1929	7.8	2063	8.4	2186	8.9	2299	9.3
2000	1859	7.6	2001	8.1	2132	8.7	2252	9.2	2363	9.6

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
1200	2011	8.2	2126	8.6	2236	9.1	2341	9.5	2442	9.9
1300	2061	8.4	2174	8.8	2281	9.3	2383	9.7	—	—
1400	2114	8.6	2224	9.0	2329	9.5	2429	9.9	—	—
1500	2169	8.8	2277	9.3	2379	9.7	—	—	—	—
1600	2226	9.0	2331	9.5	2432	9.9	—	—	—	—
1700	2284	9.3	2388	9.7	—	—	—	—	—	—
1800	2344	9.5	2446	9.9	—	—	—	—	—	—
1900	2405	9.8	—	—	—	—	—	—	—	—
2000	—	—	—	—	—	—	—	—	—	—

High Static 1262-2460 rpm

## APPENDIX C — FAN PERFORMANCE (cont)

### 48GEHM05 Three Phase — 4 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
1200	1262	0.21	1452	0.33	1614	0.45	1757	0.58	1888	0.72
1300	1333	0.25	1516	0.37	1674	0.50	1813	0.63	1942	0.78
1400	1405	0.29	1583	0.42	1735	0.55	1872	0.70	1997	0.84
1500	1478	0.34	1650	0.48	1798	0.62	1932	0.76	2054	0.92
1600	1552	0.40	1718	0.54	1863	0.68	1993	0.84	2114	1.00
1700	1627	0.46	1787	0.60	1928	0.76	2057	0.92	2174	1.09
1800	1704	0.52	1857	0.68	1995	0.84	2121	1.01	2236	1.18
1900	1781	0.60	1929	0.76	2063	0.93	2185	1.10	2299	1.28
2000	1859	0.68	2001	0.85	2132	1.02	2252	1.21	2363	1.39

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
1200	2011	0.87	2126	1.02	2236	1.19	2341	1.37	2442	1.55
1300	2061	0.93	2174	1.09	2281	1.26	2384	1.44	2482	1.62
1400	2114	1.00	2224	1.17	2329	1.34	2429	1.52	2526	1.71
1500	2169	1.08	2277	1.25	2379	1.43	2477	1.61	2572	1.80
1600	2226	1.17	2331	1.34	2432	1.52	2528	1.71	2621	1.91
1700	2284	1.26	2388	1.44	2486	1.63	2581	1.82	—	—
1800	2344	1.36	2446	1.55	2543	1.74	2636	1.94	—	—
1900	2405	1.47	2505	1.66	2600	1.86	—	—	—	—
2000	2467	1.59	2565	1.78	2659	1.99	—	—	—	—

Standard Static 1262-2170 rpm, 1.06 max bhp

High Static 1262-2660 rpm, 1.96 max bhp

### 48GEHM05 Three Phase — Standard/Medium Static — 4 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
1200	1262	5.8	1453	6.7	1614	7.4	1757	8.1	1888	8.7
1300	1333	6.1	1517	7.0	1674	7.7	1813	8.4	1942	8.9
1400	1405	6.5	1583	7.3	1735	8.0	1872	8.6	1997	9.2
1500	1478	6.8	1650	7.6	1799	8.3	1932	8.9	2055	9.5
1600	1552	7.2	1718	7.9	1863	8.6	1994	9.2	2114	9.7
1700	1627	7.5	1787	8.2	1929	8.9	2057	9.5	—	—
1800	1704	7.9	1857	8.6	1995	9.2	2121	9.8	—	—
1900	1781	8.2	1929	8.9	2063	9.5	—	—	—	—
2000	1859	8.6	2001	9.2	2132	9.8	—	—	—	—

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
1200	2011	9.3	2126	9.8	—	—	—	—	—	—
1300	2061	9.5	—	—	—	—	—	—	—	—
1400	2114	9.7	—	—	—	—	—	—	—	—
1500	—	—	—	—	—	—	—	—	—	—
1600	—	—	—	—	—	—	—	—	—	—
1700	—	—	—	—	—	—	—	—	—	—
1800	—	—	—	—	—	—	—	—	—	—
1900	—	—	—	—	—	—	—	—	—	—
2000	—	—	—	—	—	—	—	—	—	—

Standard/Medium Static 1262-2170 rpm

## APPENDIX C — FAN PERFORMANCE (cont)

### 48GEHM05 Three Phase — High Static — 4 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
1200	1262	4.7	1452	5.5	1614	6.1	1757	6.6	1888	71
1300	1333	5.0	1516	5.7	1674	6.3	1813	6.8	1942	7.3
1400	1405	5.3	1583	6.0	1735	6.5	1872	7.0	1997	7.5
1500	1478	5.6	1650	6.2	1798	6.8	1932	7.3	2054	7.7
1600	1552	5.8	1718	6.5	1863	7.0	1993	7.5	2114	7.9
1700	1627	6.1	1787	6.7	1928	7.2	2057	7.7	2174	8.2
1800	1704	6.4	1857	7.0	1995	7.5	2121	8.0	2236	8.4
1900	1781	6.7	1929	7.3	2063	7.8	2185	8.2	2299	8.6
2000	1859	7.0	2001	7.5	2132	8.0	2252	8.5	2363	8.9

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
1200	2011	7.6	2126	8.0	2236	8.4	2341	8.8	2442	9.2
1300	2061	7.7	2174	8.2	2281	8.6	2384	9.0	2482	9.3
1400	2114	7.9	2224	8.4	2329	8.8	2429	9.1	2526	9.5
1500	2169	8.2	2277	8.6	2379	8.9	2477	9.3	2572	9.7
1600	2226	8.4	2331	8.8	2432	9.1	2528	9.5	2621	9.9
1700	2284	8.6	2388	9.0	2486	9.3	2581	9.7	—	—
1800	2344	8.8	2446	9.2	2543	9.6	2623	9.9	—	—
1900	2405	9.0	2505	9.4	2600	9.8	—	—	—	—
2000	2467	9.3	2565	9.6	2659	10.0	—	—	—	—

High Static 1262-2660 rpm

## APPENDIX C — FAN PERFORMANCE (cont)

### 48GEHM06 Single Phase — 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
1500	1388	0.28	1561	0.40	1712	0.53	1845	0.66	1967	0.80
1625	1473	0.34	1638	0.46	1785	0.60	1915	0.74	2034	0.89
1750	1561	0.40	1717	0.53	1859	0.68	1987	0.83	2104	0.98
1875	1650	0.47	1798	0.61	1935	0.77	2060	0.92	2174	1.08
2000	1741	0.56	1881	0.70	2013	0.86	2134	1.03	2247	1.20
2125	1832	0.65	1965	0.80	2092	0.97	2210	1.14	2320	1.32
2250	1925	0.75	2050	0.91	2172	1.08	2287	1.26	2394	1.45
2375	2018	0.87	2137	1.03	2254	1.21	2365	1.40	2470	1.59
2500	2112	1.00	2225	1.16	2337	1.35	2445	1.55	2547	1.75

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
1500	2079	0.95	2185	1.10	2286	1.26	2381	1.43	2473	1.60
1625	2145	1.04	2249	1.20	2347	1.37	2441	1.54	2531	1.71
1750	2212	1.14	2314	1.31	2410	1.48	2502	1.65	2591	1.84
1875	2281	1.25	2381	1.43	2476	1.60	2566	1.78	2653	1.97
2000	2351	1.37	2450	1.55	2543	1.74	2632	1.93	—	—
2125	2423	1.50	2520	1.69	2612	1.88	—	—	—	—
2250	2495	1.64	2591	1.84	—	—	—	—	—	—
2375	2569	1.79	—	—	—	—	—	—	—	—
2500	2644	1.95	—	—	—	—	—	—	—	—

Standard/Medium Static 1388-2390 rpm, 1.44 max bhp

High Static 1388-2660 rpm, 1.96 max bhp

### 48GEHM06 Single Phase — Standard/Medium Static — 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
1500	1387	5.8	1561	6.5	1711	7.2	1845	7.7	1966	8.2
1625	1473	6.2	1638	6.9	1784	7.5	1914	8.0	2034	8.5
1750	1560	6.5	1717	7.2	1859	7.8	1986	8.3	2103	8.8
1875	1650	6.9	1798	7.5	1935	8.1	2059	8.6	2174	9.1
2000	1741	7.3	1881	7.9	2012	8.4	2134	8.9	2246	9.4
2125	1832	7.7	1965	8.2	2091	8.7	2209	9.2	2320	9.7
2250	1925	8.1	2050	8.6	2172	9.1	2286	9.6	—	—
2375	2018	8.4	2137	8.9	2254	9.4	2365	9.9	—	—
2500	2113	8.8	2225	9.3	2337	9.8	—	—	—	—

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
1500	2079	8.7	2185	9.1	2285	9.6	2381	10.0	—	—
1625	2144	9.0	2248	9.4	2346	9.8	—	—	—	—
1750	2211	9.3	2313	9.7	—	—	—	—	—	—
1875	2281	9.5	2380	10.0	—	—	—	—	—	—
2000	2351	9.8	—	—	—	—	—	—	—	—
2125	—	—	—	—	—	—	—	—	—	—
2250	—	—	—	—	—	—	—	—	—	—
2375	—	—	—	—	—	—	—	—	—	—
2500	—	—	—	—	—	—	—	—	—	—

Standard/Medium Static 1388-2390 rpm

## APPENDIX C — FAN PERFORMANCE (cont)

### 48GEHM06 Single Phase — High Static — 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
1500	1388	5.2	1561	5.9	1712	6.4	1845	6.9	1967	7.4
1625	1473	5.5	1638	6.2	1785	6.7	1915	7.2	2034	7.6
1750	1561	5.9	1717	6.5	1859	7.0	1987	7.5	2104	7.9
1875	1650	6.2	1798	6.8	1935	7.3	2060	7.7	2174	8.2
2000	1741	6.5	1881	7.1	2013	7.6	2134	8.0	2247	8.4
2125	1832	6.9	1965	7.4	2092	7.9	2210	8.3	2320	8.7
2250	1925	7.2	2050	7.7	2172	8.2	2287	8.6	2394	9.0
2375	2018	7.6	2137	8.0	2254	8.5	2365	8.9	2470	9.3
2500	2112	7.9	2225	8.4	2337	8.8	2445	9.2	2547	9.6

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
1500	2079	7.8	2185	8.2	2286	8.6	2381	9.0	2473	9.3
1625	2145	8.1	2249	8.5	2347	8.8	2441	9.2	2531	9.5
1750	2212	8.3	2314	8.7	2410	9.1	2502	9.4	2591	9.7
1875	2281	8.6	2381	9.0	2476	9.3	2566	9.6	2653	10.0
2000	2351	8.8	2450	9.2	2543	9.6	2632	9.9	—	—
2125	2423	9.1	2520	9.5	2612	9.8	—	—	—	—
2250	2495	9.4	2591	9.7	—	—	—	—	—	—
2375	2569	9.7	—	—	—	—	—	—	—	—
2500	2644	9.9	—	—	—	—	—	—	—	—

High Static 1388-2660 rpm

## APPENDIX C — FAN PERFORMANCE (cont)

### 48GEHM06 Three Phase — 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
1500	1387	0.28	1560	0.40	1711	0.53	1845	0.66	1966	0.80
1625	1473	0.34	1638	0.46	1784	0.60	1915	0.74	2034	0.89
1750	1561	0.40	1717	0.53	1858	0.68	1986	0.83	2103	0.98
1875	1650	0.47	1798	0.61	1934	0.76	2059	0.92	2174	1.08
2000	1741	0.56	1881	0.70	2012	0.86	2133	1.02	2246	1.20
2125	1832	0.65	1965	0.80	2091	0.97	2209	1.14	2319	1.32
2250	1925	0.75	2050	0.91	2172	1.08	2286	1.26	2394	1.45
2375	2018	0.87	2137	1.03	2254	1.21	2364	1.40	2469	1.59
2500	2113	1.00	2225	1.16	2337	1.35	2444	1.54	2547	1.75

