

# CVA9, HVA9, TVA9

## R-410A Variable Speed Split System Air Conditioner

### Installation Instructions

**NOTE:** Read the entire instruction manual before starting the 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 CVA9, HVA9, TVA9 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.

**Table 1 – Indoor Thermostat Control Options**

Model	Ion™ Wall Control	Standard Thermostat
CVA9, HVA9, TVA9	Yes	Yes*

NOTE: SYST0101CW Communicating Wi-Fi wall control.

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

\* Using standard 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.

## 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.

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 ([Check Charge on p7](#)) for proper charging procedure.

**IMPORTANT:** Liquid-line size is 3/8-in. OD for all CVA9, HVA9, TVA9 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.

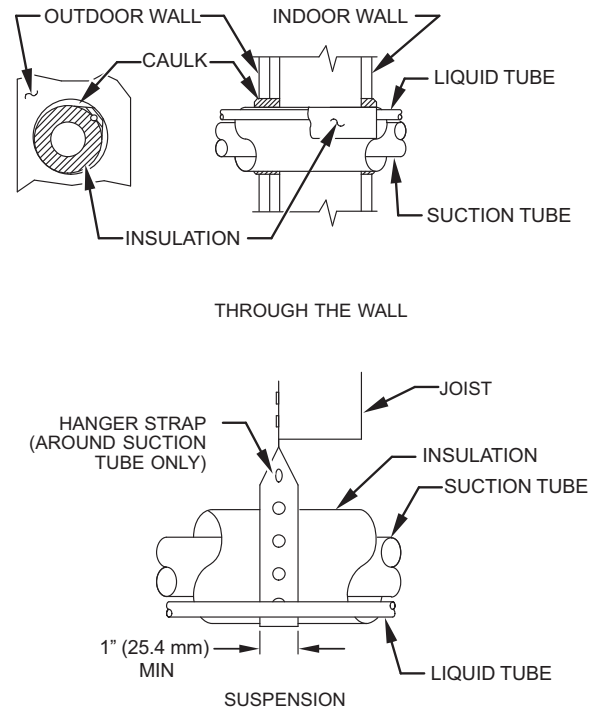


Fig. 1 – Connecting Tubing Installation

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## 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.

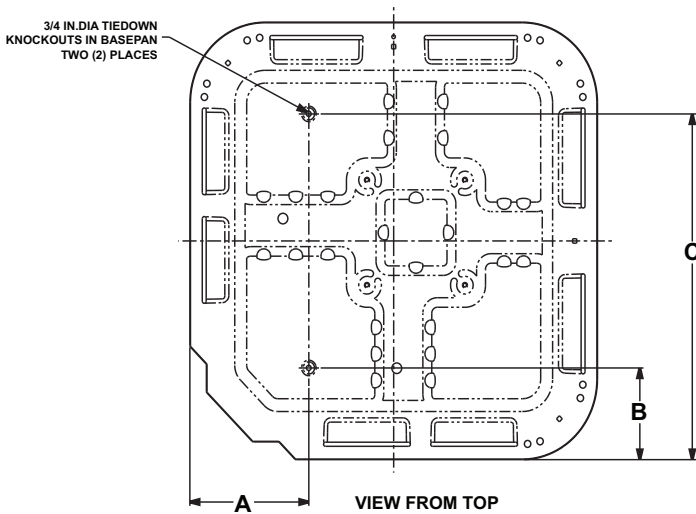
Roof mounted units exposed to winds above 5 mph may require wind baffles. Consult the Service Manual - Residential Split System Air Conditioners and Heat Pumps Using R-410A Refrigerant for wind baffle construction.

**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)
35 X 35 (889 X 889)	9-1/8 (232)	6-9/16 (167)	28-7/16 (722)

**Fig. 2 – Tie-down Knockout Locations**

**Step 4 – Operating Ambient**

The minimum outdoor operating ambient is 40°F (4.4°C) with Ion™ Wall Control, 55°F (12.8°C) with non-communicating systems. The maximum outdoor operating ambient is 115°F (46.1°C). Compressor protections will prevent 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.

**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 CVA9, HVA9, TVA9 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 2** 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 2 – Refrigerant Connections and Recommended Liquid and Vapor Tube Diameters (in.)**

CVA9, HVA9, TVA9	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, 49	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:

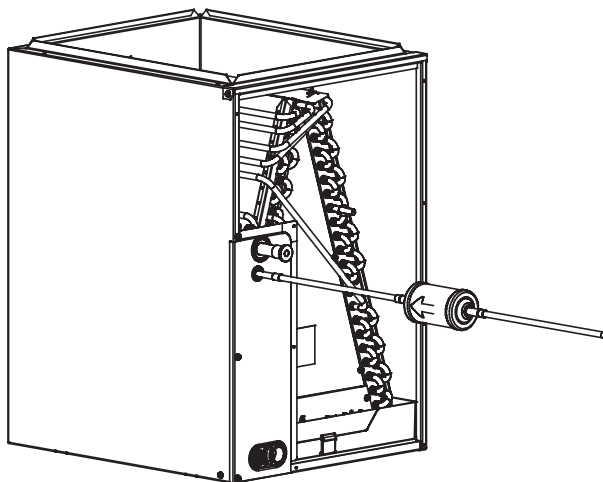
1. Braze 5-in. (127 mm) liquid tube to the indoor coil.
2. Wrap filter drier with damp cloth.
3. Braze filter drier to above 5-in. (127 mm) liquid tube.
4. Connect and braze liquid refrigerant tube to the filter drier.

**! 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 2).

**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**

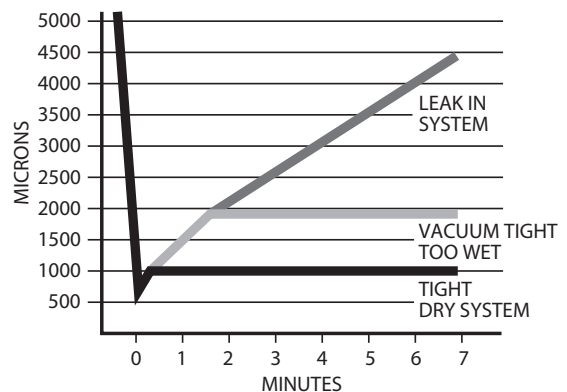
Failure to follow this caution may result in equipment damage or improper operation.

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 (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.

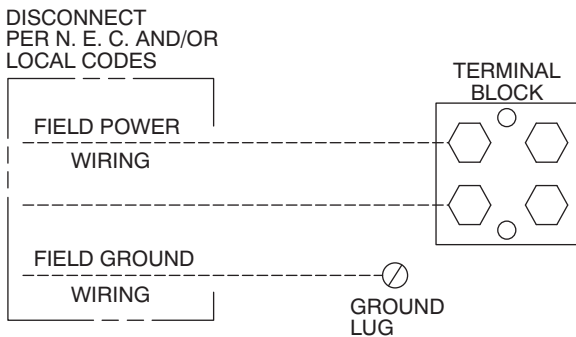


Fig. 5 – Line Power Connections

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**Ion™ Control Wiring - Ion™ Wall**

Connect all four wires from Ion™ to communicating furnace / fan coil with communicating motor capability. Only two wires from furnace / fan coil DX+ (GR), DX- (YL) are connected to the outside inverter wiring GR (DX+), YL (DX-) (see Fig. 6). Connect C (WT) is recommended if wires are available. This will reduce the chance of communication issues. Unused low voltage wires should be bundled together and

terminated with a wire nut at each end. The end nearest indoor coil should be connected to C terminal.

