

# INSTALLATION MANUAL

## R-410A VARIABLE CAPACITY OUTDOOR SPLIT-SYSTEM HEAT PUMP

MODELS: 20 SEER  
YZV, HC20, HL20 SERIES

2 – 5 TONS – 1 PHASE



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## IMPORTANT

*It is recommended before starting the system to connect the thermostat to Wi-Fi using a local network or portable hot-spot so the thermostat and system receive the latest software updates to optimize system performance.*

## CAUTION

*The EEV is factory installed but shipped in the closed position. Prior to any brazing, power must be applied to the Indoor Unit. If installing a coil furnace match or multi-piece air handler system, the EEV harness must be plugged into the Comm port prior to applying power to the indoor unit. Allow 1 minute for the EEV to open to allow proper nitrogen flow through the coil and lineset. If you are not able to power the indoor unit before brazing the line set, a tool to manually open the EEV is available through Source 1 under part number S1-02649686000.*

### SECTION I: GENERAL

The outdoor units are designed to be connected to a matching indoor coil with sweat connect lines. Sweat connect units are factory charged with refrigerant for a nominal sized matching indoor coil plus 15 feet of field-supplied lines.

### SECTION II: SAFETY



This is a safety alert symbol. When you see this symbol on labels or in manuals, be alert to the potential for personal injury.

Understand and pay particular attention to the signal words **DANGER**, **WARNING**, or **CAUTION**.

**DANGER** indicates an **imminently** hazardous situation, which, if not avoided, **will result in death or serious injury**.

**WARNING** indicates a **potentially** hazardous situation, which, if not avoided, **could result in death or serious injury**.

**CAUTION** indicates a potentially hazardous situation, which, if not avoided **may result in minor or moderate injury**. It is also used to alert against unsafe practices and hazards involving only property damage.

## WARNING

*Improper installation may create a condition where the operation of the product could cause personal injury or property damage.*

*Improper installation, adjustment, alteration, service or maintenance can cause injury or property damage. Refer to this manual for assistance or for additional information, consult a qualified contractor, installer or service agency.*

**⚠ CAUTION**

*This product must be installed in strict compliance with the enclosed installation instructions and any applicable local, state, and national codes including, but not limited to building, electrical, and mechanical codes.*

**⚠ CAUTION**

*R-410A systems operate at higher pressures than R-22 systems. Do not use R-22 service equipment or components on R-410A equipment. Service equipment **Must Be Rated** for R-410A.*

**INSPECTION**

As soon as a unit is received, it should be inspected for possible damage during transit including copper distributor lines that may have shifting during transit, and are touching either copper lines or the cabinet. If damage is evident, the extent of the damage should be noted on the carrier's delivery receipt. A separate request for inspection by the carrier's agent should be made in writing. See Local Distributor for more information.

**Requirements For Installing/Serviceing R-410A Equipment**

- Gauge sets, hoses, refrigerant containers, and recovery system must be designed to handle the POE type oils, and the higher pressures of R-410A.
- Manifold sets should be high side and low side with low side retard.
- All hoses must have a 700 psig service pressure rating.
- Leak detectors should be designed to detect HFC refrigerant.
- Recovery equipment (including refrigerant recovery containers) must be specifically designed to handle R-410A.

**LIMITATIONS**

The unit should be installed in accordance with all National, State and Local Safety Codes and the limitations listed below:

1. Limitations for the indoor unit, coil, and appropriate accessories must also be observed.
2. The outdoor unit must not be installed with any duct work in the air stream. The outdoor fan is the propeller type and is not designed to operate against any additional external static pressure.
3. The maximum and minimum conditions for operation must be observed to ensure a system will give maximum performance with minimal service.

**TABLE 1:** Minimum / Maximum Operating Limit Conditions

AIR TEMPERATURE AT OUTDOOR COIL, °F (°C)				AIR TEMPERATURE AT INDOOR COIL, °F (°C)			
Min.		Max.		Min.		Max.	
DB Cool	DB Heat	DB Cool	DB Heat	WB Cool	DB Heat	WB Cool	DB Heat
35(2)*	-5(-21)	125(52)*	75(24)	57(14)	50(10)	72(22)	80(27)

\*Reference the NOTICE under the "Unit Reduced Capacity Conditions" section.

4. The maximum allowable equivalent line length for this product is 80 feet.

**Standard Lineset Applications**

Maximum allowable lineset varies depending on the vertical separation between the evaporator and condenser. See Table 2 for allowable line set lengths and sizing.

**TABLE 2:** Allowable Vertical Linesets

Model	Liquid Line	Suction Line	Max Line Length Units on Equal Level	Max Suction Line Riser - If OD Unit is Above ID Unit	Max Liquid Line Riser - If OD Unit is Below ID Unit
24	3/8"	3/4"	80 feet	25 feet	25 feet
36		7/8"			
48		±1-1/8"			
60					

‡ 7/8" lineset required if line length is over 25' or if there is any vertical rise.

**Unit Reduced Capacity Conditions**

**NOTICE**

**Inverter Temperature Protection**

*If excessive inverter temperatures are sensed, the compressor speed / capacity is reduced until an acceptable condition is reached.*

*When the inverter temperature returns to an acceptable level, the system returns to normal operation.*

**Over / Under Current Protection:** *If a low or high Current Condition is sensed, the compressor speed / capacity is reduced until an acceptable current level is reached.*

*When the system reaches an acceptable current level, the compressor and fan return to normal operating conditions.*

**Over / Under Voltage Protection:** *If a low or high supply Voltage Condition is experienced (below 187 VAC or above 265 VAC), the compressor speed / capacity is automatically reduced until an acceptable voltage level is sensed.*

*When an acceptable voltage level is sensed, the system automatically returns to a normal state of operation.*

**High Altitude Protection:** *If the unit is installed in Altitudes of 6,500 ft / 2,000 m above sea level or higher, the compressor and outdoor fan reduce speeds to protect the system. It is not recommended these units be installed at altitudes greater than 6,500 ft / 2,000 m above sea level.*

**Low Ambient Protection**

**Cooling Mode:** *The unit automatically adjusts to maintain cooling operation in outdoor ambient conditions down to 35 °F (2 °C). The unit reduces capacity and Low Ambient Protection (cooling mode) or cycles off if asked to provide cooling when the outdoor temperature is at or below these conditions.*

**Heating Mode:** *The unit provides compressor heat down to an outdoor ambient temperature of -5 °F (-29 °C). As the outdoor ambient temperature reduces, available heat reduces for all air source heat pumps. Make sure the balance point and auxiliary heat are appropriately set and sized for the application of the heat pump.*

**SECTION III: UNIT INSTALLATION**

**LOCATION**

Before starting the installation, select and check the suitability of the location for both the indoor and outdoor unit. Observe all limitations and clearance requirements.

The outdoor unit must have sufficient clearance for air entrance to the condenser coil, air discharge, and service access. See Figure 1.

**NOTICE**

*For multiple unit installations, units must be spaced a minimum of 24" (61 cm) apart (coil face to coil face).*

If the unit is to be installed on a hot sun exposed roof or a paved ground area that is seasonally hot, the unit should be raised sufficiently above the roof or ground to avoid taking the accumulated layer of hot air into the outdoor unit (which can cause the unit to derate prematurely).

If the system is being installed during seasonally cold weather of 55°F or below, the preferred method is to weigh in the charge. For charging or checking the system charge at 55°F or below, refer to the "Optional Cold Weather Charging" procedures near the end of SECTION VI: SYSTEM CHARGE. There is an "Optional Cold Weather Charging" accessory kit to prevent the outdoor unit from taking in cold air below 55°F. The kit part number can be found in the list of accessory kits on the UPGNET web site.

Provide adequate structural support for the unit.

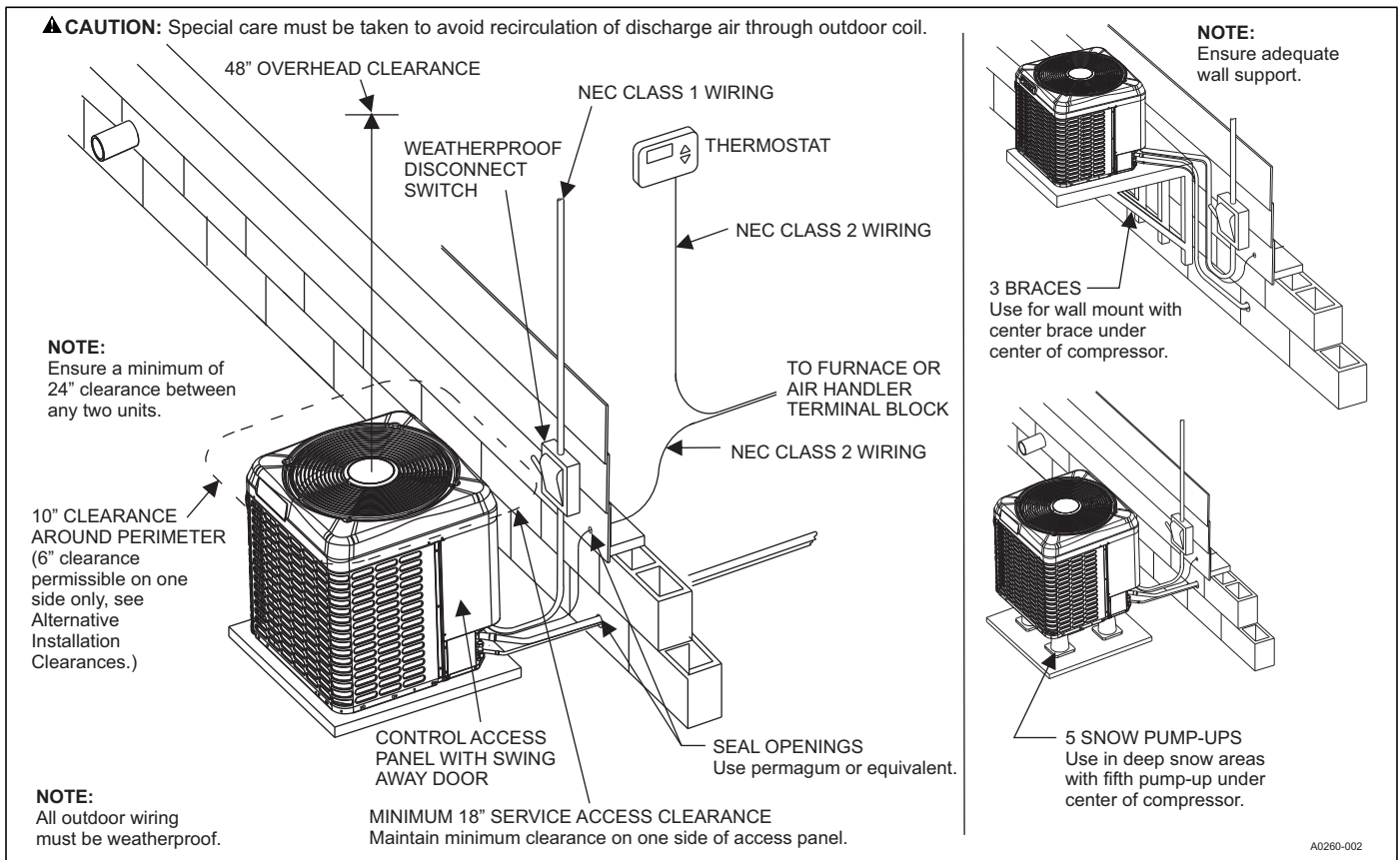


FIGURE 1: Typical Installation Clearances

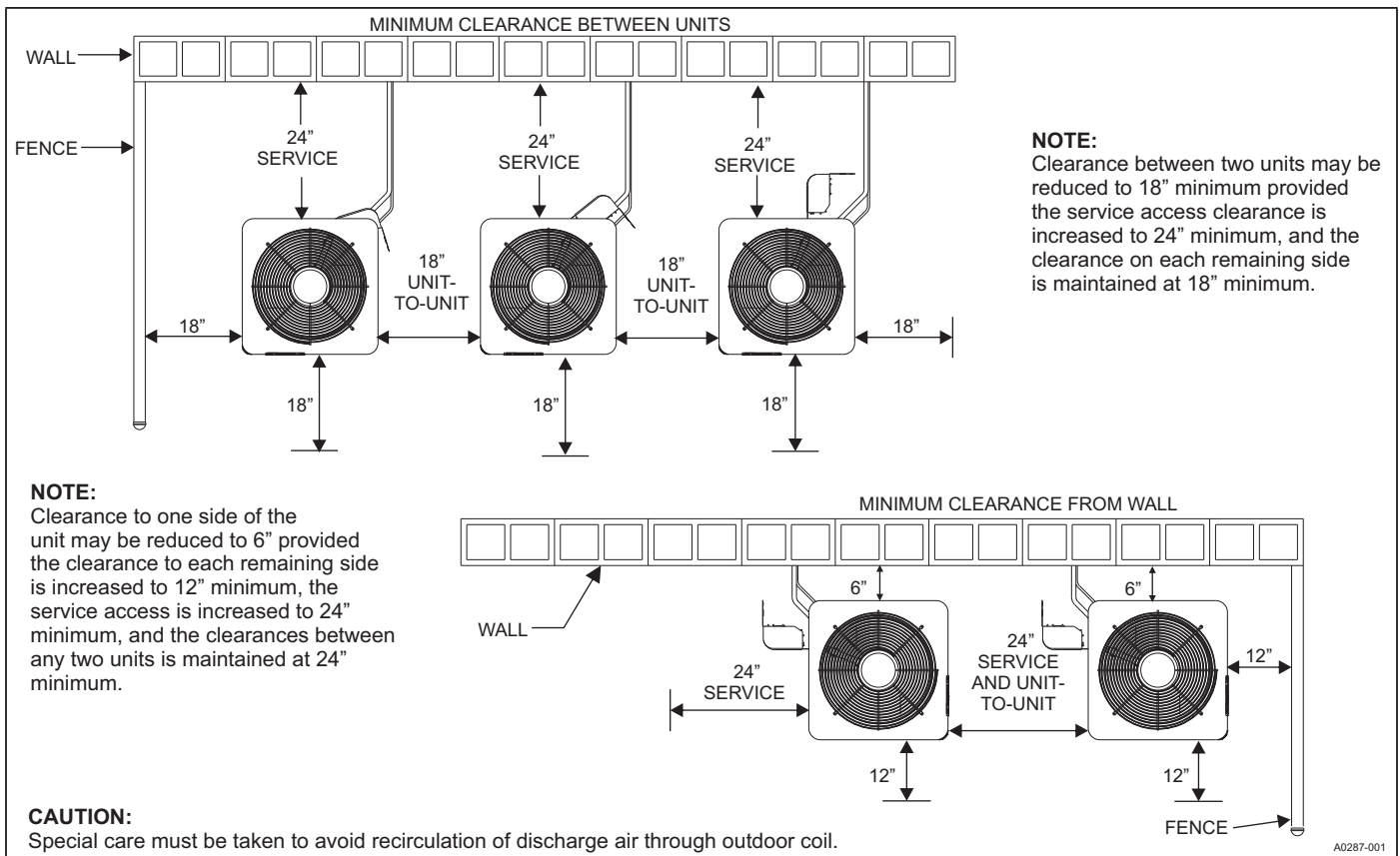


FIGURE 2: Alternative Installation Clearances

## ADD-ON REPLACEMENT/RETROFIT

When this unit is being used as a replacement for an existing R-410A unit, these are matched systems. The indoor coil and outdoor unit must both be replaced. The following steps should be performed in order to insure proper system operation and performance. Line-set change out is also recommended.

1. Change-out of the indoor coil to an approved R-410A coil / air handling unit combination with the appropriate metering device.
2. Change-out of the line-set when replacing an R-22 unit with an R410-A unit is highly recommended to reduce cross-contamination of oils and refrigerants.
3. If change-out of the line set is not practical, then the following precautions should be taken.
  - Inspect the line set for kinks, sharp bends, or other restrictions, and for corrosion.
  - Determine if there are any low spots which might be serving as oil traps.
  - Flush the line set with a commercially available flush kit to remove as much of the existing oil and contaminants as possible.
  - Install a suction line filter-drier to trap any remaining contaminants, and remove after 50 hours of operation.
4. If the outdoor unit is being replaced due to a compressor burnout, then installation of a 100% activated alumina suction-line filter drier in the suction-line is required, in addition to the factory installed bi-flow liquid-line drier. Operate the system for 10 hours. Monitor the suction drier pressure drop. If the pressure drop exceeds 3 psig, replace both the suction-line and liquid-line driers. After a total of 10 hours run time where the suction-line pressure drop has not exceeded 3 psig, replace the liquid line drier, and remove the suction-line drier. Never leave a suction-line drier in the system longer than 50 hours of run time.

## GROUND INSTALLATION

The unit may be installed at ground level on a solid base that will not shift or settle, causing strain on the refrigerant lines and possible leaks. The unit must be installed in as level a position as possible while maintaining the clearances shown in Figure 2.

Normal operating sound levels may be objectionable if the unit is placed directly under windows of certain rooms (bedrooms, study, etc.).

Condensate will drain from beneath the coil of the outdoor unit during the defrost cycle. Normally this condensate may be allowed to drain directly on the ground.

## ⚠ WARNING

*The outdoor unit should not be installed in an area where mud or ice could cause personal injury.*

Elevate the unit sufficiently to prevent any blockage of the air entrances by snow in areas where there will be snow accumulation. Check the local weather bureau for the expected snow accumulation in your area. Isolate the unit from rain gutters to avoid any possible wash out of the foundation.

## ROOF INSTALLATION

When installing units on a roof, the structure must be capable of supporting the total weight of the unit, including a pad, lintels, rails, etc., which should be used to minimize the transmission of sound or vibration into the conditioned space.

## WALL MOUNT INSTALLATION

Care must be taken to mount the outdoor unit on a solid base that is sloped to shed water, secure from settlement, and is isolated from the structural foundation or walls to prevent sound and vibration transmission into the living space.