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
1500	2079	0.95	2185	1.10	2285	1.26	2381	1.43	2473	1.60
1625	2144	1.04	2248	1.20	2346	1.36	2440	1.53	2530	1.71
1750	2212	1.14	2313	1.31	2410	1.48	2502	1.65	2590	1.83
1875	2281	1.25	2381	1.43	2475	1.60	2566	1.78	2653	1.97
2000	2351	1.37	2449	1.55	2543	1.74	2632	1.93	2717	2.12
2125	2422	1.50	2519	1.69	2611	1.88	2699	2.08	2783	2.28
2250	2495	1.64	2590	1.84	2681	2.04	2767	2.24	—	—
2375	2569	1.79	2663	2.00	2752	2.20	—	—	—	—
2500	2643	1.95	2736	2.17	2824	2.38	—	—	—	—

Standard/Medium Static 1387-2390 rpm, 1.44 max bhp

High Static 1387-2836 rpm, 2.43 max bhp

### 48GEHM06 Three Phase — Standard/Medium Static — 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
1500	1387	5.8	1560	6.5	1711	7.2	1845	7.7	1966	8.2
1625	1473	6.2	1638	6.9	1784	7.5	1915	8.0	2034	8.5
1750	1561	6.5	1717	7.2	1858	7.8	1986	8.3	2103	8.8
1875	1650	6.9	1798	7.5	1934	8.1	2059	8.6	2174	9.1
2000	1741	7.3	1881	7.9	2012	8.4	2133	8.9	2246	9.4
2125	1832	7.7	1965	8.2	2091	8.7	2209	9.2	2319	9.7
2250	1925	8.1	2050	8.6	2172	9.1	2286	9.6	—	—
2375	2018	8.4	2137	8.9	2254	9.4	2364	9.9	—	—
2500	2113	8.8	2225	9.3	2337	9.8	—	—	—	—

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
1500	2079	8.7	2185	9.1	2285	9.6	2381	10.0	—	—
1625	2144	9.0	2248	9.4	2346	9.8	—	—	—	—
1750	2212	9.3	2313	9.7	—	—	—	—	—	—
1875	2281	9.5	2381	10.0	—	—	—	—	—	—
2000	2351	9.8	—	—	—	—	—	—	—	—
2125	—	—	—	—	—	—	—	—	—	—
2250	—	—	—	—	—	—	—	—	—	—
2375	—	—	—	—	—	—	—	—	—	—
2500	—	—	—	—	—	—	—	—	—	—

Standard/Medium Static 1387-2390 rpm

## APPENDIX C — FAN PERFORMANCE (cont)

### 48GEHM06 Three Phase — High Static — 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
1500	1387	4.9	1560	5.5	1711	6.0	1845	6.5	1966	6.9
1625	1473	5.2	1638	5.8	1784	6.3	1915	6.8	2034	7.2
1750	1561	5.5	1717	6.1	1858	6.6	1986	7.0	2103	7.4
1875	1650	5.8	1798	6.3	1934	6.8	2059	7.3	2174	7.7
2000	1741	6.1	1881	6.6	2012	7.1	2133	7.5	2246	7.9
2125	1832	6.5	1965	6.9	2091	7.4	2209	7.8	2319	8.2
2250	1925	6.8	2050	7.2	2172	7.7	2286	8.1	2394	8.4
2375	2018	7.1	2137	7.5	2254	7.9	2364	8.3	2469	8.7
2500	2113	7.5	2225	7.8	2337	8.2	2444	8.6	2547	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
1500	2079	7.3	2185	7.7	2285	8.1	2381	8.4	2473	8.7
1625	2144	7.6	2248	7.9	2346	8.3	2440	8.6	2530	8.9
1750	2212	7.8	2313	8.2	2410	8.5	2502	8.8	2590	9.1
1875	2281	8.0	2381	8.4	2475	8.7	2566	9.0	2653	9.4
2000	2351	8.3	2449	8.6	2543	9.0	2632	9.3	2717	9.6
2125	2422	8.5	2519	8.9	2611	9.2	2699	9.5	2783	9.8
2250	2495	8.8	2590	9.1	2681	9.5	2767	9.8	—	—
2375	2569	9.1	2663	9.4	2752	9.7	—	—	—	—
2500	2643	9.3	2736	9.6	2824	10.0	—	—	—	—

High Static 1387-2836 rpm

## APPENDIX C — FAN PERFORMANCE (cont)

### 48GEGM04 Single Phase — 3 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
900	1097	0.09	1331	0.16	1524	0.25	1692	0.34	1842	0.44
975	1146	0.10	1373	0.18	1562	0.27	1728	0.36	1877	0.46
1050	1197	0.12	1416	0.20	1601	0.29	1765	0.38	1912	0.49
1125	1249	0.14	1460	0.22	1642	0.31	1803	0.41	1949	0.52
1200	1303	0.15	1506	0.24	1684	0.33	1842	0.44	1986	0.55
1275	1359	0.17	1553	0.26	1727	0.36	1883	0.46	2025	0.58
1350	1415	0.20	1602	0.29	1771	0.39	1925	0.50	2064	0.61
1425	1472	0.22	1652	0.31	1817	0.42	1967	0.53	2105	0.65
1500	1530	0.25	1703	0.34	1863	0.45	2010	0.57	2147	0.69

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
900	1980	0.54	2107	0.65	2225	0.77	2337	0.89	2443	1.02
975	2013	0.57	2139	0.68	2258	0.80	2369	0.93	2475	1.06
1050	2048	0.60	2173	0.71	2291	0.84	2401	0.96	—	—
1125	2083	0.63	2207	0.75	2324	0.87	2435	1.01	—	—
1200	2119	0.66	2242	0.78	2359	0.91	2468	1.05	—	—
1275	2156	0.70	2278	0.82	2394	0.96	—	—	—	—
1350	2194	0.74	2315	0.86	2429	1.00	—	—	—	—
1425	2233	0.78	2353	0.91	2466	1.04	—	—	—	—
1500	2273	0.82	2391	0.95	—	—	—	—	—	—

Standard/Medium Static 1097-2190 rpm, 0.71 max bhp

High Static 1097-2490 rpm, 1.07 max bhp

### 48GEGM04 Single Phase — Standard/Medium Static — 3 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
900	1097	5.0	1331	6.1	1524	7.0	1692	7.7	1842	8.4
975	1146	5.2	1373	6.3	1562	7.1	1728	7.9	1877	8.6
1050	1197	5.5	1416	6.5	1601	7.3	1765	8.1	1912	8.7
1125	1249	5.7	1460	6.7	1642	7.5	1803	8.2	1949	8.9
1200	1303	5.9	1506	6.9	1684	7.7	1842	8.4	1986	9.1
1275	1359	6.2	1553	7.1	1727	7.9	1883	8.6	2025	9.2
1350	1415	6.5	1602	7.3	1771	8.1	1925	8.8	2064	9.4
1425	1472	6.7	1652	7.5	1817	8.3	1967	9.0	2105	9.6
1500	1530	7.0	1703	7.8	1863	8.5	2010	9.2	2147	9.8

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
900	1980	9.0	2107	9.6	—	—	—	—	—	—
975	2013	9.2	2139	9.8	—	—	—	—	—	—
1050	2048	9.4	2173	9.9	—	—	—	—	—	—
1125	2083	9.5	—	—	—	—	—	—	—	—
1200	2119	9.7	—	—	—	—	—	—	—	—
1275	2156	9.8	—	—	—	—	—	—	—	—
1350	—	—	—	—	—	—	—	—	—	—
1425	—	—	—	—	—	—	—	—	—	—
1500	—	—	—	—	—	—	—	—	—	—

Standard/Medium Static 1097-2190 rpm

## APPENDIX C — FAN PERFORMANCE (cont)

### 48GEGM04 Single Phase — High Static — 3 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
900	1097	4.4	1331	5.3	1524	6.1	1692	6.8	1842	7.4
975	1146	4.6	1373	5.5	1562	6.3	1728	6.9	1877	7.5
1050	1197	4.8	1416	5.7	1601	6.4	1765	7.1	1912	7.7
1125	1249	5.0	1460	5.9	1642	6.6	1803	7.2	1949	7.8
1200	1303	5.2	1506	6.0	1684	6.8	1842	7.4	1986	8.0
1275	1359	5.5	1553	6.2	1727	6.9	1883	7.6	2025	8.1
1350	1415	5.7	1602	6.4	1771	7.1	1925	7.7	2064	8.3
1425	1472	5.9	1652	6.6	1817	7.3	1967	7.9	2105	8.5
1500	1530	6.1	1703	6.8	1863	7.5	2010	8.1	2147	8.6

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
900	1980	8.0	2107	8.5	2225	8.9	2337	9.4	2443	9.8
975	2013	8.1	2139	8.6	2258	9.1	2369	9.5	2475	9.9
1050	2048	8.2	2173	8.7	2291	9.2	2401	9.6	—	—
1125	2083	8.4	2207	8.9	2324	9.3	2435	9.8	—	—
1200	2119	8.5	2242	9.0	2359	9.5	2468	9.9	—	—
1275	2156	8.7	2278	9.1	2394	9.6	—	—	—	—
1350	2194	8.8	2315	9.3	2429	9.8	—	—	—	—
1425	2233	9.0	2353	9.4	2466	9.9	—	—	—	—
1500	2273	9.1	2391	9.6	—	—	—	—	—	—

High Static 1097-2490 rpm

## APPENDIX C — FAN PERFORMANCE (cont)

### 48GEGM04 Three Phase — 3 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
900	1097	0.09	1331	0.16	1524	0.25	1692	0.34	1842	0.44
975	1146	0.10	1373	0.18	1562	0.27	1728	0.36	1877	0.46
1050	1197	0.12	1416	0.20	1601	0.29	1765	0.38	1912	0.49
1125	1249	0.14	1460	0.22	1642	0.31	1803	0.41	1949	0.52
1200	1303	0.15	1506	0.24	1684	0.33	1842	0.44	1986	0.55
1275	1359	0.17	1553	0.26	1727	0.36	1883	0.46	2025	0.58
1350	1415	0.20	1602	0.29	1771	0.39	1925	0.50	2064	0.61
1425	1472	0.22	1652	0.31	1817	0.42	1967	0.53	2105	0.65
1500	1530	0.25	1703	0.34	1863	0.45	2010	0.57	2147	0.69

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
900	1980	0.54	2107	0.65	2225	0.77	2337	0.89	2443	1.02
975	2013	0.57	2139	0.68	2258	0.80	2369	0.93	2475	1.06
1050	2048	0.60	2173	0.71	2291	0.84	2401	0.96	—	—
1125	2083	0.63	2207	0.75	2324	0.87	2435	1.01	—	—
1200	2119	0.66	2242	0.78	2359	0.91	2468	1.05	—	—
1275	2156	0.70	2278	0.82	2394	0.96	—	—	—	—
1350	2194	0.74	2315	0.86	2429	1.00	—	—	—	—
1425	2233	0.78	2353	0.91	2466	1.04	—	—	—	—
1500	2273	0.82	2391	0.95	—	—	—	—	—	—

Standard/Medium Static 1097-2190 rpm, 0.71 max bhp

High Static 1097-2490 rpm, 1.07 max bhp

### 48GEGM04 Three Phase — Standard/Medium Static — 3 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
900	1097	5.0	1331	6.1	1524	7.0	1692	7.7	1842	8.4
975	1146	5.2	1373	6.3	1562	7.1	1728	7.9	1877	8.6
1050	1197	5.5	1416	6.5	1601	7.3	1765	8.1	1912	8.7
1125	1249	5.7	1460	6.7	1642	7.5	1803	8.2	1949	8.9
1200	1303	5.9	1506	6.9	1684	7.7	1842	8.4	1986	9.1
1275	1359	6.2	1553	7.1	1727	7.9	1883	8.6	2025	9.2
1350	1415	6.5	1602	7.3	1771	8.1	1925	8.8	2064	9.4
1425	1472	6.7	1652	7.5	1817	8.3	1967	9.0	2105	9.6
1500	1530	7.0	1703	7.8	1863	8.5	2010	9.2	2147	9.8