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

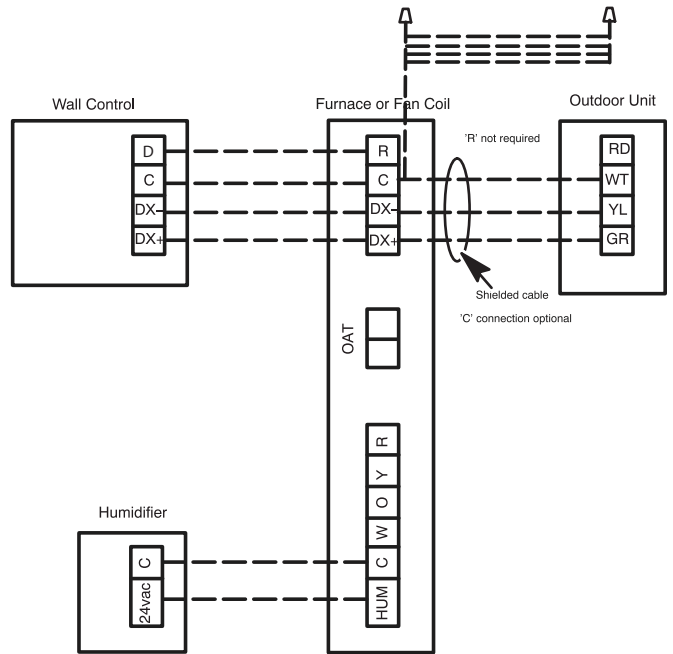


Fig. 6 – Communicating Furnace or Fan Coil Wiring with Communicating Variable Speed AC

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**Connect Control Wiring- Non-Communicating**

4 wires are required when connecting CVA9, HVA9, TVA9 models to non-communicating 2-stage thermostats. Use Fig. 7 For required connections. Unit is configured by factory for Ion™ communicating control. To wire unit for non-communicating control, disconnect the DX+ = GN and DX- = YL 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 harness.

**General Information**

Use 18-20 solid AWG color-coded, insulated (355C minimum) wire for low voltage control wires. All wiring must be NEC Class 2 and must be separated from incoming power leads.

Installations using greater than 200 feet of low voltage wiring should consult the Ion™ wall control manual for additional guidelines regarding daisy chaining wiring method and terminating resistors.

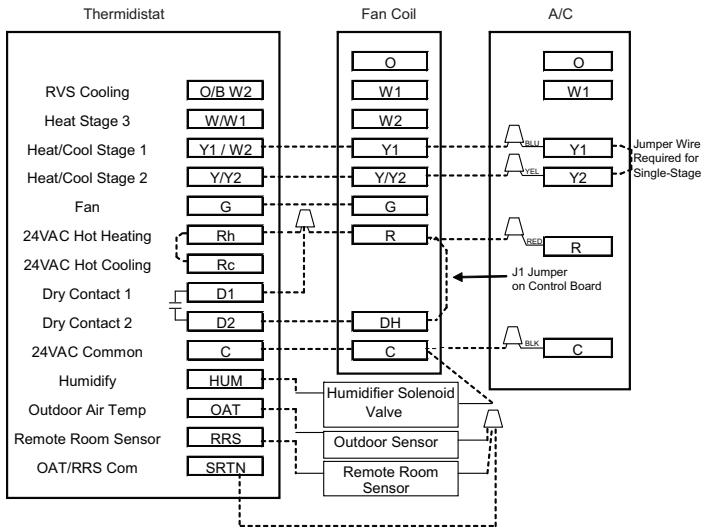
Never route control wiring in parallel to high voltage power wires when possible as electrical noise may transfer and generate nuisance fault codes. Where low voltage control and high voltage wires must cross paths, do so at perpendicular angles to eliminate transferred noise. If further communication issues exist, consider using shielded low voltage wires and only connect shielding to C terminal at end nearest indoor coil.

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.

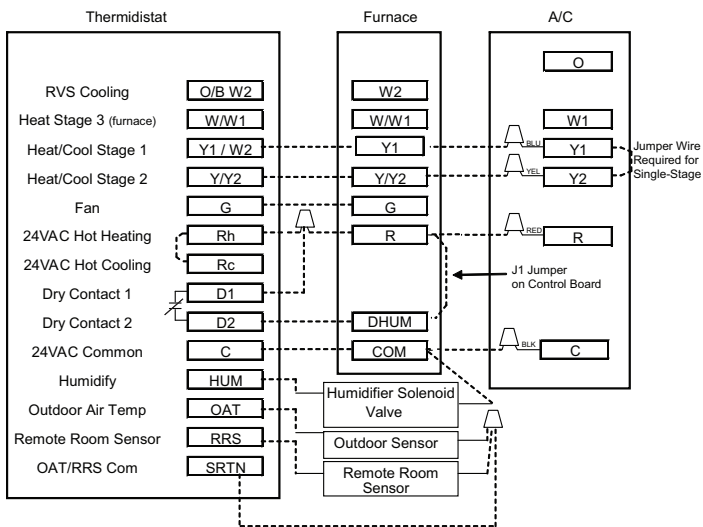
**Final Wiring Check**

**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. Ensure that high and low voltage is separated where possible, to minimize induced noise from VFD to communication wiring.





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A160118

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

**Airflow Setup for Ion™ Furnace or FCM4X Fan Coil (communicating)**

This system can only be installed with communicating indoor and Ion™ Wall Control SYST0101CW. When using a Ion™ Wall Control, airflow is automatically selected based on equipment size. The user has the option of selecting Comfort, Efficiency and Max airflow for Cooling modes. These should be selected based on balance between the homeowner’s comfort and energy consumption expectations. See Ion™ 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 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.

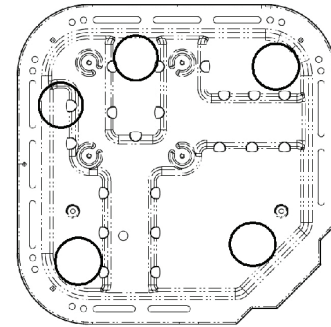


Fig. 8 – Recommended Support Feet Location (for 23 x 23 base pans)

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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 CVA9, HVA9, TVA9 models utilize either Ion™ Wall Communicating Wall Control or conventional 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 Ion™ Wall Control displays the operation mode and fault codes as specified in the troubleshooting section. See [Table 7](#) 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, R and C. Depending on thermostat and indoor unit, the system will operate at 1 or 2 capacities in 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 Ion™ Wall Control.

Upon a call for cooling through the Ion™ Wall Control (or the Y1 and/or Y2 connections in a non-communicating system), the Application Operation Control (AOC) board (see [Fig. 17](#)) will request a compressor speed and outdoor fan motor speed based on the indoor space demand and outdoor conditions.

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 nameplate for compressor LRA will be stamped N/A (not applicable).

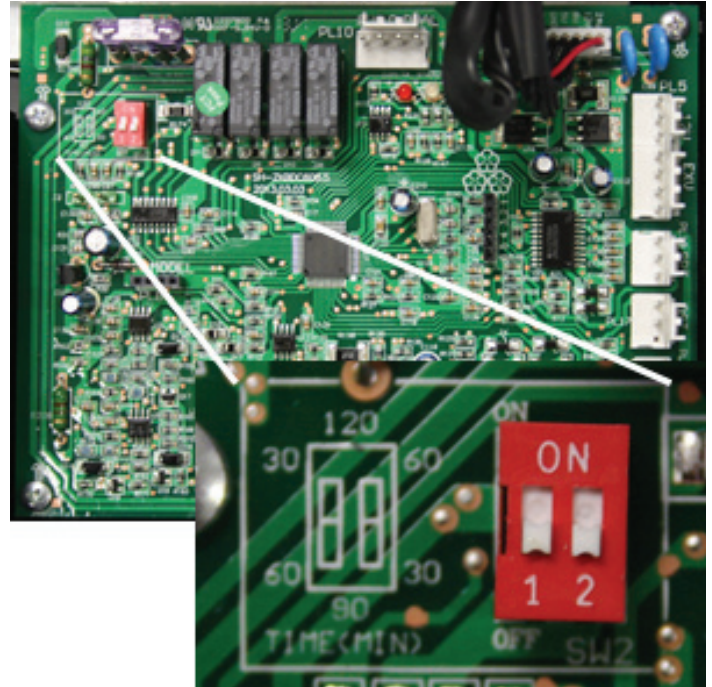
During operation, the AOC monitors itself and the compressor operation along with the system pressures and temperatures. The MOC board monitors the temperature, current and operational status of the compressor, OD fan and the inverter itself. During operation, the compressor speed will be adjusted to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

### Outdoor Fan Motor Operation

The compact ECM outdoor fan motor is a variable-speed brushless DC (BLDC) motor that operates at speeds from 400 to 1050 RPM. The motor is a 3-phase permanent magnet-type motor. Just like the compressor, this motor speed is determined by the inverter output frequency and amplitude ([Fig. 9](#)).

