**⚠WARNING:**
**RECOGNIZE THIS SYMBOL AS AN INDICATION OF IMPORTANT SAFETY INFORMATION**

**⚠WARNING**

**THESE INSTRUCTIONS ARE INTENDED AS AN AID TO QUALIFIED, LICENSED SERVICE PERSONNEL FOR PROPER INSTALLATION, ADJUSTMENT, AND OPERATION OF THIS UNIT. READ THESE INSTRUCTIONS THOROUGHLY BEFORE ATTEMPTING INSTALLATION OR OPERATION. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN IMPROPER INSTALLATION, ADJUSTMENT, SERVICE, OR MAINTENANCE POSSIBLY RESULTING IN FIRE, ELECTRICAL SHOCK, PROPERTY DAMAGE, PERSONAL INJURY, OR DEATH.**

**Do not destroy this manual. Please read carefully and keep in a safe place for future reference by a serviceman.**

[ ] indicates metric conversions.

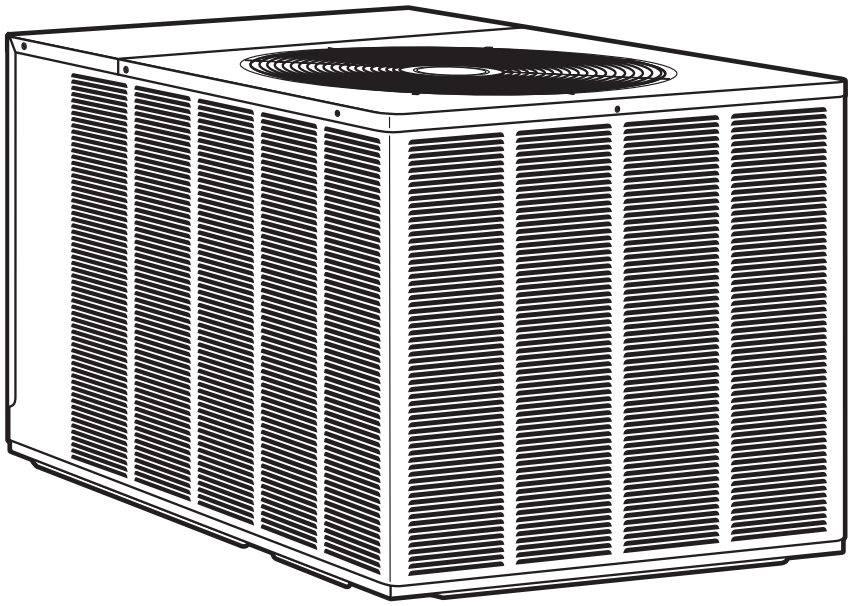
92-20522-88-01 (2/13) Printed in USA

# TWO-STAGE R-410A HEAT PUMP OUTDOOR UNITS

# INSTALLATION INSTRUCTIONS

## (-)PRL-JEC 16 SEER EQUIPPED WITH THE COMFORT CONTROL² SYSTEM™

Comfort Control² System™



c UL US

AHRI CERTIFIED™ www.ahridirectory.org
Unitary Small HP
AHRI Standard 210/240
Certification applies only when the complete system is listed with AHRI.

Accredited by the RvA

ANAB ACCREDITED

ISO 9001:2008
Certificate Number: 30164

# CONTENTS

Contents

# IMPORTANT SAFETY INFORMATION



## ⚠WARNINGS:

- These instructions are intended as an aid to qualified, licensed service personnel for proper installation, adjustment, and operation of this unit. Read these instructions thoroughly before attempting installation or operation. **Failure to follow these instructions may result in improper installation, adjustment, service, or maintenance possibly resulting in fire, electrical shock, property damage, personal injury, or death.**
- **The unit must be permanently grounded. Failure to do so can cause electrical shock resulting in severe personal injury or death.**
- **Turn off electric power at the fuse box or service panel before making any electrical connections.**
- **Complete the ground connection before making line voltage connections. Failure to do so can result in electrical shock, severe personal injury, or death.**
- **Disconnect all power to unit before starting maintenance. Failure to do so can cause electrical shock resulting in severe personal injury or death.**
- **Never assume the unit is properly wired and/or grounded. Always test the unit cabinet with a noncontact voltage detector available at most electrical supply houses or home centers before removing access panels or coming into contact with the unit cabinet.**
- **Do not use oxygen to purge lines or pressurize system for leak test. Oxygen reacts violently with oil, which can cause an explosion resulting in severe personal injury or death.**
- The top of the scroll compressor shell is hot. Touching the compressor top may result in serious personal injury.
- The manufacturer's warranty does not cover any damage or defect to the unit caused by the attachment or use of any components, accessories, or devices (other than those authorized by the manufacturer) into, onto, or in conjunction with the heat pump. **You should be aware that the use of unauthorized components, accessories, or devices may adversely affect the operation of the heat pump and may also endanger life and property.** The manufacturer disclaims any responsibility for such loss or injury resulting from the use of such unauthorized components, accessories, or devices.

## ⚠CAUTIONS:

- R-410A systems operate at approximately 60% higher pressures (1.6 times) than R-22 systems. Do not use R-22 service equipment or components on R-410A equipment. Use appropriate care when using this refrigerant. Failure to exercise care may result in equipment damage or personal injury.
- Only match this outdoor unit with a matched indoor coil or air handler approved for use with this outdoor unit per the unit manufacturer's specification sheet. The use of unmatched coils or air handler will likely result in a charge imbalance between the cooling and heating modes which can cause unsatisfactory operation including a high-pressure switch lockout condition.
- Only use indoor coils approved for use on R-410A systems. An R-22 coil will have a TXV or fixed restrictor device that is not designed to operate properly in an R-410A system and will result in serious operational issues. The R-22 coil could also contain mineral oil which is incompatible with the POE oil used in R-410A systems and could result in reliability issues with the compressor and TXVs.
- When coil is installed over a finished ceiling and/or living area, it is required that a secondary sheet metal condensate pan be constructed and installed under the entire unit. Failure to do so can result in property damage.
- The compressor has an internal overload protector. Under some conditions, it can take up to 2 hours for this overload to reset. Make sure overload has had time to reset before condemning the compressor.
- UNIT MAY START SUDDENLY AND WITHOUT WARNING. Solid red light indicates a thermostat call for unit operation is present at the ICC control. ICC control will attempt to start unit after short cycle timer expires or, when in Active Protection mode, will attempt to restart unit prior to Lockout mode.

# GENERAL INFORMATION



## ⚠WARNING:

**Improper installation, or installation not made in accordance with these instructions, can result in unsatisfactory operation and/or dangerous conditions and can cause the related warranty not to apply.**

The (-)PRL series of heat pump is designed to operate as a component of the communicating *Comfort Control² System*™ or with standard 24 VAC thermostats and air handlers or gas furnaces. These units are equipped with the *Comfort Control² System*™. To take full advantage of the *Comfort Control² System*™, the preferred method of installation is matching this unit with a thermostat and indoor unit equipped with communicating *Comfort Control² System*™. Your installation must have these components to use the *Comfort Control² System*™:

- (-)PRL heat pump with the *Comfort Control² System*™
- Air handler or furnace equipped with the *Comfort Control² System*™
- *Comfort Control²* thermostat

If your installation does not meet the above requirements, you must use a thermostat and indoor unit with traditional noncommunicating 24 VAC controls.

This installation instruction manual contains complete instructions for installation and setup using the *Comfort Control²* or conventional 24 VAC controls. Please refer to the manufacturer's specification sheets for complete performance data, thermostat, and accessory listings.

The information contained in this manual has been prepared to assist in the proper installation, operation, and maintenance of the air conditioning system.

Read this manual and any instructions packaged with separate equipment required to make up the system prior to installation. Homeowner should retain this manual for future reference.

To achieve optimum efficiency and capacity, the indoor cooling coils listed in the manufacturer's specification sheet must be used for this model heat pump.

## Checking Product Received

Upon receiving unit, inspect it for any shipping damage. Claims for damage, either apparent or concealed, should be filed immediately with the shipping company. Check model number, electrical characteristics, and accessories to determine if they are correct. Check system components (indoor coil, outdoor unit, air handler/furnace, etc.) to make sure they are properly matched.

## Application

Before specifying any heat pump equipment, a survey of the structure and a heat loss and heat gain calculation must be made. A heat loss calculation involves identifying all surfaces and openings that lose heat to the surrounding air and quantifying that heat loss. A cooling heat gain calculation makes similar measurements and determines the amount of heat needed to be removed. A heat gain calculation also calculates the extra heat load caused by sunlight and by humidity removal. These factors must be considered before selecting a heat pump system to provide year-round comfort. The Air Conditioning Contractors of America (ACCA) J Manual method of load calculation is one recognized procedure for determining the heating and cooling load.

After the proper equipment combination has been selected, satisfying both sensible and latent requirements, the system must be properly installed. Only then can the unit provide the comfort it was designed to provide.

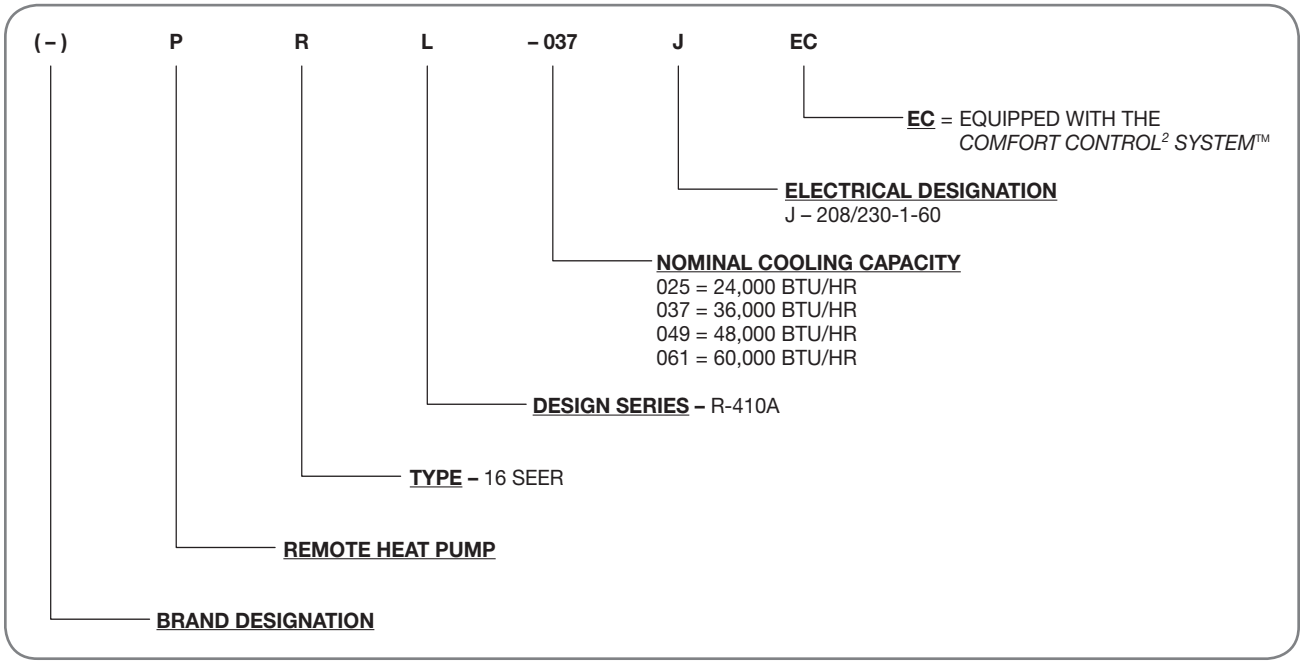
There are several factors that installers must consider.

- Outdoor unit location
- Indoor unit blower speed and airflow
- Proper equipment evacuation
- Supply and return air duct design and sizing
- Refrigerant charge
- System air balancing
- Diffuser and return air grille location and sizing

# Electrical and Physical Data

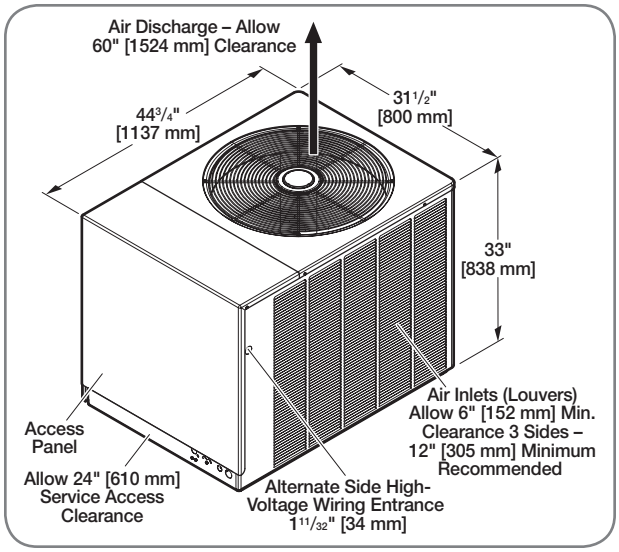
| Rev. 12/10 | ELECTRICAL | | | | | | |
|---|---|---|---|---|---|---|---|
| | | Compressor | | | | Fuse or HACR Circuit Breaker | |
| Model Number (-)PRL- | Phase Frequency (Hz) Voltage (Volts) | Rated Load Amperes (RLA) | Locked Rotor Amperes (LRA) | Fan Motor Full Load Amperes (FLA) | Minimum Circuit Ampacity Amperes | Minimum Amperes | Maximum Amperes |
| 025JEC | 1-60-208/230 | 11.7/11.7 | 46 | 1 | 14/14 | 20/20 | 25/25 |
| 037JEC | 1-60-208/230 | 15.3/15.3 | 83 | 2.8 | 22/22 | 30/30 | 35/35 |
| 049JEC | 1-60-208/230 | 21.2/21.2 | 104 | 2.2 | 29/29 | 35/35 | 45/45 |
| 061JEC | 1-60-208/230 | 28.8/28.8 | 153 | 2.5 | 39/39 | 50/50 | 60/60 |

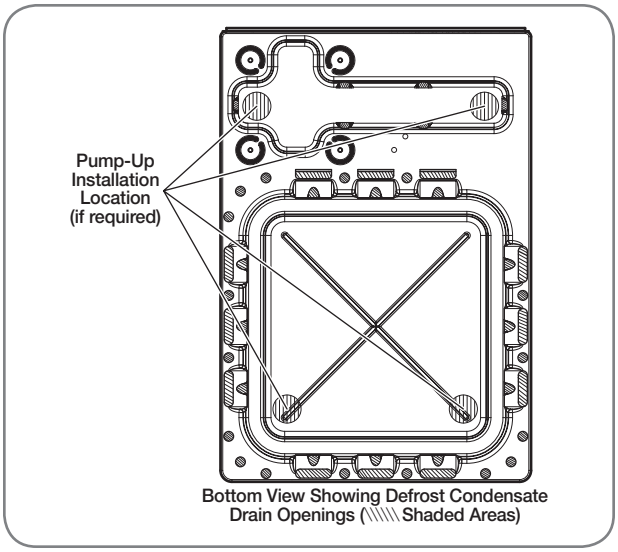
| Rev. 12/10 | PHYSICAL | | | | | |
|---|---|---|---|---|---|---|
| | Outdoor Coil | | | | Weight | |
| Model Number (-)PRL- | Face Area Sq. Ft. [$m^2$] | No. Rows | CFM [L/s] | Refrig. Per Circuit Oz. [g] | Net Lbs. [kg] | Shipping Lbs. [kg] |
| 025JEC | 23 [2.14] | 1 | 2300/2800 [1085/1321] | 160 [4536] | 234 | 241 |
| 037JEC | 22.22 [2.06] | 1 | 2800/3700 [1321/1746] | 151 [4281] | 231 | 239 |
| 049JEC | 22.22 [2.06] | 2 | 2800/3500 [1321/1652] | 260 [7371] | 296 | 303 |
| 061JEC | 22.22 [2.06] | 2 | 3800 [1793] | 270 [7665] | 316 | 323 |

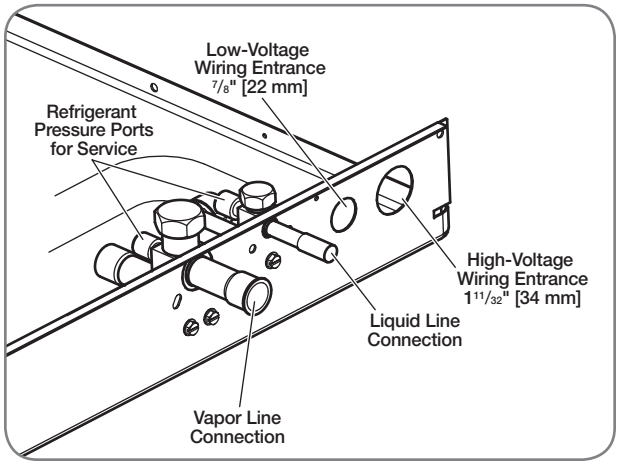


# GENERAL INFORMATION

## Specifications




### Proper Installation

Proper sizing and installation of this equipment is critical to achieve optimal performance. Use the information in this Installation Instruction Manual and reference the applicable manufacturer's specification sheet when installing this product.

**IMPORTANT:** This product has been designed and manufactured to meet ENERGY STAR criteria for energy efficiency when matched with appropriate indoor components. However, proper refrigerant charge and proper airflow are critical to achieve rated capacity and efficiency. Installation of this product should follow the manufacturer's refrigerant charging and airflow instructions. **Failure to confirm proper charge and airflow may reduce energy efficiency and shorten equipment life.**

### MATCH ALL COMPONENTS:

- OUTDOOR UNIT
- INDOOR COIL
- INDOOR AIR HANDLER/FURNACE
- REFRIGERANT LINES
- INDOOR THERMOSTAT

# Choosing a Location

**IMPORTANT:** Consult local and national building codes and ordinances for special installation requirements. Following location information will provide longer life and simplified servicing of the outdoor heat pump.