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
900	1980	9.0	2107	9.6	—	—	—	—	—	—
975	2013	9.2	2139	9.8	—	—	—	—	—	—
1050	2048	9.4	2173	9.9	—	—	—	—	—	—
1125	2083	9.5	—	—	—	—	—	—	—	—
1200	2119	9.7	—	—	—	—	—	—	—	—
1275	2156	9.8	—	—	—	—	—	—	—	—
1350	—	—	—	—	—	—	—	—	—	—
1425	—	—	—	—	—	—	—	—	—	—
1500	—	—	—	—	—	—	—	—	—	—

Standard/Medium Static 1097-2190 rpm

## APPENDIX C — FAN PERFORMANCE (cont)

### 48GEGM04 Three Phase — High Static — 3 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
900	1097	4.4	1331	5.3	1524	6.1	1692	6.8	1842	7.4
975	1146	4.6	1373	5.5	1562	6.3	1728	6.9	1877	7.5
1050	1197	4.8	1416	5.7	1601	6.4	1765	7.1	1912	7.7
1125	1249	5.0	1460	5.9	1642	6.6	1803	7.2	1949	7.8
1200	1303	5.2	1506	6.0	1684	6.8	1842	7.4	1986	8.0
1275	1359	5.5	1553	6.2	1727	6.9	1883	7.6	2025	8.1
1350	1415	5.7	1602	6.4	1771	7.1	1925	7.7	2064	8.3
1425	1472	5.9	1652	6.6	1817	7.3	1967	7.9	2105	8.5
1500	1530	6.1	1703	6.8	1863	7.5	2010	8.1	2147	8.6

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
900	1980	8.0	2107	8.5	2225	8.9	2337	9.4	2443	9.8
975	2013	8.1	2139	8.6	2258	9.1	2369	9.5	2475	9.9
1050	2048	8.2	2173	8.7	2291	9.2	2401	9.6	—	—
1125	2083	8.4	2207	8.9	2324	9.3	2435	9.8	—	—
1200	2119	8.5	2242	9.0	2359	9.5	2468	9.9	—	—
1275	2156	8.7	2278	9.1	2394	9.6	—	—	—	—
1350	2194	8.8	2315	9.3	2429	9.8	—	—	—	—
1425	2233	9.0	2353	9.4	2466	9.9	—	—	—	—
1500	2273	9.1	2391	9.6	—	—	—	—	—	—

High Static 1097-2490 rpm

## APPENDIX C — FAN PERFORMANCE (cont)

### 48GEHM05 Single Phase — 4 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
1200	1217	0.19	1411	0.30	1576	0.42	1722	0.55	1855	0.68
1300	1283	0.23	1470	0.34	1631	0.46	1774	0.60	1904	0.74
1400	1351	0.26	1531	0.38	1688	0.51	1827	0.65	1955	0.80
1500	1420	0.31	1593	0.43	1746	0.57	1883	0.71	2008	0.86
1600	1491	0.35	1657	0.48	1805	0.63	1939	0.78	2062	0.93
1700	1563	0.41	1722	0.54	1866	0.69	1997	0.85	2118	1.01
1800	1635	0.46	1789	0.61	1928	0.76	2056	0.92	2174	1.09
1900	1709	0.53	1856	0.68	1991	0.84	2116	1.01	2232	1.18
2000	1784	0.60	1925	0.76	2056	0.92	2178	1.10	2291	1.28

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
1200	1978	0.83	2094	0.98	2204	1.15	2308	1.32	2409	1.50
1300	2025	0.89	2138	1.05	2246	1.21	2349	1.39	2447	1.57
1400	2074	0.95	2185	1.11	2291	1.28	2391	1.46	—	—
1500	2124	1.02	2234	1.19	2338	1.36	2436	1.54	—	—
1600	2176	1.10	2284	1.27	2386	1.45	—	—	—	—
1700	2230	1.18	2336	1.36	2436	1.54	—	—	—	—
1800	2285	1.27	2389	1.45	—	—	—	—	—	—
1900	2341	1.36	2444	1.55	—	—	—	—	—	—
2000	2398	1.46	—	—	—	—	—	—	—	—

Standard/Medium Static 1217-2170 rpm, 1.06 max bhp

High Static 1217-2460 rpm, 1.53, max bhp

### 48GEHM05 Single Phase — Standard/Medium Static — 4 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
1200	1217	5.6	1411	6.5	1576	7.3	1722	7.9	1855	8.5
1300	1283	5.9	1470	6.8	1631	7.5	1774	8.2	1904	8.8
1400	1351	6.2	1531	7.1	1688	7.8	1827	8.4	1955	9.0
1500	1420	6.5	1593	7.3	1746	8.0	1883	8.7	2008	9.3
1600	1491	6.9	1657	7.6	1805	8.3	1939	8.9	2062	9.5
1700	1563	7.2	1722	7.9	1866	8.6	1997	9.2	2118	9.8
1800	1635	7.5	1789	8.2	1928	8.9	2056	9.5	—	—
1900	1709	7.9	1856	8.6	1991	9.2	2116	9.8	—	—
2000	1784	8.2	1925	8.9	2056	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
1200	1978	9.1	2094	9.6	—	—	—	—	—	—
1300	2025	9.3	2138	9.9	—	—	—	—	—	—
1400	2074	9.6	—	—	—	—	—	—	—	—
1500	2124	9.8	—	—	—	—	—	—	—	—
1600	—	—	—	—	—	—	—	—	—	—
1700	—	—	—	—	—	—	—	—	—	—
1800	—	—	—	—	—	—	—	—	—	—
1900	—	—	—	—	—	—	—	—	—	—
2000	—	—	—	—	—	—	—	—	—	—

Standard/Medium Static 1217-2170 rpm

## APPENDIX C — FAN PERFORMANCE (cont)

### 48GEHM05 Single Phase — High Static — 4 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
1200	1217	4.9	1411	5.7	1576	6.4	1722	7.0	1855	7.5
1300	1283	5.2	1470	6.0	1631	6.6	1774	7.2	1904	7.7
1400	1351	5.5	1531	6.2	1688	6.9	1827	7.4	1955	7.9
1500	1420	5.8	1593	6.5	1746	7.1	1883	7.7	2008	8.2
1600	1491	6.1	1657	6.7	1805	7.3	1939	7.9	2062	8.4
1700	1563	6.4	1722	7.0	1866	7.6	1997	8.1	2118	8.6
1800	1635	6.6	1789	7.3	1928	7.8	2056	8.4	2174	8.8
1900	1709	6.9	1856	7.5	1991	8.1	2116	8.6	2232	9.1
2000	1784	7.3	1925	7.8	2056	8.4	2178	8.9	2291	9.3

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
1200	1978	8.0	2094	8.5	2204	9.0	2308	9.4	2409	9.8
1300	2025	8.2	2138	8.7	2246	9.1	2349	9.5	2447	9.9
1400	2074	8.4	2185	8.9	2291	9.3	2391	9.7	—	—
1500	2124	8.6	2234	9.1	2338	9.5	2436	9.9	—	—
1600	2176	8.8	2284	9.3	2386	9.7	—	—	—	—
1700	2230	9.1	2336	9.5	2436	9.9	—	—	—	—
1800	2285	9.3	2389	9.7	—	—	—	—	—	—
1900	2341	9.5	2444	9.9	—	—	—	—	—	—
2000	2398	9.7	—	—	—	—	—	—	—	—

High Static 1217-2460 rpm 1.53, max bhp

## APPENDIX C — FAN PERFORMANCE (cont)

### 48GEHM05 Three Phase — 4 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
1200	1216	0.19	1411	0.30	1576	0.42	1722	0.55	1855	0.68
1300	1283	0.23	1470	0.34	1631	0.46	1774	0.60	1904	0.74
1400	1351	0.26	1531	0.38	1687	0.51	1827	0.65	1955	0.80
1500	1420	0.31	1593	0.43	1746	0.57	1882	0.71	2008	0.86
1600	1491	0.35	1657	0.48	1806	0.63	1939	0.78	2062	0.93
1700	1562	0.41	1722	0.54	1866	0.69	1998	0.85	2117	1.01
1800	1636	0.47	1788	0.61	1928	0.76	2056	0.92	2175	1.09
1900	1710	0.53	1856	0.68	1991	0.84	2117	1.01	2233	1.18
2000	1784	0.60	1924	0.76	2055	0.92	2178	1.10	2292	1.28

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
1200	1978	0.83	2094	0.98	2204	1.15	2308	1.32	2409	1.50
1300	2025	0.89	2138	1.05	2246	1.21	2349	1.39	2447	1.57
1400	2073	0.95	2185	1.11	2291	1.28	2392	1.46	2488	1.64
1500	2124	1.02	2233	1.19	2338	1.36	2437	1.54	2532	1.73
1600	2176	1.10	2284	1.27	2386	1.45	2483	1.63	2577	1.82
1700	2230	1.18	2336	1.36	2436	1.54	2532	1.73	2624	1.92
1800	2285	1.27	2389	1.45	2488	1.64	2582	1.83	—	—
1900	2341	1.36	2443	1.55	2541	1.74	2634	1.94	—	—
2000	2399	1.46	2499	1.66	2595	1.85	—	—	—	—

Standard/Medium Static 1216-2170 rpm, 1.06 max bhp

High Static 1216-2660 rpm, 1.96 max bhp

### 48GEHM05 Three Phase — Standard/Medium Static — 4 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
1200	1216	5.6	1411	6.5	1576	7.3	1722	7.9	1855	8.5
1300	1283	5.9	1470	6.8	1631	7.5	1774	8.2	1904	8.8
1400	1351	6.2	1531	7.1	1687	7.8	1827	8.4	1955	9.0
1500	1420	6.5	1593	7.3	1746	8.0	1882	8.7	2008	9.3
1600	1491	6.9	1657	7.6	1806	8.3	1939	8.9	2062	9.5
1700	1562	7.2	1722	7.9	1866	8.6	1998	9.2	2117	9.8
1800	1636	7.5	1788	8.2	1928	8.9	2056	9.5	—	—
1900	1710	7.9	1856	8.6	1991	9.2	2117	9.8	—	—
2000	1784	8.2	1924	8.9	2055	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
1200	1978	9.1	2094	9.6	—	—	—	—	—	—
1300	2025	9.3	2138	9.9	—	—	—	—	—	—
1400	2073	9.6	—	—	—	—	—	—	—	—
1500	2124	9.8	—	—	—	—	—	—	—	—
1600	—	—	—	—	—	—	—	—	—	—
1700	—	—	—	—	—	—	—	—	—	—
1800	—	—	—	—	—	—	—	—	—	—
1900	—	—	—	—	—	—	—	—	—	—
2000	—	—	—	—	—	—	—	—	—	—

Medium Static 1216-2170 rpm

## APPENDIX C — FAN PERFORMANCE (cont)

### 48GEHM05 Three Phase — High Static — 4 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
1200	1216	4.6	1411	5.3	1576	5.9	1722	6.5	1855	7.0
1300	1283	4.8	1470	5.5	1631	6.1	1774	6.7	1904	7.2
1400	1351	5.1	1531	5.8	1687	6.3	1827	6.9	1955	7.3
1500	1420	5.3	1593	6.0	1746	6.6	1882	7.1	2008	7.5
1600	1491	5.6	1657	6.2	1806	6.8	1939	7.3	2062	7.8
1700	1562	5.9	1722	6.5	1866	7.0	1998	7.5	2117	8.0
1800	1636	6.2	1788	6.7	1928	7.2	2056	7.7	2175	8.2
1900	1710	6.4	1856	7.0	1991	7.5	2117	8.0	2233	8.4
2000	1784	6.7	1924	7.2	2055	7.7	2178	8.2	2292	8.6