Motor speed is controlled through the inverter board in the outdoor unit and no electronic module is attached. Motor speed is slowed as the building load decreases, maintaining the proper condensing temperature for both cooling and dehumidification. As the building load increases, the motor will increase speed until it is at maximum speed at the maximum building load.

At unit start-up, there is a slight delay and thrust motion of the fan motor/blade in the reverse direction, prior to ramping-up the fan assembly.



**Fig. 9 – AOC Control Board**

A14021

### 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. If using conventional 2-stage thermostat, use multi-meter to verify that 24VAC 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](#) through [Fig. 16](#) 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 3. 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.

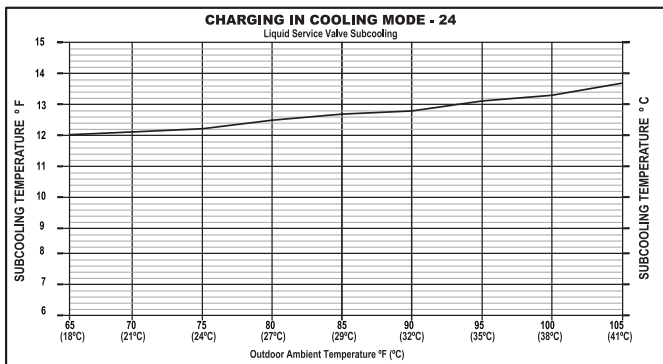
**Table 3 – Required Charge (values in lbs.)  
Adjustment for Indoor Coil Model**

Furnace Coil or Fan Coil Model	24	25	36	37	48	49	60
EA*4X24	-	-	/	/	/	/	/
EHD4X24	-	-	/	/	/	/	/
EHD4X30	-	-	/	/	/	/	/
F(V,C)M4X24	/	-	-	/	/	/	/
EA*4X30	-	-	/	/	/	/	/
EN(A,D)4X30	-	-	/	/	/	/	/
ENH4X36	-	-	-	-	/	/	/
F(V,C)M4X36	/	-	-	-	/	/	/
EA*4X36	-	+0.50	-	-	/	/	/
END4X42	+0.50	+0.50	-	+0.75	/	/	/
EA*4X42	+0.50	+0.50	-	+0.75	/	/	/
EHD4X36	+0.50	+0.50	-	+0.75	/	/	/
EHD4X42	+0.50	+0.50	+0.75	+0.75	/	/	/
EN(A,D)4X31	+0.50	+1.25	+0.75	+0.75	/	/	/
EN*4X48	+0.50	+1.25	+0.75	+0.75	-	-	/
EHD4X48	+0.63	+1.25	+0.75	+1.00	-	-	/
EN(A,D)4X37	+0.63	+1.25	+0.75	+1.00	-	-	/
EN(A,D)4X43	+0.63	+1.25	+0.75	+1.00	-	-	/
EA*4X48	/	/	+0.75	+1.00	-	-	/
EN*4X60	/	/	/	+1.00	-	+0.13	-
EHD4X60	/	/	/	+1.00	-	+0.13	-
F(V,C)M4X48	.63	+1.25	+0.75	+1.00	-	+0.13	/
F(V,C)M4X60	/	/	+0.75	+1.00	+1.50	+0.63	+1.00
EA*4X60	/	/	/	/	+1.50	+0.63	+1.00
EN*4X61	/	/	/	/	+1.50	+0.63	+1.00

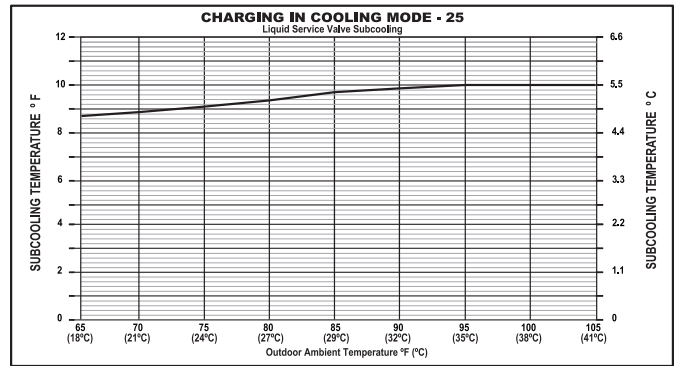
/ = Comb. not allowed

- = No charge adjust for ID

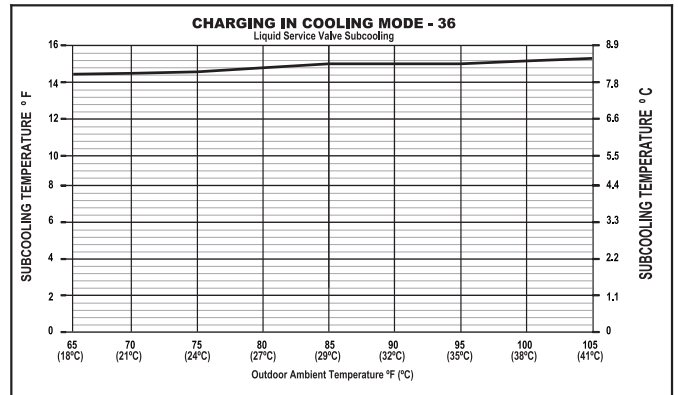
Note: Charge adders are in decimal format



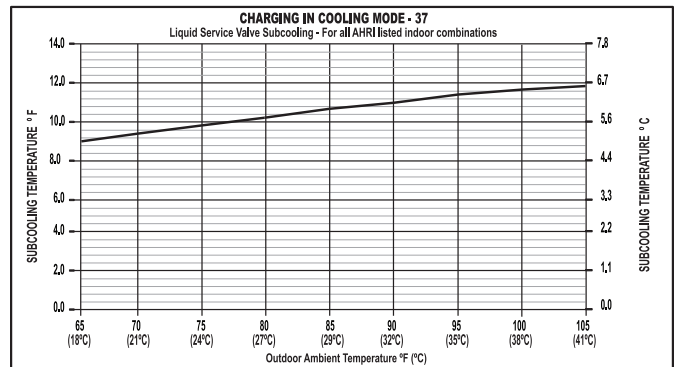
**Fig. 10 – Charging in Cooling Mode CVA9, HVA9, TVA924**



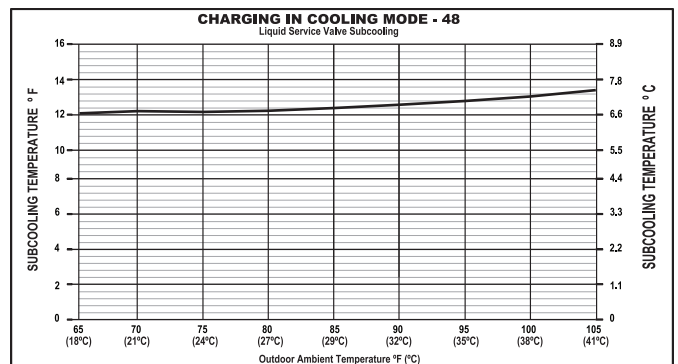
**Fig. 11 – Charging in Cooling Mode CVA9, HVA9, TVA925**



