**48LC**
**Single Package Rooftop**
**Gas Heating/Electric Cooling Unit**
**with Puron® (R−410A) Refrigerant**
**Sizes: 14, 17, 20, 24, 26**

Carrier
turn to the experts

# Installation Instructions

**NOTE**: Read the entire instruction manual before starting the installation

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# SAFETY CONSIDERATIONS

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

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

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

**FIRE, EXPLOSION HAZARD**

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

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

## ⚠ WARNING

**ELECTRICAL SHOCK HAZARD**

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

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

## ⚠ WARNING

**UNIT OPERATION AND SAFETY HAZARD**

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

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

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

## ⚠ CAUTION

**CUT HAZARD**

Failure to follow this caution may result in personal injury.

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

## Rated Indoor Airflow (cfm)

The table to the right lists the rated indoor airflow used for the AHRI efficiency rating for the units covered in this document.

| Model Number | Full Load Airflow (cfm) |
|---|---|
| 48LC**14 | 4375 |
| 48LC**17 | 4875 |
| 48LC**20 | 5690 |
| 48LC**24 | 6500 |
| 48LC**26 | 7500 |



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

**Unit Heat Type**
48 - Gas Heat Packaged Rooftop

**Model Series - WeatherExpert™**
LC - Ultra High Efficiency

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

**Refrig. Systems Options**
0 = Three stage cooling capacity control with TXV
A = Three stage cooling capacity control with TXV and Humidi-MiZer®

**Cooling Tons**
14 - 12.5 ton
17 - 15 ton
20 - 17.5 ton
24 - 20 ton
26 - 23 ton

**Sensor Options**
A = None
B = RA Smoke Detector
C = SA Smoke Detector
D = RA + SA Smoke Detector
E = $CO_2$
F = RA Smoke Detector and $CO_2$
G = SA Smoke Detector and $CO_2$
H = RA + SA Smoke Detector and $CO_2$

**Indoor Fan Motor Options**
1 = Standard Static / Vertical Supply, Return Air Flow
2 = Medium Static / Vertical Supply, Return Air Flow
3 = High Static / Vertical Supply, Return Air Flow
4 = Ultra High Static / Vertical Supply, Return Air Flow
5 = Standard Static / Horizontal Supply, Return Air Flow
6 = Medium Static / Horizontal Supply, Return Air Flow
7 = High Static / Horizontal Supply, Return Air Flow
8 = Ultra High Static / Horizontal Supply, Return Air Flow

**Coil Options: Fin/Tube (Condenser- Evaporator - Hail Guard)**
A = Al/Cu - Al/Cu
B = Precoat Al/Cu - Al/Cu
C = E-coat Al/Cu - Al/Cu
D = E-coat Al/Cu - E-coat Al/Cu
E = Cu/Cu - Al/Cu
F = Cu/Cu - Cu/Cu
M = Al/Cu -Al/Cu — Louvered Hail Guard
N = Precoat Al/Cu - Al/Cu — Louvered Hail Guard
P = E-coat Al/Cu - Al/Cu — Louvered Hail Guard
Q = E-coat Al/Cu - E-coat Al/Cu — Louvered Hail Guard
R = Cu/Cu - Al/Cu — Louvered Hail Guard
S = Cu/Cu - Cu/Cu — Louvered Hail Guard

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

**Design Revision**
- = Factory Design Revision

**Base Unit Controls**
0 = Electromechanical Controls
1 = RTU Open Multi-Protocol Controller

**Intake / Exhaust Options**
A = None
N = Temperature Ultra Low Leak Economizer with Barometric Relief
P = Temperature Ultra Low Leak Economizer with Centrifugal Power Exhaust - Vertical Only
R = Enthalpy Ultra Low Leak Economizer with Barometric Relief
S = Enthalpy Ultra Low Leak Economizer with Centrifugal Power Exhaust - Vertical Only

**Service Options**
0 = None
1 = Unpowered Convenience Outlet
2 = Powered Convenience Outlet
3 = Hinged Panels
4 = Hinged Panels and Unpowered Convenience Outlet
5 = Hinged Panels and Powered Convenience Outlet

**Electrical Options**
A = None
B = HACR Circuit Breaker
C = Non-Fused Disconnect

**Packaging**
0 = Standard
1 = LTL

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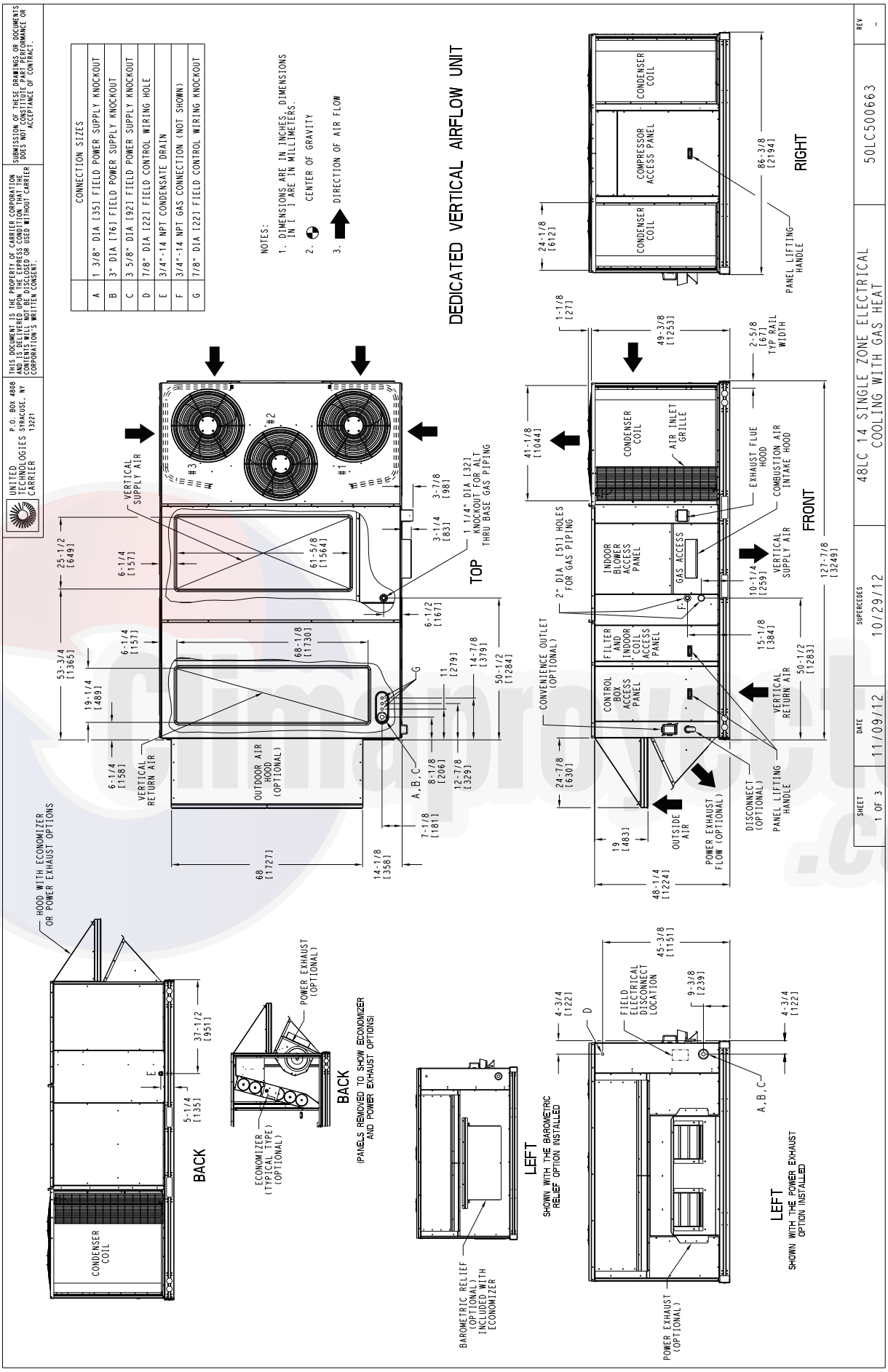
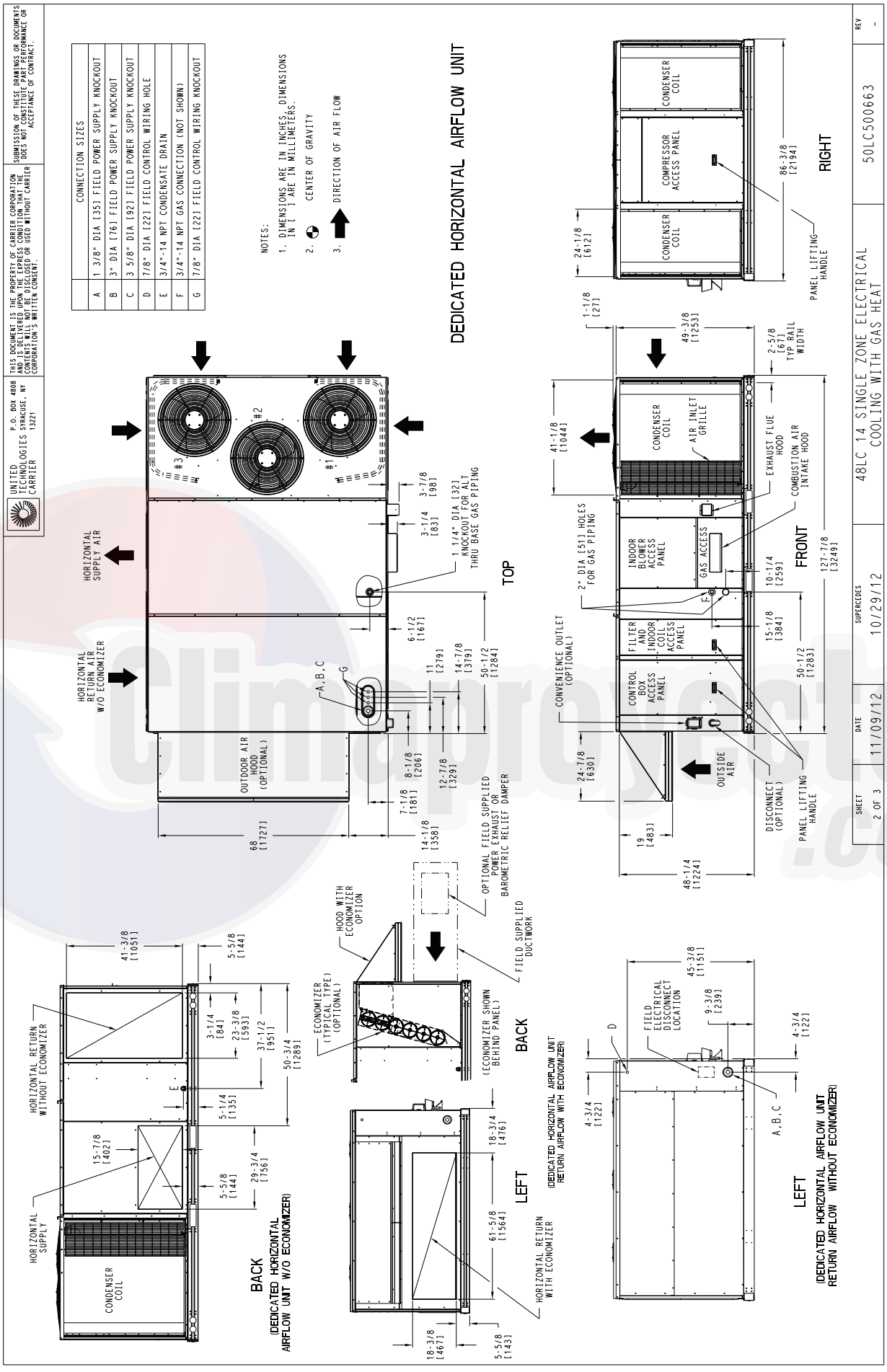
**Fig. 1 - 48LC 14-26 Model Number Nomenclature (Example)**




C13057

**Fig. 2 - Unit Dimensional Drawing – 14 Size Unit, Sheet 1 of 3**

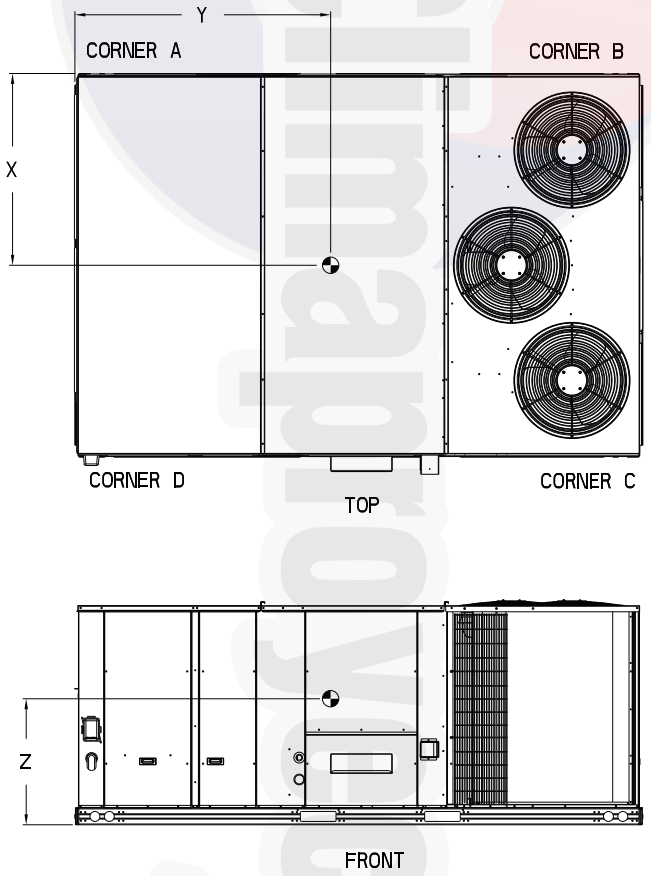



C13058

**Fig. 2 (cont.) - Unit Dimensional Drawing – 14 Size Unit, Sheet 2 of 3**

| UNIT | BASE UNIT OPERATING WEIGHT * | | CORNER WEIGHT (A) | | CORNER WEIGHT (B) | | CORNER WEIGHT (C) | | CORNER WEIGHT (D) | | C.G. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | LBS. | KG. | LBS. | KG. | LBS. | KG. | LBS. | KG. | LBS. | KG. | X | Y | Z |
| 48LC14 | 1853 | 842.3 | 457.5 | 208.0 | 532.4 | 242.0 | 481.3 | 218.8 | 413.6 | 188.0 | 40 29/32 [1039.02] | 68 21/32 [1743.87] | 16 1/2 [419.1] |

* BASE UNIT WEIGHT IS WITH LOW GAS HEAT, STD ID FAN MOTOR, AND WITHOUT PACKAGING.
FOR OTHER OPTIONS AND ACCESSORIES, REFER TO THE PRODUCT DATA CATALOG.






| SHEET | DATE | SUPERCEDES | | | REV |
|---|---|---|---|---|---|
| 3 OF 3 | 11/09/12 | 10/29/12 | 48LC 14 SINGLE ZONE ELECTRICAL COOLING WITH GAS HEAT | 50LC500663 | - |

**Fig. 2 (cont.) - Unit Dimensional Drawing – 14 Size Unit, Sheet 3 of 3**

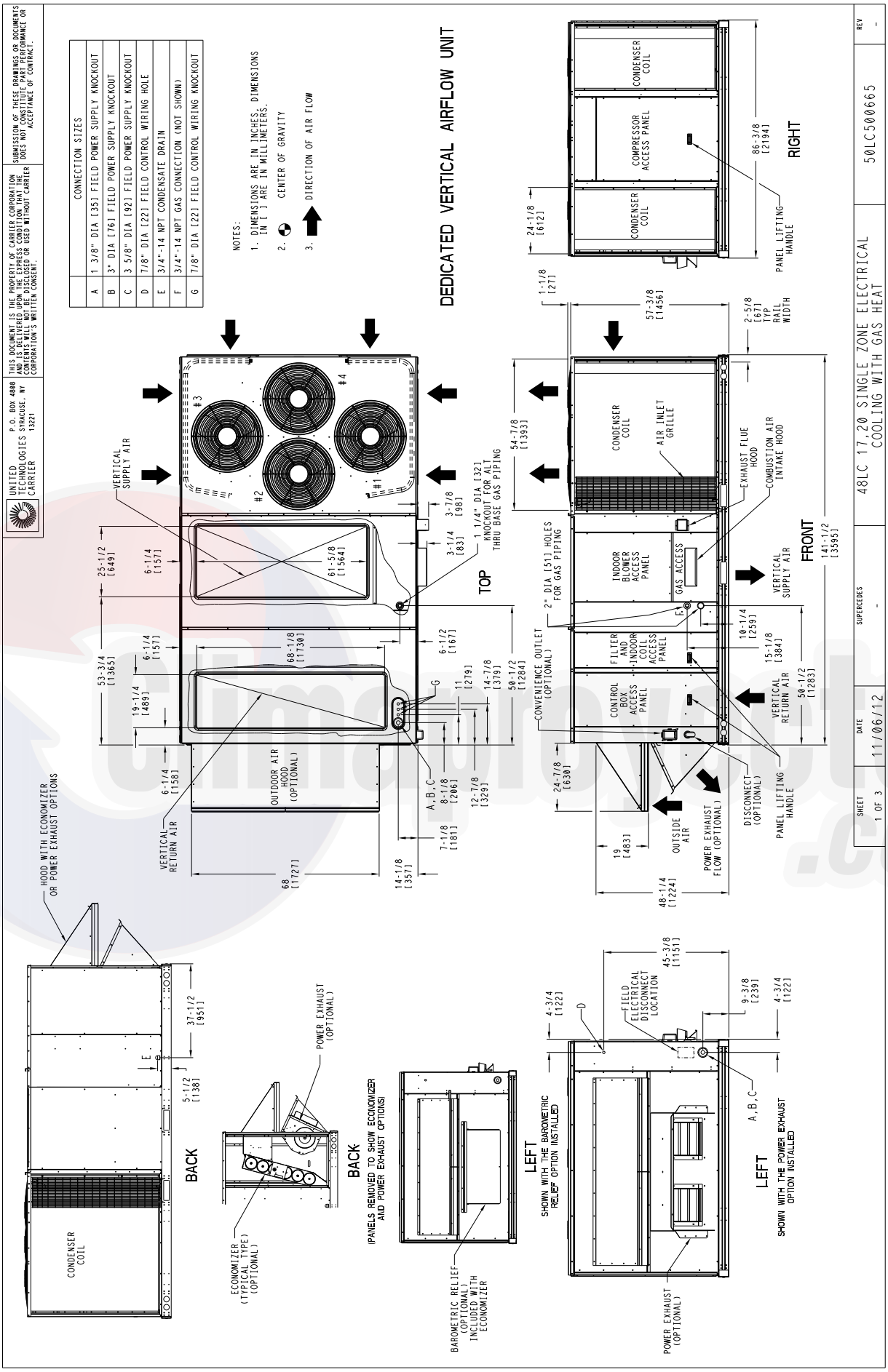



**Fig. 3 - Unit Dimensional Drawing – 17 and 20 Size Units, Sheet 1 of 3**

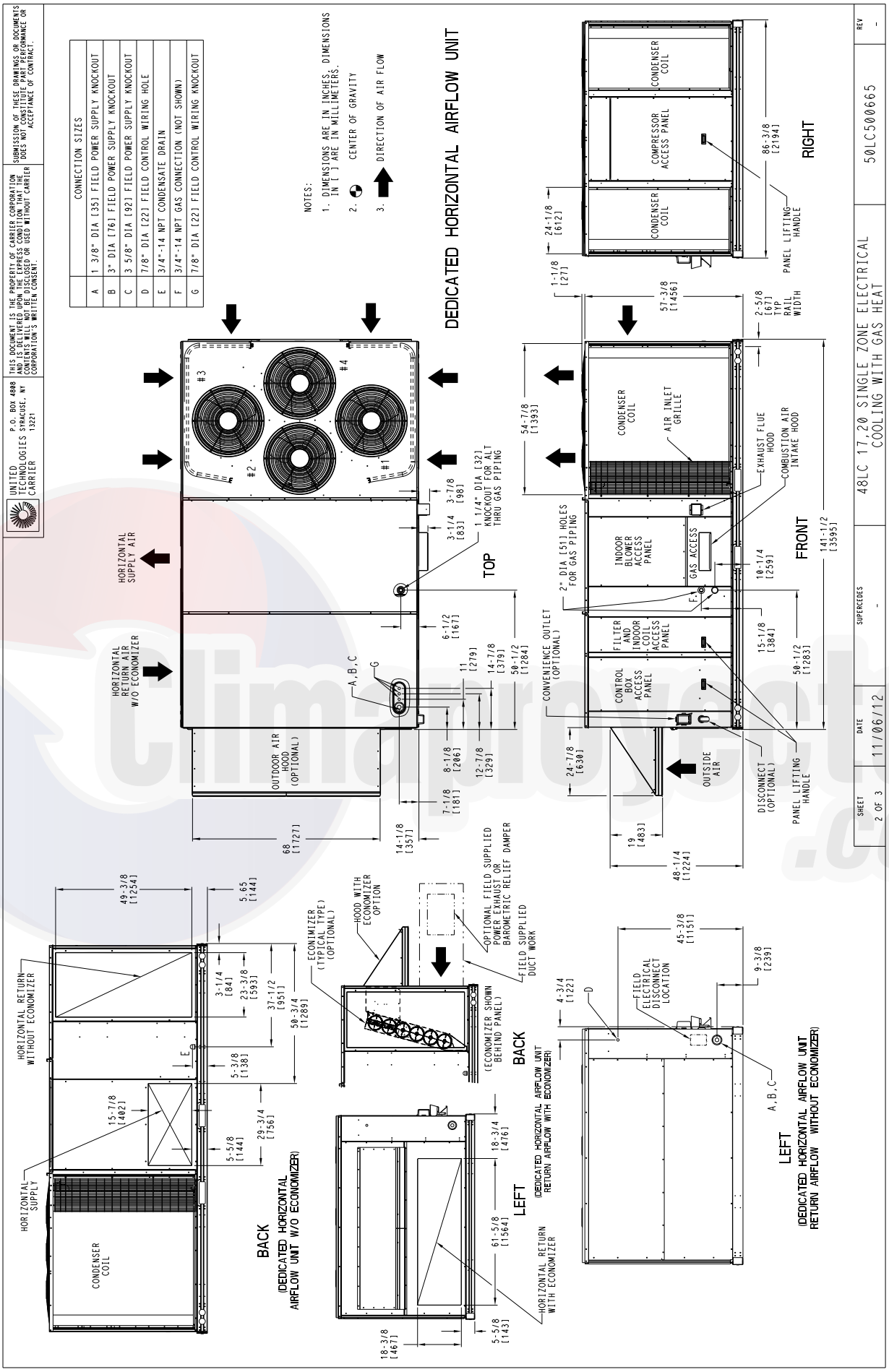



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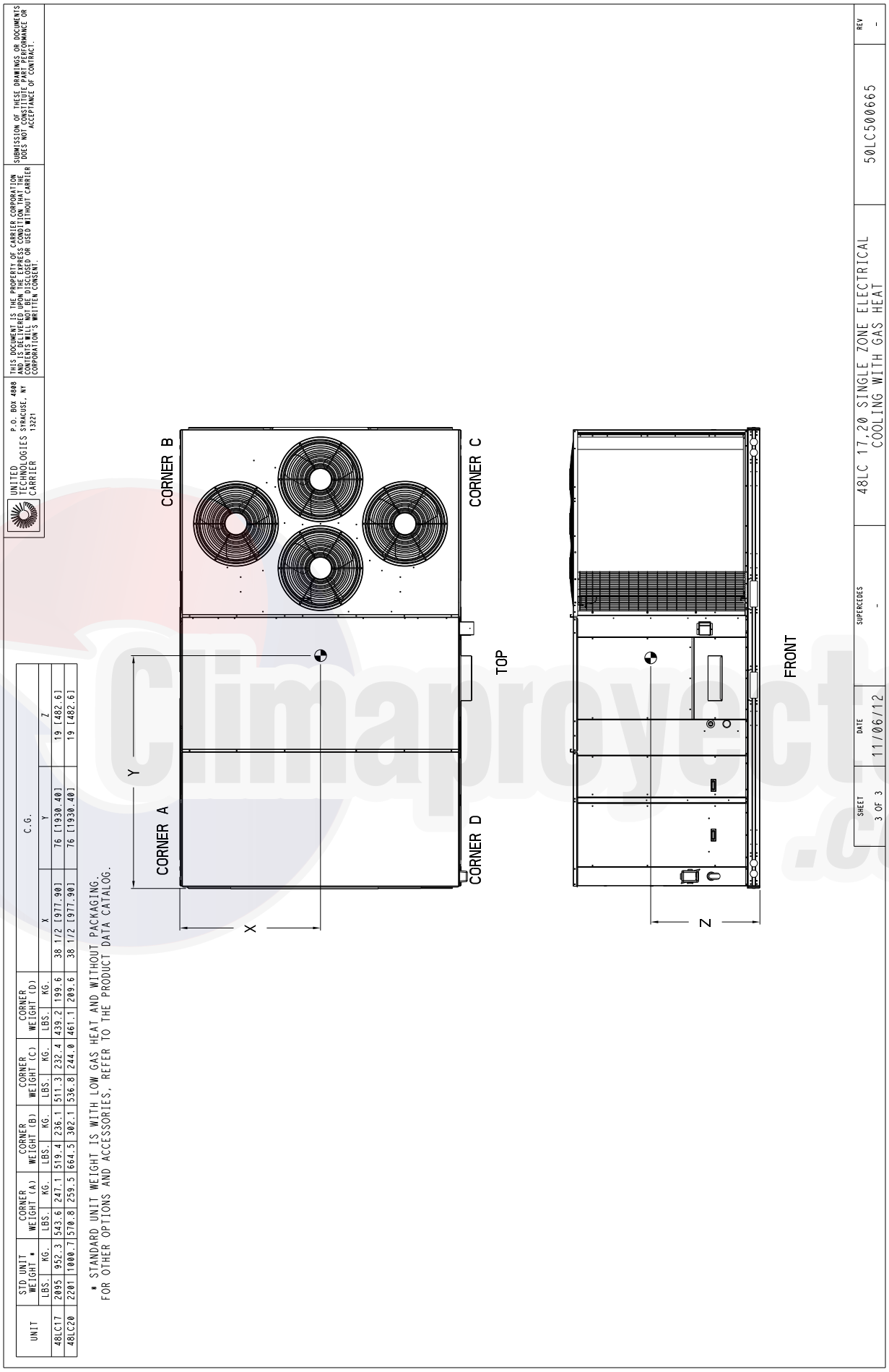
**Fig. 3 (cont.) - Unit Dimensional Drawing – 17 and 20 Size Units, Sheet 2 of 3**

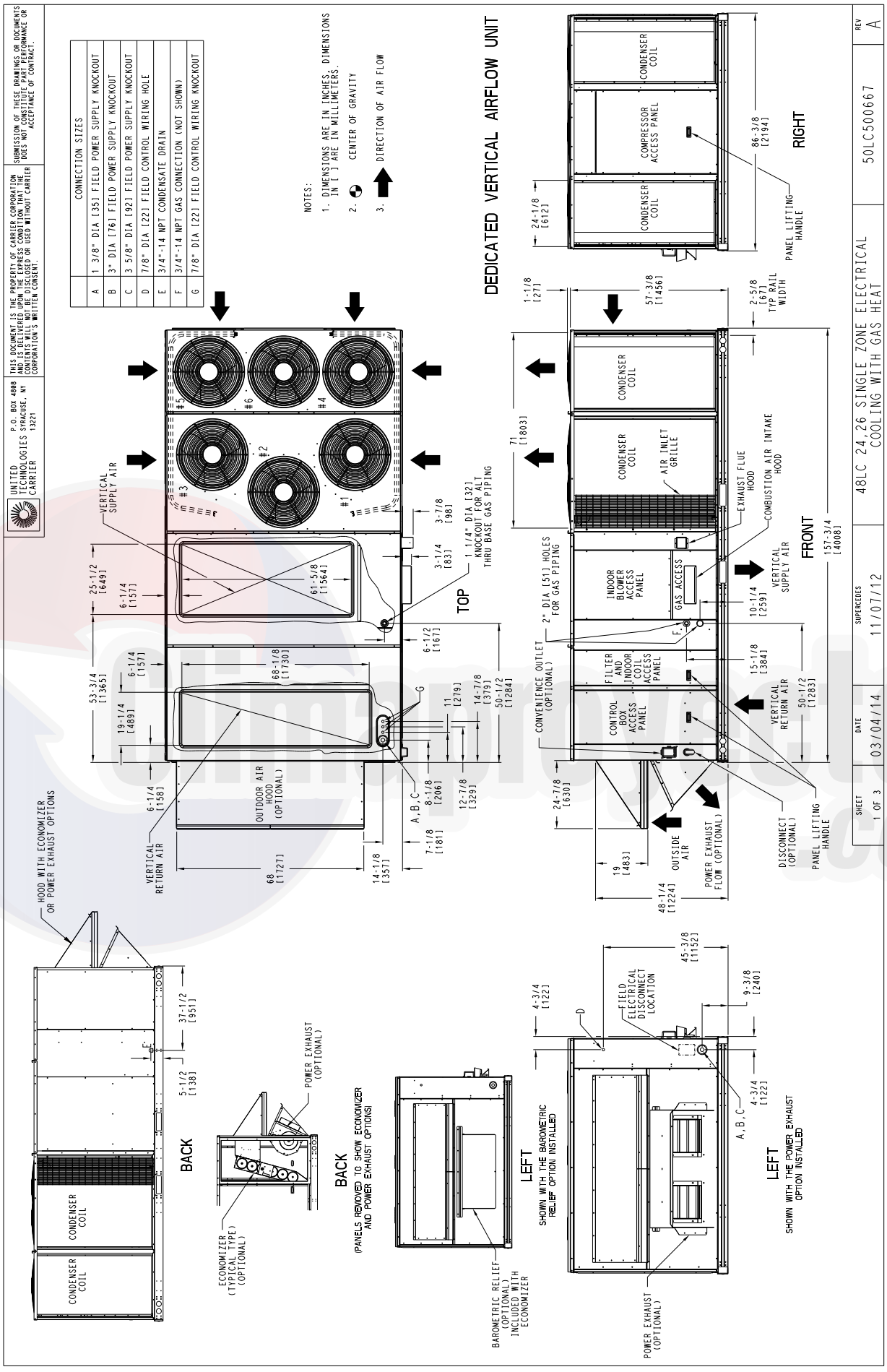



| UNIT | STD UNIT WEIGHT * | | CORNER WEIGHT (A) | | CORNER WEIGHT (B) | | CORNER WEIGHT (C) | | CORNER WEIGHT (D) | | C.G. | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | LBS. | KG. | LBS. | KG. | LBS. | KG. | LBS. | KG. | LBS. | KG. | X | | Y | Z |
| 48LC17 | 2095 | 952.3 | 543.6 | 247.1 | 519.4 | 236.1 | 511.3 | 232.4 | 439.2 | 199.6 | 38 1/2 [977.90] | | 76 [1930.40] | 19 [482.6] |
| 48LC20 | 2201 | 1000.7 | 570.8 | 259.5 | 664.5 | 302.1 | 536.8 | 244.0 | 461.1 | 209.6 | 38 1/2 [977.90] | | 76 [1930.40] | 19 [482.6] |

* STANDARD UNIT WEIGHT IS WITH LOW GAS HEAT AND WITHOUT PACKAGING.
FOR OTHER OPTIONS AND ACCESSORIES, REFER TO THE PRODUCT DATA CATALOG.

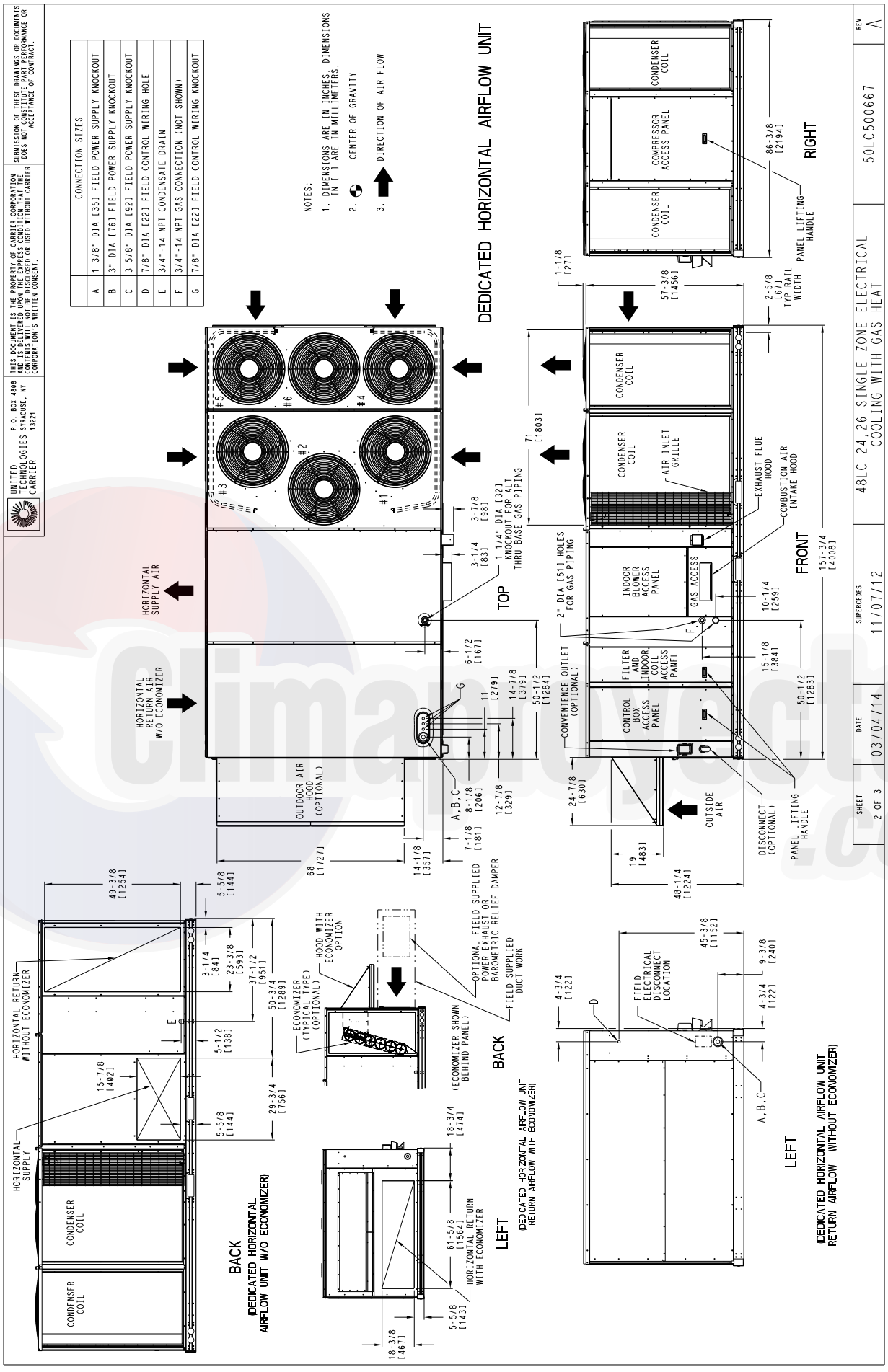
C13034

**Fig. 3 (cont.) - Unit Dimensional Drawing – 17 and 20 Size Units, Sheet 3 of 3**




C14106

**Fig. 4 - Unit Dimensional Drawing – 24 and 26 Size Units, Sheet 1 of 3**

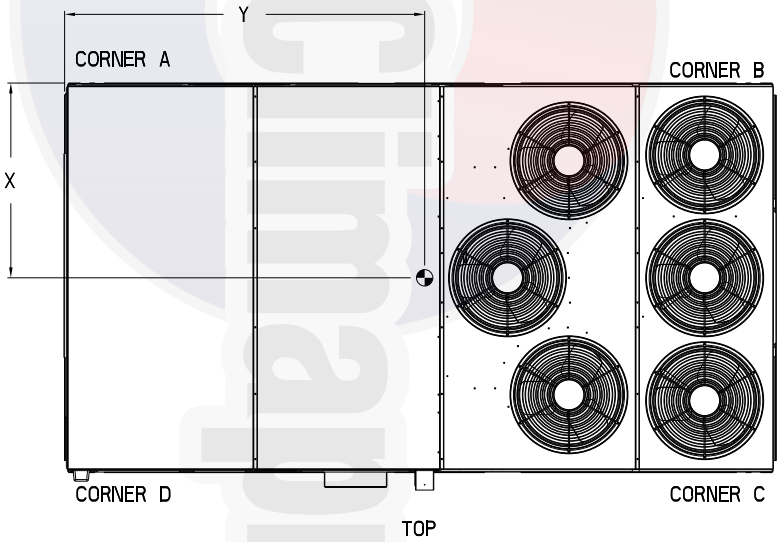


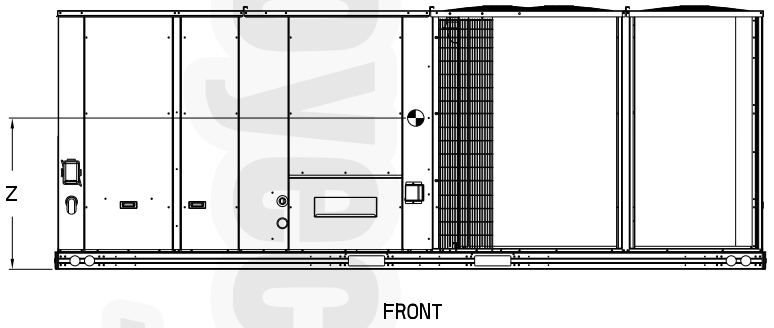

C14107

**Fig. 4 (cont.) - Unit Dimensional Drawing – 24 and 26 Size Units, Sheet 2 of 3**

| UNIT | STD UNIT WEIGHT * | | CORNER WEIGHT (A) | | CORNER WEIGHT (B) | | CORNER WEIGHT (C) | | CORNER WEIGHT (D) | | C.G. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | LBS. | KG. | LBS. | KG. | LBS. | KG. | LBS. | KG. | LBS. | KG. | X | Y | Z |
| 48LC24 | 2347 | 1067.0 | 485.0 | 220.4 | 568.8 | 258.5 | 715.5 | 325.2 | 610.1 | 277.3 | 48 [1219.20] | 85 1/32 [2159.79] | 19 [482.6] |
| 48LC26 | 2492 | 1132.6 | 563.2 | 256.0 | 627.7 | 285.3 | 702.4 | 319.3 | 630.3 | 286.5 | 45 1/2 [1155.70] | 83 1/32 [2108.99] | 19 [482.6] |

* STANDARD UNIT WEIGHT IS WITH LOW GAS HEAT AND WITHOUT PACKAGING.
FOR OTHER OPTIONS AND ACCESSORIES, REFER TO THE PRODUCT DATA CATALOG.



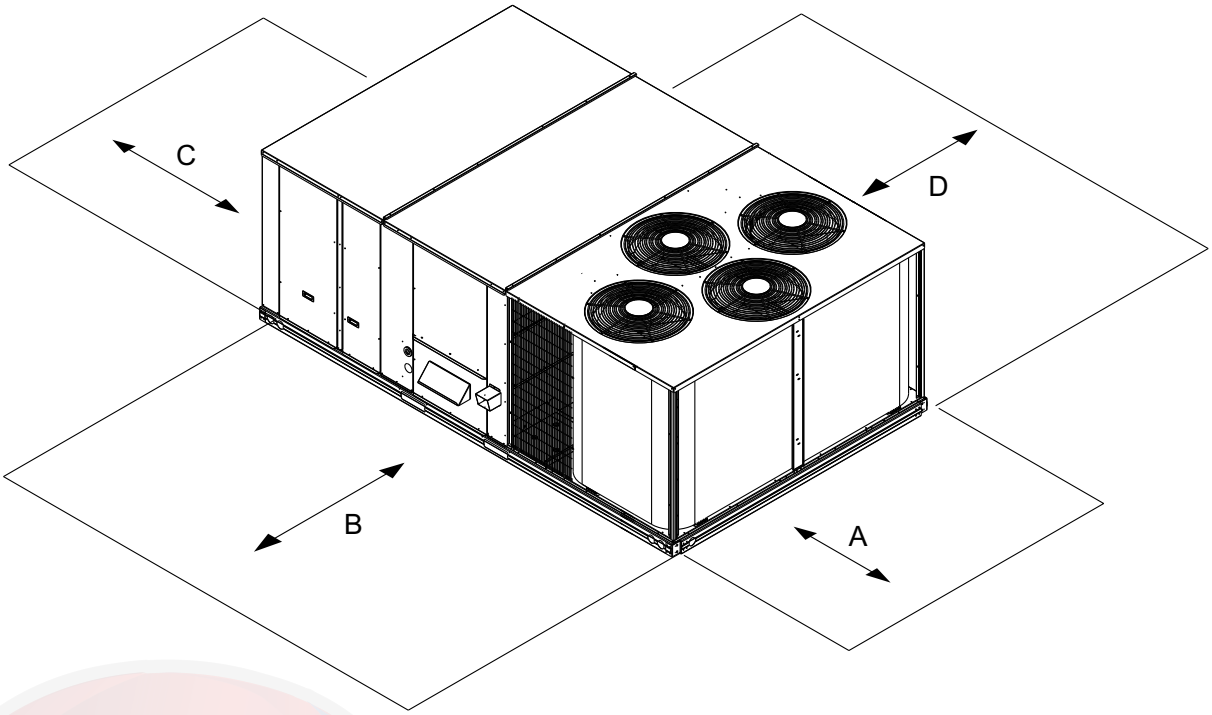




UNITED TECHNOLOGIES CARRIER P.O. BOX 4808 SYRACUSE, NY 13221



| SHEET | DATE | SUPERCEDES | | | REV |
|---|---|---|---|---|---|
| 3 OF 3 | 03/04/14 | 11/07/12 | 48LC 24,26 SINGLE ZONE ELECTRICAL COOLING WITH GAS HEAT | 50LC500667 | A |

**Fig. 4 (cont.) - Unit Dimensional Drawing – 24 and 26 Size Units, Sheet 3 of 3**




C12384

| LOCATION | DIMENSION | CONDITION |
|---|---|---|
| A | 36–in (914 mm) | • Recommended clearance for air flow and service |
| B | 42–in (1067 mm) | • Recommended clearance for air flow and service |
| C | 18–in (457 mm) | • No Convenience Outlet<br>• No Economizer<br>• No field installed disconnect on economizer hood side (Factory–installed disconnect installed). |
| | 36–in (914 mm) | • Convenience Outlet installed.<br>• Vertical surface behind servicer is electrically non–conductive (e.g.: wood, fiberglass). |
| | 42–in (1067 mm) | • Convenience Outlet installed.<br>• Vertical surface behind servicer is electrically conductive (e.g.: metal, masonry). |
| | 96–in (2438 mm) | • Economizer and/or Power Exhaust installed.<br>• Check for sources of flue products with 10 feet (3 meters) of economizer fresh air intake. |
| D | 42–in (1067 mm) | • Recommended clearance for service. |

**NOTE:** Unit not designed to have overhead obstruction. Contact Application Engineering for guidance on any application planning overhead obstruction or for vertical clearances.