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
1200	1978	7.4	2094	7.9	2204	8.3	2308	8.7	2409	9.1
1300	2025	7.6	2138	8.0	2246	8.4	2349	8.8	2447	9.2
1400	2073	7.8	2185	8.2	2291	8.6	2392	9.0	2488	9.4
1500	2124	8.0	2233	8.4	2338	8.8	2437	9.2	2532	9.5
1600	2176	8.2	2284	8.6	2386	9.0	2483	9.3	2577	9.7
1700	2230	8.4	2336	8.8	2436	9.2	2532	9.5	2624	9.9
1800	2285	8.6	2389	9.0	2488	9.4	2582	9.7	—	—
1900	2341	8.8	2443	9.2	2541	9.6	2634	9.9	—	—
2000	2399	9.0	2499	9.4	2595	9.8	—	—	—	—

High Static 1216-2660 rpm

## APPENDIX C — FAN PERFORMANCE (cont)

### 48GEHM06 Single Phase — 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
1500	1335	0.25	1508	0.36	1661	0.49	1797	0.62	1921	0.75
1625	1418	0.30	1580	0.42	1727	0.55	1861	0.68	1983	0.83
1750	1502	0.36	1654	0.48	1797	0.61	1927	0.76	2046	0.91
1875	1589	0.42	1731	0.55	1867	0.69	1994	0.84	2111	0.99
2000	1676	0.50	1810	0.63	1940	0.77	2063	0.93	2177	1.09
2125	1765	0.58	1891	0.71	2015	0.86	2133	1.02	2245	1.19
2250	1855	0.67	1973	0.81	2091	0.96	2206	1.13	2314	1.31
2375	1946	0.78	2057	0.92	2169	1.07	2279	1.25	2385	1.43
2500	2038	0.89	2142	1.03	2249	1.20	2355	1.37	2457	1.56

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
1500	2036	0.89	2143	1.04	2245	1.20	2342	1.36	2435	1.53
1625	2096	0.97	2201	1.13	2301	1.29	2396	1.46	2487	1.63
1750	2157	1.06	2261	1.22	2359	1.39	2453	1.56	2542	1.74
1875	2220	1.16	2322	1.32	2419	1.49	2511	1.67	2600	1.85
2000	2284	1.26	2385	1.43	2480	1.61	2571	1.79	2658	1.98
2125	2350	1.37	2449	1.55	2543	1.73	2632	1.92	—	—
2250	2417	1.49	2514	1.67	2607	1.87	—	—	—	—
2375	2485	1.62	2581	1.81	—	—	—	—	—	—
2500	2555	1.76	2648	1.95	—	—	—	—	—	—

Standard/Medium Static 1335-2390 rpm, 1.44 max bhp

High Static 1335-2660 rpm, 1.96 max bhp

### 48GEHM06 Single Phase — Standard/Medium Static — 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
1500	1335	5.6	1507	6.3	1660	6.9	1796	7.5	1921	8.0
1625	1417	5.9	1580	6.6	1727	7.2	1860	7.8	1982	8.3
1750	1502	6.3	1654	6.9	1796	7.5	1926	8.1	2046	8.6
1875	1589	6.6	1731	7.2	1867	7.8	1993	8.3	2110	8.8
2000	1677	7.0	1810	7.6	1940	8.1	2062	8.6	2177	9.1
2125	1765	7.4	1890	7.9	2015	8.4	2133	8.9	2244	9.4
2250	1855	7.8	1972	8.3	2091	8.7	2206	9.2	2314	9.7
2375	1946	8.1	2057	8.6	2169	9.1	2279	9.5	2385	10.0
2500	2038	8.5	2142	9.0	2249	9.4	2355	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
1500	2036	8.5	2143	9.0	2245	9.4	2342	9.8	—	—
1625	2095	8.8	2201	9.2	2301	9.6	—	—	—	—
1750	2157	9.0	2261	9.5	2359	9.9	—	—	—	—
1875	2219	9.3	2322	9.7	—	—	—	—	—	—
2000	2284	9.6	2384	10.0	—	—	—	—	—	—
2125	2349	9.8	—	—	—	—	—	—	—	—
2250	—	—	—	—	—	—	—	—	—	—
2375	—	—	—	—	—	—	—	—	—	—
2500	—	—	—	—	—	—	—	—	—	—

Standard/Medium Static 1335-2390 rpm

## APPENDIX C — FAN PERFORMANCE (cont)

### 48GEHM06 Single Phase — High Static — 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
1500	1335	5.0	1508	5.7	1661	6.2	1797	6.8	1921	7.2
1625	1418	5.3	1580	5.9	1727	6.5	1861	7.0	1983	7.5
1750	1502	5.6	1654	6.2	1797	6.8	1927	7.2	2046	7.7
1875	1589	6.0	1731	6.5	1867	7.0	1994	7.5	2111	7.9
2000	1676	6.3	1810	6.8	1940	7.3	2063	7.8	2177	8.2
2125	1765	6.6	1891	7.1	2015	7.6	2133	8.0	2245	8.4
2250	1855	7.0	1973	7.4	2091	7.9	2206	8.3	2314	8.7
2375	1946	7.3	2057	7.7	2169	8.2	2279	8.6	2385	9.0
2500	2038	7.7	2142	8.1	2249	8.5	2355	8.9	2457	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
1500	2036	7.7	2143	8.1	2245	8.4	2342	8.8	2435	9.2
1625	2096	7.9	2201	8.3	2301	8.7	2396	9.0	2487	9.3
1750	2157	8.1	2261	8.5	2359	8.9	2453	9.2	2542	9.6
1875	2220	8.3	2322	8.7	2419	9.1	2511	9.4	2600	9.8
2000	2284	8.6	2385	9.0	2480	9.3	2571	9.7	2658	10.0
2125	2350	8.8	2449	9.2	2543	9.6	2632	9.9	—	—
2250	2417	9.1	2514	9.5	2607	9.8	—	—	—	—
2375	2485	9.3	2581	9.7	—	—	—	—	—	—
2500	2555	9.6	2648	10.0	—	—	—	—	—	—

High Static 1335-2660 rpm

## APPENDIX C — FAN PERFORMANCE (cont)

### 48GEHM06 Three Phase — 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
1500	1335	0.25	1507	0.36	1660	0.49	1796	0.61	1921	0.75
1625	1418	0.30	1579	0.42	1727	0.55	1860	0.68	1982	0.82
1750	1502	0.36	1654	0.48	1797	0.61	1927	0.76	2046	0.91
1875	1589	0.42	1731	0.55	1867	0.69	1994	0.84	2111	0.99
2000	1676	0.50	1810	0.63	1940	0.77	2063	0.93	2177	1.09
2125	1765	0.58	1890	0.71	2015	0.86	2133	1.02	2245	1.19
2250	1855	0.67	1973	0.81	2091	0.96	2206	1.13	2314	1.31
2375	1946	0.78	2057	0.92	2169	1.07	2279	1.25	2385	1.43
2500	2038	0.89	2142	1.03	2249	1.20	2355	1.37	2457	1.56

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
1500	2036	0.89	2144	1.05	2245	1.20	2342	1.36	2435	1.53
1625	2095	0.97	2201	1.13	2301	1.29	2396	1.46	2487	1.63
1750	2157	1.06	2261	1.22	2359	1.39	2453	1.56	2543	1.74
1875	2219	1.15	2322	1.32	2419	1.49	2511	1.67	2599	1.85
2000	2284	1.26	2384	1.43	2480	1.61	2571	1.79	2658	1.98
2125	2350	1.37	2449	1.55	2542	1.73	2632	1.92	2718	2.12
2250	2417	1.49	2514	1.67	2607	1.87	2695	2.06	2779	2.26
2375	2485	1.62	2581	1.81	2672	2.01	2759	2.21	—	—
2500	2555	1.76	2648	1.95	2738	2.16	2824	2.37	—	—

Standard/Medium Static 1335-2390 rpm, 1.44 max bhp

High Static 1335-2836 rpm, 2.43 max bhp

### 48GEHM06 Three Phase — Standard/Medium Static — 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
1500	1335	5.6	1507	6.3	1660	6.9	1796	7.5	1921	8.0
1625	1418	5.9	1579	6.6	1727	7.2	1860	7.8	1982	8.3
1750	1502	6.3	1654	6.9	1797	7.5	1927	8.1	2046	8.6
1875	1589	6.6	1731	7.2	1867	7.8	1994	8.3	2111	8.8
2000	1676	7.0	1810	7.6	1940	8.1	2063	8.6	2177	9.1
2125	1765	7.4	1890	7.9	2015	8.4	2133	8.9	2245	9.4
2250	1855	7.8	1973	8.3	2091	8.7	2206	9.2	2314	9.7
2375	1946	8.1	2057	8.6	2169	9.1	2279	9.5	2385	10.0
2500	2038	8.5	2142	9.0	2249	9.4	2355	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
1500	2036	8.5	2144	9.0	2245	9.4	2342	9.8	—	—
1625	2095	8.8	2201	9.2	2301	9.6	—	—	—	—
1750	2157	9.0	2261	9.5	2359	9.9	—	—	—	—
1875	2219	9.3	2322	9.7	—	—	—	—	—	—
2000	2284	9.6	2384	10.0	—	—	—	—	—	—
2125	2350	9.8	—	—	—	—	—	—	—	—
2250	—	—	—	—	—	—	—	—	—	—
2375	—	—	—	—	—	—	—	—	—	—
2500	—	—	—	—	—	—	—	—	—	—

Standard/Medium Static 1335-2390 rpm

## APPENDIX C — FAN PERFORMANCE (cont)

### 48GEHM06 Three Phase — High Static — 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
1500	1335	4.7	1507	5.3	1660	5.9	1796	6.3	1921	6.8
1625	1418	5.0	1579	5.6	1727	6.1	1860	6.6	1982	7.0
1750	1502	5.3	1654	5.8	1797	6.3	1927	6.8	2046	7.2
1875	1589	5.6	1731	6.1	1867	6.6	1994	7.0	2111	7.4
2000	1676	5.9	1810	6.4	1940	6.8	2063	7.3	2177	7.7
2125	1765	6.2	1890	6.7	2015	7.1	2133	7.5	2245	7.9
2250	1855	6.5	1973	7.0	2091	7.4	2206	7.8	2314	8.2
2375	1946	6.9	2057	7.3	2169	7.6	2279	8.0	2385	8.4
2500	2038	7.2	2142	7.6	2249	7.9	2355	8.3	2457	8.7

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
1500	2036	7.2	2144	7.6	2245	7.9	2342	8.3	2435	8.6
1625	2095	7.4	2201	7.8	2301	8.1	2396	8.4	2487	8.8
1750	2157	7.6	2261	8.0	2359	8.3	2453	8.6	2543	9.0
1875	2219	7.8	2322	8.2	2419	8.5	2511	8.9	2599	9.2
2000	2284	8.1	2384	8.4	2480	8.7	2571	9.1	2658	9.4
2125	2350	8.3	2449	8.6	2542	9.0	2632	9.3	2718	9.6
2250	2417	8.5	2514	8.9	2607	9.2	2695	9.5	2779	9.8
2375	2485	8.8	2581	9.1	2672	9.4	2759	9.7	—	—
2500	2555	9.0	2648	9.3	2738	9.7	2824	10.0	—	—