**Fig. 12 – Charging in Cooling Mode CVA9, HVA9, TVA936**



**Fig. 13 – Charging in Cooling Mode CVA9, HVA9, TVA937**



**Fig. 14 – Charging in Cooling Mode CVA9, HVA9, TVA948**



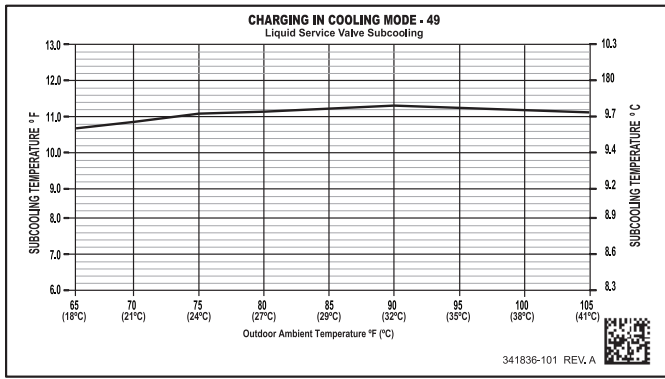


Fig. 15 – Charging in Cooling Mode CVA9, HVA9, TVA9<sup>A200131</sup>

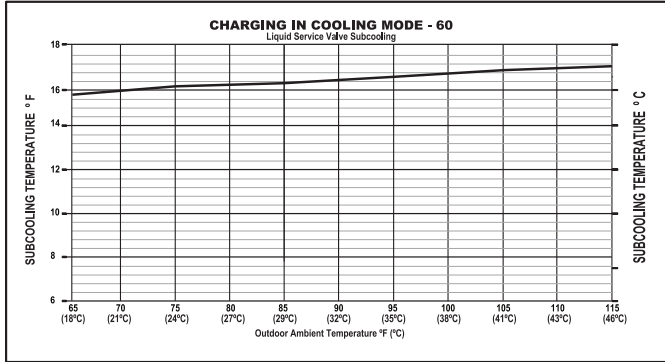


Fig. 16 – Charging in Cooling Mode CVA9, HVA9, TVA9<sup>A200132</sup>

**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**

Because this system has an inverter controlled compressor, suction pressure transducer, conventional procedure cannot be used to “pump down” and isolate the refrigerant into the outdoor unit.

1. Connect gauges to CVA9, HVA9, TVA9 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 outdoor 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 CVA9, HVA9, TVA9**

1. Connect gauges to CVA9, HVA9, TVA9 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.
2. Begin evacuation or refrigerant. Allow extra time for refrigerant recovery and establishing a thorough evacuation.

**Major Components**

**Variable Speed Control Board**



Fig. 17 – AOC (Application Operational Control) Board<sup>A160120</sup>

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

- Compressor speed control
- Outdoor fan motor control
- Crankcase heater operation
- Pressure switch monitoring
- Time Delays
- Pressure Transducer measurements
- PEV control (pressure equalizer valve)
- Temperature measurements
- 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 Ion™ Wall Control or a standard 2-stage thermostat. Ion™ Wall Control will utilize 5 stages cooling, while 2-stage thermostat will only allow 2 discrete stages of 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.



### **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.

## **Field control Connections**

For communicating operation use the communication Ion™ plug only. D, C, DX+, DX- (GN,YL), are required (see Fig. 6). If using standard 2-stage thermostat, connect discrete inputs (R,C,Y2,Y1) for 2-stage control in 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, and lubrication management.

## **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 Ion™ Wall Control, the green LED will go out. Check the wiring to the Ion™ Wall Control 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.

When installing AC unit with older fan coils, a model plug change may be required.

**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 4 – Factory Supplied Model Plug Information**

CVA9, HVA9, TVA9	FAST PART Number	Pin Resistance (K-ohms)	
		1-4 (R1)	2-3 (R2)
24	1184942	18K	91K
25	1188023	18K	5.1K
36	1184944	18K	150K
37	1188024	18K	18K
48	1184946	18K	220K
49	1188025	18K	33K
60	1184948	18K	360K

## **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 7).
2. After a 6 minute delay, if there is a call for cooling 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. The staging down and resetting to the highest stage will end after 2 hours of accumulated operation without further HPS trips.
3. A system malfunction will occur after repeated HPS faults and the stages has reached the lowest level. This could take five consecutive HPS trips if the first occurred in stage 5 demand or 1 HPS trip if in stage 1 demand.
4. 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.
5. In the event of a low-pressure trip or low-pressure lockout, check the refrigerant charge and indoor airflow (cooling).

## **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 7).

## **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 demand, the appropriate fault code is displayed on Wall Control (communicating only – see Table 7). If system is configured with conventional 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**

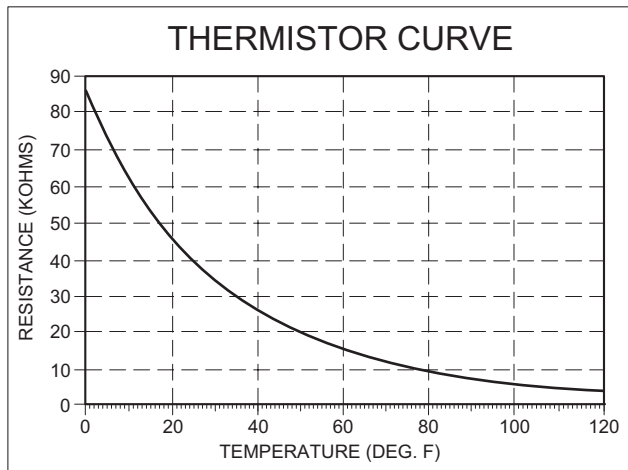
Thermistors are electronic devices which sense temperature. As the temperature increases, the resistance decreases. 10Kohm thermistors are used to sense outdoor air temperature (OAT), coil temperature (OCT)

and the suction line temperature (OST) located between the reversing valve and the accumulator. A 50Kohm thermistor is used to sense discharge temperature (ODT).

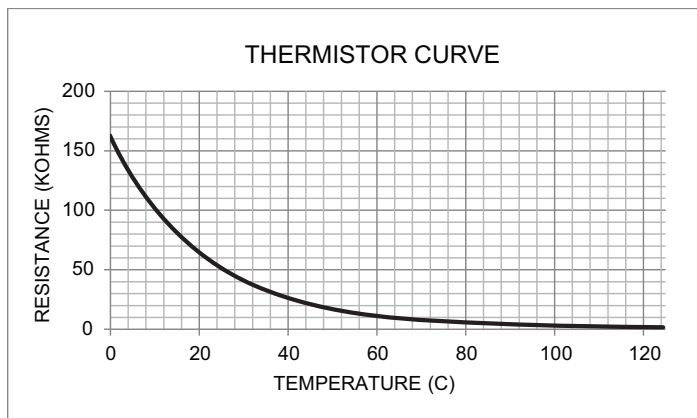
Refer to Table 5 and Fig. 18 and Fig. 19 for resistance values versus temperature.

**Table 5 – 10K/50Kohm Resistance Values vs Temperature**

10Kohms °C (°F)	
TEMPERATURE	RESISTANCE (Kohms)
25.0 (77.0)	10.0 +/- 2.3%
0.0 (32.0)	32.6 +/- 3.2%
-28.0 (-18.4)	85.5 +/- 3.4%
50Kohms	
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. 18 – 10K Thermistor Resistance Versus Temperature** <sup>A91431</sup>



**Fig. 19 – 50K Thermistor Resistance Versus Temperature** <sup>A14022</sup>

If the outdoor air or coil thermistor should fail, the control will flash the appropriate fault code (see Table 7).