**NOTICE:** These units must be installed outdoors. No ductwork can be attached, or other modifications made, to the discharge grille. Modifications will affect performance or operation.

## Operational Issues

**IMPORTANT:** Locate the unit in a manner that will not prevent, impair, or compromise the performance of other equipment installed in proximity to the unit. Maintain all required minimum distances to gas and electric meters, dryer vents, and exhaust and inlet openings. In the absence of national codes or manufacturers' recommendations, local code recommendations and requirements will take precedence.

- Refrigerant piping and wiring should be properly sized and kept as short as possible to avoid capacity losses and increased operating costs.
- Locate the unit where water runoff will not create a problem with the equipment. Position the unit away from the drip edge of the roof whenever possible. Units are weatherized, but can be affected by the following:
  - Water pouring into the unit from the junction of rooflines, without protective guttering. Large volumes of water entering the heat pump while in operation can impact fan blade or motor life, and coil damage may occur to a heat pump if moisture cannot drain from the unit under freezing conditions.
  - Freezing moisture or sleeting conditions can cause the cabinet to ice-over prematurely and prevent heat pump operation, requiring backup heat, which generally results in less economical operation.
- Closely follow the clearance recommendations on page 8.
  - 24" [61.0 cm] to the service panel access
  - 60" [152.4 cm] above heat pump fan discharge (unit top) to prevent recirculation
  - 6" [15.2 cm] to heat pump coil grille air inlets with 12" [30.5 cm] minimum recommended

## Corrosive Environment

The metal parts of this unit may be subject to rust or deterioration if exposed to a corrosive environment. This oxidation could shorten the equipment's useful life.

Corrosive elements include, but are not limited to, salt spray, fog or mist in seacoast areas, sulphur or chlorine from lawn watering systems, and various chemical contaminants from industries such as paper mills and petroleum refineries.

If the unit is to be installed in an area where contaminants are likely to be a problem, special attention should be given to the equipment location and exposure.

- Avoid having lawn sprinkler heads spray directly on the unit cabinet.
- In coastal areas, locate the unit on the side of the building away from the waterfront.
- Shielding provided by a fence or shrubs may give some protection, but cannot violate minimum airflow and service access clearances.
- Elevating the unit off its slab or base enough to allow air circulation will help avoid holding water against the base pan.

**⚠WARNING:** Disconnect all power to unit before starting maintenance. Failure to do so can cause electrical shock resulting in severe personal injury or death.

Regular maintenance will reduce the buildup of contaminants and help to protect the unit's finish.

- Frequent washing of the cabinet, fan blade, and coil with fresh water will remove most of the salt or other contaminants that build up on the unit.
- Regular cleaning and waxing of the cabinet with a good automobile polish will provide some protection.
- A good liquid cleaner may be used several times a year to remove matter that will not wash off with water.

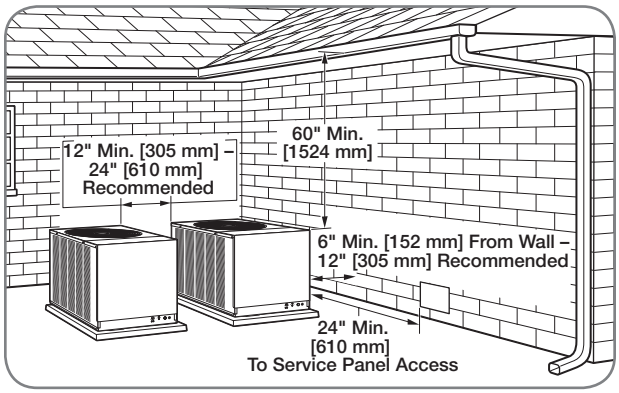
# Choosing a Location (cont.)

## For Units With Space Limitations

In the event that a space limitation exists, we will permit the following clearances:

Single-Unit Applications: Clearances below 6" [15.2 cm] will reduce unit capacity and efficiency. Do not reduce the 60" [152.4 cm] discharge or the 24" [61.0 cm] service clearances.

Multiple-Unit Applications: When multiple condenser grille sides are aligned, a 6" [15.2 cm] per unit clearance is recommended for a total of 12" [30.5 cm] between two units. Two combined clearances below 12" [30.5 cm] will reduce capacity and efficiency. Do not reduce the 60" [152.4 cm] discharge or 24" [61.0 cm] service clearances.




## Customer Satisfaction Issues

- The heat pump should be located away from the living, sleeping, and recreational spaces of the owner and those spaces on adjoining property.
- To prevent noise transmission, the mounting pad for the outdoor unit should not be connected to the structure and should be located a sufficient distance above grade to prevent ground water from entering the unit.

## Unit Mounting

**⚠WARNING:** Secure an elevated unit and its elevating stand in order to prevent tipping. Failure to do so may result in severe personal injury or death.

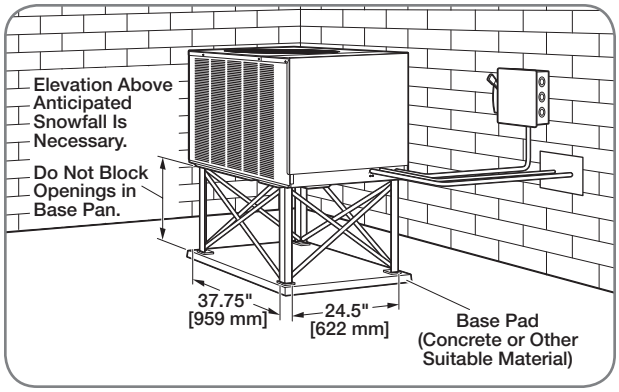
## Elevation of Unit

If elevating the heat pump, either on a flat roof or on a slab, observe the following guidelines.

- The base pan provided elevates the heat pump 3/4" [1.9 cm] above the base pad.
- If elevating a unit on a flat roof, use 4" x 4" [10.2 cm x 10.2 cm] or equivalent stringers positioned to distribute unit weight evenly and prevent noise and vibration.
- Where snowfall is anticipated, raise the unit above the base pad to prevent ice buildup and coil damage. Mount the unit high enough to be above the average accumulated area snowfall. See “Ground Snow Depth” chart on page 9 for representative snow depths.

**NOTICE:** Do not block drain openings on bottom of unit.

- If unit must be elevated because of anticipated snowfall, secure unit and elevating stand such that unit and/or stand will not tip over or fall off. Keep in mind that someone may try to climb on unit.




## Factory-Preferred Tie-Down Method

**IMPORTANT:** The manufacturer-approved/recommended method is a guide to securing equipment for wind and seismic loads. Other methods might provide the same result, but the manufacturer method is the only one endorsed by the manufacturer for securing equipment where wind or earthquake damage can occur. Additional information is available in the PTS (Product Technical Support) section of the manufacturer’s Web sites Rheemote.net, MyRheem.com, or MyRuud.com and can be found as a listing under each outdoor model. If you do not have access to this site, your distributor can offer assistance.

# Choosing a Location (cont.)

## GROUND SNOW DEPTH – INCHES

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **ALABAMA** | | **INDIANA** | | **MINNESOTA** | | **NEW MEXICO** | | **PENNSYLVANIA** | | **VIRGINIA** | |
| Huntsville | 7 | Evansville | 12 | Duluth | 64 | Albuquerque | 4 | Allentown | 23 | Dulles Airport | 19 |
| **ARIZONA** | | Fort Wayne | 17 | International Falls | 43 | Clayton | 10 | Erie | 19 | Lynchburg | 16 |
| Flagstaff | 48 | Indianapolis | 21 | Minneapolis/St. Paul | 50 | Roswell | 8 | Harrisburg | 23 | National Airport | 18 |
| Prescott | 3 | South Bend | 44 | Rochester | 50 | **NEW YORK** | | Philadelphia | 16 | Norfolk | 9 |
| Winslow | 7 | **IOWA** | | St. Cloud | 53 | Albany | 25 | Pittsburgh | 22 | Richmond | 12 |
| **ARKANSAS** | | Burlington | 17 | **MISSISSIPPI** | | Binghamton | 35 | Scranton | 16 | Roanoke | 17 |
| Ft. Smith | 5 | Des Moines | 22 | Jackson | 3 | Buffalo | 42 | Williamsport | 20 | **WASHINGTON** | |
| Little Rock | 6 | Dubuque | 38 | MISSOURI | | NYC – Kennedy Airport | 18 | **RHODE ISLAND** | | Olympia | 24 |
| **CALIFORNIA** | | Sioux City | 33 | Columbia | 21 | NYC – LaGuardia Airport | 18 | Providence | 21 | Quillayute | 24 |
| Blue Canyon | 25 | Waterloo | 36 | Kansas City | 18 | Rochester | 38 | **SOUTH CAROLINA** | | Seattle-Tacoma | 14 |
| Mt. Shasta | 69 | **KANSAS** | | St. Louis | 16 | Syracuse | 35 | Columbia | 12 | Spokane | 41 |
| **COLORADO** | | Concordia | 23 | Springfield | 14 | **NORTH CAROLINA** | | Greenville | 4 | Stampede Pass | 51 |
| Alamosa | 15 | Dodge City | 12 | **MONTANA** | | Asheville | 12 | **SOUTH DAKOTA** | | Yakima | 25 |
| Colorado Springs | 14 | Goodland | 14 | Billings | 17 | Cape Hattaras | 5 | Aberdeen | 42 | **WEST VIRGINIA** | |
| Denver | 15 | Topeka | 19 | Glasgow | 17 | Charlotte | 10 | Huron | 43 | Beckley | 51 |
| Grand Junction | 16 | Wichita | 11 | Great Falls | 16 | Greensboro | 11 | Rapid City | 14 | Charleston | 20 |
| Pueblo | 7 | **KENTUCKY** | | Havre | 24 | Raleigh-Durham | 10 | Sioux Falls | 38 | Elkins | 21 |
| **CONNECTICUT** | | Covington | 12 | Helena | 18 | Wilmington | 9 | **TENNESSEE** | | Huntington | 15 |
| Bridgeport | 23 | Lexington | 12 | Kalispell | 53 | Winston-Salem | 17 | Bristol | 8 | **WISCONSIN** | |
| Hartford | 29 | Louisville | 11 | Missoula | 23 | **NORTH DAKOTA** | | Chattanooga | 6 | Green Bay | 36 |
| New Haven | 15 | **MAINE** | | **NEBRASKA** | | Bismarck | 25 | Knoxville | 8 | La Crosse | 32 |
| **DELAWARE** | | Caribou | 100 | Grand Island | 30 | Fargo | 34 | Memphis | 5 | Madison | 32 |
| Wilmington | 13 | Portland | 62 | Lincoln | 20 | Williston | 25 | Nashville | 8 | Milwaukee | 32 |
| **GEORGIA** | | **MARYLAND** | | Norfolk | 29 | **OHIO** | | **TEXAS** | | **WYOMING** | |
| Athens | 5 | Baltimore | 17 | North Platte | 15 | Akron-Canton | 15 | Abilene | 6 | Casper | 10 |
| Macon | 8 | **MASSACHUSETTS** | | Omaha | 20 | Cleveland | 16 | Amarillo | 10 | Cheyenne | 15 |
| **IDAHO** | | Boston | 30 | Scottsbluff | 11 | Columbus | 10 | Dallas | 3 | Lander | 20 |
| Boise | 6 | Nantucket | 18 | Valentine | 22 | Dayton | 11 | El Paso | 5 | Sheridan | 25 |
| Lewiston | 9 | Worcester | 35 | **NEVADA** | | Mansfield | 17 | Fort Worth | 6 | | |
| 0 Pocatello | 7 | **MICHIGAN** | | Elko | 20 | Toledo Express | 8 | Lubbock | 10 | | |
| **ILLINOIS** | | Alpena | 53 | Ely | 9 | Youngstown | 12 | Midland | 2 | | |
| Chicago O'Hare | 18 | Detroit City | 9 | Reno | 11 | **OKLAHOMA** | | San Antonio | 3 | | |
| Chicago | 22 | Detroit Airport | 17 | Winnemucca | 6 | Oklahoma City | 5 | Wichita Falls | 5 | | |
| Moline | 17 | Detroit – Willow Run | 21 | **NEW HAMPSHIRE** | | Tulsa | 8 | **UTAH** | | | |
| Peoria | 16 | Flint | 28 | Concord | 66 | **OREGON** | | Milford | 16 | | |
| Rockford | 25 | Grand Rapids | 37 | **NEW JERSEY** | | Burns City | 24 | Salt Lake City | 8 | | |
| Springfield | 23 | Houghton Lake | 56 | Atlantic City | 11 | Eugene | 17 | Wendover | 3 | | |
| | | Lansing | 42 | Newark | 15 | Medford | 8 | **VERMONT** | | | |
| | | Marquette | 53 | | | Pendleton | 11 | Burlington | 37 | | |
| | | Muskegon | 43 | | | Portland | 10 | | | | |
| | | Sault Ste. Marie | 80 | | | Salem | 7 | | | | |

NOTICE: Local records and experience must be considered when establishing the unit installation height. There is a 2% probability that the ground snow depth shown in this table will be exceeded annually. Drifts have not been considered. This data represents 184 National Weather Service locations at which measurements are made and assumes a nationwide snow density of 12 lb./ft.$^3$

# Tools and Refrigerant



## Tools Required for Installing and Servicing R-410A Models

Manifold Sets:

– Up to 800 PSIG High-Side

– Up to 250 PSIG Low-Side

– 550 PSIG Low-Side Retard

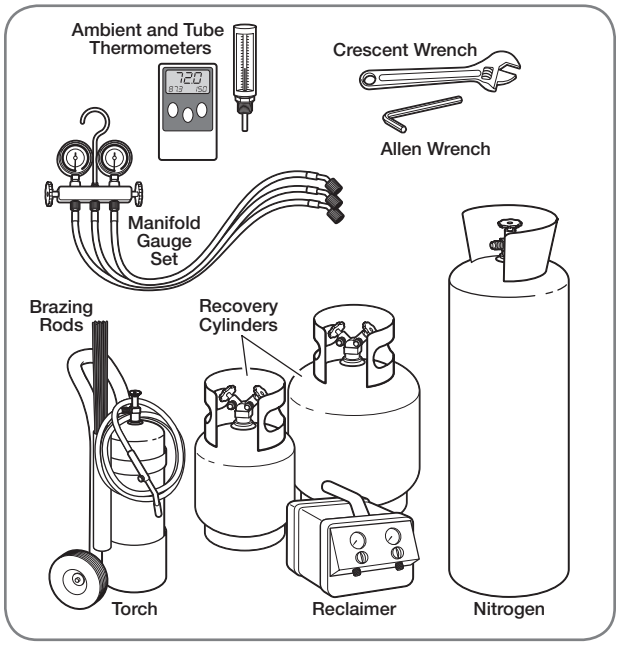
Manifold Hoses:

– Service Pressure Rating of 800 PSIG

Recovery Cylinders:

– 400 PSIG Pressure Rating

– Dept. of Transportation 4BA400 or BW400




**⚠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.

## Specifications of R-410A

**Application: R-410A is not a drop-in replacement for R-22.** Equipment designs must accommodate its higher pressures. It cannot be retrofitted into R-22 heat pumps.

**Physical Properties:** R-410A has an atmospheric boiling point of -62.9°F [-52.7°C] and its saturation pressure at 77°F [25°C] is 224.5 psig.

**Composition:** R-410A is a near-azeotropic mixture of 50% by weight difluoromethane (HFC-32) and 50% by weight pentafluoroethane (HFC-125).

**Pressure: The pressure of R-410A is approximately 60% (1.6 times) greater than R-22.** Recovery and recycle equipment, pumps, hoses, and the like must have design pressure ratings appropriate for R-410A. *Manifold sets need to range up to 800 psig high-side and 250 psig low-side with a 550 psig low-side retard. Hoses need to have a service pressure rating of 800 psig. Recovery cylinders need to have a 400 psig service pressure rating, DOT 4BA400 or DOT BW400.*

**Combustibility:** At pressures above 1 atmosphere, a mixture of R-410A and air can become combustible. **R-410A and air should never be mixed in tanks or supply lines or be allowed to accumulate in storage tanks. Leak checking should never be done with a mixture of R-410A and air.** Leak-checking can be performed safely with nitrogen or a mixture of R-410A and nitrogen.

## Quick-Reference Guide For R-410A

- R-410A refrigerant operates at approximately 60% higher pressure (1.6 times) than R-22. Ensure that servicing equipment is designed to operate with R-410A.
- R-410A refrigerant cylinders are light rose in color.
- R-410A, as with other HFCs, is only compatible with POE oils.
- Vacuum pumps will not remove moisture from POE oil used in R-410A systems.
- R-410A systems are to be charged with liquid refrigerants. Prior to March 1999, R-410A refrigerant cylinders had a dip tube. These cylinders should be kept upright for equipment charging. Post-March 1999 cylinders do not have a dip tube and should be inverted to ensure liquid charging of the equipment.
- Do not install a suction line filter drier in the liquid line.
- A factory-approved biflow liquid line filter drier is shipped with every unit and must be installed in the liquid line at the time of installation. Only manufacturer-approved liquid line filter driers can be used. These are Sporlan (CW083S) and Alco (80K083S) driers. These filter driers are rated for minimum working pressure of 600 psig. The filter drier will only have adequate moisture-holding capacity if the system is properly evacuated.
- Desiccant (drying agent) must be compatible for POE oils and R-410A refrigerant.

## Replacement Units

To prevent failure of a new unit, the existing line set must be correctly sized and cleaned or replaced. Care must be exercised that the expansion device is not plugged. For new and replacement units, a liquid line filter drier must be installed and refrigerant tubing must be properly sized. Test the oil for acid. If positive, a suction line filter drier is mandatory.

**IMPORTANT:** When replacing an R-22 unit with an R-410A unit, either replace the line set or ensure that the existing line set is thoroughly flushed of any old oil or debris. Flush kits are available through aftermarket HVAC stores such as Prostock.

## Indoor Coil

**⚠CAUTION:** Only use evaporators approved for use on R-410A systems that are specifically matched with the outdoor unit per the manufacturer's specification sheets. Use of existing R-22 evaporators can introduce mineral oil to the R-410A refrigerant, forming two different liquids and decreasing oil return to the compressor. This can result in compressor failure.