High Static 1335-2836 rpm

## APPENDIX D – WIRING DIAGRAMS

### 48GE(G/H)\*04-06 — Ultra Low NOx — Wiring Diagrams

UNIT	VOLTAGE	CONTROL	PAGE	POWER	PAGE
48GE(G/H)*04-06 Electromechanical with POL224 Controller	208/230-1-60	48TC007304	108	48TC005590	111
	208/230-3-60	48TC007303	109	48TC005591	112
	460-3-60			48TC005592	113
48GE(G/H)*04-06 with SystemVu Controller	208/230-1-60	48TC007307	110	48TC005593	114
	208/230-3-60			48TC005594	115
	460-3-60			48TC005595	116

## APPENDIX D — WIRING DIAGRAMS (cont)

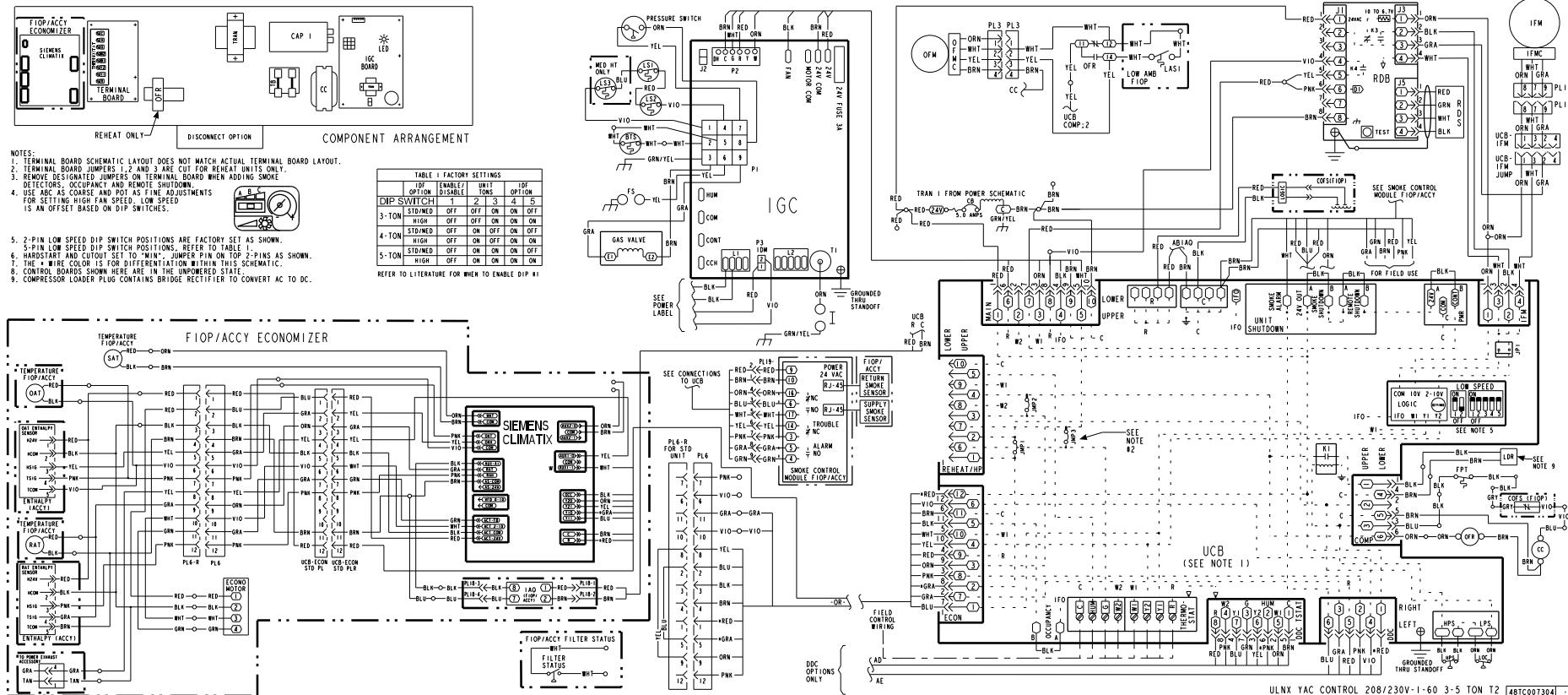


Fig. B — Control Wiring Diagram — 48GE(G/H)\*04-06 208/230-1-60 Unit — Electromechanical with POL224 Controller

## APPENDIX D – WIRING DIAGRAMS (cont)

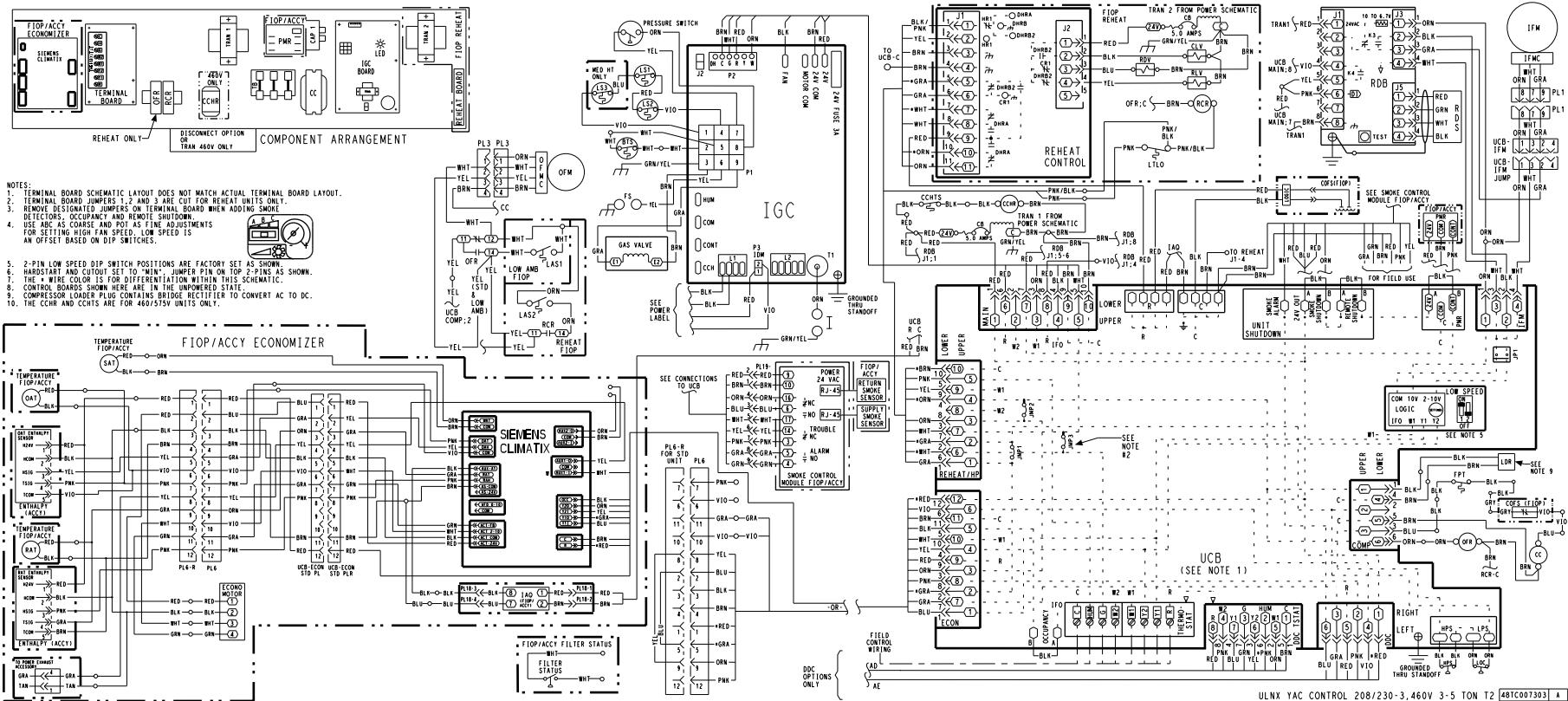


Fig. C – Control Wiring Diagram – 48GE(G/H)\*04-06 208/230,460-3-60 Unit – Electromechanical with POL224 Controller

## APPENDIX D — WIRING DIAGRAMS (cont)

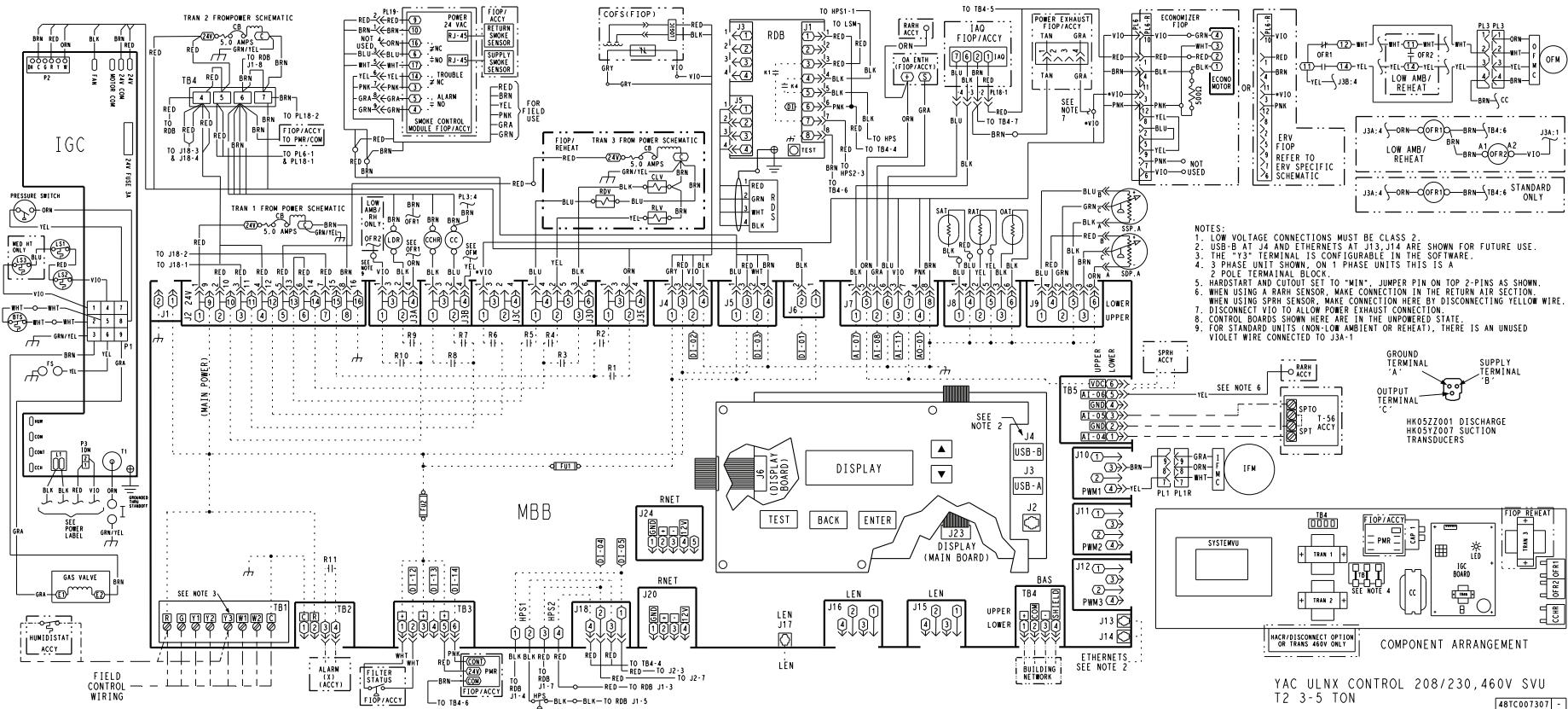
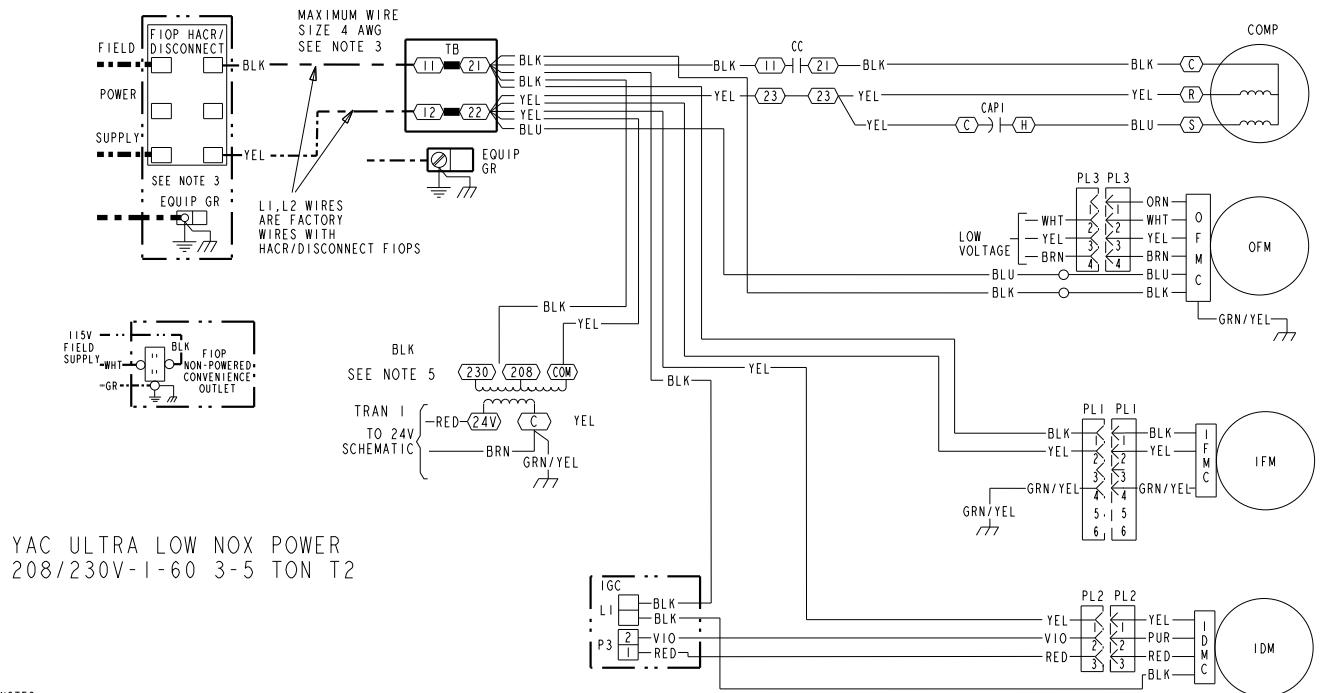


