

# INSTALLATION INSTRUCTIONS

## R-410A Variable Speed Split System Heat Pumps

### CVH8, HVH8, TVH8

**These instructions must be read and understood completely before attempting installation.**

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**IMPORTANT:** Effective January 1, 2015, all split system and packaged air conditioners must be installed pursuant to applicable regional efficiency standards issued by the Department of Energy.


Information in these installation instructions pertains only to CVH8, HVH8, TVH8 series units.


#### SAFETY CONSIDERATIONS

Improper installation, adjustment, alteration, service, maintenance, or use can cause explosion, fire, electrical shock, or other conditions which may cause death, 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, protective clothing, and work gloves. Use quenching cloth for brazing operations. Have fire extinguisher available. Read these instructions thoroughly and follow all warnings or cautions included in literature and attached to the unit. Consult local building codes and current editions of the National Electrical Code (NEC) NFPA 70.

In Canada, refer to current editions of the Canadian electrical code CSA 22.1.


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 these signal words; DANGER, WARNING, and CAUTION. 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 **would** 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.

 **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 and gloves when handling parts.

 **WARNING**

**UNIT OPERATION AND SAFETY HAZARD**

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

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

 **WARNING**

**ELECTRICAL SHOCK HAZARD**

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

Before installing, modifying, or servicing system, main electrical disconnect switch must be in the OFF position. There may be more than 1 disconnect switch. Lock out and tag switch with a suitable warning label.

### Indoor Thermostat Control Options

Model	Observer® Wall Control	Standard HP Thermostat
CVH8, HVH8, TVH8	Yes*	Yes**

**NOTE:** TSTAT0201CW Communicating Wi- Fi® wall control. Non Wi- Fi® cannot be used.

All trademarks are the property of their respective owners. Wi- Fi® is a registered trademark of Wi- Fi Alliance Corporation.

\* Version 5.0 software or newer required.

\*\* Using standard HP thermostat limits functionality of system.

## ⚠ WARNING

### ELECTRICAL HAZARD - HIGH VOLTAGE!

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

Electrical components may hold charge. DO NOT remove control box cover for 2 minutes after power has been removed from unit.

#### PRIOR TO TOUCHING ELECTRICAL COMPONENTS:

Verify zero (0) voltage at inverter connections shown on inverter cover.

## ⚠ WARNING



### EXPLOSION HAZARD

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

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

### Inverter Cover

**IMPORTANT:** The inverter cover should NEVER be removed because there is no reason to remove the inverter cover to access the inverter. The inverter has limited serviceability. Refer to Service Manual for details on field replaceable parts. A replacement cover is provided with a replacement inverter.

## INSTALLATION RECOMMENDATIONS

In some cases noise in the living area has been traced to gas pulsations from improper installation of equipment.

1. Locate unit away from windows, patios, decks, etc. where unit operation sound may disturb customer.
2. In noise sensitive applications (such as bedrooms), when a lineset is mounted to ceiling joists or floor joists, the outdoor unit must be located at least 10 ft (3.05 m) away. If this is not possible, create a line set configuration with enough bends to provide 10 ft (3.05 m) of total line set length outside the dwelling
3. Ensure that vapor and liquid tube diameters are appropriate for unit capacity.
4. Run refrigerant tubes as directly as possible by avoiding unnecessary turns and bends.
5. Leave some slack between structure and unit to absorb vibration.
6. When passing refrigerant tubes through the wall, seal opening with RTV or other pliable silicon-based caulk (see Fig. 1).
7. Avoid direct tubing contact with water pipes, duct work, floor joists, wall studs, floors, and walls.

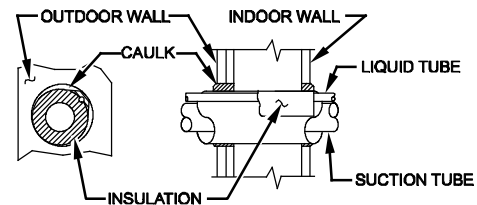
8. Do not suspend refrigerant tubing from joists and studs with a rigid wire or strap which comes in direct contact with tubing (see Fig. 1).
9. Ensure that tubing insulation is pliable and completely surrounds vapor tube.
10. When necessary, use hanger straps which are 1 in. wide and conform to shape of tubing insulation. (See Fig. 1.)
11. Isolate hanger straps from insulation by using metal sleeves bent to conform to shape of insulation.
12. If these installation recommendations were not followed, gas pulsation may be transmitted through improperly mounted line sets. In this case, an external vapor line muffler accessory (part no. 1187979) is available to minimize noise due to gas pulsations.

## ⚠ CAUTION

### EQUIPMENT DAMAGE HAZARD

Failure to follow this caution may result in equipment damage.

If proper lineset routing techniques are not followed, variable speed systems can be susceptible to lineset transmitted noise inside the dwelling and, in extreme cases, tubing breakage.



THROUGH THE WALL

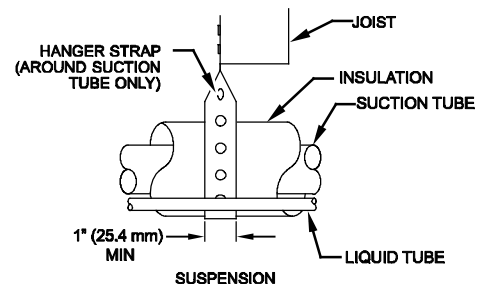


Fig. 1 - Connecting Tubing Installation

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The outdoor unit contains the correct amount of refrigerant charge for operation with AHRI rated indoor units when connected by 15 ft. (4.57 m) of field-supplied or factory accessory tubing.

See Step 12. on page 8 for proper charging procedure.

**IMPORTANT:** Liquid-line size is 3/8-in. OD for all CVH8, HVH8, TVH8 applications. The maximum allowable equivalent line set length is 100 ft. (30.5 m).

**IMPORTANT:** Always install the factory-supplied liquid-line filter drier. Obtain replacement filter driers from your distributor or branch.

## INSTALLATION

Specifications for this unit in residential new construction market require the outdoor unit, indoor unit (including metering device), refrigerant tubing sets, and filter drier listed in pre-sale literature. There can be no deviation. Consult the Service Manual – Air Conditioners and Heat Pumps Using R-410A Refrigerant to obtain required unit changes for specific applications and for R-22 retrofit.

## Step 1 — Check Equipment and Job Site

### Unpack Unit

Move to final location. Remove carton taking care not to damage unit.

### Inspect Equipment

File claim with shipping company prior to installation if shipment is damaged or incomplete. Locate unit rating plate on unit corner panel. It contains information needed to properly install unit. Check rating plate to be sure unit matches job specifications.

## Step 2 — Install on a Solid, Level Mounting Pad

If conditions or local codes require the unit be attached to pad, tie down bolts should be used and fastened through knockouts provided in unit base pan. Refer to unit mounting pattern in Fig. 2 to determine base pan size and knockout hole location.

For hurricane tie downs, contact distributor for details and PE (Professional Engineer) Certification, if required.

On rooftop applications, mount on level platform or frame. Place unit above a load-bearing wall and isolate unit and tubing set from structure. Arrange supporting members to adequately support unit and minimize transmission of vibration to building. Consult local codes governing rooftop applications.

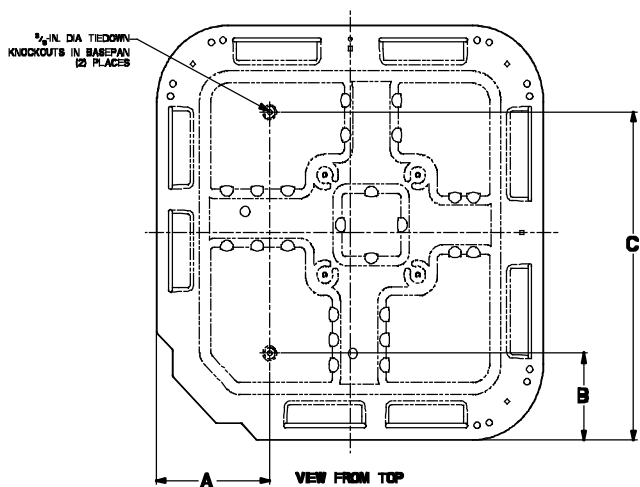
Roof mounted units exposed to winds above 5 mph may require wind baffles. Consult the Service Manual - Residential Split System Air Conditioners and Heat Pumps Using R-410A Refrigerant for wind baffle construction.

**NOTE:** Unit must be level to within  $\pm 2^\circ$  ( $\pm 3/8$  in./ft.,  $\pm 9.5$  mm/m.) per compressor manufacturer specifications.

## Step 3 — Clearance Requirements

When installing, allow sufficient space for airflow clearance, wiring, refrigerant piping, and service. Allow 24 in. (609.6 mm) clearance to service end of unit and 48 in. (1219.2 mm) (above unit). For proper airflow, a 6-in. (152.4 mm) clearance on 1 side of unit and 12-in. (304.8 mm) on all remaining sides must be maintained. Maintain a distance of 24 in. (609.6 mm) between units. Position so water, snow, or ice from roof or eaves cannot fall directly on unit.

On rooftop applications, locate unit at least 6 in. (152.4 mm) above roof surface.



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UNIT BASE PAN Dimension in. (mm)	TIEDOWN KNOCKOUT LOCATIONS in. (mm)		
	A	B	C
23 X 23 (596 X 596)	7- 13/16 (198)	4- 7/16 (102)	18- 1/8 (458)
31.2 X 31.2 (792 X 792)	9- 1/8 (232)	6- 9/16 (167)	24- 11/16 (627)

Fig. 2 - Tie-down Knockout Locations

## Step 4 — Operating Ambient

The minimum outdoor operating ambient in cooling mode is 40°F (4.4°C) with Observer® Wall Control, 55°F (12.8°C) with non-communicating systems. The maximum outdoor operating ambient in cooling mode is 115°F (46.1°C). Compressor protections will prevent cooling mode operation below minimum ambient temperature range. The system may operate in cooling up to 125°F (52°C) with significant reduced capacity cutback above 115°F (46.1°C). Refer to Product Data “Detailed Cooling Capacity” table. Low ambient cooling operation is not currently available. The maximum heating operation ambient is 66°F (18.9°C). Compressor protections will prevent starting below 10°F (-12.2°C) and operation below 2°F (-16.7°C).

## Step 5 — Elevate Unit

Elevate unit per local climate and code requirements to provide clearance above estimated snowfall level and ensure adequate drainage of unit.



## CAUTION

### UNIT OPERATION HAZARD

Failure to follow this caution may result in equipment damage or improper operation.

Do not allow water and/or ice to build up in base pan.



## CAUTION

### UNIT OPERATION HAZARD

Failure to follow this caution may result in equipment damage or improper operation.

Locate the unit in such a way that it is stable in all circumstances including adverse weather conditions.

## Step 6 — Make Piping Connections



## WARNING

### PERSONAL INJURY AND UNIT DAMAGE HAZARD

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

Relieve pressure and recover all refrigerant before system repair or final unit disposal. Use all service ports and open all flow-control devices, including solenoid valves.



## CAUTION

### UNIT DAMAGE HAZARD

Failure to follow this caution may result in equipment damage or improper operation.

Do not leave system open to atmosphere any longer than minimum required for installation. POE oil in compressor is extremely susceptible to moisture absorption. Always keep ends of tubing sealed during installation.



## CAUTION

### UNIT DAMAGE HAZARD

Failure to follow this caution may result in equipment damage or improper operation.

If ANY refrigerant tubing is buried, provide a 6 in. (152.4 mm) vertical rise at service valve. Refrigerant tubing lengths up to 36 in. (914.4 mm) may be buried without further special consideration. Do not bury lines longer than 36 in. (914.4 mm).

Outdoor units may be connected to indoor section using accessory tubing package or field-supplied refrigerant grade tubing of correct size and condition. For tubing requirements between 80 - 100 ft. (24.38 - 30.48 m), capacity and performance losses can occur. Follow the pipe sizing recommendations in the CVH8, HVH8, TVH8 Product data to manage these losses. This unit shall not be

installed with greater than 100 ft (30.48 m) of equivalent line length.

Refer to Table 1 for field tubing diameters. No additional accessories are required for line lengths between 80 - 100 ft. (24.4 - 30.5 m) on this product.

**Table 1 – Refrigerant Connections and Recommended Liquid and Vapor Tube Diameters (in.)**

UNIT SIZE	LIQUID		VAPOR†		
	Connection Diameter	Tube Diameter	Connection Diameter	Max (Rated) Diameter	Minimum Tube Diameter
24	3/8	3/8	3/4	3/4	5/8
25	3/8	3/8	3/4	7/8	5/8
36	3/8	3/8	3/4	7/8	5/8
37	3/8	3/8	7/8	(1- 1/8)	5/8
48	3/8	3/8	7/8	(1- 1/8)	3/4
60	3/8	3/8	7/8	(1- 1/8)	3/4

† Units are rated with 25 ft. (7.6 m) of lineset. See Product Data sheet for performance data when using different size and length line sets.

**Notes:**

1. Do not apply capillary tube indoor coils to these units.

**Outdoor Unit Connected to Factory-Approved Indoor Unit**

Outdoor unit contains correct system refrigerant charge for operation with factory-approved, AHRI-rated indoor units when connected by 15 ft. (4.57 m) of field-supplied or factory-accessory tubing, and factory-supplied filter drier. Check refrigerant charge for maximum efficiency.

**NOTE:** If the indoor furnace coil width is more than the furnace casing width, refer to the indoor coil Installation Instructions for transition requirements.