**REFER TO INDOOR COIL MANUFACTURER'S INSTALLATION INSTRUCTIONS.**

**IMPORTANT:** The manufacturer is not responsible for the performance and operation of a mismatched system or for a match listed with another manufacturer's coil.

**NOTICE:** All (-)PRL units must be installed with a matched TXV indoor coil. Refer to manufacturer's outdoor unit specification sheet for approved indoor coils.

The thermostatic expansion valve in the matching coil is specifically designed to operate with R-410A. **DO NOT use an R-22 TXV or evaporator. The existing evaporator must be replaced with the factory-specified TXV evaporator specifically designed for R-410A.**

### Location

Do not install the indoor coil in the return duct system of a gas or oil furnace. Provide a service inlet to the coil for inspection and cleaning. Keep the coil pitched toward the drain connection.

**⚠CAUTION:** When coil is installed over a finished ceiling and/or living area, it is required that a secondary condensate pan be installed under entire unit. Failure to do so can result in property damage.

## Interconnecting Tubing

All units are factory-charged with R-410A refrigerant to cover 15 feet of line set. Adjustment of charge may be necessary even if the application has exactly 15 feet of line due to other installation variables and conditions. All models are supplied with service valves. Keep tube ends sealed until connection is to be made to prevent system contamination.

### Vapor and Liquid Lines

Keep all lines sealed until connection is made.

Make connections at the indoor coil first.

Refer to line size information in the tables on page 12 for correct size and multipliers to be used to determine capacity for various vapor line diameters and lengths of run. The losses due to the lines being exposed to outdoor conditions are not included.

The factory refrigeration charge in the outdoor unit is sufficient for the unit and 15 feet [4.6 m] of standard size interconnecting liquid and vapor lines without a filter drier. For different lengths, adjust the charge as indicated below.

1/4" ± .3 oz./foot [6.4 mm ± 8.5 g/.30 m]

5/16" ± .4 oz./foot [7.9 mm ± 11.3 g/.30 m]

3/8" ± .6 oz./foot [9.5 mm ± 17.0 g/.30 m]

1/2" ± 1.2 oz./foot [12.7 mm ± 34.0 g/.30 m]

Add 6 oz. for field-installed filter drier.

### Maximum Length of Lines

The maximum length of interconnecting line is 150 feet [45.7 m]. Always use the shortest length possible with a minimum number of bends. Additional compressor oil is not required for any length up to 150 feet [45.7 m].

**NOTICE:** Excessively long refrigerant lines cause loss of equipment capacity.

# Interconnecting Tubing (cont.)

## Outdoor Unit Installed Above or Below Indoor Coil

Use the following guidelines when installing the unit:

1. Expansion Valve Coil:
   a. The vertical separation cannot exceed the value in the tables below.
   b. No changes are required for expansion valve coils due to vertical separation or line length.
2. It is recommended to use the smallest liquid line size permitted to minimize the system charge.
3. The tables below may be used for sizing lines for a combination of horizontal and vertical runs.

**VAPOR LINE SIZING – TWO-STAGE HEAT PUMP**

Allowed suction line size is determined by total line length based on oil return. Liquid size determines total line length and vertical separation. After selecting allowed suction line by outdoor unit position, see the liquid line chart for allowable vertical height and total line length.

| R-410A System Capacity Model | Line Size Connection Size (Inch I.D.) [mm] | Line Size (Inch O.D.) [mm] | Suction Line Size | | | | | | Suction Line Size | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Outdoor unit **ABOVE** Indoor Coil (Heat Pumps) | | | | | | Outdoor unit **BELOW** Indoor Coil (Heat Pumps) | | | | | |
| | | | Total **Equivalent** Length - Feet [m] | | | | | | Total **Equivalent** Length - Feet [m] | | | | | |
| | | | 25 [7.62] | 50 [15.24] | 75 [22.86] | 100 [30.48] | 125 [45.72] | 150 [45.72] | 25 [7.62] | 50 [15.24] | 75 [22.86] | 100 [30.48] | 125 [45.72] | 150 [45.72] |
| 2 Ton | 3/4" [22.23] | 5/8" [15.88] | NA | | | | | | Same as Liquid Line Size Table | | | NA | | |
| | | 3/4" [19.05]* | NA | | | | | | NA | | | | | |
| | | 7/8" [22.23] | NA | | | | | | NA | | | | | |
| 3 Ton | 3/4" [22.23] | 5/8" [15.88] | Same as Liquid Line Size Table | | | | | | Same as Liquid Line Size Table | | | | | |
| | | 3/4" [19.05]* | NA | | | | | | Same as Liquid Line Size Table | | | NA | | |
| | | 7/8" [22.23] | NA | | | | | | Same as Liquid Line Size Table | | | NA | | |
| 4 Ton | 7/8" [22.23] | 5/8" [15.88] | Same as Liquid Line Size Table | | | | | | Same as Liquid Line Size Table | | | | | |
| | | 3/4" [19.05] | Same as Liquid Line Size Table | | | | | | Same as Liquid Line Size Table | | | | | |
| | | 7/8" [22.23]* | NA | | | | | | Same as Liquid Line Size Table | | | NA | | |
| 5 Ton | 7/8" [22.23] | 3/4" [19.05] | Same as Liquid Line Size Table | | | | | | Same as Liquid Line Size Table | | | | | |
| | | 7/8" [22.23]* | Same as Liquid Line Size Table | | | | | | Same as Liquid Line Size Table | | | | | |
| | | 1-1/8" [28.58] | NA | | | | | | NA | | | | | |

**NOTES:** Using suction line larger than shown in table will result in poor oil return and is not recommended.

**LIQUID LINE SIZING – TWO-STAGE HEAT PUMP**

| R-410A System Capacity Model | Line Size Connection Size (Inch I.D.) [mm] | Line Size (Inch O.D.) [mm] | **Liquid Line Size Outdoor unit Above or Below Indoor Coil (Heat Pump Only)** | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Total **Equivalent** Length – Feet [m] | | | | | |
| | | | 25 [7.62] | 50 [15.24] | 75 [22.86] | 100 [30.48] | 125 [38.1] | 150 [45.72] |
| | | | **Maximum** Vertical Separation – Feet [m] | | | | | |
| 2 Ton | 3/8" [9.53] | 1/4" [6.35] | 25 [7.62] | 39 [11.89] | 26 [7.93] | 9 [2.74] | N/A | N/A |
| | | 5/16" [7.93] | 25 [7.62] | 50 [15.24] | 54 [16.46] | 51 [15.55] | 48 [14.63] | 44 [13.41] |
| | | 3/8" [9.52]* | 25 [7.62] | 50 [15.24] | 60 [18.29] | 59 [17.98] | 58 [17.68] | 57 [17.37] |
| 3 Ton | 3/8" [9.53] | 5/16" [7.93] | 25 [7.62] | 26 [7.93] | 20 [6.10] | 9 [2.74] | N/A | N/A |
| | | 3/8" [9.52]* | 25 [7.62] | 34 [10.36] | 32 [9.75] | 30 [9.14] | 27 [8.23] | 25 [7.62] |
| | | 1/2" [12.70] | 25 [7.62] | 37 [11.28] | 37 [11.28] | 36 [10.97] | 36 [10.97] | 36 [10.97] |
| 4 Ton | 3/8" [9.53] | 5/16" [7.93] | 25 [7.62] | 33 [10.06] | 15 [4.56] | N/A | N/A | N/A |
| | | 3/8" [9.52]* | 25 [7.62] | 46 [14.02] | 43 [13.11] | 39 [11.89] | 36 [10.97] | 32 [9.75] |
| | | 1/2" [12.70] | 25 [7.62] | 50 [15.24] | 51 [15.55] | 51 [15.55] | 50 [15.24] | 49 [14.94] |
| 5 Ton | 3/8" [9.53] | 3/8" [9.52]* | 25 [7.62] | 18 [5.49] | 11 [3.35] | N/A | N/A | N/A |
| | | 1/2" [12.70] | 25 [7.62] | 29 [8.84] | 27 [8.23] | 26 [7.93] | 25 [7.62] | 23 [7.01] |

**NOTES:** N/A – Application is not recommended.

# Interconnecting Tubing (cont.)

**VAPOR LINE CAPACITY MULTIPLIER (PERFORMANCE PENALTY)**

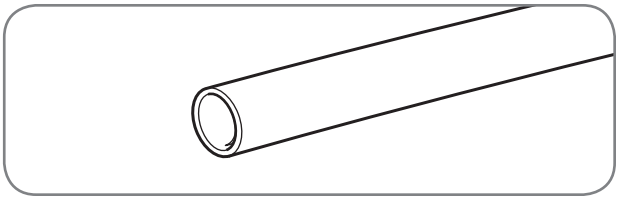
| (-)PRL- Unit Vapor Line Connection Size (inches I.D.) [mm] | | 025 | 037 | 049 | 061 |
|---|---|---|---|---|---|
| | | 3/4" [19.05] I.D. Sweat | 3/4" [19.05] I.D. Sweat | 7/8" [22.23] I.D. Sweat | 7/8" [22.23] I.D. Sweat |
| Vapor Line Run (Feet) [m] | | Vapor Line Diameter (inches O.D.) [mm] | | | |
| | | 5/8" [15.88] Optional | 5/8" [15.88] Optional | 5/8" [15.88] Optional | 3/4" [19.05] Optional |
| | | 3/4" [19.05] Standard | 3/4" [19.05] Standard | 3/4" [19.05] Standard | 7/8" [22.23] Standard |
| | | — | — | 7/8" [22.23] Optional | |
| 25' [7.62] | Optional | 1.00 | 0.99 | 0.98 | 0.99 |
| | Standard | 1.00 | 1.00 | 1.00 | 1.00 |
| | Optional | N/A | N/A | 1.01 | N/A |
| 50' [15.24] | Optional | 0.99 | 0.98 | 0.96 | 0.98 |
| | Standard | 1.00 | 1.00 | 0.99 | 1.00 |
| | Optional | N/A | N/A | 1.00 | N/A |
| 75' [22.86] | Optional | 0.98 | 0.96 | 0.93 | 0.97 |
| | Standard | 1.00 | 0.99 | 0.98 | 0.99 |
| | Optional | N/A | N/A | 1.00 | N/A |
| 100' [30.48] | Optional | 0.97 | 0.95 | 0.92 | 0.96 |
| | Standard | N/A | N/A | 0.97 | 0.98 |
| | Optional | N/A | N/A | N/A | N/A |
| 125' [38.10] | Optional | 0.97 | 0.94 | 0.90 | 0.95 |
| | Standard | N/A | N/A | 0.97 | 0.98 |
| | Optional | N/A | N/A | N/A | N/A |
| 150' [45.72] | Optional | 0.96 | 0.93 | 0.88 | 0.93 |
| | Standard | N/A | N/A | 0.96 | 0.98 |
| | Optional | N/A | N/A | N/A | N/A |

**NOTES:**
1. Do NOT exceed the limits in the liquid and vapor line-sizing charts.
2. Do NOT use 7/8" OD vapor lines in 2- or 3-ton applications or 1 1/8" OD vapor lines for 4- or 5-ton applications.

## Tubing Installation

Observe the following when installing correctly sized type “L” refrigerant tubing between the condensing unit and evaporator coil:

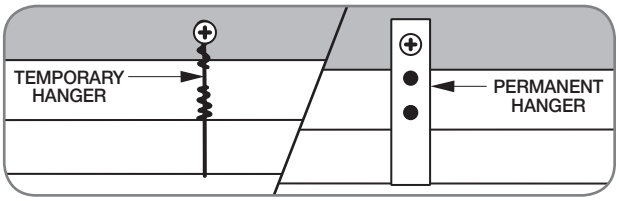
- Check the tables on page 12 for the correct suction line size and liquid line size.
- If a portion of the liquid line passes through a very hot area where liquid refrigerant can be heated to form vapor, insulating the liquid line is required.
- Use clean, dehydrated, sealed refrigeration-grade tubing.
- Always keep tubing sealed until tubing is in place and connections are to be made.
- A high-quality biflow filter drier is included with all R-410A heat pump units and must be installed in the liquid line upon unit installation.
- When replacing an R-22 system with an R-410A system and the line set is not replaced, use a flush kit available through aftermarket stores such as Prostock.



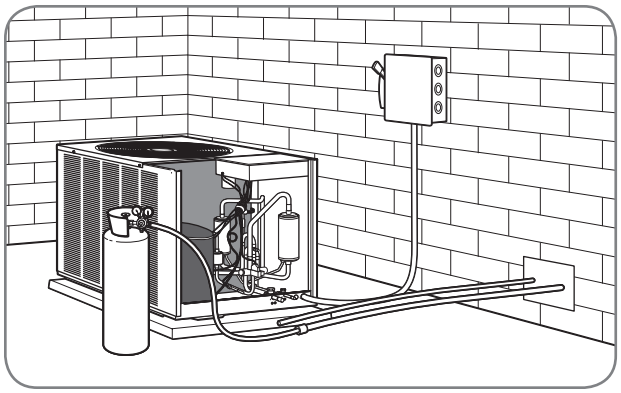
- If tubing has been cut, make sure ends are deburred while holding in a position to prevent chips from falling into tubing. Burrs such as those caused by tubing cutters can affect performance dramatically, particularly on small liquid line sizes.
- For best operation, keep tubing run as short as possible with a minimum number of elbows or bends.
- Locations where the tubing will be exposed to mechanical damage should be avoided. If it is necessary to use such locations, the copper tubing should be housed to prevent damage.

## Interconnecting Tubing (cont.)

- If tubing is to be run underground, it must be run in a sealed watertight chase.
- Use care in routing tubing and do not kink or twist. Use a good tubing bender on the vapor line to prevent kinking.




- Route the tubing using temporary hangers; then straighten the tubing and install permanent hangers. Line must be adequately supported.
- If the vapor line comes in contact with inside walls, ceiling, or flooring, the vibration of the vapor line in the heating mode will result in noise inside the structure.

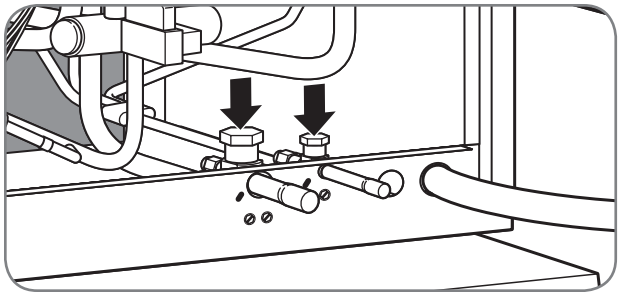


- Blow out the liquid and vapor lines with dry nitrogen before connecting to the outdoor unit and indoor coil. Any debris in the line set will end up plugging the expansion device.

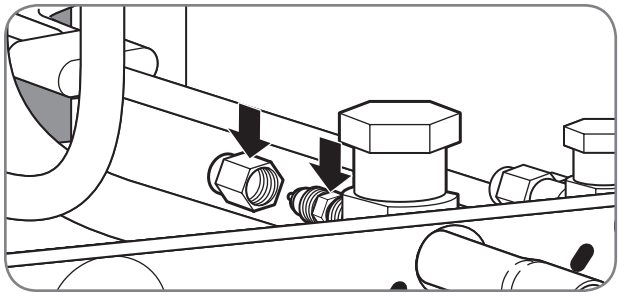
### Tubing Connections

Indoor coils have only a holding charge of dry nitrogen. Keep all tube ends sealed until connections are to be made.

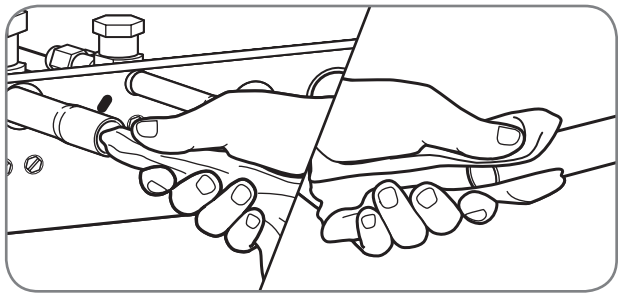
- Use type “L” copper refrigeration tubing. Braze the connections with the following alloys:
  - copper to copper, 5% silver minimum
  - copper to steel or brass, 15% silver minimum



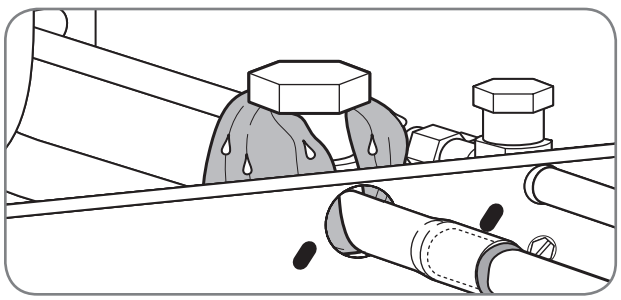
- Be certain both refrigerant shutoff valves at the outdoor unit are closed.



- Remove the caps and Schrader cores from the pressure ports to protect seals from heat damage. Both the Schrader valves and the service valves have seals that may be damaged by excessive heat.

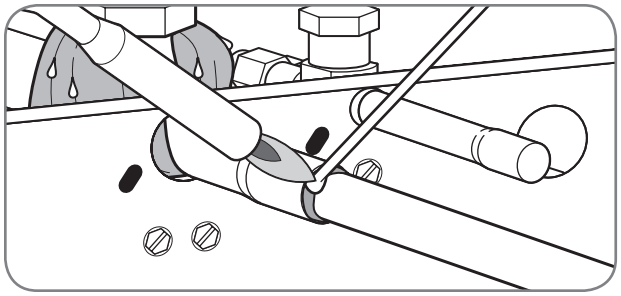


- Clean the inside of the fittings and outside of the tubing with a clean, dry cloth before soldering. Clean out debris, chips, dirt, etc., that enters tubing or service valve connections.