Fig. D — Control Wiring Diagram — 48GE(G/H)\*04-06 208/230, 460-3-60 Units with SystemVu™ Controller

## APPENDIX D — WIRING DIAGRAMS (cont)



ACCY	ACCESSORY	HPC	HEAD PRESSURE CONTROL	PER	POWER EXHAUST RELAY
AUX	AUXILIARY	HPS	HIGH PRESSURE SWITCH	PH	PHASE
AWG	AMERICAN WIRE GAGE	HUM	HUMIDISTAT	PL	PLUG ASSEMBLY
BA	BUILDING AUTOMATION NETWORK	IAQ	INDOOR AIR QUALITY SENSORS	POT	POTENTIOMETER
CC	CONTACTOR,COMPRESSOR	IDM	INDUCED DRAFT MOTOR	PMR	PHASE MONITOR RELAY
C	COMMON	IDMC	INDUCER DRAFT MOTOR CONTROLLER	PS	PRESSURE SWITCH
CAP	CAPACITOR	IDMR	INDUCED DRAFT RELAY	PTM	PULSE MODULATION
CB	CIRCUIT BREAKER	IFM	INDOOR FAN MOTOR	QT	QUADRUPLE TERMINAL
CCH	CRANKCASE HEATER	IFO	INDOOR FAN ON SIGNAL	RAT	RETURN AIR TEMP. SEN
CCHR	CRANKCASE HEATER RELAY	IGC	INTEGRATED GAS CONTROL	RCR	REHEAT CONTROL RELAY
CCHTS	CRANKCASE HEATER TEMP SWITCH	IRH	INDOOR RELATIVE HUMIDITY	RDB	REFRIGERANT DISSIPATION BOARD
CLO	COMPRESSOR LOCKOUT	JMP	JUMPER	RDS	REFRIGERANT DISSIPATION SENSOR
CLV	COOLING LIQUID VALVE	LT	LINE	RDV	RELAY DISCHARGE VALVE
CMB	CENTRIFUGAL MOTOR BLOWER	LA	LOW AMBIENT LOCKOUT	RLV	RELATIVE LIQUID VALVE
CNS	CONDENSATE OVERFLOW SWITCH	LAR	LOW AMBIENT RELAY	RNET	LOCAL ACCESS NETWORK
COM	SIGNAL COMMON	LAS	LOW AMBIENT SWITCH	RS	ROLLOUT SWITCH
COMP	COMPRESSOR MOTOR	LDR	COMPRESSOR LOADER	RVS	REVERSING VALVE SOLENOID
DDC	DIRECT DIGITAL CONTROL	LEN	LOCAL EQUIPMENT NETWORK	SAT	SUPPLY AIR TEMP SENSOR
DFB	DEFROST BOARD	LOC	LOSS OF CHARGE	SDP	SYSTEM DISCHARGE PRESSURE
DET	DEFROST THERMOSTAT	LOOP PWR	CURRENT LOOP POWER	SPRH	SPACE RELATIVE HUMIDITY
EHR	ELECTRIC HEAT RELAY	LPS	LOW PRESSURE SWITCH	SPTO	SPACE TEMPERATURE SENSOR
ENTH	ENTHALPY	LS	LIMIT SWITCH	SSP	SYSTEM SUCTION PRESSURE
EQUIP	EQUIPMENT	LSM	LIMIT SWITCH (MANUAL RESET)	STD	STANDARD
ERV	ENERGY RECOVERY VENTILATOR	LTLO	LOW TEMP LOCKOUT	SW	SWITCH
ESL	ENTHALPY SENSOR - LOW	MBB	MAIN BASE BOARD	TB	TERMINAL BLOCK
FB	FUSE BLOCK	MOV	METAL OXIDE VARISTOR	TDR	TIME DELAY RELAY
FIOP	FACTORY INSTALLED OPTION	MTR	MOTOR	TRAN	TRANSFORMER
FPT	FREEZE PROTECTION THERMOSTAT	OAO	OUTDOOR AIR QUALITY	UCB	USER CONTROL BOARD
FS	FLAME SWITCH	OAT	OUTDOOR AIR TEMP. SEN	W1	1st STAGE OF HEATING CALL
FST	FAN HOUSING TEMP SENSOR	OFM	OUTDOOR FAN MOTOR	W2	2nd STAGE OF HEATING CALL
FU	FUSE	OFMC	OUTDOOR FAN MOTOR CONTROL	Y1	1st STAGE OF COOLING CALL
G	THERMOSTAT FAN CALL	OFR	OUTDOOR FAN RELAY	Y2	2nd STAGE OF COOLING CALL
GR(GND)	GROUND	OL	OVERLOAD		
HACR	HEATING, AIR-CONDITIONING, REFRIGERATION BREAKER				
HGRH	HOT GAS REHEAT				

48TC005590 A

Fig. E — Power Wiring Diagram — 48GE(G/H)\*04-06 208/230-1-60 Unit  
Electromechanical with POL224 Controller

## APPENDIX D — WIRING DIAGRAMS (cont)

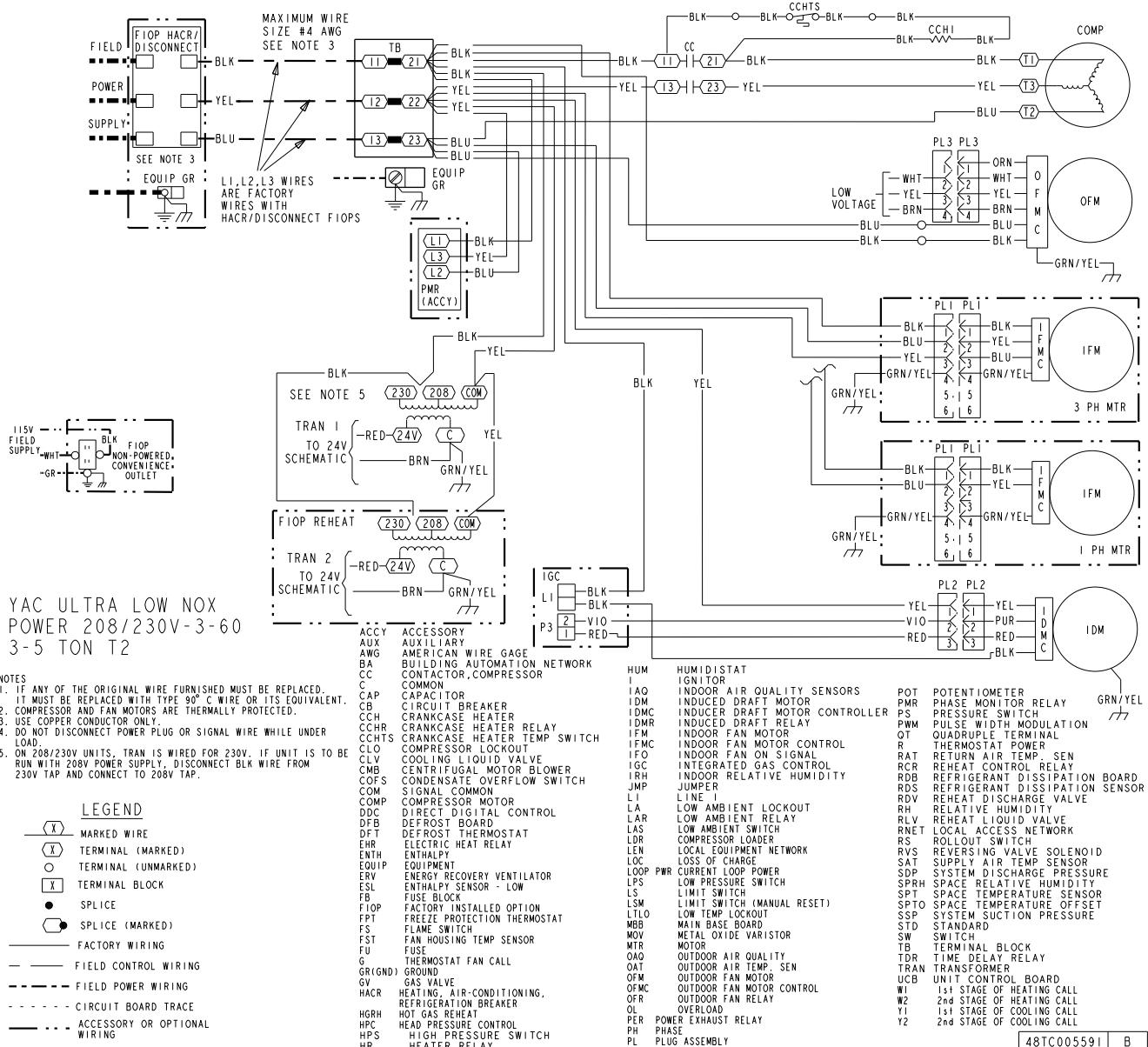


Fig. F — Power Wiring Diagram — 48GE(G/H)\*04-06 208/230-3-60 Unit Electromechanical with POL224 Controller