**Install Liquid-Line Filter Drier Indoor**

Refer to Fig. 3 and install filter drier as follows:

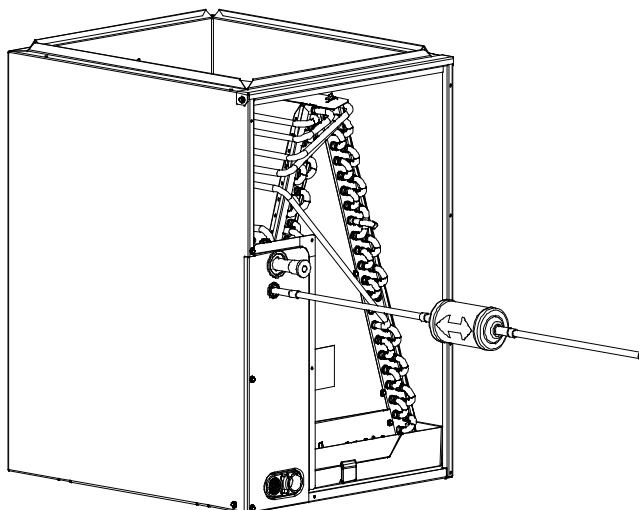
1. Braze 5-in. (127 mm) liquid tube to the indoor coil.
2. Wrap filter drier with damp cloth.
3. Braze filter drier to above 5-in. (127 mm) liquid tube.
4. Connect and braze liquid refrigerant tube to the filter drier.

**CAUTION**

**UNIT DAMAGE HAZARD**

Failure to follow this caution may result in unit damage or improper operation.

Installation of filter drier in liquid line is required.



**Fig. 3 - Liquid-Line Filter Drier**

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**Refrigerant Tubing connection Outdoor**

Connect vapor tube to fitting on outdoor unit vapor service valves (see Table 1).

**No Installation of Adapter Tube**

Although it is a heat pump this unit has a standard AC liquid service valve. An electronic expansion valve (EXV) inside the unit serves as the heating expansion device.

**Sweat Connections**

**CAUTION**

**UNIT DAMAGE HAZARD**

Failure to follow this caution may result in equipment damage or improper operation.

- Use a brazing shield
- Wrap service valves with wet cloth or heat sink material.

Use refrigerant grade tubing. Service valves are closed from factory and ready for brazing. After wrapping service valve with a wet cloth, braze sweat connections using industry accepted methods and materials. Consult local code requirements. Refrigerant tubing and indoor coil are now ready for leak testing. This check should include all field and factory joints.

**Evacuate Refrigerant Tubing and Indoor Coil**

**CAUTION**

**UNIT DAMAGE HAZARD**

Failure to follow this caution may result in equipment damage or improper operation.

Never use the system compressor as a vacuum pump.

Refrigerant tubes and indoor coil should be evacuated using the recommended deep vacuum method of 500 microns. The alternate triple evacuation method may be used. See Service Manual for triple evacuation method. Always break a vacuum with dry nitrogen prior to opening the refrigerant system for servicing.

**Deep Vacuum Method**

The deep vacuum method requires a vacuum pump capable of pulling a vacuum of 500 microns and a vacuum gauge capable of accurately measuring this vacuum depth. The deep vacuum method is the most positive way of assuring a system is free of air and liquid water. (See Fig. 4)

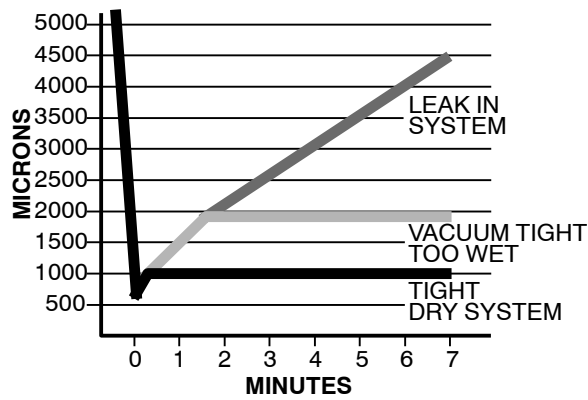


Fig. 4 - Deep Vacuum Graph

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### Final Tubing Check

**IMPORTANT:** Check to be certain factory tubing on both indoor and outdoor unit has not shifted during shipment. Ensure tubes are not rubbing against each other or any sheet metal. Pay close attention to feeder tubes, making sure wire ties on feeder tubes are secure and tight.

### Step 7 — Make Electrical Connections

⚠ WARNING

ELECTRICAL SHOCK HAZARD

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

Do not supply power to unit with compressor terminal box cover removed.

Be sure field wiring complies with local and national fire, safety, and electrical codes, and voltage to system is within limits shown on unit rating plate. Contact local power company for correction of improper voltage. See unit rating plate for recommended circuit protection device.

**NOTE:** Operation of unit on improper line voltage constitutes abuse and could affect unit reliability. See unit rating plate. Do not install unit in system where voltage may fluctuate above or below permissible limits.

**NOTE:** Use copper wire only between disconnect switch and unit.

**NOTE:** Install branch circuit disconnect of adequate size per NEC to handle unit starting current. Locate disconnect within sight from and readily accessible from unit, per Section 440-14 of NEC.

### Route Ground and Power Wires

Remove access panel to gain access to unit wiring. Extend wires from disconnect through power wiring hole provided and into unit control box.

⚠ WARNING

ELECTRICAL SHOCK HAZARD

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

The unit cabinet must have an uninterrupted or unbroken ground to minimize personal injury if an electrical fault should occur. The ground may consist of electrical wire or metal conduit when installed in accordance with existing electrical codes.

### Connect Ground and Power Wires

Connect ground wire to ground connection in control box for safety. Connect power wiring to contactor as shown in Fig. 5.

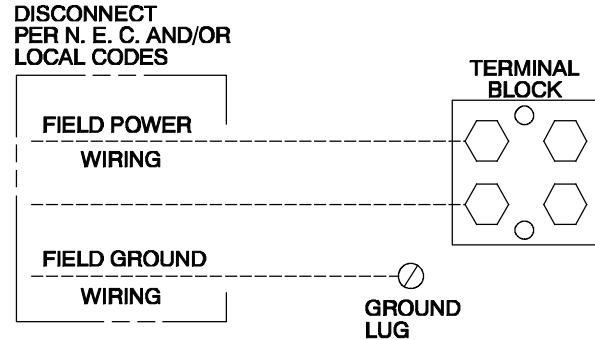


Fig. 5 - Line Power Connections

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### Connect Control Wiring- Observer® Wall

Connect to Observer connections. Only two wires DX+, DX- (GN, YL) to Observer capable indoor unit (furnace or fan coil) are required. Connect C if additional grounding required (see Fig. 6).

**IMPORTANT:** This system requires the power supplied to the outdoor unit, and the indoor unit, for the Wall Control to communicate with the outdoor unit.

### Connect Control Wiring- Non-Communicating

Six wires are required when connecting CVH8, HVH8, TVH8 models to non-communicating 2-stage thermostats. Use Fig. 7 For required connections. Unit is configured by factory for Observer communicating control. To wire unit for non-communicating control, disconnect the green (DX+) and yellow (DX-) wires from green plug and connect appropriate wires to low voltage terminal block. Use wire nuts to attach thermostat wire to low voltage choke harness (LVCH).

### General Information

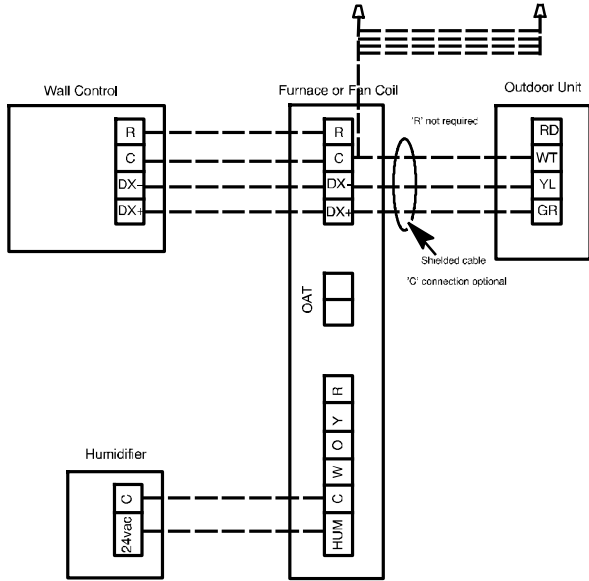
Use No. 18 AWG or larger color-coded, insulated (35°C minimum) wire for low voltage control wires.

All wiring must be NEC Class 2 and must be separated from incoming power leads.

Use furnace transformer, fan coil transformer, or accessory transformer for control power requirement of system accessories external to the OD unit. The outdoor unit has its own transformer power.

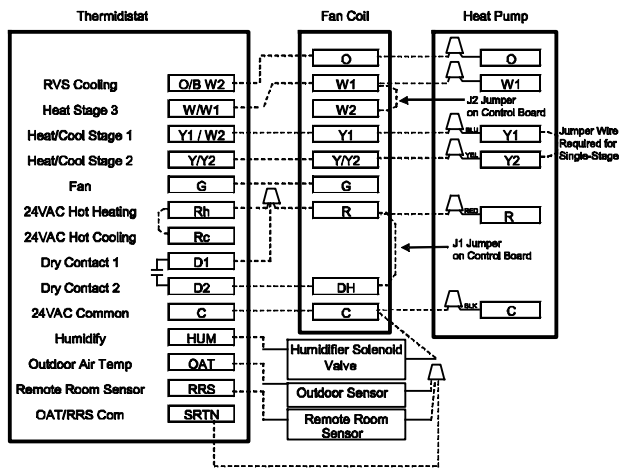
## Final Wiring Check

**IMPORTANT:** Check factory wiring and field wire connections to ensure terminations are secured properly. Check wire routing to ensure wires are not in contact with tubing, sheet metal, etc.

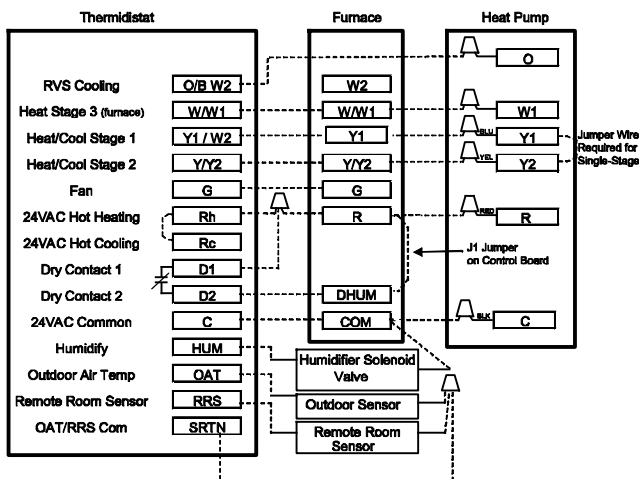


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**Fig. 6 - Communicating Furnace or Fan Coil Wiring with Communicating Variable Speed HP**



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**Fig. 7 - Low Voltage Wiring (Non-Communicating)**

## Step 8 — Compressor Crankcase Heater

**This compressor has an internal crankcase heater. Furnish power to the unit a minimum of 24 hr before starting the unit for the first time.**

Upon initial start-up of unit, status code 68 will be generated and system will operate at stage 2 for 11 minutes. This operation is important to system reliability and cannot be bypassed. Each time high voltage is removed and reapplied this behavior will be repeated.

To furnish power to heater only, set thermostat to OFF and close electrical disconnect to outdoor unit.

Power is not required to the indoor unit or Wall Control for proper operation of heater. Crankcase heater will be intelligently energized as needed between operations, even when the Wall Control or thermostat and indoor unit is not installed, as long as there is power to the outdoor unit.

## Airflow Setup for Observer® Wall Control Furnace or FCM4X Fan Coil (communicating)

This system can only be installed with communicating indoor and Observer Wall Control TSTAT0201CW with Version 5.0 or higher software or newer. When using an Observer Wall Control, airflow is automatically selected based on equipment size. The user has the option of selecting Comfort, Efficiency and Max airflow for Heating and/or Cooling modes. These should be selected based on balance between the homeowner's comfort and energy consumption expectations. See Observer Wall Control Installation Instructions for additional available adjustments.

Due to using a communicating control with the fan coil or the furnace, dip switch adjustments are not necessary. The outdoor unit configuration and the indoor airflows are determined by communicating control setup.

## Airflow Setup for Non-communicating Fan Coil

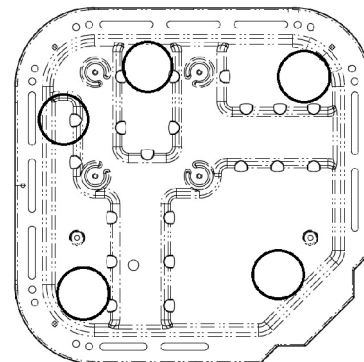
The system can be installed with a standard 2-stage heat pump thermostat and FVM4X fan coil without additional accessories. Select appropriate unit size on fan coil Easy select board.

## Airflow Setup for Non-communicating Furnaces

For installations with non-communicating furnaces, set airflows to 350-400 cfm/nominal ton in high stage and 70-80 percent of high stage airflow in low stage.

## Step 9 — Install Accessories

No refrigeration circuit accessories are required or are available for installation within the unit. External to the unit, the same accessories such as support feet, wind baffle etc., available on other units, can also be used on this line of product. For models utilizing 23 inch x 23 inch base pans, it is recommended to use 5 support feet in order to fully support unit. See Fig. 8. Refer to the individual Installation Instructions packaged with kits or accessories when installing.