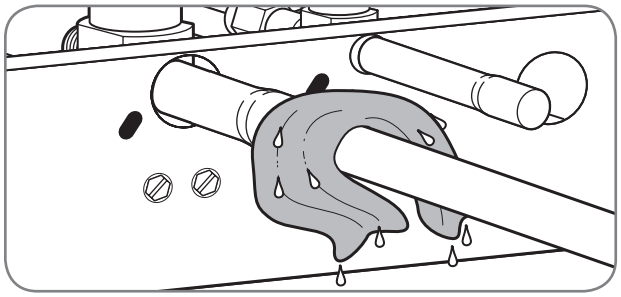


- Wrap valves with a wet rag or thermal barrier compound before applying heat.

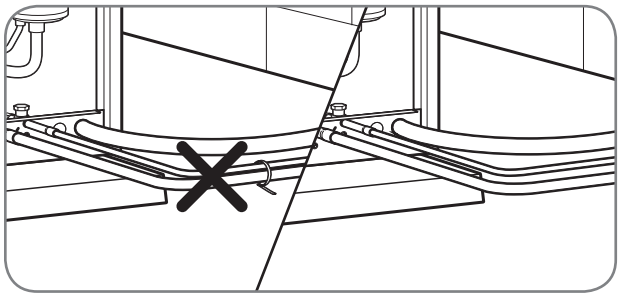
# Interconnecting Tubing (cont.)



- Braze the tubing between the outdoor unit and indoor coil. Flow dry nitrogen into a pressure port and through the tubing while brazing, but do not allow pressure inside tubing which can result in leaks. Once the system is full of nitrogen, the nitrogen regulator should be turned off to avoid pressuring the system.



- After brazing, use an appropriate heatsink material to cool the joint.
- Reinstall the Schrader cores into both pressure ports.

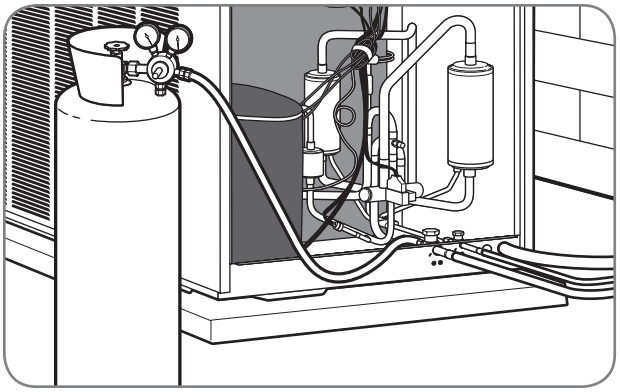


- Do not allow the vapor line and liquid line to be in contact with each other. This causes an undesirable heat transfer resulting in capacity loss and increased power consumption.

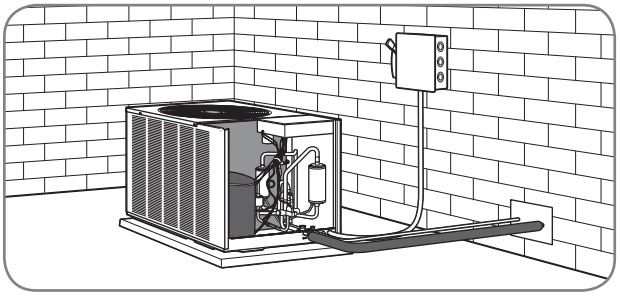
## Leak Testing

Indoor coils have only a holding charge of dry nitrogen. Keep all tube ends sealed until connections are to be made.

**⚠WARNING:** Do not use oxygen to purge lines or pressurize system for leak test. Oxygen reacts violently with oil, which can cause an explosion resulting in severe personal injury or death.



- Pressurize line set and coil through service fittings with dry nitrogen to 150 PSIG maximum. Close nitrogen tank valve, let system sit for at least 15 minutes, and check to see if the pressure has dropped. If the pressure has dropped, check for leaks at the line set braze joints with soap bubbles and repair leak as necessary. Repeat pressure test. If line set and coil hold pressure, proceed with line set and coil evacuation (see page 21).



- The vapor line must be insulated for its entire length to prevent dripping (sweating) and prevent performance losses. Closed-cell foam insulation such as Armaflex and Rubatex® are satisfactory insulations for this purpose. Use 1/2" [12.7 mm] minimum insulation thickness. Additional insulation may be required for long runs.

# WIRING

## Control Wiring

**⚠WARNING:** Turn off electric power at the fuse box or service panel before making any electrical connections. Also, the ground connection must be completed before making line voltage connections. Failure to do so can result in electrical shock, severe personal injury, or death.

### Control Wiring

Running low-voltage wires in conduit with line voltage power wires is not recommended. Low-voltage wiring may be run through the insulated bushing provided in the 7/8" [19 mm] hole in the base panel, up to and attached to the pigtails from the bottom of the control box. Conduit can be run to the base panel if desired by removing the insulated bushing.

A thermostat and a 24-volt, 40 VA minimum transformer are required for the control circuit of the system. The furnace or the air handler transformer may be used if sufficient. See the wiring diagram for reference. Use “Wire Size” table on page 18 to size the 24-volt control wiring.

### Communicating *Comfort Control²* Control Wiring

The four 18 AWG low-voltage control wires must be installed from the thermostat to the indoor unit and from the indoor unit to the outdoor unit. The wire length between the thermostat and indoor unit should not be greater than 100 feet [30.5 m]. The wire length between the indoor unit and outdoor unit should not be greater than 125 feet [38.1 m].

A serial communicating HVAC system consists of these matched components:

- Serial communicating heat pump or serial communicating condensing unit.
- Serial communicating air handler or serial communicating furnace.
- Serial communicating thermostat.

**IMPORTANT:** If the installed system does not meet these requirements, the system must be wired using traditional control wiring. See “Conventional 24 VAC Thermostat Control Wiring” on page 17.

Do not use phone cord to connect indoor and outdoor units. This will damage the controls.

**NOTICES:** *Comfort Control²* requires continuous 18 AWG thermostat wire.

Term dip switches should be in the “ON” position.

The *Comfort Control²* requires four (4) control wires for unit operation:

- R 24 VAC
- C 24 VAC common
- Data wire 1/1 Communications
- Data wire 2/2 Communications

| Thermostat | Air Handler Furnace Indoor | Air Conditioner Heat Pump Outdoor |
|---|---|---|
| R | R | R |
| 1 | 1 | 1 |
| 2 | 2 | 2 |
| C | C | C |

These wires need to be connected to each device thermostat, indoor air handler, and outdoor unit (heat pump or AC).

If the communications wires are wired backwards at any point, the green LED (D52) will always be on. If this happens, check the wires at each point to ensure they are not reversed.

Once all devices are connected, power up the line and low voltage to the system.

When all devices are powered, the thermostat should detect the indoor and outdoor units within 45 seconds. The air handler and outdoor units have a set of bias dip switches set at a factory default to the ON position. These dip switches are for future use. DO NOT CHANGE DIP SWITCHES.

Once the system is powered, the airflow settings will be configured for all devices.

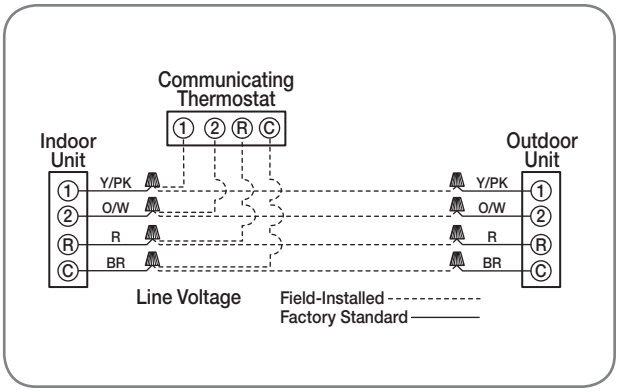
The outdoor unit will send information to configure indoor airflow. If the indoor unit is incapable of supplying the required airflow, a d3 fault will be displayed on the thermostat and outdoor unit.

All devices have a LEARN button. This button is for future use and has no function at this time.

# Control Wiring (cont.)

All adjustments for airflow are made at the thermostat at this point. Items that can be changed are airflow trim adjustment dehumidification set point, and mode of operation. The thermostat also has a wide range of fault and history information. To go down into a menu, press “Install Config.” To move back up the menu, press “Menu.” Refer to the air handler or furnace installation manual and the communicating thermostat installation manual for further details on setting up the system and available adjustment options.

The serial communicating air handler or serial communicating furnace is equipped with a 24-volt, 50 VA transformer for proper system operation. See the wiring diagram below for reference.




## Conventional 24 VAC Thermostat Control Wiring

The (-)PRL series of heat pumps allow the installer to use conventional 24 VAC control wiring and a conventional thermostat for proper unit operation.

**IMPORTANT:** The preferred method of unit installation and operation is by the *Comfort Control² System*™, which allows access to the fault history of the system. This diagnostic information is not available when the (-)PRL unit is using a conventional thermostat. See “Communicating *Comfort Control²* Control Wiring” on page 16.

Thermostat control wiring requires a minimum of six (6) wires for proper unit operation:

R – 24 VAC

C – 24 VAC common

Y1 – First-stage operation

Y2 – Second-stage operation

B – Heat pump operation

D – Defrost

Optional wiring:

L – ICC fault information

## L Terminal Output

- Flash 1 – Compressor running extremely long run cycle or low pressure
- Flash 2 – High-pressure control trip
- Flash 3 – Unit short cycling
- Flash 4 – Locked rotor
- Flash 5 – Compressor will not run; open circuit
- Flash 6 – Open start circuit
- Flash 7 – Open run circuit
- Flash 8 – Control misoperation
- Flash 9 – Low control voltage

When the L terminal from the outdoor unit is connected to a conventional thermostat that is L terminal-compatible, the thermostat display will flash the codes above.

If the low-voltage control wiring is run in conduit with the power supply, Class I insulation is required. Class II insulation is required if run separately. Low-voltage wiring may be run through the insulated bushing provided in the 7/8" [22.2 mm] hole in the base panel, up to and attached to the pigtails from the bottom of the control box. Conduit can be run to the base panel if desired by removing the insulated bushing.

## Control Wiring (cont.)

A thermostat and a 24-volt, 40 VA minimum transformer are required for the control circuit of the heat pump. The furnace or the air handler transformer may be used if sufficient. See the appropriate wiring diagram for reference. Use table below to size the 24-volt control wiring.

**FIELD WIRE SIZE FOR 24-VOLT THERMOSTAT CIRCUITS**

| Thermo-stat Load (amps) | SOLID COPPER WIRE – AWG | | | | | |
|---|---|---|---|---|---|---|
| 3.0 | 16 | 14 | 12 | 10 | 10 | 10 |
| 2.5 | 16 | 14 | 12 | 10 | 10 | 10 |
| 2.0 | 16 | 14 | 12 | 10 | 10 | 10 |
| | 50 [15] | 100 [30] | 150 [46] | 200 [61] | 250 [76] | 300 [91] |
| | Length of Run – Feet [m] (1) | | | | | |

(1) Wire length equals twice the run distance.

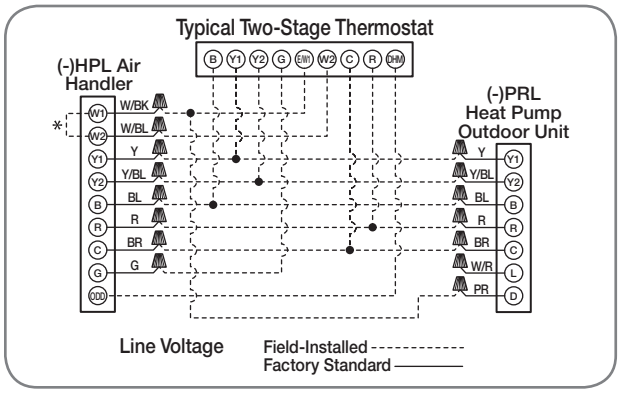
NOTICE: Do not use control wiring smaller than No. 18 AWG between thermostat and outdoor unit.

## Typical Noncommunicating Thermostat Wiring Diagrams

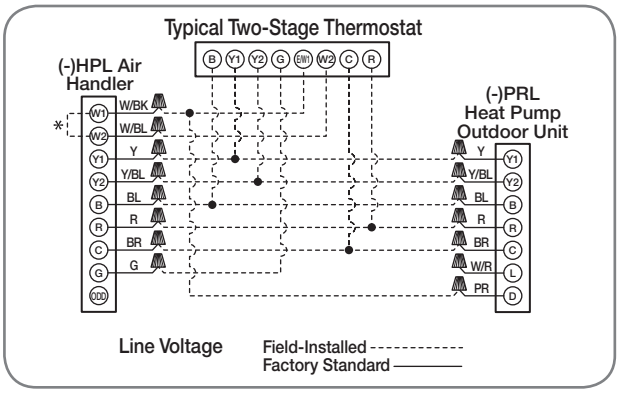
The following figures show the typical wiring diagrams with (-)HPL air handler and (-)PRL heat pump. Cooling and heat pump airflows may need to be adjusted for homeowner comfort once the system is operational.

| WIRE COLOR CODE | | |
|---|---|---|
| BK – BLACK | GY – GRAY | W – WHITE |
| BR – BROWN | O – ORANGE | Y – YELLOW |
| BL – BLUE | PR – PURPLE | |
| G – GREEN | R – RED | |

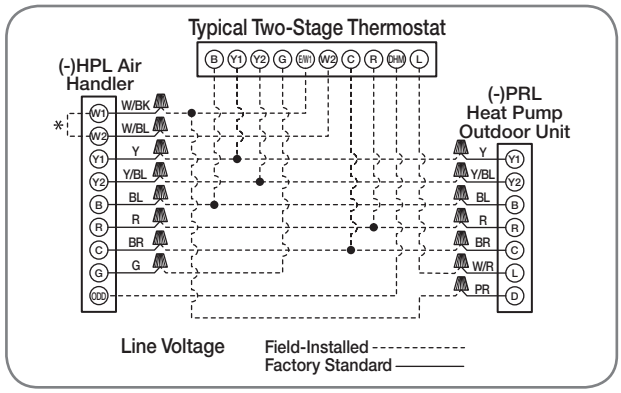
**TYPICAL 2-STAGE THERMOSTAT: (-)PRL HEAT PUMP WITH ELECTRIC HEAT USING A TWO-STAGE THERMOSTAT WITH DEHUMIDIFICATION**




**TYPICAL 2-STAGE THERMOSTAT: HEAT PUMP WITH ELECTRIC HEAT**

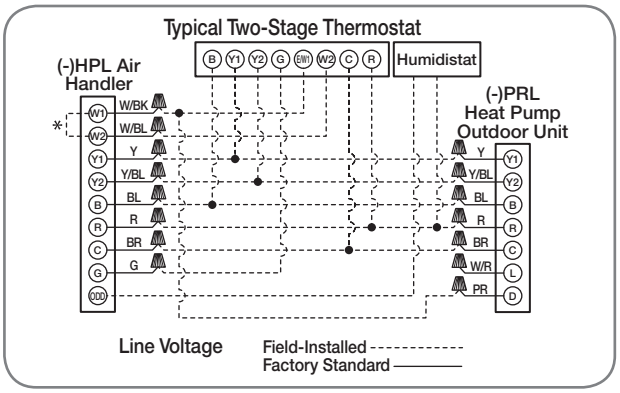



**TYPICAL 2-STAGE THERMOSTAT: (-)PRL HEAT PUMP WITH ELECTRIC HEAT USING A TWO-STAGE THERMOSTAT WITH DEHUMIDIFICATION AND A MALFUNCTION LIGHT**



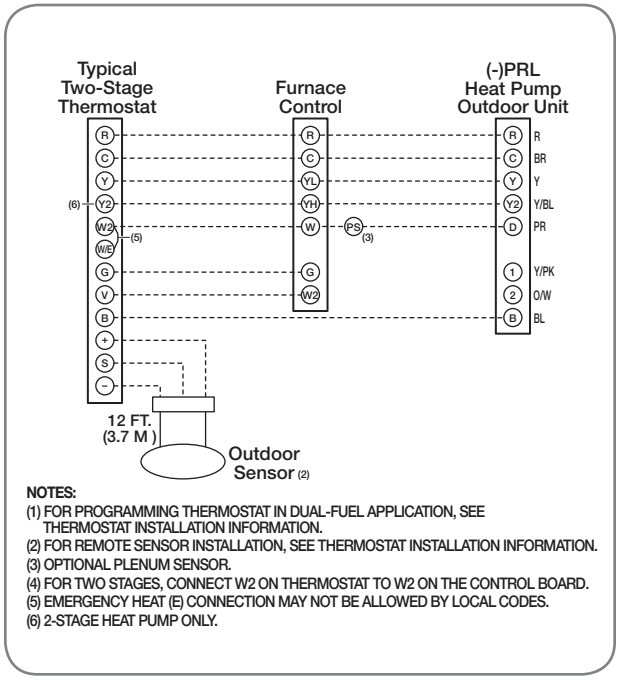

*Add jumper between W1 and W2 for maximum temperature rise if desired.

**TYPICAL 2-STAGE THERMOSTAT: (-)PRL HEAT PUMP WITH ELECTRIC HEAT USING A HUMIDISTAT FOR HUMIDIFICATION**



# Control Wiring (cont.)

**TYPICAL 2-STAGE THERMOSTAT AND DUAL-FUEL APPLICATION**




NOTES:
(1) FOR PROGRAMMING THERMOSTAT IN DUAL-FUEL APPLICATION, SEE THERMOSTAT INSTALLATION INFORMATION.
(2) FOR REMOTE SENSOR INSTALLATION, SEE THERMOSTAT INSTALLATION INFORMATION.
(3) OPTIONAL PLENUM SENSOR.
(4) FOR TWO STAGES, CONNECT W2 ON THERMOSTAT TO W2 ON THE CONTROL BOARD.
(5) EMERGENCY HEAT (E) CONNECTION MAY NOT BE ALLOWED BY LOCAL CODES.
(6) 2-STAGE HEAT PUMP ONLY.