**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. 20, Fig. 21, Fig. 22 and Fig. 23).

**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:

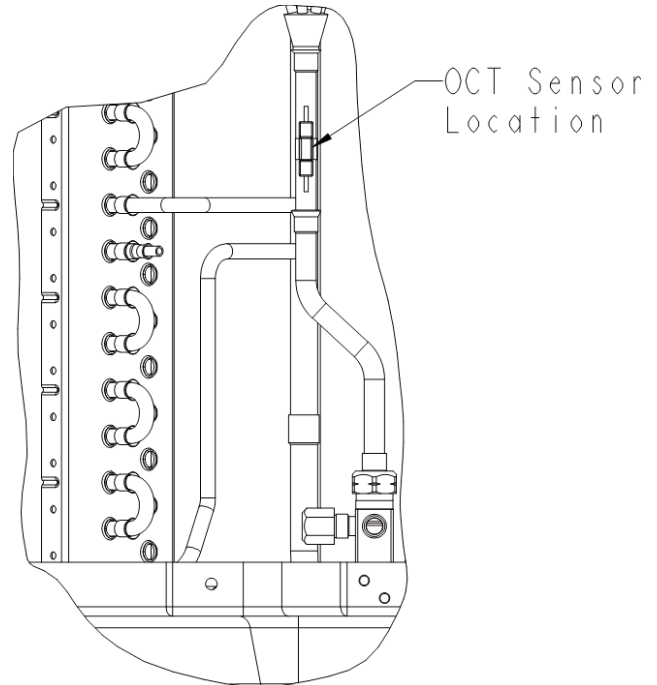
- SIn cooling if the outdoor air sensor indicates <sup>3</sup> 10\_F (<sup>3</sup> 5.6\_C) warmer than the coil sensor (or) the outdoor air sensor indicates <sup>3</sup> 25\_F (<sup>3</sup> 12\_C) cooler than the coil sensor, the sensors are out of range.

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.

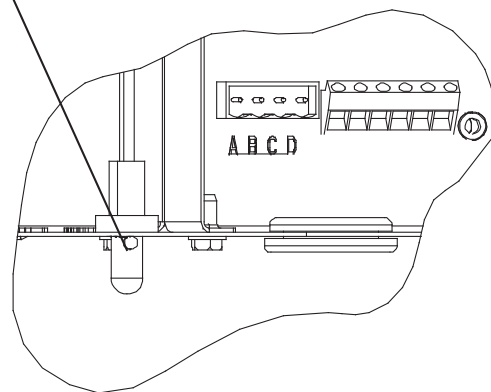
**Outdoor Coil Thermistor**

The outdoor coil thermistor is a 10Kohm resistor used for multiple system operations. It provides the coil/liquid line temperature to the AC unit board and Ion™ Wall Control. Low ambient operation, and assistance with OAT temperature measurement are some of the functions. The sensor must be securely mounted to the tube connecting the coil and distributor. See Fig. 21 for proper placement. See Table 4 for proper resistances.



**Fig. 20 – Outdoor Coil Thermistor (OCT) Attachment (On Distributor Tube)** <sup>A14328</sup>

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



**Fig. 21 – OAT Thermistor Location (Bottom of Control Box)** <sup>A11142</sup>

**Suction Thermistor (OST)**

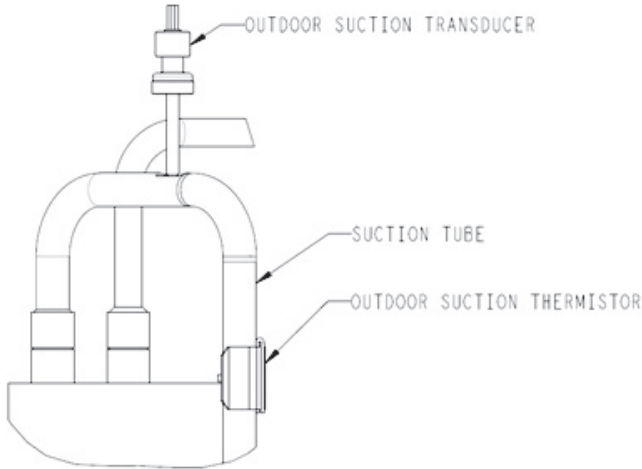
Suction Thermistor is used to accurately measure suction temperature and must be secured on the suction tube and aligned longitudinally to the vertical surface of the tube axis (see Fig. 22).

**! 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.

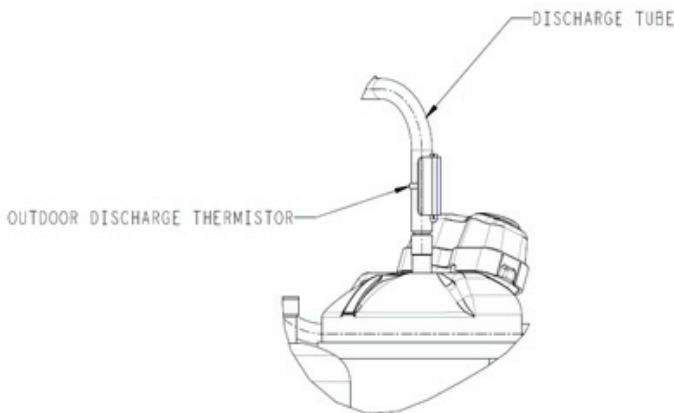


**Fig. 22 – Suction Thermistor (OST) Attachment (On Suction Tube)**

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. 23). Maximum ODT is approximately 240 F° (116 C°).



**Fig. 23 – 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 6 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 6.
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 6 – Variable Speed Compressor Resistance (winding resistance at 70\_F? 20\_F)**

WINDING	MODEL CVA9, HVA9, TVA9 (OHMS)				
	24	25	36	37, 48	49, 60
Between terminals	1.13	.59	.59	.37	.24
Between terminal & ground	>1 mega				

**! 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:

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

Fan Motor Resistance	
Unit Size	Resistance (Ohms)
24	21.2
25, 36, 37, 48, 49, 60	11.1



**Status Codes**

**NOTICE**

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 7 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 Ion™ Wall Control.

**EXAMPLE:**

3 short flashes followed by 2 long flashes indicates a 32 code. Table 7 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.

**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.

**Table 7 – 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 Cutback	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.