## APPENDIX D — WIRING DIAGRAMS (cont)

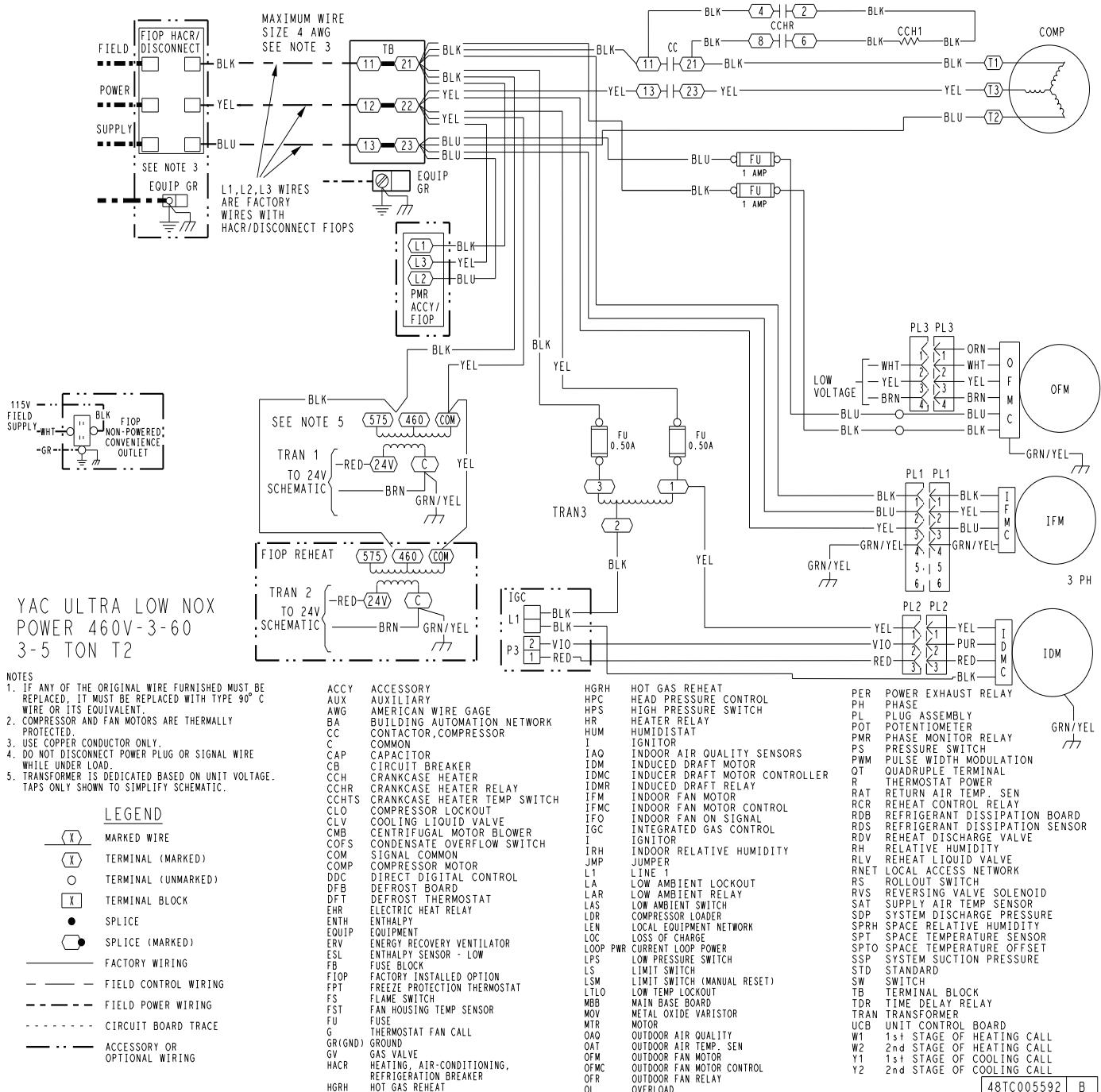


Fig. G — Power Wiring Diagram — 48GE(G/H)\*04-06 460-3-60 Unit  
Electromechanical with POL224 Controller

## APPENDIX D — WIRING DIAGRAMS (cont)

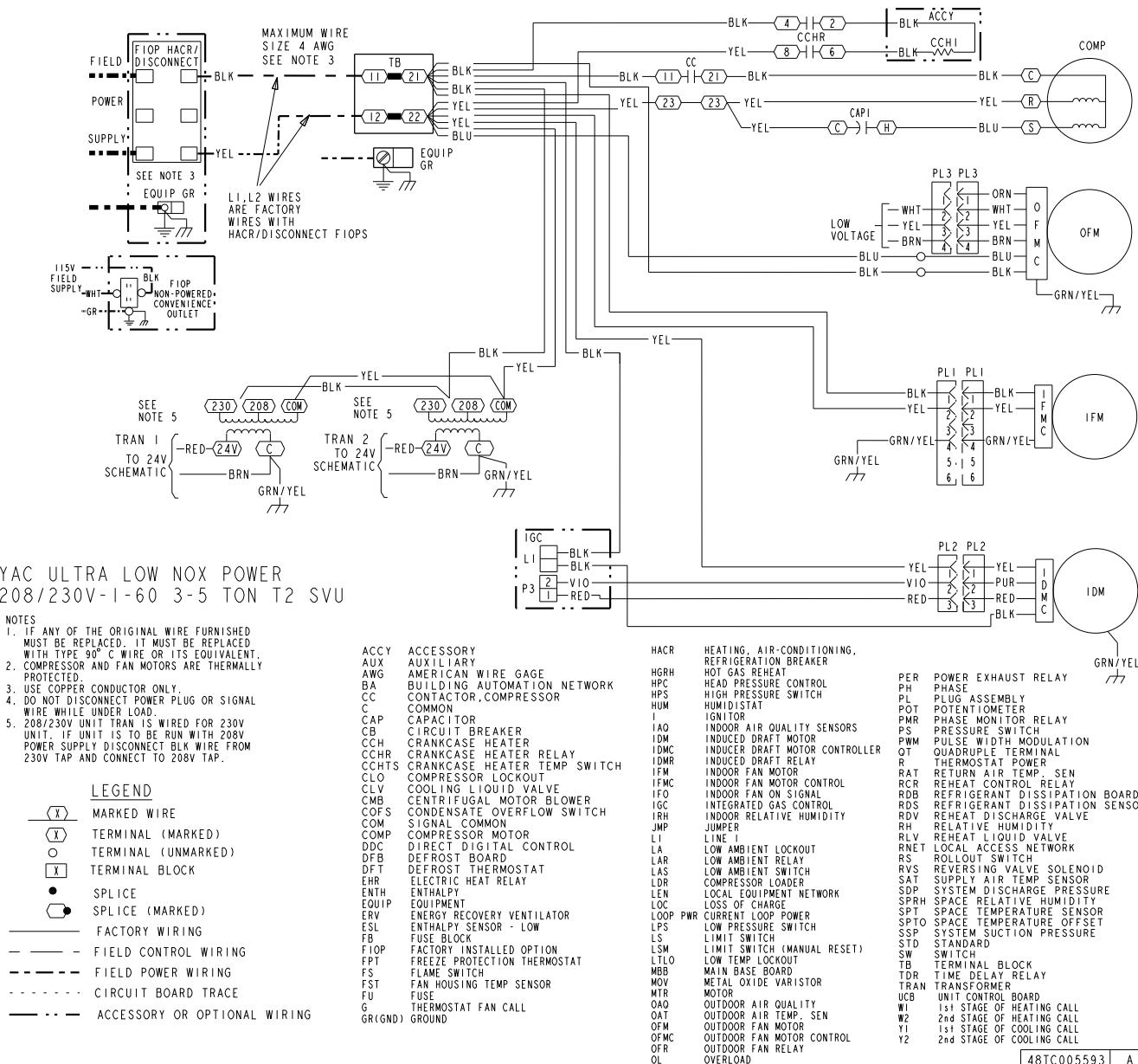
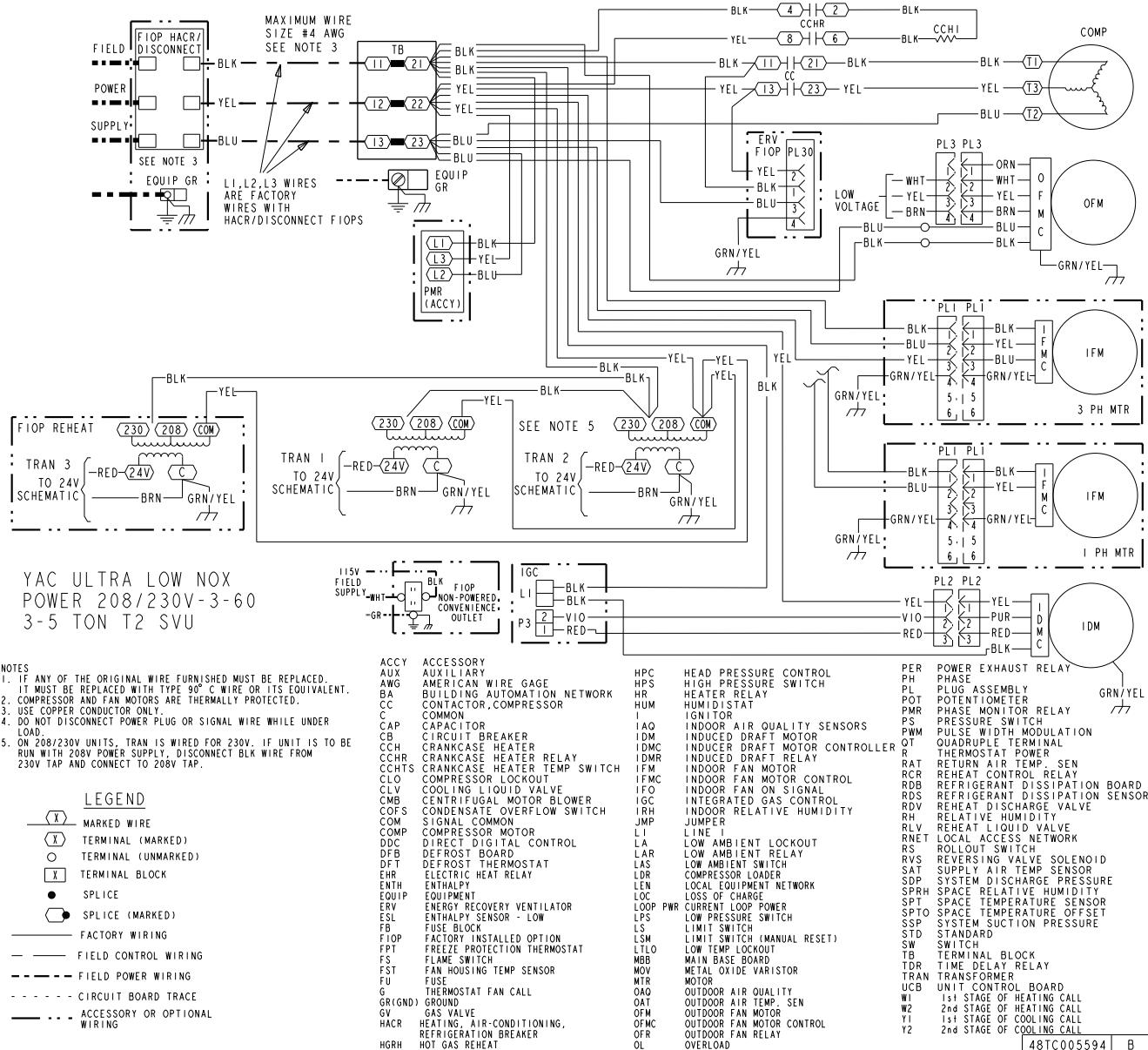


Fig. H — Power Wiring Diagram — 48GE(G/H)\*04-06 208/230-1-60 Unit with SystemVu™ Controller