**Fig. 5 - Service Clearance Dimensional Drawing**

**Table 1 – Operating Weights**

| 48LC** | UNIT LB (KG) | | | | |
|---|---|---|---|---|---|
| | 14 | 17 | 20 | 24 | 26 |
| Base Unit | 1853 (842.3) | 2095 (952.3) | 2201 (1000.7) | 2347 (1067.0) | 2492 (1132.6) |
| Economizer | 246 (112) | 246 (112) | 246 (112) | 246 (112) | 246 (112) |
| Powered Outlet | 35 (16) | 35 (16) | 35 (16) | 35 (16) | 35 (16) |
| Curb | | | | | |
| 14–in/356 mm | 240 (109) | 240 (109) | 255 (116) | 255 (116) | 273 (124) |
| 24–in/610 mm | 340 (154) | 340 (154) | 355 (161) | 355 (161) | 355 (161) |

# INSTALLATION

## Jobsite Survey

Complete the following checks before installation.

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

### Step 1 — Plan for Unit Location

Select a location for the unit and its support system (curb or other) that provides for the minimum clearances required for safety. This includes the clearance to combustible surfaces, unit performance and service access below, around and above unit as specified in unit drawings. See Fig. 5.

**NOTE**: Consider also the effect of adjacent units.

Be sure that the unit is installed such that snow will not block the combustion air intake or flute outlet.

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

Do not install unit in an indoor location. Do not locate air inlets near exhaust vents or other sources of contaminated air. For proper unit operation, adequate combustion and ventilation air must be provided in accordance with Section 5.3 (Air for Combustion and Ventilation) of the National Fuel Gas Code, ANSI Z223.1 (American National Standards Institute) and NFPA (National Fire Protection Association) 54 TIA--54--84--1. In Canada, installation must be in accordance with the CAN1--B149 installation codes for gas burning appliances.

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

Locate mechanical draft system flue assembly at least 4 ft (1.2 m) from any opening through which combustion products could enter the building, and at least 4 ft (1.2 m) from any adjacent building (or per local code). Locate the flue assembly at least 10 ft (3.05 m) from an adjacent unit's fresh air intake hood if within 3 ft (0.91 m) of same elevation (or per local code). When unit is located adjacent to public walkways, flue assembly must be at least 7 ft (2.1 m) above grade.

Select a unit mounting system that provides adequate height to allow installation of condensate trap per requirements. Refer to Step 11 — Install External Condensate Trap and Line – for required trap dimensions.

**Roof Mount —**

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

### Step 2 — Plan for Sequence of Unit Installation

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

**Curb-mounted installation —**

Install curb
Install field-fabricated ductwork inside curb
Install thru-base service connection fittings (affects curb and unit)
Rig and place unit
Remove top skid
Install outside air hood
Install smoke detector tube
Install combustion air hood
Install flue hood
Install gas piping
Install condensate line trap and piping
Make electrical connections
Install other accessories

**Pad-mounted installation —**

Prepare pad and unit supports
Rig and place unit
Remove duct covers and top skid
Install smoke detector return air sensor tube
Install field-fabricated ductwork at unit duct openings
Install outside air hood
Install combustion air hood
Install flue hood
Install gas piping
Install condensate line trap and piping
Make electrical connections
Install other accessories

**Frame-mounted installation —**

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

### Step 3 — Inspect unit

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

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

On units with hinged panel option, check to be sure all latches are tight and in closed position.

Locate the carton containing the outside air hood parts; see Figs. 7 and 13. Do not remove carton until unit has been rigged and located in final position.

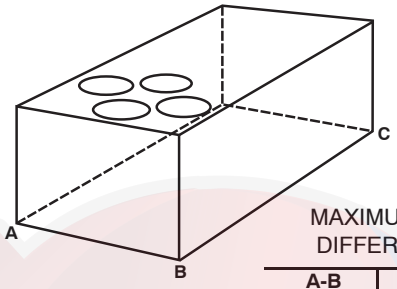
## Step 4 — Provide Unit Support

### Roof Curb Mount —

Accessory roof curb details and dimensions are shown in Figs. 8, 9 and 10. Assemble and install accessory roof curb in accordance with instructions shipped with the curb.

**NOTE**: The gasketing of the unit to the roof curb is critical for a watertight seal. Install gasket supplied with the roof curb as shown in Figs. 8, 9 and 10. Improperly applied gasket can also result in air leaks and poor unit performance.

Curb should be level. This is necessary for unit drain to function properly. Unit leveling tolerances are show in Fig. 6. Refer to Accessory Roof Curb Installation Instructions for additional information as required.




MAXIMUM ALLOWABLE DIFFERENCE IN. (MM)

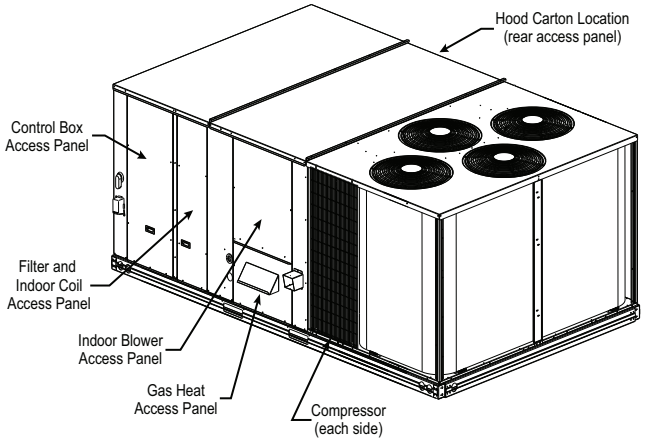
| A-B | B-C | A-C |
|---|---|---|
| 0.25” (6) | 0.5” (12) | 0.5” (12) |

C10628

**Fig. 6 - Unit Leveling Tolerances**

Install insulation, cant strips, roofing felt, and counter flashing as shown. *Ductwork must be attached to curb and not to the unit. Thru-the-base power connection must be installed before the unit is set on the roof curb.* If field-installed thru-the-roof curb gas connections are desired remove knockout in basepan located in the gas section, see Fig. 7 for location. Gas connections and power connections to the unit must be field installed after the unit is installed on the roof curb.

If electric and control wiring is to be routed through the basepan, remove knockouts in basepan located in control box area of access panel; see Fig. 2, 3, or 4 for basepan knockout locations for location. Attach the service connections to the basepan.




C11154

**Fig. 7 - Typical Access Panel and Compressor Locations**

### Slab Mount (Horizontal Units Only) —

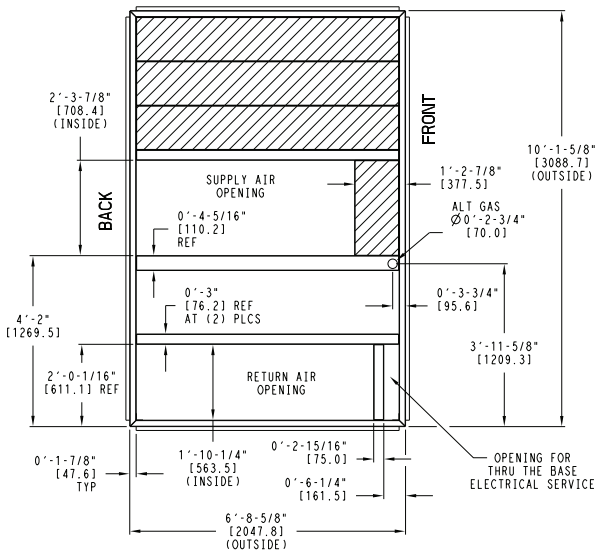
Provide a level concrete slab that extends a minimum of 6–in. (150 mm) beyond unit cabinet. Install a gravel apron in front of condenser coil air inlet to prevent grass and foliage from obstructing airflow.

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

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

A non-combustible sleeper rail can be used in the unit curb support area. If sleeper rails cannot be used, support the long sides of the unit with a minimum of 4 equally spaced 4-in. x 4-in. (102 mm x 102 mm) pads on each side. Locate pads so that they support the rails. Make sure to avoid the fork openings.

| UNIT SIZE | "A" | ROOF CURB ACCESSORY |
|---|---|---|
| 14 | 1′-2" [356.0]<br>2′-0" [610.0] | CRRFCURB045A00<br>CRRFCURB046A00 |




NOTES:

1 ROOF CURB ACCESSORY IS SHIPPED UNASSEMBLED.

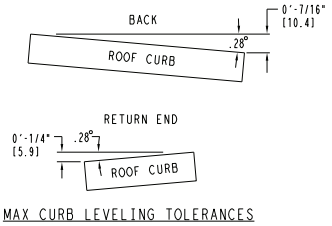
2 DIMENSIONS IN [ ] ARE IN MILLIMETERS.

3 ROOF CURB GALVANIZED STEEL.

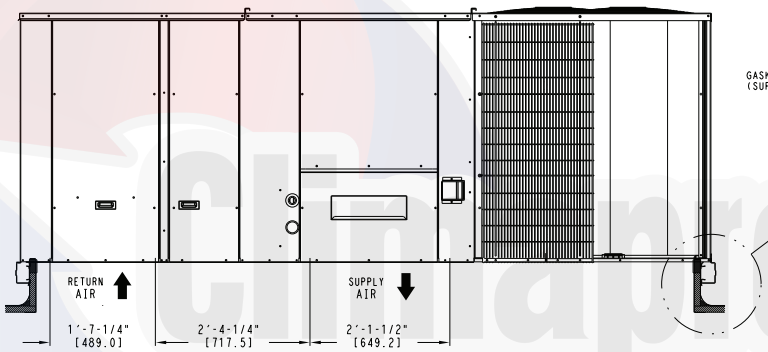
4 ATTACH DUCTWORK TO CURB (FLANGES ON DUCT REST ON CURB)

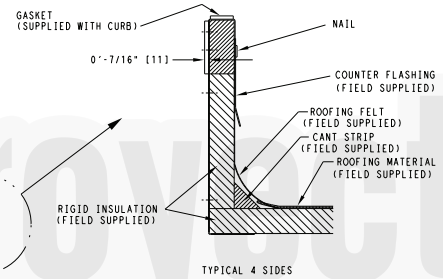
5 SERVICE CLEARANCE 4 ft ON EACH SIDE

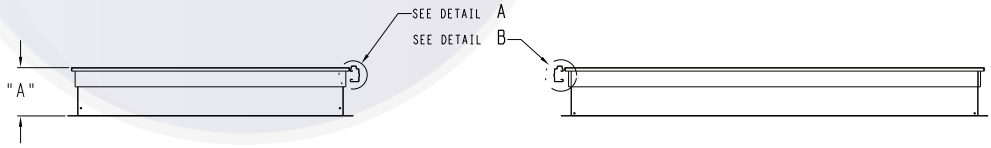
➡ DIRECTION OF AIR FLOW

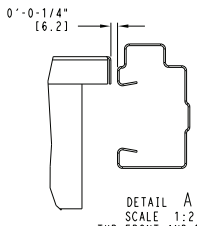


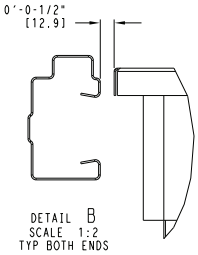

MAX CURB LEVELING TOLERANCES

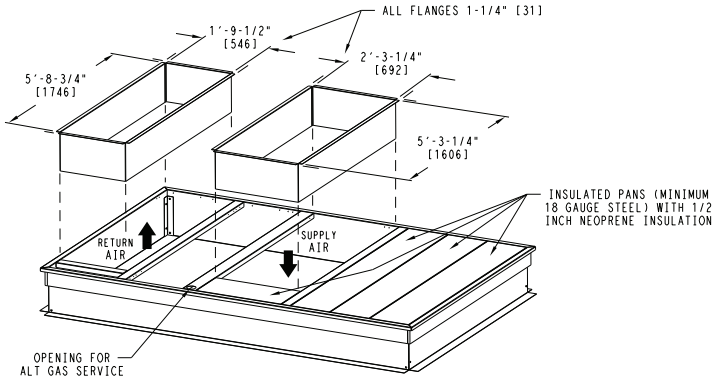


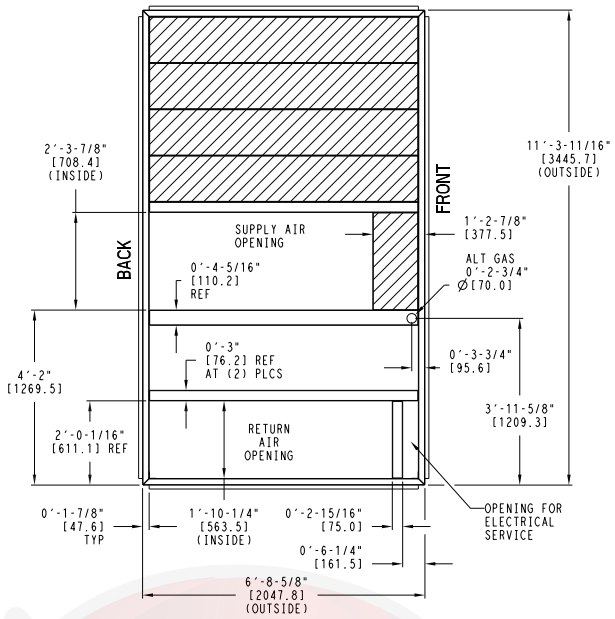




C13054

**Fig. 8 - Roof Curb Details – 14 Size Unit**

| UNIT SIZE | "A" | ROOF CURB ACCESSORY |
|---|---|---|
| 17, 20 | 1′-2" [356.0]<br>2′-0" [610.0] | CRRFCURB047A00<br>CRRFCURB048A00 |




NOTES:

1 ROOF CURB ACCESSORY IS SHIPPED UNASSEMBLED.

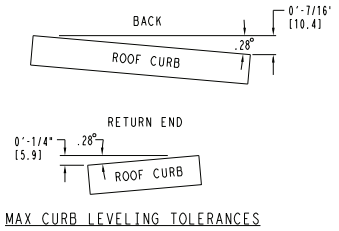
2 DIMENSIONS IN [ ] ARE IN MILLIMETERS.

3 ROOF CURB GALVANIZED STEEL.

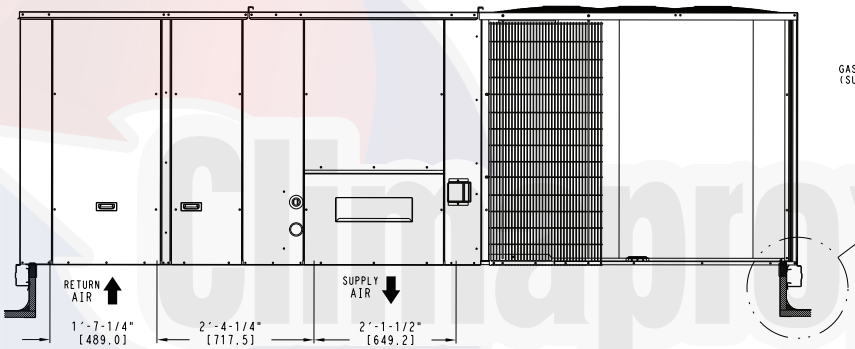
4 ATTACH DUCTWORK TO CURB (FLANGES ON DUCT REST ON CURB)

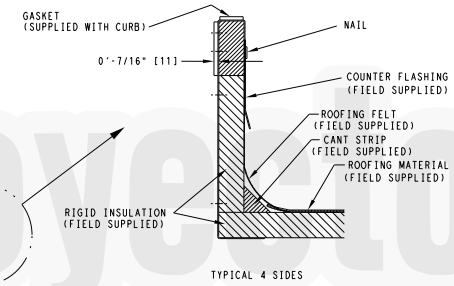
5 SERVICE CLEARANCE 4 ft ON EACH SIDE

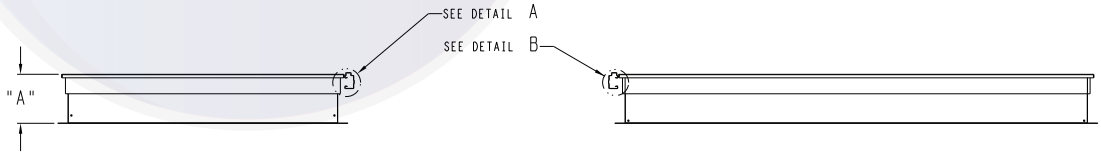
➡ DIRECTION OF AIR FLOW

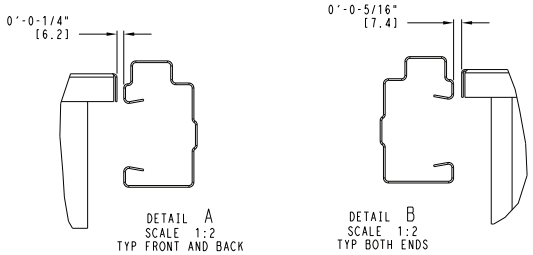


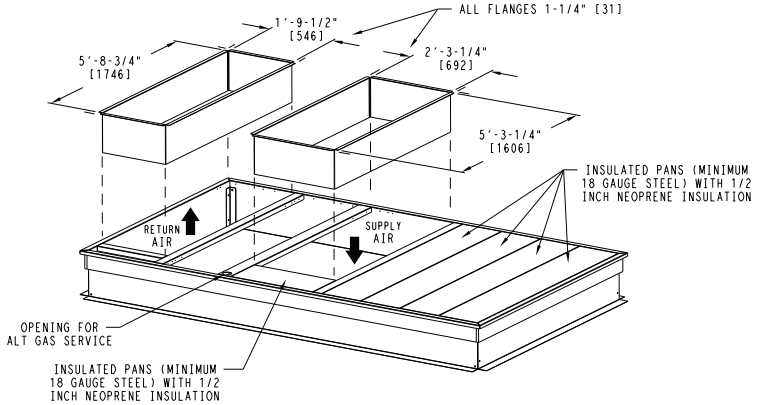

MAX CURB LEVELING TOLERANCES



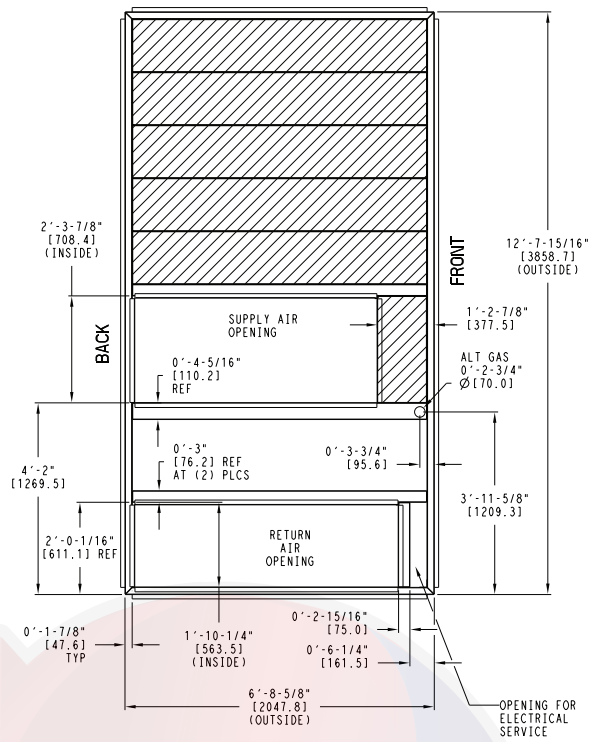




C13055

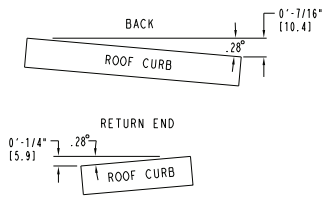
**Fig. 9 - Roof Curb Details – 17 and 20 Size Units**

| UNIT SIZE | "A" | ROOF CURB ACCESSORY |
|---|---|---|
| 24, 26 | 1′-2" [356.0]<br>2′-0" [610.0] | CRRFCURB049A00<br>CRRFCURB050A00 |

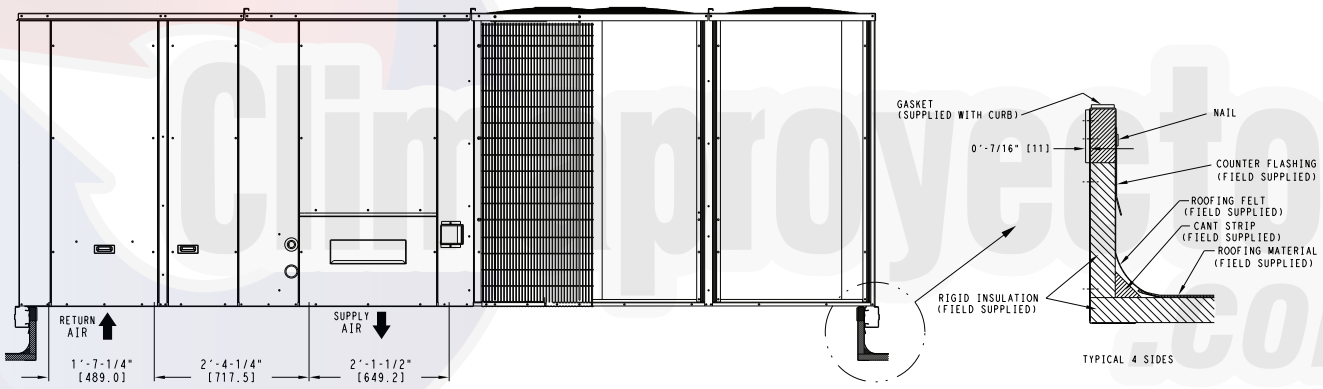


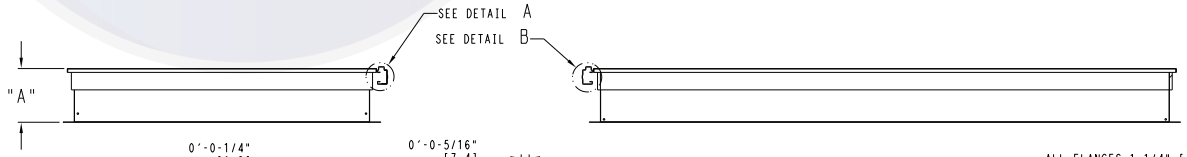

NOTES:
1 ROOF CURB ACCESSORY IS SHIPPED UNASSEMBLED.
2 BOLT HEADS TO BE ON INSIDE OF FLANGE. CLEARANCE IS [11] 0-0-7/16" TYP ALL CORNERS.
3 DIMENSIONS IN [ ] ARE IN MILLIMETERS.
4 ROOF CURB GALVANIZED STEEL.
5 ATTACH DUCTWORK TO CURB (FLANGES ON DUCT REST ON CURB)
6 SERVICE CLEARANCE 4 ft ON EACH SIDE
7 GAS SERVICE PLATE IS PART OF A SEPERATELY SHIPPED ACCESSORY PACKAGE.
8 GAS SERVICE PLATE CAN BE USED WITH EITHER ACCESSORY ROOFCURB.

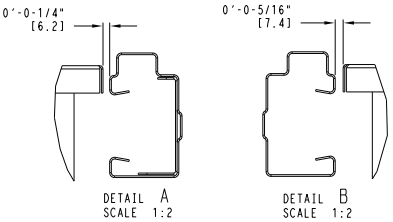
➡ DIRECTION OF AIR FLOW

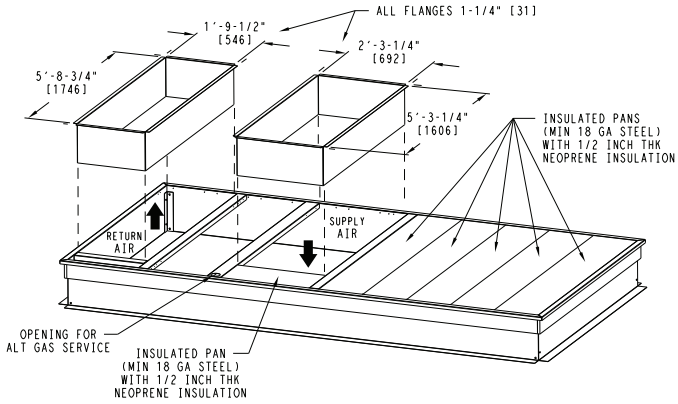



MAX CURB LEVELING TOLERANCES




C13056

**Fig. 10 - Roof Curb Details – 24 and 26 Size Units**

### Step 5 — Field Fabricate Ductwork

Cabinet return-air static pressure (a negative condition) shall not exceed 0.5 in. wg (87 Pa) with economizer or without economizer.

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

Fabricate supply ductwork so that the cross sectional dimensions are equal to or greater than the unit supply duct opening dimensions for the first 18 in. (458 mm) of duct length from the unit basepan.

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

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

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

A minimum clearance is not required around ductwork.

**⚠ CAUTION**

**PROPERTY DAMAGE HAZARD**

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

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

### Step 6 — Rig and Place Unit

Keep unit upright and do not drop. Spreader bars are not required if top crating is left on unit. Rollers may be used to move unit across a roof. Level by using unit frame as a reference. See Table 1 (on page 14) and Fig. 11 (below) for additional information.

Lifting holes are provided in base rails as shown in Fig. 11. Refer to rigging instructions on unit.

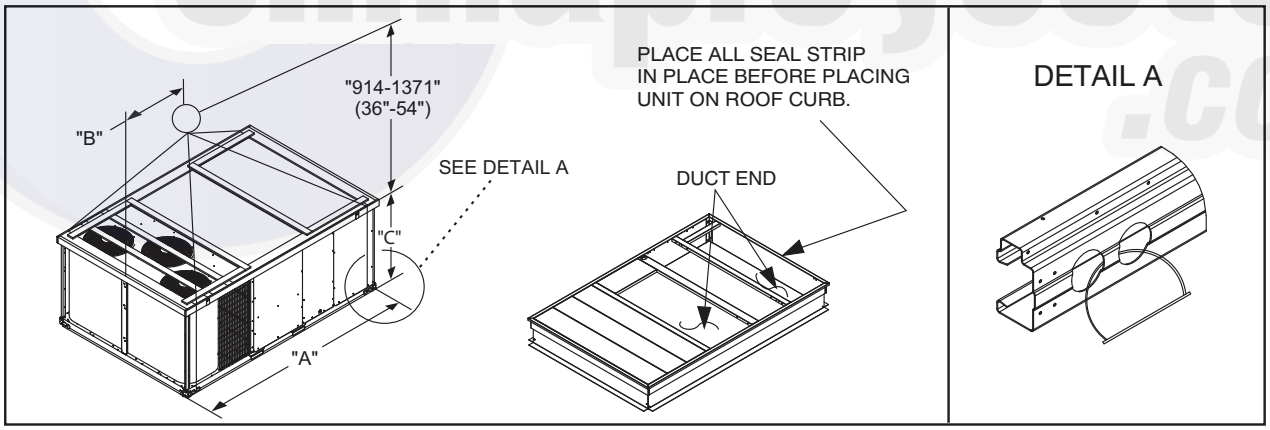
**⚠ CAUTION**

**UNIT DAMAGE HAZARD**

Failure to follow this caution may result in equipment damage.

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

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




C09107

| UNIT | MAX WEIGHT | | DIMENSIONS | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | A | | B | | C | |
| | LB | KG | IN | MM | IN | MM | IN | MM |
| 48LC**14 | 2135 | 970 | 127.8 | 3249 | 59.1 | 1501 | 52.3 | 1328 |
| 48LC**17 | 2377 | 1080 | 141.5 | 3595 | 65.5 | 1664 | 60.3 | 1532 |
| 48LC**20 | 2483 | 1129 | 141.5 | 3595 | 65.5 | 1664 | 60.3 | 1532 |
| 48LC**24 | 2629 | 1195 | 157.8 | 4007 | 72.8 | 1849 | 60.3 | 1532 |
| 48LC**26 | 2774 | 1261 | 157.8 | 4007 | 7208 | 1849 | 60.3 | 1532 |

**NOTES**:

1. Dimensions in ( ) are inches.
2. Hook rigging shackles through holes in base rail, as shown in detail “A.” Holes in base rails are centered around the unit center of gravity. Use wooden top to prevent rigging straps from damaging unit.

**Fig. 11 - Rigging Details**

**Positioning on Curb —**

Position unit on roof curb so that the following clearances are maintained: $^1/_4$ in. (6 mm) clearance between the roof curb and the base rail inside the right and left, $^1/_2$ in. (12 mm) clearance between the roof curb and the base rail inside the front and back. This will result in the distance between the roof curb and the base rail inside on the condenser end of the unit being approximately equal to Details A and B in Figs. 8, 9 and 10.

Do not attempt to slide unit on curb after unit is set. Doing so will result in damage to the roof curb seal.

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

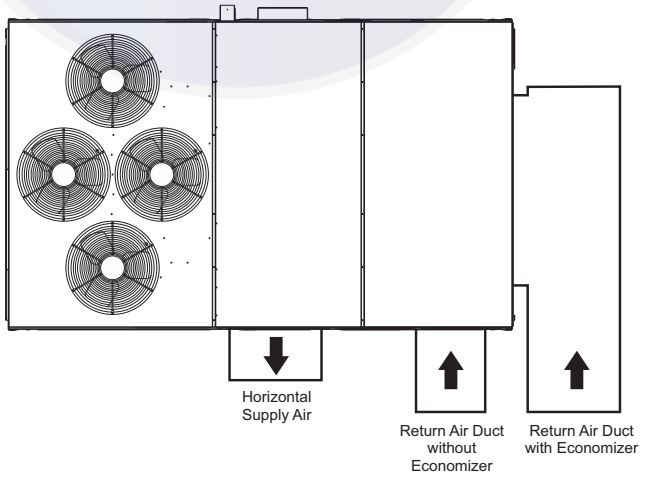
*Flue vent discharge must have a minimum horizontal clearance of 48 in. (1220 mm) from electric and gas meters, gas regulators, and gas relief equipment. Minimum distance between unit and other electrically live parts is 48 inches (1220 mm).*

Flue gas can deteriorate building materials. Orient unit such that flue gas will not affect building materials. Locate mechanical draft system flue assembly at least 48 in. (1220 mm) from an adjacent building or combustible material.

After unit is in position, remove rigging skids and shipping materials.

## Step 7 — Horizontal Duct Connection

Refer to Figs. 2, 3 and 4 for locations and sizes of the horizontal duct connections. Note that there are two different return air duct connection locations – one for unit without an economizer (on back side of unit) and a different one for unit equipped with an economizer (on left end, under the economizer hood). The supply air duct connection is on the back side. See Fig. 12 for top view depicting typical horizontal duct arrangements.




C10626

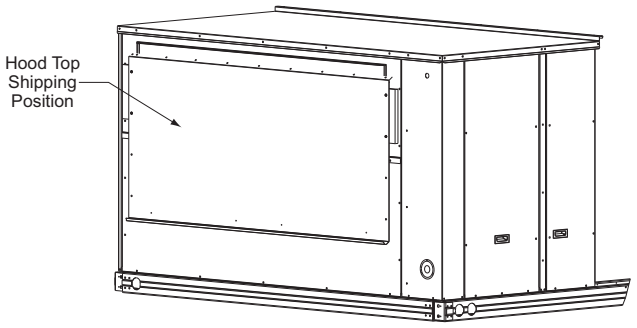
| | Supply | Return without Economizer | Return with Economizer |
|---|---|---|---|
| Location | Back | Back | Left end |
| Height – In. (mm) | $15^7/_8$ (402) | $49^3/_8$ (1253) | $18^3/_8$ (467) |
| Width – in. (mm) | $29^3/_4$ (756) | $23^3/_8$ (593) | $61^5/_8$ (1564) |

**Fig. 12 - Horizontal Duct Opening Dimensions**

Field-supplied ($^3/_4$-inch) flanges should be attached to horizontal duct openings (see Fig. 12) and all ductwork should be secured to the flanges. Insulate and weatherproof all external ductwork, joints, and roof or building openings with counter flashing and mastic in accordance with applicable codes.

## Step 8 — Install Outside Air Hood — Factory Option

The outside air hood for factory-option economizer is shipped in knock-down form and requires field assembly. The panel for the hood top is shipped on the end of the unit (see Fig. 13). The remaining parts for the hood assembly (including side panels, filters and tracks) are shipped in a carton that is secured to the rear of the blower assembly. Access the carton location through rear panel (see Fig. 14).



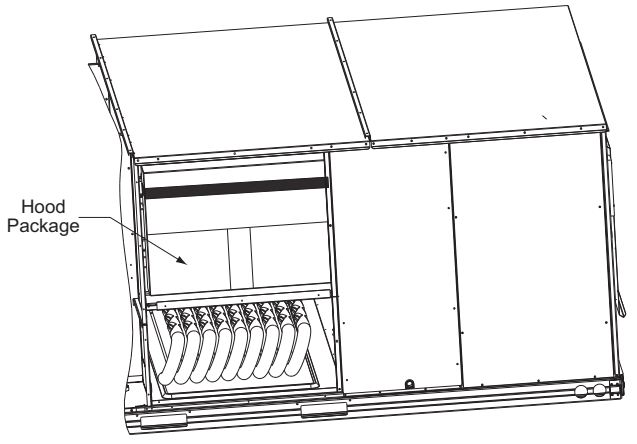

C09134

**Fig. 13 - Hood Top – Shipping Position**

**To remove the hood parts package:**

1. Remove the back blower access panel.
2. Locate and cut the strap, being careful to not damage any wiring.
3. Carefully lift the hood package carton through the back blower access opening.

See Fig. 15 for identification of the various parts of the hood assembly.

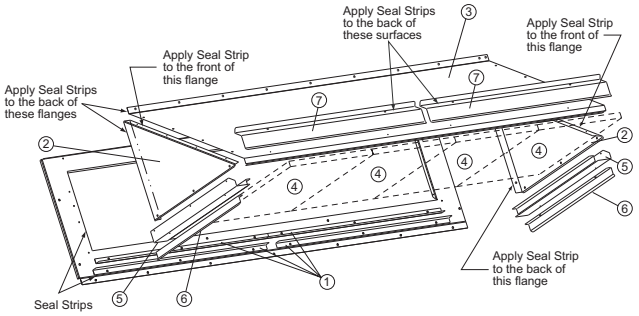



C09133

**Fig. 14 - Hood Package – Shipping Location**

**To assemble the outside air hood:**

1. Remove hood top panel from shipping position on unit end.
2. Install four angles to the upper end panel using the screws provided.
3. Apply seal strip to mating flanges on the side plates of the hood (see Fig. 15).

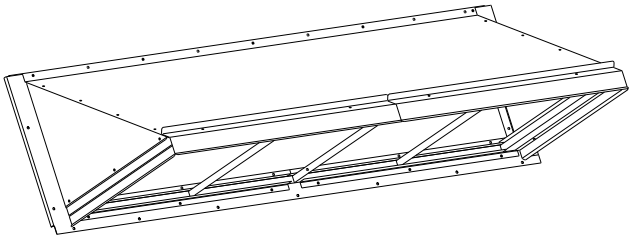



| Item # | Description | Qty |
|---|---|---|
| 1 | Angles | 4 |
| 2 | Side Plates | 2 |
| 3 | Hood | 1 |
| 4 | Outdoor Air Screens | 4 |
| 5 | Side Filter Supports | 2 |
| 6 | Side Drip Angles | 2 |
| 7 | Top Diverters | 2 |

C09079

**Fig. 15 - Hood Part Identification and Seal Strip Application Areas**

4. Secure side plates to panel using the screws provided.
5. Apply seal strip to mating flange of the hood (see Fig. 15).
6. Secure top flange using screws provided in kit.
7. Install outdoor air screens by sliding them into the channel formed by the four angles installed in step 2. Make sure that the screens extend across the entire length of the hood.
8. Install side filter supports using the screws provided.
9. Install side drip angles using the screws provided.
10. Run a continuous length of seal strip across the hood covering the engagement holes in the lower hood.
11. Install top diverter using the screws provided.
12. On units with barometric relief, remove screws at bottom of relief damper. **Do not discard damper door**.



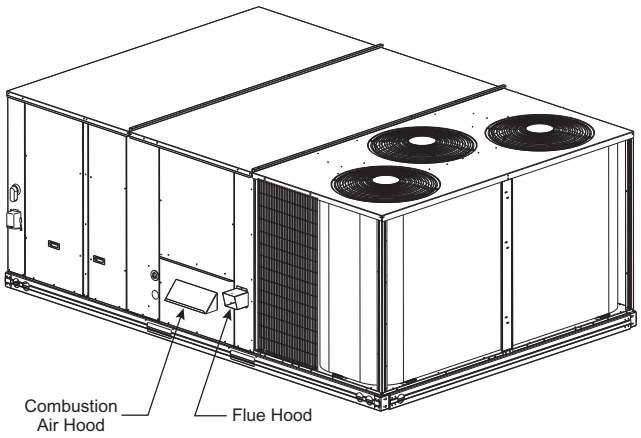
C09090

**Fig. 16 - Hood Assembly – Completed**

## Step 9 — Install Flue Hood and Combustion Air Hood

The flue hood is shipped screwed to the fan deck inside the burner compartment. Remove the burner access panel and then remove the flue hood from its shipping location. Using the screws provided, install flue hood in the location shown in Fig. 17.

The combustion air hood is attached to the back of the burner access panel. Remove the two screws securing the hood to the back of the burner access panel. Using the two screws, re-attach the hood to the front of the burner access panel as shown in Fig. 17.




C10744

**Fig. 17 - Flue Hood and Combustion Air Hood Details**

## Step 10 — Install Gas Piping

Installation of the gas piping must be in accordance with local building codes and with applicable national codes. In U.S.A., refer to NFPA 54/ANSI Z223.1 National Fuel Gas Code (NFGC). In Canada, installation must be accordance with the CAN/CSA B149.1 and CAN/CSA B149.2 installation codes for gas burning appliances.

This unit is factory equipped for use with Natural Gas fuel at elevations up to 2000 ft (610 m) above sea level. Unit may be field converted for operation at elevations above 2000 ft (610 m) and/or for use with liquefied petroleum fuel. See accessory kit installation instructions regarding these accessories.

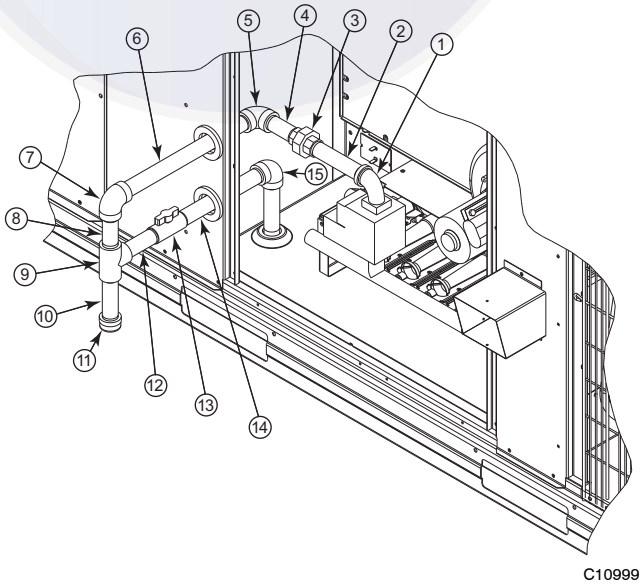
**NOTE**: Furnace gas input rate on rating plate is for installation up to 2000 ft (610 m) above sea level. In U.S.A. the input rating for altitudes above 2000 ft (610 m) must be derated by 4% for each 1000 ft (305 m) above sea level. In Canada the input rating must be derated by 10% for altitudes of 2000 ft (610 m) to 4500 ft (1372 m) above sea level.

*For natural gas applications, gas pressure at unit gas connection must not be less than 5 in. wg (1246 Pa) or greater than 13 in. wg (3240 Pa) while the unit is operating. For liquified petroleum applications, the gas pressure must not be less than 11 in. wg (2740 Pa) or greater than 13 in. wg (3240 Pa) at the unit connection.*

**Gas Supply Line —**

The gas supply pipe enters the unit adjacent to the burner access panel on the front side of the unit, through the grommeted hole. The gas connection to the unit is made to the $^3/_4$ in. FPT gas inlet port on the unit gas valve.

Table 2 lists typical $^3/_4$ inch NPT (National Pipe Thread) field supplied pipe fittings required for Thru-Base gas supply, starting from the unit gas valve (see Fig. 18).




C10999

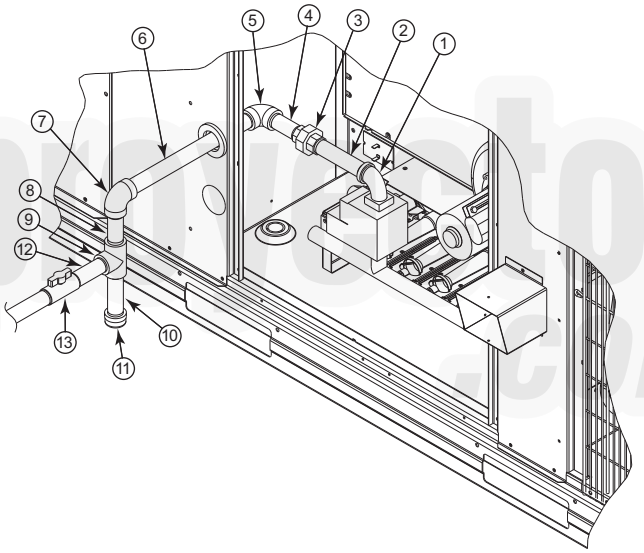
**Fig. 18 - Gas Supply Line Piping with Thru-Base**

**Table 2 – Typical $^3/_4$-in NPT Field Supplied Piping Parts**

| Item | Qty | Description |
|---|---|---|
| 1 | 1 | 90 Deg Street Elbow |
| 2 | 1 | 5 Inch Long Nipple |
| 3 | 1 | Ground–Joint Union |
| 4 | 1 | 3 Inch Long Nipple |
| 5 | 1 | 90 Deg Elbow |
| 6 | 1 | 12 Inch Long Nipple |
| 7 | 1 | 90 Deg Elbow |
| 8 | 1 | 3 Inch Long Nipple |
| 9 | 1 | TEE |
| 10 | 1 | 4 Inch Long Nipple (Sediment Trap) |
| 11 | 1 | Cap |
| 12 | 1 | 3 $^1/_2$ Inch Long Nipple |
| 13 | 1 | NIBCO® Ball Valve (GB30) |
| 14 | 1 | 8 Inch Long Nipple |
| 15 | 1 | 90 Deg Elbow |

Pipe gas supply into 90 degree elbow item 15 (see Table 2) through the hole in the unit basepan.