On occasion, site conditions may require direct wall mounted brackets to be used to locate and support the outdoor unit. In these applications, care must be taken to address unit base pan support, structural integrity, safe access and serviceability, as well as the possible sound and vibration transmission into the structure. Wall mounting requires 3 mounting brackets and best served by a properly engineered solution. See price pages for specific part number for your application.

## UNIT PLACEMENT

## NOTICE

*Heat pumps will defrost periodically resulting in water drainage. The unit should not be located where water drainage may freeze and create a hazardous condition - such as sidewalks and steps.*

1. Provide a base in the pre-determined location.
2. Remove the shipping carton and inspect for possible damage.
3. Ensure that compressor tie-down bolts remain tightened.
4. Position the unit on the base provided.

## LIQUID LINE FILTER-DRIER

The heat pumps have a stainless steel solid core bi-flow filter/drier located in the liquid line.

## ⚠ CAUTION

*Failure to use the same as the original factory drier or using a substitute drier or a granular type may result in damage to the equipment.*

## NOTICE

*Replacements for the liquid line drier must be exactly the same as marked on the original factory drier. See Source 1 for O.E.M. replacement driers.*

R-410A Filter-Drier Source 1 Part No.	Apply with Models
S1-32649682000	All

## PIPING CONNECTIONS

The outdoor condensing unit must be connected to the indoor evaporator coil using field supplied refrigerant grade (ACR) copper tubing that is internally clean and dry. Units should be installed only with the tubing sizes for approved system combinations as specified in tabular data sheet. The charge given is applicable for total tubing lengths up to 15 feet (4.6 m).

## NOTICE

*Using a larger than specified line size could result in oil return problems. Using too small a line will result in loss of capacity and other problems caused by insufficient refrigerant flow. For the heat pump, maintain level horizontal refrigerant lines between the indoor unit and the outdoor unit to facilitate proper oil return.*

## ⚠ WARNING

*Never install a suction-line filter drier in the liquid line of an R-410A system. Failure to follow this warning can cause a fire, injury or death.*

## ⚠ CAUTION

*This system uses R-410A refrigerant which operates at higher pressures than R-22. No other refrigerant may be used in this system. Gauge sets, hoses, refrigerant containers, and recovery system must be designed to handle R-410A. If you are unsure, consult the equipment manufacturer.*



## PRECAUTIONS DURING LINE INSTALLATION

1. Install the refrigerant lines with as few bends as possible. Care must be taken not to damage the couplings or kink the tubing. Use clean hard drawn copper tubing where no appreciable amount of bending around obstruction is necessary. If soft copper must be used, care must be taken to avoid sharp bends which may cause a restriction.
2. The lines should be installed so that they will not obstruct service access to the coil, air handling system, or filter.
3. Care must also be taken to isolate the refrigerant lines to minimize noise transmission from the equipment to the structure.
4. The vapor line must be insulated with a minimum of 1/2" foam rubber insulation (Armaflex or equivalent). Liquid lines that will be exposed to direct sunlight, high temperatures, or excessive humidity must also be insulated.
5. Tape and suspend the refrigerant lines as shown. DO NOT allow tube metal-to-metal contact. See Figure 3.
6. Use PVC piping as a conduit for all underground installations as shown in Figure 4. Buried lines should be kept as short as possible to minimize the build up of liquid refrigerant in the vapor line during long periods of shutdown.

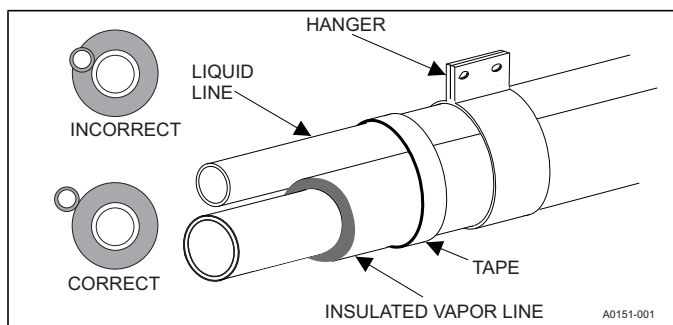


FIGURE 3: Installation of Vapor Line

7. Pack fiberglass insulation and a sealing material such as permagum around refrigerant lines where they penetrate a wall to reduce vibration and to retain some flexibility.

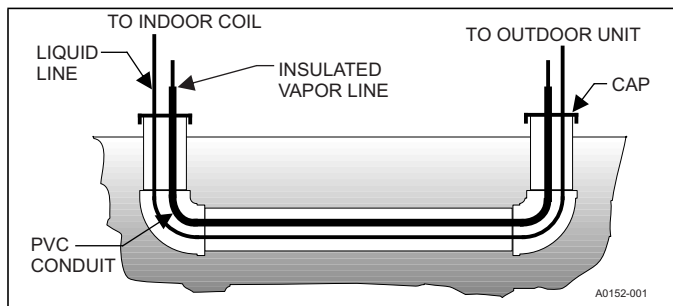


FIGURE 4: Underground Installation

## PRECAUTIONS DURING BRAZING OF LINES

All outdoor unit and evaporator coil connections are copper-to-copper and should be brazed with a phosphorous-copper alloy material such as Silfos-5, silver solder or equivalent. DO NOT use soft solder. The outdoor units have reusable service valves on both the liquid and vapor connections. The system refrigerant charge for 15 feet of lineset is retained within the outdoor unit during shipping and installation. The reusable service valves are provided to evacuate and charge per this instruction.

Serious service problems can be avoided by taking adequate precautions to assure an internally clean and dry system.

## CAUTION

Dry nitrogen should always be purged through the tubing while it is being brazed, because the temperature required is high enough to cause oxidation of the copper unless an inert atmosphere is provided. The flow of dry nitrogen should continue until the joint has cooled. Always use a pressure regulator and safety valve to insure that only low pressure dry nitrogen is introduced into the tubing. Only a small flow is necessary to displace air and prevent oxidation.

## CAUTION

The EEV is factory installed but shipped in the closed position. Prior to any brazing, power must be applied to the Indoor Unit. If installing a coil furnace match or multi-piece air handler system, the EEV harness must be plugged into the Comm port prior to applying power to the indoor unit. Allow 1 minute for the EEV to open to allow proper nitrogen flow through the coil and lineset. If you are not able to power the indoor unit before brazing the line set, a tool to manually open the EEV is available through Source 1 under part number S1-02649686000.

## PRECAUTIONS DURING BRAZING SERVICE VALVE

Precautions should be taken to prevent heat damage to service valve by wrapping a wet rag around it as shown in Figure 5. Also, protect all painted surfaces, insulation, and plastic base during brazing. After brazing, cool joint with wet rag.

## WARNING

This is not a backseating valve. The service access port has a valve core. Opening or closing valve does not close service access port. If the valve stem is backed out past the chamfered retaining wall, the O-ring can be damaged causing leakage or system pressure could force the valve stem out of the valve body possibly causing personal injury.

Valve can be opened by removing the service valve cap and fully inserting a hex wrench into the stem and backing out counter-clockwise until valve stem just touches the chamfered retaining wall.

### Connect the refrigerant lines using the following procedure:

1. Remove the cap and Schrader core from both the liquid and vapor service valve service ports at the outdoor unit. Connect low pressure nitrogen to the liquid line service port, allow nitrogen to flow.
2. Braze the liquid line to the liquid valve at the outdoor unit. Be sure to wrap the valve body with a wet rag. Allow the nitrogen to continue flowing.
3. Carefully remove the plugs from liquid and vapor connections at the indoor coil.

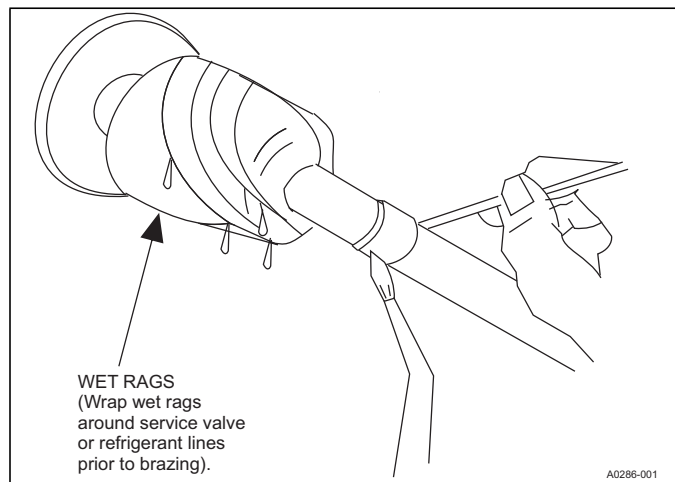


FIGURE 5: Heat Protection

**⚠ CAUTION**

*Do not install any coil with a furnace which is to be operated during the heating season without attaching the refrigerant lines to the coil. The coil is under pressure which must be released to prevent excessive pressure build-up and possible coil damage.*

4. Power must be applied to the indoor unit. If installing a coil/furnace match or multi piece air handler system, the EEV harness must be plugged into the communication port on furnace or blower control board. Allow 1 minute for the EEV to open to allow proper nitrogen flow through the coil and line-set.
5. Protect the vapor valve with a wet rag and braze the vapor line connection to the outdoor unit. The nitrogen flow should be exiting the system from the vapor service port connection. After this connection has cooled, remove the nitrogen source from the liquid fitting service port.
6. Braze the liquid line to the indoor liquid connection. Nitrogen should be flowing through the indoor coil.
7. Slide the grommet away from the vapor connection at the indoor coil and wrap with a wet rag as shown in Figure 5. Braze the vapor line to the indoor vapor connection. After the connection has cooled, slide the grommet back into original position. After this connection has cooled, remove the nitrogen source from the liquid fitting service port.
8. Replace the Schrader core in the liquid and vapor valves.
9. Leak test all refrigerant piping connections including the service port flare caps to be sure they are leak tight. DO NOT OVERTIGHTEN (between 40 and 60 inch - lbs. maximum).

**NOTICE**

*Line set and indoor coil can be pressurized to 250 psig with dry nitrogen and leak tested with a bubble type leak detector. Then release the nitrogen charge. Do not use the system refrigerant in the outdoor unit to purge or leak test.*

10. Evacuate the vapor line, indoor coil, and liquid line to 500 microns or less.
11. Replace cap on service ports. Do not remove the flare caps from the service ports except when necessary for servicing the system.

**⚠ CAUTION**

*Do not connect manifold gauges unless trouble is suspected. Approximately 3/4 ounce of refrigerant will be lost each time a standard manifold gauge is connected.*

12. Release the refrigerant charge into the system. Open both the liquid and vapor valves by removing the service valve cap and with an hex head wrench back out counter-clockwise until valve stem just touches the chamfered retaining wall. If the service valve is a ball valve, use a Adjustable end wrench to turn valve stem one-quarter turn counterclockwise to open. Do not overturn or the valve stem may break or become damaged. See "PRECAUTIONS DURING BRAZING SERVICE VALVE".

13. Replace service valve cap finger tight, then tighten an additional 1/2 turn (1/2 hex flat). Cap must be replaced to prevent leaks.

**⚠ WARNING**

*Never attempt to repair any brazed connections while the system is under pressure. Personal injury could result.*

14. See Section VI "System Charge" section for checking and recording system charge.

**SECTION IV: EVACUATION**

Evacuate the system to 500 microns or less. If a leak is suspected, leak test with dry nitrogen to locate the leak. Repair the leak and test again.

To verify that the system has no leaks, simply close the valve to the vacuum pump suction to isolate the pump and hold the system under vacuum. Watch the micron gauge for a few minutes. If the micron gauge indicates a steady and continuous rise, it's an indication of a leak. If the gauge shows a rise, then levels off after a few minutes and remains fairly constant, it's an indication that the system is leak free but still contains moisture and may require further evacuation if the reading is above 500 microns.

**SECTION V: ELECTRICAL CONNECTIONS****GENERAL INFORMATION & GROUNDING**

The control box cover is held in place with 5 screws (one screw near each lower corner, one each and the midpoint of each side and one at top middle).

Check the electrical supply to be sure that it meets the values specified on the unit nameplate and wiring label.

Power wiring, control (low voltage) wiring, disconnect switches and over current protection must be supplied by the installer. Wire size should be sized per NEC requirements.

**⚠ CAUTION**

*All field wiring must USE COPPER CONDUCTORS ONLY and be in accordance with Local, National, Fire, Safety & Electrical Codes. This unit must be grounded with a separate ground wire in accordance with the above codes.*

The complete connection diagram and schematic wiring label is located on the inside surface of the unit service access panel. An example of typical field connections can be found in Figure 7.

**FIELD CONNECTIONS POWER WIRING**

1. Install the proper size weatherproof disconnect switch outdoors and within sight of the unit, per local code.
2. Remove the screws at the top and sides of the corner cover. Slide the control box cover down and remove from unit.
3. Run power wiring from the disconnect switch to the unit.
4. Route wires from disconnect through power wiring exit provided and into the unit control box as shown in Figure 1 and view the openings in Figure 6.
5. Make the power supply connections to the supplied terminal block.

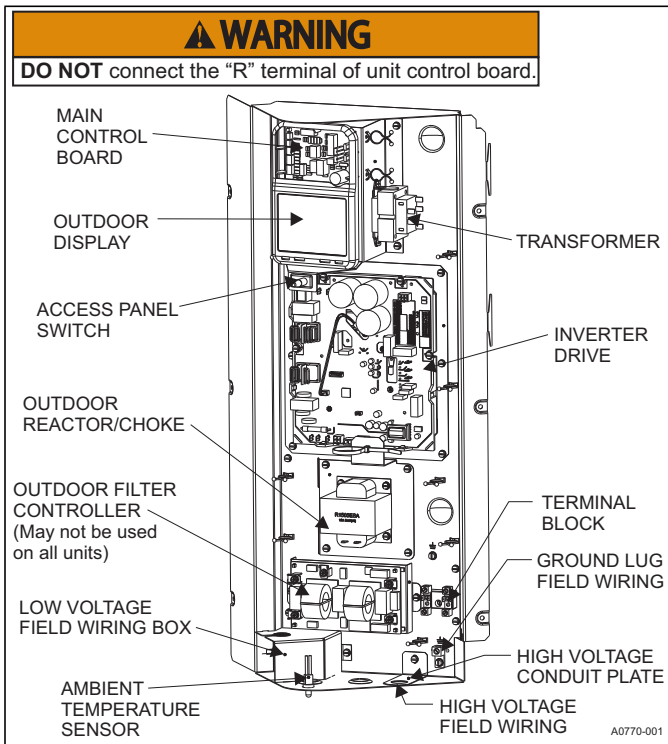


FIGURE 6: Outdoor Unit Control Box

**FIELD CONNECTIONS CONTROL WIRING**

1. Route low voltage wiring into bottom of control box through the hole inside the low voltage box. Connect low voltage wiring inside the low voltage box by clipping and discarding the connector plug and stripping the low voltage wires. See Figure 6.
2. The complete connection diagram and schematic wiring label is located on the inside surface of the unit service access panel.
3. Replace the control box cover removed in Step 2 of the FIELD CONNECTIONS POWER WIRING procedures.
4. All field wiring to be in accordance with national electrical codes (NEC) and/or local-city codes.
5. Mount the thermostat about 5 ft. above the floor, where it will be exposed to normal room air circulation. Do not place it on an outside wall or where it is exposed to the radiant effect from exposed glass or appliances, drafts from outside doors or supply air grilles.
6. Route the 24-volt control wiring (NEC Class 2) from the outdoor unit to the indoor unit and thermostat. Keep the low voltage wiring 4" or more away from the high voltage wires that are leaving the control box. If this isn't possible, install shielded low voltage wiring to reduce EMI risk.

**NOTICE**

*To eliminate erratic operation, seal the hole in the wall at the thermostat with permagum or equivalent to prevent air drafts affecting the operation of in the thermostat.*

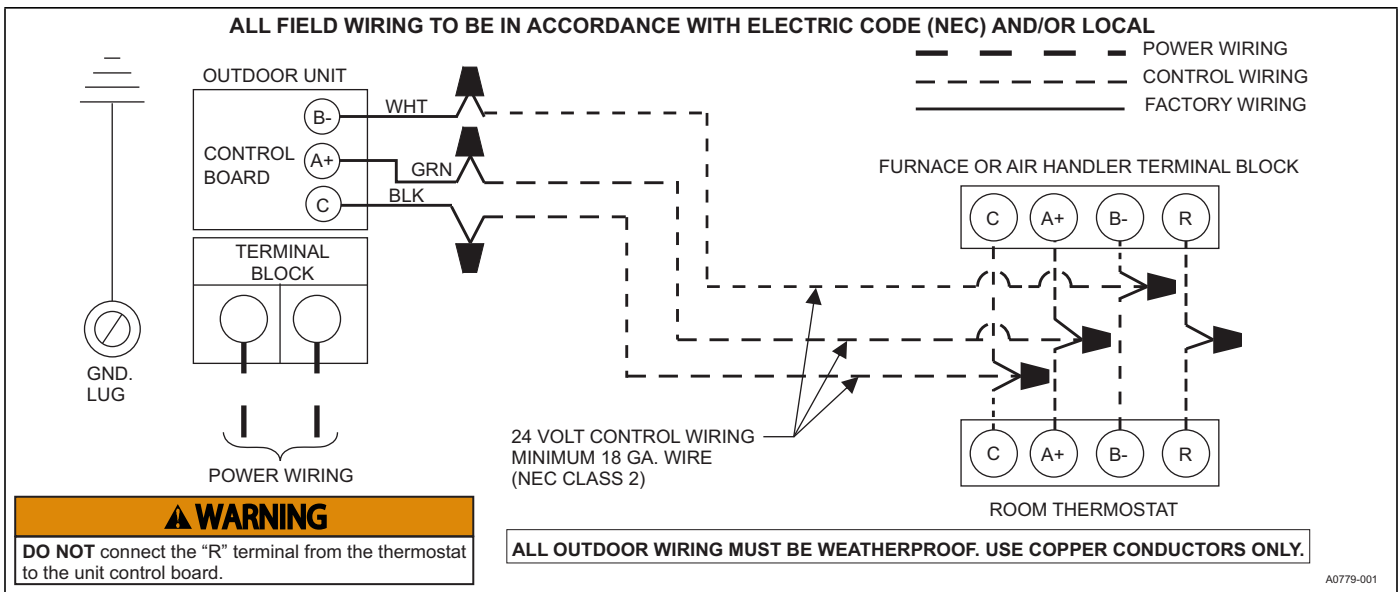


FIGURE 7: Typical Communicating Field Wiring (Air Handler / Furnace)

**Demand Response - Load Shedding**

The main outdoor control has a conventional 24VAC input (DR) for utility demand response signals. When a 24VAC signal is present on the DR input the Hx™ thermostat will adjust the indoor temperature set-point by the user selected setting. For further details on available settings, please refer to the Hx™ thermostat installation and operation manual. The DR input terminal location can be found in Figure 10 and typical wiring is found in Figure 8.