## APPENDIX D — WIRING DIAGRAMS (cont)



**Fig. I — Power Wiring Diagram — 48GE(G/H)\*04-06 208/230-3-60 Unit with SystemVu™ Controller**

## APPENDIX D — WIRING DIAGRAMS (cont)

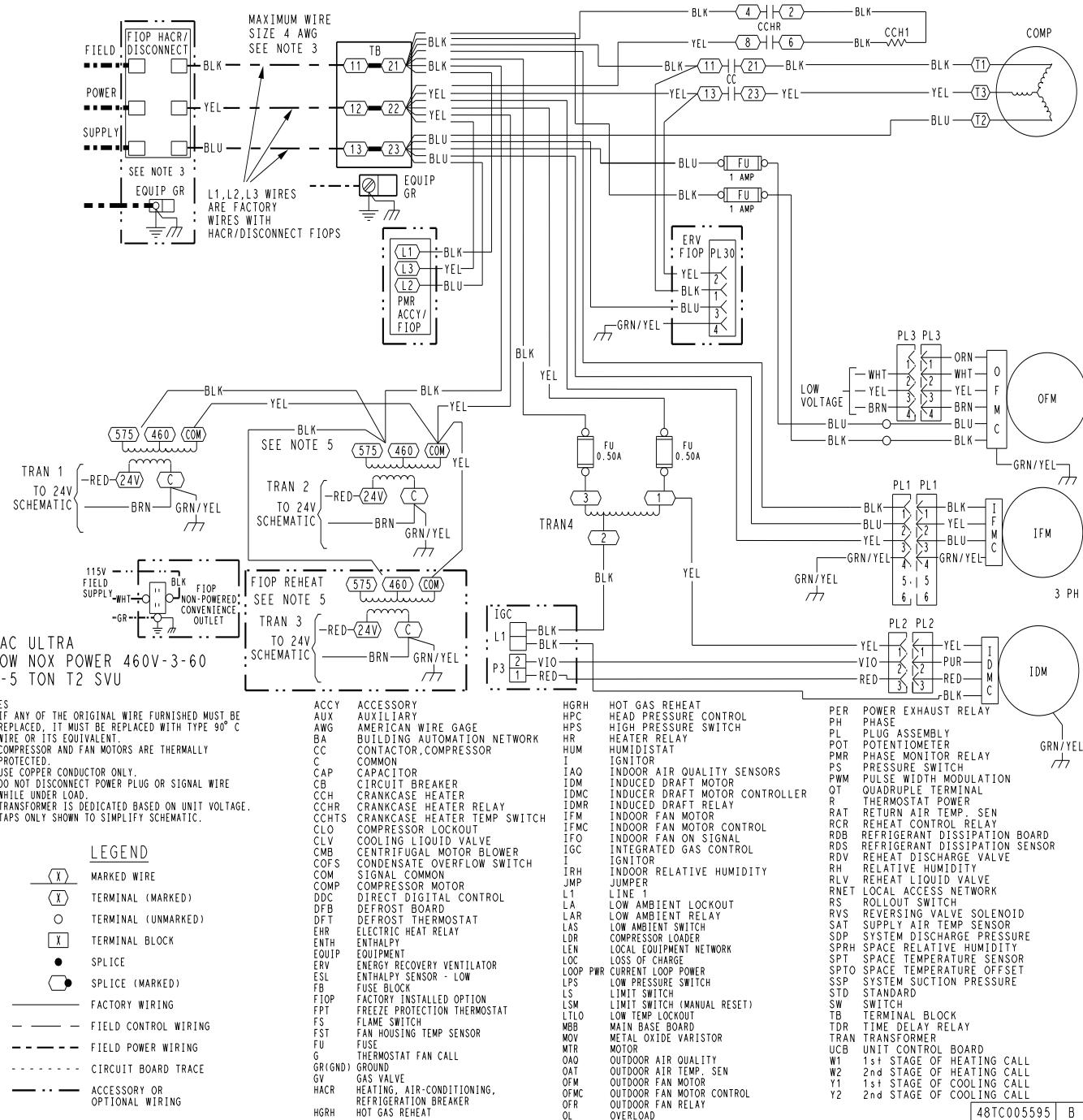
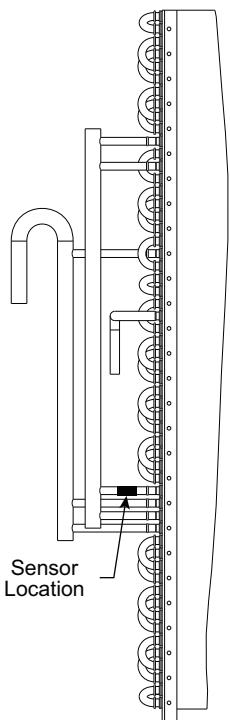
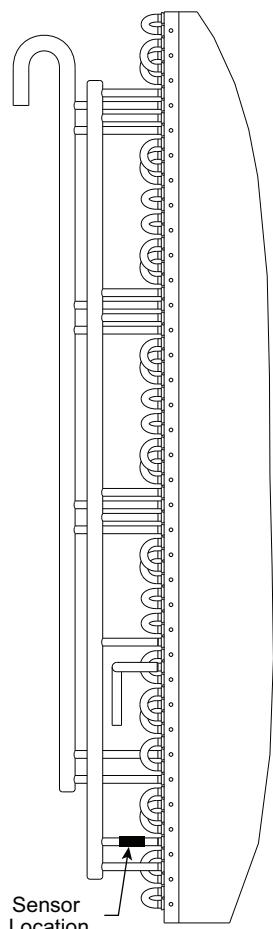


Fig. J — Power Wiring Diagram — 48GE(G/H)\*04-06 460-3-60 Unit with SystemVu™ Controller

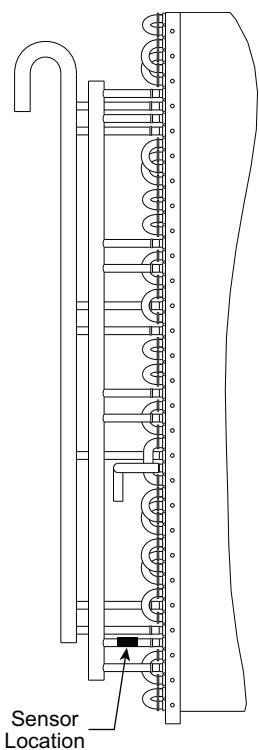
## APPENDIX E – LOW AMBIENT CONTROL SENSOR LOCATION



**Fig. K – 48GE\*\*04 Outdoor Circuiting**



**Fig. M – 48GE\*\*06 Outdoor Circuiting**



**Fig. L – 48GE\*\*05 Outdoor Circuiting**







## START-UP CHECKLIST

48GE(G/H)\*04-06 Packaged Rooftop Units with Gas Heat and Electric Cooling  
(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 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) _____
Check fan propellers for location in housing/orifice and verify setscrew is tight.	(Y/N) _____
Verify that scroll compressors are rotating in the correct direction.	(Y/N) _____
Verify yellow LED light on dissipation board is steady.	(Y/N) _____
Verify the dissipation board test button will operate the indoor fan for 1 minute.	(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 _____
Supply Voltage to Ground	L1 to Ground _____	L2 to Ground _____	L3 to Ground _____
Compressor Amps 1	L1 _____	L2 _____	L3 _____
Compressor Amps 2	L1 _____	L2 _____	L3 _____
Supply Fan Amps	L1 _____	L2 _____	L3 _____

#### 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			

## PRESSES

Gas Inlet Pressure	_____	in. wg
Gas Manifold Pressure	STAGE 1	_____ in. wg
	STAGE 2	_____ in. wg
Refrigerant Suction	STAGE 1	_____ PSIG
	STAGE 2	_____ PSIG
Refrigerant Discharge	STAGE 1	_____ PSIG
	STAGE 2	_____ 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) \_\_\_\_\_

## IV. HUMIDI-MIZER® START-UP

### STEPS

- UCB (Unit Control Board) for jumper 1, 2, 3 (Jumper 1, 2, 3 must be cut and open). (Y/N) \_\_\_\_\_
- Open humidistat contacts. (Y/N) \_\_\_\_\_
- 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. Liquid line temperature at outlet or reheat coil \_\_\_\_\_ ° F
- e. Confirm correct rotation for compressor. (Y/N) \_\_\_\_\_
- f. Check for correct ramp-up of outdoor fan motor as condenser coil warms. (Y/N) \_\_\_\_\_
4. Check unit charge per charging chart. (Y/N) \_\_\_\_\_
5. Switch unit to high-latent mode (sub-cooler) by closing humidistat with Y1 closed. (Y/N) \_\_\_\_\_

### OBSERVE

- a. Reduction in suction pressure (5 to 7 psi expected). (Y/N) \_\_\_\_\_
- b. Discharge pressure unchanged. (Y/N) \_\_\_\_\_
- c. Liquid temperature drops to 50°F to 55°F range. (Y/N) \_\_\_\_\_
- d. LSV solenoid energized (valve closes). (Y/N) \_\_\_\_\_
6. Switch unit to dehumid (reheat) by opening Y1. (Y/N) \_\_\_\_\_

### OBSERVE

- a. Suction pressure increases to normal cooling level. (Y/N) \_\_\_\_\_
- b. Discharge pressure decreases (35 to 50 psi) (Limited by Motormaster control). (Y/N) \_\_\_\_\_
- c. Liquid temperature returns to normal cooling level. (Y/N) \_\_\_\_\_
- d. LSV solenoid energized (valve closes). (Y/N) \_\_\_\_\_
- e. DSV solenoid energized, valve opens. (Y/N) \_\_\_\_\_
7. With unit in dehumid mode close W1 compressor and outdoor fan stop; LSV and DSV solenoids de-energized. (Y/N) \_\_\_\_\_
8. Open W1 restore unit to dehumid mode. (Y/N) \_\_\_\_\_
9. Open humidistat input compressor and outdoor fan stop; LSV and DSV solenoids de-energized. (Y/N) \_\_\_\_\_
10. Restore setpoints for thermostat and humidistat. (Y/N) \_\_\_\_\_

## V. TEMPORARY FURNACE OPERATION DURING CONSTRUCTION

The furnace may be operated during the finishing stage of construction. To ensure proper operation follow checklist below:

1. Prior to the finishing stage of construction, ensure that return air and vent openings are covered to minimize penetration of dust and construction debris into the unit. (Y/N) \_\_\_\_\_
2. Interior drywall installation shall be completed and covered with paint or primer prior to unit operation. (Y/N) \_\_\_\_\_
3. Premises shall be substantially free of debris and dust. (Y/N) \_\_\_\_\_
4. Ensure all return and vent coverings have been removed. (Y/N) \_\_\_\_\_
5. Verify the return ducts and supply ducts are connected, are free from obstructions, are clean, and are properly sealed. (Y/N) \_\_\_\_\_
6. Ensure proper vent installation per installation instructions. (Y/N) \_\_\_\_\_
7. Ensure gas piping has been connection per installation instructions. (Y/N) \_\_\_\_\_
8. Verify that the gas piping is free of leaks. (Y/N) \_\_\_\_\_
9. Furnace to be set to operate under appropriate control to ensure proper operation. (Y/N) \_\_\_\_\_
10. Minimum MERV 11 air filters to be installed during the finishing stages of construction. (Y/N) \_\_\_\_\_
11. Set furnace input rate and temperature rise per rating plate marking. (Y/N) \_\_\_\_\_
12. Ensure means for providing combustion air in accordance with the manufacturer's shipped installation instructions. (Y/N) \_\_\_\_\_
13. Return air temperature to be maintained between 55°F (13°C) and 80°F (27°C). (Y/N) \_\_\_\_\_
14. Furnace shall be set up to operate in accordance with installation instructions and shall be verified for operating conditions including ignition, input rate, temperature rise, and venting. (Y/N) \_\_\_\_\_
15. Install new filters as per installation instructions prior to final occupancy. (Y/N) \_\_\_\_\_

CUT ALONG DOTTED LINE

CUT ALONG DOTTED LINE