342865-101 REV. A



# Technical Labels

		924 Size Outdoor With FCM4X24***L Stage 5 Indoor Cooling																													
		Outdoor Ambient Temperature - Degrees F, Dry Bulb																													
		65					75					85					95					105					115#				
		Entering Indoor Temperature - Degrees F, Wet Bulb																													
STAGE-5 Mode		72	67	63††	57	72	67	63††	57	72	67	63††	57	72	67	63††	57	72	67	63††	57	72	67	63††	57						
Comfort + De-Humidity	SCFM	708				663				634				608				642													
	MBh†	30.22	27.45	25.48	23.97	28.48	25.86	24.00	22.54	26.87	24.40	22.64	21.29	25.27	22.96	21.31	20.08	24.17	21.96	20.38	19.56										
	S/T‡	0.52	0.70	0.73	1.00	0.52	0.70	0.72	1.00	0.52	0.70	0.72	1.00	0.52	0.70	0.73	1.00	0.54	0.73	0.75	1.00										
	AMPS*	5.78	5.82	5.85	5.88	6.85	6.86	6.85	6.84	7.99	7.95	7.92	7.88	9.22	9.13	9.05	8.99	10.63	10.50	10.40	10.34										
	HI PR	256	251	248	246	293	289	285	283	335	330	327	324	382	376	372	369	428	422	418	417										
LO PR	155	141	131	124	155	141	131	124	156	142	132	124	157	143	133	125	160	146	136	131											
Efficiency	SCFM	825				825				825				825				825													
	MBh†	30.94	28.12	26.11	25.17	29.44	26.76	24.85	24.16	27.93	25.39	23.58	23.12	26.39	24.00	22.29	22.07	24.96	22.69	21.07	21.05	23.36	21.24	19.74	19.93						
	S/T‡	0.54	0.73	0.76	1.00	0.55	0.75	0.77	1.00	0.55	0.76	0.79	1.00	0.56	0.78	0.80	1.00	0.57	0.80	0.82	1.00	0.59	0.82	0.85	1.00						
	AMPS*	5.94	5.99	6.02	6.04	7.08	7.09	7.09	7.08	8.29	8.25	8.22	8.21	9.57	9.49	9.41	9.41	10.95	10.83	10.73	10.73	12.40	12.22	12.08	12.10						
	HI PR	257	252	249	248	296	291	287	286	338	333	329	328	385	379	375	374	431	425	421	421	487	480	475	476						
LO PR	159	145	135	131	161	147	137	133	163	149	138	136	165	151	140	139	166	152	142	142	169	154	144	145							
Maximum	SCFM	848				840				833				825				825													
	MBh†	30.58	27.95	26.04	25.26	29.18	26.66	24.83	24.23	27.74	25.35	23.61	23.18	26.26	24.00	22.35	22.12	24.91	22.73	21.15	21.11	23.41	21.35	19.87	20.04						
	S/T‡	0.55	0.74	0.77	1.00	0.55	0.75	0.78	1.00	0.56	0.77	0.79	1.00	0.56	0.78	0.80	1.00	0.57	0.80	0.82	1.00	0.59	0.82	0.84	1.00						
	AMPS*	5.83	5.92	5.97	5.98	6.99	7.04	7.07	7.07	8.22	8.23	8.23	8.23	9.53	9.49	9.45	9.44	10.92	10.85	10.79	10.78	12.42	12.29	12.19	12.21						
	HI PR	256	252	249	247	295	291	288	287	338	334	331	330	385	381	378	378	432	428	425	425	490	485	482	482						
LO PR	160	146	136	132	162	148	137	134	163	149	139	137	165	151	140	139	167	152	142	142	168	154	143	145							

		925 Size Outdoor With FCM4X48***L Stage 5 Indoor Cooling																													
		Outdoor Ambient Temperature - Degrees F, Dry Bulb																													
		65					75					85					95					105					115#				
		Entering Indoor Temperature - Degrees F, Wet Bulb																													
STAGE-5 Mode		72	67	63††	57	72	67	63††	57	72	67	63††	57	72	67	63††	57	72	67	63††	57	72	67	63††	57						
Comfort + De-Humidity	SCFM	708				663				634				608				608													
	MBh†	29.49	26.97	25.13	23.77	27.98	25.56	23.79	22.41	26.55	24.24	22.54	21.23	25.12	22.91	21.29	20.08	19.12	17.42	16.21	16.12										
	S/T‡	0.52	0.70	0.73	1.00	0.52	0.70	0.72	1.00	0.52	0.70	0.72	1.00	0.52	0.70	0.73	1.00	0.57	0.79	0.81	1.00										
	AMPS*	4.64	4.90	5.08	5.18	5.79	5.99	6.12	6.19	6.97	7.10	7.18	7.21	8.15	8.23	8.26	8.26	7.02	7.10	7.14	7.14										
	HI PR	237	234	232	231	276	273	271	269	319	315	313	311	365	362	360	358	396	394	392	392										
LO PR	160	145	134	127	159	145	134	126	159	145	134	126	160	145	134	127	170	155	144	144											
Efficiency	SCFM	825				825				825				825				825													
	MBh†	30.15	27.61	25.77	25.00	28.89	26.45	24.67	24.09	27.59	25.24	23.54	23.15	26.25	24.00	22.38	22.18	24.94	22.78	21.22	21.20	23.52	21.46	19.97	20.15						
	S/T‡	0.54	0.74	0.77	1.00	0.55	0.75	0.78	1.00	0.56	0.77	0.79	1.00	0.57	0.78	0.80	1.00	0.57	0.80	0.82	1.00	0.59	0.82	0.84	1.00						
	AMPS*	4.64	4.92	5.11	5.16	5.82	6.03	6.17	6.20	7.02	7.17	7.27	7.28	8.24	8.35	8.40	8.39	9.56	9.61	9.64	9.63	10.87	10.85	10.83	10.83						
	HI PR	241	238	235	234	280	276	274	273	323	319	316	316	369	366	363	363	416	413	411	411	472	469	467	467						
LO PR	164	150	138	135	166	151	140	137	167	152	141	139	169	154	143	142	170	155	144	145	172	157	146	148							
Maximum	SCFM	840				850				850				825				825													
	MBh†	30.29	27.73	25.87	25.16	29.06	26.59	24.81	24.33	27.75	25.38	23.67	23.38	26.30	24.04	22.40	22.20	24.99	22.81	21.24	21.22	23.56	21.49	19.99	20.17						
	S/T‡	0.55	0.75	0.77	1.00	0.56	0.76	0.78	1.00	0.56	0.77	0.80	1.00	0.57	0.78	0.80	1.00	0.57	0.80	0.82	1.00	0.58	0.82	0.84	1.00						
	AMPS*	4.65	4.93	5.12	5.17	5.84	6.05	6.19	6.22	7.04	7.20	7.30	7.30	8.25	8.36	8.41	8.41	9.58	9.63	9.65	9.64	10.88	10.87	10.84	10.84						
	HI PR	242	238	236	235	281	277	274	274	323	320	317	317	370	367	364	364	417	413	411	411	473	470	468	468						
LO PR	165	150	139	135	167	152	140	138	168	153	142	141	170	155	143	143	170	155	144	145	172	157	146	148							

Manufacturer reserves the right to change, at any time, specifications and designs without notice and without obligations.

		936 Size Outdoor With FCM4X48***L Stage 5 Indoor Cooling																							
		Outdoor Ambient Temperature - Degrees F, Dry Bulb																							
		65	75				85				95				105				115#						
		Entering Indoor Temperature - Degrees F, Wet Bulb																							
STAGE-5 Mode		72	67	63††	57	72	67	63††	57	72	67	63††	57	72	67	63††	57	72	67	63††	57				
Comfort + De-Humidity	SCFM	948				887				848				812				812							
	MBh†	43.26	39.72	37.11	34.42	40.98	37.60	35.10	32.41	38.82	35.61	33.23	30.66	36.65	33.60	31.34	28.95	34.90	31.95	29.78	27.71				
	S/T‡	0.51	0.68	0.70	1.00	0.51	0.67	0.70	1.00	0.51	0.67	0.70	1.00	0.51	0.67	0.70	1.00	0.52	0.68	0.71	1.00				
	AMPS*	8.54	8.70	8.80	8.87	10.31	10.38	10.42	10.42	12.21	12.20	12.17	12.10	14.26	14.14	14.04	13.90	16.49	16.32	16.16	15.99				
	HI PR	263	259	256	254	304	300	297	294	350	345	342	338	400	395	391	388	447	442	438	435				
LO PR	152	138	128	118	152	138	128	117	152	138	128	118	153	139	128	118	155	141	130	121					
Efficiency	SCFM	1050				1050				1050				1050				1050							
	MBh†	43.98	40.39	37.79	35.64	42.08	38.66	36.17	34.31	40.10	36.86	34.48	32.95	38.09	35.00	32.74	31.53	36.21	33.23	31.07	30.14	34.04	31.25	29.21	28.61
	S/T‡	0.52	0.70	0.72	1.00	0.53	0.71	0.73	1.00	0.53	0.72	0.74	1.00	0.54	0.73	0.75	1.00	0.55	0.74	0.77	1.00	0.56	0.76	0.78	1.00
	AMPS*	8.60	8.76	8.87	8.93	10.46	10.54	10.59	10.60	12.45	12.45	12.44	12.41	14.59	14.49	14.40	14.34	16.86	16.71	16.57	16.50	19.29	19.04	18.84	18.77
	HI PR	264	260	257	255	306	301	298	296	352	347	344	342	403	397	394	392	449	444	441	439	510	504	501	500
LO PR	156	142	131	123	157	143	133	126	159	145	134	128	161	146	136	131	162	148	137	134	164	150	139	137	
Maximum	SCFM	1080				1200				1200				1200				1050				1050			
	MBh†	43.97	40.42	37.85	35.88	42.57	39.17	36.72	35.61	40.53	37.31	34.98	34.15	38.43	35.39	33.18	32.64	36.05	33.12	30.99	30.09	33.89	31.14	29.14	28.55
	S/T‡	0.53	0.71	0.73	1.00	0.55	0.74	0.77	1.00	0.55	0.76	0.78	1.00	0.56	0.77	0.79	1.00	0.55	0.74	0.77	1.00	0.56	0.76	0.78	1.00
	AMPS*	8.60	8.76	8.87	8.92	10.61	10.71	10.77	10.77	12.64	12.64	12.64	12.62	14.79	14.71	14.63	14.60	16.81	16.66	16.52	16.45	19.23	18.98	18.78	18.71
	HI PR	263	259	256	254	306	302	298	297	352	347	344	342	403	397	393	392	448	442	439	437	508	502	499	497
LO PR	157	143	132	125	161	147	136	132	163	148	138	135	165	150	139	137	163	148	137	134	165	150	139	137	