Field wiring must comply with the National Electric Code (C.E.C. in Canada) and any applicable local code.

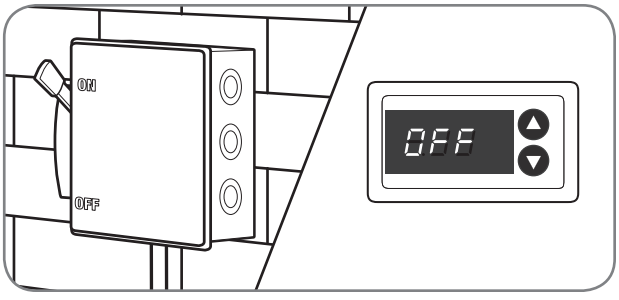
## Power Wiring

It is important that proper electrical power from a commercial utility is available at the heat pump contactor. Voltage ranges for operation are shown below.

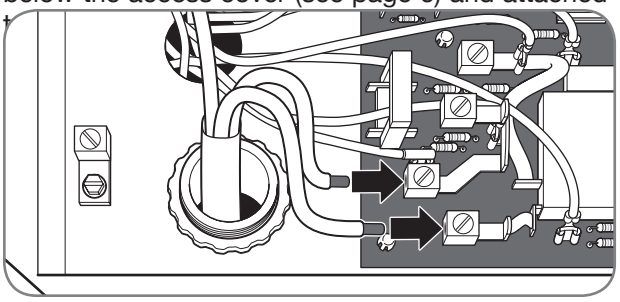
**VOLTAGE RANGES (60 HZ)**

| Nameplate Voltage | Operating Voltage Range at Copeland Maximum Load Design Conditions for Compressors |
|---|---|
| 208/230 (1 Phase) | 197–253 |

Install a branch circuit disconnect within sight of the unit and of adequate size to handle the starting current (see “Electrical Data” on page 5.)




Power wiring must be run in a rain-tight conduit. Conduit must be run through the connector panel below the access cover (see page 6) and attached



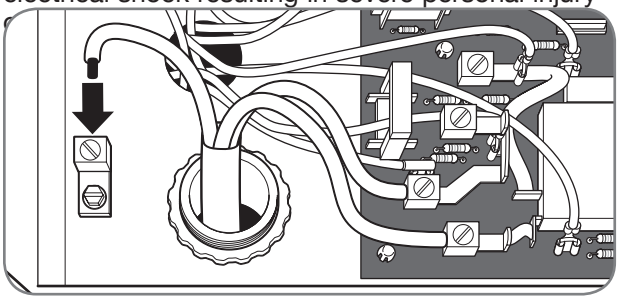
Connect power wiring to line-voltage lugs located in the outdoor heat pump unit electrical box. (See wiring diagram attached to unit access panel.)

Check all electrical connections, including factory wiring within the unit and make sure all connections are tight.

DO NOT connect aluminum field wire to the *Comfort Control*[2] terminals.

## Grounding

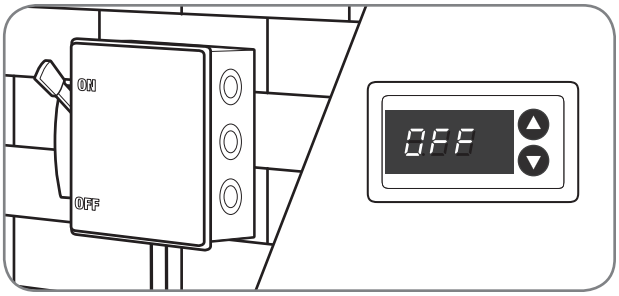
**⚠WARNING:** The unit must be permanently grounded. Failure to do so can cause electrical shock resulting in severe personal injury



A grounding lug is provided near the line-voltage power entrance for a ground wire.

# START-UP

## Start-Up




**At initial start-up or after extended shutdown periods, make sure the crankcase heater is energized for at least 12 hours before the compressor is started. (Disconnect switch is on and wall thermostat is off.)**

Connect the communicating system according to the wiring diagram on page 17. Once all devices are connected, power up the line and low voltage to the system. When all devices are powered, the thermostat should detect the indoor and outdoor units within 45 seconds.

Even though the unit is factory-charged with Refrigerant-410A, the charge must be checked to the charge table attached to the service panel and adjusted, if required. Allow a minimum of 15 minutes of run time before analyzing charge.

## Checking Airflow

The air distribution system has the greatest effect on airflow. The duct system is totally controlled by the contractor. For this reason, the contractor should use only industry-recognized procedures.

The correct air quantity is critical to air conditioning systems. Proper operation, efficiency, compressor life, and humidity control depend on the correct balance between indoor load and outdoor unit capacity. Excessive indoor airflow increases the possibility of high humidity problems. Low indoor airflow reduces total capacity and causes coil icing. Serious harm can be done to the compressor by low airflow, such as that caused by refrigerant flooding.

Heat pump systems require a specified airflow. Each ton of cooling requires between 350 and 450 cubic feet of air per minute (CFM). See the manufacturer's spec sheet for rated airflow for the system being installed.

Duct design and construction should be carefully done. System performance can be lowered dramatically through bad planning or workmanship.

Air supply diffusers must be selected and located carefully. They must be sized and positioned to deliver treated air along the perimeter of the space. If they are too small for their intended airflow, they become noisy. If they are not located properly, they cause drafts. Return air grilles must be properly sized to carry air back to the blower. If they are too small, they also cause noise.

The installers should balance the air distribution system to ensure proper quiet airflow to all rooms in the home. This ensures a comfortable living space.

These simple mathematical formulas can be used to determine the CFM in a residential or light commercial system.

Electric resistance heaters can use:

$$CFM = \frac{\text{volts x amps x } 3.413}{\text{SHC x temp rise}}$$

Gas furnaces can use:

$$CFM = \frac{\text{Output Capacity in BTUH*}}{\text{SHC x temp rise}}$$

*Refer to furnace data plate for furnace output capacity.
SHC = Sensible Heat Constant (see table below)

An air velocity meter or airflow hood can give a more accurate reading of the system CFM.

The measurement for temperature rise should be performed at the indoor coil inlet and near the outlet, but out of direct line of sight of the heater element or heat exchanger. For best results, measure air temperature at multiple points and average the measurements to obtain coil inlet and outlet temperatures.

| ALTITUDE (FEET) | SENSIBLE HEAT CONSTANT (SHC) | ALTITUDE (FEET) | SENSIBLE HEAT CONSTANT (SHC) |
|---|---|---|---|
| Sea Level | 1.08 | 6000 | 0.87 |
| 500 | 1.07 | 7000 | 0.84 |
| 1000 | 1.05 | 8000 | 0.81 |
| 2000 | 1.01 | 9000 | 0.78 |
| 3000 | 0.97 | 10000 | 0.75 |
| 4000 | 0.94 | 15000 | 0.61 |
| 5000 | 0.90 | 20000 | 0.50 |

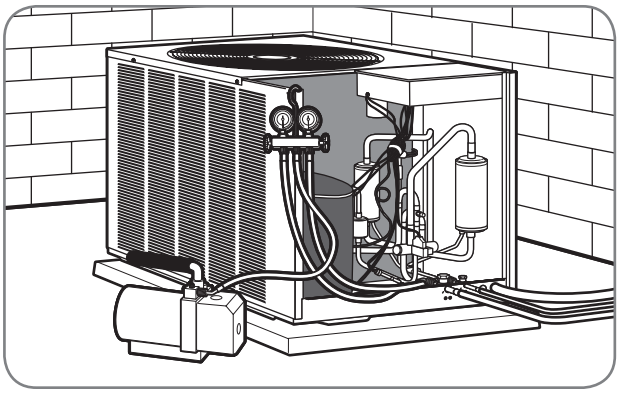
# Evacuation and Leak Testing

## Evacuation Procedure

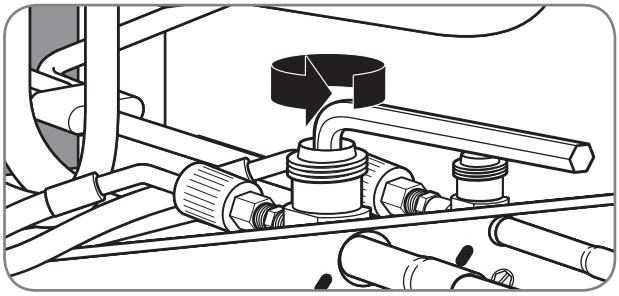
Evacuation is the most important part of the entire service procedure. The life and efficiency of the equipment is dependent upon the thoroughness exercised by the serviceman when evacuating air and moisture from the system.

Air or nitrogen in the system causes high condensing temperatures and pressure, resulting in increased power input and nonverifiable performance.

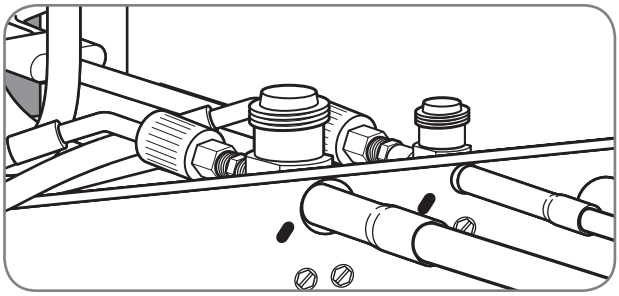
Moisture chemically reacts with the refrigerant and oil to form corrosive hydrofluoric acid. This attacks motor windings and parts, causing breakdown.



- After the system has been leak-checked and proven sealed, connect the vacuum pump and evacuate system to 500 microns and hold 500 microns or less for at least 15 minutes. The vacuum pump must be connected to both the high and low sides of the system by connecting to the two pressure ports. Use the largest size connections available since restrictive service connections may lead to false readings because of pressure drop through the fittings.



- After adequate evacuation, open both service valves by removing both brass service valve caps with an adjustable wrench. Insert a 3/16" [5 mm] or 5/16" [8 mm] hex wrench into the stem and turn counterclockwise until the wrench stops.



- Gauges must be connected at this point to check and adjust charge. Do not replace caps yet.

**IMPORTANT:** Compressors (especially scroll type) should never be used to evacuate the air conditioning system because internal electrical arcing may result in a damaged or failed compressor. Never run a scroll compressor while the system is in a vacuum or compressor failure will occur.

## Final Leak Testing

After the unit has been properly evacuated and service valves opened, a halogen leak detector should be used to detect leaks in the system. All piping within the heat pump, evaporator, and interconnecting tubing should be checked for leaks. If a leak is detected, the refrigerant should be recovered before repairing the leak. The Clean Air Act prohibits releasing refrigerant into the atmosphere.

# START-UP

## Checking Refrigerant Charge

Charge for all systems should be checked against the Charging Chart inside the access panel cover.

**⚠WARNING:** The top of the scroll compressor shell is hot. Touching the compressor top may result in serious personal injury.

**IMPORTANT:** Use factory-approved charging method as outlined on the next page to ensure proper system charge.

**NOTICE:** The optimum refrigerant charge for any outdoor unit matched with a CFL/CFM/H*L indoor coil/air handler is affected by the application. Therefore, charging data has been developed to assist the field technician in optimizing the charge for all mounting configurations (UF – Upflow, DF – Downflow, LH – Left-Hand Discharge, and RH – Right-Hand Discharge). Refer to the charging chart inside the access panel cover on the unit and choose the appropriate column for the specific application being installed or serviced. New installations utilizing either a CFL/CFM indoor coil installed on a gas furnace or an H*L air handler in the downflow or horizontal right-hand discharge may require removal of refrigerant since the factory charge could result in an overcharge condition.

### Charging Units With R-410A Refrigerant

**⚠CAUTION:** R-410A pressures are approximately 60% higher (1.6 times) than R-22 pressures. Use appropriate care when using this refrigerant. Failure to exercise care may result in equipment damage or personal injury.

Charge for all systems should be checked against the Charging Chart inside the access panel cover.

**IMPORTANT:** Do not operate the compressor without charge in the system.

Addition of R-410A will raise high-side pressures (liquid and discharge).

**NOTICE:** System maintenance is to be performed by a qualified and certified technician.

The following method is used for charging systems in the cooling and heating mode. All steps listed should be performed to ensure proper charge has been set. For measuring pressures, the service valve port on the liquid valve (small valve) and the service port on the suction line between the reversing valve and compressor are to be used.

### Confirm ID Airflow and Coils Are Clean

Confirm adequate indoor supply airflow prior to starting the system. See the Technical Specification Sheet for rated airflow for each ID/OD unit match. Air filter(s) and coils (indoor and outdoor) are to be clean and free of frost prior to starting the system. Supply airflow must be between 375 and 450 cfm per rated cooling ton prior to adjusting system charge. If a humidification system is installed, disengage it from operation prior to charge adjustment. *Verify that the outdoor unit is operating in second stage and the indoor air mover is delivering the second-stage airflow for this system size.* Refer to the "Checking Airflow" section of this manual for further instruction.

**NOTICE:** Verify system components are matched according to the outdoor unit Specification Sheet.

### Measurement Device Setup

1. With an R-410A gauge set, attach the high-pressure hose to the access fitting on the liquid line (small) service valve at the OD unit.
2. Attach the low-pressure hose to the common suction port connected to the common suction line between the reversing valve and compressor.
3. Attach a temperature probe within 6" [15.2 cm] outside of the unit on the copper liquid line (small line). For more accurate measurements, clean the copper line prior to measurement and use a calibrated clamp-on temperature probe or an insulated surface thermocouple.

### Charging by Weight

**NOTICE:** Adjust the system charge by weight for the straight length of the refrigerant line set.

For a new installation, evacuation of inter-connecting tubing and indoor coil is adequate; otherwise, evacuate the entire system. Use the factory charge shown in "Electrical and Physical Data" on page 5 of these instructions or on the unit data plate. Note that the charge value includes charge required for 15 ft. [4.6 m] of standard-size interconnecting liquid line without a filter drier.

Calculate actual charge required with installed liquid line size and length using:

1/4" [6.4 mm] O.D. = .3 oz./ft. [8.5 g/.30 m]

5/16" [7.9 mm] O.D. = .4 oz./ft. [11.3 g/.30 m]

3/8" [9.5 mm] O.D. = .6 oz./ft. [17.0 g/.30 m]

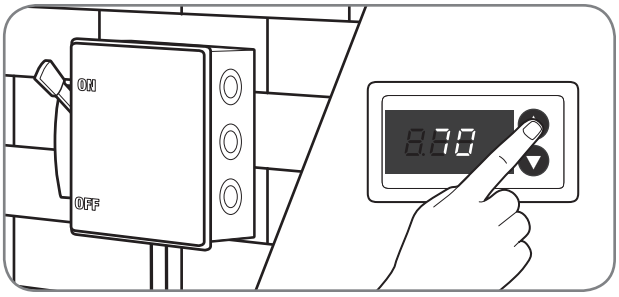
1/2" [12.7 mm] O.D. = 1.2 oz./ft. [34.0 g/.30 m]

Add 6 oz. for field-installed filter drier.

# Checking Refrigerant Charge (cont.)

With an accurate scale (+/– 1 oz. [28.3 g]) or volumetric charging device, adjust charge difference between that shown on the unit data plate and that calculated for the new system installation. If the entire system has been evacuated, add the total calculated charge.

**IMPORTANT:** Charging by weight is not always accurate since the application can affect the optimum refrigerant charge. Charging by weight is considered a starting point ONLY. Always check the charge by using the Charging Chart and adjust as necessary. CHARGING BY LIQUID SUBCOOLING MUST BE USED FOR FINAL CHARGE ADJUSTMENT.




With thermostat in the “Off” position, turn on the power to the furnace or air handler and the heat pump. Start the heat pump and the furnace or air handler with the thermostat. Verify that the outdoor unit is operating in second stage and the indoor air mover is delivering the second-stage airflow for the system size.

## Gross Charging by Pressures

1. Following airflow verification and charge weigh-in, run the unit for a minimum of 15 minutes prior to noting pressures and temperature.

**IMPORTANT:** Indoor conditions as measured at the indoor coil must be within 2°F [1.1°C] of the following during gross charge (pressure) evaluation:

Cooling Mode: 80°F [26.7°C] Dry Bulb

Heating Mode: 70°F [21.1°C] Dry Bulb

**NOTICE:** If the Indoor temperature is above or below this range, run the system to bring the temperature down or run the electric heat/furnace to bring the temperature within this range. System pressure values provided in the Charging Chart for outdoor dry bulbs corresponding to conditions outside of these ranges are provided as reference ONLY.

2. Note the Outdoor Dry Bulb Temperature, ODDB° = _____°F [_____°C]. Unit charging is recommended under the following outdoor conditions ONLY:

   Cooling Mode ONLY: 55°F [12.8°C] outdoor dry bulb and above

   Heating Mode ONLY: Between 40°F [4.4°C] and 60°F [15.6°C] outdoor dry bulb

3. Locate and note the design pressures. The correct liquid and vapor pressures are found at the intersection of the installed system and the outdoor ambient temperature on the Charging Chart located inside the access panel cover.

   Liquid Pressure: = _____psig; Vapor Pressure = _____psig

**NOTICE:** The refrigerant pressures provided are for gross charge check ONLY. These pressure values are typical, but may vary due to application. Evaporator load (indoor coil in cooling mode/outdoor coil in heating mode) will cause pressures to deviate. Note that all systems have unique pressure curves. The variation in the slope and value is determined by the component selection for that indoor/outdoor matched system. The variation from system to system seen in the table is normal. The values listed are for the applicable indoor coil match ONLY!

4. If the measured liquid pressure is below the listed requirement for the given outdoor and indoor conditions, add charge. If the measured liquid pressure is above the listed requirement for the given outdoor and indoor conditions, remove charge.

## Final Charge by Subcooling

1. After gross charging, note the designed subcooling value. The correct subcooling value is found at the intersection of the installed system and the outdoor ambient temperature on the Charging Chart located inside the access panel cover.

   SC° from Charging Chart = _____°F [_____°C].