For typical $^3/_4$ inch NPT field supplied fittings required for NON Thru-Base gas supply starting from the unit gas valve, omit items 14 and 15 from Table 2 and pipe gas supply into TEE. See Fig. 19.




C101006

**Fig. 19 - Gas Supply Line Piping**

**Table 3 – Natural Gas Supply Line Pressure Ranges**

| UNIT MODEL | UNIT SIZE | MIN | MAX |
|---|---|---|---|
| 48LC** | 14, 17, 20, 24, 26 | 5.0 in. wg (1246 Pa) | 13.0 in. wg (3240 Pa) |

**Table 4 – Liquid Propane Supply Line Pressure Ranges**

| UNIT MODEL | UNIT SIZE | MIN | MAX |
|---|---|---|---|
| 48LC** | 14, 17, 20, 24, 26 | 11.0 in. wg (2740 Pa) | 13.0 in. wg (3240 Pa) |

Manifold pressure is factory-adjusted for NG fuel use. Adjust as required to obtain best flame characteristics.

**Table 5 – Natural Gas Manifold Pressure Ranges**

| UNIT MODEL | UNIT SIZE | HIGH FIRE | LOW FIRE |
|---|---|---|---|
| 48LC** | 14, 17, 20, 24, 26 | 3.0 in. wg (747 Pa) | 2.0 in. Wg (498 Pa) |

Manifold pressure for LP fuel must be adjusted to specified range. Follow instructions in the accessory kit to make initial readjustment.

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

| UNIT MODEL | UNIT SIZE | HIGH FIRE | LOW FIRE |
|---|---|---|---|
| 48LC** | 14, 17, 20, 24, 26 | 11.0 in. wg (2740 Pa) | 7.3 in. Wg (1818 Pa) |
| 48LCS* | 14 only | 9.8 in. wg (2441 Pa) | 6.5 in. Wg (1619 Pa) |



## ⚠ CAUTION

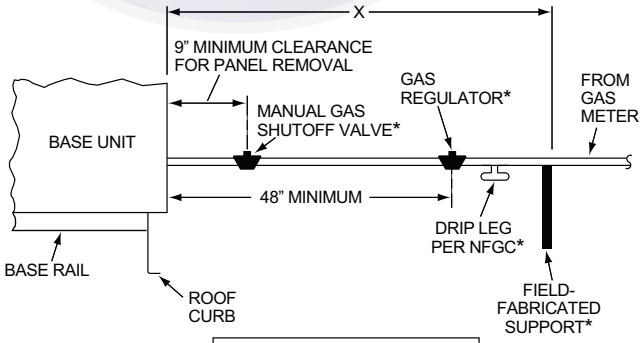
**EQUIPMENT DAMAGE HAZARD**

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

When connecting the gas line to the unit gas valve, the installer MUST use a backup wrench to prevent damage to the valve.

Install a gas supply line that runs to the unit heating section. Refer to the NFPA 54/NFGC or equivalent code for gas pipe sizing data. Do not use a pipe smaller than the size specified. Size the gas supply line to allow for a maximum pressure drop of 0.5-in wg (124 Pa) between gas regulator source and unit gas valve connection when unit is operating at high-fire flow rate.

The gas supply line can approach the unit in two ways: horizontally from outside the unit (across the roof), or through unit basepan. Observe clearance to gas line components per Fig. 20.




| STEEL PIPE NOMINAL DIAMETER (in.) | SPACING OF SUPPORTS X DIMENSION (ft) |
|---|---|
| 1/2 | 6 |
| 3/4 or 1 | 8 |
| 1 1/4 or larger | 10 |

C11121

**Fig. 20 - Gas Piping Guide**

**Factory-Option Thru-Base Connections —**

**Electrical Connections:** Knockouts are located in the control box area. Remove the appropriate size knockout for high voltage connection. Use the field supplied connector depending on wiring or conduit being utilized. Remove the 7/8-in (22mm) knockout and appropriate connector for low voltage wiring. If non-unit powered convenience outlet is being utilized, remove the 7/8-in (22mm) knockout and utilize appropriate connector for 115 volt line. See "Step 12 — Making Electrical Connections" for details.

**Gas Connections:** Remove the knockout in the base pan and route 3/4-in. gas line up through the opening. Install an elbow and route gas line through opening in panel after first removing plastic bushing. Install a gas shut off followed by a drip leg and ground-joint union. Route gas line into gas section through the grommet (Part #: KA56SL112) at the gas inlet and into the gas valve. See Fig. 18 and Table 2. If a regulator is installed, it must be located 4 feet (1.22 meters) from the flue outlet.

Some municipal codes require that the manual shutoff valve be located upstream of the sediment trap. See Fig. 19 for typical piping arrangements for gas piping that has been routed through the sidewall of the base pan.

When installing the gas supply line, observe local codes pertaining to gas pipe installations. Refer to the NFPA 54/ANSI Z223.1 NFGC latest edition (in Canada, CAN/CSA B149.1). In the absence of local building codes, adhere to the following pertinent recommendations:

1. Avoid low spots in long runs of pipe. Grade all pipe 1/4-in. in every 15 ft (7 mm in every 5 m) to prevent traps. Grade all horizontal runs downward to risers. Use risers to connect to heating section and to meter.
2. Protect all segments of piping system against physical and thermal damage. Support all piping with appropriate straps, hangers, etc. Use a minimum of one hanger every 6 ft (1.8 m). For pipe sizes larger than 1/2-in., follow recommendations of national codes.
3. Apply joint compound (pipe dope) sparingly and only to male threads of joint when making pipe connections. Use only pipe dope that is resistant to action of liquefied petroleum gases as specified by local and/or national codes. If using PTFE (Teflon) tape, ensure the material is Double Density type and is labeled for use on gas lines. Apply tape per manufacturer's instructions.
4. Pressure-test all gas piping in accordance with local and national plumbing and gas codes before connecting piping to unit.

**NOTE**: Pressure test the gas supply system after the gas supply piping is connected to the gas valve. The supply piping must be disconnected from the gas valve during the testing of the piping systems when test pressure is in excess of 0.5 psig (3450 Pa). Pressure test the gas supply piping system at pressures equal to or less than 0.5 psig (3450 Pa). The unit heating section must be isolated from the gas piping system by closing the external main manual shutoff valve and slightly opening the ground-joint union.

Check for gas leaks at the field-installed and factory-installed gas lines after all piping connections have

been completed. Use soap-and-water solution (or method specified by local codes and/or regulations).

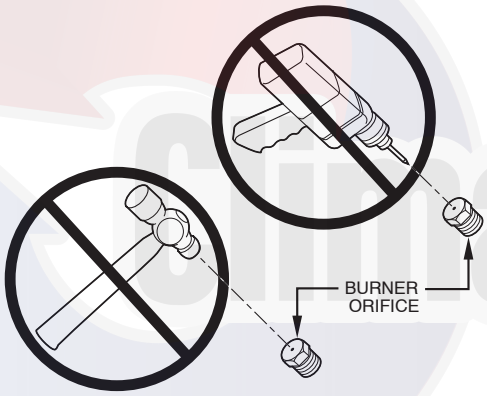
## ⚠ WARNING

**FIRE OR EXPLOSION HAZARD**

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

- Connect gas pipe to unit using a backup wrench to avoid damaging gas controls.
- Never purge a gas line into a combustion chamber.
- Never test for gas leaks with an open flame. Use a commercially available soap solution made specifically for the detection of leaks to check all connections.
- Use proper length of pipe to avoid stress on gas control manifold.

**NOTE**: If orifice hole appears damaged or it is suspected to have been redrilled, check orifice hole with a numbered drill bit of correct size. Never redrill an orifice. A burr-free and squarely aligned orifice hole is essential for proper flame characteristics.




A93059

**Fig. 21 - Orifice Hole**

### Step 11 — Install External Condensate Trap & Line

The unit has one $^{3}/_{4}$-in. condensate drain connection on the end of the condensate pan (see Fig. 22). See Figs. 2, 3 and 4, item "E", in the view labeled "BACK (HORIZONTAL DISCHARGE)" (located on sheet 2 of 3 of each figure) for the location of the condensate drain connection.

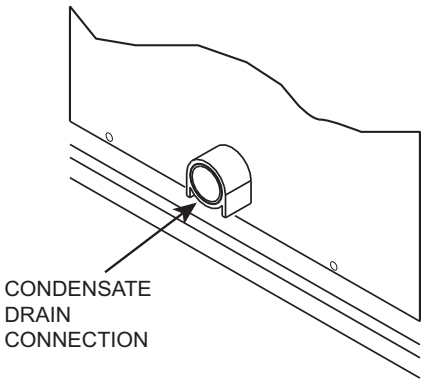



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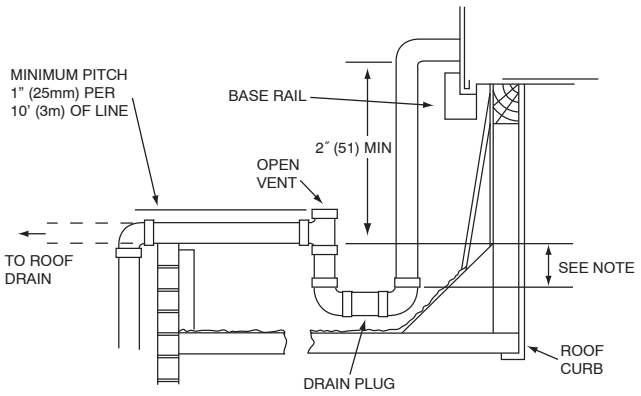
**Fig. 22 - Condensate Drain Pan Connection**

The piping for the condensate drain and external trap can be completed after the unit is in place. Hand tighten fittings to the drain pan fitting. Provide adequate support for the drain line. Failure to do so can result in damage to the drain pan. See Fig. 23.




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

C08022

**Fig. 23 - Condensate Drain Piping Details**

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

### Step 12 — Make Electrical Connections

## ⚠ WARNING

**ELECTRICAL SHOCK HAZARD**

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

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

**NOTE**: Field-supplied wiring shall conform with the limitations of minimum 63°F (33°C) rise.

**Field Power Supply —**

If equipped with optional Powered Convenience Outlet: The power source leads to the convenience outlet's transformer primary are not factory connected. Installer must connect these leads according to required operation of the convenience outlet. If an always-energized convenience outlet operation is desired, connect the source leads to the line side of the unit-mounted

disconnect. (Check with local codes to ensure this method is acceptable in your area.) If a de-energize via unit disconnect switch operation of the convenience outlet is desired, connect the source leads to the load side of the unit disconnect. On a unit without a unit-mounted disconnect or HACR, connect the source leads to the terminal block with unit field power leads. See Fig. 24.

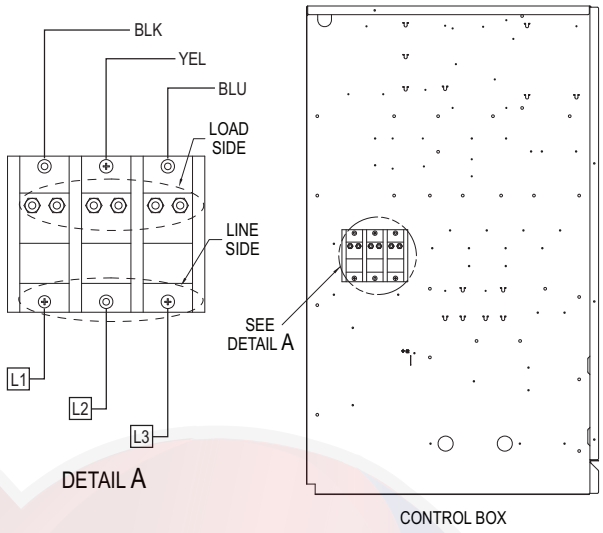



**Fig. 24 - Location of TB1**

Field power wires are connected to the unit at line-side pressure lugs on the terminal block (see wiring diagram label for control box component arrangement) or at factory-installed option non-fused disconnect switch or HACR breaker. Use copper conductors only.

**NOTE**: Make field power connections directly to line connection pressure lugs only.

## ⚠ WARNING

**FIRE HAZARD**

Failure to follow this warning could result in intermittent operation or unsatisfactory performance.

Do not connect aluminum wire between disconnect switch and air conditioning unit. Use only copper wire. (See Fig. 25.)

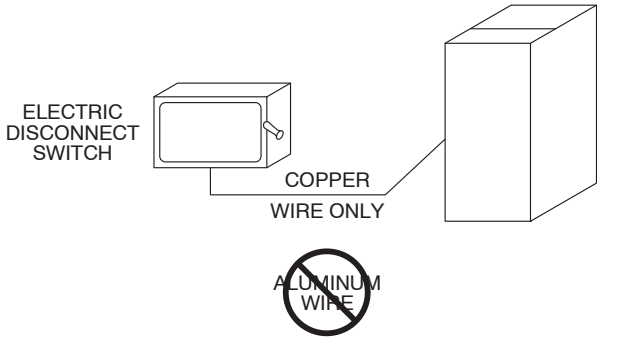



**Fig. 25 - Disconnect Switch and Unit**

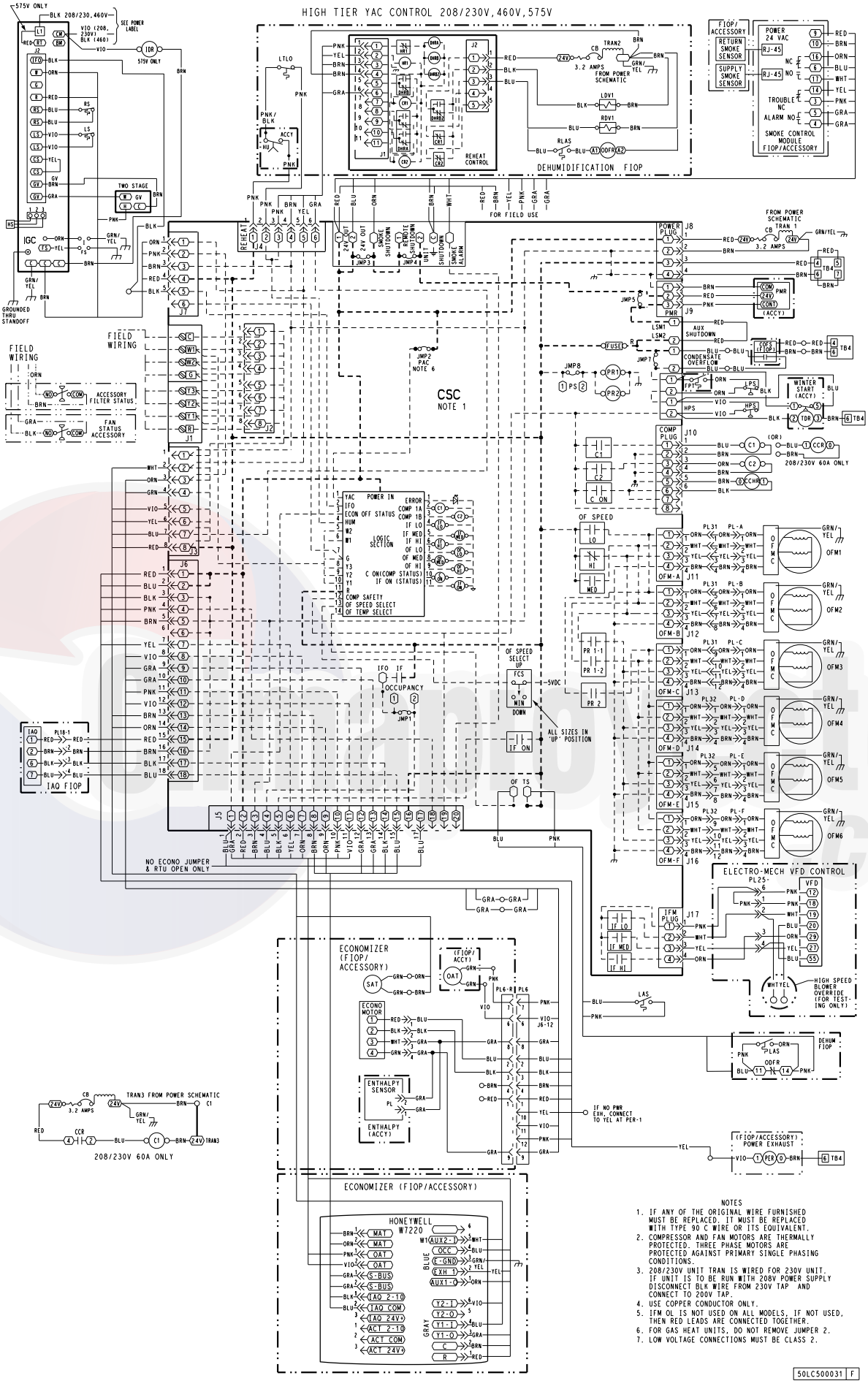



**Fig. 26 - 48LC 14-26 Electromechanical Control Wiring Diagram**

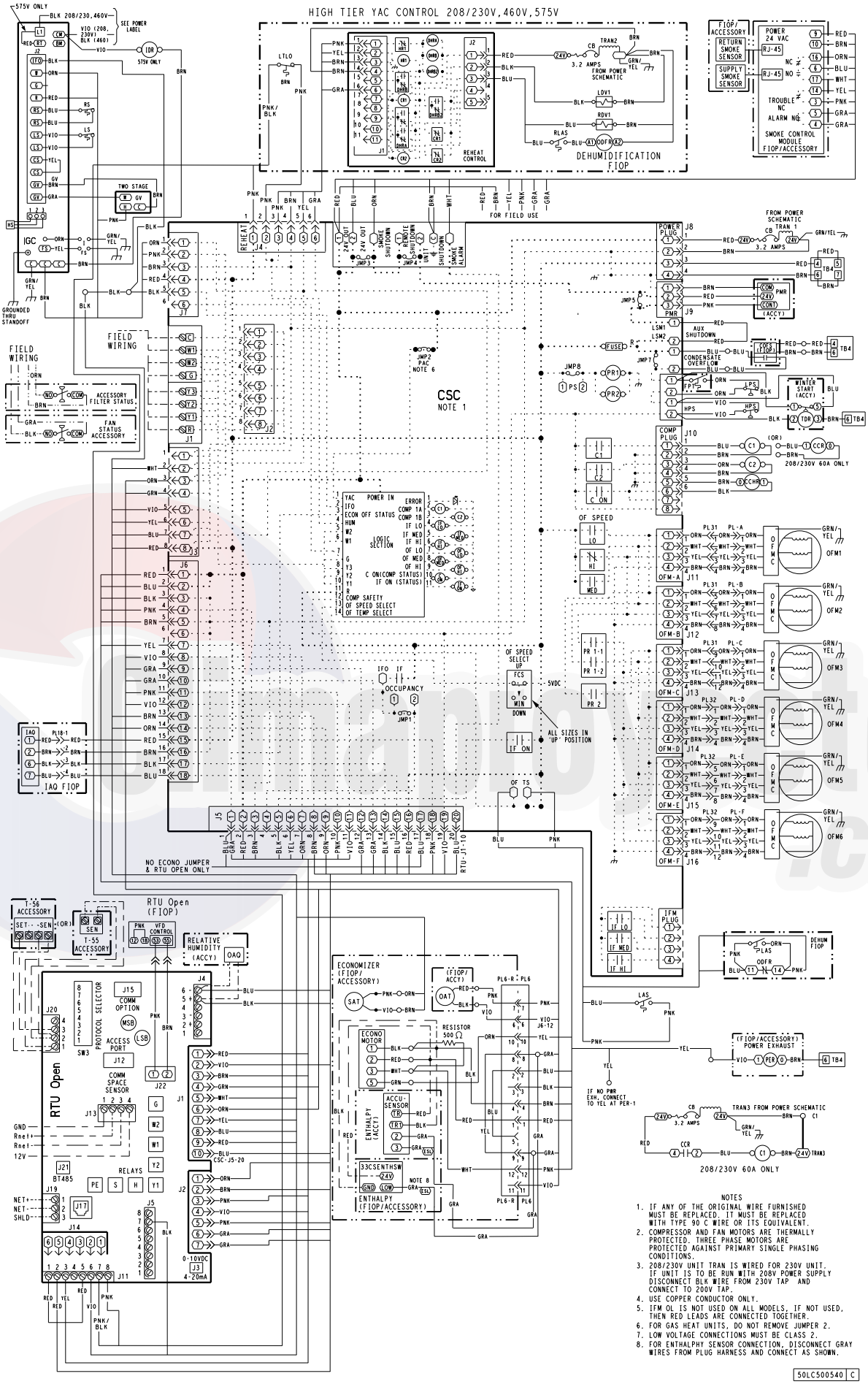
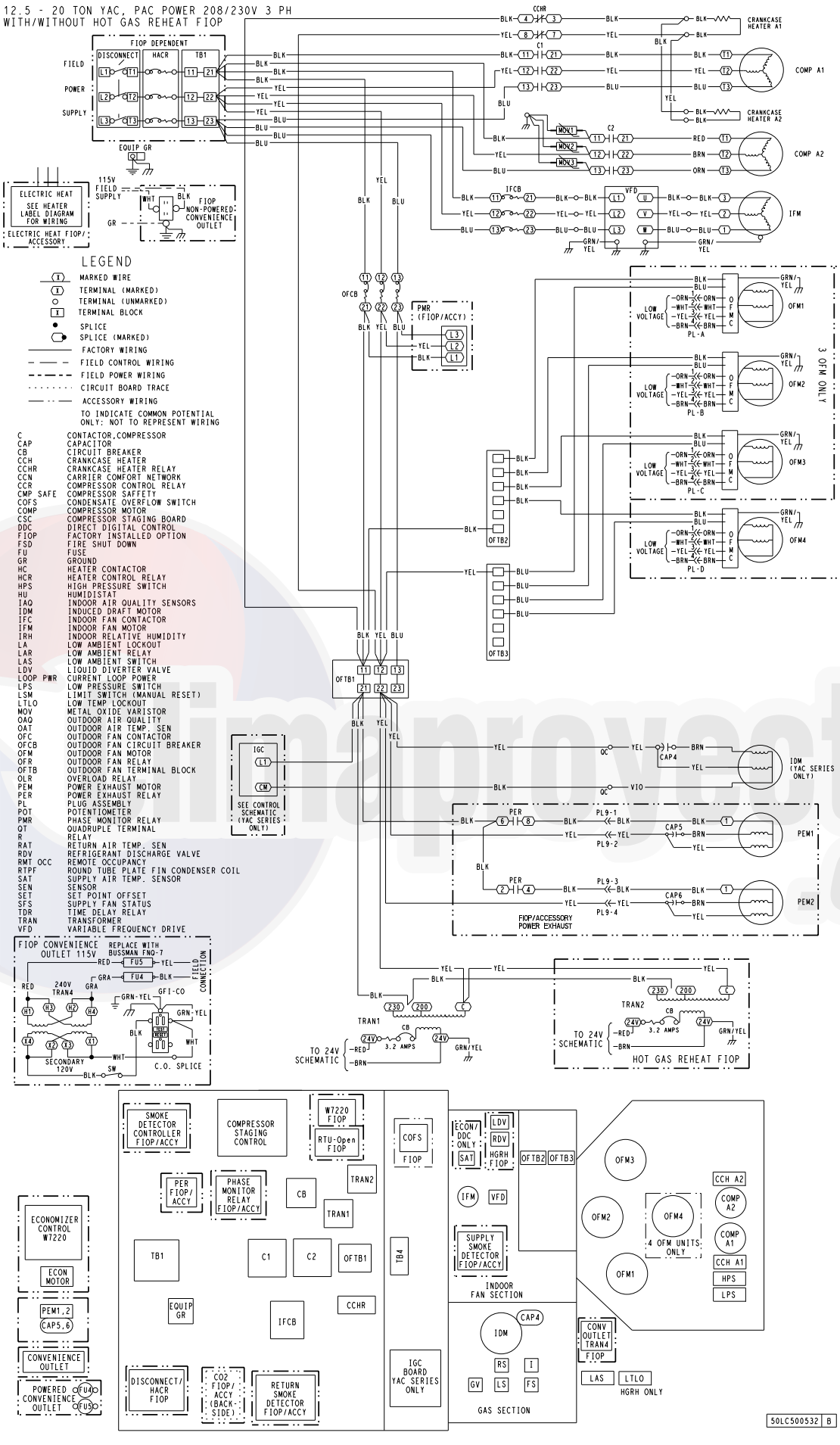



**Fig. 27 - 48LC 14-26 RTU Open Control Wiring Diagram**




C14112

**Fig. 28 - Typical Power Wiring Diagram, 48LC 14-20 208/230V Shown**

**Units Without Factory-Installed Non-Fused Disconnect or HACR —**

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

**Units With Factory-Installed Non-Fused Disconnect or HACR—**

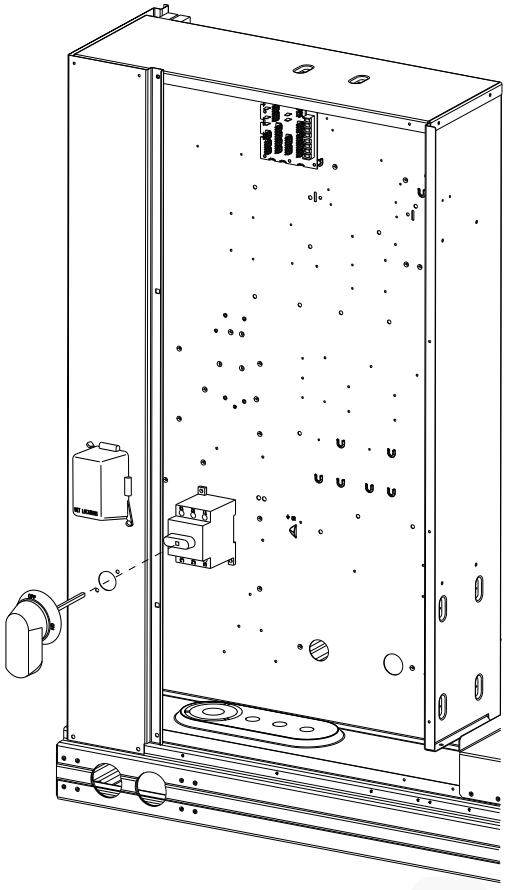
The factory-installed option non-fused disconnect switch (NFD) or HACR is located in the main control box. The manual switch handle and shaft are shipped in the control box and must be mounted on the corner post adjacent to the control box (see Fig. 29 or 30). Note that the tape covering the hole for the shaft in the corner post must be removed prior to handle and shaft installation.

**To field install the NFD shaft and handle:**

1. Open the control box panel.
2. Make sure the NFD shipped from the factory is at OFF position (the arrow on the black handle knob or on the silver metal collar is at OFF).
3. Insert the shaft with the cross pin on the top of the shaft in the horizontal position.
4. Measure the tip of the shaft to the outside surface of the corner post to be 0.88”.
5. Tighten the locking screw to secure the shaft to the NFD.
6. Turn the handle to OFF position with red arrow pointing at OFF.
7. Install the handle on to the corner post vertically with the red arrow pointing up.
8. Secure the handle to the corner post with (2) screws and lock washers supplied.

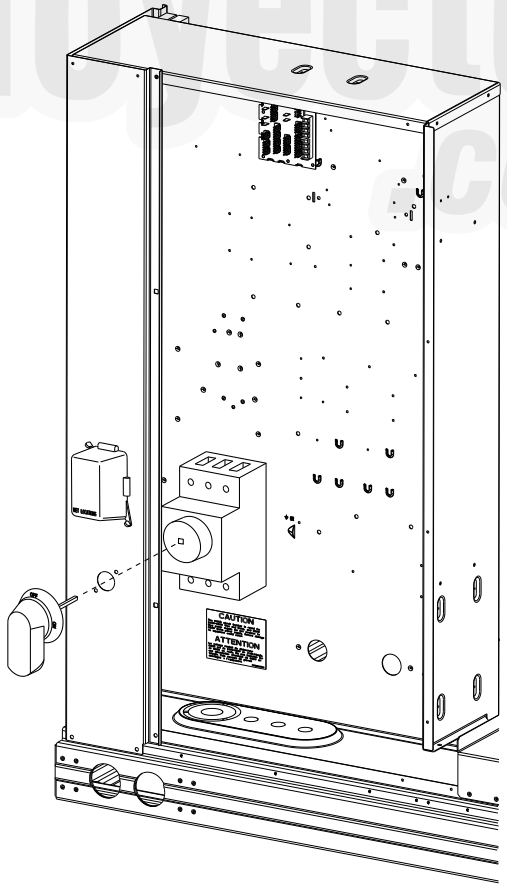
**To field install the HACR shaft and handle:**

1. Open the control box panel.
2. Make sure the HACR shipped from the factory is at OFF position (the white arrow pointing at OFF).
3. Insert the shaft with the cross pin on the top of the shaft in the horizontal position.
4. Measure the tip of the shaft to the outside surface of the corner post to be 0.88”.
5. Tighten the locking screw to secure the shaft to the HACR.
6. Turn the handle to OFF position with red arrow pointing at OFF.
7. Install the handle on to the corner post vertically with the red arrow pointing up.
8. Secure the handle to the corner post with (2) screws and lock washers supplied.



C12385

**Fig. 29 - Handle and Shaft Assembly for NFD**



C12386

**Fig. 30 - Handle and Shaft Assembly for HACR**

**All Units -**

All field wiring must comply with NEC and all local code requirements.

Size wire based on MCA (Minimum Circuit Amps) on the unit informative plate. See Fig. 31 for power wiring connections to the unit power terminal block and equipment ground. Maximum wire size is 2/0 AWG per pole.

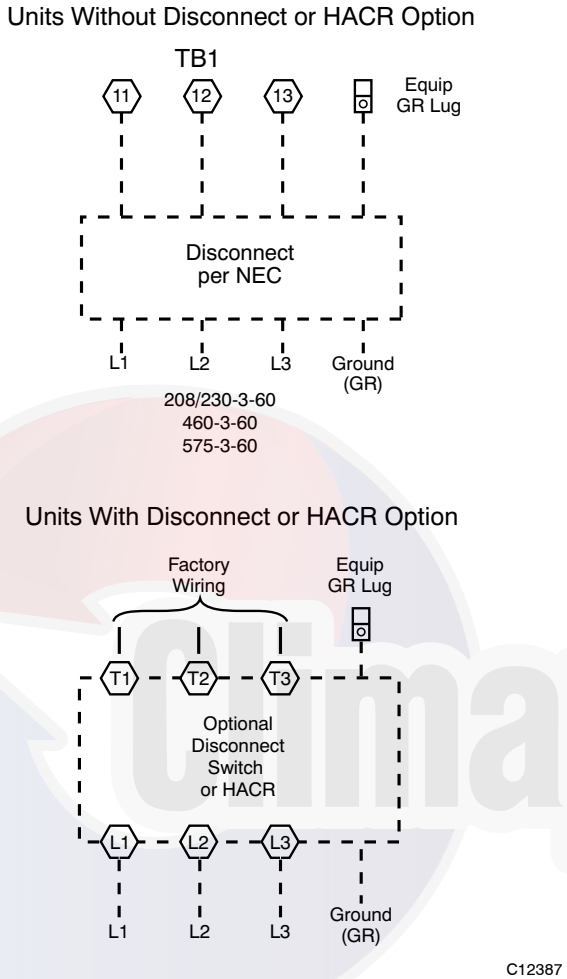



**Fig. 31 - Power Wiring Connections**

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

**NOTE**: Units ordered with factory installed HACR do not need additional ground-fault and short circuit over current protection device unless required by local codes.

Voltage to compressor terminals during operation must be within voltage range indicated on unit nameplate. See Tables 26 and 27. On 3-phase units, voltages between phases must be balanced within 2% and the current within 10%. Use the formula shown in the legend for Tables 26 and 27 (see Note 2 on page 77) to determine the percent of voltage imbalance.

## ⚠ CAUTION

**UNIT DAMAGE HAZARD**

Failure to follow this caution may result in equipment damage.

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

**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.

Two types of convenience outlets are offered on 48LC models: Non-unit powered and unit-powered. Both types provide a 125-volt GFCI (ground-fault circuit-interrupter) duplex receptacle rated at 15-A behind a hinged access cover, located on the corner panel of the unit. See Fig. 32.

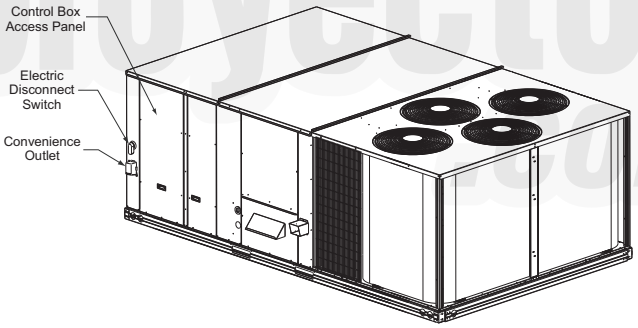



**Fig. 32 - Convenience Outlet Location**

**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; it must be installed at unit installation. For shipment, the convenience outlet is covered with a blank cover plate.

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

DISCONNECT ALL POWER TO UNIT AND CONVENIENCE OUTLET. LOCK-OUT AND TAG-OUT ALL POWER.

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

Loosen the two screws at the GFCI duplex outlet, until approximately $^1/_2$-in (13 mm) under screw heads are exposed. Press the gasket over the screw heads. Slip the backing plate over the screw heads at the keyhole slots and align with the gasket; tighten the two screws until snug (do not over-tighten).

Mount the weatherproof cover to the backing plate as shown in Fig. 33. Remove two slot fillers in the bottom of the cover to permit service tool cords to exit the cover. Check for full closing and latching.

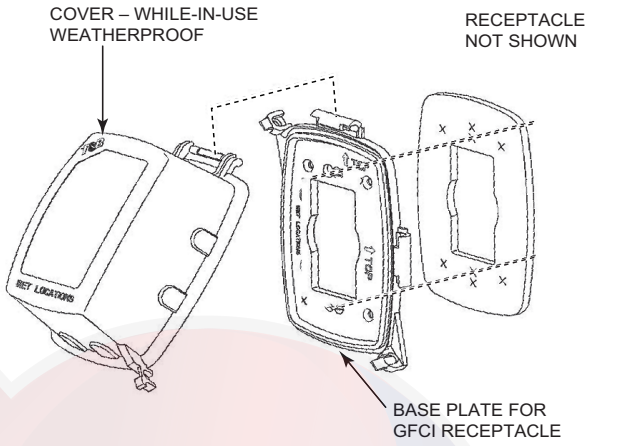



**Fig. 33 - Weatherproof Cover Installation**

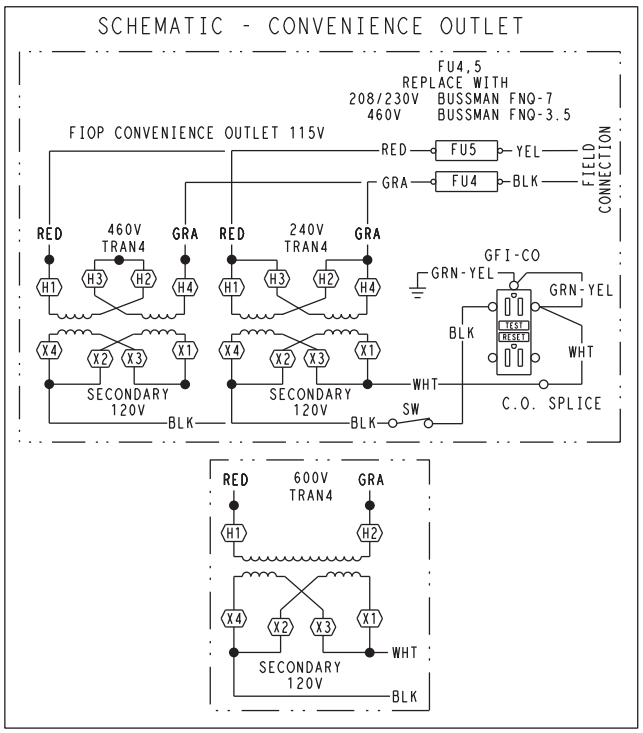
**Non-unit powered type:** This type requires the field installation of a general-purpose 125-volt 15-A circuit powered from a source elsewhere in the building. Observe national and local codes when selecting wire size, fuse or breaker requirements and disconnect switch size and location. Route 125-v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

**Unit-powered type:** A unit-mounted transformer is factory-installed to stepdown 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 control 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. If local codes permit, the transformer primary leads can be connected at the line-side terminals on the unit-mounted non-fused disconnect switch; this will provide service power to the unit when the unit disconnect switch is open. See Fig. 34.

Test the GFCI receptacle by pressing the TEST button on the face 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.

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.




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

**Fig. 34 - Powered Convenience Outlet Wiring**

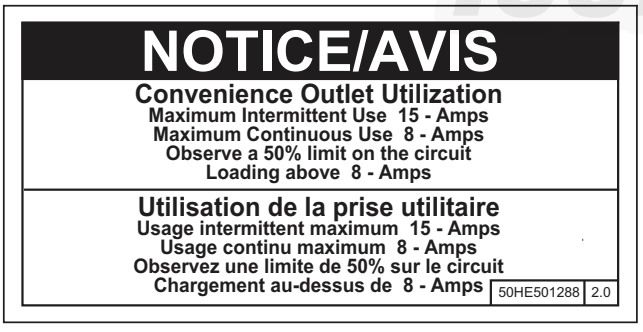
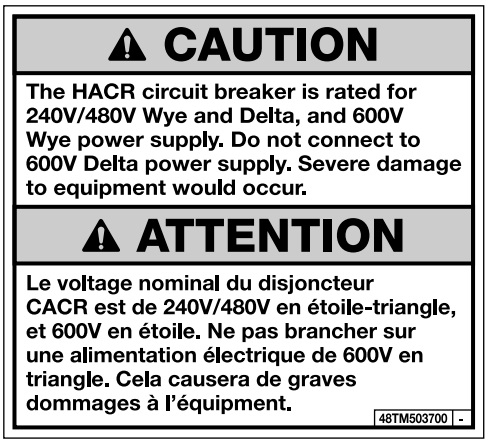



**Fig. 35 - Convenience Outlet Utilization Notice**

**HACR —**

The amp rating of the HACR factory installed option is based on the size, voltage, indoor motor and other electrical options of the unit as shipped from the factory. If field installed accessories are added or changed in the field (i.e., power exhaust), the HACR may no longer be of the proper amp rating and therefore will need to be removed from the unit. See unit nameplate and label on factory installed HACR for the amp rating of the HACR that was shipped with the unit from the factory. See unit

nameplates for the proper fuse, HACR or maximum over-current protection device required on the unit with field installed accessories.




C12105

**Fig. 36 - HACR Caution Label**

**Factory-Option Thru-Base Connections —**

All units are equipped with the ability to bring utilities through the base.

Gas is brought up through an embossed area located in the gas section behind the gas entrance post. Access is gained through the gas access panel. A knock out must be removed to accomplish this.

The electrical entrance is located in the control box area and can be accessed through the control box access panel. An embossed area is provided with three knock outs. High voltage is brought through the multi knock out by removing the appropriate size for the size of the fitting required. A $^{7}/_{8}$-in. knock out is provided for low voltage. An additional $^{7}/_{8}$-in. knock out is provided for a 115 volt line which is used when the unit is equipped with the non-unit powered convenience outlet option.

All required fittings are field supplied. Install fittings when access to both top and bottom of the base pan is available. See electrical and gas connections for routing and connection information.

**Units Without Thru-Base Connections —**

1. Install liquid tight conduit between disconnect and control box.
2. Pull correctly rated high voltage wires through the conduit.
3. Install power lines to terminal connections as shown in Fig. 31.

**Field Control Wiring —**

The 48LC unit requires an external temperature control device such as a thermostat (field-supplied).

**Thermostat —**

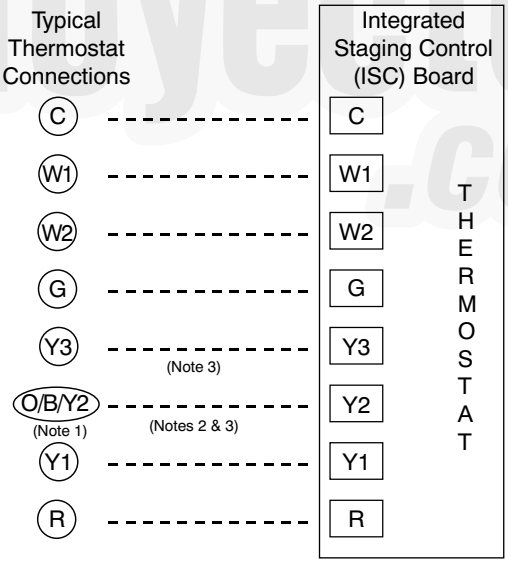
Install a Carrier-approved accessory 3-stage thermostat according to installation instructions included with the accessory. If a 3-stage cooling thermostat is not available use a 2-stage cooling thermostat instead, but note that this will limit cooling to just 2 stages.. Locate the thermostat accessory on a solid wall in the conditioned space to sense average temperature in accordance with the thermostat installation instructions.

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

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

**Unit Without Thru-Base Connection Kit —**

Correctly rated low voltage wire can be routed through the rubber grommet located on the corner post adjacent to the control box access panel. Route wire through the grommet and then route the wire behind the corner post utilizing the factory provided wire ties secured to the control box. This will insure separation of the field low voltage wire and the high voltage circuit. Route the low voltage wire to the Integrated Staging Control (ISC) board. See Fig. 37.