		937 Size Outdoor With FCM4X60***L Stage 5 Indoor Cooling																							
		Outdoor Ambient Temperature - Degrees F, Dry Bulb																							
		65	75				85				95				105				115#						
		Entering Indoor Temperature - Degrees F, Wet Bulb																							
STAGE-5 Mode		72	67	63††	57	72	67	63††	57	72	67	63††	57	72	67	63††	57	72	67	63††	57				
Comfort + De-Humidity	SCFM	990				953				902				812				812							
	MBh†	43.10	39.20	36.40	34.29	40.72	37.05	34.42	32.45	38.22	34.78	32.32	30.44	35.42	32.21	29.92	27.94	33.51	30.47	28.29	26.63				
	S/T‡	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				
	AMPS*	6.55	6.66	6.74	6.80	7.88	7.94	7.98	8.00	9.35	9.35	9.35	9.34	10.93	10.89	10.84	10.78	12.88	12.80	12.73	12.67				
	HI PR	239	236	234	233	276	273	271	269	318	314	311	309	362	358	355	353	407	403	401	399				
LO PR	158	144	134	126	158	144	134	127	158	144	134	126	157	143	133	124	159	145	135	127					
Efficiency	SCFM	1050				1050				1050				1050				1050							
	MBh†	43.48	39.55	36.75	34.96	41.32	37.59	34.94	33.49	39.14	35.61	33.12	32.00	36.91	33.60	31.25	30.45	34.86	31.71	29.48	28.98	32.58	31.43	27.56	27.36
	S/T‡	0.53	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	0.56	0.77	0.79	1.00	0.57	0.76	0.81	1.00
	AMPS*	6.68	6.79	6.88	6.93	8.09	8.15	8.19	8.21	9.61	9.63	9.63	9.62	11.27	11.24	11.20	11.18	13.24	13.17	13.11	13.10	15.18	13.38	14.94	14.94
	HI PR	239	236	234	233	277	274	271	270	319	315	312	311	365	361	357	357	409	405	403	402	464	399	457	456
LO PR	160	146	135	129	161	147	137	131	163	149	138	134	165	151	140	137	166	152	141	139	168	152	143	143	
Maximum	SCFM	1080				1200				1200				1200				1050				1050			
	MBh†	43.11	39.40	36.72	35.16	41.64	38.08	35.51	34.83	39.55	36.14	33.70	33.29	37.40	34.16	31.85	31.71	34.80	31.73	29.54	29.02	32.60	29.71	27.66	27.43
	S/T‡	0.53	0.72	0.75	1.00	0.56	0.76	0.79	1.00	0.56	0.78	0.80	1.00	0.57	0.79	0.82	1.00	0.56	0.77	0.79	1.00	0.57	0.78	0.81	1.00
	AMPS*	6.49	6.62	6.70	6.74	8.11	8.20	8.26	8.26	9.68	9.74	9.76	9.75	11.39	11.40	11.39	11.39	13.10	13.07	13.03	13.01	15.08	14.98	14.90	14.88
	HI PR	235	232	230	229	275	272	269	269	317	314	312	312	364	361	359	359	408	405	403	403	464	460	459	458
LO PR	161	147	136	131	165	151	140	138	167	152	142	140	168	154	143	143	166	152	141	139	168	154	143	142	

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		948 Size Outdoor With FCM4X60***L Stage 5 Indoor Cooling																													
		Outdoor Ambient Temperature - Degrees F, Dry Bulb																													
		65					75					85					95					105					115#				
		Entering Indoor Temperature - Degrees F, Wet Bulb																													
STAGE-5 Mode		72	67	63††	57	72	67	63††	57	72	67	63††	57	72	67	63††	57	72	67	63††	57	72	67	63††	57						
Comfort + De-Humidify	SCFM	1227				1330				1247				1184				1110													
	MBh†	58.25	53.26	49.62	45.76	56.25	51.47	47.99	45.10	52.90	48.38	45.08	42.24	49.62	45.38	42.27	39.58	46.26	42.29	39.38	36.80										
	S/T‡	0.51	0.67	0.70	1.00	0.52	0.70	0.72	1.00	0.52	0.69	0.72	1.00	0.52	0.69	0.72	1.00	0.52	0.69	0.71	1.00										
	AMPS*	12.59	10.61	16.67	18.98	14.52	12.64	19.00	8.86	16.32	14.79	8.87	10.76	18.53	16.81	10.77	12.63	8.60	19.23	12.64	14.62										
	HI PR	340	306	443	502	390	352	503	256	435	403	256	298	495	448	298	344	263	508	344	393										
LO PR	126	161	148	150	129	163	150	132	126	165	132	137	129	163	136	138	157	165	138	140											
Efficiency	SCFM	1400				1400				1400				1400				1400													
	MBh†	59.48	54.45	50.78	47.82	56.66	51.86	48.37	45.84	53.76	49.21	45.91	43.81	50.77	46.50	43.37	41.72	47.74	43.71	40.79	39.59	44.60	40.84	38.13	37.36						
	S/T‡	0.52	0.70	0.72	1.00	0.53	0.71	0.73	1.00	0.53	0.72	0.74	1.00	0.54	0.73	0.75	1.00	0.55	0.74	0.77	1.00	0.56	0.76	0.79	1.00						
	AMPS*	8.60	8.76	8.87	8.92	10.61	10.71	10.77	10.77	12.64	12.64	12.64	12.62	14.79	14.71	14.63	14.60	16.81	16.66	16.52	16.45	19.23	18.98	18.78	18.71						
	HI PR	263	259	256	254	306	302	298	297	352	347	344	342	403	397	393	392	448	442	439	437	508	502	499	497						
LO PR	157	143	132	125	161	147	136	132	163	148	138	135	165	150	139	137	163	148	137	134	165	150	139	137							
Maximum	SCFM	1440				1600				1600				1600				1400				1400									
	MBh†	59.00	54.13	50.59	47.97	56.77	52.12	48.76	47.31	53.76	49.38	46.21	45.16	50.67	46.57	43.60	42.93	47.05	43.21	40.42	39.32	43.91	40.34	37.77	37.08						
	S/T‡	0.53	0.71	0.73	1.00	0.55	0.74	0.77	1.00	0.55	0.76	0.78	1.00	0.56	0.77	0.79	1.00	0.55	0.75	0.77	1.00	0.56	0.77	0.79	1.00						
	AMPS*	8.60	8.76	8.87	8.92	10.61	10.71	10.77	10.77	12.64	12.64	12.64	12.62	14.79	14.71	14.63	14.60	16.81	16.66	16.52	16.45	19.23	18.98	18.78	18.71						
	HI PR	263	259	256	254	306	302	298	297	352	347	344	342	403	397	393	392	448	442	439	437	508	502	499	497						
LO PR	157	143	132	125	161	147	136	132	163	148	138	135	165	150	139	137	163	148	137	134	165	150	139	137							