**IMPORTANT:** Indoor conditions as measured at the indoor coil are required to be between 70°F [21.1°C] and 80°F [26.7°C] dry bulb for fine-tuned unit charge adjustment. Unit charging is recommended under the following outdoor conditions ONLY:

Cooling Mode ONLY: 55°F [12.8°C] outdoor dry bulb and above

Heating Mode ONLY: Between 40°F [4.4°C] and 60°F [15.6°C] outdoor dry bulb

# START-UP

## Checking Refrigerant Charge (cont.)

**NOTICE:** If the indoor temperature is above or below the recommended range, run the system to bring the temperature down or run the electric heat/furnace to bring the temperature up. System subcooling values provided in the Charging Chart for outdoor dry bulbs corresponding to conditions outside of the above range are provided as reference ONLY.

2. Note the measured Liquid Pressure, Pliq = _____psig, as measured from the liquid (small) service valve. Use the Temperature Pressure Chart below to note the corresponding saturation temperature for R-410A at the measured liquid pressure.

   Liquid Saturation Temperature, SAT°= _____°F [_____°C].

3. Note the liquid line temperature, Liq° = _____°F [_____°C], as measured from a temperature probe located within 6" [15.2 cm] outside of the unit on the copper liquid line (small line). It is recommended to use a calibrated clamp-on temperature probe or an insulated surface thermocouple.

4. Subtract the liquid line temperature from the saturation temperature to calculate subcooling. SAT°_____°F [_____°C] - Liq°_____°F [_____°C] = SC°_____°F [_____°C]

5. Adjust charge to obtain the specified subcooling value. If the measured subcool is below the listed requirement for the given outdoor and indoor conditions, add charge. If the measured subcool is above the listed requirement for the given outdoor and indoor conditions, remove charge.

### Finishing Up Installation

- Disconnect pressure gauges from pressure ports; then replace the pressure port caps and tighten adequately to seal caps. **Do not overtighten.**
- Replace the service valve caps finger-tight and then tighten with an open-end wrench adequately to seal caps. **Do not overtighten.**
- Replace control box cover and service panel and install screws to secure service panel.
- Restore power to unit at disconnect if required.
- Configure indoor thermostat per the thermostat installation instructions and set thermostat to desired mode and temperature.

**NOTICE:** Systems should not be fine-tune charged below 40°F [4.4°C] outdoor dry bulb.

**IMPORTANT:** Excessive use of elbows in the refrigerant line set can produce excessive pressure drop. Follow industry best practices for installation. Installation and commissioning of this equipment is to be performed by trained and qualified HVAC professionals. For technical assistance, contact your Distributor Service Coordinator.

**TEMPERATURE PRESSURE CHART**

| SATURATION TEMP (Deg. F) [Deg. C] | R-410A PSIG | SATURATION TEMP (Deg. F) [Deg. C] | R-410A PSIG | SATURATION TEMP (Deg. F) [Deg. C] | R-410A PSIG | SATURATION TEMP (Deg. F) [Deg. C] | R-410A PSIG |
|---|---|---|---|---|---|---|---|
| -150 [-101] | – | -30 [-34] | 17.9 | 35 [2] | 107.5 | 100 [38] | 317.4 |
| -140 [-96] | – | -25 [-32] | 22.0 | 40 [4] | 118.5 | 105 [41] | 340.6 |
| -130 [-90] | – | -20 [-29] | 26.4 | 45 [7] | 130.2 | 110 [43] | 365.1 |
| -120 [-84] | – | -15 [-26] | 31.3 | 50 [10] | 142.7 | 115 [46] | 390.9 |
| -110 [-79] | – | -10 [-23] | 36.5 | 55 [13] | 156.0 | 120 [49] | 418.0 |
| -100 [-73] | – | -5 [-21] | 42.2 | 60 [16] | 170.1 | 125 [52] | 446.5 |
| -90 [-68] | – | 0 [-18] | 48.4 | 65 [18] | 185.1 | 130 [54] | 476.5 |
| -80 [-62] | – | 5 [-15] | 55.1 | 70 [21] | 201.0 | 135 [57] | 508.0 |
| -70 [-57] | – | 10 [-12] | 62.4 | 75 [24] | 217.8 | 140 [60] | 541.2 |
| -60 [-51] | 0.4 | 15 [-9] | 70.2 | 80 [27] | 235.6 | 145 [63] | 576.0 |
| -50 [-46] | 5.1 | 20 [-7] | 78.5 | 85 [29] | 254.5 | 150 [66] | 612.8 |
| -40 [-40] | 10.9 | 25 [-4] | 87.5 | 90 [32] | 274.3 | | |
| -35 [-37] | 14.2 | 30 [-1] | 97.2 | 95 [35] | 295.3 | | |

## Compressor Crankcase Heat (CCH)

CCH is standard on these models due to refrigerant migration during the off cycle that can result in a noisy start-up and compressor damage.

**Crankcase Heater Operation:**

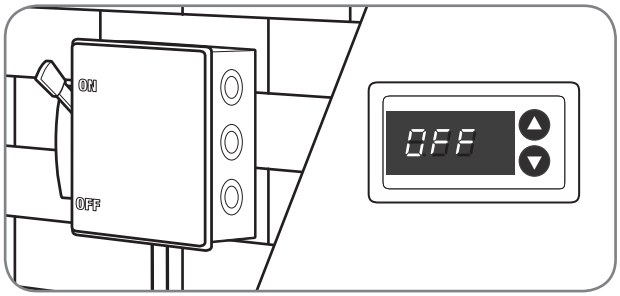
Supplemental crankcase heat is required to prevent refrigerant migration in systems with relatively high system refrigerant charges.

The crankcase heater control is integrated into the ICC and is designed for maximum energy savings. It uses a 30-minute off delay.

Summary of operation:

- The crankcase heater is off whenever the compressor is running.
- Once the compressor turns off, the crankcase heater control (CCH) begins the 30-minute timer countdown.
- If the compressor stays off for 30 minutes, the CCH turns on the crankcase heater.

All heaters are located on the lower half of the compressor shell. Its purpose is to drive refrigerant from the compressor shell during long off cycles, thus preventing damage to the compressor during start-up.




At initial start-up or after extended shutdown periods, make sure the heater is energized for at least 12 hours before the compressor is started. (Disconnect switch is on and wall thermostat is off.)

## Hard-Start Components

Factory-installed start components are standard on all models. While scroll compressors typically do not require hard-start components under normal circumstances, they are provided on these premium models to reduce light dimming and to ensure positive starts under low-voltage conditions.

## High- and Low-Pressure Controls (HPC and LPC)

These controls keep the compressor from operating in pressure ranges which can cause damage to the compressor. Both controls are in the low-voltage control circuit.

The high-pressure control (HPC) is an automatic-reset which opens near 610 PSIG and closes near 420 PSIG.

The low-pressure control (LPC) is an automatic-reset which opens near 15 PSIG and closes near 40 PSIG.

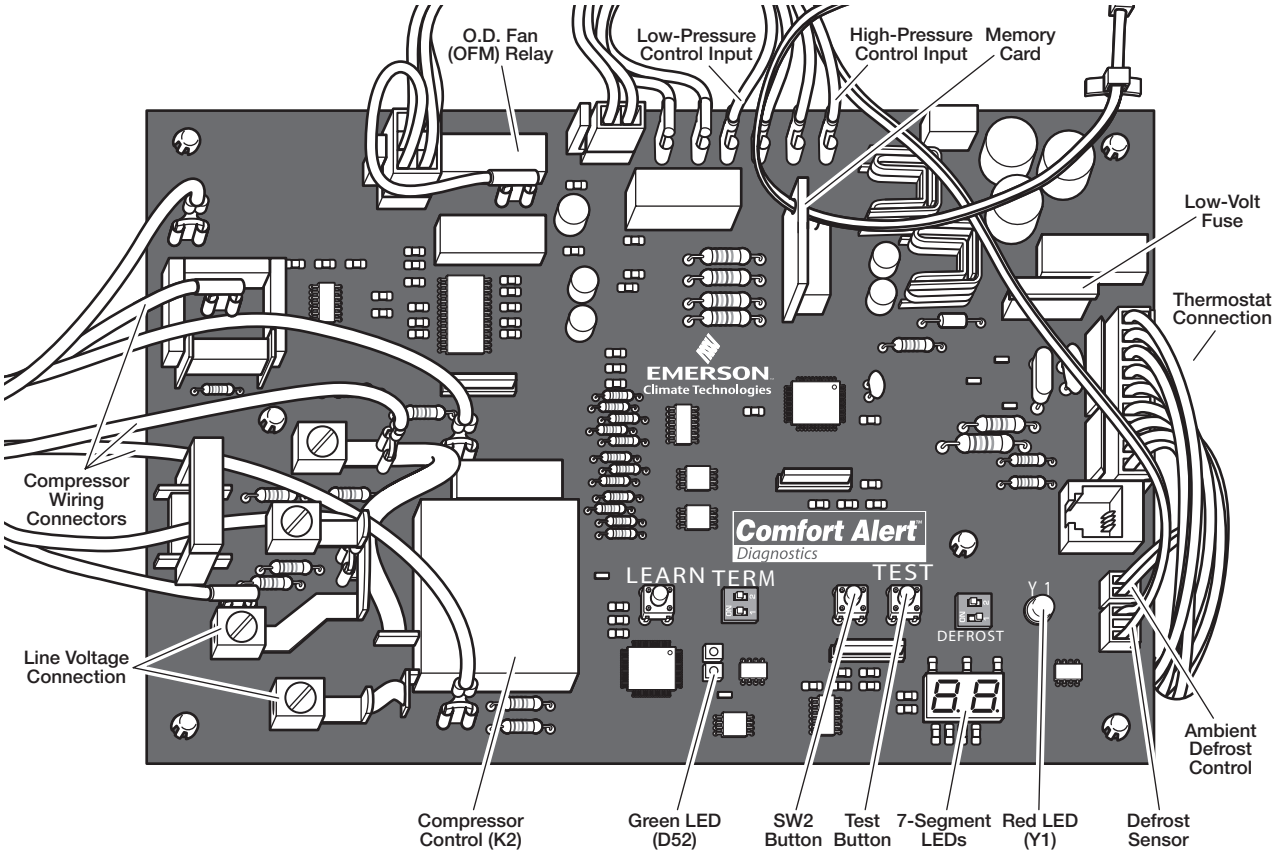
**NOTICE:** HPC and LPC are monitored by the *Comfort Control² System*™. See "*Comfort Control² System*™" on page 26.

**⚠CAUTION:** The compressor has an internal overload protector. Under some conditions, it can take up to 2 hours for this overload to reset. Make sure overload has had time to reset before condemning the compressor.

# COMPONENTS AND CONTROLS

## *Comfort Control² System™*

### ICC Board

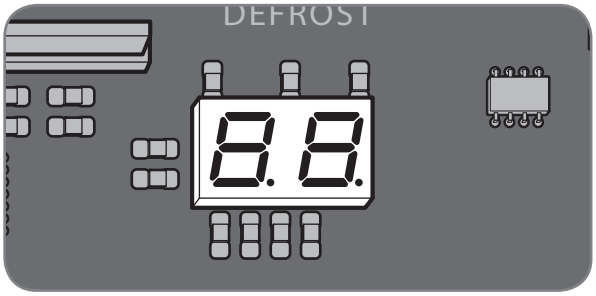



The *Comfort Control²* is the next generation of the integrated compressor control (ICC) and is an integral part of the *Comfort Control² System*™ with the following features:

## Control Description (see above)

**Dual 7-Segment LEDs**

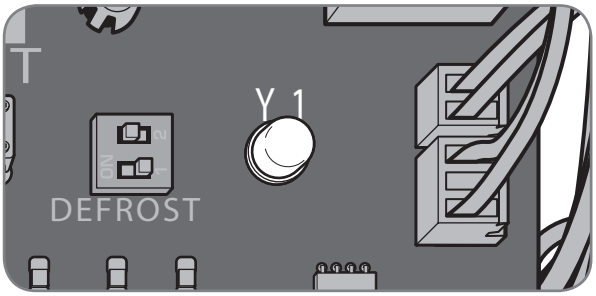
- Displays status and diagnostic codes. (See Status and Diagnostic Description on pages 19–27.)
- Displays diagnostic/fault recall. (See "Test and Fault Recall Modes" on pages 34 and 35.)




**Red LED (Y1)**

**⚠CAUTION:** UNIT MAY START SUDDENLY AND WITHOUT WARNING. Solid red light indicates a thermostat call for unit operation is present at the ICC control. ICC control will attempt to start unit after short-cycle timer expires or when in Active Protection mode will attempt to restart unit prior to Lockout mode.

- Y1 red LED (solid on) indicates Y1 call from thermostat is present.

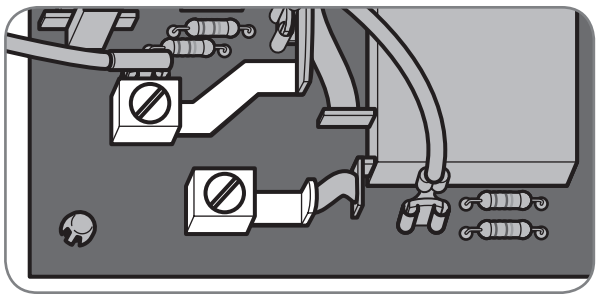


## Comfort Control² System™ (cont.)



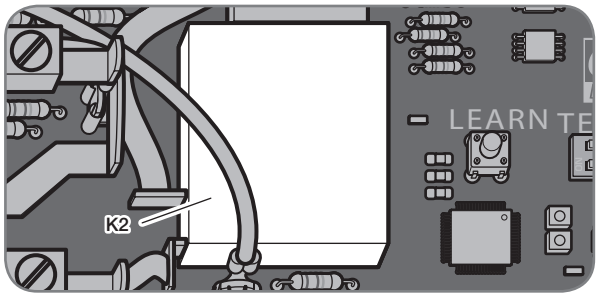
**Line-Voltage Connector**

- Line voltage is connected to control board at lug terminals L1 and L2.
- Maximum wire size accepted is 6 AWG copper wire.
- #4–6 AWG – 45 in./lbs.
  #8 AWG – 40 in./lbs.
  #10–14 AWG – 35 in./lbs.
  (Check wire terminations annually.)



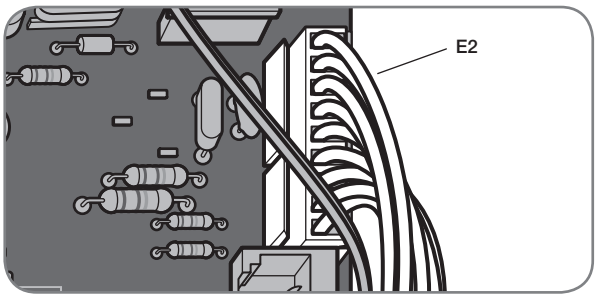
**Compressor Control (K2)**

- Sealed single pole compressor relay switch with optical feedback feature (arc detection)



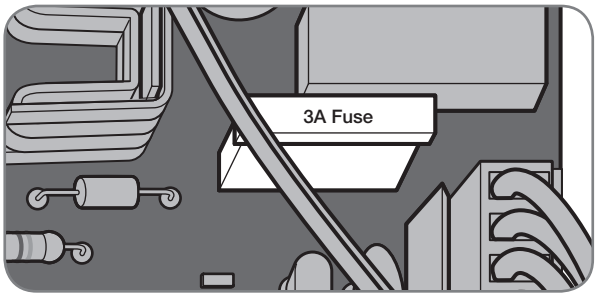

**Thermostat Connector (E2)**

- R – 24 VAC from the indoor unit 24 VAC transformer (40 VA minimum)
- C – 24 VAC common from the indoor unit 24 VAC transformer
- 1-Data: System Communications Line 1
- 2-Data: System Communications Line 2



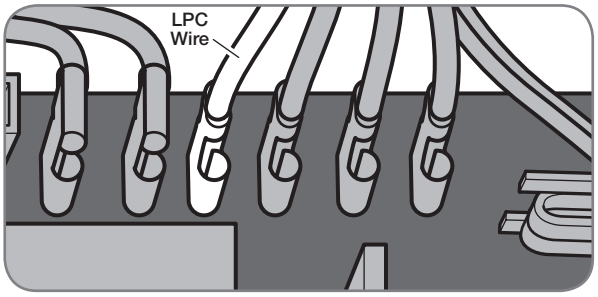

**Low-Volt Fuse**

- If required, replace with 3A automotive ATC-style blade fuse.



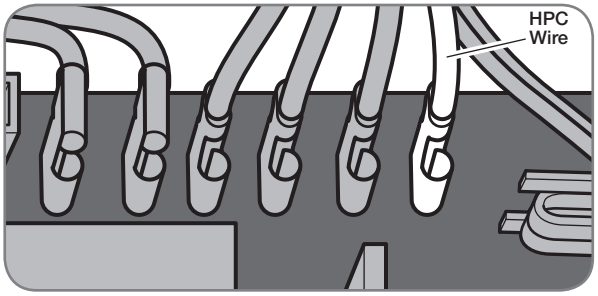

**Low-Pressure Control (LPC Input)**

- Low-pressure control is factory-installed.
- Low-pressure control is an automatic resetting device.



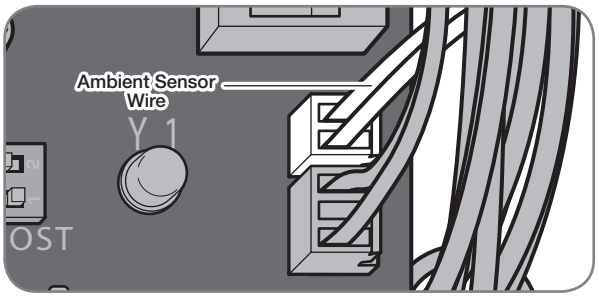

**High-Pressure Control (HPC Input)**

- High-pressure control is factory-installed.
- High-pressure control is an automatic resetting device.




**Ambient Temperature Sensor**

- Included with all applications.