Note 1: Typical multi-function marking. Follow manufacturer's configuration Instructions to select Y2.

Note 2: Y2 to Y3 connection required for 2 stage cooling operation and when integrated economizer function is desired.

Note 3: To Connect a 2-Stage Thermostat:
Y2 to Y3 connection required for 2 stage cooling operation which provides low and high cooling states.

- - - Field Wiring

C13326

**Fig. 37 - Typical Low-Voltage Control Connections**

**NOTE**: If utilizing the through the base connections, route the low voltage wire through the wire ties to the Integrated Staging Control (ISC) board (see Fig. 38).

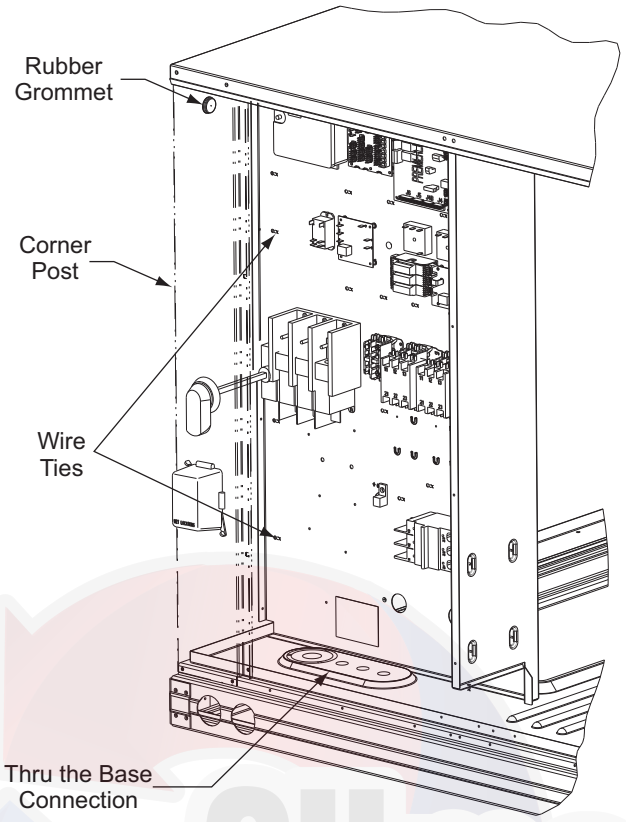



**Fig. 38 - Field Control Wiring Raceway**

**Heat Anticipator Settings —**

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

**Transformer Connection for 208-v Power Supply —**

All units except 208/230-v units are factory wired for the voltage shown on the nameplate. *If the 208/230-v unit is to be connected to a 208-v power supply, the control transformer must be rewired by moving the black wire with the $^1/_4$-in. female spade connector from the 230-v connection and moving it to the 208-v $^1/_4$-in. male terminal on the primary side of the transformer.* Refer to unit label diagram for additional information.

## RTU Open (Factory Option)

For details on operating 48LC*014-26 units equipped with the factory installed RTU Open option refer to *48/50LC 07-26 Factory Installed Option RTU Open Multi-Protocol Controller Controls, Start-up, Operation and Troubleshooting*.

## Humidi-MiZer® Control Connections

**NOTE**: It is suggested to ensure the Auto-Changeover function of an installed thermostat is enabled when used in conjunction with the Humidi-MiZer Adaptive Dehumidification system.

**Humidi-MiZer – Space RH Controller —**

The Humidi-MiZer dehumidification system requires a field-supplied and -installed space relative humidity control device. This device may be a separate humidistat control (contact closes on rise in space RH above control setpoint) or a combination thermostat-humidistat control device with isolated contact set for dehumidification control.

**NOTE**: Use of a humidistat device is not permitted on 48LC units equipped with RTU Open control; these units require use of a field-supplied RH sensor (33ZCSENSRH-02 or 33ZHCSENDRH-02).

**To connect the Carrier humidistat (HL38MG029):**

1. Route the humidistat 2-conductor cable (field-supplied) through the hole provided in the unit corner post.
2. Feed wires through the raceway built into the corner post (see Fig. 38) to the 24-v barrier located on the left side of the control box. The raceway provides the ETL-required clearance between high-voltage and low-voltage wiring.
3. Use wire nuts to connect humidistat cable to two PINK leads in the low–voltage wiring as shown in Fig. 40.

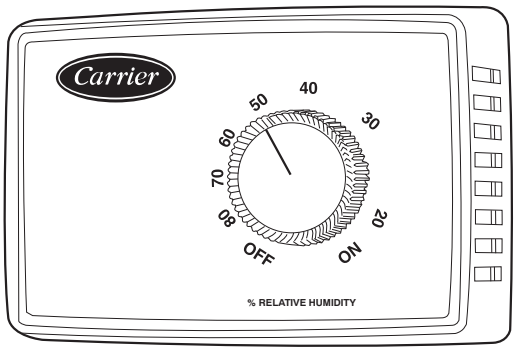



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**Fig. 39 - Accessory Field-Installed Humidistat**

**NOTE**: 48LC**014 - 26 units require a 3-stage cooling thermostat device and are not compatible with Carrier's EDGE Pro thermidistat.

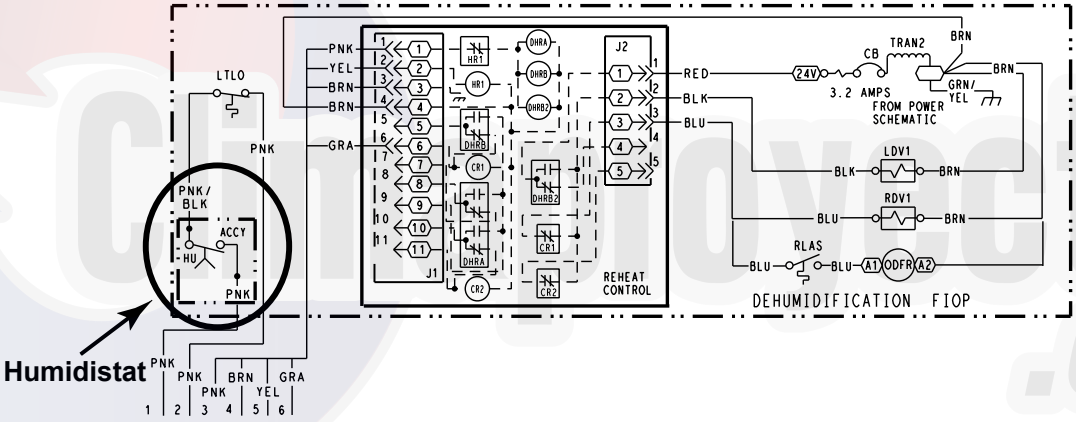


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**Fig. 40 - Typical Humidi-MiZer® Adaptive Dehumidification System Humidistat Wiring**

## Integrated Staging Control (ISC) Board

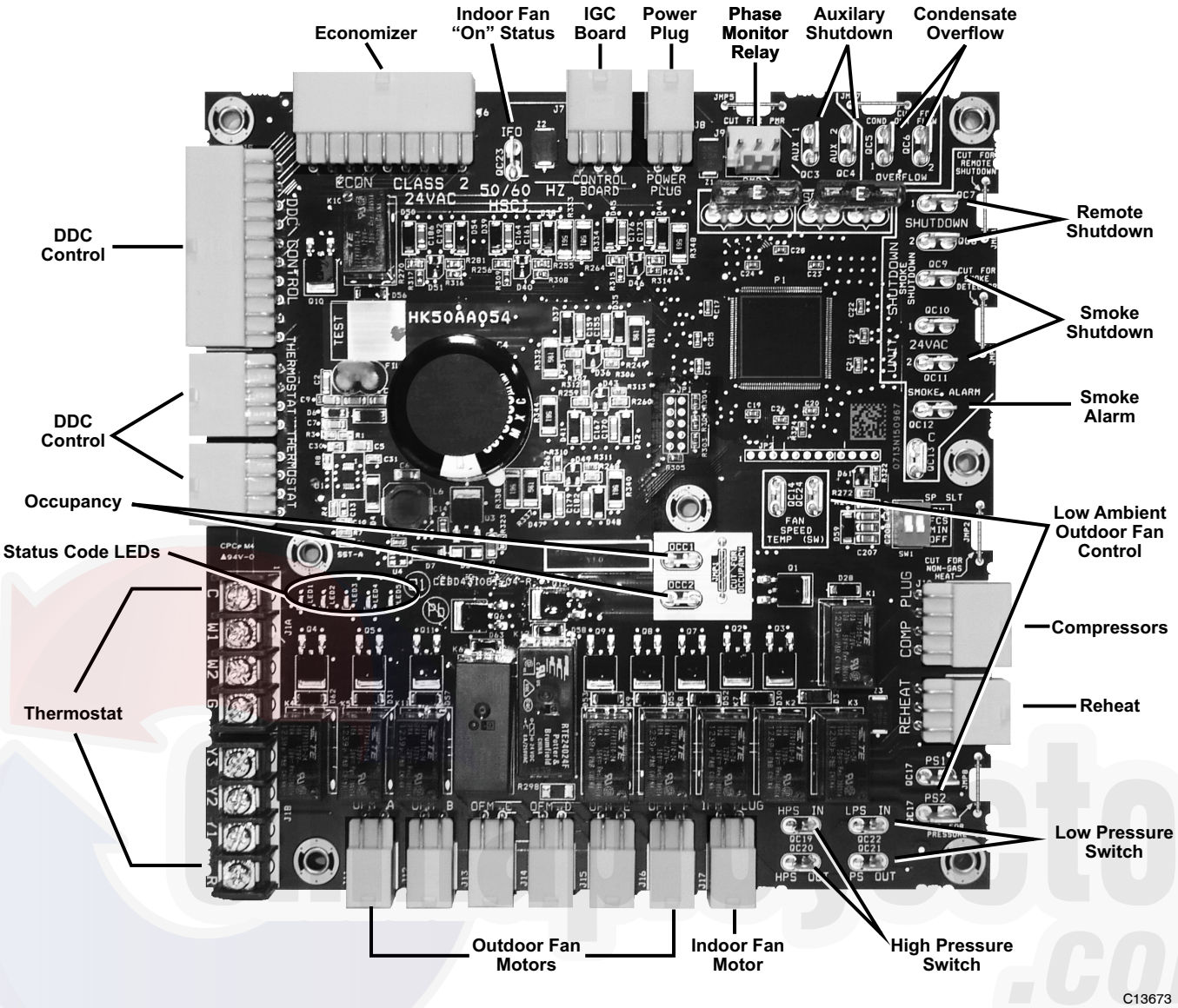


**Fig. 41 - Integrated Staging Control (ISC) Board**

## ISC Board - Sequence of Operation

### General —

The Carrier Integrated Staging Control (ISC) is intended for use with a standard thermostat or direct digital control (DDC) capable of three cooling stages. After initial power to the board, a Green LED will blink with a 1 second duty cycle indicating the unit is running properly. In the event of the ISC board failing, the Green LED will be OFF or continuously ON. When the unit is not running properly, the Green LED will blink along with Red LED lights. The Red LED light configuration will indicate the type of error the board has identified. See Fig. 41 for LED locations and Table 7 for a list of status codes.

The ISC board can be remotely shutdown by removing Jumper 4 and wiring to the Remote Shutdown terminal. The Smoke Control Module can shutdown the unit by removing Jumper 3 and wiring to the Smoke Shutdown terminal. The Smoke Alarm terminal on the ISC Board provides a pass thru connection should a smoke alarm signal be connected. In the case of the RTU Open option, the RTU Open controller provides the signal which is passed thru the ISC board to the Smoke Alarm terminal.

The crankcase heater will run at all times except when the compressors are running. An auxiliary power supply (24Vac) available at TB-4 Terminal is provided to power auxiliary equipment. An optional Phase Monitor Relay can be wired to the PMR terminal by removing Jumper 5. An optional Condensate Flow Switch can be wired to the COFS Terminal by removing Jumper 7.

### Ventilation —

In the Ventilation/Fan Mode (G on the thermostat), the indoor-fan will run at low speed and the damper will operate at minimum position.

**Table 7 – Status Code Descriptions for ISC Board LEDs**

| ERROR# | ERROR NAME | LED INDICATION | | | | |
|---|---|---|---|---|---|---|
| | | LED01 | LED02 | LED03 | LED04 | LED05 |
| 1 | Check Smoke Detector/PMR/AUX | | RED | Blinking Green LED (Note 1) | | |
| 2 | Check HPS/LPS/COFS | RED | RED | | | |
| 3 | Call for Y3 with no call for Y1. Check Y1 wiring. | | | | RED | |
| 4 | Call for Y3 with no call for Y1/Y2. Check Y1 wiring. | | | | RED | RED |
| 5 | Call for Y2 with no call for Y1. Check Y1 wiring. | | RED | | RED | |
| 6 | Call for W2 with no call for W1. Check W1 wiring. | RED | | | | RED |
| 7 | Call for heat (W1/W2) and cooling (Y1/Y2/Y3). Check thermostat wiring. | RED | RED | | RED | RED |
| 8 | Call for heat (W1/W2) with no IFM. Check G wiring. | | RED | | RED | RED |
| 9 | Call for cooling (Y1/Y2/Y3) with no G. Check G wiring | RED | RED | | RED | |
| 10 | Call for heat (W1/W2) and cooling (Y1/Y2/Y3) with no G. Check thermostat and G wiring. | RED | RED | | | RED |
| 11 | Check ISC Board and the thermostat wiring | RED | | | RED | RED |
| 12 | Call for Economizer Y1 Feedback (ECON) from economizer with no call for Y1 from thermostat. Check thermostat and economizer wiring. | RED | | | | |
| 13 | Check ISC Board and the thermostat wiring | RED | | | RED | |
| 14 | Check ISC Board and the thermostat wiring | | | | | RED |
| 15 | Check ISC Board and the thermostat wiring | | RED | | | RED |

NOTES: 1. Green LED Blinking at 1HZ indicates normal operation.
2. Solid red LED indicates an error exists, see above LED configuration.



### Cooling —

In the Cooling Mode, the small and large compressors will be sequenced to maintain the thermostat temperature setpoint. The chart below shows the cooling operation based on the following conditions.

| INPUT | OUTPUT | | | |
|---|---|---|---|---|
| Thermostat | Compressor C1 | Compressor C2 | Indoor Fan Speed | Outdoor Fan Speed |
| First Stage Cooling (Y1) | On | Off | Low | Low (700 rpm) |
| Second Stage Cooling (Y2) | Off | On | Medium | Medium (800 rpm) |
| Third Stage Cooling (Y3) | On | On | High | High (1000 rpm) |

The outdoor fan and VFD controlled indoor-fan will operate at low, medium and high speed. The indoor-fan speed (rpm) is factory set by the CFM and static pressure requirements for the unit installed.

### Humidi-MiZer® (Optional) —

In the Dehumidification Mode, both compressors will run and Indoor airflow will be rise to High Speed.

At subcooler reheating mode (reheat-1), during part load conditions when the room temperature and humidity are above the set point, the unit initiates the sub-cooling mode of operation; a call for cooling and dehumidification. RDV (Reheat Discharge Valve) and TWV (Three Way Valve) close; Indoor and Outdoor airflow will rise until reaching 100% of Speed.

At hot-gas-bypass reheating mode (reheat-2), when there is a call for dehumidification without a call for cooling, a portion of the hot gas from the compressor bypasses the condenser coil when RDV opens and hot gas is fed into the liquid line, TWV closes in this mode and the system provides mainly latent cooling. Indoor airflow will rise until reaching 100% of Speed, Outdoor airflow will run at High speed as long as outdoor temperature is above 80°F (26.7°C); when operating in this mode below 80°F (26.7°C) OAT, the system outdoor fan will operate as shown in the table below based on Size:

| LC Size | RPM | Number of Fans On | Number of Fans Off |
|---|---|---|---|
| 14 | 250 | 3 | 0 |
| 17 | 250 | 4 | 0 |
| 20 | 160 | 4 | 0 |
| 24 | 250 | 6 | 0 |
| 26 | 250 | 6 | 0 |

### Economizer (Optional) —

When the Economizer is in Free Cooling Mode and a demand for cooling exist (Y1 on the thermostat), the Economizer will modulate the outdoor-air damper to provide a 50°F (10°C) to 55°F (13°C) mixed-air temperature into the zone and run the indoor-fan at high speed. As mixed-air temperature fluctuates above 55 ºF (13°C) or below 50°F (10°C) dampers will be modulated (open or close) to bring the mixed-air temperature back within control. Upon more call for cooling (Y2 on the thermostat), the outdoor-air damper will maintain its current position, compressor C1 will run and the outdoor-fan will run at low speed. If there is further demand for cooling, the outdoor-air damper will maintain its current position, compressor C2 will run and the outdoor-fan will run at medium speed. The VFD controlled indoor-fan will operate at high speed regardless of the cooling demand.

If the increase in cooling capacity causes the mixed-air temperature to drop below 45°F (7°C), the outdoor-air damper will return to the minimum position. If the mixed-air temperature continues to fall, the outdoor-air damper will close. Control returns to normal once the mixed-air temperature rises above 48°F (9°C). The power exhaust fans will be energized and de-energized, if installed, as the outdoor-air damper opens and closes.

In field-installed accessory $CO_2$ sensors are connected to the Economizer, a demand controlled ventilation strategy will begin to operate. As the $CO_2$ level in the zone increases above the $CO_2$ set-point, the minimum position of the damper will be increased proportionally. As the $CO_2$ level decreases because of the increase of fresh air, the outdoor-air damper will be proportionally closed. For economizer operation, there must be a thermostat call for the fan (G). If the unit is occupied and the fan is on, the damper will operate at minimum position. Otherwise, the damper will be closed.

**Low Ambient Cooling Operation Down to 40°F (4°C)—**

In Low Ambient RTU conditions when the temperature is between 55°F (13°C) and 40°F (4°C), the Low Ambient Switch (LAS) will be active and the outdoor-fans will run to the pre-set factory outdoor-fan speed. When the temperature is greater than 65°F (18°C), the Low Ambient Switch will deactivate and the outdoor-fans will run in the standard cooling mode. If the Outdoor Fan Select Switch (see Fig. 42) is in the up position, the outdoor fans will run in the Fan Cycle Speed Mode (FCS) set to 250 rpm. If the Outdoor Fan Select Switch is in the down position, the outdoor fans will run in the Minimum Fan Speed Mode (MIN) set to 160 rpm regardless of the cooling demand.

LC Size 14 through 26 Units have a SPST normally open Low Ambient Switch wired across the TS and OF terminal and a jumper placed across the PS terminal (see Fig. 43). When the LAS is active, the switch will close making contact to the OF terminal. This is done for units that require all outdoor fans to run at the same pre-set factory Low Ambient Speed.

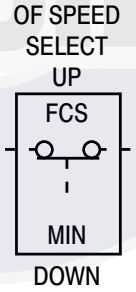


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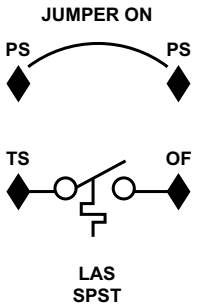
**Fig. 42 - Outdoor Fan Speed Select Switch**




C13328

**Fig. 43 - Schematic of SPST Low Ambient Switch**

The Low Ambient Temperature Outdoor Fan Control Table (below) shows the operation of the outdoor fan for each unit.

**Table 8 – Low Ambient Temperature Outdoor Fan Control**

| LC Size | No. of Fans On | No. of Fans Off | Switch | Outdoor Fan Select Switch | RPM |
|---|---|---|---|---|---|
| 14 | 3 | 0 | SPST | Up | 250 |
| 17 | 4 | 0 | SPST | Up | 250 |
| 20 | 4 | 0 | SPST | Up | 250 |
| 24 | 6 | 0 | SPST | Up | 250 |
| 26 | 6 | 0 | SPST | Up | 250 |

**Heating —**

In the Heating Mode (W1 and G on the thermostat), the ISC board sends power to W on the IGC board. Assuming the unit is controlled through a room thermostat set for fan auto, the indoor-fan motor will energize and the outdoor-air dampers will open to their minimum position. The ISC board upon seeing W1 and G ON will turn the indoor fan to high speed

The IGC board starts its gas ignition process. A check is made to ensure that the rollout switch and limit switch are closed. If the check was successful, the induced draft motor is energized, and when its speed is satisfactory, as proven by the "hall effect" sensor, the ignition activation period begins. The burners will ignite within 5 seconds. If the burners do not light, there is a 22-second delay before another 5 second attempt. This sequence is repeated for 15 minutes or until the burners light. If, after the 15 minutes, the burners still have not lit, heating is locked out. To reset the control, break 24VAC power to the thermostat.

When gas ignition occurs, the IGC board will continue to monitor the condition of the rollout switch, the limit switches, the "hall effect" sensor, as well as the flame sensor.

When W1 is turned OFF, the IGC board turns off the gas valve. The IGC board has a delay time before it turns IFO=OFF. At this time, the ISC board sees W1=OFF and IFO=ON. The ISC will keep the indoor fan ON high speed. Once the IGC board delay times out, the ISC board will see W1=OFF and IFO=OFF, which then turns the indoor fan OFF.

If the call for W1 lasted less than 1 minute, the heating cycle will not terminate until 1 minute after W1 became active. If the unit is controlled through a room thermostat set for fan auto, the indoor fan motor will continue to operate for an additional 45 seconds then stop. If the over temperature limit opens after the indoor motor is stopped, but within 10 minutes of W1 becoming inactive, on the next cycle the time will be extended by 15 seconds. The maximum delay is 3 minutes. Once modified, the fan OFF delay will not change back to 45 seconds unless power is reset to the control. A LED indicator is provided on the IGC to monitor operation.

When additional heat is required, W2 closes and initiates power to the second stage of the main gas valve. When the thermostat is satisfied, the gas valve closes, interrupting the flow of gas to the main burners.

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

EconoMi$er X is an ultra low leak economizer system which is available for 48LC 14-26 units.

The factory-installed option consists of:

- Low leak economizer damper assembly
- Direct-drive damper actuator with local equipment bus communications
- W7220 economizer controller with keypad and display
- Supply Air Temperature sensor (20K ohm)
- Outdoor changeover condition sensor (either 20K ohm dry-bulb or enthalpy sensor)

**Unit Installation —**

All damper hardware and standard economizer control components except the enthalpy sensor are factory-mounted in their operating location. Complete the unit installation by relocating the enthalpy sensor (when provided; see below), then assembling and mounting the unit's outside air hood. Refer to the base unit's installation instruction manual for directions on locating the hood parts package and assembling the hood with filters.

**Enthalpy Sensor Relocation —**

See Fig. 52 for view of the enthalpy sensor. Locate the enthalpy sensor on the side of the economizer housing; remove mounting screws and save screws. Confirm the DIP switches are set at OFF, OFF, OFF (see Table 16). Move the enthalpy sensor to the front face of the economizer housing and mount per label.

## W7220 Economizer Controller

The economizer controller used on electro mechanical units is the Honeywell W7220.

The W7220 provides typical economizer functions, including:

- Management of outside air damper for base unit Occupied (damper open and modulating) and unit OFF or Unoccupied status (damper closed)
- Free-cooling using all outside air when outdoor conditions permit Integrated cooling operation using outside air and mechanical cooling when required
- Demand Control Ventilation (DCV) for modulating ventilation airflow according to space $CO_2$ level (requires factory-option or field-installed $CO_2$ sensor)

The W7220 control also includes a new capability that will adjust the damper control points during DCV or minimum ventilation operation as the indoor fan speed is changed. This control function ensures that required space ventilation airflow quantities are maintained during reduced fan speed operation.

Additional control capabilities include automatic detection of new sensors and detection of sensor failure or loss of communication.

The W7220 control module includes an integral user interface with keypad and LCD display that permits direct input of setpoint values and configurations and display of status and alarms.

The W7220 controller is located in the RTU base unit's Control Box. See the Installation Instructions for this base unit for the location of the Control Box access panel.

**User Interface —**

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

**Keypad —**

The four navigation buttons (see Fig. 44) are used to scroll through the menus and menu items, select menu items, and to change parameter and configuration settings.

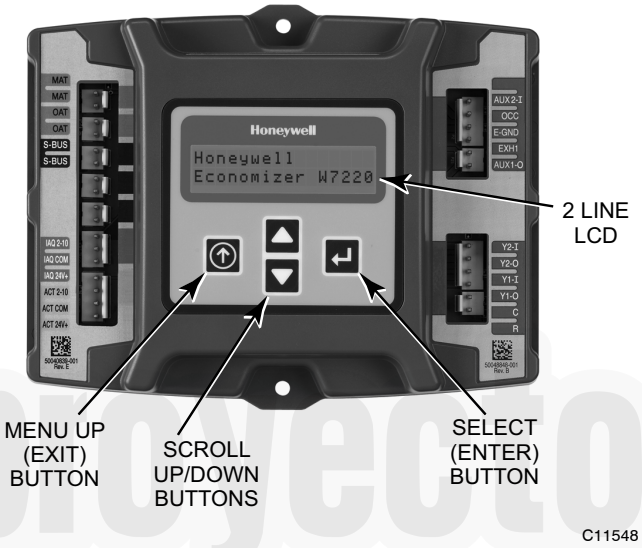



**Fig. 44 - W7220 Controller**

**Using the Keypad with Menus —**

To use the keypad when working with menus:

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

The Menus in display order are:

- STATUS
- SETPOINTS
- SYSTEM SETUP
- ADVANCED SETUP
- CHECKOUT
- ALARMS

**Using the Keypad with Settings and Parameters —**

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

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

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

## Menu Structure

**IMPORTANT**: Table 9 illustrates the complete hierarchy. Your menu parameters may be different depending on your configuration. For example if you do not have a DCV ($CO_2$) sensor, then none of the DCV parameters appear.

The menu hierarchy has been modified to reflect controller configuration for 2-speed indoor fan application in the Staged Air Volume option.

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

**Table 9 – Menu Structure[a1]**

| Menu | Parameter | Parameter Default Value | Parameter Range and Increment[b] | EXPANDED PARAMETER NAME Notes |
|---|---|---|---|---|
| **STATUS** | ECON AVAIL | NO | YES/NO | ECONOMIZING AVAIALBLE<br>YES = economizing available; the system can use outside air for free cooling when required |
| | ECONOMIZING | NO | YES/NO | ECONOMIZING ACTIVE<br>YES = Outside air being used for 1st stage cooling.<br>NO = Economizing not active |
| | OCCUPIED | NO | YES/NO | OCCUPIED<br>YES = OCC signal received from space thermostat or unitary controller.<br>YES = 24 Vac on terminal OCC.<br>NO = 0 Vac on terminal OCC. |
| | HEAT PUMP | n/a[c] | COOL<br>HEAT | HEAT PUMP MODE<br>(Not available on 2–Speed configuration) |
| | COOL Y1–IN | OFF | ON/OFF | FIRST STAGE COOLING DEMAND (Y1–IN)<br>Y1–I signal from space thermostat or unitary controller for Cooling Stage 1.<br>ON = 24 Vac on terminal Y1–I<br>OFF = 0Vac on terminal Y1–I |
| | COOL Y1–OUT | OFF | ON/OFF | FIRST STAGE COOLING RELAY OUTPUT<br>ON = 24 Vac on terminal Y1–O; Stage 1 mechanical cooling called on<br>OFF = 0 Vac on terminal Y1–O; no mechanical cooling |
| | COOL Y2–IN | OFF | ON/OFF | SECOND STAVE COOLING DEMAND (Y2–IN)<br>Y2–I signal from space thermostat or unitary controller for Cooling Stage 2.<br>ON = 24 Vac on terminal Y2–I<br>OFF = 0 Vac on terminal Y2–I |
| | COOL Y2–OUT | OFF | ON/OFF | SECOND STAGE COOLING RELAY OUTPUT<br>ON = 24 Vac on terminal Y2–O; Stage 2 mechanical cooling called on<br>OFF = 0 Vac on terminal Y2–O; no Stage 2 mechanical cooling |
| | MA TEMP | nn°F (or °C) | 0 to 140°F<br>(–18 to 60°C) | SUPPLY AIR TEMPERATRUE, Cooling Mode<br>Displays value of measured mixed/cooled air from SAT sensor in fan section.<br>Displays ––.– if not connected, short or out–of–range. See Menu Note 2 |
| | DA TEMP | nn°F (or °C) | 0 to 140°F<br>(–18 to 60°C) | DISCHARGE AIR TEMPERATRUE, after Heating section<br>(Accessory sensor required)<br>Displays when Discharge Air sensor is connected and displays measured discharge temperature.<br>Displays –– –– –– if sensor sends invalid value, if not connected, short or out–of–range. |
| | OA TEMP | nn°F (or °C) | –40 to 140°F<br>(–40 to 60°C) | OUTSIDE AIR TEMPERATRUE<br>Displays measured value of outdoor air temperature.<br>Displays –– –– –– if sensor sends invalid value, if not connected, short or out–of–range. |
| | OA HUM | nn% | 0 to 100% | OUTSIDE AIR RELATIVE HUMIDITY<br>Displays measured value of outdoor humidity from OA enthalpy sensor. |
| | RA TEMP | nn°F (or °C) | 0 to 140°F<br>(–18 to 60°C) | RETURN AIR TEMPERATRUE<br>(Accessory sensor required)<br>Displays measured value of return air temperature from RAT sensor. |

## Table 9 - Menu Structure[a] (cont)

| Menu | Parameter | Parameter Default Value | Parameter Range and Increment[b] | EXPANDED PARAMETER NAME Notes |
|---|---|---|---|---|
| **STATUS (cont)** | RA HUM | nn% | 0 to 100% | RETURN AIR RELATIVE HUMIDITY<br>(Accessory enthalpy sensor required)<br>Displays measured value of return air humidity from RA sensor. |
| | IN CO2 | ___ppm | 0 to 2000 ppm | SPACE/RETURN AIR CO2<br>($CO_2$ sensor required, accessory or factory option)<br>Displays value of measured $CO_2$ from $CO_2$ sensor.<br>Invalid if not connected, short or out−of−range |
| | DCV STATUS | n/a | ON/OFF | DEMAND CONTROL VENTILATION STATUS<br>($CO_2$ sensor required, accessory or factory option)<br>Displays ON if IN CO2 value above setpoint DCV SET and OFF if below setpoint DCV SET. |
| | DAMPER OUT | 2.0V | 2.0 to 10.0V | Displays voltage output to the damper actuator.<br>0% = OSA Damper fully closed<br>100% = OSA Damper full open<br>See Menu Note 3. |
| | ACT POS | nn% | 0 to 100% | Displays actual position of outdoor air damper actuator<br>2.0V = OSA Damper fully−closed<br>10.0V = OSA Damper full open |
| | ACT COUNT | n/a | 1 to 65535 | Displays number of times actuator has cycled.<br>1 Cycle equals accrued 180° of actuator movement in any direction |
| | ACTUATOR | n/a | OK/Alarm<br>(on Alarm menu) | Displays Error if voltage or torque is below actuator range |
| | EXH1 OUT | OFF | ON/OFF | EXHAUST STAGE 1 RELAY OUTPUT<br>Output of EXH1 terminal:<br>ON = relay closed<br>OFF = relay open |
| | EXH2 OUT | OFF | ON/OFF | EXHAUST STAGE 2 RELAY OUTPUT<br>Output of AUX terminal; displays only if AUX = EXH2<br>ON = relay closed<br>OFF = relay open |
| | MECH COOL ON | 0 | 0, 1, or 2 | Displays stage of mechanical cooling that is active. |
| | FAN SPEED | n/a | LOW or HIGH | SUPPLY FAN SPEED<br>Displays speed setting of fan on a 2−speed fan unit. |
| | W (HEAT ON) | n/a | ON/OFF | HEAT DEMAND STATUS<br>Displays status of heat demand on a 2−speed fan unit. |
| **SETPOINTS** | MAT SET | 53°F (12°C) | 38 to 65°F; (3 to 18°C) increment by 1 | SUPPLY AIR SETPOINT<br>Setpoint determines where the economizer will modulate the OA damper to maintain the mixed air temperature.<br>See Menu Note 2. |
| | LOW T LOCK | 32°F (0°C) | −45 to 80°F; (−43 to 27°C) increment by 1 | COMPRESSOR LOW TEMPERATURE LOCKOUT<br>Setpoint determines outdoor temperature when the mechanical cooling cannot be turned on. |
| | DRYBLB SET | 63°F (17°C) | 48 to 80°F (9 to 27°C) increment by 1 | OA DRY BULB TEMPERATURE CHANGEOVER SETPOINT<br>Setpoint determines where the economizer will assume outdoor air temperature is good for free cooling; e.g.: at 63°F (17°C), unit will economize at 62°F (16.7°C) and below and not economize at 64°F (17.8°C) and above. There is a 2°F (1.1°C)deadband.<br>See Menu Note 3 |
| | ENTH CURVE | ES3 | ES1, ES2, ES3, ES4, or ES5 | ENTHALPY CHANGEOVER CURVE<br>(Requires enthalpy sensor option)<br>Enthalpy boundary “curves” for economizing using single enthalpy. |
| | DCV SET | 1100ppm | 500 to 2000 ppm; increment by 100 | DEMAND CONTROL VENTILATION SETPOINT<br>Displays only if $CO_2$ sensor is connected. Setpoint for Demand Control Ventilation of space. Above the setpoint, the OA dampers will modulate open to bring in additional OA to maintain a space ppm level below the setpoint. |
| | MIN POS L | 6.0 V | 2 to 10 Vdc | VENTILATION MINIMUM POSITION AT LOW SPEED<br>Displays ONLY if a $CO_2$ sensor is NOT connected. |
| | MIN POS H | 4.4 V | 2 to 10 Vdc | VENTILATION MINIMUM POSITION AT HIGH SPEED<br>Displays ONLY if a $CO_2$ sensor is NOT connected. |
| | VENTMAX L | 6.0 V | 2 to 10 Vdc | DCV MAXIMUM DAMPER POSITION AT LOW SPEED<br>(Requires $CO_2$ sensor connected) |
| | VENTMAX H | 4.4 V | 2 to 10 Vdc | DCV MAXIMUM DAMPER POSITION AT HIGH SPEED<br>(Requires $CO_2$ sensor connected) |
| | VENTMIN L | 3.7 V | 2 to 10 Vdc | DCV MINIMUM DAMPER POSITION AT LOW SPEED<br>(Requires $CO_2$ sensor connected) |
| | VENTMIN H | 2.8 V | 2 to 10 Vdc | DCV MINIMUM DAMPER POSITION AT HIGH SPEED<br>(Requires $CO_2$ sensor connected) |
| | EXH1 L SET | 65% | 0 to 100%; Increment by 1 | EXHAUST FAN STAGE 1 SETPOINT AT LOW SPEED<br>Setpoint for OA damper position when exhaust fan1 is powered by the economizer |
| | EXH1 H SET | 50% | 0 to 100%; Increment by 1 | EXHAUST FAN STAGE 1 SETPOINT AT HIGH SPEED<br>Setpoint for OA damper position when exhaust fan1 is powered by the economizer |

**Table 9 - Menu Structure[a] (cont)**

| Menu | Parameter | Parameter Default Value | Parameter Range and Increment[b] | EXPANDED PARAMETER NAME Notes |
|---|---|---|---|---|
| **SETPOINTS (cont)** | EXH2 L SET | 80% | 0 to 100%; Increment by 1 | EXHAUST FAN STAGE 2 SETPOINT AT LOW SPEED<br>Setpoint for OA damper position when exhaust fan1 is powered by the economizer. Only used when AUX1−O is set to EHX2. |
| | EXH2 H SET | 75% | 0 to 100%; Increment by 1 | EXHAUST FAN STAGE 2 SETPOINT AT HIGH SPEED<br>Setpoint for OA damper position when exhaust fan1 is powered by the economizer. Only used when AUX1−O is set to EHX2. |
| **SYSTEM SETUP** | INSTALL | 01/01/10 | | Display order = MM/DD/YY<br>Setting order = DD, MM, then YY. |
| | UNITS DEG | °F | °F or °C | Sets economizer controller in degrees Fahrenheit or Celsius. |
| | EQUIPMENT | CONV | Conventional or HP | CONV = conventional;<br>HP O/B = Enable Heat Pump mode. Not available with 2−speed<br>See Menu Note 4 |
| | AUX2 I | W | W required for 2−speed mode | W = Informs controller that system is in heating mode.<br>SD = Enables configuration of shutdown (not available on 2−Speed)<br>See Menu Note 4 |
| | FAN TYPE | 2speed | 2speed required | Sets the economizer controller for operation of 1 speed or 2 speed indoor fan system.<br>See Menu Note 4. |
| | FAN CFM | 5000cfm | 100 to 15000 cfm; increment by 100 | UNIT DESIGN AIRFLOW (CFM)<br>Enter ONLY of using DCVCAL ENA = AUTO<br>The value is found in the Project Submittal documents for the specific RTU. |
| | AUX OUT | NONE | NONE<br>EXH2<br>SYS | Select OUTPUT for AUX1 O relay<br>NONE = not configured (output is not used)<br>EXH2 = second damper position relay closure for second exhaust fan<br>SYS = use output as an alarm signal |
| | OCC | INPUT | INPUT or ALWAYS | OCCUPIED MODE BY EXTERNAL SIGNAL<br>When using a setback thermostat with occupancy out (24 Vac), the 24 Vac is input to the OCC terminal. RTU control circuit provides 24−Vac to OCC through OCCUPIED terminals on Integrated Staging Control. Board<br>See Menu Note 2. |
| | FACTORY DEFAULT | NO | NO or YES | Resets all set points to factory defaults when set to YES. LCD will briefly flash YES and change to NO but all parameters will change to the factory default values. **RECHECK AUX2 I and FANTYPE for required 2−speed values.** |
| **ADVANCED SETUP** | MA LO SET | 45°F (7°C) | 35 to 55°F; (2 to 12°C) Incremented by 1° | SUPPLY AIR TEMPERATURE LOW LIMIT<br>Temperature to achieve Freeze Protection (close damper and alarm if temperature falls below setup value) |
| | FREEZE POS | CLO | CLO or MIN | FREEZE PROTECTION DAMPER POSITION<br>Damper position when freeze protection is active<br>CLO = closed<br>MIN = MIN POS or VENTMAX |
| | CO2 ZERO | 0ppm | 0 to 500 ppm: Increment by 10 | $CO_2$ ppm level to match $CO_2$ Sensor start level. |
| | CO2 SPAN | 2000ppm | 1000 to 3000 ppm; Increment by 50 | $CO_2$ ppm span to match $CO_2$ sensor. |
| | STG3 DLY | 2.0h | 0 min, 5 min, 15 min, then 15 min intervals. Up to 4 h or OFF | COOLING STAGE 3 DELAY<br>Delay after stage 2 for cool has been active. Turns on 2nd stage of cooling when economizer is 1st stage and mechanical cooling is 2nd |
| | SD DMPR POS | CLO | CLO or OPN | Function NOT AVAILABLE with 2−speed mode |
| | DCVCAL ENA | MAN | MAN (manual) | Turns on the DCV automatic control of the dampers. Resets ventilation. |
| | MATTCAL | 0.0°F (or C) | +/−2.5°F (+/−1.4°C) | SUPPLY AIR TEMPERATURE CALIBRATION<br>Allows for the operator to adjust for an out of calibration supply air temperature (SAT) sensor |
| | OA T CAL | 1.0°F (or C) | +/−2.5°F (+/−1.4°C) | OUTSIDE AIR TEMPERATURE CALIBRATION<br>Allows for the operator to adjust for an out of calibration outside air temperature (OAT) sensor |
| | OA H CAL | 0% RH | +/−10% RH | OURTSIDE AIR HUMIDITY CALIBRATION<br>Allows for the operator to adjust for an out of outside air enthalpy sensor |
| | RA T CAL | 2.0°F (or C) | +/−2.5°F (+/−1.4°C) | RETURN AIR TEMPERATURE CALIBRATION<br>Allows for the operator to adjust for an out of calibration return air temperature (RA) sensor |
| | RA H CAL | 0% RH | +/−10% RH | RETURN AIR HUMIDITY CALIBRATION<br>Allows for the operator to adjust for an out of calibration return air enthalpy sensor |
| | DA T CAL | 0.0°F (or C) | +/−2.5°F (+/−1.4°C) | DISCHARGE AIR TEMPERATURE CALIBRATION<br>Allows for the operator to adjust for an out of calibration discharge air temperature (DAT) sensor |
| | 2SP FAN DELAY | 5 Minutes | 0 to 20 minutes in 1 minute increments | TIME DELAY ON 2nd STAGE ECONOMIZING<br>While in the Economizing mode, this is the delay between thermostat Y2 call and Y1−O output to mechanical cooling stage, to allow high speed fan operation to attempt to cool space first. |

## Table 9 - Menu Structure[a] (cont)

| Menu | Parameter | Parameter Default Value | Parameter Range and Increment[b] | EXPANDED PARAMETER NAME Notes |
|---|---|---|---|---|
| **CHECKOUT** | DAMPER VMIN .HS | n/a | n/a | Positions OA damper to VMIN High Speed position |
| | DAMPER VMAX .HS | n/a | n/a | Positions OA damper to VMAX High Speed position |
| | DAMPER OPEN | n/a | n/a | Positions OA damper to the full open position. |
| | DAMPER CLOSE | n/a | n/a | Positions damper to the fully closed position |
| | CONNECT Y1–O | n/a | n/a | Closes the Y1–O relay (Y1–O) |
| | CONNECT Y2–O | n/a | n/a | Closes the Y2–O relay (Y2–O) |
| | CONNECT AUX1O | n/a | n/a | Energizes the AUX1O output. If Aux setting is:<br>• NONE – not action taken<br>• ERV – 24 Vac out. Turns on or signals an ERV that the conditions are not good for economizing but are good for ERV operation.[d]<br>• SYS – 24 Vac out. Issues a system alarm |
| **ALARMS(_)** | | | | Alarms display only when they are active. The menu title "ALARMS(_)" includes the number of active alarms in parenthesis ( ). |
| | MA T SENS ERR | n/a | n/a | SUPPLY AIR TEMPERATURE SENSOR ERROR |
| | CO2 SENS ERR | n/a | n/a | CO2 SENSOR ERROR |
| | OA T SENS ERR | n/a | n/a | OUTSIDE AIR TEMPERATURE SENSOR ERROR<br>OAT sensor connected at input terminals OAT |
| | OA SYLK SENS ERR | n/a | n/a | OUTSIDE AIR TEMPERATURE SENSOR ERROR<br>OAT sensor connected on S– bus |
| | DA T SENS ERR | n/a | n/a | DISCHARGE AIR TEMPERATURE SENSOR ERROR |
| | SYS ALARM | n/a | n/a | When AUX is set to SYS and there is any alarm (e.g., failed sensors, etc.), the AUX terminal has 24 Vac out. |
| | ACT UNDER V | n/a | n/a | ACTUATOR VOLTAGE LOW<br>Voltage received at actuator is below expected range |
| | ACT OVER V | n/a | n/a | ACTUATOR VOLTAGE HIGH<br>Voltage received at actuator is above expected range |
| | ACT STALLED | n/a | n/a | ACTUATOR STALLED<br>Actuator stopped before reaching commanded position |

[a] Table 9 illustrates the complete hierarchy. your menu parameters may be different depending on your configuration. For example if you do not have a DCV ($CO_2$) sensor, then none of the DCV parameters appear.