		949 Size Outdoor With EN(A,D,W)4X60L24**+*8MV*1352422**L Stage 5 Indoor Cooling																													
		Outdoor Ambient Temperature - Degrees F, Dry Bulb																													
		65					75					85					95					105					115#				
		Entering Indoor Temperature - Degrees F, Wet Bulb																													
STAGE-5 Mode		72	67	63††	57	72	67	63††	57	72	67	63††	57	72	67	63††	57	72	67	63††	57	72	67	63††	57						
Comfort + De-Humidify	SCFM	1236				1200				1196				1184				1110													
	MBh†	54.08	49.07	45.47	42.65	52.34	47.51	44.02	41.42	50.72	46.04	42.67	40.47	48.93	44.41	41.17	39.33	46.59	42.29	39.20	37.41										
	S/T‡	0.52	0.69	0.71	1.00	0.52	0.69	0.72	1.00	0.52	0.70	0.73	1.00	0.53	0.71	0.74	1.00	0.53	0.71	0.74	1.00										
	AMPS*	10.98	10.75	10.59	10.48	12.30	12.06	11.89	11.78	13.91	13.65	13.47	13.36	15.71	15.44	15.25	15.15	17.61	17.32	17.13	17.03										
	HI PR	236	233	232	231	273	270	268	267	315	311	309	307	360	356	353	352	410	405	402	401										
LO PR	151	137	128	120	152	139	129	122	154	140	130	124	156	142	132	127	156	143	133	127											
Efficiency	SCFM	1200				1200				1200				1200				1200													
	MBh†	53.80	48.81	45.22	42.21	52.34	47.51	44.02	41.42	50.75	46.06	42.70	40.51	49.03	44.50	41.26	39.51	47.12	42.79	39.67	38.37	45.05	40.90	37.94	37.10						
	S/T‡	0.51	0.68	0.71	1.00	0.52	0.69	0.72	1.00	0.52	0.70	0.73	1.00	0.53	0.71	0.74	1.00	0.54	0.73	0.75	1.00	0.55	0.75	0.77	1.00						
	AMPS*	10.89	10.66	10.51	10.39	12.30	12.06	11.89	11.78	13.92	13.66	13.48	13.38	15.75	15.48	15.29	15.20	17.83	17.54	17.34	17.27	20.20	19.89	19.67	19.63						
	HI PR	236	233	232	231	273	270	268	267	315	311	309	308	360	356	354	352	411	406	403	402	466	461	458	457						
LO PR	150	137	127	119	152	139	129	122	154	141	131	124	156	143	132	127	158	145	135	131	161	147	137	134							
Maximum	SCFM	1400				1400				1400				1400				1400				1200									
	MBh†	54.94	49.92	46.30	44.40	53.44	48.55	45.04	43.51	51.76	47.05	43.64	42.52	49.94	45.40	42.12	41.40	47.94	43.60	40.47	40.16	45.01	40.92	37.97	37.11						
	S/T‡	0.53	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	0.56	0.77	0.80	1.00	0.55	0.75	0.77	1.00						
	AMPS*	11.36	11.12	10.95	10.86	12.81	12.55	12.37	12.30	14.45	14.19	13.99	13.94	16.30	16.03	15.84	15.80	18.41	18.12	17.92	17.91	20.18	19.90	19.70	19.64						
	HI PR	234	232	230	229	273	270	268	266	315	311	309	308	361	357	355	354	412	407	405	404	466	462	458	457						
LO PR	154	141	131	126	156	143	133	129	158	145	134	132	160	147	136	135	162	149	138	138	161	147	137	134							

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		960 Size Outdoor With FCM4X60***L Stage 5 Indoor Cooling																							
		Outdoor Ambient Temperature - Degrees F, Dry Bulb																							
		65	75				85				95				105				115#						
		Entering Indoor Temperature - Degrees F, Wet Bulb																							
STAGE-5 Mode		72	67	63††	57	72	67	63††	57	72	67	63††	57	72	67	63††	57	72	67	63††	57				
Comfort + De-Humidify	SCFM	1488				1566				1514				1440				1367							
	MBh†	71.59	65.29	60.75	55.91	68.97	62.96	58.62	54.72	65.28	59.62	55.53	51.93	61.47	56.15	52.31	48.92	57.61	52.65	49.06	45.90				
	S/T‡	0.51	0.67	0.70	1.00	0.52	0.69	0.71	1.00	0.52	0.69	0.71	1.00	0.52	0.69	0.71	1.00	0.52	0.69	0.71	1.00				
	AMPS*	12.59	10.61	16.67	18.98	14.52	12.64	19.00	8.86	16.32	14.79	8.87	10.76	18.53	16.81	10.77	12.63	8.60	19.23	12.64	14.62				
	HI PR	340	306	443	502	390	352	503	256	435	403	256	298	495	448	298	344	263	508	344	393				
LO PR	126	161	148	150	129	163	150	132	126	165	132	137	129	163	136	138	157	165	138	140					
Efficiency	SCFM	1600				1600				1600				1600				1600							
	MBh†	72.44	66.10	61.52	57.24	69.15	63.13	58.78	55.06	65.82	60.10	55.99	52.83	62.40	57.00	53.13	50.51	58.86	53.83	50.18	48.12	55.24	50.50	47.11	45.62
	S/T‡	0.51	0.68	0.71	1.00	0.52	0.69	0.72	1.00	0.52	0.70	0.73	1.00	0.53	0.71	0.74	1.00	0.54	0.72	0.75	1.00	0.54	0.74	0.76	1.00
	AMPS*	8.60	8.76	8.87	8.92	10.61	10.71	10.77	10.77	12.64	12.64	12.64	12.62	14.79	14.71	14.63	14.60	16.81	16.66	16.52	16.45	19.23	18.98	18.78	18.71
	HI PR	263	259	256	254	306	302	298	297	352	347	344	342	403	397	393	392	448	442	439	437	508	502	499	497
LO PR	157	143	132	125	161	147	136	132	163	148	138	135	165	150	139	137	163	148	137	134	165	150	139	137	
Maximum	SCFM	1680				1905				2000				2000				1600				1600			
	MBh†	72.23	66.23	61.81	58.03	69.91	64.18	59.97	57.77	66.70	61.24	57.27	56.00	63.17	58.03	54.29	53.46	58.65	53.88	50.35	48.26	55.04	50.57	47.31	45.78
	S/T‡	0.52	0.69	0.72	1.00	0.54	0.73	0.76	1.00	0.55	0.76	0.78	1.00	0.56	0.77	0.80	1.00	0.54	0.72	0.75	1.00	0.54	0.74	0.76	1.00
	AMPS*	8.60	8.76	8.87	8.92	10.61	10.71	10.77	10.77	12.64	12.64	12.64	12.62	14.79	14.71	14.63	14.60	16.81	16.66	16.52	16.45	19.23	18.98	18.78	18.71
	HI PR	263	259	256	254	306	302	298	297	352	347	344	342	403	397	393	392	448	442	439	437	508	502	499	497
LO PR	157	143	132	125	161	147	136	132	163	148	138	135	165	150	139	137	163	148	137	134	165	150	139	137	

† 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.

## NOTES:



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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