**Fig. 8 - Recommended Support Feet Location (for 23" x 23" basepan)**

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## Step 10 — Start-Up



### CAUTION

#### UNIT OPERATION AND SAFETY HAZARD

Failure to follow this caution may result in minor personal injury, equipment damage or improper operation.

Observe the following:

1. Do not overcharge system with refrigerant.
2. Do not operate unit in a vacuum or at negative pressure.
3. Do not disable low pressure transducer or system safety devices such as discharge thermistor or the high pressure switch.
4. Dome temperatures may be hot.
5. Discharge thermistor is engaged tight on the discharge tube.



### CAUTION

#### PERSONAL INJURY HAZARD

Failure to follow this caution may result in personal injury.

Wear safety glasses, protective clothing, and gloves when handling refrigerant.



### CAUTION

#### ENVIRONMENTAL HAZARD

Failure to follow this caution may result in environmental damage.

Federal regulations require that you do not vent refrigerant to the atmosphere. Recover during system repair or final unit disposal.

## Step 11 — System Functions and Sequence of Operation

The CVH8, HVH8, TVH8 models utilize either Observer® Wall Control or conventional HP thermostat. When using Wall Control controls, a call for cooling will energize the outdoor fan and compressor to run at lowest cooling demand. If this does not satisfy cooling demand, the system will ramp up in stages until it satisfies the demand. After coping with the higher demand, the unit returns to lower capacity operation until the demand is satisfied or until an increase in demand. When using a conventional thermostat, the thermostat controls the staging of outdoor unit.

Upon initial start-up (or any power cycle) of the unit there will be a 5-minute delay before the unit will start, once a call for heating or cooling is given. The compressor will then ramp to stage 2 and operate there for one minute. When the one-minute time has elapsed, status code 68 will be generated and the system will continue to operate at stage 2 for 10 minutes. This operation is important to system reliability and cannot be bypassed. Each time high voltage is removed and reapplied, this behavior will be repeated.

When the 10 minutes has elapsed, the unit will ramp to the called-for stage. It will take approximately three additional minutes to get to high-stage compressor RPM.

When all demand is satisfied, the compressor will shut off. As the unit operates at lower capacity, system vapor (suction) pressure will be higher than it is during a standard single-stage system operation or during a higher capacity operation.

The Observer Wall Control displays the operation mode and fault codes as specified in the troubleshooting section. See Table 6 for codes and definitions.

The conventional thermostat inputs are designed to work with most indoor units. See AHRI for approved combinations. Connections are Y/Y2, Y1, O, R, W, and C. Depending on thermostat and indoor unit, the system will operate at 1 or 2 capacities in heating or cooling mode.

**NOTE:** Only one code will be displayed on the outdoor unit control board (the most recent, with the highest priority). The latest codes are stored and can be accessed via the Observer Wall Control.

Upon a call for cooling through the Observer Wall Control (or the Y1 and/or Y2 connections in a non-communicating system), the Application Operation Control (AOC) board (see Fig. 22) will open the EXV to the fully open position. For heating, the AOC board will open the EXV to a preset position, depending upon the conditions. Based upon the indoor space demand and the outdoor conditions, the Observer Wall Control will then request a compressor speed and outdoor fan motor speed.

If the conditions are correct for operation, the control board will allow the requested operation to begin, but if the control board determines that the conditions are not correct, the board will decide what other operation nearing that condition is acceptable. The inverter Motor Operational Control (MOC) then outputs the three-phase PWM signal and frequency that gently ramps the compressor speed up to stage 2, and then will adjust to the demanded speed. The gentle ramp-up results in no locked rotor amps to the compressor motor. The unit 0 for compressor LRA will be stamped N/A (not applicable).

During operation, the AOC monitors itself and the compressor operation along with the system pressures and temperatures. The MOC board monitors the temperature, current and operational status of the compressor, OD fan and the inverter itself. During operation, the compressor speed will be adjusted to meet the changes to the demand.

When the demand is satisfied, the inverter will ramp-down the compressor speed and stop. The EXV will step down to the completely closed position.

When the compressor stops, a 3.5 minute Time Guard period is activated which is followed by opening of the PEV valve for 150 seconds to equalize the refrigerant pressure difference between the high and low sides of the compressor. Upon equalizing the refrigerant pressure, and an additional 15 seconds of the Time Guard period, the compressor will be ready for the next operational demand.

If there is a power cycle, the Pressure Equalizer Valve (PEV) will open for 150 seconds before the compressor start-up. Opening the PEV valve returns the discharge gas directly back to the suction side of the compressor. This is done in either cooling or heating mode so that the rotary compressor will start with a very low pressure differential.

The 3.5 minute Time Guard can be bypassed by momentarily shorting the Forced Defrost pins. Only the 3.5 minute time delay can be bypassed. Because it is important for compressor reliability, the 150-second PEV delay cannot be bypassed.

### Crankcase Heater Operation

This unit has an internal crankcase heater that will be energized during the off cycle and is intelligently demanded by the system to prevent the compressor from being the coldest part of the system thus enhancing the reliability. The crankcase heater will function as needed any time the outdoor unit is powered. The indoor unit and Observer Wall Control do not need to be installed for the crankcase heater to operate properly.

The compressor windings will occasionally be energized during the OFF cycle (depending on the length of the OFF cycle) to start the stator heat operation, thus maintaining a sump temperature that is essential for compressor reliability. The compressor will not run during this process.

## Outdoor Fan Motor Operation

The outdoor unit control (Fig. 9) energizes outdoor fan anytime the compressor is operating, except for defrost. The OD fan motor is variable speed. The speed will change depending on the ambient temperature and the cooling or heating capacity required. When the OFM begins to start, it will rotate back and forth a couple times slowly. It will eventually rotate full speed.

## Time Delays

The unit time delays include:

- 3.5 minute time delay after last cycle, initial power up, return from brown-out condition. To bypass this feature, momentarily short and release Forced Defrost pins.
- At the end of every compressor ON cycle, there will be 150 seconds of PEV open period for pressure equalization followed by 15 seconds of PEV Off period before the next compressor ON cycle. This delay cannot be bypassed as it helps compressor reliability.
- 15 second delay at termination of defrost before the auxiliary heat is de-energized.
- See Table 6 for other delay information.

## Communication and Status Function Lights

### **Observer® Wall Control, Green Communications (COMM)Light**

A green LED (COMM light) on the outdoor board (see Fig. 9) indicates successful communication with the other system products. The green LED will remain OFF until communication is established. Once a valid command is received, the green LED will turn ON continuously. If no communication is received within 2 minutes, the LED will be turned OFF until the next valid communication. The green LED will be turned off when using a standard 2-stage non-communicating heat pump thermostat.

### **Amber Status Light**

Amber colored **STATUS light** indicates operation and error status. See Table 6 for definitions.

- Two minute time delay to return to standby operation from last valid communication.

## Defrost

The Observer Wall Control offers 5 possible defrost interval times: 30, 60 and 90 minutes, or AUTO. The default is AUTO.

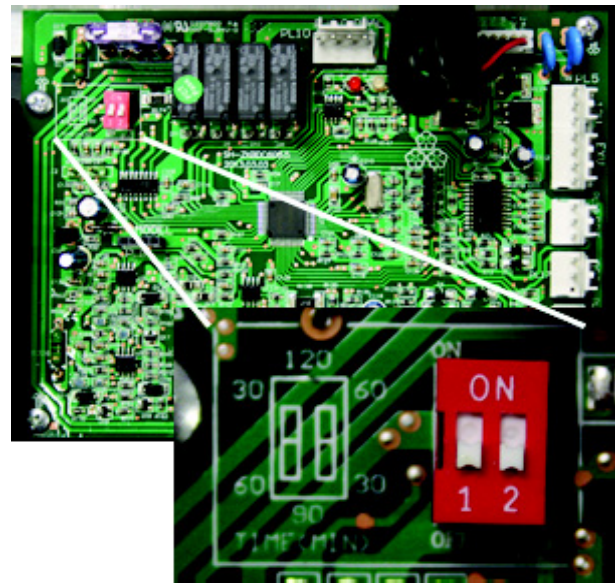
Defrost interval times: 30, 60, and 90 minutes or AUTO are selected by the Observer® Wall Control if using Wall Control. The 90 and 120 minute selection will default to 60 minutes at ambient below 37 degrees. The 120 minute selection will default to 90 minutes at ambient above 37 degrees.

If using a non-communicating thermostat, defrost intervals are set using dip switches on the outdoor control board (see Fig. 9), and AUTO is not available.

AUTO defrosts adjusts the defrost interval time based on the last defrost time as follows:

- When defrost time <5 minutes, the next defrost interval=90 minutes. (outdoor temperature above 37°F)
- When defrost time 5-7 minutes, the next defrost interval=60 minutes.
- When defrost time >7 minutes, the next defrost interval=30 minutes.

The control board accumulates compressor run time. As the accumulated run time approaches the selected defrost interval time, the control board monitors the coil temperature sensor for a defrost demand. If a defrost demand exists, a defrost cycle will be initiated at the end of the selected time interval. A defrost demand exists when the coil temperature is at or below 32°F (0°C) for 4 minutes during the interval. If the coil temperature does not reach 32°F (0°C) within the interval, the interval timer will be reset and start over.



A14021

**Fig. 9 - AOC Control Board**

- Upon initial power up the first defrost interval is defaulted to 30 minutes. Remaining intervals are at selected times.
- Defrost is only allowed to occur below 50°F (10°C) outdoor ambient temperature.

The defrost cycle is terminated as described below.

- When OAT is > 25°F (+3.89°C), defrost terminates if outdoor coil temperature (OCT) > 60°F (+15.6°C). And a minimum of 2 minutes defrost length.
- When OAT ≥ 25°F (+3.89°C), defrost will terminate if OCT is >45°F (+4.4°C) and a minimum of 2 minutes defrost length.
- Or 10 minutes has passed.

At the defrost termination, the outdoor fan will turn on 10 seconds before the reversing valve switching.

NOTE: Compressor speed during defrost will go to defrost speed.

## **Step 12 — Check Charge**

**Charging Procedure:** Force system to operate in high stage cooling by creating a large differential between room temperature and set point on thermostat. Use multi-meter to verify that 24 VAC is present between C, Y1 /Y2 terminals at outdoor unit.

Factory charge amount is shown on unit rating plate for high stage. Target subcooling chart is provided on back of control box door see Fig. 10 - 15 for example. To properly check or adjust charge, condition must be favorable for subcooling charging. Favorable conditions exist when outdoor temperature is between 65°F (18°C) and 100°F (38°C), and the indoor temperature is between 70°F (21°C) and 80°F (27°C). Follow the procedure below:

Unit is factory charged for 15ft (4.57 m) of lineset. Adjust charge by adding or removing 0.6 oz/ft (17.7 g/m) of 3/8 liquid line above or below 15ft (4.57 m) respectively.

For standard refrigerant line lengths (80ft/24.4 m or less), allow system to operate in cooling mode at least 25 minutes. If conditions are favorable, check system charge by subcooling method. If any adjustment is necessary, adjust charge slowly and allow system to operate for 25 minutes to stabilize before declaring a properly charged system.

If the indoor temperature is below 70°F (21.11°C), or the outdoor temperature is not in the favorable range, adjust charge for line set length above or below 15ft (4.57 m) and indoor fan coil /furnace coil per Table 4. Charge level should then be appropriate for the system to achieve rated capacity. The charge level should then be checked at another time when the both indoor and outdoor temperatures are in a more favorable range.



NOTE: If the line length is beyond 80ft (24.38 m) or greater than 20ft (6.10 m) vertical separation see Long line guideline for special charging requirement.