[b] When values are displayed, pressing and holding the ▲ or ▼ button causes the display to automatically increment.

[c] n/a = not applicable

[d] ERV Operation: When in Cooling mode AND the conditions are NOT OK for economizing – the ERV terminal will be energized. In the Heating mode the ERV terminal will be energized when the OA is below the ERV OAT setpoint in the setpoint menu.

**Menu Notes**

1 ***STATUS –> OCCUPIED –*** The factory-standard Occupancy signal originates with a thermostat or other controller call for indoor fan operation at ISC terminal G. This signal passes through the Integrated Staging Control Board's OCCUPIED jumper JMP1 to the ECONO connector and to the W7220's OCC input terminal. An external timeclock or relay is required to implement an Occupancy schedule on the economizer damper position.

2 ***STATUS -> MA TEMP, SETPOINTS -> MAT SET –*** The W7220 menu parameters and labels include designations MA , MAT and Mixed Air for the economizer cooling control sensor. On these rooftop units, the economizer control sensor is located downstream of the evaporator/indoor coil in the supply fan section where this sensor is designated as Supply Air Temperature (SAT) sensor.

3 ***SETPOINTS -> DRYBLB SET –*** This point is not displayed if a Return Air (differential) temperature sensor or an Outdoor Air enthalpy sensor is connected.

4 ***SYSTEM SETUP*** parameters must be configured as noted for 2-Speed unit operation:
***EQUIPMENT*** = CONV
***AUX2 I*** = W
***FAN TYPE*** = 2SPEED

## Connections and Applications

### W7220 Economizer Module Wiring —

Use Fig. 45 and Tables 10 and 11 to locate the wiring terminals for the Economizer module.

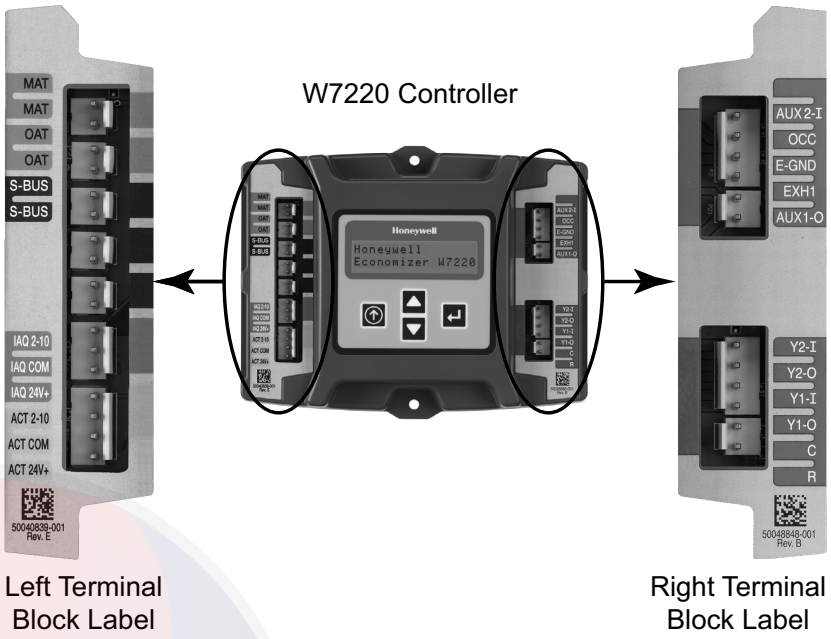



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**Fig. 45 - W7220 Economizer Module Terminal Connection Labels**

**Table 10 – Economizer Module - Left Hand Terminal Blocks**

| Label | Type | Description |
|---|---|---|
| **Top Left Terminal Block** | | |
| MAT<br>MAT | 20k NTC and COM | Supply Air Temperature Sensor (polarity insensitive connection) |
| OAT<br>OAT | 20k NTC and COM | Outdoor Air Temperature Sensor (polarity insensitive connection) |
| S–BUS<br>S–BUS | S–Bus (Sylk Bus) | Enthalpy Control Sensor (polarity insensitive connection) |
| **Bottom Left Terminal Block** | | |
| IAQ 2–10 | 2–10 Vdc | Air Quality Sensor Input (e.g. $CO_2$ sensor) |
| IAQ COM | COM | Air Quality Sensor Common |
| IAQ 24V | 24 Vac | Air Quality Sensor 24 Vac Source |
| ACT 2–10 | 2–10 Vdc | Damper Actuator Output (2–10 Vdc) |
| ACT COM | COM | Damper Actuator Output Common |
| ACT 24V | 24 Vac | Damper Actuator 24 Vac Source |

**Table 11 – Economizer Module - Right Hand Terminal Blocks**

| Label | Type | Description |
|---|---|---|
| **Top Right Terminal Block** | | |
| | n/a | The first terminal is not used |
| AUX2 I | 24 Vac IN | Input from Thermostat W1 indicating base unit is in Heat mode, damper controls to High Fan Speed setpoints |
| OCC | 24 Vac IN | Occupied / Unoccupied Input |
| E–GND | E–GND | Earth Ground – System Required |
| EXH1 | 24 Vac OUT | Exhaust Fan 1 Output |
| AUX1 O | 24 Vac OUT | Programmable:<br>Exhaust fan 2 output<br>or<br>Erv<br>or<br>System Alarm output |
| **Bottom Right Terminal Block** | | |
| Y2–I | 24 Vac IN | Y2 in – Cooling Stage 2 Input from space thermostat |
| Y2–O | 24 Vac OUT | Y2 out – Cooling Stage 2 Output to stage 2 mechanical cooling |
| Y1–I | 24 Vac IN | Y1 in – Cooling Stage 2 Input from space thermostat |
| Y1–O | 24 Vac OUT | Y1 out – Cooling Stage 2 Output to stage 2 mechanical cooling |
| C | COM | 24 Vac Common |
| R | 24 Vac | 24 Vac Power (Hot) |

Refer to Figs 46 and 47 for sensor and controls connections.

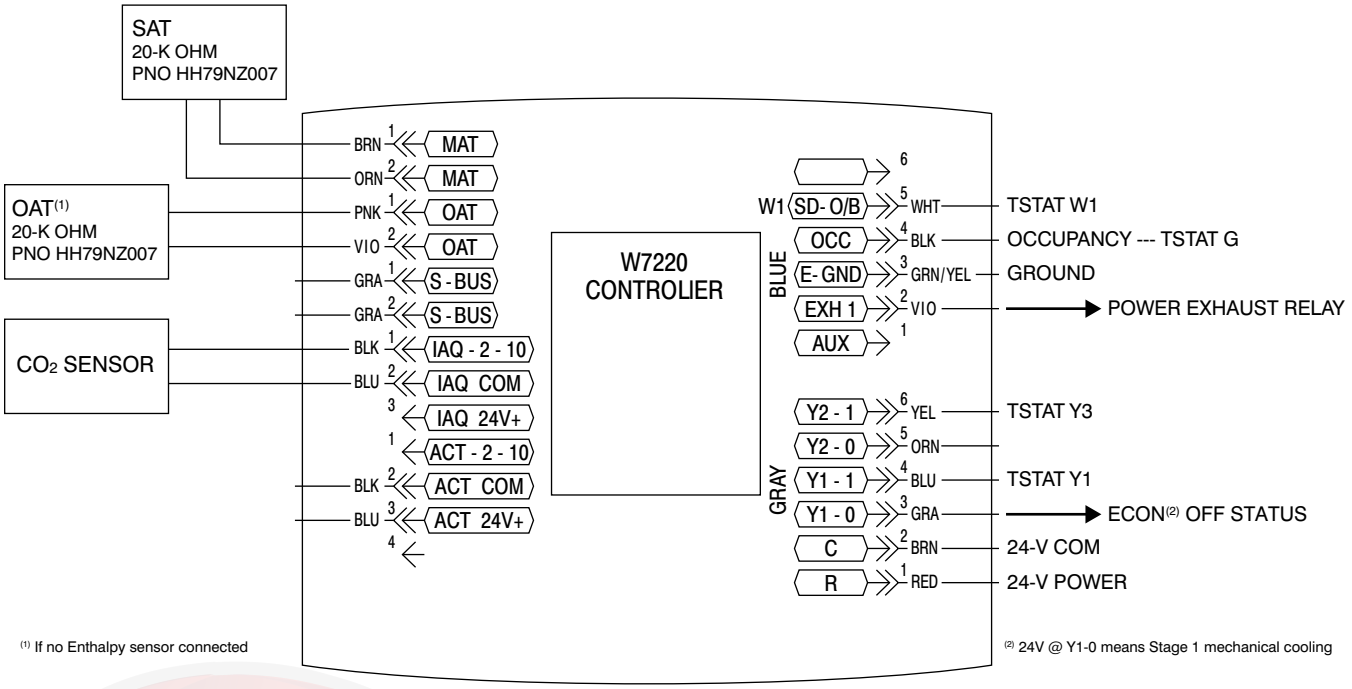



**Fig. 46 - W7220 Sensor and Control I/O Connections**

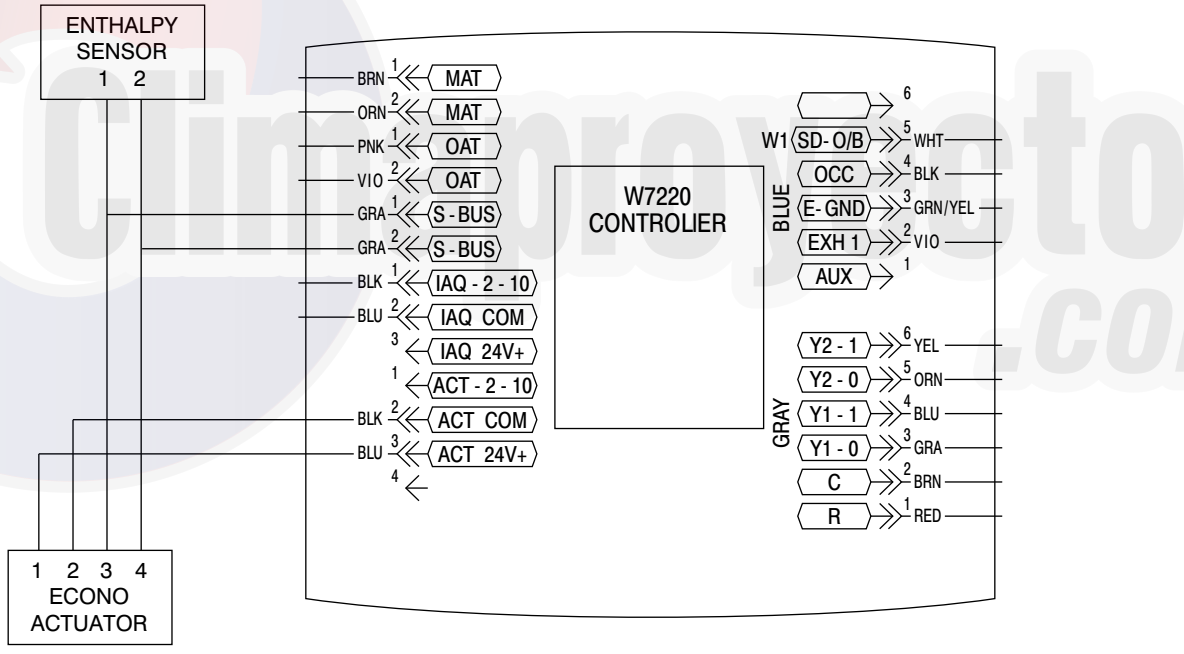



**Fig. 47 - Actuator/S-BUS**

## Economizer Control Configurations

### Enthalpy Changeover Control —

Economizer changeover based on outdoor air enthalpy requires an outdoor air enthalpy sensor to replace the OAT sensor. The enthalpy sensor is available as a factory-installed option or as a field-installed accessory (part number HH57AC081). See Fig. 1 for model number nomenclature; check Position #15 for codes N or R indicating a factory-installed enthalpy sensor. Use Fig. 48 and Table 12 to select the enthalpy changeover setting to enter in menu item SETPOINTS -> ENTH CURVE.

### Enthalpy Settings —

When the OA temperature, enthalpy and dew point are below the respective setpoints, the Outdoor Air can be used for economizing. Fig. 48 shows the new single enthalpy boundaries in the W7220. There are 5 boundaries (setpoints ES1 through ES5), which are defined by dry bulb temperature, enthalpy and dew point.

Refer to Table 12 for ENTH CURVE setpoint values.

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

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

Fig. 48 shows the 5 current boundaries. There is also a high limit boundary for differential enthalpy. The high limit boundary is ES1 when there are no stages of mechanical cooling energized and HL (high limit) when a compressor stage is energized.

Table 12 provides the values for each boundary limit.

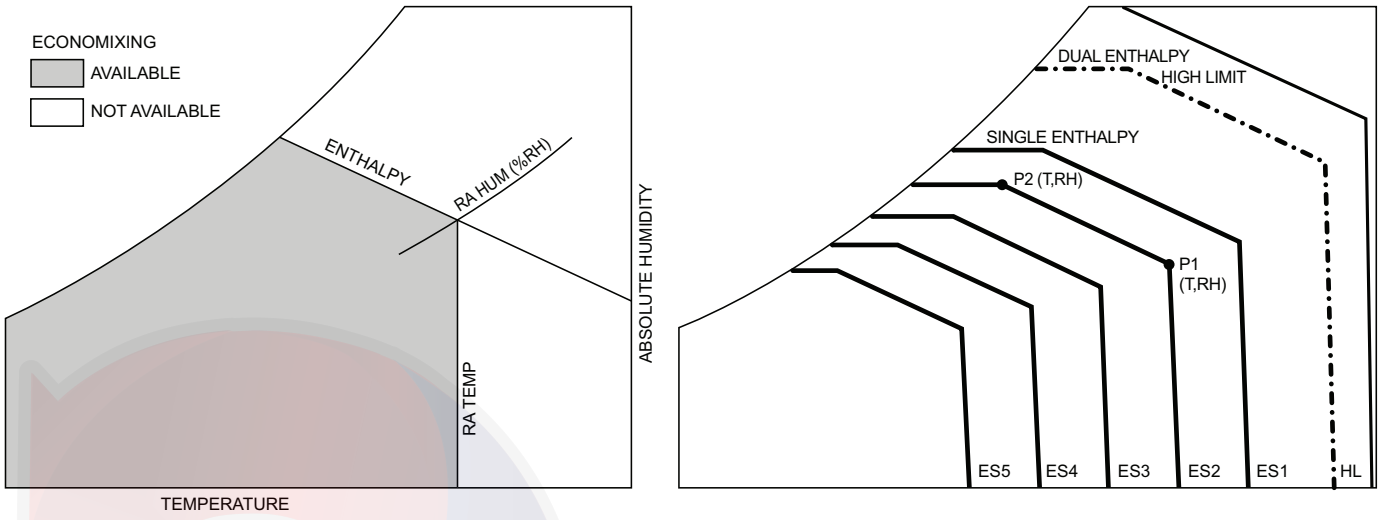



**Fig. 48 - Single Enthalpy Curve and Boundaries**

**Table 12 – Single Enthalpy and Dual Enthalpy High Limit Curves (EN Units)**

| Enthalpy Curve | Temp. Dry–Bulb (°F) | Temp. Dewpoint (°F) | Enthalpy (btu/lb/da) | Point P1 | | Point P2 | |
|---|---|---|---|---|---|---|---|
| | | | | Temp. (°F) | Humidity %RH | Temp. (°F) | Humidity %RH |
| ES1 | 80.0 | 60.0 | 28.0 | 80.0 | 36.8 | 66.3 | 80.1 |
| ES2 | 75.0 | 57.0 | 26.0 | 75.0 | 39.6 | 63.3 | 80.0 |
| ES3 | 70.0 | 54.0 | 24.0 | 70.0 | 42.3 | 59.7 | 81.4 |
| ES4 | 65.0 | 51.0 | 22.0 | 65.0 | 44.8 | 55.7 | 84.2 |
| ES5 | 60.0 | 48.0 | 20.0 | 60.0 | 46.9 | 51.3 | 88.5 |
| HL | 86.0 | 66.0 | 32.4 | 86.0 | 38.9 | 72.4 | 80.3 |

**Demand Control Ventilation —**

Demand Control Ventilation (DCV) function requires a space air $CO_2$ sensor be connected to the W7220 controller. The $CO_2$ sensor provides a 2 to 10 vdc signal proportional to the space $CO_2$ level. This sensor is available as a factory-installed option (located in the unit's return air plenum) or as a field-installed accessory. See Fig. 1 for model number nomenclature; check Position #9 for codes E, F, G or H indicating a factory-installed $CO_2$ sensor. The W7220 automatically recognizes the connection of this sensor and self-enables the DCV function after the Configuration period.

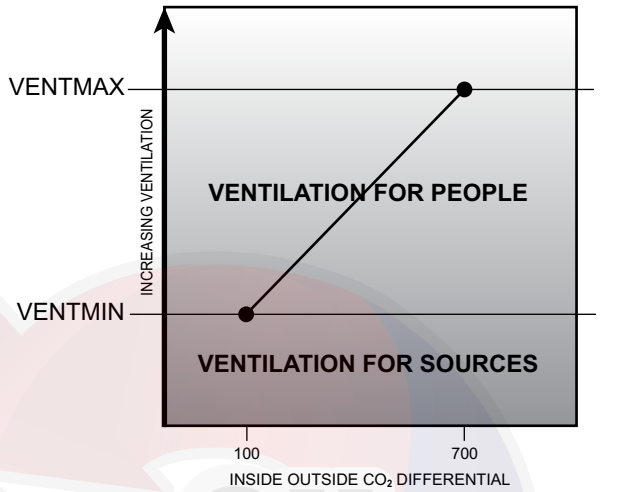



**Fig. 49 - DCV Single-Speed System Setpoints**

**DCV With Single-Speed Fan System:** During DCV, the outside air damper modulates between two user configurations depending upon the signal level of the space or return air $CO_2$ sensor representing the space occupancy level. The lower of these two positions is referred to as the Minimum IAQ Damper Position (designated VENTMIN) while the higher is referred to as Economizer Minimum Position (designated MINIMUM POSITION or VENTMAX). The VENTMIN position should be set to an economizer position that brings in enough fresh air to remove contaminants and $CO_2$ generated by sources other than people; this airflow rate is designated Va. The VENTMAX should be set to an economizer position that brings in enough fresh air to remove contaminants and $CO_2$ generated by all sources including people at the design condition for maximum space occupancy; this airflow rate is designated Vbz.

**DCV With Two-Speed Fan System:** Ventilation codes require that the same ventilation rates (Vbz and Va, expressed as CFM) be provided regardless of supply fan speed. When the supply fan speed is reduced, the internal static pressure in the unit's return plenum also decreases. If the same outside air damper position is retained, the airflow rate through the OA damper decreases below the Va and Vbz levels. To restore ventilation rates to design levels, the damper positions VENTMIN and VENTMAX must be automatically adjusted when the fan speed changes. The W7220 provides this function when it is configured for 2-speed fan operation through a second set of damper position setpoints.

During operation at High fan speed, the damper setpoint limits are designated VENTMIN H and VENTMAX H. Damper operation is same as described under Single-Speed Fan above.

During operation at Low fan speed, the damper setpoint limits change to VENTMIN L and VENTMIN L. These settings are higher than the comparable High speed settings and cause the outside air damper to open more to allow the same Va and Vbz airflow rates to be admitted to the space.

Adjust the DCV setpoints VENTMAX H and VENTMAX L with supply fan speed in High speed and Low speed respectively to provide the design load ventilation airflow rate Vbz by measuring outside air temperature, return air temperature and supply air temperature. Make damper position adjustments with at least 10°F temperature difference between the outdoor and return-air temperatures.

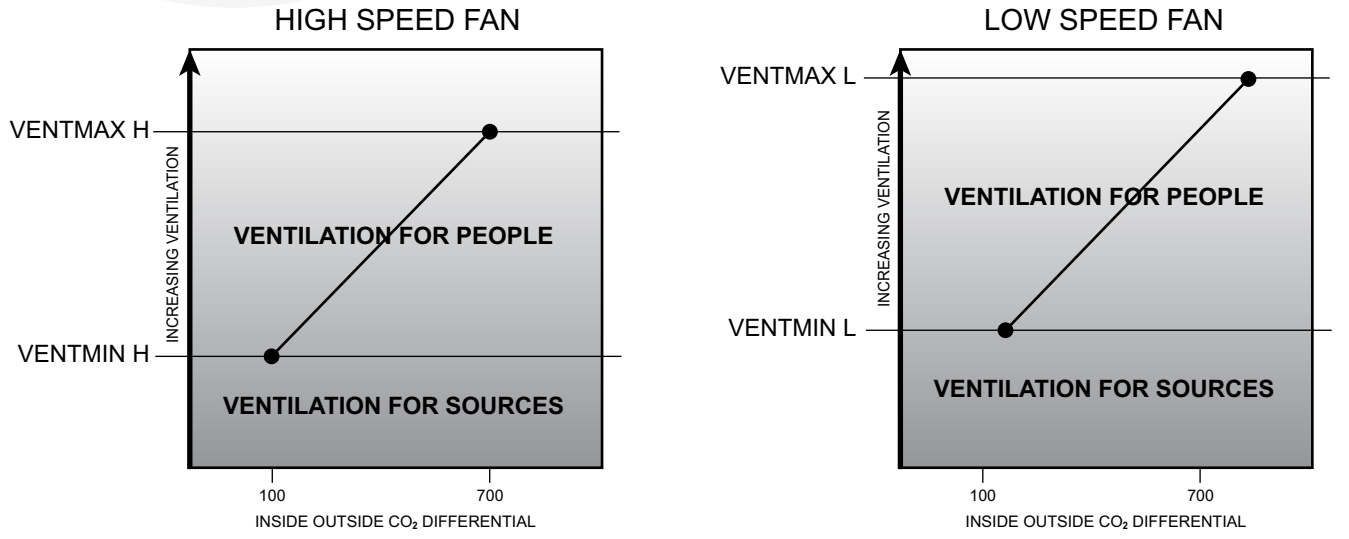



**Fig. 50 - DCV 2-Speed System Setpoints — Same Ventilation CFM at Both Speeds**

To determine the damper setpoint position, perform the following procedure for each condition setpoint, with mechanical cooling OFF:

Calculate the appropriate supply air temperature using the following formula:

TS = (TO x Vbz/CFM) + TR x (CFM – Vbz)/CFM

TS = Supply Air Temperature
TO = Outdoor Air Temperature
Vbz = Design Maximum Ventilation CFMr
CFM= Unit Supply Airflow Rate
TR = Return Air Temperature

As an example:

Unit Airflow Rate at High Speed is 4000 CFM
Ventilation CFM at design occupancy Vbz is 1200 CFM
TO = 60 F
TR = 75 F

Required TS = 60 x (1200/4000) + 75 x (4000 – 1200/4000)
= 60 x 0.30 + 75 x 0.70 = 18.0 + 52.5
= 70.5

At the W7220 keypad, enter the parameter SETUP -> VENTMAX H and adjust the setpoint value until the observed Supply Air Temperature (MA TEMP) reaches 70.5. Press the ↵ "Enter" key to save this setpoint to controller memory.

When determining VENTMIN setpoints, substitute the value for Va in place of Vbz in the formula.

**DCV Setpoint:** The SETPOINTS parameter DCV SET defines the space $CO_2$ level above which the DCV mode begins to open the outside air damper beyond its VENTMIN ventilation lower limit. This setpoint should be a minimum of 100 ppm greater than the outdoor ambient $CO_2$ level to ensure the outside air will be capable of diluting the space CO2 level. A typical value for outdoor $CO_2$ is 400 ppm; adjust the setpoint DCV SET to 500 ppm if outdoor $CO_2$ level is not known. The factory default value for DCV SET is 1100 ppm.

**Economizer Occupancy Control —**

The 24-v signal that terminates at the W7220's OCC input to place the economizer control in Occupied mode when the supply fan starts is routed through the rooftop unit's Integrated Staging Control Board at its OCCUPANCY jumper. To implement an occupancy control for the economizer operation, connect a contact set at ISC OCCUPANCY quick-connect terminals and cut jumper JMP1. To allow automatic occupancy mode, close the control contacts. To place the economizer in Unoccupied mode, open the control contacts.

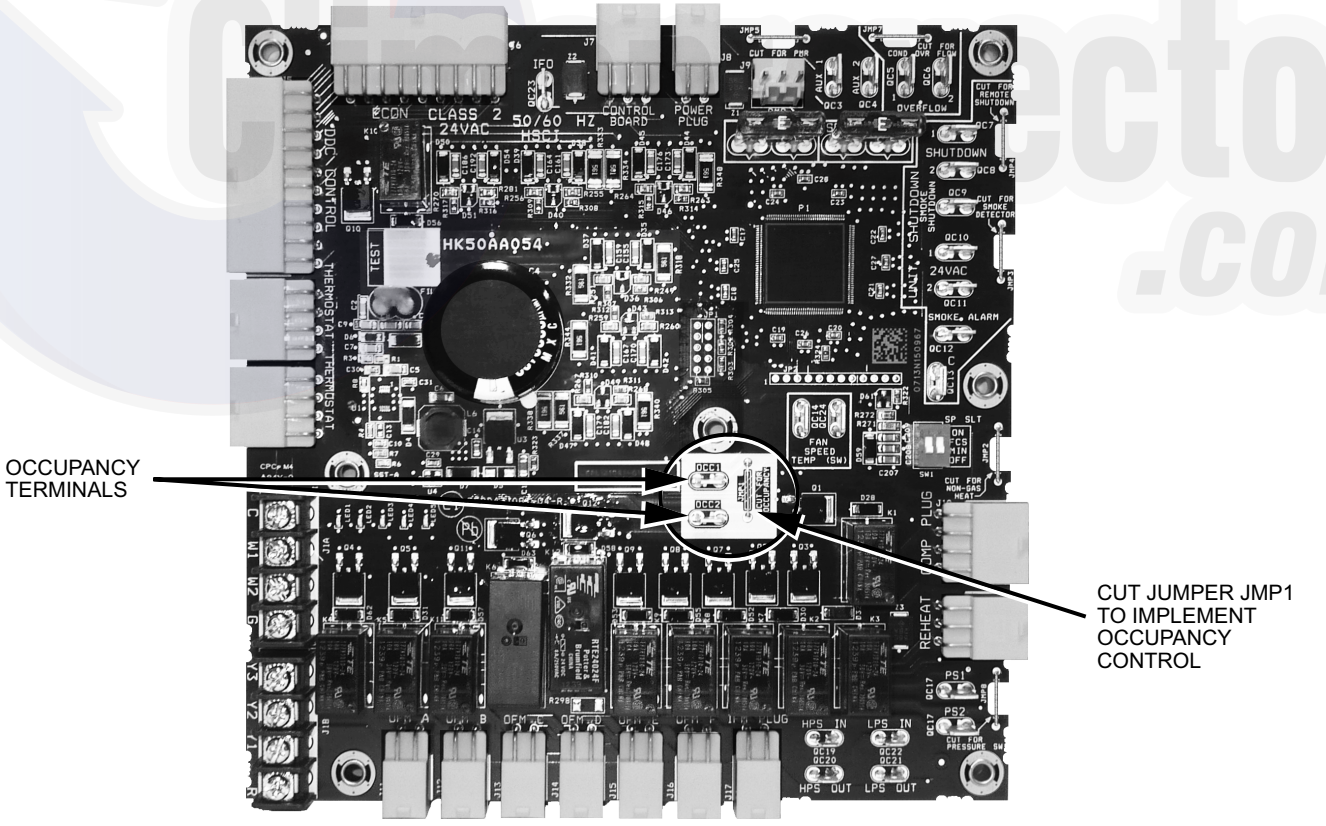



**Fig. 51 - Integrated Staging Control (ISC) Board - Occupancy Terminals and Jumper**

## Hardware

### Actuators —

The Economizer X damper actuators are direct-coupled types with spring-return. Power is 24-v from the W7220 outputs. Range of rotation is 95-degrees; timing for full-range movement is 90 seconds to drive open in normal operation, 30 seconds in Test Mode and 25 seconds for spring return.

These actuators are S-bus enabled. The S-bus is a proprietary local equipment network that connects the W7220 controller, one S-enabled actuator and up to three S-type enthalpy sensors on a two-wire communication network. The S-bus is polarity-insensitive. Devices attached to the S- bus are automatically recognized by the controller.

Actuator command position is defined in a 2-10 vdc value. 2.0-v is outside air damper position fully-closed (0% open); 10.0-v is damper position fully-open (100% open). See Table 13 to correlate control voltage values to outside air damper opening percentage.

**Table 13 – Actuator Voltage vs. Damper Position**

| Vdc | % Open | Vdc | % Open | Vdc | % Open |
|---|---|---|---|---|---|
| 2.0 | 0 | 4.8 | 35 | 7.6 | 70 |
| 2.4 | 5 | 5.2 | 40 | 8.0 | 75 |
| 2.8 | 10 | 5.6 | 45 | 8.4 | 80 |
| 3.2 | 15 | 6.0 | 50 | 8.8 | 85 |
| 3.6 | 20 | 6.4 | 55 | 9.2 | 90 |
| 4.0 | 25 | 6.8 | 60 | 9.6 | 95 |
| 4.4 | 30 | 7.2 | 65 | 10.0 | 100 |

These units use a 5-Nm (44 lb-in) torque model, Honeywell Series MS3105K actuator.

### Supply Air Temperature Sensor —

The W7220 controller uses a 20-k ohm analog sensor for Supply Air Temperature (SAT). The thermistor is attached to a ring terminal. The ring terminal is attached to the unit's supply fan housing, downstream of the unit's indoor coil. The SAT sensor is connected to the W7220 input terminals marked MAT. See Table 14 for sensor resistance to temperature correlations.

The W7220 controller requires a valid signal from its SAT channel in order to function. If the SAT connection to the W7220 is lost, the W7220 will initiate an alarm condition immediately. No economizing operation will be permitted until this alarm is cleared.

**Table 14 – SAT/OAT Sensor Characteristics**

| Deg C | Ohms |
|---|---|
| –30 | 415156 |
| –25 | 301540 |
| –20 | 221210 |
| –15 | 163834 |
| –10 | 122453 |
| –5 | 92382 |
| 0 | 70200 |
| 5 | 53806 |
| 10 | 41561 |
| 15 | 32341 |
| 20 | 25346 |
| 25 | 20000 |
| 30 | 15886 |
| 35 | 12698 |
| 40 | 10212 |
| 45 | 8261 |
| 50 | 6720 |

| Deg F | Ohms |
|---|---|
| –20 | 386130 |
| 0 | 193070 |
| 20 | 101820 |
| 32 | 70200 |
| 40 | 55420 |
| 45 | 47771 |
| 50 | 41258 |
| 55 | 35725 |
| 60 | 31035 |
| 65 | 27069 |
| 70 | 23719 |
| 77 | 20000 |
| 80 | 18473 |
| 100 | 11544 |
| 120 | 6768 |

### Outside Air Temperature Sensor —

Economizer X systems equipped with outdoor dry bulb temperature changeover control include a 20-k ohm analog sensor to measure Outdoor Air Temperature (OAT). This is the same sensor used for the SAT function; see Table 14 for resistance vs temperature characteristics.

The OAT sensor is attached to the outside air damper frame. It is connected to the W7220's OAT input terminals.

If an accessory enthalpy sensor is added to an Economizer X system with factory dry bulb changeover, disconnect this OAT sensor wiring at the W7220's OAT input terminals.

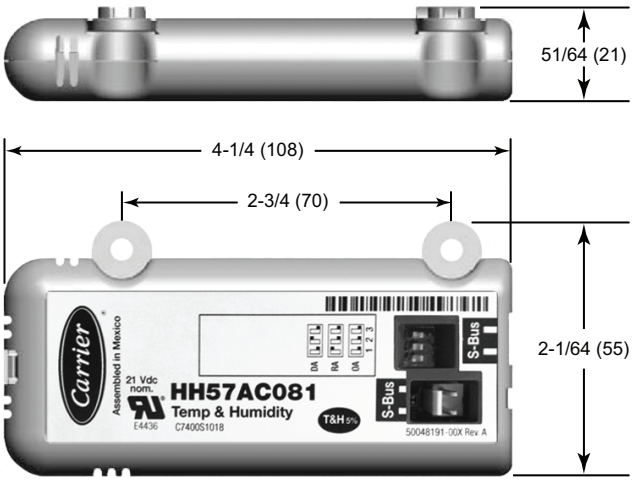
### Enthalpy Control Sensor Configuration—

The W7220 economizer control system can accommodate up to three S-bus enthalpy sensors. On Economizer X models with factory-installed Enthalpy Changeover control, one S-bus sensor is provided in the economizer outdoor section. Additional sensors may be added to measure Return Air and Discharge Air conditions.

The Enthalpy Control sensor (Part Number: HH57AC081) communicates with the W7220 Economizer controller on the two-wire local equipment network bus (S-bus) and can either be wired using a two pin header or using a side connector. This sensor is used for all OAT (Outdoor Air Temperature), RAT (Return Air Temperature) and DAT (Discharge Air Temperature), depending on how its three position DIP switch is set.

Use Fig. 52 and Table 15 to locate the wiring terminals for each Enthalpy Control sensor.

Use Fig. 52 and Table 16 to set the DIP switches for the desired use (location) of the sensor.




**NOTE**: Dimensions in ( ) are in mm

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**Fig. 52 - Enthalpy Control Sensor, Dimensions and DIP Switch Location**

**Table 15 – Enthalpy Control Sensor Wiring Terminations**[a]

| Terminal | | Type | Description |
|---|---|---|---|
| Nbr | Label | | |
| 1 | S–BUS | S–BUS | S–Bus Communications (Enthalpy Control Sensor Bus) |
| 2 | S–BUS | S–BUS | S–Bus Communications (Enthalpy Control Sensor Bus) |

a Terminals are polarity insensitive.

**Table 16 – Enthalpy Control Sensor DIP Switch Settings**

| Use | DIP Switch Positions for Switches 1, 2, & 3 | | |
|---|---|---|---|
| | 1 | 2 | 3 |
| DA[a] | OFF | ON | OFF |
| RA[b] | ON | OFF | OFF |
| OA[c] | OFF | OFF | OFF |

a DA = Discharge Air
b RA = Return Air
c OA = Outside Air

When a S-bus sensor is connected to an existing network, it will take 60 minutes for the network to recognize and auto-configure itself to use the new sensor. During the 60 minute setup period, no alarms for sensor failures (except SAT) will be issued and no economizing function will be available.

## Operating Sequences

### Staged Air Volume (3-Speed) Fan Motor —

The Integrated Staging Control (ISC) Board in the main unit determines the operating speed (LOW/MED/HIGH) of the indoor fan based on space thermostat demand conditions. See Table 17 for this logic.

**Table 17 – Supply Fan Speed Logic without Economizer**

| TSTAT OUTPUT | | | | |
|---|---|---|---|---|
| G/OCC | 0–V | **24–V** | 0–V | 0–V |
| Y1 | 0–V | **24–V** | 0–V | 0–V |
| Y2 | 0–V | 0–V | **24–V** | 0–V |
| Y3 | 0–V | 0–V | 0–V | **24–V** |
| W1 | 0–V | 0–V | 0–V | **24–V** |
| W2 | 0–V | 0–V | 0–V | **24–V** |
| | | | | |
| SUPPLY FAN MOTOR SPEED | OFF | LOW | MED | HIGH |

### W7220 Economizer Control —

Tables 18 and 19 provide the W7220 Input/Output Logic. Table 18 describes economizer functions for a unit without a $CO_2$ sensor. Table 19 describes economizer functions for a unit with Demand Control Ventilation ($CO_2$ sensor connected). The supply fan speed is included in these tables for reference; this is neither an input or output of the W7220 controller.

### Base Unit Controls —

Base unit includes standard electromechanical controls, Staged Air Volume (3-speed supply fan motor with VFD), EconoMi$er X (with W7220 controller) and thermostat or unitary controller that energizes the G terminal in cooling and heating to control the supply fan operation.

### Cooling, Unit With EconoMi$er X Without $CO_2$ —

For Occupied mode operation of EconoMi$er X, there must be a 24-v signal at terminal G at the unit's Integrated Staging Control Board from the thermostat; supply fan motor will start and run in Low Speed. The signal at G is connected to W7220 input OCC, placing the EconoMi$er X control in Occupied mode; the economizer actuator is commanded open to the MIN POS L ventilation position. Removing the signal at OCC places the EconoMi$er X control in Unoccupied mode; the economizer actuator is driven back to full-closed position.

When free cooling using outside air is not available, the unit cooling sequence will be controlled directly by the space thermostat. Thermostat call for Stage 1 Cooling energizes ISC terminals G and Y1; supply fan motor starts and runs in Low Speed. The Y1 demand is received at W7220 terminal Y1-I. Outside air damper position will be at MIN POS L. W7220 output Y1-O is energized; first stage mechanical cooling starts.

As space temperature falls and space cooling load is satisfied, the thermostat will remove its call for first stage cooling; ISC terminal Y1 call is removed. The W7220 input Y1-I is removed; output Y1-O is de-energized, stopping first stage cooling.

When ISC terminal Y1 is de-energized, terminal G may remain energized, indicating Continuous Fan operation. The supply fan motor will continue to run in Low Speed.

W7220 input OCC remains energized; the outside air damper remains in MIN POS L. If ISC terminal G is also de-energized with Y1, indicating AUTO Fan operation, then the supply fan motor will stop. The W7220 input at OCC is removed; the outside air damper closes.

If the space temperature continues to rise, the thermostat will call for second stage cooling; ISC terminal Y2 is also energized. The supply fan motor shifts to MED Speed. Outside air damper position will remain in MIN POS L, second stage cooling starts.

As space temperature falls, the thermostat will remove its call for second stage cooling; ISC terminal Y2 call is removed. The supply fan motor shifts back to Low Speed. The outside air damper will remain at MIN POS L and the ISC board will stop second stage mechanical cooling.

If the space temperature continues to rise, the thermostat will call for third stage cooling; ISC terminal Y-3 is also energized. The supply fan motor shifts to High Speed. The outside air damper position will shift to MIN POS H, third stage cooling starts.

As space temperature falls, the thermostat will remove its call for third stage cooling; ISC terminal Y3 call is removed. The supply fan will shift to Medium Speed. The outside air damper is repositioned to MIN POS L and stop third stage mechanical cooling.

When free cooling is available as determined by the appropriate changeover command (outdoor dry bulb, outdoor enthalpy, differential dry bulb or differential enthalpy), a space thermostat call for Stage 1 Cooling energizes ISC terminals G and Y1; supply fan motor starts and runs in High Speed. The G demand is received at W7220 input OCC; outside air damper moves to MIN POS L. The Y1 demand is received at W7220 terminal Y1-I. The W7220 economizer control will modulate the outside air damper open and closed to maintain the unit cooling supply air temperature at setpoint MAT SET (default 53°F (12°C)). Compressor will not run.

During free cooling operation, a supply air temperature (SAT) above MAT SET will cause the outside air damper to modulate between MIN POS L setpoint and 100% open. As SAT decreases and approaches setpoint MA LO SET (default 45°F (7°C)), the outside air damper will maintain at the MIN POS L setting. With SAT below MA LO SET, the outside air damper will be closed or at minimum (see FREEZE POS) When SAT rises to MA LO SET plus 3°F, the outside air damper will re-open to MIN POS L setting.

Should 100% outside air not be capable of satisfying the space cooling load, space temperature will rise and the thermostat will call for second stage cooling; ISC terminal Y2 is also energized. The supply fan motor remains at High Speed. Outside air damper position will remain at MIN POS L, starting second stage cooling (Compressor 1 operation). Damper will modulate to maintain SAT at MAT SET concurrent with Compressor 1 operation.



**Table 18 – W7220 Input/Output without $CO_2$ Sensor**

| INPUTS | | | | Ref: | OUTPUTS | | | |
|---|---|---|---|---|---|---|---|---|
| DEMAND CONTROL VENTILATION | OUTSIDE AIR Good to economize? | Y1 – I | Y2 – I | FAN SPD (a) | Mechanical Cooling Stage | | Occupancy | |
| | | | | | | | OCC Yes | OCC No |
| | | | | | Y1 – O/1ST | Y2 – O/2ND | Outside Air Damper Position | |
| NO $CO_2$ SENSOR | No | Off | Off | Low | 0 – v/Off | 0 – v/Off | MIN POS L | Closed |
| | | On | Off | Low | 24 – v/On | 0 – v/Off | MIN POS L | Closed |
| | | On | On | High | 24 – v/On | 24 – v/On | MIN POS H | Closed |
| | Yes | Off | Off | Low | 0 – v/Off | 0 – v/Off | MIN POS L | Closed |
| | | On | Off | Low | 0 – v/Off | 0 – v/Off | Modulating: MIN POS L to Full – Open | Modulating: Closed to Full – Open |
| | | On | On | High | 2SP DELAY (b); 24v/On | 0 – v/Off (c) | Modulating: MIN POS H to Full – Open | Modulating: Closed to Full – Open |

(a) Fan Speed for reference only; this is not an input or output function of the W7220

(b) See Menu ADV SETUP –> 2SP FAN DELAY for details

(c) See Menu ADV SETUP –> STG# DLY. With Stage 3 delay enabled, control can turn on 2nd stage of cooling Y2 – O after delay if the call for Y2 – I has not been satisfied.