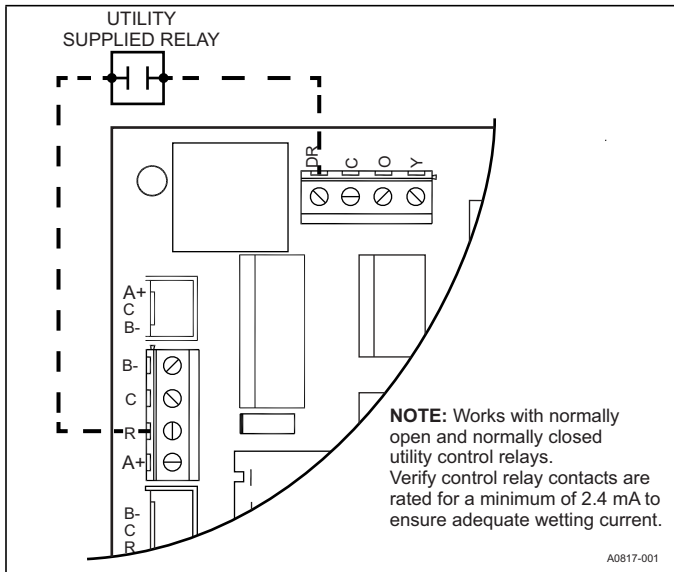


FIGURE 8: Demand Response Wiring

**SECTION VI: SYSTEM CHARGE**

After completion of system connections, apply power to the system, it is recommended before starting the system to connect the thermostat to Wi-Fi using a local network or portable hot-spot so the thermostat and system receive the latest software updates to optimize system performance. Utilize the Hx™ thermostat to “discover” the system components and identify the Indoor and Outdoor Communicating Equipment. AVV air handler or MVC modular blower with electric heat. Inputs to air handler control board come from the thermostat which are communicated from the main control of the outdoor unit. This maintains proper sensible/latent balance during cooling and proper discharge temperature during heating.

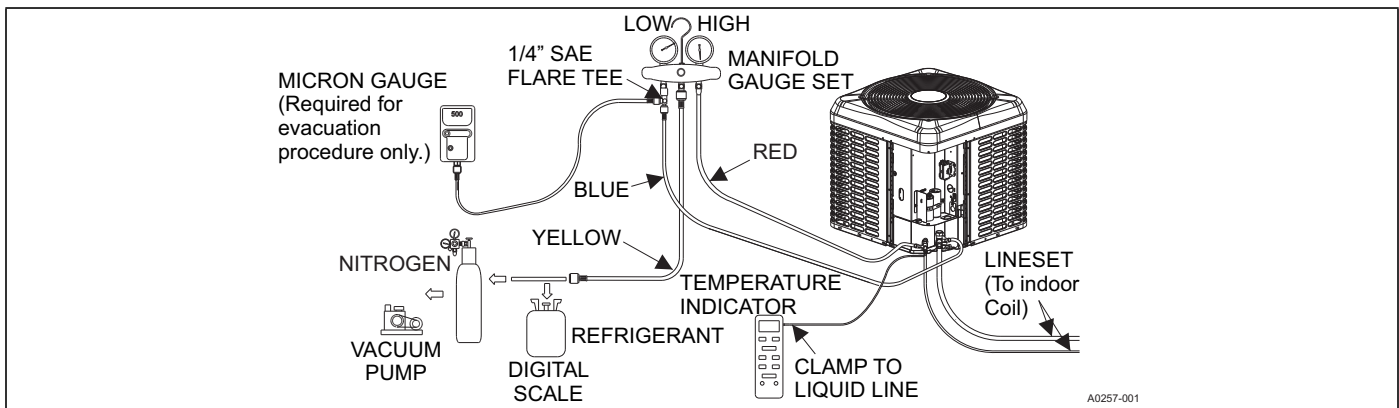


FIGURE 9: System Charging Connections

Proper indoor unit airflow is determined by the system and requires no initial set-up by the installing contractor unless using an AVV or MVC modular blower air handler with electric heat. If a unit is using electric heat, the unit must have the electric heat airflow set at the air handler control board.

After the system is started during the initial set-up process using the Hx™ thermostat, additional fine tuning of the airflow is accomplished by selecting one of the three operating profiles. The three operating profiles include: humid, dry or normal. Select the one that best reflects the outdoor environment where the conditioned space is located. This selection adjusts the how the indoor blower and the compressor work together to manage temperature and humidity. Additional fine tune adjustments are available using the Hx™ thermostat. Refer to the Hx™ thermostat manual for additional detail.

The proper airflow is determined by the main outdoor control in the outdoor unit.

**⚠ CAUTION**

*If the outdoor temperature is below 55°F, an attempt to start the compressor without at least 2 hours of crankcase/stator heat can damage the compressor.*

**⚠ CAUTION**

*Refrigerant charging should only be carried out by a licensed qualified air conditioning contractor.*

To ensure that your unit performs at the published levels, it is important that the indoor airflow is determined and refrigerant charge added accordingly.

**CHARGING THE UNIT**

The factory charge in the outdoor unit includes enough charge for the unit, 15 ft. (4.6 m) of refrigerant piping, and the smallest indoor coil/air handler match-up. Some indoor coil / air handler matches may require additional charge.

**⚠ CAUTION**

*Compressor damage will occur if system is improperly charged. On new system installations, charge system per tabular data sheet for the matched coil and follow guidelines in this instruction.*

**⚠ CAUTION**

*Do not leave the system open to the atmosphere. Unit damage could occur due to moisture being absorbed by the POE oil in the system. This type of oil is highly susceptible to moisture absorption.*



## TOTAL SYSTEM CHARGE DETERMINED

1. Determine outdoor unit factory charge from Tabular Data Sheet.
2. Determine indoor coil adjustment (if any) from Tabular Data Sheet.
3. Calculate the additional charge for refrigerant piping using the Tabular Data Sheet if line length is greater than 15 feet (4.6 m).
4. Total system charge = item 1 + item 2 + item 3.
5. The manifold gauge set is already installed on the unit for evacuation and charging. Use these gauges to initially charge the system using system pressures and subcooling. Before charging put the equipment into "Service Mode" at the outdoor control. You will find the charging information for charging mode printed on the bottom of the unit data tag. Charging data for cooling & heating mode is found on Page 25 of this manual or available in the "Service Data Application Guide", available online. For subsequent annual maintenance visits the charge verification display can be used to quickly check overall system condition and the system charge without attaching a separate manifold gauge set or temperature sensors.
6. Permanently mark the unit data plate with the total amount of refrigerant in the system.

## ⚠ WARNING

DO NOT attempt to pump "Total System Charge" into outdoor unit for maintenance, service, etc. This may cause damage to the compressor and/or other components. Recover and weigh "System Charge" into an appropriate recovery cylinder for any instances requiring evacuation.

## ⚠ CAUTION

It is unlawful to knowingly vent, release or discharge refrigerant into the open air during repair, service, maintenance or the final disposal of this unit.

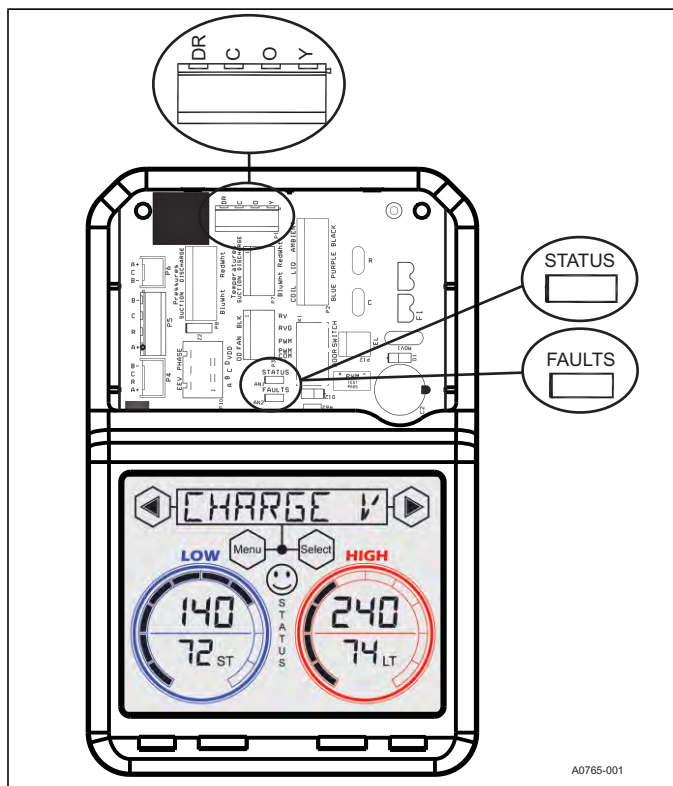


FIGURE 10: Main Outdoor Control and Display

## CHARGE VERIFICATION MODE

The outdoor display will assist the installer with charging the system. Through interaction with the Outdoor Display the system will operate at predetermined nominal speed values. During this operation the system will monitor pressures and temperatures. When the subcooling is within the predetermined values set by the OEM, the outdoor display will indicate SYSTEM CHARGE VALIDATED. This mode is only available when the ID temperature is within 73 to 83°F and humidity is less than 73% as measured by the Hx™ thermostat. Operation will continue but charge will not be verified.

### User Interaction/Operation:

1. Press Menu, press Arrow until Modes is displayed, press Select. Press Arrow until Charge Verification is displayed, press Select.
2. Press Select while in Charge Verification Mode. The system will detect the Unit Type and Unit Tonnage. The outdoor display will update and scroll text, see the example below.  
**Example:** 4-TON HP FOUND \* VERIFY CHARGE? \* 4-TON HP FOUND \* VERIFY CHARGE?
3. Press Select to verify charge, the outdoor display will update and scroll text, see the example below.  
**Example:** VERIFYING CHARGE \* PLEASE WAIT \* VERIFYING CHARGE \* PLEASE WAIT (5 minute wait time during initial charge calculation)
4. ADD CHARGE or REMOVE CHARGE will display on the banner with the appropriate response dependent upon the OEM's predetermined values, user may press Select when the banner displays ADD CHARGE or REMOVE CHARGE. The display will indicate ACCEPTED for 5 seconds and return to the example defined in Step 1. However, if the system does meet the charge requirements defined by the OEM, the outdoor display will indicate the below text example for 5 seconds and return to the text example in Step 2 until charge verification has fully completed.  
**Example:** SYSTEM CHARGE VALIDATED

The system will repeat steps 1-3 until the subcooling has reached the predetermined values set by the OEM.

5. Once charge verification is fully complete the outdoor display will return to the Second Menu Layer.

## SECTION VII: SYSTEM OPERATION

### SERVICE MODE

Service mode locks the system into maximum capacity operation based on ambient conditions. The unit will be locked into steady state conditions where operation and performance can be evaluated using the available service information. This function is outside of the charge verification mode, available for all system component diagnostics and can only be accessed from the outdoor control.

### ANTI SHORT-CYCLE DELAY

The control includes a five-minute anti short-cycle delay (ASCD) timer to prevent the compressor from short-cycling after a power or thermostat signal interruption. The ASCD timer is applied when the control is first powered and immediately following the completion of a compressor run cycle. The compressor and the outdoor fan will not operate during the five minutes that the timer is active.

### LOW VOLTAGE DETECTION

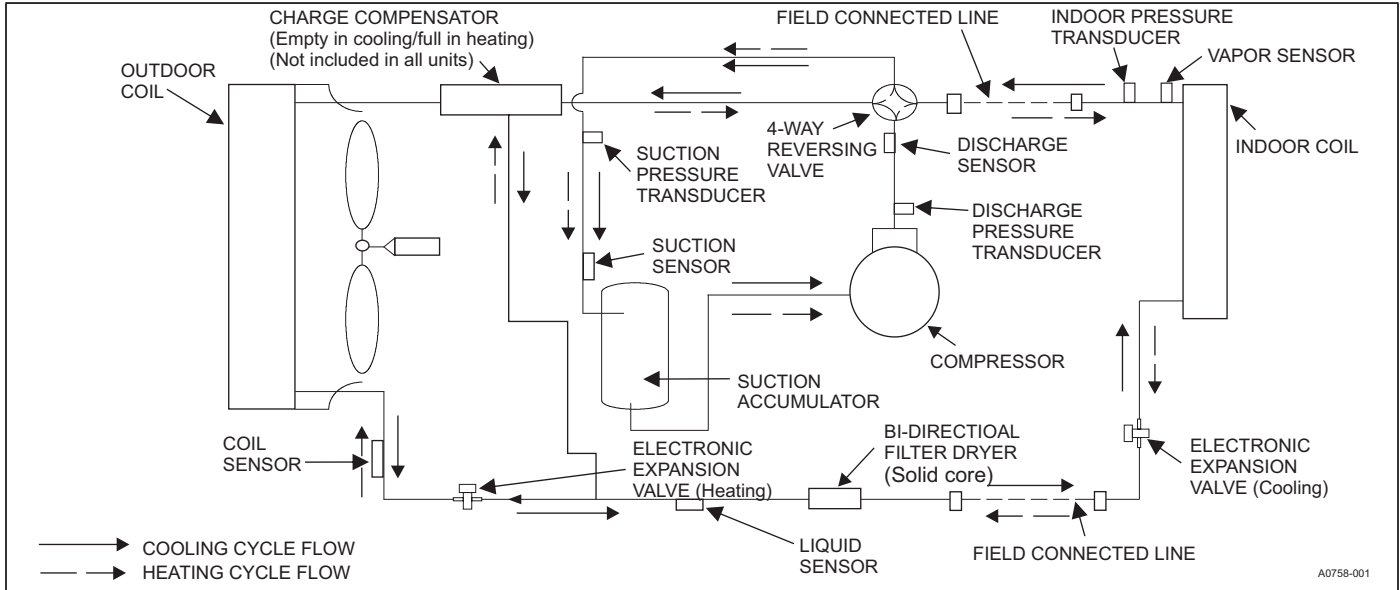
The control monitors the outdoor transformer secondary (24 VAC) voltage and provides low voltage protection for the heat pump and its components. If the voltage drops below approximately 22 VAC, the control continues to energize any outputs that are already energized. If the voltage drops below approximately 19 VAC, the control immediately de-energizes the outputs and can no longer energize any outputs until the voltage level increases above 22VAC. The control stores and displays the appropriate fault codes when low voltage conditions occur.

**TEST MODE OPERATION**

Test mode operation provides the features found in Table 3 to assist in unit commissioning and troubleshooting. TEST MODE is accessed through the Outdoor Display. Please see Page 11 & Table 6 for detailed Outdoor Display operation. Test mode can only be accessed from the outdoor control.

**TABLE 3: TEST Mode Option**

TEST MODE OPTION	
Menu Options	Operation
OPERATIONAL MODE (AC - HP)	Display current system configuration (AC or HP) and unit capacity stored in memory.
BYPASS ASCD TIMER	Bypass ASCD timer and initiate system operation if a call for space conditioning is present from the HX™ thermostat.
START FORCED DEFROST	Initiate defrost cycle and record that defrost cycle was initiated in TEST MODE. This option will not be present if a call for space conditioning is present from the HX™ thermostat. This operation applies only to heat pump systems.



**FIGURE 11: Heat Pump Flow Diagram**

**FAULT AND STATUS CODE BEHAVIOR**

**Fault Code Storage**

The main control stores the ten most recent fault codes for review by the service technician. These codes are stored even when power is removed from the control and will remain in memory until the control is powered for 30 consecutive days or manually cleared from the control. All codes are stored in order of occurrence and time stamped.

The control stores only one identical fault code during the same series of events. For example, if two or more high pressure switch (HPS) faults occur sequentially without another fault occurring in between the HPS faults, the control only stores the HPS fault once.

In addition, the main unit control stores the following unit sensor values when a fault and/or event occurs.

1. Suction Superheat
2. Liquid Subcooling
3. Liquid Temperature
4. Discharge Pressure
5. Suction Temperature
6. Suction Pressure

When a fault and/or event is present, the system will indicate the corresponding fault and/or event text on the Outdoor Display status banner.

NOTICE

*The display will continue to indicate the above fault (saved) value(s) on the Outdoor Display with the active Fault and/or Event text, while the fault and/or event is still present. When the fault and/or event has cleared, the system will return to the General Display Operation.*

**Fault Code Display**

The system will provide fault and/or event text, using the Outdoor Display when CURRENT and/or STORED SYSTEM FAULT(s) are selected from the FAULT MODE category. Tables 7 & 8 describe the fault codes in more detail, giving potential causes and troubleshooting actions. If multiple faults and/or events are present at the same time, the Outdoor Display will show the most recent fault and/or event with the highest priority. In the event that multiple faults and/or events are populated at the same time, the Outdoor Display will indicate the most recent system fault and/or event that is stored in memory. The second system fault will not be displayed, but will be stored in memory. For example see Table 4.