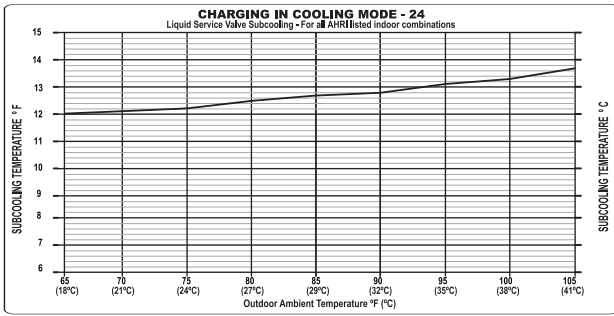


Fig. 10 - Charging in Cooling Mode CVH8, HVH8, TVH824

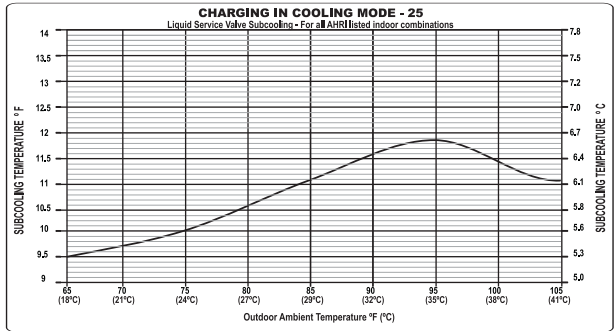


Fig. 11 - Charging in Cooling Mode CVH8, HVH8, TVH825

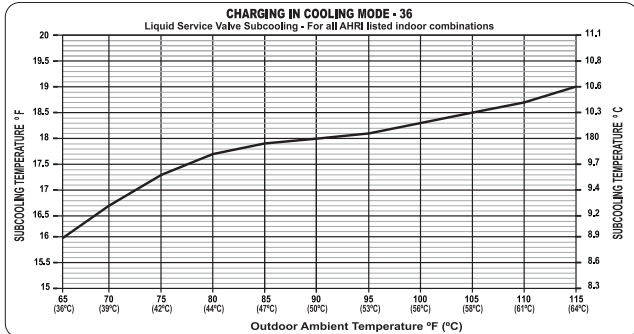


Fig. 12 - Charging in Cooling Mode CVH8, HVH8, TVH836

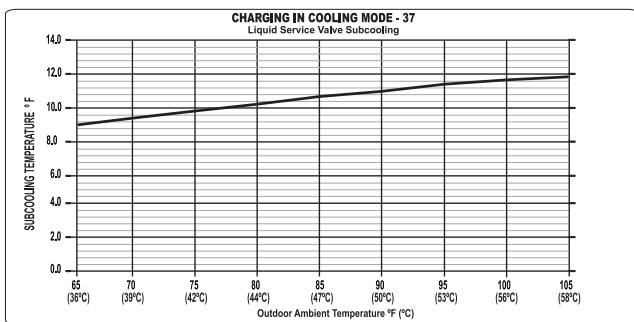


Fig. 13 - Charging in Cooling Mode CVH8, HVH8, TVH837

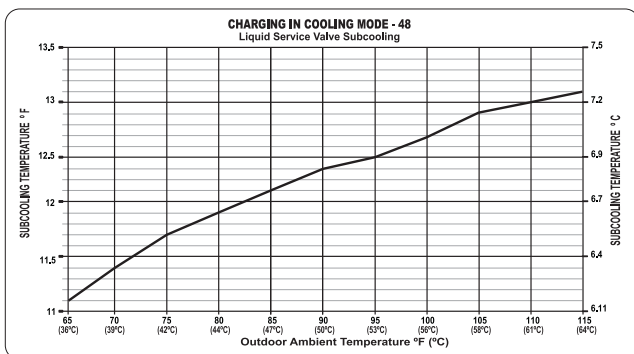


Fig. 14 - Charging in Cooling Mode CVH8, HVH8, TVH848

Fig. 14 - Charging in Cooling Mode CVH8, HVH8, TVH848

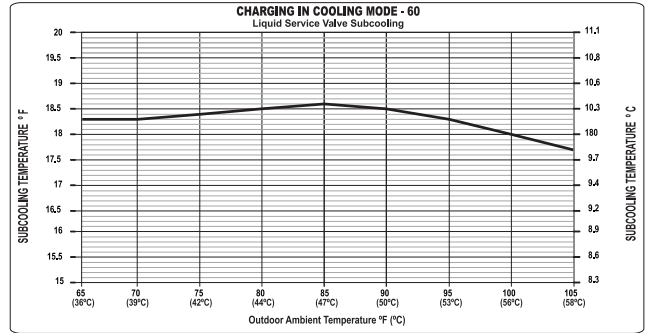


Fig. 15 - Charging in Cooling Mode CVH8, HVH8, TVH860

**Heating Check Chart Procedure (See Fig.17 - 20) (Communicating / Non-communicating Systems)**

In heating mode, the required charging method is by weigh-in. On new installations or complete recharge, refer to the unit 0 and indoor fan coil / furnace coil per Table 2 for additional charge needed. Refrigerant charge adjustment amount for adding or removing 0.6 oz./ft (17.74 g/m) of 3/8 liquid line above or below 15ft (4.57 m) respectively.

Use the Forced Defrost mode to remove ice or frost from coil, if present, prior to checking the heating pressures.

To use the Heating Check Chart in non-communicating systems, operate system at Y1+Y2-high stage with a large room temperature difference with heat pump only mode. These charts indicate whether a correct relationship exists between system operating pressure and air temperature entering indoor and outdoor units. If pressure and temperature do not match on chart, system refrigerant charge may not be correct. **DO NOT USE CHART TO ADJUST REFRIGERANT CHARGE.**

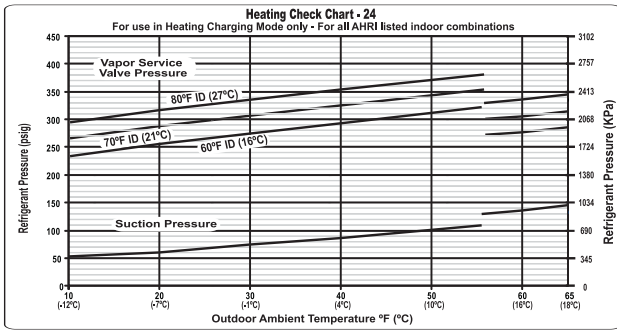
NOTE: High pressure is at vapor service valve. Add 12 psig if high pressure is taken from liquid service valve.

NOTE: When charging is necessary during heating season, charge must be weighed in accordance with unit rating plate, ±0.6 oz./ft (±17.74 g/m), of 3/8-in. liquid-line above or below 15 ft (4.57 m), respectively.

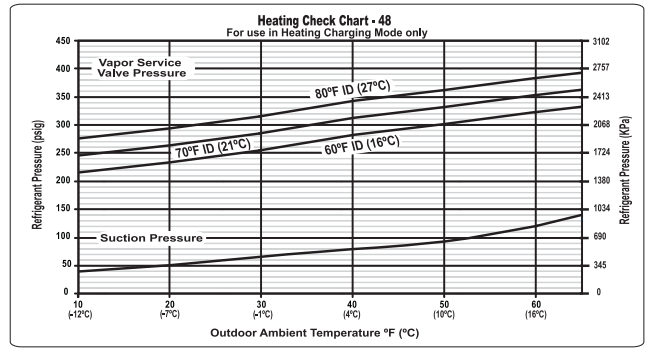
**Table 2 – Required Charge (values in lbs.) Adjustment for Indoor Coil Model**

Furnace Coil or Fan Coil Model Number	24	25	36	37	48	60
EA*4X24	/	/	/	/	/	/
EHD4X24	/	/	/	/	/	/
EHD4X30	/	/	/	/	/	/
F(V,C)M4X24	-	-	-	-	/	/
EA*4X30	-	/	/	/	/	/
EN(A,D)4X30	-	/	/	/	/	/
ENH4X36	-	-	-	-	/	/
F(V,C)M4X36	-	-	-	-	/	/
EA*4X36	-	-	-	-	/	/
END4X42	+ .50	-	-	+ .75	/	/
EA*4X42	+ .50	-	-	+ .75	/	/
EHD4X36	/	-	-	+ .75	/	/
EHD4X42	/	+ .75	+ .75	+ .75	/	/
EN(A,D)4X31	/	+ .75	+ .75	+ .75	/	/
EN*4X48	/	+ .75	+ .75	+ .75	-	/
EHD4X48	/	+ .75	+ .75	+ 1.00	-	/
EN(A,D)4X37	/	/	/	/	/	/
EN(A,D)4X43	/	/	/	/	/	/
EA*4X48	/	/	+ .75	+ 1.00	-	/
EN*4X60	/	/	/	+ 1.00	-	-
EHD4X60	/	/	/	+ 1.00	-	-
F(V,C)M4X48	/	+ .75	+ .75	+ 1.00	-	/
F(V,C)M4X60	/	/	/	+ 1.00	+ 2.2	+ 1.00
EA*4X60	/	/	/	/	+ 2.2	+ 1.00
EN*4X61	/	/	/	/	/	/

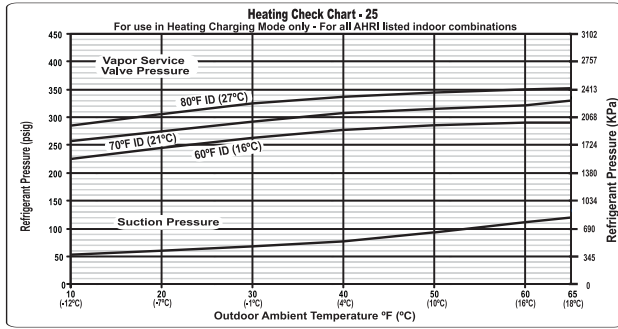
/ = Comb. not allowed  
 - = No charge adjust for ID



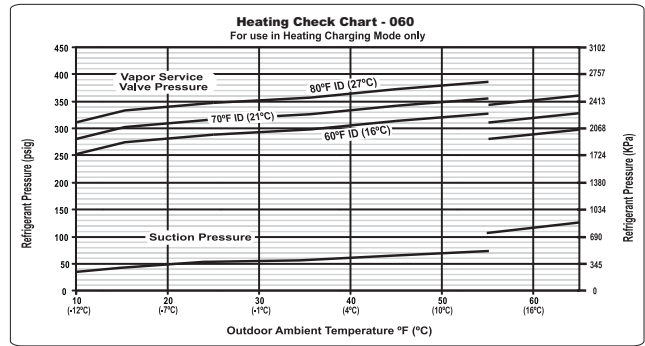
**Fig. 16 - Heating Pressure Check Chart CVH8, HVH8, TVH824**



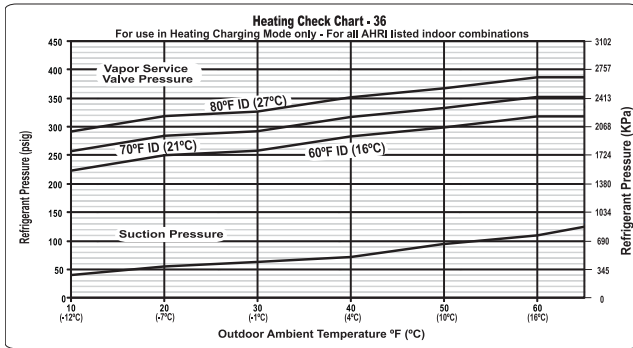
**Fig. 20 - Heating Pressure Check Chart CVH8, HVH8, TVH848**



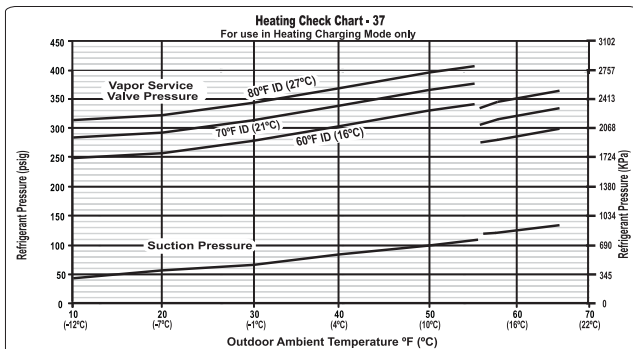
**Fig. 17 - Heating Pressure Check Chart CVH8, HVH8, TVH825**



**Fig. 21 - Heating Pressure Check Chart CVH8, HVH8, TVH860**



**Fig. 18 - Heating Pressure Check Chart CVH8, HVH8, TVH836**



**Fig. 19 - Heating Pressure Check Chart CVH8, HVH8, TVH837**

### Step 13 — Pumpdown & Evacuation

⚠ CAUTION

ENVIRONMENTAL HAZARD

Failure to follow this caution may result in environmental damage.

Federal regulations require that you do not vent refrigerant to the atmosphere. Recover during system repair or final unit disposal.

If this system requires either a Pump Down or Evacuation for any reason, the procedures below must be followed:

#### Pump Down

1. Connect gauges to CVH8, HVH8, TVH8 liquid and vapor service valve ports to monitor operating pressures during and at completion of the procedure.
2. Force system to operate in high stage by creating a large differential between room temperature and set point on thermostat. Use multi-meter to verify that 24 VAC is present between C and Y1 and Y2 terminals at outdoor unit.
3. Close the liquid service valve.
4. The unit will continue to run until high or low pressure switches open. Close vapor service valve once compressor shuts down.
5. Remove power from indoor and heat pump unit prior to servicing unit.
6. A quantity of charge will remain in isolated section of system dependent on ambient temperature and overall system charge. This charge must be manually recovered. A recovery system will be required to remove final quantity of refrigerant from indoor coil and line set.

#### Evacuation and recovery of refrigerant from CVH8, HVH8, TVH8

Refrigerant recovery and evacuation can be performed but will take more time. If EXV is not forced open the recovery and evacuation must rely on check valve as a bypass.

1. Connect gauges to CVH8, HVH8, TVH8 liquid and vapor service valve ports to monitor operating pressures during and at completion of the procedure. Attach recovery system or vacuum pump to gauge set as needed for the service procedure. The service valves must be open to evacuate the unit through the line set service ports. The suction capillary service port is a direct connection to the suction port of the compressor and may also be used.
2. Begin evacuation or refrigerant. Allow extra time for refrigerant recovery and establishing a thorough evacuation.

## MAJOR COMPONENTS

### Variable speed Control Board



A160120

**Fig. 22 - AOC (Application Operational Control) Board**

The AOC board is located in the lower right hand side of inverter tray. It's functions include:

- Compressor speed control
- Outdoor fan motor control
- Reversing valve operation
- Defrost operation
- Crankcase heater operation
- Pressure switch monitoring
- Time Delays
- Pressure Transducer measurements
- PEV control (pressure equalizer valve)
- Temperature measurements
- EXV (Electronic Expansion Valve) operation control
- Inverter communication and control

### Inverter

The inverter is located inside the control box. This is an air-cooled device that communicates with the control board and drives the compressor and fan motor to the demanded RPM. The inverter is always powered with line voltage since no contactor is used. The inverter changes the line voltage to DC volts and then recreates 3 phase sine waves that vary in frequency to drive the compressor and fan motor at the desired RPM.

NOTE: The unit may be operated with an Observer® Wall Control or a standard 2-stage HP thermostat. Observer Wall Control will utilize 5 stages of heating and cooling, while 2-stage HP thermostat will only allow 2 discrete stages of heating and cooling operation.