**Table 19 – W7220 Input'/Output with Demand Control Ventilation (DCV)**

| INPUTS | | | | Ref: | OUTPUTS | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Mechanical Cooling Stage | | Occupancy | |
| DEMAND CONTROL VENTILATION | OUTSIDE AIR Good to economize? | Y1 – I | Y2 – I | FAN SPD (a) | | | OCC Yes | OCC No |
| | | | | | Y1 – O/1ST | Y2 – O/2ND | Outside Air Damper Position | |
| Below set | No | Off | Off | Low | 0 – v/Off | 0 – v/Off | VENTMIN L | Closed |
| | | On | Off | Low | 24 – v/On | 0 – v/Off | VENTMIN L | Closed |
| | | On | On | High | 24 – v/On | 24 – v/On | VENTMIN H | Closed |
| | Yes | Off | Off | Low | 0 – v/Off | 0 – v/Off | VENTMIN L | Closed |
| | | On | Off | Low | 0 – v/Off | 0 – v/Off | Modulating: VENTMIN L to Full – Open | Modulating: Closed to Full – Open |
| | | On | On | High | 2SP DELAY (b); 24v/On | 0 – v/Off (c) | Modulating: VENTMIN H to Full – Open | Modulating: Closed to Full – Open |
| Above set | No | Off | Off | Low | 0 – v/Off | 0 – v/Off | Modulating: VENTMIN L to VENTMAX L | Closed |
| | | On | Off | Low | 24 – v/On | 0 – v/Off | Modulating: VENTMIN L to VENTMAX L | Closed |
| | | On | On | High | 24 – v/On | 24 – v/On | Modulating: VENTMIN H to VENTMAX H | Closed |
| | Yes | Off | Off | Low | 0 – v/Off | 0 – v/Off | Modulating: VENTMIN L to VENTMAX L | Closed |
| | | On | Off | Low | 0 – v/Off | 0 – v/Off | Modulating: VENTMIN L to Full – Open | Modulating: Closed to Full – Open |
| | | On | On | High | 2SP DELAY (b); 24v/On | 0 – v/Off (c) | Modulating: VENTMIN H to Full – Open | Modulating: Closed to Full – Open |

(a) Fan Speed for reference only; this is not an input or output function of the W7220
(b) See Menu ADV SETUP – > 2SP FAN DELAY for details
(c) See Menu ADV SETUP – > STG# DLY. With Stage 3 delay enabled, control can turn on 2nd stage of cooling Y2 – O after delay if the call for Y2 – I has not been satisfied.

As space temperature falls, the thermostat will remove its call for second stage cooling; ISC terminal Y2 call is removed. The supply fan motor remains High Speed. The outside air damper limit is repositioned to between MIN POS L and 100% open. Second stage cooling (Compressor 1 operation) stops. As space temperature continues to fall and space cooling load is satisfied, the thermostat will remove its call for first stage cooling; ISC terminal Y1 call is removed. The W7220 input Y1-I is removed; free cooling mode ends. Outside air damper will remain at MIN POS L if supply fan remains in operation (CONT FAN) or to closed if supply fan stops (AUTO FAN).

Should 100% outside air and second stage cooling (Compressor 1 operation) not be capable of satisfying the space cooling load, space temperature will rise and the thermostat will call for third stage cooling: ISC terminal Y3 is also energized, starting third stage cooling (Compressor 2 operation). The supply fan motor will remain at High Speed. The Y3 demand is received at W7220 input Y2-I. The outdoor air damper position will modulate from MIN POS H to 100% Open to maintain SAT at MAT SET concurrent with Compressor 2 operation.

As space temperature falls, the thermostat will remove its call for third stage cooling; ISC terminal Y3 call is removed. The supply fan will remain at High Speed. The W7220 input Y2-I is also removed; the outside air damper is repositioned to modulate from MIN POS L to 100% Open, third stage cooling (Compressor 2 operation) stops.

**Power Exhaust:** If accessory power exhaust is installed, the power exhaust fan motors will be energized by the economizer control as the dampers open above the setpoint EXH1 SET L during Low Speed operation or EXH1 SET H during High Speed fan operation. The EXH1 output will be de-energized as the dampers close below the EXH1 setpoint value.

Damper movement from full closed to full open (or vice versa) will take approximately 1-$^1/_2$ minutes.

**Heating With EconoMi$er X —**

When the space temperature calls for heat (W1 closes), ISC terminal W1 is energized. The supply fan will start and run in High Speed. The W1 signal will connect toW7220 input AUX2I; the outside air damper will move to MIN POS H. Unit heating sequence will follow base unit control sequences.

**Demand Control Ventilation —**

If a space or return air $CO_2$ sensor is connected to the Economize X control, a Demand Control Ventilation strategy will operate automatically.

When the space $CO_2$ level is below setpoint DCV SET (default 1100 ppm), the minimum ventilation position for the outside air damper will be reset to lower settings suited for offsetting $CO_2$ loads from space sources not including people. The settings will vary according to supply fan speed. When the supply fan speed is Low, the DCV minimum ventilation point is VENTMIN L. When the supply fan speed is High, the DCV minimum ventilation point is VENTMAX H.

As the $CO_2$ level in the space increases above the setpoint DCV SET (default 1100 ppm), the DCV ventilation position of the outside air damper will be increased proportionally, until the Maximum Ventilation setting is reached. The settings will vary according to supply fan speed. When the supply fan speed is Low, the DCV maximum ventilation point is VENTMAX L. When the supply fan speed is High, the DCV maximum ventilation point is VENTMAX H.

DCV operation will float between its VENTMIN and VENTMAX settings, never exceeding the VENTMAX limit as the space $CO_2$ level varies according to changes in people occupancy levels.

During concurrent demand for DCV and free cooling, the outdoor-damper will follow the higher demand condition from the DCV mode or from the free-cooling mode.

## Setup and Configuration

Before being placed into service, the W7220 Economizer module must be setup and configured for the installed system according to project control specifications.

Inspect all wiring connections at the Economizer module's terminals, and verify compliance with the installation wiring diagrams.

**Initial Menu Display —**

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

**Time-out and Screensaver —**

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

**IMPORTANT**: During setup, the Economizer module is live at all times.

Setup and configuration involves stepping through three menus and enabling required functions and re-selecting setpoints to meet project requirements. The menus used are SYSTEM SETUP, ADV SETUP and SETPOINTS.

Obtain a copy of the project control specifications before starting setup and configuration process.

**NOTE**: W7220 will be in the "set up" mode for the first 60 minutes after powered. If a sensor for OA air or S-bus device (sensor, actuator) is disconnected during the set up mode, the W7220 will not alarm that failure. The SAT sensor is a system "critical" sensor, if the SAT sensor is removed during the set up mode, the W7220 will alarm. After 60 minutes the W7220 controller will change to operation mode and all components removed or failed will alarm in the operation mode.

For this application with the 2-speed supply fan option, note that parameters EQUIPMENT, AUX2I and FAN TYPE have required settings. Check that these parameters are set at these required settings:

EQUIPMENT must be CONV
AUX2I must be W
FAN SPEED must be 2SPEED

Press the ⓣ (EXIT) button to exit the SYSTEM SETUP menu and return to top level menu. Scroll down to ADV SETUP menu and press ↵ (ENTER) button to enter this menu. Scroll down through the list of parameters and adjust settings as required. Be sure that the message CHANGE STORED appears with every change in parameter setting.

Press the ⓣ (EXIT) button to exit the ADV SETUP menu and return to top level menu. Scroll down to SETPOINTS menu and press ↵ (ENTER) button to enter this menu. Scroll down through the list of parameters and adjust settings as required. Be sure that the message CHANGE STORED appears with every change in parameter setting.

**SETPOINT Defaults:** The default setpoint values represent many years of successful experience with economizing systems. Any changes that represent significant deviations from the default values should be well considered.

**DCV SETPOINT:** The default value for DCV SET is 1100 ppm. It is recommended that this setpoint be adjusted down to 500 ppm (or $CO_2$ level of outdoor air plus 100 ppm, whichever is higher) to permit an earlier initiation of the DCV mode as space occupancy increases.

## Checkout

For checkout, review the Status of each configured parameter by observing the scrolling display from the Screensaver mode or by entering the STATUS menu.

Use the Checkout menu (see Table 9 on page 43) to test the damper operation and any configured outputs. Only items that are configured are shown in the Checkout menu.

To perform a Checkout test:

1. Scroll to the desired test in the Checkout menu using the the ▲ and ▼ buttons.
2. Press the ↵ button to select the item.
3. RUN? appears.
4. Press the ↵ button to start the test.
5. The unit pauses and then displays IN PROGRESS.
6. When the test is complete, DONE appears.
7. When all desired parameters have been tested, press the ⓣ (Menu up) button to end the test.

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



**⚠ CAUTION**

**EQUIPMENT DAMAGE HAZARD**

Failure to follow this caution may result in equipment damage.

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

**Status —**

Use the STATUS menu (see pages 40 and 41) to check the parameter values for the various devices and sensors configured.

**Calibration of Sensors —**

There are up to six sensor calibration settings available in the ADV SETUP menu (depending on which sensors are connected to the W7220). See page 42 for this menu.

**Resetting All Defaults —**

Menu SYSTEM SETUP contains parameter FACTORY DEFAULT. This parameter will reset all setpoints back to factory default values.

To reset all values to defaults, scroll to the SYSTEM SETUP menu, enter the menu and scroll to parameter FACTORY DEFAULT. Enter this parameter and change the display value from NO to YES. Press ENTER ↵.

After resetting all values, scroll up in SYSTEM SETUP to ensure the three parameters requiring special values for use with 2-speed fan system are correct.

## Troubleshooting

**Power Up Delay—**

Upon power up (or after a power outage or brownout), the W7220 controller module begins a 5 minute power up delay before enabling mechanical cooling.

**Power Loss (Outage or Brownout) —**

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

**NOTE**: If the power goes below 18 Vac, the W7220 controller module assumes a power loss and the 5 minute power up delay will become functional when power returns above 18 Vac.

**Alarms —**

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

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

If one or more alarms are present and there has been no keypad activity for at least 5 minutes, the Alarms menu displays and cycles through the active alarms. You can also navigate to the Alarms menu at any time. The list of alarms included in Table 9 (see page 43) is not a complete list of available alarm messages. Each sensor has alarms for temperature, humidity and enthalpy. The list of possible alarms will vary from unit to unit as different sensors are connected.

**Clearing Alarms —**

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

To clear an alarm, perform the following:

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

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

## Table 20 – Operating Issues and Concerns

| Issue or Concern | Possible Cause and Remedy |
|---|---|
| My outdoor temperature reading on the STATUS menu is not accurate. | Check the sensor wiring:<br>• Enthalpy sensors are to be wired to the S–Bus terminals.<br>• Temperature sensors are to be wired to the OAT and MAT terminals. |
| If my enthalpy sensor drifts in accuracy over time, can I re–calibrate it? | The sensor are not able to be re–calibrated in the field. However there is a menu item under the ADVANCED menu where you are able to input a limited offset in temperature and humidity for each sensor you have connected to the economizer. |
| Can I go back to factory defaults and start over? | Under the SYSTEM SETUP menu you can change the setpoints to the factory defaults. |
| Will I be able to see the LCD screen when it is in the unit? | The LCD screen has a backlight that is always illuminated. |
| What is a good setpoint for the Supply Air Temperature (SAT)? | The supply air temperature is the temperature of air that you want to supply to the space. In a commercial building, this is between 50 to 55°F (10 to 13°C). The supply air is the mixing of the return air and the outdoor air. |
| I am using enthalpy sensors. Why did the control ask me to input a dry bulb changeover temperature? | In the event the humidity sensor in the enthalpy sensors fails, the backup algorithm in the control is to default to the temperature sensor in the enthalpy sensor. |
| In checkout, the outdoor damper closes when i command it to open. | Check the actuator linkage or rotation. In the CHECKOUT mode, the outdoor damper should drive open or closed with the return air damper having the opposite effect. |
| How do I set my minimum position? | The minimum position is set using the VENTMIN and VENTMAX setup in the SETPOINTS menu. VENTMIN is the minimum ventilation required when using an occupancy sensor and VENTMAX is the minimum ventilation when not using an occupancy sensor for Demand Control Ventilation. The VENTMAX position is set the same as with the potentiometer on the analog economizers and is the output voltage to the damper actuator. The range is 2 Vdc closed OA damper and 10 Vdc open OA damper. |
| What if my damper does not go completely closed in the checkout operation? | Check the damper linkage or hub to make sure the damper is able to close completely. |
| How do I set the OCC? | There are two setting for the OCC setting, INPUT and ALWAYS. INPUT is from the space thermostat, if it has an occupancy output. ALWAYS is the unit in the occupied mode, if the economizer is powered (fan on). |
| Does the economizer save my program values if the unit loses power? | Yes, once the changes are stored in the controller they will be stored until they are changed by the operator. |
| If the unit is left in checkout, how long will the unit stay in checkout mode without input? | The unit will remain in checkout for 10 minutes, then return to normal operation. |

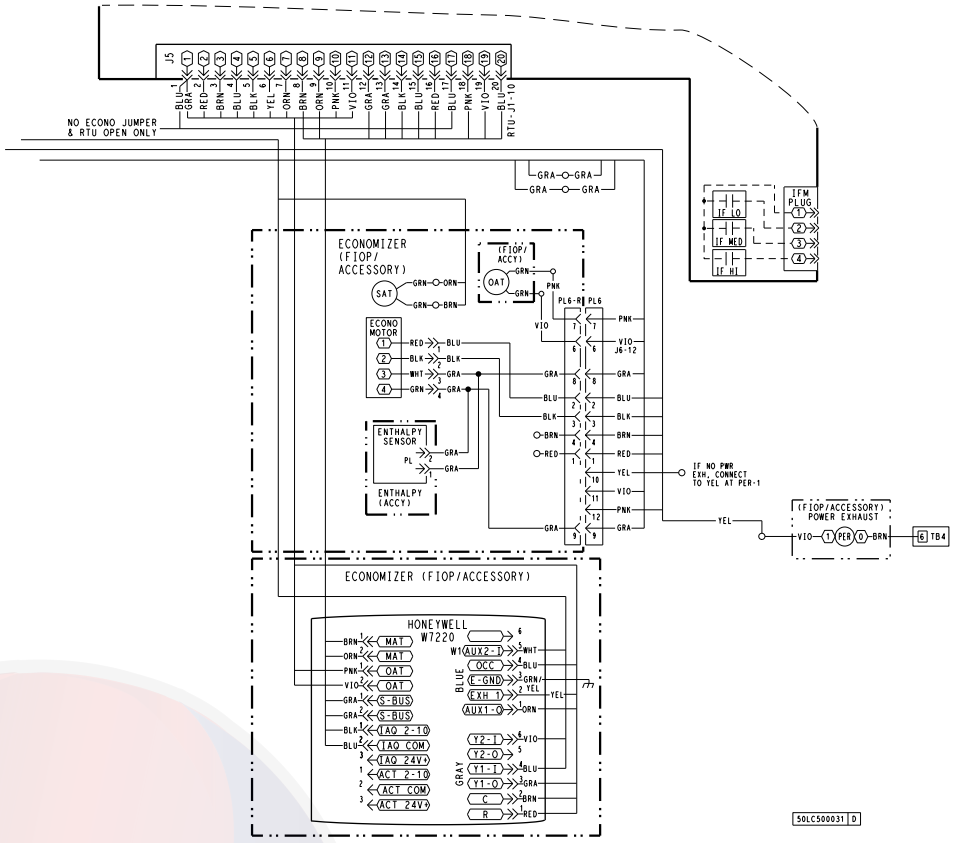


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**Fig. 53 - Typical EconoMi$er X Wiring Diagram**

# CONTROL SET POINT AND CONFIGURATION LOG

Project Name/Location: _____

Model Number: _____

Serial Number: _____

Date: _____

Technician _____

Menu Tables:

1. SYSTEM SETUP
2. ADVANCED SETUP
3. SETPOINTS



## Menu 1: System Setup

| Parameter | Project Value | Parameter Default Value | Parameter Range and Increment | Notes |
|---|---|---|---|---|
| INSTALL | | 01/01/10 | | Display order = MM/DD/YY<br>Setting order = DD, MM, then YY |
| UNITS DEG | | _F | _F or _C | Sets economizer controller in degrees Fahrenheit or Celsius. |
| EQUIPMENT | | CONV | CONV required for 2−speed mode | CONV = conventional;<br>HP O/B = Enable Heat Pump mode; not available with 2−speed<br>See Menu Note 4 (on page 43) |
| AUX2 I | | W | W required for 2−speed mode | W = Informs controller that system is in heating mode.<br>SD = Enables configuration of shutdown (not available on 2−speed)<br>See Menu Note 4 (on page 43) |
| FAN TYPE | | 2speed | 2speed required | Sets the economizer controller for operation of 1 speed or 2 speed indoor fan system.<br>See Menu Note 4 (on page 43) |
| FAN CFM | | 5000cfm | 100 to 15000 cfm; | UNIT DESIGN AIRFLOW (CFM)<br>Enter ONLY if using DCVCAL ENA = AUTO<br>The value is found in the Project Submittal documents for the specific RTU. |
| AUX OUT | | NONE | NONE<br>ERV<br>EXH2<br>SYS | Select OUTPUT for AUX1 O relay<br>NONE = not configured (output is not used)<br>ERV = Energy Recovery Ventilator<br>EXH2 = second damper position relay closure for second exhaust fan<br>SYS = use output as an alarm signal |
| OCC | | INPUT | INPUT or ALWAYS | OCCUPIED MODE BY EXTERNAL SIGNAL<br>When using a setback thermostat with occupancy out (24 Vac), the 24−Vac is input to the OCC terminal. RTU control circuit provides 24−Vac to OCC through OCCUPIED terminals on Integrated Staging Control Board. (see Menu Note 2 on page 43) |
| FACTORY DEFAULT | | NO | NO or YES | Resets all set points to factory defaults when set to YES. LCD will briefly flash YES and change to NO but all parameters will change to the factory default values.<br>**RECHECK AUX2 I and FANTYPE for required 2−speed values.** |

**Menu 2: Advanced Setup**

| Parameter | Project Value | Parameter Default Value | Parameter Range and Increment | Notes |
|---|---|---|---|---|
| MA LO SET | | 45°F (7°C) | 35 to 55°F; (2 to 13°C) incremented by 1° | SUPPLY AIR TEMPERATRUE LOW LIMIT<br>Temperature to achieve Freeze Protection (close damper and alarm if temperature at SAT location falls below setup value) |
| FREEZE POS | | CLO | CLO or MIN | FREEZE PROTECTION DAMPER POSITION<br>Damper position when freeze protection is active<br>CLO =closed<br>MIN = MIN POS or VENTMAX |
| CO2 ZERO | | 0ppm | 0 to 500 ppm: Increment by 10 | $CO_2$ ppm level to match CO2 Sensor start level. |
| CO2 SPAN | | 2000ppm | 1000 to 3000 ppm; Increment by 50 | $CO_2$ ppm span to match CO2 sensor. |
| STG3 DLY | | 2.0h | 0 min, 5 min, 15 min, then 15 min intervals. Up to 4 h or OFF | COOLING STAGE 3 DELAY<br>Delay after stage 2 for cool has been active. Turns on 2nd stage of cooling when economizer is 1st stage and mechanical cooling is 2nd |
| SD DMPR POS | | CLO | CLO or OPN | Function NOT AVAILABLE with 2−speed mode |
| DCVCAL ENA | | MAN | MAN (manual) | Turns on the DCV automatic control of the dampers. Resets ventilation |
| MAT T CAL | 0.0 | 1.0°F (or °C) | +/− 2.5°F (+/−1.4°C) | SUPPLY AIR TEMPERATURE CALIBRATION<br>Allows for the operator to adjust for an out of calibration supply air temperature (SAT) sensor |
| OA T CAL | 2.0 | 3.0°F (or °C) | +/− 2.5°F (+/−1.4°C) | OUTSIDE AIR TEMPERATURE CALIBRATION<br>Allows for the operator to adjust for an out of calibration outside air temperature (OAT) sensor |
| OA H CAL | | 0% RH | +/− 10% RH | OUTSIDE AIR HUMIDITY CALIBRATION<br>Allows for the operator to adjust for an out of calibration of outside air enthalpy sensor |
| RA T CAL | 4.0 | 5.0°F (or °C) | +/− 2.5°F (+/−1.4°C) | RETURN AIR TEMPERATURE CALIBRATION<br>Allows for the operator to adjust for an out of calibration return air temperature (RA) sensor |
| RA H CAL | | 0% RH | +/− 10% RH | RETURN AIR HUMIDITY CALIBRATION<br>Allows for the operator to adjust for an out of calibration return air enthalpy sensor |
| DA T CAL | 0.0 | 1.0°F (or °C) | +/− 2.5°F (+/−1.4°C) | DISCHARGE AIR TEMPERATURE CALIBRATION<br>Allows for the operator to adjust for an out of calibration discharge air temperature (DAT) sensor |
| 2SP FAN DELAY | | 5 Minutes | 0 to 20 minutes in 1 minute increments | TIME DELAY ON 2ND STAGE ECONOMIZING<br>While in the Economizing mode, this is the delay between thermostat Y2 call and Y1−O output to mechanical cooling stage, to allow high speed fan operation to attempt to cool space first. |

## Menu 3: Setpoints

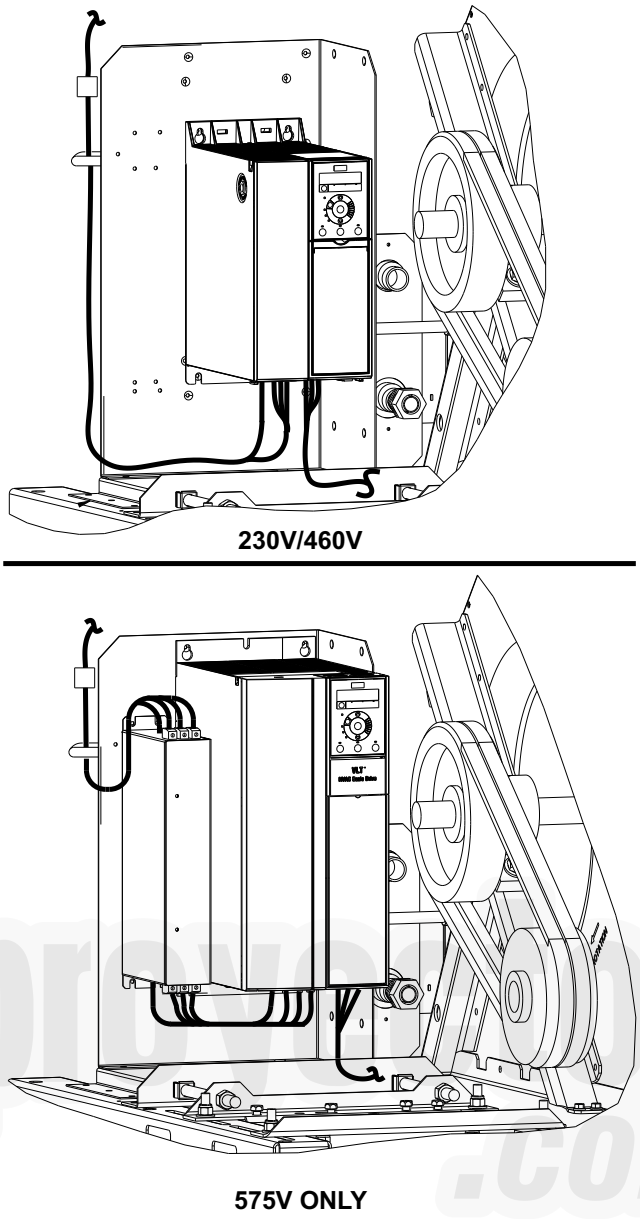
| Parameter | Project Value | Parameter Default Value | Parameter Range and Increment | Notes |
|---|---|---|---|---|
| MAT SET | | 53°F (12°C) | 38 to 65°F; (3 to 18°C) increment by 1° | SUPPLY AIR SETPOINT<br>Setpoint determines where the economizer will modulate the OA damper to maintain the supply air temperature.<br>See Menu Note 2 (on page 43). |
| LOW T LOCK | | 32°F (0°C) | –45 to 80°F (–43 to 27°C) increment by 1° | COMPRESSOR LOW TEMPERATURE LOCKOUT<br>Setpoint determines outdoor temperature when the mechanical cooling cannot be turned on. |
| DRYBLB SET | | 63°F (17°C) | 48 to 80°F; (9 to 27°C) increment by 1° | OA DRY BULB TEMPERATURE CHANGEOVER SETPOINT<br>Setpoint determines where the economizer will assume outdoor air temperature is good for free cooling; e.g.: at 63°F (17°C), unit will economize at 62°F (16.7°C) and below and not economize at 64°F (17.8°C) and above. There is a 2°F (1.1°C) deadband.<br>See Menu Note 3 (on page 43). |
| ENTH CURVE | | ES3 | ES1, ES2, ES3, ES4, or ES5 | ENTHALPY CHANGEOVER CURVE<br>(Requires enthalpy sensor option)<br>Enthalpy boundary “curves” for economizing using single enthalpy. |
| DCV SET | | 1100ppm | 500 to 2000 ppm; increment by 100 | DEMAND CONTROL VENTILATION SETPOINT<br>Displays only if $CO_2$ sensor is connected. Setpoint for Demand Control Ventilation of space. Above the setpoint, the OA dampers will modulate open to bring in additional OA to maintain a space ppm level below the setpoint. |
| MIN POS L | | 6.0 V | 2 to 10Vdc | VENTILATION MINIMUM POSITION AT LOW SPEED<br>Displays ONLY if a CO2 sensor is NOT connected. |
| MIN POS H | | 4.4 V | 2 to 10Vdc | VENTILATION MINIMUM POSITION AT HIGH SPEED<br>Displays ONLY if a CO2 sensor is NOT connected. |
| VENTMAX L | | 6.0 V | 2 to 10Vdc | DCV MAXIMUM DAMPER POSITION AT LOW SPEED<br>(Requires $CO_2$ sensor connected) |
| VENTMAX H | | 4.4 V | 2 to 10Vdc | DCV MAXIMUM DAMPER POSITION AT HIGH SPEED<br>(Requires $CO_2$ sensor connected) |
| VENTMIN L | | 3.7 V | 2 to 10Vdc | DCV MINIMUM DAMPER POSITION AT LOW SPEED<br>(Requires $CO_2$ sensor connected) |
| VENTMIN H | | 2.8 V | 2 to 10Vdc | DCV MINIMUM DAMPER POSITION AT HIGH SPEED<br>(Requires $CO_2$ sensor connected) |
| ERV OAT SP | | 32°F (0°C) | 0 to 50°F; (–18 to 10°C) increment by 1° | ENERGY RECOVERY VENTILATION UNIT OUTDOOR AIR TEMPERATURE SETPOINT<br>Only when AUX1 O = ERV |
| EXH1 L SET | | 65% | 0 to 100%; increment by 1 | EXHAUST FAN STAGE 1 SETPOINT AT LOW SPEED<br>Setpoint for OA damper position when exhaust fan1 is powered by the economizer. |
| EXH1 H SET | | 50% | 0 to 100%; increment by 1 | EXHAUST FAN STAGE 1 SETPOINT AT HIGH SPEED<br>Setpoint for OA damper position when exhaust fan1 is powered by the economizer. |
| EXH2 L SET | | 80% | 0 to 100%; increment by 1 | EXHAUST FAN STAGE 2 SETPOINT AT LOW SPEED<br>Setpoint for OA damper position when exhaust fan 2 is powered by the economizer.<br>Only used when AUX1–O is set to EHX2. |
| EXH2 H SET | | 75% | 0 to 100%; increment by 1 | EXHAUST FAN STAGE 2 SETPOINT AT HIGH SPEED<br>Setpoint for OA damper position when exhaust fan 2 is powered by the economizer.<br>Only used when AUX1–O is set to EHX2. |

## Staged Air Volume (SAV™) with Variable Frequency Drive

The Staged Air Volume (SAV) system utilizes a Variable Frequency Drive (VFD) to automatically adjust the indoor fan motor speed in sequence with the unit's ventilation, cooling and heating operation. Per ASHRAE 90.1 2010 standard section 6.4.3.10.b, during the first stage of cooling operation the SAV system will adjust the fan motor to provide two-thirds (2/3) of the design airflow rate for the unit. When the call for the second stage of cooling is required, the SAV system will allow the design airflow rate for the unit established (100%). During the heating mode, the SAV system will allow total design airflow rate (100%) operation. During ventilation mode, the SAV system will operate the fan motor at 2/3 speed.


C13110

**Fig. 54 - Variable Frequency Drive (VFD)**



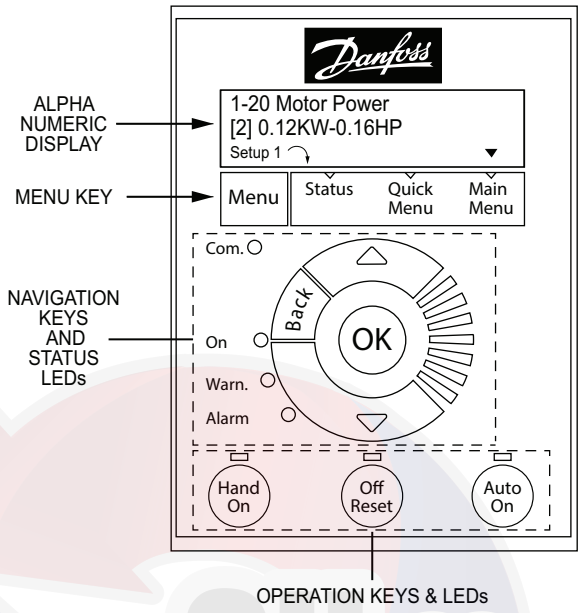

C13209

**Fig. 55 - VFD Location**

## Multi-Speed VFD Display Kit (Field-Installed Option)

**NOTE**: The Remote VFD Keypad is part of the Multi-Speed VFD display kit (PN: CRDISKIT002A00) which is a field-installed option. It is not included with the 48LC 14-26 base units.

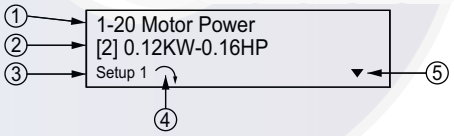
The VFD keypad as shown in Fig. 56 consists of the following sections:




C13112

**Fig. 56 - VFD Keypad**

**Alpha Numeric Display:** The LCD display is back lit with 2 alpha-numeric lines. All data is displayed on the LCD.

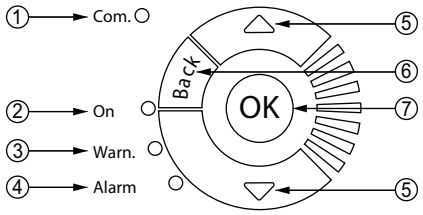



C13113

| | |
|---|---|
| 1 | Parameter number and name. |
| 2 | Parameter value. |
| 3 | Setup number shows the active setup and the edit setup. If the same set-up acts as both the active and edit set-up, only that setup number is shown (factory setting). When the active and edit setup differ, both numbers are shown in the display (SETUP 12). The flashing number indicates the edit setup. |
| 4 | The symbol in the number 4 position in the figure above indicates motor direction. The arrow point either clockwise or counter-clockwise to show the motor's current direction. |
| 5 | The position of the triangle indicates the currently selected menu: Status, Quick Menu or Main Menu. |

**Menu Key:** Use the Menu key to select between Status, Quick Menu or Main Menu. The triangle icon at the bottom of the LCD display indicates the currently selected mode. (See number 5 in the table above.)

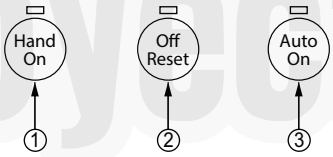
**Navigation Keys and Status LEDs:** The Navigation keys and Status LEDs are detailed in the following table.




C13114

| | |
|---|---|
| 1 | **Com.** LED: Flashes when bus communications is communicating. |
| 2 | Green LED/**On**: Control selection is working. |
| 3 | Yellow LED/**Warn**.: Indicates a warning. |
| 4 | Flashing Red LED/**Alarm**: Indicates an alarm. |
| 5 | **Arrows ▲▼**: Use the Up and Down arrow keys to navigate between parameter groups, parameters and within parameters. Also used for setting local reference. |
| 6 | **Back** key: Press to move to the previous step or layer in the navigation structure. |
| 7 | **OK** key: Press to select the currently displayed parameter and for accepting changes to parameter settings. |

**Operation Keys and LEDs:** The following table details the functions of the Operating keys. An illuminated yellow LED above the key indicates the active key.




C13115

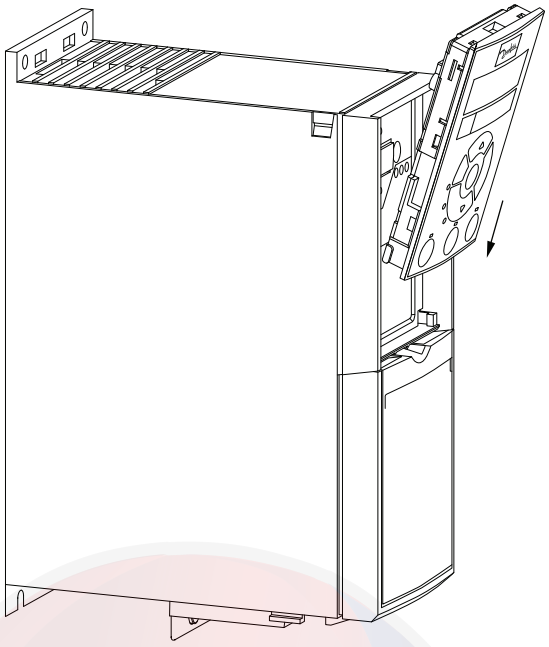
| | |
|---|---|
| 1 | **Hand On** key: Starts the motor and enables control of the variable frequency drive (VFD) via the VFD Keypad option.<br>**NOTE**: Please note that terminal 27 Digital Input *(5-12 Terminal 27 Digital Input)* has coast inverse as default setting. This means that the Hand On key will not start the motor if there is no 24V to terminal 27, so be sure to connect terminal 12 to terminal 27. |
| 2 | **Off/Reset** key: Stops the motor (off). If in alarm mode the alarm will be reset. |
| 3 | **Auto On** key: The variable frequency drive is controlled either via control terminals or serial communication. |

### Connecting the Keypad to the VFD

The VFD keypad can be mounted directly to the variable frequency drive, provided you can easily access the front panel of the VFD. If you don't have easy access to the VFD front panel, use the cable included with the kit to connect the keypad to the VFD.

**Connecting the Keypad Directly to the VFD —**

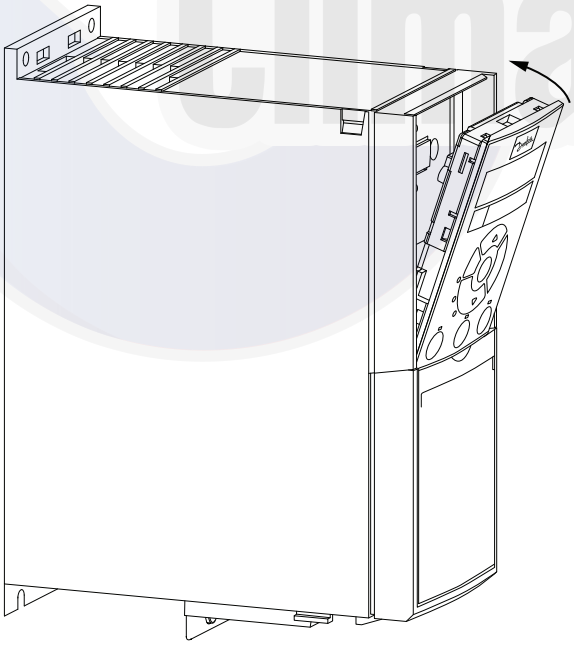
1. Place the bottom of the VFD keypad into the variable frequency drive as shown in Fig. 57.



C13116

**Fig. 57 - Align Bottom of VFD Keypad with Opening in VFD Front Panel**

2. Push the top of the VFD keypad into the variable frequency drive as shown in Fig. 58.

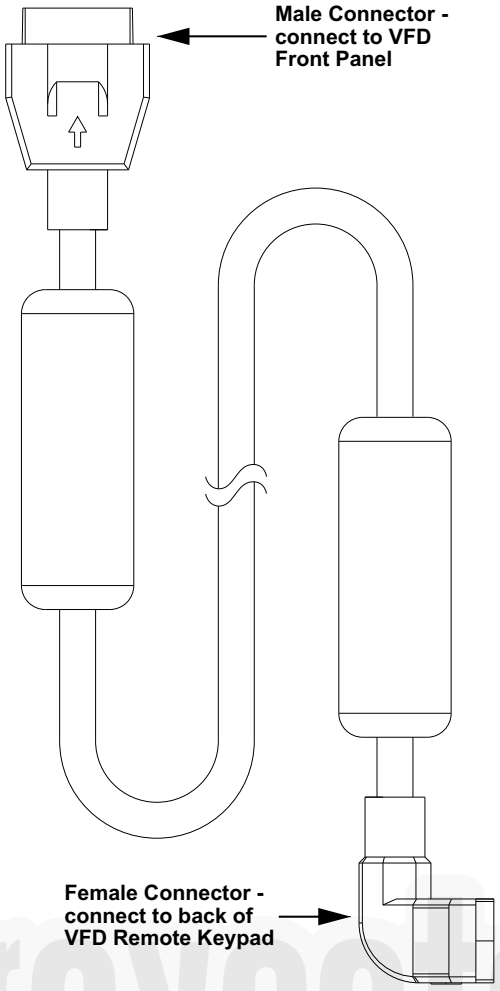


C13117

**Fig. 58 - Secure Keypad in Place**

**Using the Cable to Connect the Keypad to the VFD —**

The VFD keypad can be connected to the variable frequency drive via the cable included with the Multi-Speed VFD display kit (PN: CRDISKIT002A00).




C13118

**Fig. 59 - VFD Remote Keypad Cable**

1. Connect the male end of the cable to the front panel of the variable frequency drive. Use 2 of the screws included with the kit to secure the cable to the VFD.
2. Connect the female end of the cable to the back panel of the VFD Remote keypad. Secure the cable to the remote keypad using the 2 remaining screws from the kit.

## Program the VFD for 3 Discrete Indoor Fan Speeds

**IMPORTANT**: 48LC 14-26 units are programmed at the Factory for 3 discrete indoor fan speeds. The following procedure is only to be used to recover this function after an event such as a system crash.

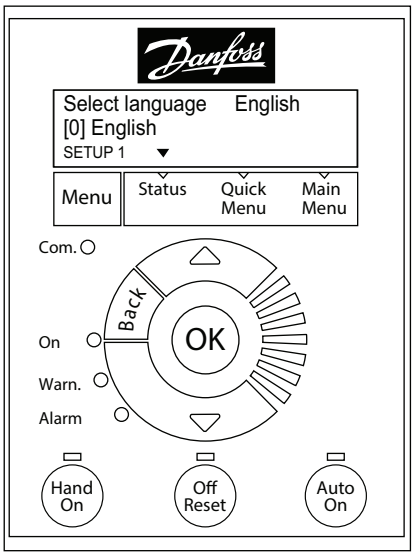
**NOTE**: This procedure requires use of the VFD Keypad which is included as part of the field-installed Multi-Speed VFD display kit (PN: CRDISKIT002A00). If the VFD keypad is not already installed, install it. See "Connecting the Keypad to the VFD" for details.

**To program the VFD for 3 discreet indoor fan motor speeds**:

1. At Power-Up:

   At the first power up the LCD displays the Select Language screen. The default setting is English. To

change the language, press the **OK** key and use the ▲ and ▼ keys to scroll to the desired language and then press **OK**.




C13119

**Fig. 60 - Keypad with Power Up Screen Displayed**

2. Selecting Regional Settings:
   a. Press the **Off Reset** key.
   b. Press the **Menu** key to move the ▼(triangle icon) so it is positioned over Main Menu. The display show the following -

| |
|---|
| 0–** Operation / Display |
| 1–** Load and Motor |

   c. Press the **OK** key, the display changes to -

| |
|---|
| 0–0* Basic Settings |
| 0–1* Set–up Operations |

**NOTE**: Press the **Back** key to return to the previous display

   d. With the top row highlighted, press **OK**. The display changes to -

| |
|---|
| 0–01 Language |
| [0] English |

   e. Press ▼**(Down Arrow** key) once; the display changes to -

| |
|---|
| 0–03 Regional Settings |
| [0] International |

   f. Press **OK**; the [0] is now highlighted.
   g. Press ▼**(Down Arrow)** key once; the display changes to -

| |
|---|
| 0–03 Regional Settings |
| [1] North America |

   h. Press **OK**

**NOTE**: If the Alarm 060 appears, follow Step 3 to clear the alarm. Make sure to press **Off Reset** when done. If there is no alarm, continue at Step 4.

3. Clearing Alarm 060: External Interlock:
   a. Press the **Menu** key twice to position the ▼(triangle icon) over Main Menu; the display changes to -

| |
|---|
| 0–** Operation / Display |
| 1–** Load and Motor |

   b. Press the ▼**(Down Arrow)** key until the following display appears -

| |
|---|
| 4–** Limits / Warnings |
| 5–** Digital In/Out |

   c. Press **OK**. The display changes to -

| |
|---|
| 5–0* Digital I/O mode |
| 5–1* Digital Inputs |

   d. Press ▼**(Down Arrow)** once to highlight the bottom row and press **OK**. The display changes to -

| |
|---|
| 5–10 Terminal 18 Digital In… |
| [8] Start |

   e. Press ▼**(Down Arrow)** twice; the following display appears-

| |
|---|
| 5–12 Terminal 27 Digital In… |
| [7] External Interlock |

   f. Press **OK** to highlight the number in the bracket.
   g. Press ▼**(Down Arrow)** until the following display appears -

| |
|---|
| 5–12 Terminal 27 Digital In… |
| [0] No operation |

   h. Press **OK**.
   i. Press **Off Reset.** The Alarm indicator disappears.

4. Entering Grid Type:
   a. Press the **Menu** key to move the ▼(triangle icon) so it is positioned over Main Menu. The display show the following -

| |
|---|
| 0–0* Basic Settings |
| 0–1* Set–up Operations |

   b. Press **OK** twice: the display changes to -

| |
|---|
| 0–01 Language |
| [0] English |

   c. Press ▼**(Down Arrow)** three times, to reach the following display -

| |
|---|
| 0–06 Grid Type |
| [102] 200–240V/60Hz |

   d. Press **OK** to highlight the number in the bracket and then use the ▲ and ▼ (**Up** and **Down Arrow**) keys to select the desired voltage and Hertz for the unit.
   e. Press **OK** to accept the selection and continue.