**TABLE 4: Same Priority Fault Storage**

Control	Description	Time of Fault	Fault Priority
Inverter Control Fault	Microelectronic Fault	10:15:00	1
Outdoor Control Fault	Inverter Control Communications Fault	10:15:01	1

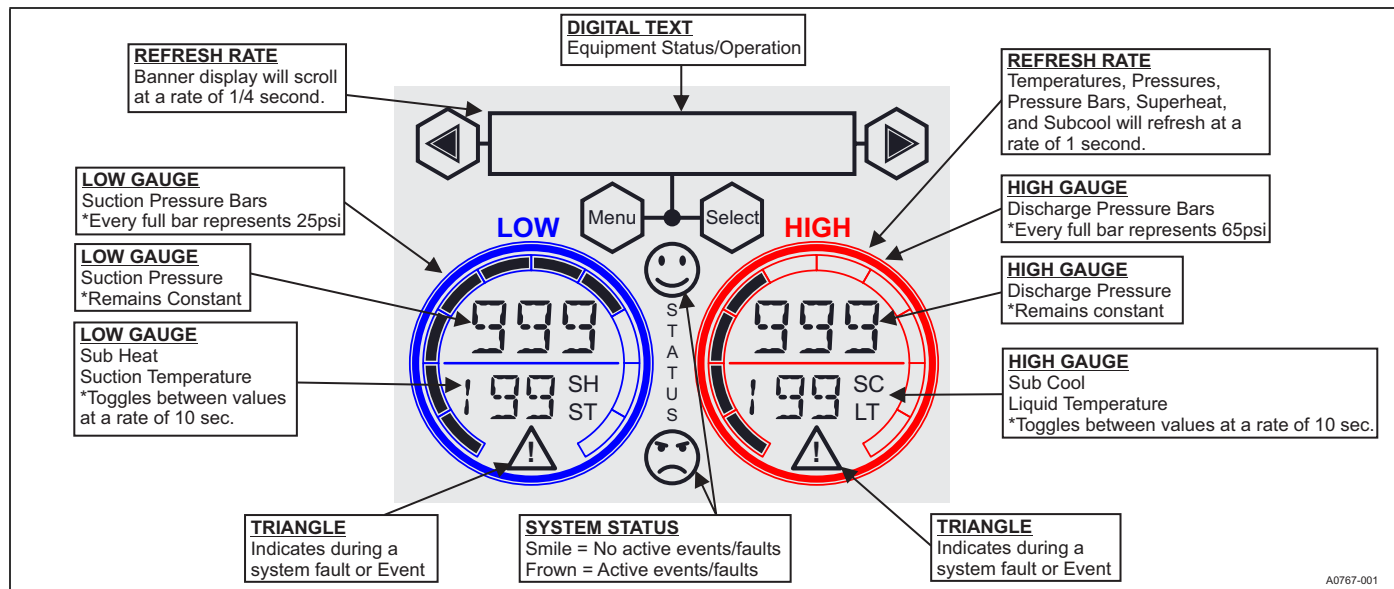
**Status Code Display**

The main control board contains 2 LED's for status and fault display as shown Figure 10. The control will provide a status code indicating the state of the system using the Yellow LED as detailed in Table 5. The Red LED indicates a system fault is present. Further details of the fault can be found on the outdoor screen.

**TABLE 5:** Status Code Display

Description	Required Condition	LED	Color
No power to control	No power to control	OFF	OFF
Control Failure	Control failure occurs and can be detected.	ON	Yellow
System has 24 VAC present and the microprocessor is active.	No faults active	2s ON / 2s OFF ("Heartbeat")	Yellow
Control normal operation – in ASCD period	No faults/events active, compressor speed > 0, ASCD timer not expired	0.1 sec ON / 0.1 sec OFF	Yellow
System is active and presently communicating successfully.	No faults/events active, compressor speed > 0, ASCD timer not expired	0.5 sec ON / 0.5 sec OFF	Yellow

## SECTION VIII: OUTDOOR SCREEN OPERATION

**FIGURE 12:** Outdoor Display

The system is provided with an advanced screen to assist in unit commissioning and troubleshooting. Operating pressures and temperatures from the system sensors are displayed in a format emulating a set of refrigerant gauges. Full description text is scrolled across a banner display to show current system operation and status. A menu structure for the outdoor display can be found in Table 6 and general operation is detailed in the following pages.

### GENERAL DISPLAY OPERATION

#### 1. During an Active Call

A. Display Current system values:

##### Value

- COMPRESSOR SPEED (RPM)
- OD FAN SPEED (RPM)
- EEV STEP (ID Status)
- EEV STEP (OD Status)
- ID FAN SPEED (CFM)
- INPUT CURRENT (AMPS) -From Inverter Input
- INPUT VOLTAGE (VOLTS) -From Inverter Input
- INPUT WATTS (WATTS) -From Inverter Input

Equipment Status information will scroll sequentially on a continuous loop, example below.

##### Continuous Loop Example:

COMPRESSOR (RPM) \* OD FAN (RPM) \* EEV STEP (ID EEV)  
 \* EEV STEP (OD EEV) \* ID FAN (CFM) \* INVERTER (APMS)  
 \* INVERTER (VOLTS) \* INVERTER (WATTS)

#### 2. No Active Call, High Voltage is applied

The control will scroll and display \* STANDBY \* when there are no active calls for compressor operation.

#### 3. If any of the following conditions exists, do not display current values defined in 1-3 in the banner.

The control will indicate ASCD TIMER (ACTIVE) and display it as the highest priority over all of the below defined active modes, if the ASCD Timer is currently active.

A. Will ONLY Display the Active Condition

- ASCD TIMER (ACTIVE)  
-Only present when the ASCD Timer is Active.
- DEMAND RESPONSE (ACTIVE)
- FACTORY RUN TEST (ACTIVE)
- REPAIR HEAT - HP (ACTIVE)
- REPAIR COOL - HP (ACTIVE)
- REPAIR COOL - AC (ACTIVE)
- EMERGENCY HEAT (ACTIVE)
- DEFROST CAL (ACTIVE)
- DEFROST DD (ACTIVE)
- DEFROST TT (ACTIVE)

#### 4. No Active Call, No High Voltage

A. Display is OFF

### MENU NAVIGATION

#### Time Duration Response

- Tap Menu = Back to the second layer string
- Press Menu 2-5 seconds = Back to main layer string
- Press Menu > 5 seconds = Exit menu layer string and Return to the General Display Operation

TABLE 6: Outdoor Display Menu Structure

MAIN LAYER	SECOND LAYER	THIRD LAYER	BASE LAYER		
EQUIPMENT STATUS	COMMANDED	COMPRESSOR (RPM)			
		OD FAN (RPM)			
		ID EEV (SP)			
		OD EEV (SP)			
		ID FAN (CFM)			
	CURRENT	COMPRESSOR (RPM)			
		OD FAN (RPM)			
		ID EEV (SP)			
		OD EEV (SP)			
		ID FAN (CFM)			
		INPUT CURRENT (AMPS)			
		INPUT VOLTAGE (VOLTS)			
		INPUT WATTS (WATTS)			
	CONFIGURATIONS	DEMAND RESPONSE	OFF (Default)		
NORMALLY OPEN RELAY					
NORMALLY CLOSED RELAY					
INVERTER REPAIR PART		System will first determine Unit Type (Reversing Valve Presence) and Unit Tonnage (Inverter Configuration) and will walk the user through the operation, per inverter part number.			
		2-TON			
		3-TON			
		4-TON			
		5-TON			
SOFT JUMPERS		COMFORT - EFFICIENCY		EFFICIENCY (Default)	
				COMFORT	
		DEFROST – TERMINATE TEMPERATURE			TEMP 50F (Default)
					TEMP 60F
					TEMP 70F
					TEMP 80F
		HP LOCKOUT (Sets low temperature cutout)			OFF (Default)
					TEMP 5F
					TEMP 10F
					TEMP 15F
					TEMP 20F
					TEMP 25F
				TEMP 30F	
				TEMP 35F	
				TEMP 40F	
				TEMP 45F	
	AUX HEAT LOCKOUT (Sets balance point)			TEMP 50F	
				TEMP 55F	
				OFF (Default)	
				TEMP 5F	
				TEMP 10F	
				TEMP 15F	
				TEMP 20F	
				TEMP 25F	
				TEMP 30F	
				TEMP 35F	
				TEMP 40F	
			TEMP 45F		
		TEMP 50F			
		TEMP 55F			

Continued on next page.



**TABLE 6:** Outdoor Display Menu Structure

MODES	FAULT MODE	CURRENT SYSTEM FAULTS
		STORED SYSTEM FAULTS
		CLEAR FAULT LOG
	TEST MODE	BYPASS ASCD TIMER
		START FORCED DEFROST
		System will walk the user through the operation.
		OPERATIONAL MODE (HP)
		System determines Unit Type (Reversing Valve Presence) and Unit Tonnage (Inverter Configuration) and will walk the user through the operation.
	SERVICE MODE	COOLING
		HEATING
	CHARGE VERIFICATION	System determines Unit Type (Reversing Valve Presence) and Unit Tonnage (Inverter Configuration) and will walk the user through the operation.

**MENU NOTES:**

ALWAYS displayed on the Gauges: Discharge Pressure, Liquid Temperature, Suction Pressure, Suction Temperature, Calculated Superheat, and Calculated Subcool. On the high gauge display, the control shall toggle at a rate of 10 seconds between the Liquid Temperature and the Subcool calculated value. On the low gauge display, the control shall toggle at a rate of 10 seconds between the Suction Temperature and the Superheat calculated value.

Time out period: While in the Menu Structure if the display does not sense a navigational response within 5 minutes, the outdoor display will return to General Display Operation.

Door Switch: If the outdoor display is in the Menu Structure and the door switch is de-activated, the system will de-energizing the outdoor screen. Upon re-energizing the outdoor screen, the display will return to the General Display Operation.

Saved Configuration/Selection: The system will save all individual configuration selections made on the Outdoor Display. Upon returning to a previously saved configuration the system shall display the previously saved configuration setting(s). Not the Default setting(s), unless the saved selection was in fact the default selection.

Operational Mode: The system will display (Inverter profile and reversing valve dependent) unit type and tonnage when the user selects Operational Mode (AC - HP).

**FAULT/STATUS CODE OUTDOOR SYSTEM TROUBLE SHOOTING****TABLE 7:** Outdoor Control Faults/Status Code Display

Outdoor Control Description	LED <sup>1</sup>	Outdoor Display Text	Operating Mode	Possible Causes	Solution	Left Triangle Indication (OD Screen)	Right Triangle Indication (OD Screen)
<b>Operational Faults</b>							
High-pressure switch fault (not in lockout yet)	RED (Solid)	HPS – OPEN	Cooling	Reduced or no OD airflow	Verify outdoor coil is clean. Verify fan is functioning. Verify there is airflow through the coil.	–	X
				Reduced or no OD airflow due to motor limits	Check motor current against limits.		
					Check input voltage to ensure within range.		
			OD air temp out of range.	Verify the outdoor ambient temperature is within the range listed in the IOM.			
			Heating	Reduced or no ID airflow	Check for dirty filter - clean or replace		
					Check blower motor operation and for airflow restrictions.		
					Dirty ID coil.		
				External static is too high - correct duct work.			
			Reduced or no ID airflow due to motor limits.	Check motor current against limits.			
			Check input voltage to ensure within range.				
			ID air temp out of range.	Verify the ID ambient temperature is with the range listed in the IOM/ design parameters.			
			All	Pressure switch is disconnected from OD unit control board.	Check high pressure switch connection on the outdoor board.		
				Pressure switch faulty.	Ohm out the switch to confirm continuity when the system pressure is below 650 PSIG.		
Faulty EEV or restriction	Check EEV operation as superheat and/or subcooling will be high.						
System overcharged.	Verify the system has the correct amount of refrigerant charge. Refer to the tables from the product technical guide.						
System in high-pressure switch lockout (last mode of operation was normal compressor)	RED (Solid)	HPS SOFT LOCKOUT – NORMAL	All	See HPS fault.	See HPS fault.	–	X
System in high-pressure switch lockout (last mode of operation was normal compressor)	RED (Solid)	HPS HARD LOCKOUT – NORMAL	All	See HPS fault.	See HPS fault.	–	X
System in high-pressure switch lockout (last mode of operation was defrost)	RED (Solid)	HPS SOFT LOCKOUT – DEFROST	Defrost	Reversing valve didn't switch.	Verify proper valve wiring and actuation.	–	X
				See other causes above from cooling.	–		

TABLE 7: Outdoor Control Faults/Status Code Display

Outdoor Control Description	LED <sup>1</sup>	Outdoor Display Text	Operating Mode	Possible Causes	Solution	Left Triangle Indication (OD Screen)	Right Triangle Indication (OD Screen)
System in high-pressure switch lockout (last mode of operation was defrost)	RED (Solid)	HPS HARD LOCKOUT – DEFROST	Defrost	See HPS fault.	See HPS fault.	–	X
Low Voltage (<19 VAC)	RED (Solid)	LOW VOLTAGE – BELOW 19VAC	All	Under Voltage	Check input power supply wires.	–	–
					Check input power supply and 24VAC circuit before and during operation to verify voltage is within range given in manual (197-252Vac and >19).		
					Check 24Vac transformer tap for correct input power supply voltage selection.		
Inverter Control Communications Fault	RED (Solid)	COMMUNICATIONS LOST – INVERTER DRIVE	All	Bad wiring	Check wiring from OD control to Inverter.	–	–
				Damaged OD Control Board	Remove power to system for 2 minutes. Reapply power. If problem remains, replace OD Control Board.		
				Damaged Inverter Board	Remove power to system for 2 minutes. Reapply power. If problem remains, replace drive.		
JCI RS-485 Communications Lost	RED (Solid)	COMMUNICATIONS LOST – SYSTEM MASTER	All	Bad wiring	Check wiring from OD to ID unit as well as to thermostat.	–	–
				System out of phase.	Check ground and phasing on the low and high voltage side.		
Repair part tonnage selection does not match the stored value programmed in the JCI factory	RED (Solid)	INVERTER CONFIGURATION ERROR	All	Correct model number of drive not installed	Verify the replacement part model number with the list supplied by Source-1.	–	–
Inverter Model Number installed does not match the stored tonnage in EEPROM	RED (Solid)	INVERTER MODEL INSTALLATION ERROR – HARD LOCKOUT	All	Correct model number of drive not installed	Verify the replacement part model number with the list supplied by Source-1.	–	–
<b>Required Sensor or Switch Faults</b>							
Outdoor ambient sensor failure (short)	RED (Solid)	OUTDOOR AMBIENT SENSOR - SHORT – SOFT LOCKOUT	All	Bad thermistor	Check temperature vs. resistance curve per Table 9.	–	–
				Bad wiring leads	Check wiring lead from sensor to board.		
				Bad main OD control board.	If leads and sensor are fine, board is bad and needs to be replaced.		
		OUTDOOR AMBIENT SENSOR - SHORT – HARD LOCKOUT	All	Bad thermistor	Check temperature vs. resistance curve per Table 9.	–	–
				Bad wiring leads	Check wiring lead from sensor to board.		
				Bad main OD control board.	If leads and sensor are fine, board is bad and needs to be replaced.		
Outdoor ambient sensor failure (open)	RED (Solid)	OUTDOOR AMBIENT SENSOR – OPEN – SOFT LOCKOUT	All	See Ambient Sensor failure.	See Ambient Sensor failure.	–	–
		OUTDOOR AMBIENT SENSOR – OPEN – HARD LOCKOUT	All	See Ambient Sensor failure.	See Ambient Sensor failure.	–	–
Coil sensor failure (short) not in lockout yet	RED (Solid)	COIL TEMP SENSOR – SHORT	All	See Ambient Sensor failure.	See Ambient Sensor failure.	–	X

TABLE 7: Outdoor Control Faults/Status Code Display

Outdoor Control Description	LED <sup>1</sup>	Outdoor Display Text	Operating Mode	Possible Causes	Solution	Left Triangle Indication (OD Screen)	Right Triangle Indication (OD Screen)
Coil sensor failure (short)	RED (Solid)	COIL TEMP SENSOR – SHORT – SOFT LOCKOUT	All	See Ambient Sensor failure.	See Ambient Sensor failure.	–	X
		COIL TEMP SENSOR – SHORT – HARD LOCKOUT	All	See Ambient Sensor failure.	See Ambient Sensor failure.	–	X
Coil sensor failure (open) not in lockout yet	RED (Solid)	COIL TEMP SENSOR – OPEN	All	See Ambient Sensor failure.	See Ambient Sensor failure.	–	X
Coil sensor failure (open)	RED (Solid)	COIL TEMP SENSOR – OPEN – SOFT LOCKOUT	All	See Ambient Sensor failure.	See Ambient Sensor failure.	–	X
		COIL TEMP SENSOR – OPEN – HARD LOCKOUT	All	See Ambient Sensor failure.	See Ambient Sensor failure.	–	X
Liquid line temperature sensor failure (short) not in lockout yet	RED (Solid)	LIQUID TEMP SENSOR – SHORT	All	See Ambient Sensor failure.	See Ambient Sensor failure.	–	X
Liquid line temperature sensor failure (short)	RED (Solid)	LIQUID TEMP SENSOR – SHORT – SOFT LOCKOUT	All	See Ambient Sensor failure.	See Ambient Sensor failure.	–	X
Liquid line temperature sensor failure (open) not in lockout yet	RED (Solid)	LIQUID TEMP SENSOR – OPEN	All	See Ambient Sensor failure.	See Ambient Sensor failure.	–	X
Liquid line temperature sensor failure (open)	RED (Solid)	LIQUID TEMP SENSOR – OPEN – SOFT LOCKOUT	All	See Ambient Sensor failure.	See Ambient Sensor failure.	–	X
Discharge temperature sensor failure (short)	RED (Solid)	DISCHARGE TEMP SENSOR – SHORT	All	See Ambient Sensor failure.	See Ambient Sensor failure.	–	X
Discharge temperature sensor failure (open) not in lockout yet	RED (Solid)	DISCHARGE TEMP SENSOR – OPEN	All	See Ambient Sensor failure.	See Ambient Sensor failure.	–	X
Discharge temperature sensor failure (open)	RED (Solid)	DISCHARGE TEMP SENSOR – OPEN – SOFT LOCKOUT	All	See Ambient Sensor failure.	See Ambient Sensor failure.	–	X
Suction temperature sensor failure (short) not in lockout yet	RED (Solid)	SUCTION TEMP SENSOR – SHORT	All	See Ambient Sensor failure.	See Ambient Sensor failure.	X	–
Suction temperature sensor failure (short)	RED (Solid)	SUCTION TEMP SENSOR – SHORT – SOFT LOCKOUT	All	See Ambient Sensor failure.	See Ambient Sensor failure.	X	–
Suction temperature sensor failure (open) not in lockout yet	RED (Solid)	SUCTION TEMP SENSOR – OPEN	All	See Ambient Sensor failure.	See Ambient Sensor failure.	X	–
Suction temperature sensor failure (open)	RED (Solid)	SUCTION TEMP SENSOR – OPEN – SOFT LOCKOUT	All	See Ambient Sensor failure.	See Ambient Sensor failure.	X	–
Discharge pressure sensor failure (low voltage) not in lockout yet	RED (Solid)	DISCHARGE PRESSURE SENSOR – LOW VOLTAGE	All	Bad wiring harness	Check harness for continuity.	–	X
				Bad OD control board	If supply voltage across BLK and RED/WHT doesn't read 4.5-5.5 VDC replace OD control board.		
				Bad transducer	If voltage across BLK and RED/WHT is within a tolerance of 4.5-5.5 VDC and the voltage across WHT and RED/WHT doesn't read between 0.5-4.5 VDC replace sensor.		
				Bad OD control board	If voltage across WHT and RED/WHT reads between 0.5-4.5 VDC but fault still exists, replace OD control board.		