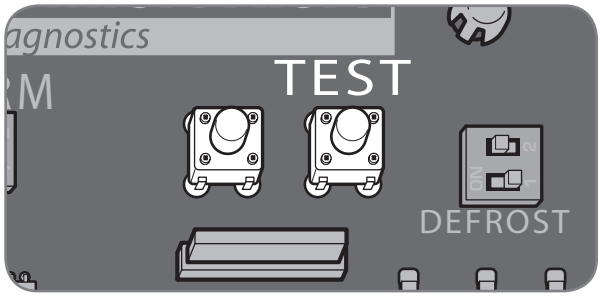


# COMPONENTS AND CONTROLS

## *Comfort Control² System*™ (cont.)

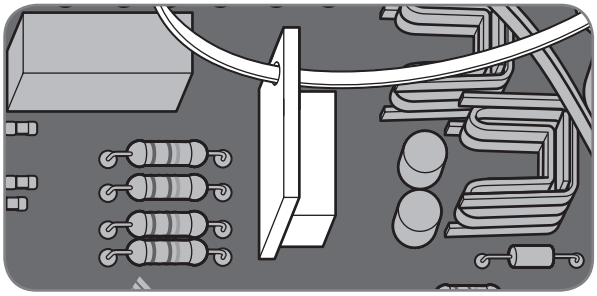
**TEST and SW2 Buttons**

- TEST and SW2 buttons are used to enter Test and Fault Recall Mode.




**Memory Card**

- The memory card stores all unit information.
- The unit information is called shared data.
- The shared data is all the information needed for proper unit operation.



## *Comfort Control²* ICC Control Operation

**Installation Verification**

- 24 VAC power on R and C must be present at the ICC for it to operate.
- Line voltage must be present at the ICC for the compressor and the outdoor fan to operate.
- The ICC displays a "0" for standby mode. Standby mode indicates line voltage and 24 VAC are present at the ICC and there is not a call for unit operation from the serial communicating thermostat.

Zero (0) displayed. The unit is in standby.

**Call for Compressor Operation (Y1 LED)**

- If a call for compressor operation is received by the ICC (first-stage/second-stage cooling or first-stage/second-stage heating), the red Y1 LED will illuminate.
- The ICC has an on/off fan delay of one (1) second for each stage of heating or cooling.
- The ICC ignores the low-pressure control for the first 90 seconds of compressor operation.
- On heat pumps, the ICC ignores the LPC during the defrost cycle.

- The dual 7-segment LEDs display five (5) operational status codes:

1) **First-Stage Cooling Operation** – When the ICC receives a call for first-stage cooling operation, a lower-case "c" is displayed on the dual 7-segment LEDs.

Lower-case "c" indicates first-stage cooling operation.

2) **Second-Stage Cooling Operation** – When the ICC receives a call for second-stage cooling operation, an upper-case "C" is displayed on the dual 7-segment LEDs.

Upper-case "C" indicates second-stage cooling operation.

3) **First-Stage Heating Operation** – When the ICC receives a call for first-stage heating operation, "h" is displayed on the dual 7-segment LEDs.

Lower-case "h" indicates first-stage heating operation.

## *Comfort Control² System™* (cont.)



**4) Second-Stage Heating Operation** – When the ICC receives a call for second-stage heating operation, an upper-case “H” is displayed on the dual 7-segment LEDs.

Upper-case “H” indicates second-stage heating operation.

**5) Defrost Operation** – When the ICC starts a defrost cycle, a lower-case “d” is displayed on the dual 7-segment LEDs.

Lower-case “d” indicates defrost operation (in heating mode).

**3-Minute Anti-Short-Cycle Timer**

- The ICC has a built-in 3-minute time delay between compressor operations to protect the compressor against short cycling. The dual 7-segment LEDs will flash “c,” “C,” “h,” or “H” while the short-cycle timer is active and a call for unit operation is received.

Flashing lower-case "c"

A call for first-stage cooling has been received.

Flashing upper-case "C"

A call for second-stage cooling has been received.

Flashing lower-case "h"

A call for first-stage heating has been received.

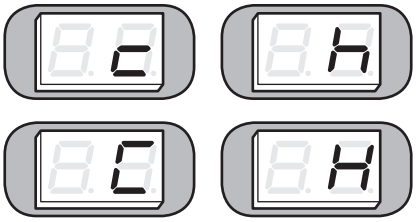
Flashing upper-case "H"

A call for second-stage heating has been received.

When a call for compressor operation is present, the 3-minute time delay can be bypassed by pressing the TEST button for 1 second and releasing. The compressor will begin operation and the dual 7-segment LEDs will stop flashing.

**30-Second Minimum Run Timer**

- The ICC has a built-in 30-second minimum unit run time. If a call for compressor operation is received by the ICC and the call is removed, the compressor will continue to operate for 30 seconds. The dual 7-segment LEDs will flash “c,” “C,” “h,” or “H” while the minimum run timer is active.



**1-Second Compressor/Fan Delay**

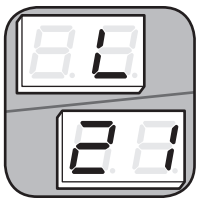
- The ICC starts/stops the outdoor fan one (1) second after the start/stop of the compressor upon a call for compressor operation to minimize current inrush and/or voltage drop.

## Active Compressor Protection Mode

- The ICC actively protects the compressor from harmful operation during a fault condition.
- When the ICC detects a condition that could damage the compressor, the ICC will enter active protection mode and lock out compressor operation.
- The condition causing active protection must be resolved before the ICC will restart the system.
- There are five (5) active protection modes:

**1) Low-Pressure Control Lockout**

- The ICC will display a flashing “L” followed by a flashing “21” when a low-pressure control lockout occurs.



Active Protection – Code L21 – Open low-pressure control

**IMPORTANT:** This mode of active protection must be manually reset.

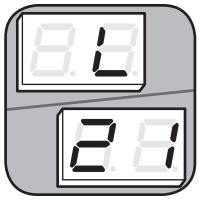
- The ICC addresses low-pressure control faults differently depending on the mode of unit operation (cooling or heating mode).

# COMPONENTS AND CONTROLS

## *Comfort Control² System™* (cont.)

**Cooling Mode**

- If the LPC opens three (3) times during the same call for cooling operation, the ICC will lock out the compressor to keep it from continuing to operate and flash an "L" on the dual 7-segment LEDs followed by a "21."




Active Protection – Code L21 – Open low-pressure control

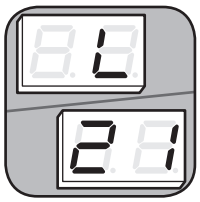
**IMPORTANT:** This mode of active protection must be manually reset.

**Heating Mode**

- There are two scenarios that will cause active protection during an LPC trip when the unit is in the heating mode:

**Active Protection With Hard Lockout:**

- If the LPC opens three (3) times within 120 minutes for the same call for heating operation, the ICC will lock out the compressor to keep it from continuing to operate and flash an "L" on the dual 7-segment LEDs followed by a "21."




Active Protection – Code L21 – Open low-pressure control

**IMPORTANT:** This mode of active protection must be manually reset.

**Active Protection With Soft Lockout:**

- If the LPC opens three (3) times for the same call for heating and the outdoor ambient temperature is below 5°F [-15°C], the ICC will lock out the compressor to keep it from continuing to operate and flash an "L" on the dual 7-segment LEDs followed by a "21." Once the outdoor ambient rises above 5°F [-15°C], the ICC will clear active protection automatically.

**IMPORTANT:** This mode of active protection will automatically deactivate once the outdoor temperature rises above 5°F [-15°C]. Wait until the outdoor ambient temperature rises above 5°F [-15°C] before performing further diagnostics.

**2) High-Pressure Control Lockout**

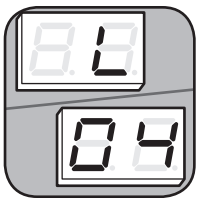
- If the HPC opens three (3) times during the same call for unit operation, the ICC will lock out the compressor to keep it from continuing to operate and flash an L" on the dual 7-segment LEDs followed by a "29."


Active Protection – Code L29 – Open high-pressure control

**IMPORTANT:** This mode of active protection must be manually reset.

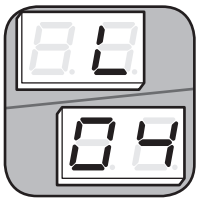
**3) Locked Rotor**

- The ICC will display a flashing "L" followed by a flashing "04" when a locked rotor condition occurs.




Active Protection – Code L4 – Locked rotor

- If the ICC detects the compressor has run less than 15 seconds for four (4) consecutive starts during the same call for unit operation, the ICC will lock out the compressor to keep it from continuing to operate and flash an "L" on the dual 7-segment LEDs followed by a "04."

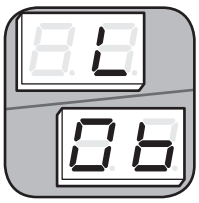



Active Protection – Code L4 – Locked rotor

**IMPORTANT:** This mode of active protection must be manually reset.

**4) Open Start Circuit Lockout**

- The ICC will display a flashing "L" followed by a flashing "06" when an open start circuit condition occurs.

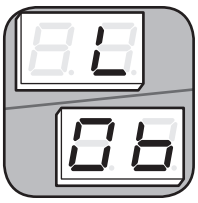



Active Protection – Code L6 – Compressor open start circuit

## *Comfort Control² System™* (cont.)



- If the ICC detects current in the run circuit without current present in the start circuit, the ICC will lock out the compressor to keep it from continuing to operate and flash an "L" on the dual 7-segment LEDs followed by a "06."

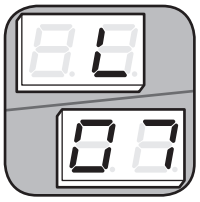


Active Protection – Code L6 – Compressor open start circuit

**IMPORTANT:** This mode of active protection must be manually reset.

**5) Open Run Circuit Lockout**

- The ICC will display a flashing "L" followed by a flashing "07" when an open run circuit condition occurs.



Active Protection – Code L7 – Compressor open run circuit

- If the ICC detects current in the start circuit without current present in the run circuit, the ICC will lock out the compressor to keep it from continuing to operate and flash an "L" on the dual 7-segment LEDs followed by a "07."

Active Protection – Code L7 – Compressor open run circuit

**IMPORTANT:** This mode of active protection must be manually reset.

**Exiting Active Compressor Protection Lockout**

There are three methods to reset the ICC after an active protection lockout:

1) Cycle the line voltage to the unit.
2) Cycle 24 VAC to the ICC (remove the R or C connection to the ICC).
3) Push the TEST button down with an insulated probe for one (1) second and release.

## NOTICES:

- The ICC will attempt to start the unit when the TEST button is pressed and released.
- The preferred method of resetting the ICC is to push the TEST button down for one (1) second.

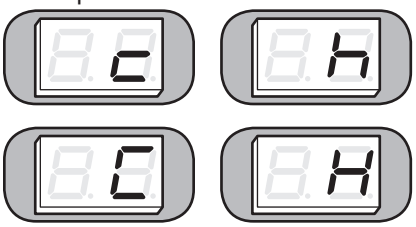
## Test and Fault Recall Modes

**Test Mode (Test Button on the ICC)**

- Enter TEST mode by pressing the TEST button with an insulated probe for one (1) second and release.
- The TEST mode causes the ICC to do the following:
  1) Resets the ICC from any active protection lockout mode.
  2) Resets the 3-minute anti-short-cycle timer.
  3) Energizes the unit without a call for unit operation.
- If the 3-minute anti-short-cycle timer or 30-second minimum run timer is active (a flashing "c," "C," "h," or "H" is displayed on the dual 7-segment LEDs) and a call for unit operation is present, the TEST mode causes:
  1) A "t" to display momentarily on the dual 7-segment display.

Lower-case "t"

  2) The compressor will start and the outdoor fan will operate.
  3) The display will change to a steady "c," "C," "h," or "H" to show the current demand for unit operation.



**NOTICE:** If a call for unit operation is present at the end of the TEST mode, the unit will continue to operate.

- If no call for unit operation is present, the TEST mode causes:
  1) A steady "t" to appear on the dual 7-segment LEDs.

Lower-case "t"

  2) The compressor will start.
  3) The compressor will turn off after 5 seconds.

**NOTICE:** Entering TEST mode without a call for unit operation will cause the compressor to run for 5 seconds.

# COMPONENTS AND CONTROLS

## *Comfort Control² System™* (cont.)

**Fault Recall Mode (TEST and SW2 Buttons)**

- Enter FAULT RECALL mode by pressing the TEST and SW2 buttons with insulated probes at the same time for one (1) second and release.
- When entering and exiting FAULT RECALL mode, the top and bottom segments of the right-hand 7-segment LED will illuminate.

Fault Recall Mode – The top and bottom segments on the right side are illuminated.

- When entering FAULT RECALL mode, the ICC will automatically scroll through stored faults on the dual 7-segment LEDs.
- Each fault is displayed one time with the top right-hand segment of the dual 7-segment LEDs activated between faults.
- Each fault is displayed with the most recent fault displayed first.
- A maximum of six individual faults can be stored.
- A maximum of three consecutive identical faults are stored.
- A “0” will be displayed when no faults are stored.
- The ICC will automatically exit the FAULT RECALL mode after displaying stored faults.

**IMPORTANT:** The ICC stores the previous six history faults. The complete stored fault history cannot be displayed using a conventional thermostat.

**Clear Fault History (TEST and SW2 Buttons)**

- Clear FAULT HISTORY by pressing both TEST and SW2 buttons for five (5) seconds with insulated probes and release.
- The top and bottom segments of the dual 7-segment LEDs flash to indicate the history has been cleared.

Fault history is cleared when the top and bottom LED segments flash.

**NOTICE:** The memory card for the unit has specific shared data for this unit. The memory card is attached to the control box with a tether. The tether has an identification tag that can be used to identify the memory card. For system data faults d1 through d8, reference the label on the memory card tether.

## Demand Defrost

The integrated compressor control (ICC) has a demand defrost algorithm so a separate defrost control is not needed. The ICC monitors the outdoor ambient temperature, outdoor coil temperature, and the compressor runtime to determine when a defrost cycle is required.

**Defrost Initiation**

A defrost will be initiated when these three conditions are satisfied:

1) The outdoor coil temperature is below 35°F [1.7°C].
2) The compressor has operated for at least 34 minutes with the outdoor coil temperature below 35°F [1.7°C].
3) The defrost algorithm determines a defrost is required.

**Defrost Termination**

Once a defrost is initiated, the defrost will continue until 14 minutes have elapsed or the coil temperature has reached the termination temperature. The termination temperature is factory-set at 70°F [21.1°C], although the temperature can be changed to 50°F [10°C], 60°F [15.6°C], 70°F [21.1°C], or 80°F [26.7°C] by relocating dip switches on the ICC.

**NOTICE:** An optional “Noise Abatement Time“ can be selected via the communicating thermostat. When 30-second noise abatement is selected, the compressor will shut down for 30 seconds when the unit goes into or comes out of defrost.

**Temperature Sensors**

The coil sensor is clipped to the top tube on the outdoor coil at the point fed by the distribution tubes from the expansion device (short 3/8" [8.3 mm] diameter tube).

If the ambient sensor fails, the defrost control will initiate a defrost every 34 minutes in heat mode with the coil temperature below 35°F [1.7°C].

**Defrost Test Mode**

The Defrost Test Mode is initiated by pressing pushbutton SW2 for 1 second with the unit running in HP mode. Upon release of pushbutton SW2, the unit will go into defrost until termination temperature is achieved or 14 minutes have expired. Pressing SW2 while in Defrost Test Mode will terminate the test mode.

## *Comfort Control² System™* (cont.)



**Troubleshooting Demand Defrost**

- Set the indoor thermostat select switch to heat and initiate a call for heat.
- Press SW2 to put the unit into defrost. If the unit goes into defrost and comes back out of defrost, the indication is that the control is working properly.

**Field Defrost Testing**

- To test the defrost control, the coil temperature must be below 70°F [21.1°C].
- If the ambient temperature is above 70°F [21.1°C], the control will not go into defrost mode.
- Run the unit in the heating mode for 1 minute to bypass any minimum run timers.
- Press the SW2 button for 1 second.

- The control will display a “d” and initiate a 30-second delay on the compressor.
- When the coil temperature reaches 70°F [21.1°C], the control will exit defrost mode and go through the second noise abatement delay.
- Pressing the SW2 button will also end the defrost call.

**Forced Defrost**

If the ambient is above 70°F [21.1°C], the control can be forced into defrost mode by holding down the SW2 button for 5 seconds.

The control will stay in defrost mode until the SW2 button is pressed again.

If left in this mode for too long, the control will trip on high pressure.

If the defrost operation is tested multiple times, a “3” fault may occur. A “3” fault occurs because the compressor did not run for 3 minutes for 3 consecutive calls. To reset the “3” fault, remove the low-voltage power from the outdoor control board.