### Variable Speed Compressor

This unit contains a variable speed rotary compressor that has a wide operating range. It operates on a variable 3 phase sine wave provided by the inverter. This compressor can only be operated by the specific inverter supplied with the unit.

## ⚠ CAUTION

### **EQUIPMENT DAMAGE HAZARD**

Failure to follow this caution may result in equipment damage and/or improper operation.

Do not attempt to apply line voltage directly to the compressor. This will destroy the compressor.

### Electronic Expansion Valve (EXV)

This unit uses an electronic expansion valve for refrigerant metering in the heating mode. The control board drives the EXV to its proper position based on the operating mode and conditions.

### Field control Connections

For communicating operation use the communication green Observer plug only. Only two wires, DX+, DX-, (GN, YL), are required. If necessary, connect C for additional grounding (see Fig. 6). If using standard 2-stage HP thermostat, connect discrete inputs (R,C,Y2,Y1,O,W) for 2-stage control in heating and cooling modes.

### Pressure Transducer (SPT)

A 5 VDC output low pressure transducer that provides a 0-5 VDC data for interpretation by the control board for a 0 to 200 psig range of pressure at the suction tube. This interpreted pressure data is then intelligently used by the AOC control board for low pressure cut-out, loss of charge management, compressor protection, oil circulation management, lubrication management and EXV control.

### Pressure Equalizer Valve (PEV)

At the end of every compressor operation (after the 3.5 minute Time Guard period), the equalizer valve opens for 150 seconds plus an additional 15 seconds of protection before allowing the compressor to start ramping up.

The PEV is located next to the suction and discharge of the compressor. The function of this valve is to prevent the compressor from starting with a high refrigerant pressure differential, thus helping the reliability of the compressor.

NOTE: A hissing sound may be heard during the equalization process. This is normal.

## TROUBLESHOOTING

### Systems Communication Failure

If communication is lost with the Observer Wall Control, the green LED will go out. Check the wiring to the User Interface and the indoor and outdoor units and power.

### Model Plug

Each control board contains a model plug. The correct model plug must be installed for the system to operate properly (see Table 3).

The model plug is used to identify the type and size of unit to the control.

On new units, the model and serial numbers are inputted into the AOC board's memory at the factory. If a model plug is lost or missing at initial installation, the unit will operate according to the information input at the factory and the appropriate error code will flash temporarily. A FAST Parts replacement AOC board contains no model and serial information. If the factory control board fails, the model plug must be transferred from the original board to the replacement board for the unit to operate.

NOTE: The model plug takes priority over factory model information input at the factory. If the model plug is removed after initial power up, the unit will operate according to the last valid model plug installed, and flash the appropriate fault code temporarily.

**Table 3 – Factory Supplied Model Plug Information**

CVH8, HVH8, TVH8	FAST PART NUMBER	PIN RESISTANCE	
		Pins 1- 4 (R1)	Pins 2- 3 (R2)
24	1184941	18K	75K
25	1188069	18K	11K
36	1184943	18K	120K
37	1188070	18K	24K
48	1184945	18K	180K
60	1184947	18K	270K

**Pressure Switch Protection**

The outdoor unit is equipped with high pressure switch. If the control senses the opening of a high pressure switch (open 600+/- 5 psig, close 470+/- 10 psig @77°F), it will respond as follows:

1. Display the appropriate fault code (see Table 6).
2. After a 15 minute delay, if there is a call for cooling or heating and HPS is reset, the PEV opens for 150 seconds to equalize system pressures. The compressor and fan will then ramp to the next lower stage of operation until demand is satisfied. In the next call for heating/cooling system will resume normal operation.
3. If the opened switch closes at any time after the 15 minute delay, then the PEV opens for 150 seconds to equalize system pressures. The compressor and fan will then ramp to the next lower stage of operation until demand is satisfied. In the next call for heating/cooling system will resume normal operation.
4. If HPS trips 3 consecutive cycles, the unit operation is locked out for 4 hours.
5. In the event of a high-pressure switch trip or high-pressure lockout, check the refrigerant charge, outdoor fan operation, and outdoor coil (in cooling) for airflow restrictions, or indoor airflow in heating.
6. In the event of a low-pressure trip or low-pressure lockout, check the refrigerant charge and indoor airflow (cooling) and outdoor fan operation and outdoor coil in heating.

**Brown-Out Protection**

If the line voltage is less than 187V for at least 4 seconds, the Compressor and OD fan goes to 0 rpm. Compressor and fan operation are not allowed until voltage is a minimum of 190V. The control will flash the appropriate fault code (see Table 6).

**230V Line (Power Disconnect) Detection**

The control board senses the presence of absence of 230V through inverter feedback. Voltage should present at all times when system is in service regardless if system is running or standby. If there is no 230V at the inverter when the indoor unit is powered with a cooling or heating demand, the appropriate fault code is displayed on the Observer®Wall Control (communicating only – see Table 6). If system is configured with conventional heat pump thermostat (non-communicating), no fault code will be displayed on AOC board, nor will any status LEDs be lit. Use multimeter to check for the presence of 230V in this situation.

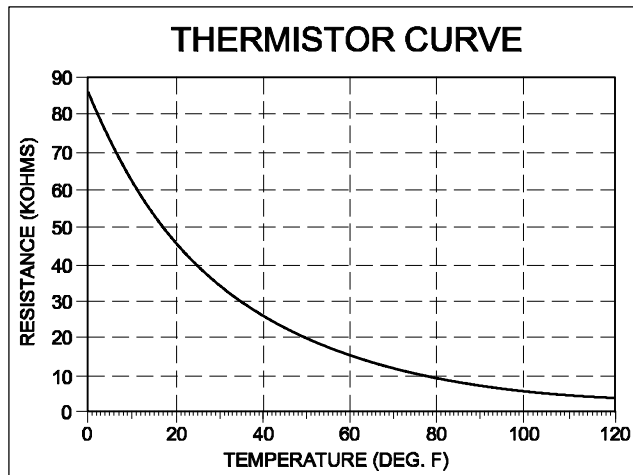
**Temperature Thermistors**

Thermistors are electronic devices which sense temperature. As the temperature increases, the resistance decreases. 10Kohm thermistors are used to sense outdoor air temperature (OAT), coil temperature (OCT) and the suction line temperature (OST) located between the reversing valve and the accumulator. A 50Kohm thermistor is used to sense discharge temperature (ODT).

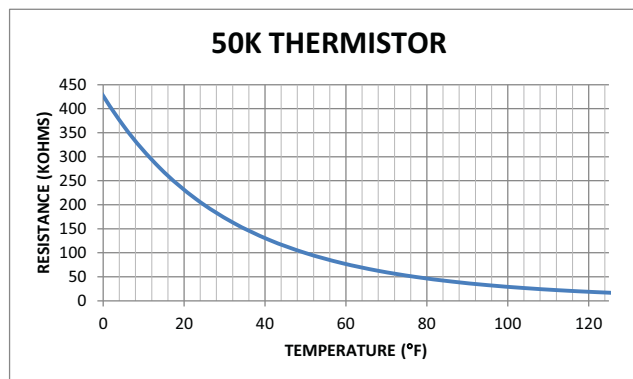
Refer to Table 4 and Fig. 23 and 24 for resistance values versus temperature.

**Table 4 – 10K/50Kohms Resistance Values vs Temperature**

10Kohms °C (°F)	
TEMPERATURE	RESISTANCE (ohms)
25.0 (77.0)	10.0 + / - 2.3%
0.0 (32.0)	32.6 + / - 3.2%
-28.0 (-18.4)	85.5 + / - 3.4%
50Kohm	
125.0 (257.0)	1.7 + / - 1.6%
75.0 (167.0)	7.40 + / - 2.0%
25.0 (77.0)	50.0 + / - 2.3%



**Fig. 23 - 10K Thermistor Resistance Versus Temperature** A91431



**Fig. 24 - 50K Thermistor Resistance Versus Temperature** A14022

If the outdoor air or coil thermistor should fail, the control will flash the appropriate fault code (see Table 6).

**IMPORTANT:** The outdoor air thermistor, coil thermistor and suction thermistor should be factory mounted in the final locations. **Check to ensure thermistors are mounted properly (See Fig. 25, 26, 27 and 28).**

**Thermistor Sensor Comparison**

The control continuously monitors and compares the outdoor air temperature sensor and outdoor coil temperature sensor to ensure proper operating conditions. The comparison is:

- In cooling if the outdoor air sensor indicates  $\geq 10^{\circ}\text{F}$  ( $\geq 5.6^{\circ}\text{C}$ ) warmer than the coil sensor (or) the outdoor air sensor indicates  $\geq 25^{\circ}\text{F}$  ( $\geq 15^{\circ}\text{C}$ ) cooler than the coil sensor, the sensors are out of range.
- In heating if the outdoor air sensor indicates  $\geq 35^{\circ}\text{F}$  ( $\geq 19.4^{\circ}\text{C}$ ) warmer than the coil sensor (or) the outdoor air sensor indicates  $\geq 10^{\circ}\text{F}$  ( $\geq 5.6^{\circ}\text{C}$ ) cooler than the coil sensor, the sensors are out of range.

If the sensors are out of range, the control will flash the appropriate fault code as shown in Table 6.

The thermistor comparisons are not performed during low ambient cooling or defrost operation.

### **Failed Thermistor Default Operation**

Factory defaults have been provided in the event of failure of outdoor air thermistor (OAT) and/or outdoor coil thermistor (OCT).

If the OAT sensor should fail, defrost will be initiated based on coil temperature and time.

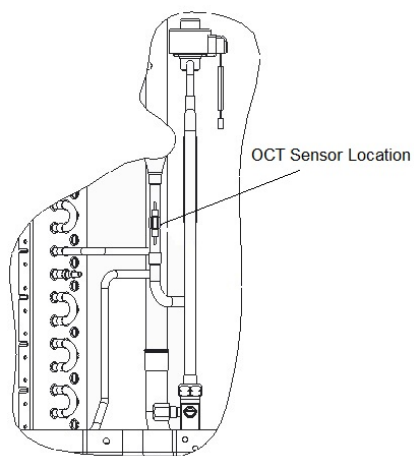
If the OCT sensor should fail, defrost will occur at each time interval during heating operation, but will terminate after 2 minutes.

If there is a thermistor out-of-range error, defrost will occur at each time interval during heating operation, but will terminate after 2 minutes.

Count the number of short and long flashes to determine the appropriate flash code. Table 6 gives possible causes and actions related to each error.

### **Outdoor Coil Thermistor**

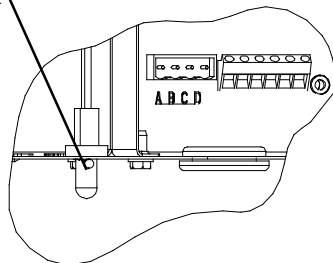
The outdoor coil thermistor is a 10Kohm resistor used for multiple system operations. It provides the coil/liquid line temperature to the heat pump board and user interface. Low ambient operation, defrost initiation, defrost termination and assistance with OAT temperature measurement of some of the functions. The sensor must be securely mounted to the tube connecting the EXV and distributor. See Fig. 26 for proper placement. See Table 4 for proper resistances.



**Fig. 25 - Outdoor Coil Thermistor (OCT) Attachment (On Distributor Tube)**

A14302

OAT Thermistor must be locked in place with spherical nib end facing towards the front of the control box



**Fig. 26 - OAT Thermistor Location (Bottom of Control Box)**

A11142

### **Suction Thermistor (OST)**

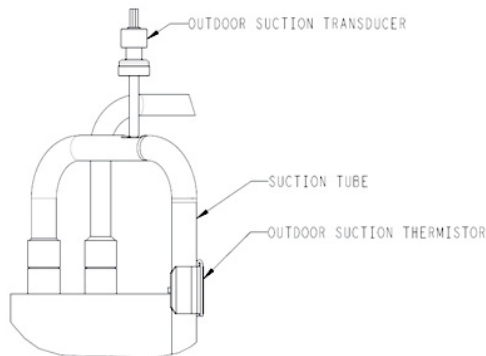
Suction Thermistor is used for assisting in EXV control and must be secured on the suction tube and aligned longitudinally to the vertical surface of the tube axis (see Fig. 27).

**⚠ CAUTION**

**UNIT DAMAGE HAZARD**

Failure to follow this caution may result in equipment damage or improper operation.

In order to minimize the ambient influence, make sure the thermistor curved surface hugs the pipe surface and is secured tight using the wire tie fished through the original slot insulating polymer body.

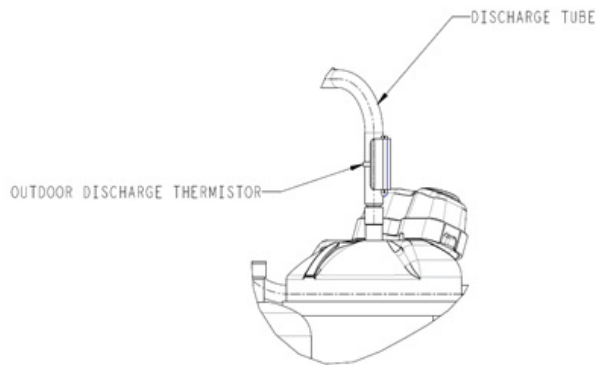


**Fig. 27 - Suction Thermistor (OST) Attachment (On Suction Tube)**

A14023

### **Discharge Thermistor (ODT)**

Discharge Thermistor is used for protection against over temperature of the compressor. The ODT is located on the compressor discharge stub-out (see Fig. 28). Maximum ODT is approximately 240 F° (116 C°).