TABLE 7: Outdoor Control Faults/Status Code Display

Outdoor Control Description	LED <sup>1</sup>	Outdoor Display Text	Operating Mode	Possible Causes	Solution	Left Triangle Indication (OD Screen)	Right Triangle Indication (OD Screen)
Discharge pressure sensor failure (low voltage)	RED (Solid)	DISCHARGE PRESSURE SENSOR – LOW VOLTAGE – SOFT LOCKOUT	All	See Discharge Pressure Sensor Fault	See Discharge Pressure Sensor Fault	–	X
Discharge pressure sensor failure (high voltage) not in lockout yet	RED (Solid)	DISCHARGE PRESSURE SENSOR – HIGH VOLTAGE	All	See Discharge Pressure Sensor Fault	See Discharge Pressure Sensor Fault	–	X
Discharge pressure sensor failure (high voltage)	RED (Solid)	DISCHARGE PRESSURE SENSOR – HIGH VOLTAGE – SOFT LOCKOUT	All	See Discharge Pressure Sensor Fault	See Discharge Pressure Sensor Fault	–	X
Suction pressure sensor failure (low voltage)	RED (Solid)	SUCTION PRESSURE SENSOR – LOW VOLTAGE – SOFT LOCKOUT	All	Bad wiring harness	Check harness for continuity.	X	–
				Bad OD control board	If supply voltage across BLK and BLU/WHT doesn't read 4.5-5.5 VDC replace OD control board.		
				Bad transducer	If voltage across BLK and BLU/WHT is within a tolerance of 4.5-5.5 VDC and the voltage across WHT and BLU/WHT doesn't read between 0.5-4.5 VDC replace sensor.		
				Bad OD control board	If voltage across WHT and BLU/WHT reads between 0.5-4.5 VDC but fault still exists, replace OD control board.		
Suction pressure sensor failure (high voltage)	RED (Solid)	SUCTION PRESSURE SENSOR – HIGH VOLTAGE – SOFT LOCKOUT	All	Bad wiring harness	Check harness for continuity.	X	–
				Bad OD control board	If supply voltage across BLK and BLU/WHT doesn't read 4.5-5.5 VDC replace OD control board.		
				Bad transducer	If voltage across BLK and BLU/WHT is within a tolerance of 4.5-5.5 VDC and the voltage across WHT and BLU/WHT doesn't read between 0.5-4.5 VDC replace sensor.		
				Bad OD control board	If voltage across WHT and BLU/WHT reads between 0.5-4.5 VDC but fault still exists, replace OD control board.		
<b>Discharge Temp Faults</b>							
High discharge temperature (not in lockout yet)	RED (Solid)	HIGH DISCHARGE TEMP	All	Insufficient charge	Check refrigerant charge	–	X
				Faulty sensor	Check discharge sensor with procedure found in discharge sensor faults.		
				Faulty EEV or restriction	Check EEV operation as superheat will be high.		
			Heating	ID and OD temperature out of range.	Bring the temperature within design parameters found in the IOM.		
Cooling	ID and OD temperature out of range.	Bring the temperature within design parameters found in the IOM.					
High discharge temperature	RED (Solid)	HIGH DISCHARGE TEMP – SOFT LOCK-OUT	All	See High Discharge Temp.	See High Discharge Temp.	–	X
High discharge temperature	RED (Solid)	HIGH DISCHARGE TEMP – HARD LOCK-OUT	All	See High Discharge Temp.	See High Discharge Temp.	–	X

TABLE 7: Outdoor Control Faults/Status Code Display

Outdoor Control Description	LED <sup>1</sup>	Outdoor Display Text	Operating Mode	Possible Causes	Solution	Left Triangle Indication (OD Screen)	Right Triangle Indication (OD Screen)
<b>Suction Pressure Faults</b>							
Low suction pressure (not in lockout yet)	RED (Solid)	LOW SUCTION PRESSURE	Cooling	Reduced or no ID airflow	Check for dirty filter - clean or replace	X	-
					Check blower motor operation and airflow restrictions.		
					Dirty ID coil.		
				External static is too high - correct duct work.			
				ID air temp out of range.	Verify the ID ambient temperature is with the range listed in the IOM/design parameters.		
				Reduced or no ID airflow due to motor limits.	Check motor current against limits.		
			Check input voltage to ensure within range.				
			Heating	Reduced or no OD airflow	Verify outdoor coil is clean. Verify fan is functioning. Verify there is airflow through the coil.		
					Reduced or no OD airflow due to motor limits		
				Check input voltage to ensure within range.			
				OD air temp out of range.	Verify the outdoor ambient temperature is within the range listed in the IOM.		
				Improperly functioning OD EEV.	Check coil windings. White/Red, Orange/Red, Yellow/Red, and Blue/Red should each read between 42 and 50 ohms.		
					Check 12VDC output signal from OD control board.		
			All	Insufficient charge	Check refrigerant charge compared to tech service guide.		
Faulty suction transducer	Check transducer						
Restriction after the EEV	Check for temperature drop at various section along the refrigerant circuit, i.e., across filter drier, etc.						
Low suction pressure	RED (Solid)	LOW SUCTION PRESSURE – SOFT LOCKOUT	All	See Low Suction Pressure	See Low Suction Pressure	X	-
Low suction pressure	RED (Solid)	LOW SUCTION PRESSURE – HARD LOCKOUT	All	See Low Suction Pressure	See Low Suction Pressure	X	-

1. Refer to Figure 10 for Outdoor Control LED location.

**TABLE 8:** Inverter Drive Fault/Status Code Display

Inverter Drive Description	LED <sup>1</sup>	Blink Codes	OD Display Text	Possible Causes	Solution
<b>Inverter - Faults</b>					
C+B6:H16 Compressor Phase Over Current	LED604 / LED2	1 or 3	COMPRESSOR PHASE OVER CURRENT – INVERTER DRIVE	Loose or incorrect wire connections	Check lead to the compressor plug and at inverter drive. W: Black Wire (BLK). V: Red Wire (RED). U: Brown Wire (BRN).
				Phase imbalance or shorted compressor windings.	Check compressor winding resistance at the compressor terminals. 2 Ton - 0.681 3 Ton - 0.203 4 Ton - 0.203 5 Ton - 0.203
				High compressor load.	Verify system is within operating conditions as outlined in IOM.
				High compressor load caused by internal damage.	Check compressor and if all looks normal and problems still persist when all other solutions have been vetted, replace compressor.
	LED 603 / LED3	4		Sensor on drive not reading properly	Replace drive.
Compressor Phase Current Foldback Timeout	LED604 / LED2	16	COMPRESSOR PHASE CURRENT FOLDBACK – INVERTER DRIVE	See Compressor Phase Over Current.	See Compressor Phase Over Current.
AC Input Over Current	LED604 / LED2	11	AC INPUT OVER CURRENT – INVERTER DRIVE	Reduced input voltage	Check the line voltage if it is < 187VAC.
		14		Distorted input voltage	Check the line voltage for noise. Call an electrician or the power company if noise is found.
		15		High compressor load.	Check the compressor is operating with in specified limits.
				Drive component issue.	Replace drive.
AC Input Current Sampling Fault	LED 603 / LED3	5		Sensor on drive not reading properly.	Replace drive.
DC Bus Over Voltage	LED604 / LED2	7	DC BUS OVER VOLTAGE – INVERTER DRIVE	High input voltage	Check the DC bus voltage if it is > 385 VDC. Use bus voltage terminals found in Figures 13-15. Check the line voltage if it is > 265VAC. (If high, contact utility provider.)
				Damaged Inverter Board	Replace drive.
DC Bus Under Voltage	LED604 / LED2	8	DC BUS UNDER VOLTAGE – INVERTER DRIVE	Low input voltage	Check the DC bus voltage if it is < 385VDC. Use bus voltage terminals found in Figures 13-15. Check the line voltage if it is < 187VAC. (If low, contact utility provider.)
				Damaged Inverter Board	Replace drive.

**TABLE 8:** Inverter Drive Fault/Status Code Display

Inverter Drive Description	LED <sup>1</sup>	Blink Codes	OD Display Text	Possible Causes	Solution
AC Input Over Voltage	LED604 / LED2	10	AC INPUT OVER VOLTAGE – INVERTER DRIVE	High input voltage	Check the line voltage if it is > 265VAC. (If high, contact utility provider.)
				Damaged Inverter Board	Check the DC bus voltage if it is > 385VDC. Use bus voltage terminals found in Figures 13-15. Replace drive.
AC Input Under Voltage	LED604 / LED2	9	AC INPUT UNDER VOLTAGE – INVERTER DRIVE	Low input voltage	Check the line voltage if it is < 187VAC. (If low, contact utility provider.)
				Damaged Inverter Board	Check the DC bus voltage if it is < 385VDC. Use bus voltage terminals found in Figures 13-15. Replace drive.
Power Module Over Temp	LED604 / LED2	4	POWER MODULE OVER TEMP – INVERTER DRIVE	Outdoor airflow is too low or off.	Verify proper airflow over the drive heat sink.
				Inverter component damage.	Replace drive.
PFC-IGBT Over Temp	LED604 / LED2	5	PFC-IGBT OVER TEMP – INVERTER DRIVE	Outdoor airflow is too low or off.	Verify proper airflow over the drive heat sink.
				Inverter component damage.	Replace drive.
Lost Rotor Position	LED604 / LED2	2	LOST ROTOR POSITION – INVERTER DRIVE	Loose or incorrect wire connections	Check lead to the compressor plug and at inverter drive. W: Red Wire (RED). V: Black Wire (BLK). U: Brown Wire (BRN).
				Phase imbalance or shorted compressor windings.	Check compressor winding resistance at the compressor terminals. 2 Ton - 0.681 3 Ton - 0.203 4 Ton - 0.203 5 Ton - 0.203
				Inverter component damage.	Replace drive.
				Internal compressor damage.	Replace compressor.
Compressor Phase Current Imbalance	LED 603 / LED3	14	COMPRESSOR PHASE CURRENT IMBALANCE – INVERTER DRIVE	Loose or incorrect wire connections	Check lead to the compressor plug and at inverter drive. W: Black Wire (BLK). V: Red Wire (RED). U: Brown Wire (BRN).
				Phase imbalance or shorted compressor windings	Check compressor winding resistance at the compressor terminals. 2 Ton - 0.681 3 Ton - 0.203 4 Ton - 0.203 5 Ton - 0.203
				Inverter component damage.	Replace drive.
				Internal compressor damage.	Replace compressor.
Microelectronic Fault	LED 603 / LED3	13	MICROELECTRONIC FAULT – INVERTER DRIVE	Digital Signal Processor self-check.	Remove power to drive for 2 minutes. Reapply power. If problem remains, replace drive.
EEPROM Fault	LED 603 / LED3	12		Digital Signal Processor self-check.	Remove power to drive for 2 minutes. Reapply power. If problem remains, replace drive.



**TABLE 8:** Inverter Drive Fault/Status Code Display

Inverter Drive Description	LED <sup>1</sup>	Blink Codes	OD Display Text	Possible Causes	Solution
Power Module Temp Low or Sensor Open Fault	LED 603 / LED3	2	POWER MODULE TEMP LOW / SENSOR OPEN – INVERTER DRIVE	Temperature sensor on the drive is potentially faulty.	Remove power to drive for 2 minutes. Reapply power. If problem remains, replace drive.
DC Bus Under Voltage	LED604 / LED2	17	NA	Low input voltage	Check the DC bus voltage if it is < 385VDC. Use bus voltage terminals found in Figures 13-15.
				Damaged Inverter Board	Check the line voltage if it is < 187VAC. (If low, contact utility provider.) Replace drive.
AC Input Current Foldback Timeout	LED 603 / LED3	15	AC INPUT CURRENT FOLDBACK – INVERTER DRIVE	Reduced input voltage	Check the line voltage if it is < 187VAC.
				Distorted input voltage	Check the line voltage for noise. Call an electrician or the power company if noise is found.
				High compressor load.	Check the compressor is operating with in specified limits.
				Drive component issue.	Replace drive.
				Sensor on drive not reading properly.	Replace drive.
Modbus Communication Lost	LED 603 / LED3	11	MODBUS COMM LOST – INVERTER DRIVE	Loose or disconnected communication harness.	Validate harness connection.
				Broken or damaged communication harness.	Check continuity of harness wires. If an problem is found, replace communication harness.
				Damaged OD Control Board	Remove power to system for 2 minutes. Reapply power. If problem remains, replace OD Control Board.
				Damaged Inverter Board	Remove power to drive for 2 minutes. Reapply power. If problem remains, replace drive.
Power Module Temp High	LED604 / LED2	18	POWER MODULE HIGH TEMP – INVERTER DRIVE	Outdoor airflow is too low or off.	Verify proper airflow over the drive heat sink.
				Inverter component damage.	Replace drive.
PFC-IGBT High Temp	LED604 / LED2	19	PFC-IGBT HIGH TEMP – INVERTER DRIVE	Outdoor airflow is too low or off.	Verify proper airflow over the drive heat sink.
				Inverter component damage.	Replace drive.
PFC MCU and DSP Communication Lost	LED 603	9	PFC MCU / DSP COMM ERROR – INVERTER DRIVE	Loose or disconnected communication harness.	Validate harness connection.
				Broken or damaged communication harness.	Check continuity of harness wires. If an problem is found, replace communication harness.
				Damaged OD Control Board	Remove power to drive for 2 minutes. Reapply power if problem remains, replace OD Control Board.
				Damaged Inverter Board	Remove power to drive for 2 minutes. Reapply power. If problem remains, replace drive.

**TABLE 8:** Inverter Drive Fault/Status Code Display

Inverter Drive Description	LED <sup>1</sup>	Blink Codes	OD Display Text	Possible Causes	Solution
COM MCU and DSP Communication Lost	LED 603	8	COM MCU / DSP COMM ERROR – INVERTER DRIVE	Loose or disconnected communication harness.	Validate harness connection.
				Broken or damaged communication harness.	Check continuity of harness wires. If an problem is found, replace communication harness.
				Damaged OD Control Board	Remove power to drive for 2 minutes. Reapply power. If problem remains, replace OD Control Board.
				Damaged Inverter Board	Remove power to drive for 2 minutes. Reapply power. If problem remains, replace drive.
PFC-IGBT Temp Low or Sensor Open Fault	LED 603	1	PFC-IGBT LOW TEMP / SENSOR OPEN – INVERTER DRIVE	Temperature sensor on the drive is potentially faulty.	Remove power to drive for 2 minutes. Reapply power. If problem remains, replace drive.
Power Module Temp. Foldback Timeout	LED604 / LED2	21	POWER MODULE TEMP FOLDBACK – INVERTER DRIVE	Outdoor airflow is too low or off.	Verify proper airflow over the drive heat sink.
				Inverter component damage.	Replace drive.
Compressor Model Configuration Error	LED 604 / LED2	22	COMPRESSOR MODEL CONFIGURATION ERROR – INVERTER DRIVE	Compressor model and configuration code do not match.	Check system configuration and select proper system tonnage in repair part menu if proper option is not available the correct drive has not been installed, replace drive.
High Pressure Sensor Type Configuration Error	LED 604 / LED2	23	HPS CONFIGURATION ERROR – INVERTER DRIVE	Pressure sensor and configuration code do not match.	Check system configuration and select proper system tonnage in repair part menu. If proper option is not available the correct drive has not been installed, replace drive.
DLT Low Temp or Open	LED 603 / LED3	3	DLT CONFIGURATION ERROR – INVERTER DRIVE	System configuration not set properly.	Check system configuration and select proper system tonnage in repair part menu. If proper option is not available the correct drive has not been installed, replace drive.
AC Input Voltage Sampling Fault	LED 603 / LED3	6	NA	Sensor on drive not reading properly.	Remove power to drive for 2 minutes. Reapply power. If problem remains, replace drive.
DC BUS Voltage Sampling Fault	LED 603 / LED3	7	NA	Sensor on drive not reading properly.	Remove power to drive for 2 minutes. Reapply power. If problem remains, replace drive.
Auto Configuration Communication Fault Timeout	LED 603 / LED3	17	NA	Baud rate or parity of the system controller not matching with drive.	Remove power to drive for 2 minutes. Reapply power. If problem remains, replace drive.
Compressor AA5 Phase Over Current (Intermediate)	LED 2	27	NA	NA	NA
Board Temp High	LED 2	26	NA	Outdoor airflow is too low or off.	Verify proper airflow over the drive heat sink.
				Inverter component damage.	Replace drive.