5. Entering Motor Data:
   a. Press the **Menu** key to move the ▼(triangle icon) so it is positioned over Main Menu. The display show the following -

| 0–** Operation / Display |
|---|
| 1–** Load and Motor |

   b. Press ▼**(Down Arrow)** once to highlight the bottom row.
   c. Press **OK**, the display changes to -

| 1–0* General Settings |
|---|
| 1–1* Motor Selection |

   d. Press ▼**(Down Arrow)** twice to reach the following display -

| 1–1* Motor Selection |
|---|
| 1–2* Motor Data |

   e. Press **OK**, the following display appears -

| 1-20 Motor Power |
|---|
| [9] 1.5kW – 2 hp |

**NOTE**: The number in the bracket may be different from what is shown above.

   f. Press **OK** and then use the ▲ and ▼ (**Up** and **Down Arrow**) keys to scroll to the proper motor horsepower. Press **OK** again to set the selected hp.
   g. Press ▼**(Down Arrow)** once, the following display appears -

| 1-22 Motor Voltage |
|---|
| 230V |

   h. Press **OK** to highlight the voltage value. Use the ▲ and ▼ (**Up** and **Down Arrow**) keys to select the nameplate voltage. Press **OK** again to set the selected voltage.
   i. Press ▼**(Down Arrow)** once to display the following -

| 1-23 Motor Frequency |
|---|
| 60Hz |

   j. Press **OK** to highlight the Frequency value and then use the ▲ and ▼ (**Up** and **Down Arrow**) keys to select the nameplate Hz. Press **OK** again to set the selected Hz.
   k. Press ▼**(Down Arrow)** once to display the following -

| 1-24 Motor Current |
|---|
| 6.61A |

   l. Press **OK** to highlight the Current value and then use the ▲ and ▼ (**Up** and **Down Arrow**) keys to select the Max Amps value provided. Press **OK** again to set the selected Max Amps.

**NOTE**: The Max Amps is greater than the nameplate value. Check the VFD Unit Parameters (see Tables 21 - 25 on pages 68 - 72) and use the value listed for the given unit in the column labeled "Motor Current Must-Hold Amps".

   m. Press ▼**(Down Arrow)** once to display the following -

| 1-25 Motor Nominal Speed |
|---|
| 1740rpm |

   n. Press **OK** to highlight the rpm value and then use the ▲ and ▼ (**Up** and **Down Arrow**) keys to select the nameplate rpm. Press **OK** again to set the selected rpm.

6. Entering Parameters for 1-71, 1-73, 1-82, and 1-90:
   a. Press the **Menu** key to move the ▼(triangle icon) so it is positioned over Main Menu. The display show the following -

| 0–** Operation / Display |
|---|
| 1–** Load and Motor |

   b. Press ▼**(Down Arrow)** once to highlight the bottom row.
   c. Press **OK**, the display changes to -

| 1–0* General Settings |
|---|
| 1–1* Motor Selection |

   d. Press ▼**(Down Arrow)** until the following display appears -

| 1–6* Load Depen. Setting |
|---|
| 1–7* Start Adjustments |

   e. Press **OK**, the following display appears -

| 1-71 Start Delay |
|---|
| 2.0s |

   f. Press **OK** to highlight the number and then use the ▲ and ▼ (**Up** and **Down Arrow**) keys to select the number provided in Tables 21 - 25. Press **OK** again to set the selected value.
   g. Press ▼**(Down Arrow)** twice, the following display appears -

| 1-73 Flying Start |
|---|
| [1] Enabled |

   h. Press **OK** to highlight the number in the bracket and then use the ▲ and ▼ (**Up** and **Down Arrow**) keys to select the number provided in Tables 21 - 25. Press **OK** again to set the selected value.
   i. Press the **Back** key once, the following display appears -

| 1–6* Load Depen. Setting |
|---|
| 1–7* Start Adjustments |

   j. Press ▼**(Down Arrow)** once, the following display appears -

| 1–7* Start Adjustments |
|---|
| 1–8* Stop Adjustments |

   k. Press **OK**, the following display appears -

| 1-80 Function at Stop |
|---|
| [0] Coast |

l. Press ▼**(Down Arrow)** once, the following display appears -

| |
|---|
| 1-82 Min Speed for Functio… |
| 1.0 Hz |

m. Press **OK** to highlight the number and then use the ▲ and ▼ (**Up** and **Down Arrow**) keys to select the number provided in Tables 21 - 25. Press **OK** again to set the selected value.

n. Press the **Back** key once, the following display appears -

| |
|---|
| 1–7* Start Adjustments |
| 1–8* Stop Adjustments |

o. Press ▼**(Down Arrow)** once, the following display appears -

| |
|---|
| 1–8* Stop Adjustments |
| 1–9* Motor Temperature |

p. Press **OK**, the following display appears -

| |
|---|
| 1-90 Motor Thermal Prote… |
| [4] ETR trip 1 |

q. Press **OK** to highlight the number in the bracket then use the ▲ and ▼ (**Up** and **Down Arrow**) keys to select the number provided in Tables 21 - 25. Press **OK** again to set the selected value.

7. Setting References:

a. Press the **Menu** key to move the ▼(triangle icon) so it is positioned over Main Menu. The display show the following -

| |
|---|
| 0–** Operation / Display |
| 1–** Load and Motor |

b. Press ▼**(Down Arrow)** three times, the following display appears -

| |
|---|
| 2–** Brakes |
| 3–** Reference / Ramps |

c. Press **OK**, the following display appears -

| |
|---|
| 3–0* Reference Limits |
| 3–1* References |

d. Press **OK** again, the following display appears -

| |
|---|
| 3-02 Minimum Reference |
| 0.000 |

**NOTE**: If the bottom row displays a number other than 0.000, press **OK** and use the ▲ and ▼ (**Up** and **Down Arrow**) key to select 0.000.

e. Press ▼**(Down Arrow)** once, the following display appears -

| |
|---|
| 3-03 Maximum Reference |
| 60.000 |

**NOTE**: If the bottom row displays a number other than 60.000, press **OK** and use the ▲ and ▼ (**Up** and **Down Arrow**) keys to select 60.000.

f. Press the **Back** key until the following display appears -

| |
|---|
| 3–0* Reference Limits |
| 3–1* References |

g. Press ▼**(Down Arrow)** once to move the highlight to the bottom row and then press **OK**. The following display appears -

| |
|---|
| 3-10 Preset Reference |
| [0]0.00% |

h. Press **OK** once to highlight the number in the bracket. Press **OK** again; the highlight moves to the current percent value.

Use the ▲ and ▼ (**Up** and **Down Arrow**) keys and the following table to enter the required Preset Reference values.

| | |
|---|---|
| [0]0.00% | Stop |
| [1]LL.LL% | Low Speed (see Tables 21 –25, column labeled “Preset References 3–10[1]” for the proper % for each unit) |
| [2]MM.MM% | Medium Speed (see Tables 21 –25, column labeled “Preset References 3–10[2]” for the proper % for each unit) |
| [3]100% | Override (High Speed) |
| [4]100% | High Speed (100% or close to 100% to achieve the required CFM at high speed) |
| [5]0.00% | Stop |
| [6]0.00% | Stop |
| [7]0.00% | Stop |

8. Setting the Ramp Time:

a. Press the **Back** key until the following display appears -

| |
|---|
| 3–0* Reference Limits |
| 3–1* References |

b. Press ▼**(Down Arrow)** twice, the following display appears -

| |
|---|
| 3–1* References |
| 3–4* Ramp 1 |

c. Press **OK**, the following display appears -

| |
|---|
| 3-41 Ramp 1 Ramp up Time |
| 3.00s |

d. Press **OK** again to highlight the bottom row and use the ▲ and ▼ (**Up** and **Down Arrow**) keys to select 10.00s. Press **OK** again to set the selected Ramp up Time.

e. Press ▼**(Down Arrow)** once, the following display appears -

| |
|---|
| 3-42 Ramp 1 Ramp Down Time |
| 3.00s |

f. Press **OK** again to highlight the bottom row and use the ▲ and ▼ (**Up** and **Down Arrow**) keys to select 10.00s. Press **OK** again to set the selected Ramp Down Time.

9. Setting Limits:

a. Press the **Back** key until the following display appears -

| |
|---|
| 2–** Brakes |
| 3–** Reference / Ramps |

b. Press ▼**(Down Arrow)** once, the following display appears -

| |
|---|
| 3–** Reference / Ramps |
| 4–** Limits / Warnings |

c. Press **OK**, the following display appears -

| |
|---|
| 4–1* Motor Limits |
| 4–4* Adj. Warning 2 |

d. Press **OK** again, the following display appears -

| |
|---|
| 4-10 Motor Speed Direction |
| [2] Both Directions |

e. Press ▼**(Down Arrow)** once, the following display appears -

| |
|---|
| 4-12 Motor Speed Low Limi… |
| 0.0Hz |

f. Press ▼**(Down Arrow)** again, the following display appears -

| |
|---|
| 4-14 Motor Speed High Limi… |
| 65.0Hz |

**NOTE**: Press **OK** to highlight the Hz value and then use the ▲ and ▼ (**Up** and **Down Arrow**) keys to enter the required values.

g. Press ▼**(Down Arrow)** once, the following display appears -

| |
|---|
| 4-18 Current Limit |
| 110% |

**NOTE**: Press **OK** to highlight the % value and then use the ▲ and ▼ (**Up** and **Down Arrow**) keys to enter the required value. See Tables 21 - 25 for proper selection of the value for this parameter then press **OK** to set the selected value.

h. Press ▼**(Down Arrow)** once, the following display appears -

| |
|---|
| 4-19 Max Output Frequency |
| 65.0Hz |

**NOTE**: Press **OK** to highlight the Hz value and then use the ▲ and ▼ (**Up** and **Down Arrow**) keys to enter the required values.

10. Setting Digital Inputs:

a. Press the **Back** key until the following display appears -

| |
|---|
| 3–** Reference / Ramps |
| 4–** Limits / Warnings |

b. Press ▼**(Down Arrow)** once, the following display appears -

| |
|---|
| 4–** Limits / Warnings |
| 5–** Digital In/Out |

c. Press **OK**, the following display appears -

| |
|---|
| 5–0* Digital I/O mode |
| 5–1* Digital Inputs |

d. Press ▼**(Down Arrow)** once to move the highlight to the bottom row and then press **OK**. The following display appears -

| |
|---|
| 5-10 Terminal 18 Digital In… |
| [8] Start |

e. Press ▼**(Down Arrow)** again. The following display appears -

| |
|---|
| 5-11 Terminal 19 Digital In… |
| [16] Preset ref bit 0 |

f. Press ▼**(Down Arrow)** again. The following display appears -

| |
|---|
| 5-12 Terminal 27 Digital In… |
| [17] Preset ref bit 1 |

g. Press ▼**(Down Arrow)** again. The following display appears -

| |
|---|
| 5-13 Terminal 29 Digital In… |
| [18] Preset ref bit 2 |

**NOTE**: By pressing **OK** the number in the bracket can be changed until the desired number appears. Press **OK** again to set the selected value.

11. Setting Analog Inputs:

a. Press the **Back** key until the following display appears -

| |
|---|
| 4–** Limits / Warnings |
| 5–** Digital In/Out |

b. Press ▼**(Down Arrow)** until the following display appears -

| |
|---|
| 5–** Digital In/Out |
| 6–** Analog In/Out |

c. Press **OK**, the following display appears -

| |
|---|
| 6–** Analog In/Out |
| 6–1* Analog Input 53 |

d. Press ▼**(Down Arrow)** once to move the highlight to the bottom row and then press **OK**. The following display appears –

| |
|---|
| 6-10 Terminal 53 Low Voltage |
| 2V |

e. Press ▼**(Down Arrow)** once to move the highlight to the bottom row and then press **OK**. The following display appears –

| |
|---|
| 6-11 Terminal 53 High Voltage |
| [10V] |

f. Press ▼**(Down Arrow)** once to move the highlight to the bottom row and then press **OK**. The following display appears –

| |
|---|
| 6-14 Set Min Reference |
| [0 Hz] |

g. Press ▼**(Down Arrow)** once to move the highlight to the bottom row and then press **OK**. The following display appears –

| |
|---|
| 6-15 Set Max Reference |
| [60 Hz] |

12. Setting Reset Mode and RFI Filter:
    a. Press the **Back** key until the following display appears –

| |
|---|
| 0–** Operation / Display |
| 1–** Load and Motor |

    b. Press ▼**(Down Arrow)** until the following display appears –

| |
|---|
| 13–** Smart Logic |
| 14–** Special Functions |

    c. Press **OK**, the following display appears –

| |
|---|
| 14–0* Inverter Switching |
| 14–1* Mains On/Off |

    d. Press ▼**(Down Arrow)** twice. The following display appears –

| |
|---|
| 14–1* Mains On/Off |
| 14–2* Reset Functions |

    e. Press **OK**, the following display appears –

| |
|---|
| 14-20 Reset Mode |
| [0] Manual reset |

    f. Press **OK** to highlight the number in the bracket.
    g. Use the ▲ and ▼ (**Up** and **Down Arrow**) keys to change the number to 3 for 3 automatic resets and then press **OK**. The display changes to –

| |
|---|
| 14-20 Reset Mode |
| [3] Automatic reset x 3 |

    h. Press ▼**(Down Arrow)** once, the following display appears –

| |
|---|
| 14-21 Automatic Restart T… |
| 10s |

    i. Press **OK** to highlight the number of seconds and use the ▲ and ▼ (**Up** and **Down Arrow**) keys to select 600 seconds. Press **OK** again to set the selected value.
    j. Press the **Back** key once, the following display appears –

| |
|---|
| 14–1* Mains On/Off |
| 14–2* Reset Functions |

    k. Press ▼**(Down Arrow)** twice, the following display appears –

| |
|---|
| 14–4* Energy Optimising |
| 14–5* Environment |

    l. Press **OK**, the following display appears –

| |
|---|
| 14-50 RFI Filter |
| [1] On |

    m. Press **OK** to highlight the number in the bracket and use the ▲ and ▼ (**Up** and **Down Arrow**) keys to select [0]. Press **OK** again to set the selected value.

13. To Complete Reprogramming:
    a. Press the **Auto On** key before disconnecting the VFD Remote Keypad from the variable frequency drive.

# Table 21 – VFD Unit Parameters - 48LC Size 14

| | | | | | | Regional Settings | Grid Type | Motor Power | Motor Voltage | Motor Frequency (Hz) | Motor Current (Must–Hold Amps) | Motor Nominal Speed (rpm) | Star Delay (Sec) | Flying Start | Min Speed for Function (Hz) | Motor Thermal Protection | Preset Reference | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Voltage | Unit Size | Motor Option | Motor P/N | VFD Carrier P/N | VFD Mfr P/N | 0–03 | 0–06 | 1–20 | 1–22 | 1–23 | 1–24 | 1–25 | 1–71 | 1–73 | 1–82 | 1–90 | 3–10 [0] | 3–10 [1] | 3–10 [2] |
| 208/230V | 14 | STD | HD58FE654 | HK30WA371 | 131L9796 | [1] | [102] | [10] | 230 | 60 | 9.2 | 1735 | 2.0 | [1] | 1.0 | [4] | 0% | 53.43% | 79.57% |
| 460V | 14 | STD | HD58FE654 | HK30WA377 | 131L9864 | [1] | [122] | [10] | 460 | 60 | 4.2 | 1735 | 2.0 | [1] | 1.0 | [4] | 0% | 53.43% | 79.57% |
| 575V | 14 | STD | HD58FE577 | HK30WA383 | 131N0227 | [1] | [132] | [11] | 575 | 60 | 4.9 | 1710 | 2.0 | [1] | 1.0 | [4] | 0% | 53.43% | 79.57% |
| 208/230V | 14 | MID | HD60FK658 | HK30WA372 | 131L9797 | [1] | [102] | [13] | 230 | 60 | 13.6 | 1745 | 2.0 | [1] | 1.0 | [4] | 0% | 53.43% | 79.57% |
| 460V | 14 | MID | HD60FK658 | HK30WA379 | 131L9866 | [1] | [122] | [13] | 460 | 60 | 6.8 | 1745 | 2.0 | [1] | 1.0 | [4] | 0% | 53.43% | 79.57% |
| 575V | 14 | MID | HD60FE576 | HK30WA387 | 134F0217 | [1] | [132] | [13] | 575 | 60 | 6.0 | 1745 | 2.0 | [1] | 1.0 | [4] | 0% | 53.43% | 79.57% |
| 208/230V | 14 | HIGH | HD60FK657 | HK30WA373 | 131L9798 | [1] | [102] | [14] | 230 | 60 | 21.2 | 1760 | 2.0 | [1] | 1.0 | [4] | 0% | 53.43% | 79.57% |
| 460V | 14 | HIGH | HD60FK657 | HK30WA380 | 131L9867 | [1] | [122] | [14] | 460 | 60 | 9.7 | 1760 | 2.0 | [1] | 1.0 | [4] | 0% | 53.43% | 79.57% |
| 575V | 14 | HIGH | HD60FL576 | HK30WA384 | 131N0229 | [1] | [132] | [14] | 575 | 60 | 7.2 | 1745 | 2.0 | [1] | 1.0 | [4] | 0% | 53.43% | 79.57% |
| 208/230V | 14 | ULTRA | HD62FK654 | HK30WA374 | 131L9799 | [1] | [102] | [15] | 230 | 60 | 28.0 | 1760 | 2.0 | [1] | 1.0 | [4] | 0% | 53.43% | 79.57% |
| 460V | 14 | ULTRA | HD62FK654 | HK30WA381 | 131L9868 | [1] | [122] | [15] | 460 | 60 | 13.7 | 1760 | 2.0 | [1] | 1.0 | [4] | 0% | 53.43% | 79.57% |
| 575V | 14 | ULTRA | HD62FL576 | HK30WA384 | 131N0229 | [1] | [132] | [15] | 575 | 60 | 8.9 | 1750 | 2.0 | [1] | 1.0 | [4] | 0% | 53.43% | 79.57% |

| | | | Preset Reference (cont.) | | | | | Ramp Up Time (Sec) | Ramp Down Time (Sec) | Current Limit | Terminal 18 Digital Input | Terminal 19 Digital Input | Terminal 27 Digital Input | Terminal 29 Digital Input | Terminal 53 Low Voltage | Terminal 53 High Voltage | Terminal 53 Low Reference | Terminal 53 High Reference | Reset Mode | Auto. Restart Time (S) | RFI Filter |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Voltage | Unit Size | Motor Option | 3–10 [3] | 3–10 [4] | 3–10 [5] | 3–10 [6] | 3–10 [7] | 3–41 | 3–42 | 4–18 | 5–10 | 5–11 | 5–12 | 5–13 | 6–10 | 6–11 | 6–14 | 6–15 | 14–20 | 14–21 | 14–50 |
| 208/230V | 14 | STD | 100% | 100% | 0% | 0% | 0% | 10.00 | 10.00 | 100% | [8] | [16] | [17] | [18] | 2 | [10] | 0 | [60] | [3] | 600 | [0] |
| 460V | 14 | STD | 100% | 100% | 0% | 0% | 0% | 10.00 | 10.00 | 100% | [8] | [16] | [17] | [18] | 2 | [10] | 0 | [60] | [3] | 600 | [0] |
| 575V | 14 | STD | 100% | 100% | 0% | 0% | 0% | 10.00 | 10.00 | 100% | [8] | [16] | [17] | [18] | 2 | [10] | 0 | [60] | [3] | 600 | [0] |
| 208/230V | 14 | MID | 100% | 100% | 0% | 0% | 0% | 10.00 | 10.00 | 100% | [8] | [16] | [17] | [18] | 2 | [10] | 0 | [60] | [3] | 600 | [0] |
| 460V | 14 | MID | 100% | 100% | 0% | 0% | 0% | 10.00 | 10.00 | 100% | [8] | [16] | [17] | [18] | 2 | [10] | 0 | [60] | [3] | 600 | [0] |
| 575V | 14 | MID | 100% | 100% | 0% | 0% | 0% | 10.00 | 10.00 | 100% | [8] | [16] | [17] | [18] | 2 | [10] | 0 | [60] | [3] | 600 | [0] |
| 208/230V | 14 | HIGH | 100% | 100% | 0% | 0% | 0% | 10.00 | 10.00 | 100% | [8] | [16] | [17] | [18] | 2 | [10] | 0 | [60] | [3] | 600 | [0] |
| 460V | 14 | HIGH | 100% | 100% | 0% | 0% | 0% | 10.00 | 10.00 | 100% | [8] | [16] | [17] | [18] | 2 | [10] | 0 | [60] | [3] | 600 | [0] |
| 575V | 14 | HIGH | 100% | 100% | 0% | 0% | 0% | 10.00 | 10.00 | 100% | [8] | [16] | [17] | [18] | 2 | [10] | 0 | [60] | [3] | 600 | [0] |
| 208/230V | 14 | ULTRA | 100% | 100% | 0% | 0% | 0% | 10.00 | 10.00 | 100% | [8] | [16] | [17] | [18] | 2 | [10] | 0 | [60] | [3] | 600 | [0] |
| 460V | 14 | ULTRA | 100% | 100% | 0% | 0% | 0% | 10.00 | 10.00 | 100% | [8] | [16] | [17] | [18] | 2 | [10] | 0 | [60] | [3] | 600 | [0] |
| 575V | 14 | ULTRA | 100% | 100% | 0% | 0% | 0% | 10.00 | 10.00 | 100% | [8] | [16] | [17] | [18] | 2 | [10] | 0 | [60] | [3] | 600 | [0] |

## Table 22 – VFD Unit Parameters - 48LC Size 17

| | | | | | | Regional Settings | Grid Type | Motor Power | Motor Voltage | Motor Frequency (Hz) | Motor Current (Must–Hold Amps) | Motor Nominal Speed (rpm) | Star Delay (Sec) | Flying Start | Min Speed for Function (Hz) | Motor Thermal Protection | Preset Reference | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Voltage | Unit Size | Motor Option | Motor P/N | VFD Carrier P/N | VFD Mfr P/N | 0–03 | 0–06 | 1–20 | 1–22 | 1–23 | 1–24 | 1–25 | 1–71 | 1–73 | 1–82 | 1–90 | 3–10 [0] | 3–10 [1] | 3–10 [2] |
| 208/230V | 17 | STD | HD58FE654 | HK30WA371 | 131L9796 | [1] | [102] | [10] | 230 | 60 | 9.2 | 1735 | 2.0 | [1] | 1.0 | [4] | 0% | 56.64% | 82.40% |
| 460V | 17 | STD | HD58FE654 | HK30WA377 | 131L9864 | [1] | [122] | [10] | 460 | 60 | 4.2 | 1735 | 2.0 | [1] | 1.0 | [4] | 0% | 56.64% | 82.40% |
| 575V | 17 | STD | HD58FE577 | HK30WA383 | 131N0227 | [1] | [132] | [11] | 575 | 60 | 4.9 | 1710 | 2.0 | [1] | 1.0 | [4] | 0% | 56.64% | 82.40% |
| 208/230V | 17 | MID | HD60FK657 | HK30WA373 | 131L9798 | [1] | [102] | [14] | 230 | 60 | 21.2 | 1760 | 2.0 | [1] | 1.0 | [4] | 0% | 56.64% | 82.40% |
| 460V | 17 | MID | HD60FK657 | HK30WA380 | 131L9867 | [1] | [122] | [14] | 460 | 60 | 9.7 | 1760 | 2.0 | [1] | 1.0 | [4] | 0% | 56.64% | 82.40% |
| 575V | 17 | MID | HD60FL576 | HK30WA384 | 131N0229 | [1] | [132] | [14] | 575 | 60 | 7.2 | 1745 | 2.0 | [1] | 1.0 | [4] | 0% | 56.64% | 82.40% |
| 208/230V | 17 | HIGH | HD62FK654 | HK30WA374 | 131L9799 | [1] | [102] | [15] | 230 | 60 | 28.0 | 1760 | 2.0 | [1] | 1.0 | [4] | 0% | 56.64% | 82.40% |
| 460V | 17 | HIGH | HD62FK654 | HK30WA381 | 131L9868 | [1] | [122] | [15] | 460 | 60 | 13.7 | 1760 | 2.0 | [1] | 1.0 | [4] | 0% | 56.64% | 82.40% |
| 575V | 17 | HIGH | HD62FL576 | HK30WA384 | 131N0229 | [1] | [132] | [15] | 575 | 60 | 8.9 | 1750 | 2.0 | [1] | 1.0 | [4] | 0% | 56.64% | 82.40% |
| 208/230V | 17 | ULTRA | HD64FK654 | HK30WA375 | 131L9800 | [1] | [102] | [16] | 230 | 60 | 37.3 | 1755 | 2.0 | [1] | 1.0 | [4] | 0% | 56.64% | 82.40% |
| 460V | 17 | ULTRA | HD64FK654 | HK30WA386 | 131L9869 | [1] | [122] | [16] | 460 | 60 | 16.9 | 1755 | 2.0 | [1] | 1.0 | [4] | 0% | 56.64% | 82.40% |
| 575V | 17 | ULTRA | HD64FL576 | HK30WA388 | 131N0233 | [1] | [132] | [16] | 575 | 60 | 12.6 | 1755 | 2.0 | [1] | 1.0 | [4] | 0% | 56.64% | 82.40% |

| | | | Preset Reference (cont.) | | | | | Ramp Up Time (Sec) | Ramp Down Time (Sec) | Current Limit | Terminal 18 Digital Input | Terminal 19 Digital Input | Terminal 27 Digital Input | Terminal 29 Digital Input | Terminal 53 Low Voltage | Terminal 53 High Voltage | Terminal 53 Low Reference | Terminal 53 High Reference | Reset Mode | Auto. Restart Time (S) | RFI Filter |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Voltage | Unit Size | Motor Option | 3–10 [3] | 3–10 [4] | 3–10 [5] | 3–10 [6] | 3–10 [7] | 3–41 | 3–42 | 4–18 | 5–10 | 5–11 | 5–12 | 5–13 | 6–10 | 6–11 | 6–14 | 6–15 | 14–20 | 14–21 | 14–50 |
| 208/230V | 17 | STD | 100% | 100% | 0% | 0% | 0% | 10.00 | 10.00 | 100% | [8] | [16] | [17] | [18] | 2 | [10] | 0 | [60] | [3] | 600 | [0] |
| 460V | 17 | STD | 100% | 100% | 0% | 0% | 0% | 10.00 | 10.00 | 100% | [8] | [16] | [17] | [18] | 2 | [10] | 0 | [60] | [3] | 600 | [0] |
| 575V | 17 | STD | 100% | 100% | 0% | 0% | 0% | 10.00 | 10.00 | 100% | [8] | [16] | [17] | [18] | 2 | [10] | 0 | [60] | [3] | 600 | [0] |
| 208/230V | 17 | MID | 100% | 100% | 0% | 0% | 0% | 10.00 | 10.00 | 100% | [8] | [16] | [17] | [18] | 2 | [10] | 0 | [60] | [3] | 600 | [0] |
| 460V | 17 | MID | 100% | 100% | 0% | 0% | 0% | 10.00 | 10.00 | 100% | [8] | [16] | [17] | [18] | 2 | [10] | 0 | [60] | [3] | 600 | [0] |
| 575V | 17 | MID | 100% | 100% | 0% | 0% | 0% | 10.00 | 10.00 | 100% | [8] | [16] | [17] | [18] | 2 | [10] | 0 | [60] | [3] | 600 | [0] |
| 208/230V | 17 | HIGH | 100% | 100% | 0% | 0% | 0% | 10.00 | 10.00 | 100% | [8] | [16] | [17] | [18] | 2 | [10] | 0 | [60] | [3] | 600 | [0] |
| 460V | 17 | HIGH | 100% | 100% | 0% | 0% | 0% | 10.00 | 10.00 | 100% | [8] | [16] | [17] | [18] | 2 | [10] | 0 | [60] | [3] | 600 | [0] |
| 575V | 17 | HIGH | 100% | 100% | 0% | 0% | 0% | 10.00 | 10.00 | 100% | [8] | [16] | [17] | [18] | 2 | [10] | 0 | [60] | [3] | 600 | [0] |
| 208/230V | 17 | ULTRA | 100% | 100% | 0% | 0% | 0% | 10.00 | 10.00 | 100% | [8] | [16] | [17] | [18] | 2 | [10] | 0 | [60] | [3] | 600 | [0] |
| 460V | 17 | ULTRA | 100% | 100% | 0% | 0% | 0% | 10.00 | 10.00 | 100% | [8] | [16] | [17] | [18] | 2 | [10] | 0 | [60] | [3] | 600 | [0] |
| 575V | 17 | ULTRA | 100% | 100% | 0% | 0% | 0% | 10.00 | 10.00 | 100% | [8] | [16] | [17] | [18] | 2 | [10] | 0 | [60] | [3] | 600 | [0] |

# Table 23 – VFD Unit Parameters - 48LC Size 20

| | | | | | | Regional Settings | Grid Type | Motor Power | Motor Voltage | Motor Frequency (Hz) | Motor Current (Must–Hold Amps) | Motor Nominal Speed (rpm) | Star Delay (Sec) | Flying Start | Min Speed for Function (Hz) | Motor Thermal Protection | Preset Reference | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Voltage | Unit Size | Motor Option | Motor P/N | VFD Carrier P/N | VFD Mfr P/N | 0–03 | 0–06 | 1–20 | 1–22 | 1–23 | 1–24 | 1–25 | 1–71 | 1–73 | 1–82 | 1–90 | 3–10 [0] | 3–10 [1] | 3–10 [2] |
| 208/230V | 20 | STD | HD60FE656 | HK30WA372 | 131L9797 | [1] | [102] | [11] | 230 | 60 | 11.7 | 1750 | 2.0 | [1] | 1.0 | [4] | 0% | 52.57% | 61.63% |
| 460V | 20 | STD | HD60FE656 | HK30WA378 | 131L9865 | [1] | [122] | [11] | 460 | 60 | 5.4 | 1750 | 2.0 | [1] | 1.0 | [4] | 0% | 52.57% | 61.63% |
| 575V | 20 | STD | HD58FE577 | HK30WA383 | 131N0227 | [1] | [132] | [11] | 575 | 60 | 4.9 | 1710 | 2.0 | [1] | 1.0 | [4] | 0% | 52.57% | 61.63% |
| 208/230V | 20 | MID | HD60FK657 | HK30WA373 | 131L9798 | [1] | [102] | [14] | 230 | 60 | 21.2 | 1760 | 2.0 | [1] | 1.0 | [4] | 0% | 52.57% | 61.63% |
| 460V | 20 | MID | HD60FK657 | HK30WA380 | 131L9867 | [1] | [122] | [14] | 460 | 60 | 9.7 | 1760 | 2.0 | [1] | 1.0 | [4] | 0% | 52.57% | 61.63% |
| 575V | 20 | MID | HD60FL576 | HK30WA384 | 131N0229 | [1] | [132] | [14] | 575 | 60 | 7.2 | 1745 | 2.0 | [1] | 1.0 | [4] | 0% | 52.57% | 61.63% |
| 208/230V | 20 | HIGH | HD62FK654 | HK30WA374 | 131L9799 | [1] | [102] | [15] | 230 | 60 | 28.0 | 1760 | 2.0 | [1] | 1.0 | [4] | 0% | 52.57% | 61.63% |
| 460V | 20 | HIGH | HD62FK654 | HK30WA381 | 131L9868 | [1] | [122] | [15] | 460 | 60 | 13.7 | 1760 | 2.0 | [1] | 1.0 | [4] | 0% | 52.57% | 61.63% |
| 575V | 20 | HIGH | HD62FL576 | HK30WA384 | 131N0229 | [1] | [132] | [15] | 575 | 60 | 8.9 | 1750 | 2.0 | [1] | 1.0 | [4] | 0% | 52.57% | 61.63% |
| 208/230V | 20 | ULTRA | HD64FK654 | HK30WA375 | 131L9800 | [1] | [102] | [16] | 230 | 60 | 37.3 | 1755 | 2.0 | [1] | 1.0 | [4] | 0% | 52.57% | 61.63% |
| 460V | 20 | ULTRA | HD64FK654 | HK30WA386 | 131L9869 | [1] | [122] | [16] | 460 | 60 | 16.9 | 1755 | 2.0 | [1] | 1.0 | [4] | 0% | 52.57% | 61.63% |
| 575V | 20 | ULTRA | HD64FL576 | HK30WA388 | 131N0233 | [1] | [132] | [16] | 575 | 60 | 12.6 | 1755 | 2.0 | [1] | 1.0 | [4] | 0% | 52.57% | 61.63% |

| | | | Preset Reference (cont.) | | | | | Ramp Up Time (Sec) | Ramp Down Time (Sec) | Current Limit | Terminal 18 Digital Input | Terminal 19 Digital Input | Terminal 27 Digital Input | Terminal 29 Digital Input | Terminal 53 Low Voltage | Terminal 53 High Voltage | Terminal 53 Low Reference | Terminal 53 High Reference | Reset Mode | Auto. Restart Time (S) | RFI Filter |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Voltage | Unit Size | Motor Option | 3–10 [3] | 3–10 [4] | 3–10 [5] | 3–10 [6] | 3–10 [7] | 3–41 | 3–42 | 4–18 | 5–10 | 5–11 | 5–12 | 5–13 | 6–10 | 6–11 | 6–14 | 6–15 | 14–20 | 14–21 | 14–50 |
| 208/230V | 20 | STD | 100% | 100% | 0% | 0% | 0% | 10.00 | 10.00 | 100% | [8] | [16] | [17] | [18] | 2 | [10] | 0 | [60] | [3] | 600 | [0] |
| 460V | 20 | STD | 100% | 100% | 0% | 0% | 0% | 10.00 | 10.00 | 100% | [8] | [16] | [17] | [18] | 2 | [10] | 0 | [60] | [3] | 600 | [0] |
| 575V | 20 | STD | 100% | 100% | 0% | 0% | 0% | 10.00 | 10.00 | 100% | [8] | [16] | [17] | [18] | 2 | [10] | 0 | [60] | [3] | 600 | [0] |
| 208/230V | 20 | MID | 100% | 100% | 0% | 0% | 0% | 10.00 | 10.00 | 100% | [8] | [16] | [17] | [18] | 2 | [10] | 0 | [60] | [3] | 600 | [0] |
| 460V | 20 | MID | 100% | 100% | 0% | 0% | 0% | 10.00 | 10.00 | 100% | [8] | [16] | [17] | [18] | 2 | [10] | 0 | [60] | [3] | 600 | [0] |
| 575V | 20 | MID | 100% | 100% | 0% | 0% | 0% | 10.00 | 10.00 | 100% | [8] | [16] | [17] | [18] | 2 | [10] | 0 | [60] | [3] | 600 | [0] |
| 208/230V | 20 | HIGH | 100% | 100% | 0% | 0% | 0% | 10.00 | 10.00 | 100% | [8] | [16] | [17] | [18] | 2 | [10] | 0 | [60] | [3] | 600 | [0] |
| 460V | 20 | HIGH | 100% | 100% | 0% | 0% | 0% | 10.00 | 10.00 | 100% | [8] | [16] | [17] | [18] | 2 | [10] | 0 | [60] | [3] | 600 | [0] |
| 575V | 20 | HIGH | 100% | 100% | 0% | 0% | 0% | 10.00 | 10.00 | 100% | [8] | [16] | [17] | [18] | 2 | [10] | 0 | [60] | [3] | 600 | [0] |
| 208/230V | 20 | ULTRA | 100% | 100% | 0% | 0% | 0% | 10.00 | 10.00 | 100% | [8] | [16] | [17] | [18] | 2 | [10] | 0 | [60] | [3] | 600 | [0] |
| 460V | 20 | ULTRA | 100% | 100% | 0% | 0% | 0% | 10.00 | 10.00 | 100% | [8] | [16] | [17] | [18] | 2 | [10] | 0 | [60] | [3] | 600 | [0] |
| 575V | 20 | ULTRA | 100% | 100% | 0% | 0% | 0% | 10.00 | 10.00 | 100% | [8] | [16] | [17] | [18] | 2 | [10] | 0 | [60] | [3] | 600 | [0] |

## Table 24 – VFD Unit Parameters - 48 LC Size 24

| | | | | | | Regional Settings | Grid Type | Motor Power | Motor Voltage | Motor Frequency (Hz) | Motor Current (Must–Hold Amps) | Motor Nominal Speed (rpm) | Star Delay (Sec) | Flying Start | Min Speed for Function (Hz) | Motor Thermal Protection | Preset Reference | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Voltage | Unit Size | Motor Option | Motor P/N | VFD Carrier P/N | VFD Mfr P/N | 0–03 | 0–06 | 1–20 | 1–22 | 1–23 | 1–24 | 1–25 | 1–71 | 1–73 | 1–82 | 1–90 | 3–10 [0] | 3–10 [1] | 3–10 [2] |
| 208/230V | 24 | STD | HD60FK657 | HK30WA373 | 131L9798 | [1] | [102] | [14] | 230 | 60 | 21.2 | 1760 | 2.0 | [1] | 1.0 | [4] | 0% | 52.33% | 64.48% |
| 460V | 24 | STD | HD60FK657 | HK30WA380 | 131L9867 | [1] | [122] | [14] | 460 | 60 | 9.7 | 1760 | 2.0 | [1] | 1.0 | [4] | 0% | 52.33% | 64.48% |
| 575V | 24 | STD | HD60FL576 | HK30WA384 | 131N0229 | [1] | [132] | [14] | 575 | 60 | 7.2 | 1745 | 2.0 | [1] | 1.0 | [4] | 0% | 52.33% | 64.48% |
| 208/230V | 24 | MID | HD62FK654 | HK30WA374 | 131L9799 | [1] | [102] | [15] | 230 | 60 | 28.0 | 1760 | 2.0 | [1] | 1.0 | [4] | 0% | 52.33% | 64.48% |
| 460V | 24 | MID | HD62FK654 | HK30WA381 | 131L9868 | [1] | [122] | [15] | 460 | 60 | 13.7 | 1760 | 2.0 | [1] | 1.0 | [4] | 0% | 52.33% | 64.48% |
| 575V | 24 | MID | HD62FL576 | HK30WA384 | 131N0229 | [1] | [132] | [15] | 575 | 60 | 8.9 | 1750 | 2.0 | [1] | 1.0 | [4] | 0% | 52.33% | 64.48% |
| 208/230V | 24 | HIGH | HD64FK654 | HK30WA375 | 131L9800 | [1] | [102] | [16] | 230 | 60 | 37.3 | 1755 | 2.0 | [1] | 1.0 | [4] | 0% | 52.33% | 64.48% |
| 460V | 24 | HIGH | HD64FK654 | HK30WA386 | 131L9869 | [1] | [122] | [16] | 460 | 60 | 16.9 | 1755 | 2.0 | [1] | 1.0 | [4] | 0% | 52.33% | 64.48% |
| 575V | 24 | HIGH | HD64FL576 | HK30WA388 | 131N0233 | [1] | [132] | [16] | 575 | 60 | 12.6 | 1755 | 2.0 | [1] | 1.0 | [4] | 0% | 52.33% | 64.48% |

| | | | Preset Reference (cont.) | | | | | Ramp Up Time (Sec) | Ramp Down Time (Sec) | Current Limit | Terminal 18 Digital Input | Terminal 19 Digital Input | Terminal 27 Digital Input | Terminal 29 Digital Input | Terminal 53 Low Voltage | Terminal 53 High Voltage | Terminal 53 Low Reference | Terminal 53 High Reference | Reset Mode | Auto. Restart Time (S) | RFI Filter |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Voltage | Unit Size | Motor Option | 3–10 [3] | 3–10 [4] | 3–10 [5] | 3–10 [6] | 3–10 [7] | 3–41 | 3–42 | 4–18 | 5–10 | 5–11 | 5–12 | 5–13 | 6–10 | 6–11 | 6–14 | 6–15 | 14–20 | 14–21 | 14–50 |
| 208/230V | 24 | STD | 100% | 100% | 0% | 0% | 0% | 10.00 | 10.00 | 100% | [8] | [16] | [17] | [18] | 2 | [10] | 0 | [60] | [3] | 600 | [0] |
| 460V | 24 | STD | 100% | 100% | 0% | 0% | 0% | 10.00 | 10.00 | 100% | [8] | [16] | [17] | [18] | 2 | [10] | 0 | [60] | [3] | 600 | [0] |
| 575V | 24 | STD | 100% | 100% | 0% | 0% | 0% | 10.00 | 10.00 | 100% | [8] | [16] | [17] | [18] | 2 | [10] | 0 | [60] | [3] | 600 | [0] |
| 208/230V | 24 | MID | 100% | 100% | 0% | 0% | 0% | 10.00 | 10.00 | 100% | [8] | [16] | [17] | [18] | 2 | [10] | 0 | [60] | [3] | 600 | [0] |
| 460V | 24 | MID | 100% | 100% | 0% | 0% | 0% | 10.00 | 10.00 | 100% | [8] | [16] | [17] | [18] | 2 | [10] | 0 | [60] | [3] | 600 | [0] |
| 575V | 24 | MID | 100% | 100% | 0% | 0% | 0% | 10.00 | 10.00 | 100% | [8] | [16] | [17] | [18] | 2 | [10] | 0 | [60] | [3] | 600 | [0] |
| 208/230V | 24 | HIGH | 100% | 100% | 0% | 0% | 0% | 10.00 | 10.00 | 100% | [8] | [16] | [17] | [18] | 2 | [10] | 0 | [60] | [3] | 600 | [0] |
| 460V | 24 | HIGH | 100% | 100% | 0% | 0% | 0% | 10.00 | 10.00 | 100% | [8] | [16] | [17] | [18] | 2 | [10] | 0 | [60] | [3] | 600 | [0] |
| 575V | 24 | HIGH | 100% | 100% | 0% | 0% | 0% | 10.00 | 10.00 | 100% | [8] | [16] | [17] | [18] | 2 | [10] | 0 | [60] | [3] | 600 | [0] |