**Fig. 28 - Discharge Thermistor (ODT)**

A14024

### **Variable Speed Compressor Winding Resistance**

This compressor operates with 3-phase variable frequency PWM variable voltage. For troubleshooting certain fault codes related to compressor resistances, follow these steps:

1. Disconnect compressor power leads from the inverter MOC terminals, U (YEL), V (RED), and W (BLK).
2. Measure the resistance between YEL to RED, YEL to BLK, and RED to BLK and compare to Table 5 values. Each resistance set should be equal.
3. Measure the resistance to ground for each lead.
4. If the resistances check out, reconnect power leads to appropriate terminal.
5. If the resistances appear to be abnormal, it will be necessary to measure the resistance at the compressor fusite terminals.

6. During the removal of the compressor fusite cap, do not remove the RTV sealant. Remove the harness plug, measure the resistances, and compare to Table 5.
7. Special care will need to be taken with the replacement of the compressor fusite cap. Make sure the two holes in the compressor fusite terminal box are still full of RTV sealant before the cap is reinstalled. The factory RTV can be reused as long as none of it has been removed during the cap removal.
8. Reinstall compressor sound blanket making sure discharge thermistor and compressor power harness are routed as they were from the factory

**Table 5 – Variable Speed Compressor Resistance (winding resistance at 70°F ± 20°F)**

WINDING	MODEL CVH8, HVH8, TVH8				
	24	25	36	37, 48	60
Between terminals	1.13 OHM	.59 OHM	.59 OHM	.37 OHM	.24 OHM
Between terminal & ground	>1 mega OHM				

**CAUTION**

**UNIT DAMAGE HAZARD**

Failure to follow this caution may result in equipment damage and/or improper operation.

Do not use Meggar for measuring the winding resistance.

**CAUTION**

**UNIT DAMAGE HAZARD**

Failure to follow this caution may result in equipment damage and/or improper operation.

To maintain water integrity of the compressor fusite terminal box, the two holes in outer ring need to be full of RTV sealant.

**Fan Motor**

If verification of proper operation is required for the fan motor used in this unit, follow these steps:

1. Disconnect fan motor connector from control board.
2. Measure resistance between any 2 of the 3 leads present.
3. Compare measurement to values below

Fan Motor Resistance	
Unit Size	Resistance (Ohms)
24	21.2
25, 36, 37, 48, 60	11.1

**Status Codes**

**ATTENTION**

Occasionally the unit may become unresponsive due to certain combinations of previous fault codes. There may not be anything wrong with the unit or components. The unit may require a high voltage power cycling for at least 2 minutes or longer to clear the condition. If the condition persists, conduct further troubleshooting per the service manual.

Table 6 shows the status codes flashed by the amber status light. Most system problems can be diagnosed by reading the status code as flashed by the amber status light on the control board.

The codes are flashed by a series of short and long flashes of the status light. The short flashes indicate the first digit in the status code, followed by long flashes indicating the second digit of the error code.

The short flash is 0.25 seconds ON and the long flash is 1.0 second ON. Time between flashes is 0.25 seconds. Time between short flash and first long flash is 1.0 second. Time between code repeating is 2.5 seconds with LED OFF.

Codes are easily read from Observer® Wall Control

**EXAMPLE:**

3 short flashes followed by 2 long flashes indicates a 32 code. Table 6 shows this to be low pressure switch open.

**Status Code Recall Mode**


Active status codes are stored in memory even when power is absent. The most recently flashing status code (highest priority active) can be recalled from memory via status code recall mode and displayed using the amber LED. The status code recall mode is accessed by shorting (use a clip wire) the “force defrost” connector (labeled J2 on the board) and then power ON the unit. Please make sure the unit is turned OFF before shorting the pins. Status call recall mode will continue as long as the “force defrost” terminals remain shorted. The unit will not attempt to heat or cool while the terminals remain shorted. Once the status code is read, power down the unit and remove the short.

**Table 6 – Troubleshooting**

SERVICE			
AMBER LED DESCRIPTION	* FLASH CODE (Amber LED)	RESET TIME (Minimum) Minutes	** TYPE
Standby	ON, no flash	--	--
Variable Capacity Mode	1, pause	--	--
Variable Speed Range Outback	1 (2 sec ON), longer pause (1 second OFF)	--	--
2-stage "LOW" Capacity	1, pause	--	--
2-stage "HIGH" Capacity	2, pause	--	--
2-stage "REDUCED" Capacity	4, pause	--	--
Invalid Model Plug/Inverter Size	25	N/A	System Malfunction
High Pressure Switch Open	31	6	Fault
Low Pressure Trip	32	6	Local
Lost Inverter Communications	33	6	Local
Brownout Event	46	6	Local
Lost Inverter Communications	48	6	System Malfunction
Compressor Over Current Fault	49	6	Local
Outdoor Air Temp Sensor Fault	53	N/A	Fault
Suction Temp Sensor Fault	54	N/A	Fault
Coil Temp Sensor Fault	55	N/A	Fault
OAT-OCT Thermistor Out of Range	56	N/A	Event
Suction Pressure Sensor Fault	57	N/A	Fault
Discharge Temperature Out of Range Event	59	15	Local
Fan Inverter Fault	61	6	Local
Fan Inverter Current Fault	63	6	Local
D C Voltage Low - SPD Limiting	65	N/A	Local
Outdoor Fan Dropped Out	66	6	Event
Stator Heater Fault	67	6	Event
10 Minute Stage 2 Warmup Delay	68	10	Event
Inverter / Compressor Internal Fault	69	15	System Malfunction
Compressor Dropped Out	71	6	Event
Suction Over Temperature Event	72	15	Local
Discharge Temp Out of Range Lockout	74	2 Hours	System Malfunction
Maximum Power Mode-Temp	75	N/A	Local
Fan Inverter Lockout	76	2 Hours	System Malfunction
Maximum Power Mode-Comp Current	77	N/A	Local
Compressor/Inverter Fault	79	6	Local
Suction Over Temp Lockout	82	4 Hours	System Malfunction
Low Pressure Lockout for 4 hours	83	4 Hours	System Malfunction
High Pressure Lockout for 4 hours	84	4 Hours	System Malfunction
Fan Inverter Current Lockout	86	6	System Malfunction
Compressor/Inverter Lockout	88	2 Hours	System Malfunction
Inverter VDC-Out Over Voltage Event	91	6	Local
Inverter VDC-Out Under Voltage Event	92	6	Local
Compressor Over Current Lockout	95	2 Hours	System Malfunction
VDC Under Voltage Lockout	96	2 Hours	System Malfunction
VDC Over Voltage Lockout	97	2 Hours	System Malfunction
High Torque Event	98	N/A	Event
High Torque Lockout	99	2 Hours	System Malfunction
--	OFF	N/A	No Power

\* Short Flashes indicate the first digit in the status code followed by long flashes indicating the second digit of the status code.

\*\* Local Faults displayed only on amber LED and not on generic wall control or recorded in fault history.



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**FINAL CHECKS**

**IMPORTANT:** Before leaving job, be sure to do the following:

1. Ensure that all wiring is routed away from tubing and sheet metal edges to prevent rub-through or wire pinching.
2. Ensure that all wiring and tubing is secure in unit before adding panels and covers. Securely fasten all panels and covers.
3. Tighten service valve stem caps to 1/12- turn past finger tight.
4. Leave User’s Manual with owner. Explain system operation and periodic maintenance requirements outlined in manual.

**CARE AND MAINTENANCE**

For continuing high performance and to minimize possible equipment failure, periodic maintenance must be performed on this equipment.

Frequency of maintenance may vary depending upon geographic areas, such as coastal applications. See Owner’s Manual for information.

TECHNICAL LABELS

824 Size Outdoor With FCM4X24\*\*\*L Stage 5 Indoor Cooling

		Outdoor Ambient Temperature - Degrees F, Dry Bulb												115#			
		85						95						105			
		75						85						95			
		Entering Indoor Temperature - Degrees F, Wet Bulb															
		634						608						642			
		663						634						608			
STAGE-5 Mode		72	67	63††	57	72	67	63††	57	72	67	63††	57	72	67	63††	57
Comfort + De-Humidify	SCFM	29.23	26.51	24.55	23.16	27.93	25.31	23.44	22.06	26.67	24.17	22.39	21.12	25.37	23.00	21.29	20.17
	MBh†	0.52	0.70	0.73	1.00	0.52	0.70	0.73	1.00	0.52	0.70	0.73	1.00	0.54	0.73	0.76	1.00
	S/†‡	5.78	5.82	5.85	5.85	6.95	6.94	6.94	6.93	8.25	8.20	8.15	8.11	9.67	9.56	9.47	9.40
	AMPS*	261	257	254	252	300	295	292	289	343	337	333	331	390	384	380	377
	HI PR	156	142	132	125	156	142	132	125	157	143	133	126	158	144	134	128
Efficiency	SCFM	29.93	27.14	25.14	24.28	28.85	26.16	24.25	23.62	27.69	25.12	23.28	22.90	26.44	24.00	22.25	22.11
	MBh†	0.54	0.73	0.76	1.00	0.54	0.75	0.77	1.00	0.55	0.77	0.79	1.00	0.56	0.79	0.81	1.00
	S/†‡	5.93	5.98	6.01	6.02	7.18	7.18	7.17	7.17	8.55	8.50	8.45	8.44	10.05	9.94	9.85	9.84
	AMPS*	263	258	255	254	302	297	293	292	346	340	336	335	394	387	383	383
	HI PR	160	146	136	132	162	148	138	135	164	150	139	138	166	152	141	141
Maximum	SCFM	29.56	26.97	25.11	24.40	28.53	26.03	24.24	23.71	27.43	25.04	23.23	22.97	26.27	23.99	22.33	22.18
	MBh†	0.54	0.74	0.77	1.00	0.55	0.76	0.78	1.00	0.56	0.77	0.80	1.00	0.56	0.79	0.81	1.00
	S/†‡	5.80	5.90	5.97	5.99	7.06	7.12	7.17	7.17	8.45	8.47	8.46	8.48	9.97	9.94	9.91	9.91
	AMPS*	256	253	252	252	296	293	292	291	341	338	335	336	391	387	385	385
	HI PR	161	147	137	133	163	149	138	136	164	150	140	138	166	152	141	141

824 Size Outdoor With FCM4X24\*\*\*L Indoor Heating

		Outdoor Ambient Temperature - Degrees F, Dry Bulb														
		17						37						47		
		7						17						27		
		Entering Indoor Temperature - Degrees F, Dry Bulb														
		523						621						720		
		402						621						819		
STAGE-5 Mode		65	70	75	65	70	75	65	70	75	65	70	75	65	70	75
Comfort	SCFM	11.97	11.86	11.66	15.44	15.28	15.11	18.09	17.90	17.71	21.48	21.22	20.95	24.94	24.60	24.26
	MBh†	23.47	28.66	28.12	31.32	30.92	30.51	30.47	30.09	29.69	30.80	30.35	29.90	31.00	30.52	30.03
	T/†	5.83	6.46	6.72	7.84	8.22	8.61	7.88	8.28	8.70	8.09	8.51	8.95	8.23	8.68	9.13
	AMPS*	282	328	347	319	340	362	315	336	358	317	337	359	318	338	359
	HI PR	47	47	102	57	58	58	69	70	70	85	86	86	102	102	103
Efficiency	SCFM	12.00	11.90	11.70	15.76	15.60	15.44	18.37	18.18	17.99	21.73	21.46	21.18	24.94	24.60	24.26
	MBh†	23.47	25.69	25.21	20.26	20.01	19.75	23.29	23.00	22.71	27.18	26.78	26.37	30.78	30.30	29.81
	T/†	5.83	6.29	6.54	7.33	7.71	8.09	7.55	7.96	8.37	7.92	8.35	8.79	8.22	8.66	9.11
	AMPS*	282	315	333	274	294	314	287	306	327	302	322	343	316	336	357
	HI PR	47	47	102	57	57	57	69	69	70	85	85	86	102	102	102
Maximum	SCFM	12.05	11.91	11.77	15.77	15.61	15.45	18.38	18.19	18.01	21.75	21.49	21.25	25.01	24.68	24.39
	MBh†	23.47	23.15	22.82	20.15	19.90	19.65	22.98	22.68	22.40	26.62	26.25	25.89	29.96	29.50	29.09
	T/†	5.83	6.15	6.45	7.33	7.71	8.10	7.54	7.95	8.37	7.90	8.34	8.78	8.18	8.63	9.10
	AMPS*	282	303	324	274	293	314	285	305	326	300	320	341	313	333	355
	HI PR	47	47	102	57	57	57	69	69	69	85	85	86	102	102	102

See Legend on page 22.