1. Refer to Figures 13-15 for LED inverter drive locations.

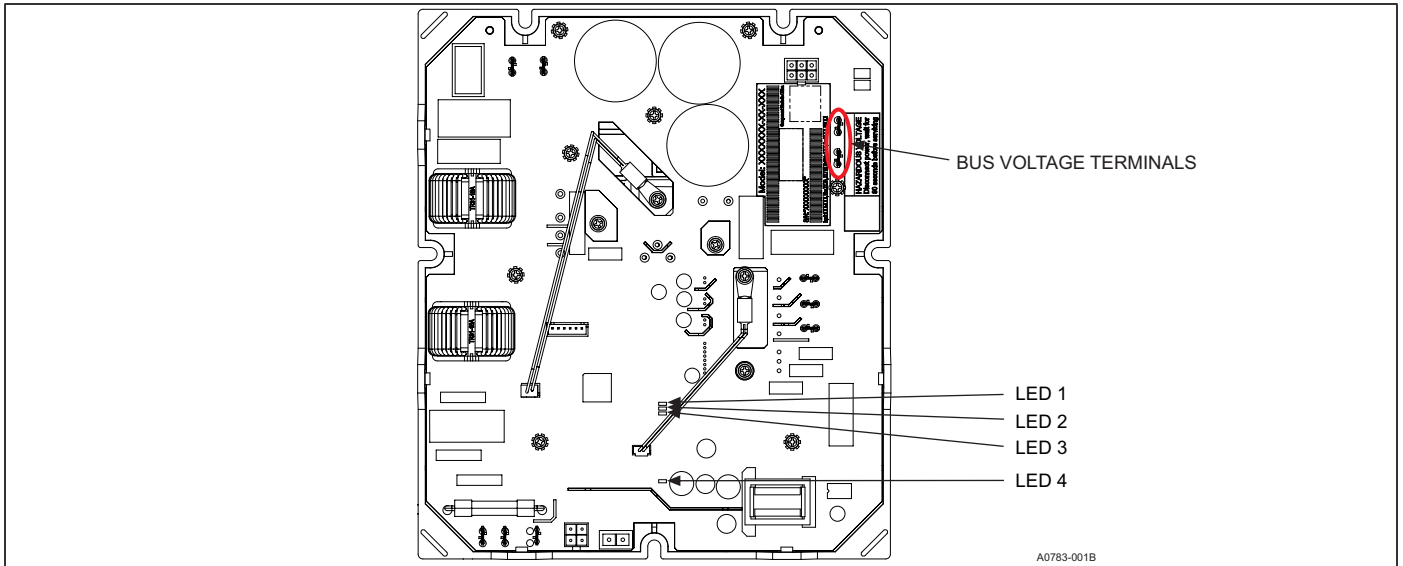


FIGURE 13: 2 Ton Inverter Drive LED Location

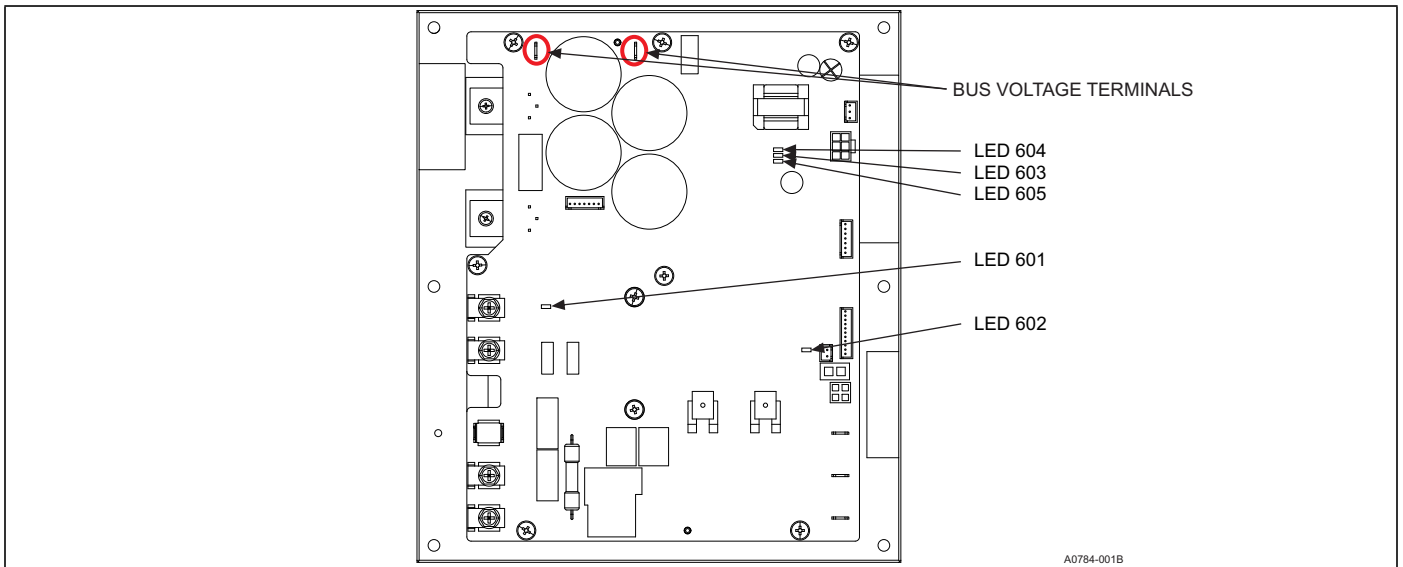


FIGURE 14: 3 & 4 Ton Inverter Drive LED Location

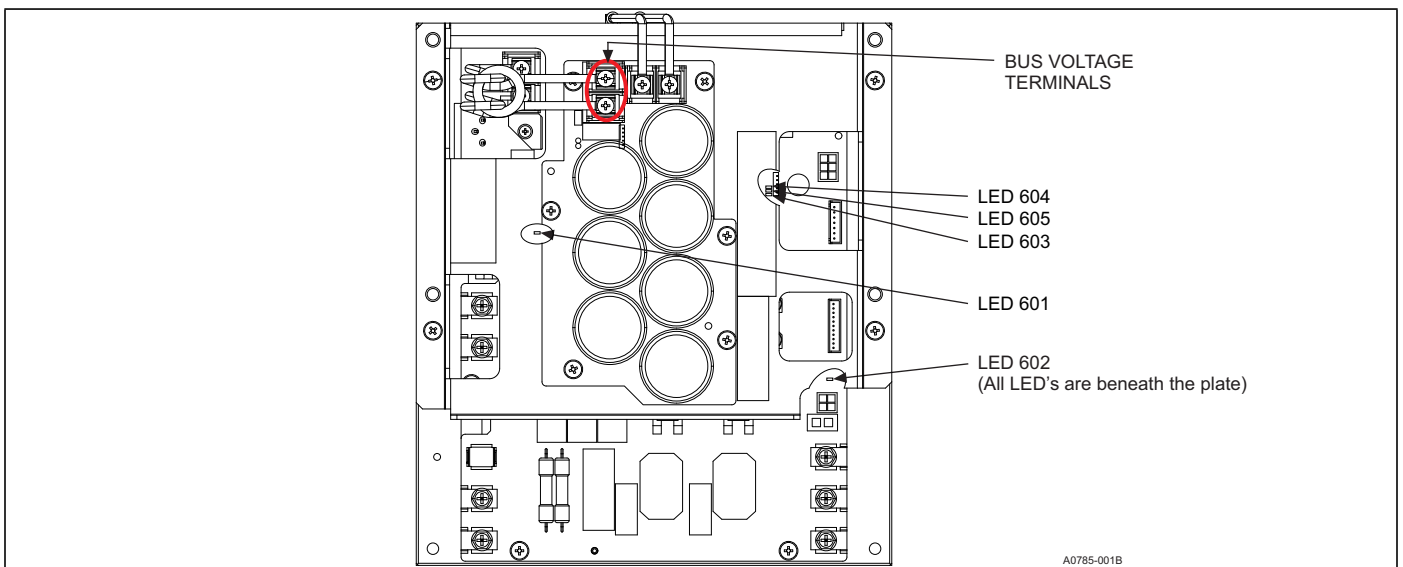


FIGURE 15: 5 Ton Inverter Drive LED Location

**INVERTER DRIVE TROUBLE SHOOTING**

<b>⚠ WARNING</b>	<b>ELECTRICAL SHOCK HAZARD</b> <ul style="list-style-type: none"> <li>• Disconnect and lock out power before servicing.</li> <li>• Wait 2 minutes to ensure that drive capacitors are discharged before servicing.</li> <li>• Use compressor with grounded system only.</li> <li>• Molded electrical plug must be used for connection to compressor.</li> </ul>
<b>⚠ WARNING</b>	<b>BURN HAZARD</b> <ul style="list-style-type: none"> <li>• Failure to follow these warnings could result in serious personal injury or property damage.</li> <li>• Ensure that materials and wiring do not touch high temperature areas of the compressor.</li> <li>• Personal safety equipment must be used.</li> </ul>
<b>⚠ WARNING</b>	<b>RCD PROTECTION</b> <ul style="list-style-type: none"> <li>• Be sure to install a Residual Current protective Device (RCD) in accordance with the applicable legislation. Failure to do so may cause electric shock or fire.</li> <li>• Be sure to use a dedicated power circuit, never use a power supply shared by another appliance.</li> <li>• When installing the RCD be sure that it is compatible with the inverter (resistant to high frequency electric noise and to higher harmonics) to avoid unnecessary opening of the RCD.</li> </ul> <p>The RCD must be a high speed type breaker of 30 mA (&lt;0.1 seconds).</p>
<b>⚠ CAUTION</b>	<b>DRIVE HANDLING</b> <ul style="list-style-type: none"> <li>• Caution must be used when lifting and installing the drive. Failure to use caution may result in bodily injury.</li> <li>• Personal safety equipment must be used.</li> <li>• Failure to follow these warnings could result in personal injury or property damage.</li> </ul>
<b>Safety Statements</b> <ul style="list-style-type: none"> <li>• Only qualified and authorized HVAC or refrigeration personnel are permitted to install, commission and maintain this equipment.</li> <li>• Electrical connections must be made by qualified electrical personnel.</li> <li>• All valid standards and codes for installing, servicing, and maintaining electrical and refrigeration equipment must be observed.</li> </ul>	

**INVERTER DRIVE LED**

There are three control chips on the drive board and all of them have their own LED status display as detailed below. The location of each LED can be found in Figures 13-15.

**Operation Indicating LED (Green - 1 or 605)** - When the drive is in normal or standby state with no protection or fault condition the LED will flash at 0.5 sec ON / 0.5 sec OFF. If the compressor is running the LED will be solid.

**Protection Indicating LED (Yellow - 2 or 604)** - When the drive is under protection, the yellow LED will flash. Refer to the fault status and troubleshooting section of this bulletin for more information.

**Hardware Fault Indicating LED (Red - 3 or 603)** - When the drive is under hardware fault, the red LED will flash. Refer to the fault status and

troubleshooting section of this bulletin for more information.

**LED for Drive Control (Green - 4 or 602)** - When the drive is in normal state, whether the compressor is running or standby, the LED will flash at 1 sec ON / 1 sec OFF. When the drive is under protection or hardware fault, the LED will flash at 8 sec ON/ 8 sec OFF.

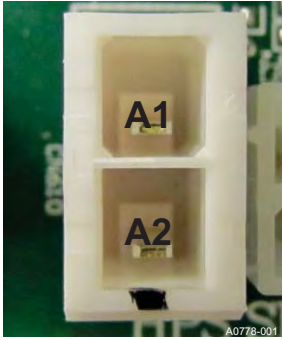
**LED for Power Factor Correction (Green-601)** - When the drive PFC is not in operation, the LED will blink at 1 sec ON / 1 sec OFF. When the PFC is in operation, the LED will be solid.

TABLE 9: Thermistor Resistance vs Temperature Table

TEMP °C	TEMP °F	Resistance	TEMP °C	TEMP °F	Resistance	TEMP °C	TEMP °F	Resistance
-40	-40.0	336000	22	71.6	11418	84	183.2	1104
-39	-38.2	314490	23	73.4	10921	85	185.0	1070
-38	-36.4	294520	24	75.2	10449	86	186.8	1037
-37	-34.6	275970	25	77.0	10000	87	188.6	1005
-36	-32.8	258730	26	78.8	9571	88	190.4	974
-35	-31.0	242700	27	80.6	9164	89	192.2	944
-34	-29.2	227610	28	82.4	8776	90	194.0	915
-33	-27.4	213570	29	84.2	8407	91	195.8	889
-32	-25.6	200510	30	86.0	8056	92	197.6	861
-31	-23.8	188340	31	87.8	7720	93	199.4	836
-30	-22.0	177000	32	89.6	7401	94	201.2	811
-29	-20.2	166342	33	91.4	7096	95	203.0	787
-28	-18.4	156404	34	93.2	6806	96	204.8	764
-27	-16.6	147134	35	95.0	6530	97	206.6	742
-26	-14.8	138482	36	96.8	6266	98	208.4	721
-25	-13.0	130402	37	98.6	6014	99	210.2	700
-24	-11.2	122807	38	100.4	5774	100	212.0	680
-23	-9.4	115710	39	102.2	5546	101	213.8	661
-22	-7.6	109075	40	104.0	5327	102	215.6	643
-21	-5.8	102868	41	105.8	5117	103	217.4	626
-20	-4.0	97060	42	107.6	4918	104	219.2	609
-19	-2.2	91588	43	109.4	4727	105	221.0	592
-18	-0.4	86463	44	111.2	4544	106	222.8	576
-17	1.4	81662	45	113.0	4370	107	224.6	561
-16	3.2	77162	46	114.8	4203	108	226.4	546
-15	5.0	72940	47	116.6	4042	109	228.2	531
-14	6.8	68957	48	118.4	3889	110	230.0	517
-13	8.6	65219	49	120.2	3743	111	231.8	503
-12	10.4	61711	50	122.0	3603	112	233.6	489
-11	12.2	58415	51	123.8	3469	113	235.4	476
-10	14.0	55319	52	125.6	3340	114	237.2	463
-9	15.8	52392	53	127.4	3217	115	239.0	450
-8	17.6	49640	54	129.2	3099	116	240.8	437
-7	19.4	47052	55	131.0	2986	117	242.6	425
-6	21.2	44617	56	132.8	2878	118	244.4	413
-5	23.0	42324	57	134.6	2774	119	246.2	401
-4	24.8	40153	58	136.4	2675	120	248.0	390
-3	26.6	38109	59	138.2	2579	121	249.8	379
-2	28.4	36182	60	140.0	2488	122	251.6	369
-1	30.2	34367	61	141.8	2400	123	253.4	359
0	32.0	32654	62	143.6	2315	124	255.2	349
1	33.8	31030	63	145.4	2235	125	257.0	340
2	35.6	29498	64	147.2	2157	126	258.8	332
3	37.4	28052	65	149.0	2083	127	260.6	323
4	39.2	26686	66	150.8	2011	128	262.4	315
5	41.0	25396	67	152.6	1943	129	264.2	308
6	42.8	24171	68	154.4	1876	130	266.0	300
7	44.6	23013	69	156.2	1813	131	267.8	293
8	46.4	21918	70	158.0	1752	132	269.6	285
9	48.2	20883	71	159.8	1693	133	271.4	278
10	50.0	19903	72	161.6	1637	134	273.2	272
11	51.8	18972	73	163.4	1582	135	275.0	265
12	53.6	18090	74	165.2	1530	136	276.8	259
13	55.4	17255	75	167.0	1480	137	278.6	253
14	57.2	16464	76	168.8	1431	138	280.4	247
15	59.0	15714	77	170.6	1385	139	282.2	241
16	60.8	15000	78	172.4	1340	140	284.0	235
17	62.6	14323	79	174.2	1297	141	285.8	230
18	64.4	13681	80	176.0	1255	142	287.6	224
19	66.2	13071	81	177.8	1215	143	289.4	219
20	68.0	12493	82	179.6	1177	144	291.2	214
21	69.8	11942	83	181.4	1140	145	293.0	209

**TABLE 10: Sensor Connector Pin Definition**

A1	High Pressure Signal
A2	3.3VDC



## DEFROST OPERATION

The system uses an adaptive defrost algorithm. The system will store four unique settings which will allow the system to defrost differently depending on the selected setting, Terminate Temperatures. This is done by changing the terminate temperature at which the defrost is terminated. This selection is made through a selectable soft jumper on the outdoor display and the thermostat, indicating “DEFROST TERMINATE TEMPERATURE”.

Should 6 hours of “Compressor Run Time” (accumulated compressor runtime during a heating call) elapse without a defrost cycle, a defrost cycle will be initiated immediately, unless the coil temperature is above the terminate temperature. If the OD ambient temperature is < 50°F after the 6 hour defrost then the system will be forced into a 6 minute defrost to allow oil return to the compressor, this will occur regardless of the coil temperature. If the OD ambient temperature is > 50°F at the 6 hour defrost then the system will terminate the defrost normally as described in Defrost Termination.

## DEFROST ENABLE TEMPERATURE

The defrost enable temperature is 35°F, the operation surrounding this temperature is described further throughout this section of the document. If the coil temperature is above 35°F and the compressor is active, the system will not accumulate defrost run time. It will however accumulate “Compressor Run Time” for purposes of running the 6 hour defrost. If the coil temperature is below 35°F and the compressor is active, the system will accumulate “Defrost Run Time” and accumulate “Compressor Run Time” (for purposes of running the 6 hour defrost).