## Table 25 – VFD Unit Parameters - 48LC Size 26

| | | | | | | Regional Settings | Grid Type | Motor Power | Motor Voltage | Motor Frequency (Hz) | Motor Current (Must–Hold Amps) | Motor Nominal Speed (rpm) | Star Delay (Sec) | Flying Start | Min Speed for Function (Hz) | Motor Thermal Protection | Preset Reference | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Voltage | Unit Size | Motor Option | Motor P/N | VFD Carrier P/N | VFD Mfr P/N | 0–03 | 0–06 | 1–20 | 1–22 | 1–23 | 1–24 | 1–25 | 1–71 | 1–73 | 1–82 | 1–90 | 3–10 [0] | 3–10 [1] | 3–10 [2] |
| 208/230V | 26 | STD | HD60FK657 | HK30WA373 | 131L9798 | [1] | [102] | [14] | 230 | 60 | 21.2 | 1760 | 2.0 | [1] | 1.0 | [4] | 0% | 60.00% | 72.00% |
| 460V | 26 | STD | HD60FK657 | HK30WA380 | 131L9867 | [1] | [122] | [14] | 460 | 60 | 9.7 | 1760 | 2.0 | [1] | 1.0 | [4] | 0% | 60.00% | 72.00% |
| 575V | 26 | STD | HD60FL576 | HK30WA384 | 131N0229 | [1] | [132] | [14] | 575 | 60 | 7.2 | 1745 | 2.0 | [1] | 1.0 | [4] | 0% | 60.00% | 72.00% |
| 208/230V | 26 | MID | HD62FK654 | HK30WA374 | 131L9799 | [1] | [102] | [15] | 230 | 60 | 28.0 | 1760 | 2.0 | [1] | 1.0 | [4] | 0% | 60.00% | 72.00% |
| 460V | 26 | MID | HD62FK654 | HK30WA381 | 131L9868 | [1] | [122] | [15] | 460 | 60 | 13.7 | 1760 | 2.0 | [1] | 1.0 | [4] | 0% | 60.00% | 72.00% |
| 575V | 26 | MID | HD62FL576 | HK30WA384 | 131N0229 | [1] | [132] | [15] | 575 | 60 | 8.9 | 1750 | 2.0 | [1] | 1.0 | [4] | 0% | 60.00% | 72.00% |
| 208/230V | 26 | HIGH | HD64FK654 | HK30WA375 | 131L9800 | [1] | [102] | [16] | 230 | 60 | 37.3 | 1755 | 2.0 | [1] | 1.0 | [4] | 0% | 60.00% | 72.00% |
| 460V | 26 | HIGH | HD64FK654 | HK30WA386 | 131L9869 | [1] | [122] | [16] | 460 | 60 | 16.9 | 1755 | 2.0 | [1] | 1.0 | [4] | 0% | 60.00% | 72.00% |
| 575V | 26 | HIGH | HD64FL576 | HK30WA388 | 131N0233 | [1] | [132] | [16] | 575 | 60 | 12.6 | 1755 | 2.0 | [1] | 1.0 | [4] | 0% | 60.00% | 72.00% |

| | | | Preset Reference (cont.) | | | | | Ramp Up Time (Sec) | Ramp Down Time (Sec) | Current Limit | Terminal 18 Digital Input | Terminal 19 Digital Input | Terminal 27 Digital Input | Terminal 29 Digital Input | Terminal 53 Low Voltage | Terminal 53 High Voltage | Terminal 53 Low Reference | Terminal 53 High Reference | Reset Mode | Auto. Restart Time (S) | RFI Filter |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Voltage | Unit Size | Motor Option | 3–10 [3] | 3–10 [4] | 3–10 [5] | 3–10 [6] | 3–10 [7] | 3–41 | 3–42 | 4–18 | 5–10 | 5–11 | 5–12 | 5–13 | 6–10 | 6–11 | 6–14 | 6–15 | 14–20 | 14–21 | 14–50 |
| 208/230V | 26 | STD | 100% | 100% | 0% | 0% | 0% | 10.00 | 10.00 | 100% | [8] | [16] | [17] | [18] | 2 | [10] | 0 | [60] | [3] | 600 | [0] |
| 460V | 26 | STD | 100% | 100% | 0% | 0% | 0% | 10.00 | 10.00 | 100% | [8] | [16] | [17] | [18] | 2 | [10] | 0 | [60] | [3] | 600 | [0] |
| 575V | 26 | STD | 100% | 100% | 0% | 0% | 0% | 10.00 | 10.00 | 100% | [8] | [16] | [17] | [18] | 2 | [10] | 0 | [60] | [3] | 600 | [0] |
| 208/230V | 26 | MID | 100% | 100% | 0% | 0% | 0% | 10.00 | 10.00 | 100% | [8] | [16] | [17] | [18] | 2 | [10] | 0 | [60] | [3] | 600 | [0] |
| 460V | 26 | MID | 100% | 100% | 0% | 0% | 0% | 10.00 | 10.00 | 100% | [8] | [16] | [17] | [18] | 2 | [10] | 0 | [60] | [3] | 600 | [0] |
| 575V | 26 | MID | 100% | 100% | 0% | 0% | 0% | 10.00 | 10.00 | 100% | [8] | [16] | [17] | [18] | 2 | [10] | 0 | [60] | [3] | 600 | [0] |
| 208/230V | 26 | HIGH | 100% | 100% | 0% | 0% | 0% | 10.00 | 10.00 | 100% | [8] | [16] | [17] | [18] | 2 | [10] | 0 | [60] | [3] | 600 | [0] |
| 460V | 26 | HIGH | 100% | 100% | 0% | 0% | 0% | 10.00 | 10.00 | 100% | [8] | [16] | [17] | [18] | 2 | [10] | 0 | [60] | [3] | 600 | [0] |
| 575V | 26 | HIGH | 100% | 100% | 0% | 0% | 0% | 10.00 | 10.00 | 100% | [8] | [16] | [17] | [18] | 2 | [10] | 0 | [60] | [3] | 600 | [0] |

## Table 26 – Unit Wire/Fuse or HACR Breaker Sizing Data

| 48LC UNIT | NOM. V–Ph–Hz | IFM TYPE | NO C.O. or UNPWR C.O. | | | | | | | | w/ PWRD C.O. | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | NO P.E. | | | | w/ P.E. (pwrd fr/ unit) | | | | NO P.E. | | | | w/ P.E. (pwrd fr/ unit) | | | |
| | | | MCA | MAX FUSE or HACR BRKR | DISC. SIZE | | MCA | MAX FUSE or HACR BRKR | DISC. SIZE | | MCA | MAX FUSE or HACR BRKR | DISC. SIZE | | MCA | MAX FUSE or HACR BRKR | DISC. SIZE | |
| | | | | | FLA | LRA | | | FLA | LRA | | | FLA | LRA | | | FLA | LRA |
| 14 | 208/ 230–3–60 | STD | 59.1/58.3 | 80/80 | 61/60 | 343 | 70.9/70.1 | 90/90 | 75/74 | 363 | 63.9/63.1 | 80/80 | 67/66 | 348 | 75.7/74.9 | 90/90 | 80/79 | 368 |
| | | MED | 64.1/63.2 | 80/80 | 67/66 | 378 | 75.9/75.0 | 90/90 | 81/80 | 398 | 68.9/68.0 | 90/90 | 73/72 | 383 | 80.7/79.8 | 100/100 | 86/85 | 403 |
| | | HIGH | 71.7 | 90 | 76 | 382 | 83.5 | 100 | 89 | 402 | 76.5 | 90 | 81 | 387 | 88.3 | 100 | 95 | 407 |
| | | ULTRA | 79.7 | 100 | 84 | 456 | 91.5 | 100 | 97 | 476 | 84.5 | 100 | 89 | 461 | 96.3 | 110 | 103 | 481 |
| | 460–3–60 | STD | 31.3 | 40 | 33 | 167 | 37.5 | 45 | 40 | 179 | 33.5 | 40 | 35 | 169 | 39.7 | 50 | 42 | 181 |
| | | MED | 33.9 | 45 | 36 | 184 | 40.1 | 50 | 43 | 196 | 36.1 | 45 | 38 | 186 | 42.3 | 50 | 45 | 198 |
| | | HIGH | 37.2 | 45 | 40 | 186 | 43.4 | 50 | 47 | 198 | 39.4 | 50 | 42 | 188 | 45.6 | 50 | 49 | 200 |
| | | SUPER | 41.8 | 50 | 44 | 223 | 48.0 | 60 | 51 | 235 | 44.0 | 50 | 47 | 225 | 50.2 | 60 | 54 | 237 |
| | 575–3–60 | STD | 24.4 | 30 | 26 | 119 | 29.2 | 35 | 31 | 127 | 26.1 | 30 | 28 | 121 | 30.9 | 35 | 33 | 129 |
| | | MED | 26.1 | 30 | 28 | 133 | 30.9 | 35 | 33 | 141 | 27.8 | 30 | 30 | 135 | 32.6 | 40 | 35 | 143 |
| | | HIGH | 27.1 | 30 | 29 | 131 | 31.9 | 35 | 34 | 139 | 28.8 | 35 | 31 | 133 | 33.6 | 40 | 36 | 141 |
| | | ULTRA | 29.0 | 35 | 31 | 158 | 33.8 | 40 | 36 | 166 | 30.7 | 35 | 33 | 160 | 35.5 | 40 | 38 | 168 |
| 17 | 208/ 230–3–60 | STD | 67.4/66.6 | 90/90 | 70/69 | 371 | 79.2/78.4 | 100/100 | 83/82 | 391 | 72.2/71.4 | 90/90 | 75/74 | 376 | 84.0/83.2 | 100/100 | 89/88 | 396 |
| | | MED | 80.0 | 100 | 84 | 410 | 91.8 | 100 | 98 | 430 | 84.8 | 100 | 90 | 415 | 96.6 | 110 | 103 | 435 |
| | | HIGH | 86.9 | 100 | 92 | 484 | 98.7 | 125 | 105 | 504 | 91.7 | 100 | 97 | 489 | 103.5 | 125 | 111 | 509 |
| | | ULTRA | 98.5 | 125 | 103 | 524 | 110.3 | 125 | 116 | 544 | 103.3 | 125 | 108 | 529 | 115.1 | 150 | 122 | 549 |
| | 460–3–60 | STD | 34.8 | 45 | 36 | 193 | 41.0 | 50 | 43 | 205 | 37.0 | 45 | 39 | 195 | 43.2 | 50 | 46 | 207 |
| | | MED | 40.7 | 50 | 43 | 212 | 46.9 | 60 | 50 | 224 | 42.9 | 50 | 46 | 214 | 49.1 | 60 | 53 | 226 |
| | | HIGH | 44.9 | 50 | 48 | 249 | 51.1 | 60 | 55 | 261 | 47.1 | 60 | 50 | 251 | 53.3 | 60 | 57 | 263 |
| | | ULTRA | 48.9 | 60 | 51 | 269 | 55.1 | 60 | 59 | 281 | 51.1 | 60 | 54 | 271 | 57.3 | 70 | 61 | 283 |
| | 575–3–60 | STD | 30.0 | 40 | 32 | 154 | 34.8 | 40 | 37 | 162 | 31.7 | 40 | 33 | 156 | 36.5 | 45 | 39 | 164 |
| | | MED | 32.7 | 40 | 35 | 166 | 37.5 | 45 | 40 | 174 | 34.4 | 40 | 37 | 168 | 39.2 | 45 | 42 | 176 |
| | | HIGH | 34.4 | 40 | 37 | 193 | 39.2 | 45 | 42 | 201 | 36.1 | 45 | 39 | 195 | 40.9 | 50 | 44 | 203 |
| | | ULTRA | 38.7 | 50 | 41 | 204 | 43.5 | 50 | 46 | 212 | 40.4 | 50 | 43 | 206 | 45.2 | 50 | 48 | 214 |

See “Legend and Notes for Tables 26 and 27” on page 77.

## Table 26 - Unit Wire/Fuse or HACR Breaker Sizing Data (cont.)

| 48LC UNIT | NOM. V–Ph–Hz | IFM TYPE | NO C.O. or UNPWR C.O. | | | | | | | | w/ PWRD C.O. | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | NO P.E. | | | | w/ P.E. (pwrd fr/ unit) | | | | NO P.E. | | | | w/ P.E. (pwrd fr/ unit) | | | |
| | | | MCA | MAX FUSE or HACR BRKR | DISC. SIZE | | MCA | MAX FUSE or HACR BRKR | DISC. SIZE | | MCA | MAX FUSE or HACR BRKR | DISC. SIZE | | MCA | MAX FUSE or HACR BRKR | DISC. SIZE | |
| | | | | | FLA | LRA | | | FLA | LRA | | | FLA | LRA | | | FLA | LRA |
| 20 | 208/ 230–3–60 | STD | 73.3/72.5 | 100/100 | 76/75 | 412 | 85.1/84.3 | 100/100 | 90/89 | 432 | 78.1/77.3 | 100/100 | 82/81 | 417 | 89.9/89.1 | 100/100 | 95/95 | 437 |
| | | MED | 85.9 | 100 | 91 | 451 | 97.7 | 125 | 104 | 471 | 90.7 | 100 | 96 | 456 | 102.5 | 125 | 110 | 476 |
| | | HIGH | 92.8 | 100 | 99 | 525 | 104.6 | 125 | 112 | 545 | 97.6 | 125 | 104 | 530 | 109.4 | 125 | 118 | 550 |
| | | ULTRA | 104.4 | 125 | 109 | 565 | 116.2 | 150 | 123 | 585 | 109.2 | 125 | 115 | 570 | 121.0 | 150 | 128 | 590 |
| | 460–3–60 | STD | 37.2 | 50 | 39 | 231 | 43.4 | 50 | 46 | 243 | 39.4 | 50 | 42 | 233 | 45.6 | 50 | 49 | 245 |
| | | MED | 43.1 | 50 | 46 | 250 | 49.3 | 60 | 53 | 262 | 45.3 | 50 | 48 | 252 | 51.5 | 60 | 56 | 264 |
| | | HIGH | 47.3 | 60 | 50 | 287 | 53.5 | 60 | 58 | 299 | 49.5 | 60 | 53 | 289 | 55.7 | 60 | 60 | 301 |
| | | ULTRA | 51.3 | 60 | 54 | 307 | 57.5 | 70 | 61 | 319 | 53.5 | 60 | 57 | 309 | 59.7 | 70 | 64 | 321 |
| | 575–3–60 | STD | 31.8 | 40 | 34 | 182 | 36.6 | 45 | 39 | 190 | 33.5 | 40 | 36 | 184 | 38.3 | 45 | 41 | 192 |
| | | MED | 34.5 | 40 | 37 | 194 | 39.3 | 45 | 42 | 202 | 36.2 | 45 | 39 | 196 | 41.0 | 50 | 44 | 204 |
| | | HIGH | 36.2 | 45 | 39 | 221 | 41.0 | 50 | 44 | 229 | 37.9 | 45 | 41 | 223 | 42.7 | 50 | 46 | 231 |
| | | ULTRA | 40.5 | 50 | 43 | 232 | 45.3 | 50 | 48 | 240 | 42.2 | 50 | 45 | 234 | 47.0 | 60 | 50 | 242 |
| 24 | 208/ 230–3–60 | STD | 101.9 | 125 | 108 | 538 | 113.7 | 125 | 121 | 558 | 106.7 | 125 | 113 | 543 | 118.5 | 150 | 127 | 563 |
| | | MED | 108.7 | 125 | 115 | 612 | 120.5 | 150 | 129 | 632 | 113.5 | 125 | 121 | 617 | 125.3 | 150 | 135 | 637 |
| | | HIGH | 119.0 | 150 | 126 | 652 | 130.8 | 150 | 140 | 672 | 123.8 | 150 | 132 | 657 | 135.6 | 150 | 145 | 677 |
| | 460–3–60 | STD | 56.6 | 70 | 60 | 278 | 62.8 | 80 | 67 | 290 | 58.8 | 70 | 62 | 280 | 65.0 | 80 | 70 | 292 |
| | | MED | 60.6 | 70 | 65 | 315 | 66.8 | 80 | 72 | 327 | 62.8 | 80 | 67 | 317 | 69.0 | 80 | 74 | 329 |
| | | HIGH | 63.8 | 80 | 68 | 335 | 70.0 | 80 | 75 | 347 | 66.0 | 80 | 71 | 337 | 72.2 | 90 | 78 | 349 |
| | 575–3–60 | STD | 45.0 | 50 | 48 | 206 | 49.8 | 60 | 54 | 214 | 46.7 | 50 | 50 | 208 | 51.5 | 60 | 56 | 216 |
| | | MED | 46.7 | 50 | 50 | 233 | 51.5 | 60 | 56 | 241 | 48.4 | 60 | 52 | 235 | 53.2 | 60 | 58 | 243 |
| | | HIGH | 50.4 | 60 | 54 | 244 | 55.2 | 60 | 60 | 252 | 52.1 | 60 | 56 | 246 | 56.9 | 70 | 62 | 254 |
| 26 | 208/ 230–3–60 | STD | 124.9 | 175 | 129 | 629 | 136.7 | 175 | 142 | 649 | 129.7 | 175 | 134 | 634 | 141.5 | 175 | 148 | 654 |
| | | MED | 131.7 | 175 | 137 | 703 | 143.5 | 175 | 150 | 723 | 136.5 | 175 | 142 | 708 | 148.3 | 175 | 156 | 728 |
| | | HIGH | 141.0 | 175 | 147 | 743 | 152.8 | 200 | 161 | 763 | 145.8 | 175 | 153 | 748 | 157.6 | 200 | 167 | 768 |
| | 460–3–60 | STD | 64.9 | 80 | 68 | 322 | 71.1 | 90 | 75 | 334 | 67.1 | 90 | 70 | 324 | 73.3 | 90 | 78 | 336 |
| | | MED | 68.9 | 90 | 73 | 359 | 75.1 | 90 | 80 | 371 | 71.1 | 90 | 75 | 361 | 77.3 | 100 | 82 | 373 |
| | | HIGH | 72.1 | 90 | 76 | 379 | 78.3 | 100 | 83 | 391 | 74.3 | 90 | 79 | 381 | 80.5 | 100 | 86 | 393 |
| | 575–3–60 | STD | 53.9 | 60 | 56 | 235 | 58.7 | 70 | 62 | 243 | 55.6 | 70 | 58 | 237 | 60.4 | 80 | 64 | 245 |
| | | MED | 55.6 | 70 | 58 | 262 | 60.4 | 80 | 64 | 270 | 57.3 | 70 | 60 | 264 | 62.1 | 80 | 66 | 272 |
| | | HIGH | 59.3 | 70 | 62 | 273 | 64.1 | 80 | 68 | 281 | 61.0 | 80 | 64 | 275 | 65.8 | 80 | 70 | 283 |

See “Legend and Notes for Tables 26 and 27” on page 77.

## Table 27 – Unit Wire Sizing Data with Factory Installed HACR Breaker

| 48LC UNIT | NOM. V–Ph–Hz | IFM TYPE | NO C.O. or UNPWR C.O. | | | | | | | | w/ PWRD C.O. | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | NO P.E. | | | | w/ P.E. (pwrd fr/ unit) | | | | NO P.E. | | | | w/ P.E. (pwrd fr/ unit) | | | |
| | | | MCA | HACR BRKR | DISC. SIZE | | MCA | HACR BRKR | DISC. SIZE | | MCA | HACR BRKR | DISC. SIZE | | MCA | HACR BRKR | DISC. SIZE | |
| | | | | | FLA | LRA | | | FLA | LRA | | | FLA | LRA | | | FLA | LRA |
| 14 | 208/ 230–3–60 | STD | 59.1/59.1 | 80/80 | 61/60 | 343 | 70.9/70.9 | 90/90 | 75/74 | 363 | 63.9/63.9 | 80/80 | 67/66 | 348 | 75.7/75.7 | 90/90 | 80/79 | 368 |
| | | MED | 64.1/64.1 | 80/80 | 67/66 | 378 | 75.9/75.9 | 90/90 | 81/80 | 398 | 68.9/68.9 | 90/90 | 73/72 | 383 | 80.7/80.7 | 100/100 | 86/85 | 403 |
| | | HIGH | 71.7 | 90 | 76 | 382 | 83.5 | 100 | 89 | 402 | 76.5 | 90 | 81 | 387 | 88.3 | 100 | 95 | 407 |
| | | ULTRA | 79.7 | 100 | 84 | 456 | 91.5 | 100 | 97 | 476 | 84.5 | 100 | 89 | 461 | 96.3 | 110 | 103 | 481 |
| | 460–3–60 | STD | 31.3 | 40 | 33 | 167 | 37.5 | 45 | 40 | 179 | 33.5 | 40 | 35 | 169 | 39.7 | 50 | 42 | 181 |
| | | MED | 33.9 | 45 | 36 | 184 | 40.1 | 50 | 43 | 196 | 36.1 | 45 | 38 | 186 | 42.3 | 50 | 45 | 198 |
| | | HIGH | 37.2 | 45 | 40 | 186 | 43.4 | 50 | 47 | 198 | 39.4 | 50 | 42 | 188 | 45.6 | 50 | 49 | 200 |
| | | ULTRA | 41.8 | 50 | 44 | 223 | 48.0 | 60 | 51 | 235 | 44.0 | 50 | 47 | 225 | 50.2 | 60 | 54 | 237 |
| | 575–3–60 | STD | 24.4 | 30 | 26 | 119 | 29.2 | 35 | 31 | 127 | 26.1 | 30 | 28 | 121 | 30.9 | 35 | 33 | 129 |
| | | MED | 26.1 | 30 | 28 | 133 | 30.9 | 35 | 33 | 141 | 27.8 | 30 | 30 | 135 | 32.6 | 40 | 35 | 143 |
| | | HIGH | 27.1 | 30 | 29 | 131 | 31.9 | 35 | 34 | 139 | 28.8 | 35 | 31 | 133 | 33.6 | 40 | 36 | 141 |
| | | ULTRA | 29.0 | 35 | 31 | 158 | 33.8 | 40 | 36 | 166 | 30.7 | 35 | 33 | 160 | 35.5 | 40 | 38 | 168 |
| 17 | 208/ 230–3–60 | STD | 67.4/67.4 | 90/90 | 70/69 | 371 | 79.2/79.2 | 100/100 | 83/82 | 391 | 72.2/72.2 | 90/90 | 75/74 | 376 | 84.0/84.0 | 100/100 | 89/88 | 396 |
| | | MED | 80.0 | 100 | 84 | 410 | 91.8 | 100 | 98 | 430 | 84.8 | 100 | 90 | 415 | 96.6 | 110 | 103 | 435 |
| | | HIGH | 86.9 | 100 | 92 | 484 | 98.7 | 125 | 105 | 504 | 91.7 | 100 | 97 | 489 | 103.5 | 125 | 111 | 509 |
| | | ULTRA | 98.5 | 125 | 103 | 524 | 110.3 | 125 | 116 | 544 | 103.3 | 125 | 108 | 529 | 115.1 | 150 | 122 | 549 |
| | 460–3–60 | STD | 34.8 | 45 | 36 | 193 | 41.0 | 50 | 43 | 205 | 37.0 | 45 | 39 | 195 | 43.2 | 50 | 46 | 207 |
| | | MED | 40.7 | 50 | 43 | 212 | 46.9 | 60 | 50 | 224 | 42.9 | 50 | 46 | 214 | 49.1 | 60 | 53 | 226 |
| | | HIGH | 44.9 | 50 | 48 | 249 | 51.1 | 60 | 55 | 261 | 47.1 | 60 | 50 | 251 | 53.3 | 60 | 57 | 263 |
| | | ULTRA | 48.9 | 60 | 51 | 269 | 55.1 | 60 | 59 | 281 | 51.1 | 60 | 54 | 271 | 57.3 | 70 | 61 | 283 |
| | 575–3–60 | STD | 30.0 | 40 | 32 | 154 | 34.8 | 40 | 37 | 162 | 31.7 | 40 | 33 | 156 | 36.5 | 45 | 39 | 164 |
| | | MED | 32.7 | 40 | 35 | 166 | 37.5 | 45 | 40 | 174 | 34.4 | 40 | 37 | 168 | 39.2 | 45 | 42 | 176 |
| | | HIGH | 34.4 | 40 | 37 | 193 | 39.2 | 45 | 42 | 201 | 36.1 | 45 | 39 | 195 | 40.9 | 50 | 44 | 203 |
| | | ULTRA | 38.7 | 50 | 41 | 204 | 43.5 | 50 | 46 | 212 | 40.4 | 50 | 43 | 206 | 45.2 | 50 | 48 | 214 |

See “Legend and Notes for Tables 26 and 27” on page 77.

## Table 27 - Unit Wire Sizing Data with Factory Installed HACR Breaker (cont.)

| 48LC UNIT | NOM. V–Ph–Hz | IFM TYPE | NO C.O. or UNPWR C.O. | | | | | | | | w/ PWRD C.O. | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | NO P.E. | | | | w/ P.E. (pwrd fr/ unit) | | | | NO P.E. | | | | w/ P.E. (pwrd fr/ unit) | | | |
| | | | MCA | HACR BRKR | DISC. SIZE | | MCA | HACR BRKR | DISC. SIZE | | MCA | HACR BRKR | DISC. SIZE | | MCA | HACR BRKR | DISC. SIZE | |
| | | | | | FLA | LRA | | | FLA | LRA | | | FLA | LRA | | | FLA | LRA |
| 20 | 208/230–3–60 | STD | 73.3/73.3 | 100/100 | 76/75 | 412 | 85.1/85.1 | 100/100 | 90/89 | 432 | 78.1/78.1 | 100/100 | 82/81 | 417 | 89.9/89.9 | 100/100 | 95/95 | 437 |
| | | MED | 85.9 | 100 | 91 | 451 | 97.7 | 125 | 104 | 471 | 90.7 | 100 | 96 | 456 | 102.5 | 125 | 110 | 476 |
| | | HIGH | 92.8 | 100 | 99 | 525 | 104.6 | 125 | 112 | 545 | 97.6 | 125 | 104 | 530 | 109.4 | 125 | 118 | 550 |
| | | ULTRA | 104.4 | 125 | 109 | 565 | 116.2 | 150 | 123 | 585 | 109.2 | 125 | 115 | 570 | 121.0 | 150 | 128 | 590 |
| | 460–3–60 | STD | 37.2 | 50 | 39 | 231 | 43.4 | 50 | 46 | 243 | 39.4 | 50 | 42 | 233 | 45.6 | 50 | 49 | 245 |
| | | MED | 43.1 | 50 | 46 | 250 | 49.3 | 60 | 53 | 262 | 45.3 | 50 | 48 | 252 | 51.5 | 60 | 56 | 264 |
| | | HIGH | 47.3 | 60 | 50 | 287 | 53.5 | 60 | 58 | 299 | 49.5 | 60 | 53 | 289 | 55.7 | 60 | 60 | 301 |
| | | ULTRA | 51.3 | 60 | 54 | 307 | 57.5 | 70 | 61 | 319 | 53.5 | 60 | 57 | 309 | 59.7 | 70 | 64 | 321 |
| | 575–3–60 | STD | 31.8 | 40 | 34 | 182 | 36.6 | 45 | 39 | 190 | 33.5 | 40 | 36 | 184 | 38.3 | 45 | 41 | 192 |
| | | MED | 34.5 | 40 | 37 | 194 | 39.3 | 45 | 42 | 202 | 36.2 | 45 | 39 | 196 | 41.0 | 50 | 44 | 204 |
| | | HIGH | 36.2 | 45 | 39 | 221 | 41.0 | 50 | 44 | 229 | 37.9 | 45 | 41 | 223 | 42.7 | 50 | 46 | 231 |
| | | ULTRA | 40.5 | 50 | 43 | 232 | 45.3 | 50 | 48 | 240 | 42.2 | 50 | 45 | 234 | 47.0 | 60 | 50 | 242 |
| 24 | 208/230–3–60 | STD | 101.9 | 125 | 108 | 538 | 113.7 | 125 | 121 | 558 | 106.7 | 125 | 113 | 543 | 118.5 | 150 | 127 | 563 |
| | | MED | 108.7 | 125 | 115 | 612 | 120.5 | 150 | 129 | 632 | 113.5 | 125 | 121 | 617 | 125.3 | 150 | 135 | 637 |
| | | HIGH | 119.0 | 150 | 126 | 652 | 130.8 | 150 | 140 | 672 | 123.8 | 150 | 132 | 657 | 135.6 | 150 | 145 | 677 |
| | 460–3–60 | STD | 56.6 | 70 | 60 | 278 | 62.8 | 80 | 67 | 290 | 58.8 | 70 | 62 | 280 | 65.0 | 80 | 70 | 292 |
| | | MED | 60.6 | 70 | 65 | 315 | 66.8 | 80 | 72 | 327 | 62.8 | 80 | 67 | 317 | 69.0 | 80 | 74 | 329 |
| | | HIGH | 63.8 | 80 | 68 | 335 | 70.0 | 80 | 75 | 347 | 66.0 | 80 | 71 | 337 | 72.2 | 90 | 78 | 349 |
| | 575–3–60 | STD | 45.0 | 50 | 48 | 206 | 49.8 | 60 | 54 | 214 | 46.7 | 50 | 50 | 208 | 51.5 | 60 | 56 | 216 |
| | | MED | 46.7 | 50 | 50 | 233 | 51.5 | 60 | 56 | 241 | 48.4 | 60 | 52 | 235 | 53.2 | 60 | 58 | 243 |
| | | HIGH | 50.4 | 60 | 54 | 244 | 55.2 | 60 | 60 | 252 | 52.1 | 60 | 56 | 246 | 56.9 | 70 | 62 | 254 |
| 26 | 208/230–3–60 | STD | 124.9 | 175 | 129 | 629 | 136.7 | 175 | 142 | 649 | 129.7 | 175 | 134 | 634 | 141.5 | 175 | 148 | 654 |
| | | MED | 131.7 | 175 | 137 | 703 | 143.5 | 175 | 150 | 723 | 136.5 | 175 | 142 | 708 | 148.3 | 175 | 156 | 728 |
| | | HIGH | 141.0 | 175 | 147 | 743 | 152.8 | 200 | 161 | 763 | 145.8 | 175 | 153 | 748 | 157.6 | 200 | 167 | 768 |
| | 460–3–60 | STD | 64.9 | 80 | 68 | 322 | 71.1 | 90 | 75 | 334 | 67.1 | 90 | 70 | 324 | 73.3 | 90 | 78 | 336 |
| | | MED | 68.9 | 90 | 73 | 359 | 75.1 | 90 | 80 | 371 | 71.1 | 90 | 75 | 361 | 77.3 | 100 | 82 | 373 |
| | | HIGH | 72.1 | 90 | 76 | 379 | 78.3 | 100 | 83 | 391 | 74.3 | 90 | 79 | 381 | 80.5 | 100 | 86 | 393 |
| | 575–3–60 | STD | 53.9 | 60 | 56 | 235 | 58.7 | 70 | 62 | 243 | 55.6 | 70 | 58 | 237 | 60.4 | 80 | 64 | 245 |
| | | MED | 55.6 | 70 | 58 | 262 | 60.4 | 80 | 64 | 270 | 57.3 | 70 | 60 | 264 | 62.1 | 80 | 66 | 272 |
| | | HIGH | 59.3 | 70 | 62 | 273 | 64.1 | 80 | 68 | 281 | 61.0 | 80 | 64 | 275 | 65.8 | 80 | 70 | 283 |

See “Legend and Notes for Tables 26 and 27” on page 77.

## Legend and Notes for Tables 26 and 27

**LEGEND:**

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

**NOTES**:

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

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

Example: Supply voltage is 230-3-60


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

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

$$= 227$$

Determine maximum deviation from average voltage.
(AB) 227 – 224 = 3 v
(BC) 231 – 227 = 4 v
(AC) 227 – 226 = 1 v
Maximum deviation is 4 v.
Determine percent of voltage imbalance.

$$\% \text{ Voltage Imbalance} = 100 \times \frac{4}{227}$$

$$= 1.76\%$$

This amount of phase imbalance is satisfactory as it is below the maximum allowable 2%.
**IMPORTANT**: If the supply voltage phase imbalance is more than 2%, contact your local electric utility company immediately.

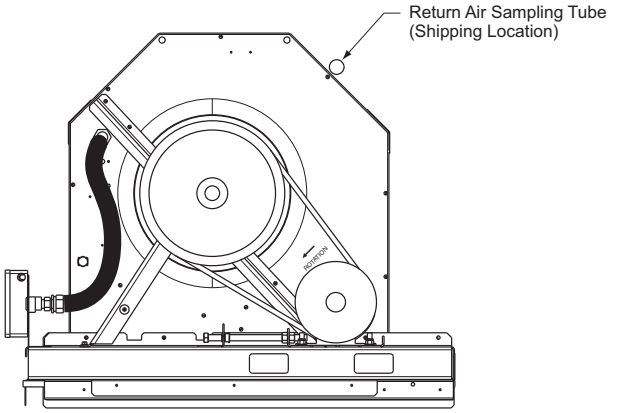
48LC

## Smoke Detectors

Smoke detectors are available as factory-installed options on 48LC 14-26 models. Smoke detectors may be specified for Supply Air only or for Return Air without or with economizer or in combination of Supply Air and Return Air. The unit is factory-configured for immediate smoke detector shutdown operation; additional wiring or modifications to unit's Integrated Staging Control (ISC) board may be necessary to complete the unit and smoke detector configuration to meet project requirements.

### Return Air Sensor Tube Installation –

The return air sampling tube is shipped in the unit s supply fan section, attached to the blower housing (see Fig. 61. Its operating location is in the return air section of the unit (see Fig. 62, unit without economizer, or Fig. 63, unit with economizer), inserted into the return air sensor module housing which protrudes through the back of the control box.

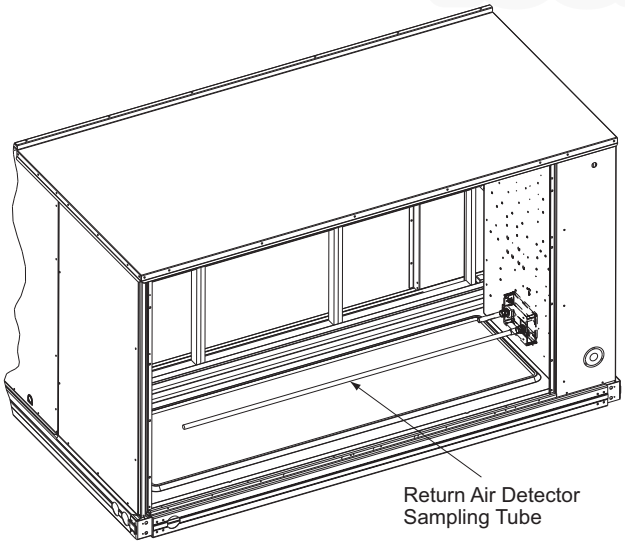



C09102

**Fig. 61 - Typical Supply Air Smoke Detector Sensor Location**

**To install the return air sensor sampling tube:**

1. Remove the tube from its shipping location.
2. Open the unit end to access the return air sensor (located on right-hand partition)
3. Orient the tube's sampling holes into the return air flow direction. For vertical application, position the sampling holes on the bottom of the tube, facing into the bottom return duct opening. For horizontal application, position the sampling holes on the side of the tube, facing the unit's end panel.
4. Insert the sampling tube into the return air sensor module until the tube snaps into position.
5. Replace end panel or outside air hood.




C09135

**Fig. 62 - Return Air Sampling Tube Location in Unit without Economizer**

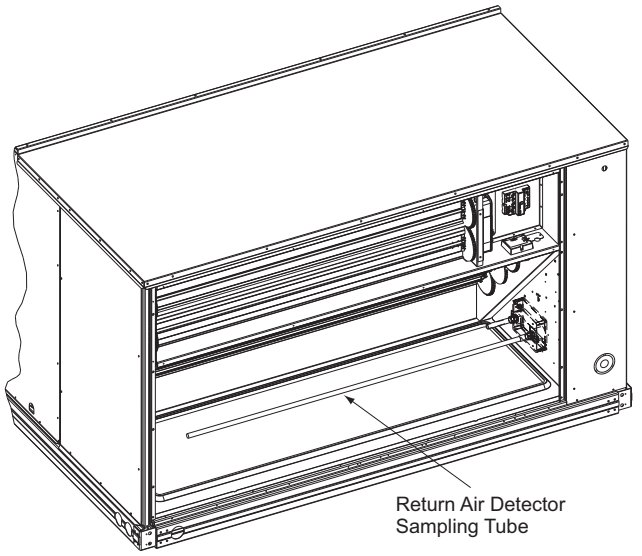



**Fig. 63 - Return Air Sampling Tube Location in Unit with Economizer**

**Smoke Detector Test Magnet —**

Locate the magnet; it is shipped in the control box area.

**Additional Application Data —**

Refer to Catalog No. HKRNKA-1XA for discussions on additional control features of these smoke detectors including multiple unit coordination.

## Step 13 — Install Accessories

Available accessories include:

Curb
Thru-base connection kit (must be installed before unit is set on curb)
EconoMi$er X (with control)
Power Exhaust
Outdoor enthalpy sensor
Differential enthalpy sensor
$CO_2$ sensor
Louvered hail guard
Phase monitor control

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

**Pre-Start and Start-Up**

This completes the mechanical installation of the unit. Refer to the unit's Service and Maintenance manual for detailed Pre-Start and Start-up instructions.




Edition Date: 04/14
Catalog No: 48LC–14–26–03SI
Manufacturer reserves the right to change, at any time, specifications and designs without notice and without obligations.
Replaces: 48LC–14–26–02SI

# UNIT START-UP CHECKLIST
**(Remove and Store in Job File)**

MODEL NO.: _____ SERIAL NO.: _____

## I. PRE-START-UP

☐ VERIFY THAT ALL PACKAGING MATERIALS HAVE BEEN REMOVED FROM UNIT

☐ VERIFY INSTALLATION OF OUTDOOR AIR HOOD

☐ VERIFY INSTALLATION OF FLUE EXHAUST AND INLET HOOD

☐ VERIFY THAT CONDENSATE CONNECTION IS INSTALLED PER INSTRUCTIONS

☐ VERIFY THAT ALL ELECTRICAL CONNECTIONS AND TERMINALS ARE TIGHT

☐ VERIFY GAS PRESSURE TO UNIT GAS VALVE IS WITHIN SPECIFIED RANGE

☐ CHECK GAS PIPING FOR LEAKS

☐ CHECK THAT INDOOR-AIR FILTERS ARE CLEAN AND IN PLACE

☐ CHECK THAT OUTDOOR AIR INLET SCREENS ARE IN PLACE

☐ VERIFY THAT UNIT IS LEVEL

☐ CHECK FAN WHEELS AND PROPELLER FOR LOCATION IN HOUSING/ORIFICE AND VERIFY SETSCREW IS TIGHT

☐ VERIFY THAT FAN SHEAVES ARE ALIGNED AND BELTS ARE PROPERLY TENSIONED

☐ VERIFY THAT SCROLL COMPRESSORS ARE ROTATING IN THE CORRRECT DIRECTION

☐ VERIFY INSTALLATION OF THERMOSTAT

☐ VERIFY THAT CRAKCASE HEATERS HAVE BENN ENERGIZED FOR AT LEAST 24 HOURS

## II. START-UP

### ELECTRICAL

| | | | | | |
|---|---|---|---|---|---|
| SUPPLY VOLTAGE | L1-L2 | _____ | L2-L3 | _____ | L3-L1 _____ |
| 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

### PRESSURES

| | | | |
|---|---|---|---|
| GAS INLET PRESSURE | | _____ | IN. WG |
| GAS MANIFOLD PRESSURE | STAGE 1 | _____ | IN. WG |
| | STAGE 2 | _____ | IN. WG |
| REFRIGERANT SUCTION | CIRCUIT A | _____ | PSIG |
| | CIRCUIT B | _____ | PSIG |
| REFRIGERANT DISCHARGE | CIRCUIT A | _____ | PSIG |
| | CIRCUIT B | _____ | PSIG |

☐ VERIFY REFRIGERANT CHARGE USING CHARGING CHARTS

### GENERAL

☐ ECONOMIZER MINIMUM VENT AND CHANGEOVER SETTINGS TO JOB REQUIREMENTS (IF EQUIPPED)

☐ VERIFY SMOKE DETECTOR UNIT SHUTDOWN BY UTILIZING MAGNET TEST

## III. HUMIDIMIZER START-UP

**STEPS**

☐ 1. OPEN HUMIDISTAT CONTACTS

☐ 2. START UNIT IN COOLING (CLOSE Y1)

**OBSERVE AND RECORD**

| | | |
|---|---|---|
| A. SUCTION PRESSURE | _____PSIG | _____PSIG |
| B. DISCHARGE PRESSURE | _____PSIG | _____PSIG |
| C. ENTERING AIR TEMPERATURE | _____°F | _____°F |
| D. LIQUID LINE TEMPERATURE AT OUTLET OR REHEAT COIL | _____°F | _____°F |

E. CONFRIM CORRECT ROTATION FOR COMPRESSOR

F. CHECK FOR CORRECT RAMP-UP OF OJUTDOOR FAN MOTOR AS CONDENSER COIL WARMS

☐ 3. CHECK UNIT CHARGE PER CHARGING CHART

☐ 4. .SWITCH UNIT TO HIGH-LATENT MODE (SUBCOOLER) BY CLOSING HUMIDISTAT WITH Y1 CLOSED

**OBSERVE**

☐ A. REDUCTION IN SUCTION PRESSURE (5 TO 7 PSI EXPECTED)

☐ B. DISCHARGE PRESSURE UNCHANGED

☐ C. LIQUID TEMPERATURE DROPS TO 50 TO 55°F RANGE

☐ D. LSV SOLENOID ENGERIZED (VALVE CLOSES)

☐ 5. .SWITCH UNIT TO DEHUMID (REHEAT) BY OPENING Y1

**OBSERVE**

☐ A. SUCTION PRESSURE INCREASES TO NORMAL COOLING LEVEL

☐ B. DISCHARGE PRESSURE DECREASES (35 TO 50 PSI)

☐ C. LIQUID TEMPERATURE RETURNS TO NORMAL COOLNG LEVEL

☐ D. LSV SOLENOID ENERGIZED (VALVE CLOSES)

☐ E. DSV SOLENOID ENERGIZED, VALVE OPENS

☐ 6. WITH UNIT IN DEHUMID MODE CLOSE W1
COMPRESSOR AND OUTDOOR FAN STOP; LSV AND DSV SOLENOIDS DE-ENERGIZED

☐ 7. .OPEN W1 RESTORE UNIT TO DEHUMID MODE

☐ 8. .OPEN HUMIDISTAT INPUT
COMPRESSOR AND OUTDOOR FAN STOP; LSV AND DSV SOLENOIDS DE-ENERGIZED

☐ 9. .RESTORE SETPOINTS FOR THERMOSTAT AND HUMIDISTAT

**REPEAT PROCESS FOR 2 COMPRESSOR SYSTEMS**