<b>825 Size Outdoor With FCM4X48***L Stage 5 Indoor Cooling</b>																																							
Outdoor Ambient Temperature - Degrees F, Dry Bulb																																							
65					75					85					95					105					115#														
STAGE-5 Mode																																							
Entering Indoor Temperature - Degrees F, Wet Bulb																																							
72					67					63††					57					72					67					63††					57				
Comfort + De-Humidity	SCFM	708	663	634	608	608	608	608	608	608	608	608	608	608	608	608	608	608	608	608	608	608	608	608	608	608													
	MBh†	30.15	27.28	25.20	23.76	22.34	26.85	24.25	22.40	21.11	25.25	22.79	21.05	19.91	23.98	21.63	19.98	19.08																					
	S/T‡	0.52	0.70	0.73	1.00	0.52	0.69	0.72	1.00	0.52	0.70	0.73	1.00	0.53	0.72	0.74	1.00																						
	AMPS*	5.12	5.22	5.28	5.34	6.10	6.17	6.20	6.22	7.14	7.16	7.17	7.16	8.24	8.22	8.19	8.16	9.56	9.50	9.44	9.41																		
	HI PR	253	248	246	244	289	286	283	281	331	327	324	322	378	373	370	368	424	419	415	413																		
LO PR	158	144	134	127	158	144	134	126	159	145	134	127	160	146	135	129	162	148	137	132																			
Efficiency	SCFM	825	825	825	825	825	825	825	825	825	825	825	825	825	825	825	825	825	825	825	825	825	825	825	825	825	825												
	MBh†	31.02	28.05	25.92	25.06	29.60	26.74	24.71	24.09	28.10	25.44	23.50	23.26	26.52	23.95	22.12	22.02	25.06	22.65	20.92	21.04	23.44	21.20	19.59	19.93														
	S/T‡	0.54	0.73	0.76	1.00	0.54	0.75	0.77	1.00	0.55	0.76	0.79	1.00	0.56	0.78	0.81	1.00	0.57	0.80	0.83	1.00	0.59	0.83	0.85	1.00														
	AMPS*	5.15	5.25	5.33	5.36	6.15	6.23	6.27	6.28	7.22	7.25	7.27	7.28	8.36	8.35	8.33	8.33	9.70	9.65	9.60	9.60	10.98	10.88	10.78	10.81														
	HI PR	254	249	247	246	291	288	284	284	334	329	326	326	381	376	372	372	426	421	417	418	482	476	472	473														
LO PR	163	148	138	134	165	150	139	136	166	152	141	139	168	154	143	143	170	156	144	146	172	158	146	149															
Maximum	SCFM	840	850	850	850	850	850	850	850	850	850	850	850	850	850	850	850	850	850	850	850	850	850	850	850	850													
	MBh†	31.08	28.07	25.94	25.18	29.66	26.78	24.77	24.28	28.15	25.44	23.50	23.26	26.52	23.95	22.12	22.02	25.06	22.65	20.92	21.04	23.44	21.20	19.59	19.93														
	S/T‡	0.54	0.74	0.76	1.00	0.55	0.76	0.78	1.00	0.56	0.77	0.80	1.00	0.56	0.78	0.81	1.00	0.57	0.80	0.83	1.00	0.59	0.83	0.85	1.00														
	AMPS*	5.14	5.23	5.31	5.34	6.15	6.22	6.26	6.27	7.23	7.26	7.27	7.28	8.36	8.34	8.31	8.31	9.61	9.56	9.50	9.51	10.90	10.78	10.68	10.71														
	HI PR	255	251	248	247	293	290	286	285	336	331	328	328	383	378	374	374	430	424	420	421	486	479	475	476														
LO PR	163	149	138	135	166	151	140	138	167	153	142	141	169	154	143	143	170	156	144	146	173	158	146	149															

<b>825 Size Outdoor With FCM4X48***L Indoor Heating</b>																																		
Outdoor Ambient Temperature - Degrees F, Dry Bulb																																		
7					17					27					37					47					57									
STAGE-5 Mode																																		
Entering Indoor Temperature - Degrees F, Dry Bulb																																		
65					70					75					85					95					105					115#				
Comfort	SCFM	407	523	622	721	819	819	819	819	819	819	819	819	819	819	819	819	819	819	819	819	819	819	819	819	819								
	MBh†	13.63	13.50	13.36	19.53	19.33	19.12	21.76	21.52	21.29	24.68	24.36	24.04	27.39	26.93	26.55	18.94	18.58	18.24															
	T/R	31.57	37.86	37.37	40.33	39.83	39.30	38.69	38.19	37.68	38.78	38.19	37.60	38.83	38.11	37.48	39.08	38.26	37.47															
	AMPS*	8.20	8.91	9.25	10.42	10.83	11.25	9.69	10.11	10.54	9.51	9.94	10.37	9.22	9.64	10.08	5.70	6.01	6.33															
	HI PR	311	360	383	350	372	395	342	363	386	342	363	386	342	363	385	339	359	381															
LO PR	47	47	101	57	58	58	69	69	69	85	85	85	101	101	102	128	129	129																
Efficiency	SCFM	450	825	825	825	825	825	825	825	825	825	825	825	825	825	825	825	825	825	825	825	825	825	825	825									
	MBh†	13.73	13.57	13.48	20.11	19.90	19.71	22.21	21.97	21.73	25.00	24.69	24.36	27.16	26.80	26.41	19.19	19.22	18.44															
	T/R	31.57	34.43	34.12	26.33	26.00	25.69	29.78	29.39	29.00	34.34	33.83	33.31	38.23	37.85	37.00	36.86	36.83	35.25															
	AMPS*	8.20	8.75	9.06	9.40	9.83	10.24	9.02	9.44	9.86	9.17	9.60	10.03	9.17	9.60	10.04	5.55	5.91	6.18															
	HI PR	311	347	366	288	309	331	303	323	345	322	343	365	340	361	383	329	353	369															
LO PR	47	47	101	56	57	57	68	68	69	84	85	85	101	101	102	128	129	129																
Maximum	SCFM	500	830	837	843	850	850	850	850	850	850	850	850	850	850	850	850	850	850	850	850	850	850	850	850									
	MBh†	13.80	13.68	13.54	20.13	19.93	19.74	22.25	22.00	21.77	25.10	24.73	24.43	27.54	27.14	26.77	19.15	19.26	18.48															
	T/R	31.57	31.23	30.84	26.20	25.88	25.57	29.39	29.01	28.64	33.73	33.17	32.68	37.63	37.00	36.41	36.77	36.91	35.32															
	AMPS*	8.20	8.49	8.83	9.38	9.79	10.21	8.98	9.40	9.83	9.12	9.54	9.98	9.13	9.56	10.00	5.54	5.92	6.19															
	HI PR	311	329	351	287	307	328	300	321	343	319	340	362	337	358	380	328	353	370															
LO PR	47	47	101	57	57	57	68	68	69	84	85	85	101	101	102	128	128	129																

See Legend on page 22.



837 Size Outdoor With FCM4X60***L Stage 5 Indoor Cooling																																		
Outdoor Ambient Temperature - Degrees F, Dry Bulb																																		
65					75					85					95					105					115#									
STAGE-5 Mode																																		
Entering Indoor Temperature - Degrees F, Wet Bulb																																		
990			953			902			812			812			1050			1050			1050			1050										
72	67	63††	57	72	67	63††	57	72	67	63††	57	72	67	63††	57	72	67	63††	57	72	67	63††	57	72	67	63††	57							
<b>Comfort + De-Humidity</b>																																		
SCFM	42.08	38.21	35.44	33.40	40.13	36.42	33.79	31.90	38.01	34.51	31.99	30.18	35.51	32.24	29.88	27.95	33.92	30.78	28.54	26.92														
MBh†	0.52	0.70	0.73	1.00	0.52	0.70	0.73	1.00	0.52	0.70	0.73	1.00	0.52	0.69	0.72	1.00	0.52	0.70	0.73	1.00														
S/T‡	6.97	7.07	7.13	7.17	8.19	8.26	8.27	8.28	9.52	9.53	9.53	9.50	10.94	10.89	10.83	10.77	12.65	12.55	12.46	12.39														
AMPS*	245	242	240	238	283	280	277	275	325	321	319	316	371	366	363	361	416	412	408	406														
HI PR	159	145	135	127	160	146	135	128	160	146	135	128	159	145	134	126	161	146	136	129														
LO PR	1050																																	
SCFM	42.44	38.54	35.77	34.02	40.70	36.94	34.29	32.88	38.88	35.31	32.77	31.68	36.99	33.60	31.19	30.44	35.26	32.01	29.71	29.25														
MBh†	0.52	0.71	0.74	1.00	0.53	0.72	0.75	1.00	0.54	0.74	0.76	1.00	0.55	0.75	0.78	1.00	0.55	0.77	0.79	1.00														
S/T‡	7.11	7.21	7.27	7.30	8.41	8.48	8.50	8.50	9.80	9.81	9.80	9.80	11.28	11.24	11.18	11.17	13.01	12.92	12.84	12.83														
AMPS*	246	242	240	238	284	281	278	276	327	322	320	319	373	369	365	365	418	414	410	410														
HI PR	161	147	136	130	162	148	138	133	164	150	139	135	166	152	141	138	168	153	143	141														
LO PR	1050																																	
SCFM	42.04	38.43	35.79	34.26	40.91	37.41	34.88	34.22	39.16	35.79	33.39	33.00	37.31	34.13	31.84	31.72	35.10	32.04	29.84	29.36														
MBh†	0.53	0.72	0.75	1.00	0.55	0.76	0.78	1.00	0.56	0.78	0.80	1.00	0.57	0.79	0.81	1.00	0.56	0.77	0.79	1.00														
S/T‡	6.89	7.03	7.12	7.16	8.39	8.51	8.59	8.60	9.82	9.89	9.95	9.95	11.35	11.38	11.40	11.39	12.83	12.81	12.81	12.79														
AMPS*	240	238	236	235	280	278	277	276	323	321	320	320	371	369	368	368	415	413	413	412														
HI PR	162	148	137	132	166	152	141	139	168	153	143	141	170	155	144	144	168	153	142	141														
LO PR	1050																																	

837 Size Outdoor With FCM4X60***L Indoor Heating																																
Outdoor Ambient Temperature - Degrees F, Dry Bulb																																
7					17					27					37					47					57							
STAGE-5 Mode																																
Entering Indoor Temperature - Degrees F, Dry Bulb																																
500			595			735			875			1014			1200			1200			1200			900								
65	70	75	65	70	75	65	70	75	65	70	75	65	70	75	65	70	75	65	70	75	65	70	75	65	70	75						
<b>Comfort</b>																																
SCFM	15.03	14.68	14.23	29.43	28.74	27.40	33.56	33.03	32.53	37.18	36.72	36.23	40.10	39.59	39.05	24.96	24.55	24.14														
MBh†	34.41	33.56	32.46	53.51	52.14	49.59	51.71	50.80	49.91	50.51	49.77	48.99	49.44	48.72	47.94	43.26	42.46	41.65														
T/R	8.46	8.70	8.86	15.38	15.65	15.40	15.40	15.87	16.32	15.11	15.68	16.24	14.52	15.09	15.67	7.68	8.07	8.47														
AMPS*	301	318	336	375	392	406	372	392	412	372	392	413	370	390	410	343	363	382														
HI PR	49	49	99	56	56	57	68	68	69	83	83	84	99	99	100	132	133	133														
LO PR	1200																															
SCFM	15.01	14.67	14.23	30.72	30.40	30.00	34.01	33.69	33.30	37.61	37.20	36.77	40.49	40.00	39.49	25.27	24.90	24.49														
MBh†	34.41	33.53	32.45	27.69	27.35	26.92	32.10	31.73	31.29	37.26	36.77	36.26	42.19	41.59	40.96	35.86	35.26	34.60														
T/R	8.46	8.69	8.86	13.99	14.56	15.10	13.94	14.55	15.14	14.07	14.68	15.29	13.97	14.56	15.15	7.22	7.63	8.03														
AMPS*	301	318	336	284	303	322	302	322	342	324	344	365	345	365	386	316	336	355														
HI PR	49	49	99	54	55	55	67	67	68	83	83	83	99	99	100	131	132	133														
LO PR	1200																															
SCFM	15.02	14.67	14.24	30.78	30.42	30.02	34.01	33.64	33.29	37.61	37.18	36.75	40.47	39.96	39.42	25.36	24.96	24.52														
MBh†	34.41	33.54	32.46	27.75	27.37	26.94	32.10	31.69	31.28	37.26	36.75	36.24	42.17	41.55	40.89	34.90	34.28	33.60														
T/R	8.46	8.70	8.86	14.01	14.57	15.10	13.94	14.54	15.14	14.07	14.67	15.28	13.96	14.55	15.14	7.17	7.58	7.98														
AMPS*	301	318	336	284	303	322	302	322	342	324	344	365	345	365	385	313	332	351														
HI PR	49	49	99	54	55	55	67	67	68	83	83	83	99	99	99	131	132	133														
LO PR	1200																															

See Legend on page 22.