## NOTICE

*The defrost run time and compressor run time are two separate timers and will work independently of one another.*

## DEFROST CALIBRATION MODE

The system is considered un-calibrated when power is applied to the system and/or if a successful calibration hasn't been completed. All defrost calibration modes are cleared when power is applied to the system. Calibration of the system occurs after a defrost cycle to ensure that there is not ice on the coil. During calibration, the temperature of both the coil and ambient sensors are measured to establish a Frost Free DeltaT (FFD), which is (AmbT-CoilT). The Frost Free DeltaT will be a different value depending on what speed the compressor operating at, what Indoor conditions exist, and what outdoor conditions exist.

When the system is in an un-calibrated state, the system will initiate a sacrificial defrost after 31 minutes of accumulated compressor runtime in heating mode with coil temperature below 35°F (Defrost Run Time). The defrost cycle will terminate if the coil sensor reaches the selected termination temperature or after a 12 minute defrost (Defrost Cycle Time). Once the sacrificial defrost has terminated, the system will command the compressor to return to the speed that the compressor was running immediately prior to initiating the defrost, this speed is called the “Calibrated Compressor Speed”, the system will run this speed during calibration mode. Upon completion of the calibration mode the system will re-enter normal operation in the same location it was prior to the defrost. A clear coil (non-iced condition) is established by averaging coil temperature readings and the outdoor ambient temperature readings once a minute for 4 minutes, starting on the 5th minute (stabilized coil condition, allowing system pressures and temperatures to stabilize) following termination of the last defrost. At that point the “Frost Free DeltaT” and the Outdoor Calibrated Ambient Temperatures are stored. From this a linear curve “Frost Free Curve” is developed based on the “Calibrated Ambient Temperature”, “Current Ambient Temperature”, “Frost Free DeltaT”, and “Defrost DeltaT Change”. This FFC curve is the curve the system will utilize for the next defrost cycle. The current ambient temperature will still be a variable and change the FFC value as the ambient temperature changes until the next defrost occurs.

As the ambient temperature changes, a slope of 1 F Defrost DeltaT Change for every 8 F ambient change will be used to adjust the detection of frost accumulation.

If a heating call ends during the process re-evaluating the clear coil temperature, it will utilize the previously stored averaged values from the previous cycle. In other words, don't clear the utilized value until the 4 values are averaged and that value is ready to populate the utilized value. If no previously stored averaged values exist, the system will remain un-calibrated and attempt calibration at the next defrost, depending on the terminating condition.

After initial calibration has been completed, the system prevents a defrost occurrence for 31 minutes of accumulated runtime in order to avoid unnecessary defrost operation due to system transient conditions.

During a Defrost Cycle the system will indicate the current mode of the defrost operation on the outdoor display. While in Calibration Mode the outdoor display will display, DEFROST CAL (ACTIVE).

## DEFROST INITIATION

To activate a defrost sequence, the “O” communication input must NOT be active and the coil temperature must be below 35°F. When these conditions are met, the defrost run time timer tracks the compressor runtime, and accumulates “Defrost Run Time” in the heating mode.

If the coil temperature is above 35°F, the “Defrost Run Time” timer is not cleared, and does not accumulate run time. If the coil temperature is above the selected “Defrost Temp” (termination temperature), the “Defrost Run Time” timer will be cleared. If the “O” communication input is active, the “Defrost Run Time” timer is cleared.

## TIME/TEMPERATURE DEFROST MODE

The system will enter “Time/Temperature Defrost Mode” if the last defrost was terminated based on “Defrost Cycle Time” and the CoilT is < 35°F for > 4 minutes. Then when the “Defrost Run Time” timer reaches 31 minutes, the defrost operation will be initiated immediately. At that time the system will record the compressor speed as the “Calibrated Compressor Speed”, this will be used during the calibration mode of the defrost algorithm. Depending on how the system exits the new defrost will determine which defrost mode the system will remain or enter.

During a Defrost Cycle the system will indicate the current mode of the defrost operation on the outdoor display. While in a Time Temperature Defrost the outdoor display will indicate, DEFROST TT (ACTIVE).



## DEMAND DEFROST MODE

The system will enter "Demand Defrost Mode" if the last defrost was terminated based on "Defrost Temp" (Termination Temperature) or the last defrost was terminated based on "Defrost Cycle Time" and the CoilT > 35°F for > 4 minutes. Then when the "Defrost Run Time" timer reaches 31 minutes, the defrost operation will be initiated by Frost Detection. At the time of initiation, the system will record the compressor speed as the "Calibrated Compressor Speed", this will be used during the calibration mode of the defrost algorithm.

## Frost Detection:

The system will be capable of detecting frost accumulation on the outdoor coil and initiate a defrost cycle when the current deltaT (AmbT-CoilT) >= "Defrost Active Variable" for the current outdoor ambient temperature for 5 seconds.

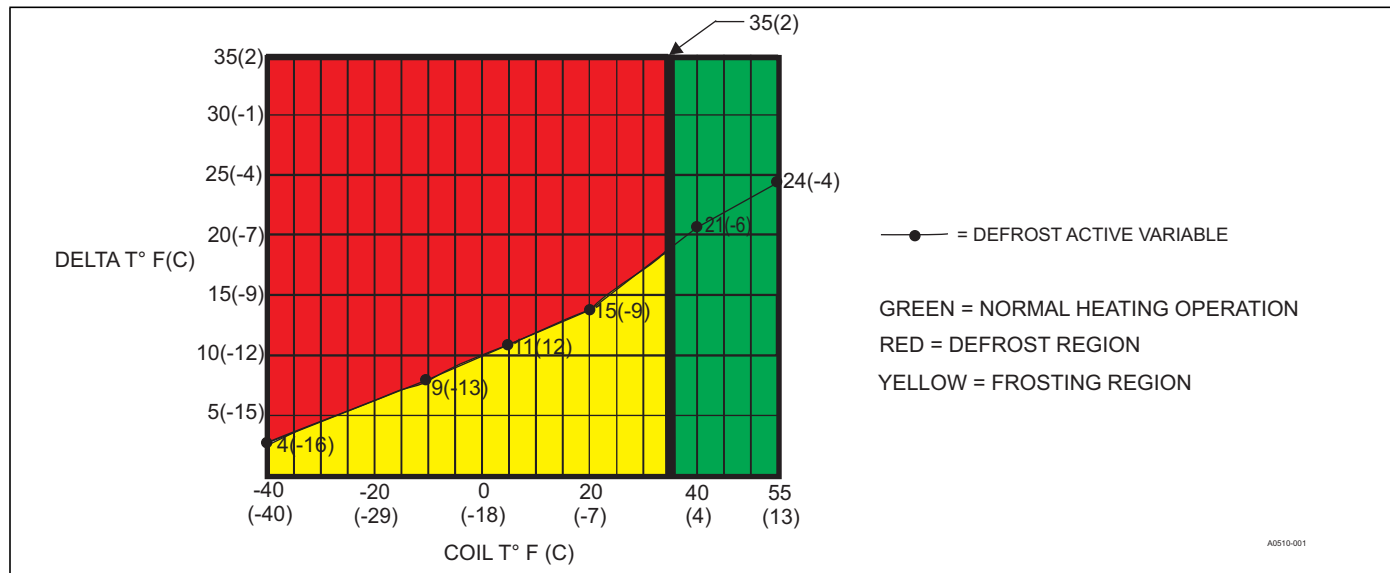


FIGURE 16: Defrost Operation Curves (Variables - Defrost Active Variable)

## DEFROST MODE

The defrost mode is equivalent to the cooling mode except that the outdoor fan motor is de-energized.

If the call for heating is removed from the control during the defrost cycle, the system will terminate the defrost cycle. The system will also stop the "Defrost Cycle Timer" but not reset it. When the system receives another call for compressor heating, it will restart the defrost cycle and the "Defrost Cycle Timer" at the point at which the call for heating was removed; if the conditions requiring a defrost still remain (coil temperature is below 35°F).

The system will remember what compressor speed and where in the operational algorithm the system is being operated before initiating a defrost. The system will run the "Defrost Compressor Speed" for the given tonnage. The system will run the "Calibrated Compressor Speed" during calibration.

- The system will do the following to initiate a defrost cycle.
- Record the Outdoor EEV Setpoint.
- Record the Calibrated Compressor Speed and where in the operational algorithm the system is.
- The Suction Pressure Fault is ignored during defrost unless the Absolute Trip value is < 5psi., then the fault is recognized as active.
- Communicate proper speed of compressor "Defrost Compressor Speed"
- Communicate proper speed of ID CFM for the "Defrost ID Airflow"
- Communicate the Outdoor Fan speed to 0
- Energize the reversing valve
- Fully open the Outdoor EEV.
- Communicate proper Indoor EEV Setpoint "ID EEV Setpoint"
- Begin the "Defrost Cycle Timer"
- Communicate the W1OUT for auxiliary heat.

## DEFROST TERMINATION

The system will terminate the defrost cycle immediately after the coil temperature goes above the selected termination temperature 50°F, 60°F, 70°F, or 80°F for 2 seconds. This selection is available on the outdoor display and the thermostat. If the terminate temperature selection is not selected, the default termination temperature is 50°F.

Once a defrost mode has been initiated, an internal timer (Defrost Cycle Timer) will count the time that the defrost mode is engaged and compressor is energized. After 12 minutes of operation in the defrost mode, the defrost sequence will terminate immediately and reset the internal timings regardless of the state of the coil sensor temperature.

The system operation is based on accumulated run time. Once a defrost mode has been initiated, an internal timer (CoilT > 35°F Timer) will count the time that the coil temperature CoilT is above 35°F. The system will be able to indicate at the end of a defrost if the CoilT has or has not been > 35°F for 4 minutes. If the system determines that it was above 35°F for greater than 4 minutes and the system terminates the defrost based on the Defrost Cycle Timer, the system will accept that the coil is frost free and remain/enter Demand Defrost Mode and calibrate for the next defrost. If the system determines that it wasn't above 35°F for greater than 4 minutes and the system terminates the defrost based on the Defrost Cycle Timer, the system will accept that the coil is NOT frost free and will remain and/or enter Time/Temperature Defrost Mode.

The Suction Pressure Fault is ignored during defrost and for 120 seconds following the termination of a Defrost. Unless the Absolute Trip value is < 5psi. then the fault is recognized as active.

The system establishes a new Dry Coil Delta T following termination of this defrost cycle. The compressor run time will be reset when the defrost cycle is complete.

The system will return to the previous compressor speed for the calibration process. Upon completing the calibration process the system will return to the same place in the control algorithm. The system will communicate the ID airflow for the proper compressor speed being operated during the calibration process.

The system will do the following to terminate a defrost cycle.

- De-energize the reversing valve
- Fully open the Indoor EEV
- Communicate proper Outdoor EEV Setpoint “OD EEV Setpoint”
- The Suction Pressure Fault is ignored for 120 seconds following the termination of a defrost unless the Absolute Trip value is < 5psi., then the fault is recognized as active.
- Wait 5 seconds
- Clear the maximum “Defrost Cycle Timer”
- Communicate to de-energize the auxiliary heat outputs (unless required by present heating call)
- Communicate the Outdoor Fan speed
- Change Compressor Speed to previously recorded Calibrated Compressor Speed
- Communicate the proper speed of ID CFM
- Wait 5 minutes (Only relative if the next defrost operation is demand defrost, not time temp)
- Take 4 readings starting on the 5th minute (complete the calibration process)
- Return the system to the same spot in the normal algorithm, place the system was in prior to initiating a defrost.
- Reset and restart defrost inhibit time

## PRESSURE SWITCH FAULT & LOCKOUT

### HIGH PRESSURE SWITCH (HPS) FAULT

If the compressor is operating and the high pressure switch is recognized as open, the control de-energizes the compressor output (and the defrost outputs if they are active). The 5 minute ASCD timer starts when the compressor speed reaches 0. The compressor contactor remains off until the high pressure switch has re-closed and the 5 minute ASCD timer has been satisfied.

If the coil (liquid line) temperature conditions allow defrost to occur when the control continues the call for heating, the control restarts the defrost cycle and the timer at the point the call for heating is interrupted.

### HIGH PRESSURE SWITCH LOCKOUT

If the system recognizes two HPS faults within six hours of accumulated compressor run-time, the system will enter the HPS lockout. During the lockout period, the defrost and compressor relays remain de-energized. While the system is locked out, the Outdoor Display will represent the appropriate fault message as described elsewhere in this document. The system will differentiate between PS faults that occur in heating or defrost modes. This is only for the system to decide which fault code to display. This may help the service person in troubleshooting issues with the unit when this lockout occurs. Otherwise it shouldn't differentiate between heating or defrost modes when counting PS faults.

The six hour timing starts after the ASCD has expired following the first PS fault. The timer only accumulates when the compressor is running. If the system recognizes a second opening of the PS before the six hour timer expires, the system will enter the PS soft lockout. If the system does not recognize a second opening of the PS before the six hour timer expires, the six hour timer is cleared and the PS fault counter is reset.

## SUCTION PRESSURE SENSOR FAULT

The system will monitor the suction pressure during operation. If the suction pressure value falls below the trending limit point and is not increasing, the low suction pressure fault is recognized. The suction pressure must remain below the trending limit for 360 seconds in heat operation or 360 seconds in cool operation. The low suction pressure fault is bypassed for 120 seconds upon system startup and after entering or leaving defrost. If the fault limit value is ever reached for > 5 seconds a low suction pressure fault is recognized regardless of a bypass time.

**TABLE 11:** Low Suction Pressure Limits

Mode of operation	Trending Limit	Fault Limit
Cool	< 90psi	< 5psi
Heat	< 20psi	< 5psi

## SECTION IX: INSTRUCTING THE OWNER

Assist the owner with registering the unit warranty using the warranty card included with the unit, or preferably online at [www.upgproductregistration.com](http://www.upgproductregistration.com). It is strongly recommended to complete a startup sheet showing the critical readings of the unit at the time of commissioning, which can be uploaded as part of the online registration process.

When applicable, instruct the owner that the compressor is equipped with a crankcase heater to prevent the migration of refrigerant to the compressor during the OFF cycle. The heater is energized only when the unit is not running. If the main switch is disconnected for long periods of shut down, do not attempt to start the unit until 2 hours after the switch has been connected. This will allow sufficient time for all liquid refrigerant to be driven out of the compressor.

The installer should also instruct the owner on proper operation and maintenance of all other system components.

## MAINTENANCE

1. Dirt should not be allowed to accumulate on the outdoor coils or other parts in the air circuit. Clean as often as necessary to keep the unit clean. Use a brush, vacuum cleaner attachment, or other suitable means.
2. The outdoor fan motor bearings are permanently lubricated and do not require periodic oiling.
3. If the coil needs to be cleaned, it should be washed with water or a PH neutral detergent. Allow solution to remain on coil for several minutes before rinsing with clean water. Solution should not be permitted to come in contact with painted surfaces.
4. Refer to the furnace or air handler instructions for filter and blower motor maintenance.
5. The indoor coil and drain pan should be inspected and cleaned regularly to prevent odors and assure proper drainage.

## **▲ CAUTION**

*It is unlawful to knowingly vent, release or discharge refrigerant into the open air during repair, service, maintenance or the final disposal of this unit.*