848 Size Outdoor With FCM4X48***L Stage 5 Indoor Cooling																					
Outdoor Ambient Temperature - Degrees F, Dry Bulb																					
65					75					85					95		105		115#		
STAGE-5 Mode																					
Entering Indoor Temperature - Degrees F, Wet Bulb																					
1227																					
1330																					
1257																					
1184																					
1110																					
Comfort + De-Humidify	SCFM	72	67	63††	57	72	67	63††	57	72	67	63††	57	72	67	63††	57	72	67	63††	57
	MBh†	58.04	52.80	49.01	45.07	55.99	50.99	47.36	44.40	52.71	48.01	44.61	41.80	49.40	45.00	41.83	39.18	46.07	41.97	39.02	36.54
	S/T‡	0.50	0.67	0.69	1.00	0.51	0.69	0.71	1.00	0.51	0.69	0.71	1.00	0.51	0.69	0.71	1.00	0.51	0.69	0.71	1.00
	AMPS*	8.48	7.06	11.55	13.26	9.89	8.45	13.27	5.97	11.43	9.97	5.97	7.16	13.08	11.63	7.17	8.48	5.80	13.39	8.46	9.91
	HI PR	335	296	436	494	384	341	494	252	432	391	252	292	490	440	292	336	256	498	335	386
LO PR	130	163	153	156	132	164	155	137	135	166	137	139	138	168	138	140	142	161	170	140	142
Efficiency	SCFM	1400																			
	MBh†	59.24	53.94	50.09	46.95	56.39	51.35	47.70	45.06	53.48	48.71	45.28	43.11	50.50	46.02	42.79	41.10	47.46	43.26	40.24	39.04
	S/T‡	0.51	0.69	0.71	1.00	0.52	0.70	0.72	1.00	0.52	0.71	0.74	1.00	0.53	0.72	0.75	1.00	0.54	0.74	0.76	1.00
	AMPS*	5.80	5.90	5.97	5.99	7.06	7.12	7.17	7.17	8.45	8.47	8.46	8.48	9.97	9.94	9.91	9.91	11.63	11.54	11.48	11.49
	HI PR	256	253	252	252	296	293	292	291	341	338	335	336	391	387	385	385	440	436	433	434
LO PR	161	147	137	133	163	149	138	136	164	150	140	138	166	152	141	141	168	153	143	144	
Maximum	SCFM	1400																			
	MBh†	56.86	53.89	50.24	47.41	56.73	51.99	48.51	46.81	53.85	49.35	46.08	44.80	50.91	46.67	43.59	42.73	47.41	43.46	40.56	39.34
	S/T‡	0.52	0.70	0.72	1.00	0.54	0.73	0.75	1.00	0.54	0.74	0.77	1.00	0.55	0.76	0.78	1.00	0.54	0.74	0.76	1.00
	AMPS*	5.80	5.90	5.97	5.99	7.06	7.12	7.17	7.17	8.45	8.47	8.46	8.48	9.97	9.94	9.91	9.91	11.63	11.54	11.48	11.49
	HI PR	259	256	254	253	302	298	296	295	349	345	342	341	400	396	393	392	455	451	447	446
LO PR	154	140	130	123	168	145	134	130	160	146	136	132	162	148	137	135	161	147	136	132	

848 Size Outdoor With FCM4X48***L Indoor Heating																				
Outdoor Ambient Temperature - Degrees F, Dry Bulb																				
7					17					27					37		47		57	
STAGE-5 Mode																				
Entering Indoor Temperature - Degrees F, Dry Bulb																				
65																				
70																				
75																				
80																				
85																				
90																				
95																				
100																				
105																				
110																				
115																				
120																				
125																				
130																				
135																				
140																				
145																				
150																				
155																				
160																				
165																				
170																				
175																				
180																				
185																				
190																				
195																				
200																				
Comfort	SCFM	600	934																	
	MBh†	22.44	20.06	20.34	34.33	33.36	32.54	39.97	40.36	39.62	45.25	45.69	46.09	50.80	51.38	51.92	35.14	34.47	34.72	
	T/R	34.81	37.55	35.44	39.09	38.16	37.15	32.28	31.87	31.42	44.04	43.45	42.83	37.11	36.67	36.19	39.76	39.15	38.50	
	AMPS*	11.88	11.31	11.18	16.09	17.34	16.65	16.53	17.65	19.30	17.78	19.00	20.25	17.90	19.22	20.59	10.73	10.16	10.96	
	HI PR	314	344	358	340	358	377	319	339	359	365	385	406	341	362	383	343	363	383	
LO PR	45	46	94	52	53	53	64	64	64	79	79	80	94	94	95	125	126	126		
Efficiency	SCFM	700	1600																	
	MBh†	22.65	22.10	20.89	35.57	35.20	34.73	40.44	40.08	39.66	46.06	45.63	45.16	51.02	50.50	49.96	35.74	35.29	34.80	
	T/R	34.81	33.73	31.80	23.64	23.35	22.98	27.44	27.13	26.79	31.91	31.54	31.15	36.11	35.67	35.20	31.55	31.09	30.59	
	AMPS*	11.88	12.05	11.86	16.26	16.86	17.40	16.82	17.47	18.12	17.46	18.17	18.88	17.95	18.70	19.46	10.39	10.93	11.48	
	HI PR	314	331	345	285	305	324	302	322	342	320	340	360	337	358	379	312	331	351	
LO PR	45	45	94	52	52	52	64	64	64	79	79	79	94	94	95	125	125	126		
Maximum	SCFM	700	1600																	
	MBh†	22.76	22.11	20.86	35.57	35.16	34.69	40.44	40.05	39.63	46.06	45.60	45.14	50.95	50.44	49.91	35.87	35.42	34.93	
	T/R	34.81	33.75	31.77	23.64	23.32	22.95	27.44	27.11	26.77	31.91	31.53	31.13	36.06	35.62	35.16	30.85	30.40	29.90	
	AMPS*	11.88	12.06	11.85	16.26	16.85	17.39	16.82	17.46	18.11	17.46	18.16	18.87	17.94	18.69	19.45	10.49	11.03	11.57	
	HI PR	314	331	345	285	305	324	302	322	342	320	340	360	337	357	379	309	329	348	
LO PR	45	45	94	52	52	52	64	64	64	79	79	79	94	94	95	125	125	126		

See Legend on page 22.

860 Size Outdoor With FCM4X60***L Stage 5 Indoor Cooling																					
Outdoor Ambient Temperature - Degrees F, Dry Bulb					85					105											
65					75					95					115#						
STAGE-5 Mode																					
Entering Indoor Temperature - Degrees F, Wet Bulb																					
1488																					
1566																					
1515																					
1440																					
1367																					
72	67	63††	57	72	67	63††	57	72	67	63††	57	72	67	63††	57						
Comfort + De-Humidify	SCFM	70.04	64.99	57.22	51.68	66.96	62.20	54.75	56.00	62.88	58.47	57.43	52.81	58.79	54.69	53.79	49.48	61.11	50.93	50.15	46.16
	MBh†	0.50	0.67	0.69	1.00	0.51	0.68	0.71	1.00	0.51	0.69	0.71	1.00	0.51	0.69	0.71	1.00	0.51	0.69	0.71	1.00
	S/T‡	19.28	17.91	19.34	19.43	21.69	20.23	21.81	17.87	24.04	22.47	19.63	19.98	26.46	24.80	21.80	22.19	23.74	27.51	24.31	24.76
	AMPS*	280	274	270	266	324	317	312	308	371	363	358	354	422	414	408	403	478	469	463	458
	HI PR	148	135	125	114	151	138	128	119	152	138	128	120	153	139	129	120	153	139	129	121
Efficiency	SCFM	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600
	MBh†	73.38	66.85	62.18	57.84	69.54	63.42	59.02	55.28	65.73	59.97	55.84	52.70	61.91	56.50	52.62	50.06	57.99	52.97	49.36	47.37
	S/T‡	0.51	0.68	0.70	1.00	0.51	0.69	0.71	1.00	0.52	0.70	0.72	1.00	0.52	0.71	0.73	1.00	0.53	0.72	0.75	1.00
	AMPS*	18.35	17.72	17.23	16.81	20.41	19.73	19.21	18.81	22.74	22.00	21.45	21.08	25.35	24.56	24.00	23.66	28.29	27.48	26.90	26.61
	HI PR	281	275	270	267	325	318	313	309	372	364	359	355	424	415	409	406	481	472	465	462
Maximum	SCFM	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600
	MBh†	73.15	66.99	62.46	58.59	70.30	64.38	60.09	57.81	65.52	60.98	56.95	55.59	62.56	57.37	53.61	52.73	57.79	53.04	49.55	47.54
	S/T‡	0.51	0.69	0.71	1.00	0.53	0.72	0.75	1.00	0.54	0.75	0.77	1.00	0.55	0.76	0.79	1.00	0.53	0.72	0.74	1.00
	AMPS*	18.53	17.91	17.44	17.08	21.54	20.89	20.40	20.17	24.35	23.68	23.18	23.04	27.01	26.33	25.83	25.74	28.19	27.53	27.06	26.81
	HI PR	276	272	269	266	321	317	313	312	370	365	361	360	423	417	414	413	478	473	470	468
LO PR	152	138	128	120	157	143	133	128	160	146	135	132	161	147	137	135	158	144	133	128	
860 Size Outdoor With FCM4X60***L Indoor Heating																					
Outdoor Ambient Temperature - Degrees F, Dry Bulb																					
7																					
17																					
27																					
37																					
47																					
57																					
STAGE-5 Mode																					
Entering Indoor Temperature - Degrees F, Dry Bulb																					
700																					
1050																					
1235																					
1415																					
1600																					
1800																					
2000																					
65	70	75	80	75	65	70	75	80	75	65	70	75	80	75							
Comfort	SCFM	29.82	29.95	30.11	51.12	52.06	52.98	55.67	57.14	57.96	64.76	65.02	65.41	73.26	73.29						
	MBh†	38.74	47.34	47.48	50.49	51.30	52.08	46.70	46.99	47.55	45.74	45.83	45.99	44.95	44.87						
	T/R	17.26	20.08	21.29	35.41	38.59	41.84	32.31	34.90	37.72	31.24	33.41	35.78	30.68	32.64						
	AMPS*	360	432	462	426	460	494	403	433	465	396	423	452	391	417						
	HI PR	42	42	89	47	47	47	59	59	59	74	74	74	89	89						
Efficiency	SCFM	840	840	840	840	840	840	840	840	840	840	840	840	840							
	MBh†	29.44	29.47	29.57	48.43	49.06	49.80	55.69	56.12	56.61	64.63	64.85	65.13	73.25	73.27						
	T/R	38.74	38.83	38.85	31.39	31.72	32.12	35.42	35.62	35.85	40.37	40.42	40.50	44.94	44.86						
	AMPS*	17.26	18.34	19.43	28.20	30.54	33.08	28.73	30.89	33.16	29.73	31.76	33.95	30.67	32.63						
	HI PR	360	387	414	333	359	387	350	375	402	370	396	423	390	417						
Maximum	SCFM	840	840	840	840	840	840	840	840	840	840	840	840	840							
	MBh†	29.35	29.35	29.38	47.92	48.49	49.23	55.43	55.81	56.11	64.57	64.75	64.93	73.88	73.72						
	T/R	38.74	38.66	38.61	29.64	29.94	30.32	31.62	31.77	31.86	34.11	34.13	34.14	36.26	36.11						
	AMPS*	17.26	18.21	19.22	27.54	29.87	32.22	27.80	29.82	31.97	28.39	30.26	32.22	29.07	30.71						
	HI PR	360	384	410	323	349	375	332	356	381	340	364	389	349	372						
LO PR	42	42	89	47	47	47	59	59	59	74	74	74	88	89							

See Legend on page 22.

**LEGEND FOR COOLING:**

- † Total capacities are net (I.D blower heat subtracted) system capacities based on 25' line set.  
If additional tubing length and/or indoor unit is located above outdoor unit, a slight variation in capacity may occur.
- \* System amps are total of indoor and outdoor amps
- ‡ S/T are based on 80 F db entering air at the indoor coil. For sensible capacities at other than 80 F db, deduct 835 Btuh per 1000 cfm of indoor coil air from MBhxS/T for each degree below 80 F, or add 835 Btuh per 1000 cfm of indoor coil air from MBhxS/T for each degree above 80 F
- †† At TVA rating indoor condition (75 F db/ 63 F wb), All other indoor air temperatures are at 80 F db
- # System runs Stage 5 Efficiency Mode for Comfort+dh Mode at 115 degrees F outdoor temperature.

**LEGEND FOR HEATING:**

- † Total capacities are net (I.D blower heat added) system capacities based on 25' line set.  
If additional tubing length and/or indoor unit is located above outdoor unit, a slight variation in capacity may occur.
- \* System amps are total of indoor and outdoor amps
- T/R - Temp Rise is based on 25' line set.  
If additional tubing length and/or indoor unit is located above outdoor unit, a slight variation in Temp Rise may occur.

## R- 410A QUICK REFERENCE GUIDE

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- Observe all **WARNINGS, CAUTIONS, NOTES**, and **bold** text.
- R- 410A refrigerant operates at 50% - 70% higher pressures than R- 22. Be sure that servicing equipment and replacement components are designed to operate with R- 410A.
- R- 410A refrigerant cylinders are rose colored.
- Recovery cylinder service pressure rating must be 400 psig, DOT 4BA400 or DOT BW400.
- R- 410A systems should be charged with liquid refrigerant. Use a commercial type metering device in the manifold hose.
- Manifold sets should be 750 psig high- side and 200 psig low- side with 520 psig low- side retard.
- Use hoses with 750 psig service pressure rating.
- Leak detectors should be designed to detect HFC refrigerant.
- R- 410A, as with other HFC refrigerants, is only compatible with POE oils.
- Vacuum pumps will not remove moisture from oil.
- Do not use liquid line filter- driers with rated working pressures less than 600 psig.
- Do not install a suction line filter- drier in liquid line.
- POE oils absorb moisture rapidly. Do not expose oil to atmosphere.
- POE oils may cause damage to certain plastics and roofing materials.
- Wrap all filter- driers and service valves with wet cloth when brazing.
- A liquid line filter- drier is required on every unit.
- Do not use with an R- 22 TXV.
- If indoor unit is equipped with an R- 22 TXV, it must be changed to an R- 410A TXV.
- Never open system to atmosphere while it is under a vacuum.
- When system must be opened for service, break vacuum with dry nitrogen and replace all filter- driers.
- Do not vent R- 410A into the atmosphere.
- Do not use capillary tube indoor coils.



Use of the AHRI Certified TM Mark indicates a manufacturer's participation in the program. For verification of certification for individual products, go to [www.ahridirectory.org](http://www.ahridirectory.org).



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