**COOLING CHARGE TABLE IS ON THE UNIT CODE PLATE ATTACHED TO THE OUTSIDE OF THE CONTROL BOX COVER.**

**SECTION X: WIRING DIAGRAM**

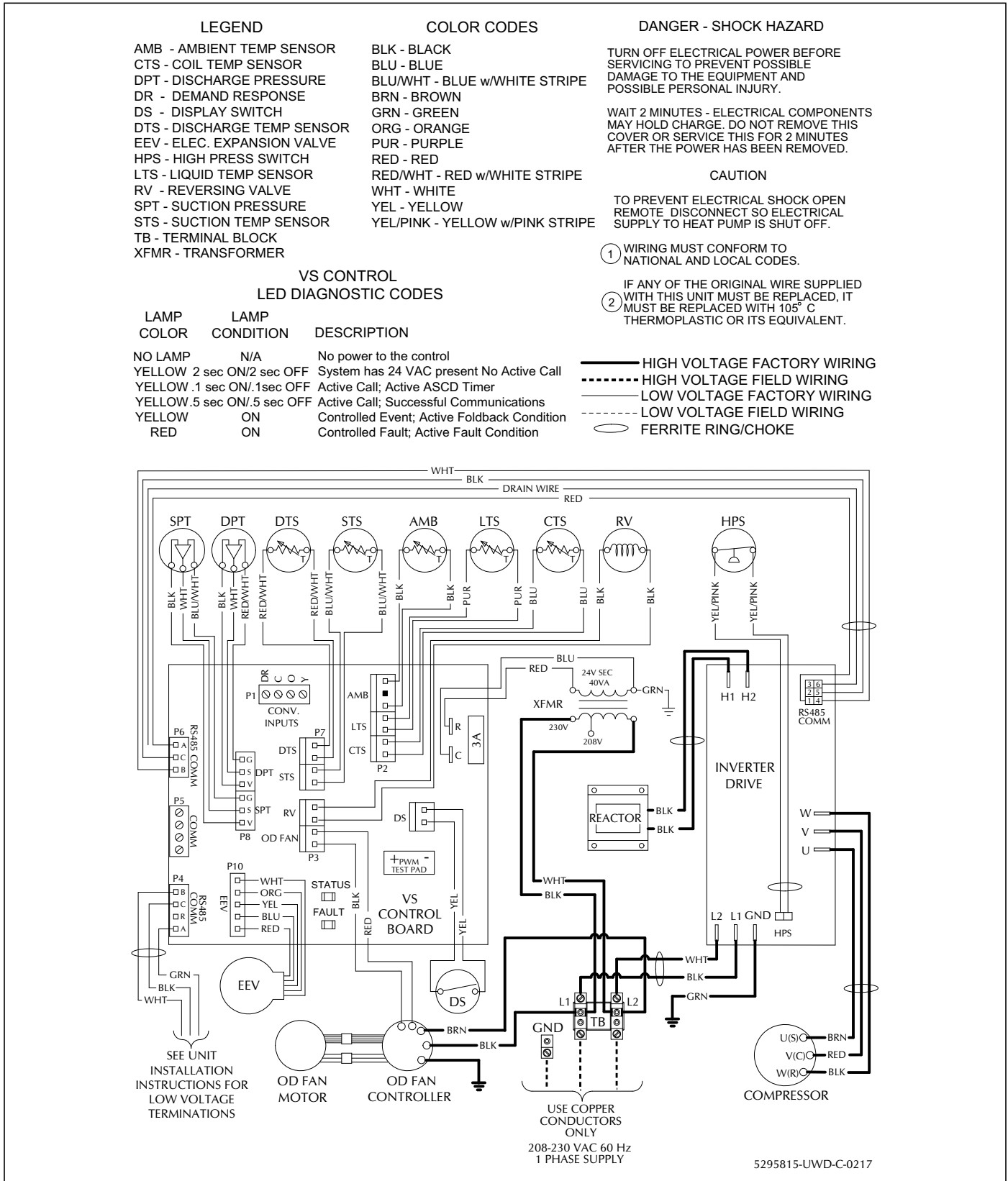


FIGURE 17: Wiring Diagram - 2 Ton

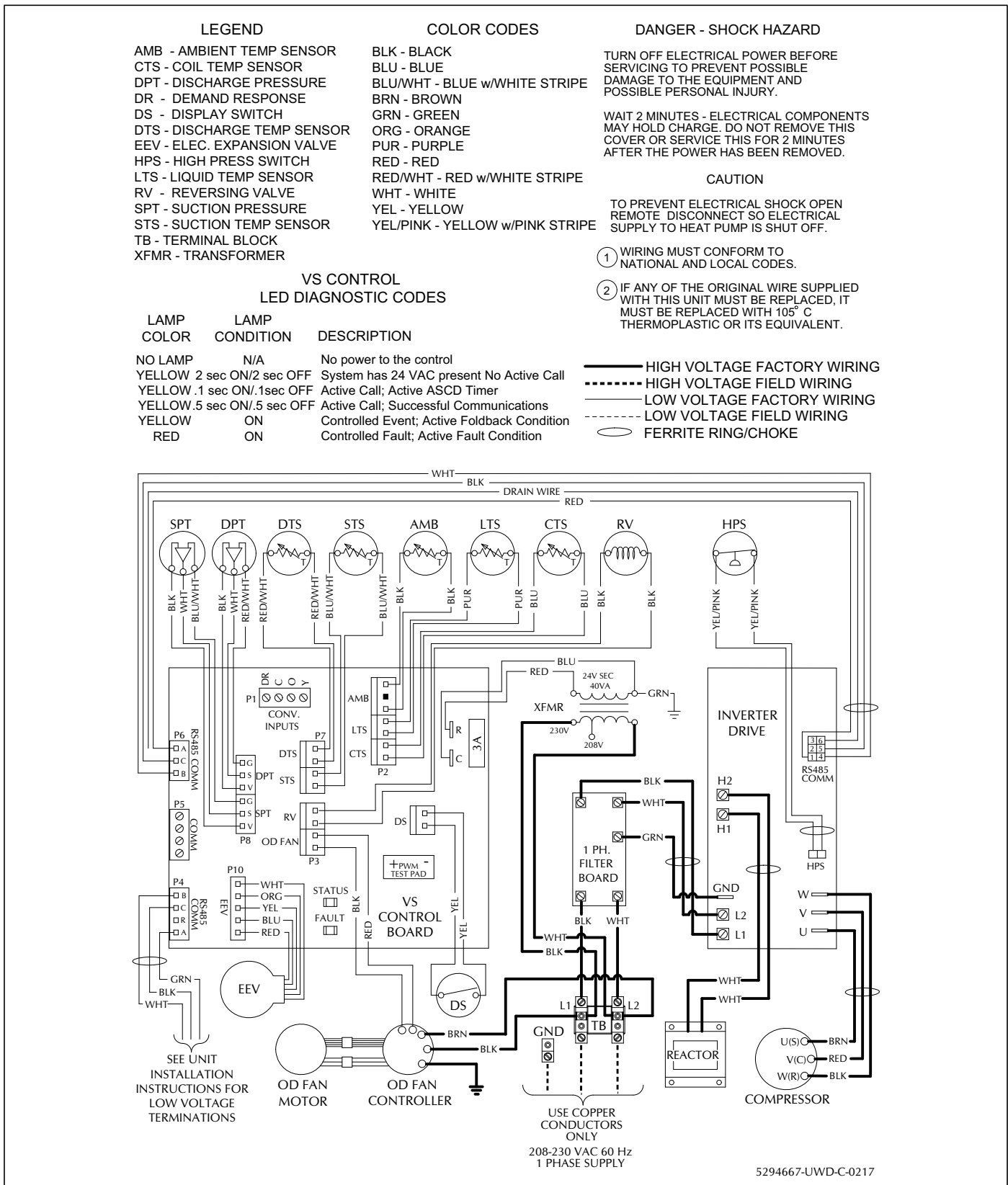


FIGURE 18: Wiring Diagram - 3-5 Ton

**SECTION XI: CHARGING CHARTS****COOLING**

2-TON HIGH SPEED COOLING SUBCOOLING CHARGING CHART				
OUTDOOR AMBIENT DB (°F)	INDOOR DRY BULB			
	60	65	70	75
	PRESSURE (PSIG)& SUBCOOLING (°F) AT LIQUID BASE VALVE			
55	203(3)	205(5)	208(3)	211(2)
60	213(4)	215(5)	218(4)	221(3)
65	225(4)	226(5)	231(5)	232(4)
70	239(5)	240(6)	245(6)	246(5)
75	255(6)	256(6)	260(7)	261(6)
80	273(6)	274(7)	277(7)	278(6)
85	293(7)	294(7)	296(7)	297(6)
90	315(8)	316(8)	317(7)	318(7)
95	339(8)	340(8)	339(7)	341(6)
100	365(9)	367(8)	363(7)	366(6)
105	393(9)	395(9)	389(6)	392(6)
110	424(10)	426(9)	417(5)	421(5)
115	456(10)	458(10)	446(4)	451(4)
120	490(11)	493(11)	476(2)	483(3)
125	527(11)	530(11)	509(1)	517(1)

Charging chart is for use in Service mode only.  
Charging chart is for use in Cooling mode only.

4-TON HIGH SPEED COOLING SUBCOOLING CHARGING CHART				
OUTDOOR AMBIENT DB (°F)	INDOOR DRY BULB			
	60	65	70	75
	PRESSURE (PSIG)& SUBCOOLING (°F) AT LIQUID BASE VALVE			
55	202(12)	202(12)	205(13)	207(13)
60	216(12)	216(12)	220(12)	221(13)
65	231(11)	232(11)	235(12)	238(13)
70	247(11)	248(11)	252(12)	255(12)
75	265(11)	266(11)	270(12)	273(12)
80	285(11)	285(11)	289(11)	293(12)
85	305(10)	306(11)	310(11)	314(12)
90	327(10)	328(10)	332(11)	337(12)
95	351(10)	351(10)	355(11)	360(12)
100	375(10)	376(10)	380(11)	385(11)
105	401(10)	402(10)	406(11)	411(11)
110	429(10)	429(10)	433(11)	438(11)
115	458(10)	458(10)	462(11)	467(11)
120	488(10)	488(10)	491(11)	496(11)
125	520(10)	519(10)	522(11)	527(11)

Charging chart is for use in Service mode only.  
Charging chart is for use in Cooling mode only.

3-TON HIGH SPEED COOLING SUBCOOLING CHARGING CHART				
OUTDOOR AMBIENT DB (°F)	INDOOR DRY BULB			
	60	65	70	75
	PRESSURE (PSIG)& SUBCOOLING (°F) AT LIQUID BASE VALVE			
55	194(6)	195(6)	197(6)	201(7)
60	209(6)	209(6)	211(6)	215(7)
65	224(6)	225(6)	227(6)	231(6)
70	242(6)	242(6)	244(6)	248(6)
75	260(6)	261(6)	263(6)	266(6)
80	280(6)	281(6)	283(6)	286(6)
85	302(6)	302(6)	305(6)	308(6)
90	325(6)	325(6)	328(6)	331(6)
95	349(7)	349(7)	352(7)	355(6)
100	375(7)	375(7)	378(7)	381(6)
105	402(7)	402(7)	405(7)	409(6)
110	431(7)	431(7)	434(7)	438(6)
115	461(8)	461(7)	465(8)	468(7)
120	492(8)	493(8)	497(8)	500(7)
125	525(8)	526(8)	530(8)	534(8)

Charging chart is for use in Service mode only.  
Charging chart is for use in Cooling mode only.

5-TON HIGH SPEED COOLING SUBCOOLING CHARGING CHART				
OUTDOOR AMBIENT DB (°F)	INDOOR DRY BULB			
	60	65	70	75
	PRESSURE (PSIG)& SUBCOOLING (°F) AT LIQUID BASE VALVE			
55	192(7)	194(8)	196(9)	198(10)
60	210(8)	212(8)	216(9)	217(10)
65	230(8)	231(9)	236(9)	238(10)
70	249(8)	251(9)	256(9)	259(10)
75	270(9)	272(9)	277(10)	281(10)
80	292(9)	294(9)	299(10)	303(10)
85	314(9)	316(9)	322(10)	326(10)
90	337(9)	340(10)	345(10)	350(10)
95	361(9)	364(10)	369(10)	374(9)
100	386(9)	389(10)	394(9)	400(9)
105	412(9)	415(10)	419(9)	425(9)
110	438(9)	441(9)	445(9)	452(9)
115	466(9)	468(9)	472(9)	479(9)
120	494(9)	497(9)	499(8)	507(9)
125	523(9)	525(9)	527(8)	536(9)

Charging chart is for use in Service mode only.  
Charging chart is for use in Cooling mode only.

**HEATING**

2-TON HIGH SPEED HEATING SUBCOOLING CHARGING CHART					
OUTDOOR AMBIENT DB (°F)	INDOOR WET BULB				
	60	65	70	75	80
	PRESSURE (PSIG)& SUBCOOLING (°F) AT LIQUID BASE VALVE				
60	313(12)	336(13)	358(13)	381(14)	403(15)
54	306(15)	327(16)	349(16)	370(17)	392(18)
47	298(18)	319(19)	339(19)	360(20)	380(20)
44	310(21)	333(22)	355(22)	377(23)	400(23)
40	322(24)	347(25)	371(25)	395(26)	419(26)
35	307(27)	335(27)	363(28)	390(28)	418(29)
30	291(29)	323(30)	354(30)	386(31)	417(31)
24	323(33)	335(32)	347(31)	359(30)	371(29)
17	354(37)	347(35)	339(32)	332(30)	324(27)
14	298(32)	305(31)	312(31)	319(30)	326(29)
10	242(27)	264(28)	285(29)	306(30)	327(31)

Charging chart is for use in Service mode only.  
Charging chart is for use in Heating mode only.

4-TON HIGH SPEED HEATING SUBCOOLING CHARGING CHART					
OUTDOOR AMBIENT DB (°F)	INDOOR WET BULB				
	60	65	70	75	80
	PRESSURE (PSIG)& SUBCOOLING (°F) AT LIQUID BASE VALVE				
60	309(27)	332(28)	354(28)	377(29)	400(29)
54	313(30)	337(30)	361(31)	386(32)	410(32)
47	317(32)	343(33)	368(34)	394(35)	420(35)
44	320(34)	346(35)	372(36)	399(37)	426(38)
40	322(36)	349(37)	376(38)	404(39)	431(40)
35	338(42)	368(43)	398(45)	428(46)	458(47)
30	354(48)	387(50)	419(51)	452(53)	485(54)
24	353(50)	378(50)	404(50)	429(49)	455(49)
17	352(51)	370(50)	388(48)	406(46)	424(44)
14	357(53)	374(51)	392(49)	410(47)	427(45)
10	361(54)	379(52)	396(49)	413(47)	430(45)

Charging chart is for use in Service mode only.  
Charging chart is for use in Heating mode only.

3-TON HIGH SPEED HEATING SUBCOOLING CHARGING CHART					
OUTDOOR AMBIENT DB (°F)	INDOOR WET BULB				
	60	65	70	75	80
	PRESSURE (PSIG)& SUBCOOLING (°F) AT LIQUID BASE VALVE				
60	283(7)	307(8)	330(9)	354(10)	377(11)
54	291(12)	314(13)	337(14)	360(14)	383(15)
47	298(17)	321(18)	343(18)	366(19)	388(19)
44	296(21)	318(20)	340(20)	362(20)	384(20)
40	293(24)	315(23)	336(22)	358(22)	379(21)
35	289(25)	312(24)	335(23)	357(23)	380(23)
30	284(25)	309(25)	333(24)	357(24)	381(24)
24	289(27)	312(27)	336(27)	359(27)	382(27)
17	293(28)	316(29)	338(29)	361(30)	383(30)
14	290(27)	307(27)	325(27)	343(26)	360(26)
10	286(26)	299(25)	312(24)	325(23)	337(22)

Charging chart is for use in Service mode only.  
Charging chart is for use in Heating mode only.

5-TON HIGH SPEED HEATING SUBCOOLING CHARGING CHART					
OUTDOOR AMBIENT DB (°F)	INDOOR WET BULB				
	60	65	70	75	80
	PRESSURE (PSIG)& SUBCOOLING (°F) AT LIQUID BASE VALVE				
60	315(14)	336(14)	357(14)	378(14)	399(13)
54	314(18)	336(18)	357(19)	379(18)	401(18)
47	313(22)	335(23)	357(23)	380(23)	402(23)
44	314(26)	331(26)	348(26)	365(26)	383(26)
40	315(29)	327(29)	339(29)	351(29)	363(29)
35	308(29)	315(27)	322(24)	329(22)	337(19)
30	301(29)	303(24)	305(19)	308(14)	310(9)
24	294(29)	298(24)	302(19)	307(14)	312(9)
17	286(29)	293(24)	299(19)	306(14)	313(9)
14	290(32)	305(29)	320(27)	335(25)	350(22)
10	294(34)	317(35)	340(35)	364(35)	387(35)

Charging chart is for use in Service mode only.  
Charging chart is for use in Heating mode only.



**SECTION XII: START UP SHEET**

## Residential Split Variable Capacity System Unit Cooling With Electric Heat Start-Up Sheet

Proper start-up is critical to customer comfort and equipment longevity

Start-Up Date	<input type="text"/>	Company Name	<input type="text"/>	Start-Up Technician	<input type="text"/>
Dealer Training Certification Number		<input type="text"/>			

**Owner Information**

Name	<input type="text"/>	Address	<input type="text"/>	Daytime Phone	<input type="text"/>
City	<input type="text"/>	State or Province	<input type="text"/>	Zip or Postal Code	<input type="text"/>

**Equipment Data**

Outdoor Model #	<input type="text"/>	Unit Serial #	<input type="text"/>
Indoor Model #	<input type="text"/>	Unit Serial #	<input type="text"/>

**General Information** (Check all that apply)

<input type="radio"/> New Construction	<input type="radio"/> Roof level	<input type="radio"/> Down flow	<input type="radio"/> Horizontal
<input type="radio"/> Retrofit	<input type="radio"/> Grade level	<input type="radio"/> Upflow	

**Unit Location and Connections** (Check all that apply)

<input type="checkbox"/> Unit is level and installed on:	<input type="checkbox"/> Slab	<input type="checkbox"/> Roof curb	<input type="checkbox"/> Duct connections are complete:	<input type="checkbox"/> Supply	<input type="checkbox"/> Return
<input type="checkbox"/> Condensate drain properly connected per the installation instructions		<input type="checkbox"/> Condensate trap has been primed with water			

**Filters**

<input type="checkbox"/> Filters installed	Number of filters	<input type="text"/>	Filter size	<input type="text"/>	<input type="radio"/> Filter located inside	<input type="radio"/> Filter located outside
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**Electrical Connections & Inspection** (Check all that apply)

<input type="radio"/> 208 volts AC	<input type="radio"/> 230 volt AC						
<input type="checkbox"/> Inspect wires and electrical connections	<input type="checkbox"/> Transformer wired properly for primary supply voltage	<input type="checkbox"/> Ground connected					
<input type="checkbox"/> Low voltage present at control board "R & C"	Measured voltage "R" and "C" outdoor unit control board	<input type="text"/>					
<input type="checkbox"/> Line voltage present at disconnect	Measured voltage "L1 to L2"	<input type="text"/>					
Compressor amperes "L1"	<input type="text"/>	"L2"	<input type="text"/>	Total amperes "L1"	<input type="text"/>	"L2"	<input type="text"/>

**Air Flow Setup / Cooling**

Blower Type & Set-Up	<input type="radio"/> ECM	COOL	<input type="radio"/> A	<input type="radio"/> B	<input type="radio"/> C	<input type="radio"/> D
		ADJUST	<input type="radio"/> A	<input type="radio"/> B	<input type="radio"/> C	<input type="radio"/> D
		DELAY	<input type="radio"/> A	<input type="radio"/> B	<input type="radio"/> C	<input type="radio"/> D
Supply static (inches of water column)	<input type="text"/>	Supply air dry bulb temperature	<input type="text"/>	Supply air wet bulb temperature	<input type="text"/>	
Return static (inches of water column)	<input type="text"/>	Return air dry bulb temperature	<input type="text"/>	Return air wet bulb temperature	<input type="text"/>	
Total external static pressure	<input type="text"/>	Temperature drop	<input type="text"/>	Outside air dry bulb temperature	<input type="text"/>	

Page 1 of 2 (3/14/17)