## ICC Diagnostic Codes

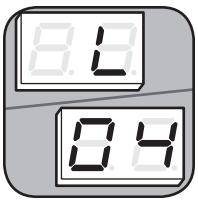
Descriptions of the ICC diagnostic codes are provided below:

**NOTE:** Codes must be read from correct side to avoid an error in reading codes.

| Dual 7-Segment LEDs Display Code | Diagnostic Description | Status/Possible Cause – Troubleshooting Information |
|---|---|---|
|  | 0 – Standby<br>No command for unit operation | Normal operation |
|  | c – First-Stage Cooling<br>Unit has received a command for first-stage cooling. | Normal operation |
|  <br>**FLASHING** | c – Anti-short-cycle timer (3 minutes) or minimum run timer (30 seconds) active | • The unit has received a command for first-stage cooling during an active anti-short-cycle timer or minimum run timer.<br>• Wait until unit timer has expired or press the TEST button to defeat short-cycle delay. |
|  | C – Second-Stage Cooling<br>Unit has received a command for second-stage cooling. | Normal operation |
|  <br>**FLASHING** | C – Anti-short-cycle timer (3 minutes) or minimum run timer (30 seconds) active. | • The unit has received a command for second-stage cooling during an active anti-short-cycle timer or minimum run timer.<br>• Wait until timer has expired or press the TEST button to defeat short-cycle delay. |
|  | h – First-Stage Heat Pump<br>Unit has received a command for first-stage heat pump. | Normal operation |

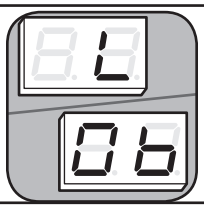
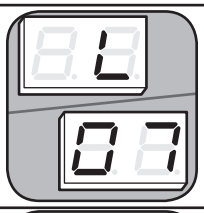
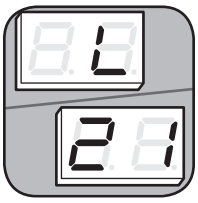
# COMPONENTS AND CONTROLS

## *Comfort Control² System™* (cont.)

| Dual 7-Segment LEDs Display Code | Diagnostic Description | Status/Possible Cause – Troubleshooting Information |
|---|---|---|
|  FLASHING | h – Anti-short-cycle timer (3 minutes) or minimum run timer (30 seconds) active. | • The unit has received a command for first-stage heat pump during an active anti-short-cycle timer or minimum run timer.<br>• Wait unit timer has expired or press the TEST button to defeat short-cycle delay. |
|  | H – Second-Stage Heat Pump<br>Unit has received a command for second-stage heat pump. | Normal operation |
|  FLASHING | H – Anti-short-cycle timer (3 minutes) or minimum run timer (30 seconds) active. | • The unit has received a command for second-stage heat pump during an active anti-short-cycle timer or minimum run timer.<br>• Wait unit timer has expired or press the TEST button to defeat short-cycle delay. |
|  | d – Defrost Active<br>The unit is undergoing a defrost cycle. | Normal operation |
|  | t – Test Mode | • The ICC is in TEST mode. |
|  | P – Protector Trip<br>A command for compressor operation is present but no current is measured to the compressor. | • Motor protector open or open windings. |
|  | 01 – Long Run Time (Compressor)<br>The compressor has continuously run for more than 18 hours in the cooling mode. | • Low refrigerant charge<br>• Air ducts have substantial leakage<br>• Dirty indoor air filter<br>• Dirty outoor coil |
|  | 02 – High-Side Fault<br>Compressor limit has opened four (4) times within a call for operation. | • Outdoor coil is dirty (cooling mode).<br>• Outdoor fan is not running (cooling mode).<br>• Dirty indoor coil or filter (heating mode)<br>• Indoor blower is not running (heating mode).<br>• Liquid line restriction<br>• Excessive refrigerant charge |
|  | 03 – Short Cycling<br>The ICC detects the run time for the past four (4) compressor cycles is less than three (3) minutes each. | • Check thermostat wire connections (R, C, 1, and 2).<br>• Check thermostat location in zone (too close to discharge grill). |
|  | L4 – Locked Rotor<br>The ICC detects four (4) consecutive protector trips have occurred and the average run time for each trip is less than 15 seconds. | • Bad run capacitor<br>• Low line voltage<br>• Excessive refrigerant in compressor<br>• Seized bearings in compressor |
|  | 05 – Open Circuit (Compressor Will Not Run)<br>• The ICC has had a protector trip for longer than 4 hours. | • Check for damaged, miswired, or wrong run capacitor.<br>• Check for broken wires, loose connectors, or miswired compressor.<br>• Check compressor windings for continuity.<br>• Check for open compressor internal protector. |

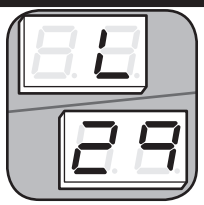
## *Comfort Control² System™* (cont.)



| Dual 7-Segment LEDs Display Code | Diagnostic Description | Status/Possible Cause – Troubleshooting Information |
|---|---|---|
|  | 06 – Compressor Open Start Circuit<br>The ICC detects current in the Run circuit but not in the Start circuit of the compressor. | • Check for damaged, miswired, or wrong run capacitor.<br>• Check for broken wires, loose connectors, or miswired compressor.<br>• Check compressor windings for continuity. |
|  | 06 – Compressor Open Start Circuit<br>The ICC detects current in the Run circuit but not in the Start circuit of the compressor four (4) times in one compressor call. | • Check for damaged, miswired, or wrong run capacitor.<br>• Check for broken wires, loose connectors, or miswired compressor.<br>• Check compressor windings for continuity. |
|  | 07 – Compressor Open Run Circuit<br>The ICC detects current in the Start circuit but not in the Run circuit of the compressor. | • Check for damaged, miswired, or wrong run capacitor.<br>• Check for broken wires, loose connectors, or miswired compressor.<br>• Check compressor windings for continuity. |
|  | 07 – Compressor Open Run Circuit<br>The ICC detects current in the Start circuit but not in the Run circuit of the compressor four (4) times in one compressor call. | • Check for damaged, miswired, or wrong run capacitor.<br>• Check for broken wires, loose connectors, or miswired compressor.<br>• Check compressor windings for continuity. |
|  | 09 – Low Secondary Volts<br>The secondary voltage at R and C is below 18VAC. | • Control transformer overloaded.<br>• Low line voltage |
|  | 21 – Low Pressure Control Open<br>The ICC detects the LPC is open.<br>Notice: The low-pressure control is ignored for the first 90 seconds of compressor operation. | • Unit has low refrigerant charge.<br>• Indoor coil is frozen (cooling mode).<br>• Indoor coil or filter is dirty (cooling mode).<br>• Indoor blower is not running (cooling mode).<br>• Outdoor coil is frozen (heating mode).<br>• Expansion valve is not operating correctly. |
|  <br>**FLASHING** | L21 – **Active Protection** Low-Pressure Control Trip | • LPC has opened 3 times in the same cooling operation, the ICC has locked out the compressor to protect it. ICC alternately flashes L and 21. |
|  | 27 – Low Line Voltage or No Line Voltage Fault | • Check incoming line voltage to the disconnect and unit.<br>• Check wiring connections. |
|  | 28 – High Line Voltage Fault | • Check line voltage. |
|  | 29 – High-Pressure Control Open<br>The ICC detects the HPC is open. | • Outdoor coil is dirty (cooling mode).<br>• Outdoor fan is not running (cooling mode).<br>• Indoor coil or filter is dirty (heating mode).<br>• Indoor blower is not running (heating mode).<br>• Liquid line restriction<br>• Excessive refrigerant charge |

# COMPONENTS AND CONTROLS

## *Comfort Control² System*™ (cont.)

| Dual 7-Segment LEDs Display Code | Diagnostic Description | Status/Possible Cause – Troubleshooting Information |
|---|---|---|
|  FLASHING | L29 – **Active Protection** High-Pressure Control Trip | • HPC has opened 3 times in the same cooling operation; the ICC has locked out the compressor to protect it. ICC alternately flashes L and 29. |
|  | 30 – Fuse Open<br>The ICC detects the on-board fuse is open. | • The 3-amp fuse on the ICC is open.<br>• Low-voltage wiring at R and C is damaged or miswired. |
|  | 80 – Low Airflow<br>The ICC detects that the indoor unit is not providing the minimum airflow requirements. | • Misapplied/wrong indoor air mover—replace with properly sized unit. |
|  | 83 – Condenser Coil Temperature Fault<br>The sensor detects an abnormally low or high coil temperature. | • Replace the sensor.<br>• Check sensor is installed correctly on control. |
|  | 84 – Outdoor Ambient Temperature Fault<br>The sensor detects an abnormally low or high outdoor ambient temperature. | • Check unit placement. If the outdoor unit is in a high-temperature area, wait until the ambient temperature drops and check sensor reading.<br>• Replace the sensor.<br>• Check sensor is installed correctly on control. |
|  | 93 – Internal Control Fault<br>The control is not functioning properly. | • Check control for proper system operation.<br>• Replace control. |
|  | d1 – No Shared Data | • Replace memory card with correct system information. |
|  | d3 – Airflow CFM Mismatch<br>The indoor air mover (air handler/furnace) cannot supply the required airflow for proper system operation. | • Misapplied/wrong indoor air mover—replace with properly sized air handler/furnace. |
|  | d4 – (Device) Memory Card Invalid for Device<br>The data in the memory card inserted into the control board does not match the data in the control. | • Check memory card to ensure it matches device.<br>• Check if memory card is present. |
|  | d8 – Old Shared Data<br>System data is obsolete. | • If system will not operate, order new memory card to update system information. |

**⚠WARNING:** Turn off electric power at the fuse box or service panel before making any electrical connections. Also, the ground connection must be completed before making line voltage connections. Failure to do so can result in electrical shock, severe personal injury, or death.

## Dual-Fuel Kit Model (Part No. RXME-A01)

This kit is required if this unit is installed in a dual-fuel application. Due to the unique latching design of the compressor relay on the *Comfort Control*$^2$, Underwriters Laboratories requires a separate nonlatching contactor on dual-fuel applications to positively disconnect power from the compressor in the unlikely event that abnormally high pressures occur when both the gas heat and compressor are operated simultaneously such as occurs during the defrost cycle.

The model RXME-A01 dual-fuel kit contains the contactor necessary to meet UL standards for dual-fuel applications.

## Remote Outdoor Temperature Model (Part No. 47-102709-03)

This is a kit that has a longer remote sensor that can be installed away from the outdoor unit for better thermostat temperature display.

## Communicating 2-Wire Kit (Part No. RXME-A02)

This kit allows the outdoor unit to operate with only 2 control wires. A communicating air handler/furnace and communicating thermostat must be used in conjunction with this kit.

## Low Ambient Control (LAC) (Part No. RXAD-A08)

This component senses compressor head pressure and shuts the heat pump fan off when the head pressure drops to approximately 250 PSIG. This allows the unit to build a sufficient head pressure at lower outdoor ambient (down to 0°F [-18°C]) in order to maintain system balance and obtain improved capacity. Low ambient control should be used on all equipment operated below 70°F [21°C} ambient.

# DIAGNOSTICS

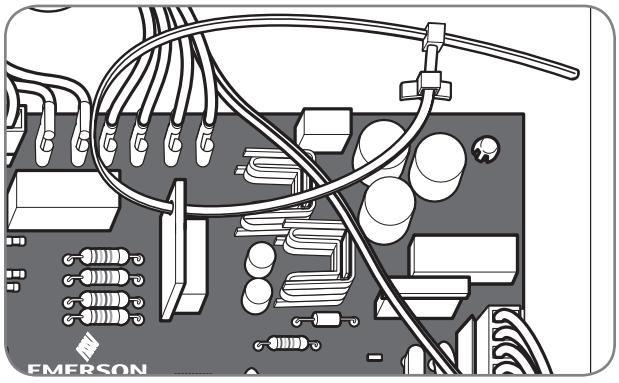
**IMPORTANT:** The JEC series units with the ICC (Integrated Compressor Control) provide status and diagnostic information that greatly enhances the ability to quickly diagnose system faults. Use the following troubleshooting guides as another tool in system diagnostics.

**NOTICE:** In diagnosing common faults in the cooling system, develop a logical thought pattern as used by experienced technicians. The charts which follow are not intended to be an answer to all problems but only to guide the technician's troubleshooting. Through a series of yes and no answers, follow the logical path to a likely conclusion.

A novice technician should use these charts like a road map. Remember that the chart should clarify a logical path to the solution.

## Replacement of *Comfort Control² System™* Control Board

Each control board in the *Comfort Control² System*™ needs information specific to the unit the control is installed in. This information is called shared data because it is distributed (shared) on the HVAC network. The shared data for a unit contains information that allows the unit to operate correctly.




When a control board requires replacement, it is important that the replacement board gets the shared data from the old control. The primary way the replacement control gets this information is by the memory card that should be installed on the old control. Remove the memory card from the old control, but leave it attached to the unit by the plastic tether, replace the control, and reinstall the memory card on the new control.

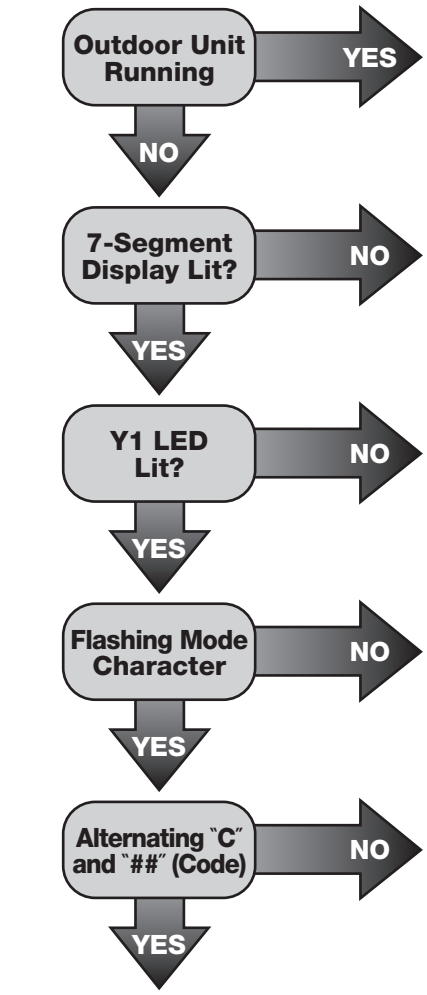
If for some reason the memory card has been damaged or is missing, the shared data from the network (air handler) will be used by the control. The network shared data is considered a backup for a lost or missing memory card. Never remove the memory card from the unit or cut the tether of the memory card since it is the most effective way to transfer the shared data. If the memory card is damaged or missing, a new memory card can be ordered from Rheem Parts Division (Prostock). The unit will operate without the memory card, but a d4 error will be displayed on the dual 7-segment LED display.

The memory card from a different unit should never be used.

**NOTE:** See links to training and service manuals at MyRheem.com or MyRuud.com, or contact the wholesale distributor selling this unit.

## Electrical Checks Flowchart

**THERMOSTAT CALL FOR COOLING, NO COOLING**




Refer to panel cover/documentation for fault code troubleshooting.

Check fault history for other faults.

Check control voltage (R and C) to control. NO → Check transformer

YES ↓

Bad control board or incorrect wiring – check wiring and replace control if bad.

No call received.

**24V systems:** Check thermostat, control wiring.

**Communicating systems:** Check comm. wiring, thermostat.

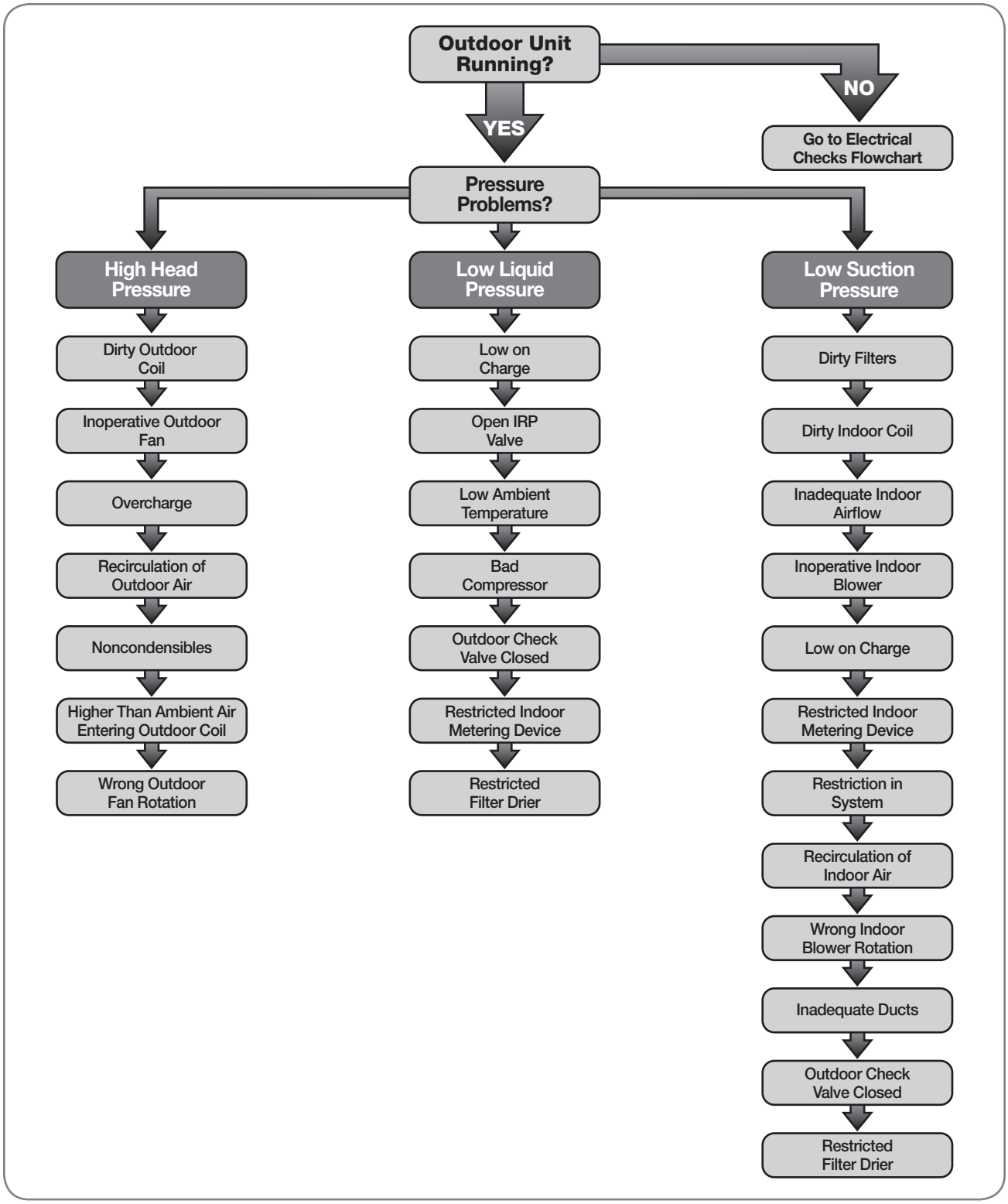
Waiting for anti-short-cycle delay to clear.

**Notice:** For solid comm. LED, check comm. wiring, term/bus switches at ICC and AH controls.

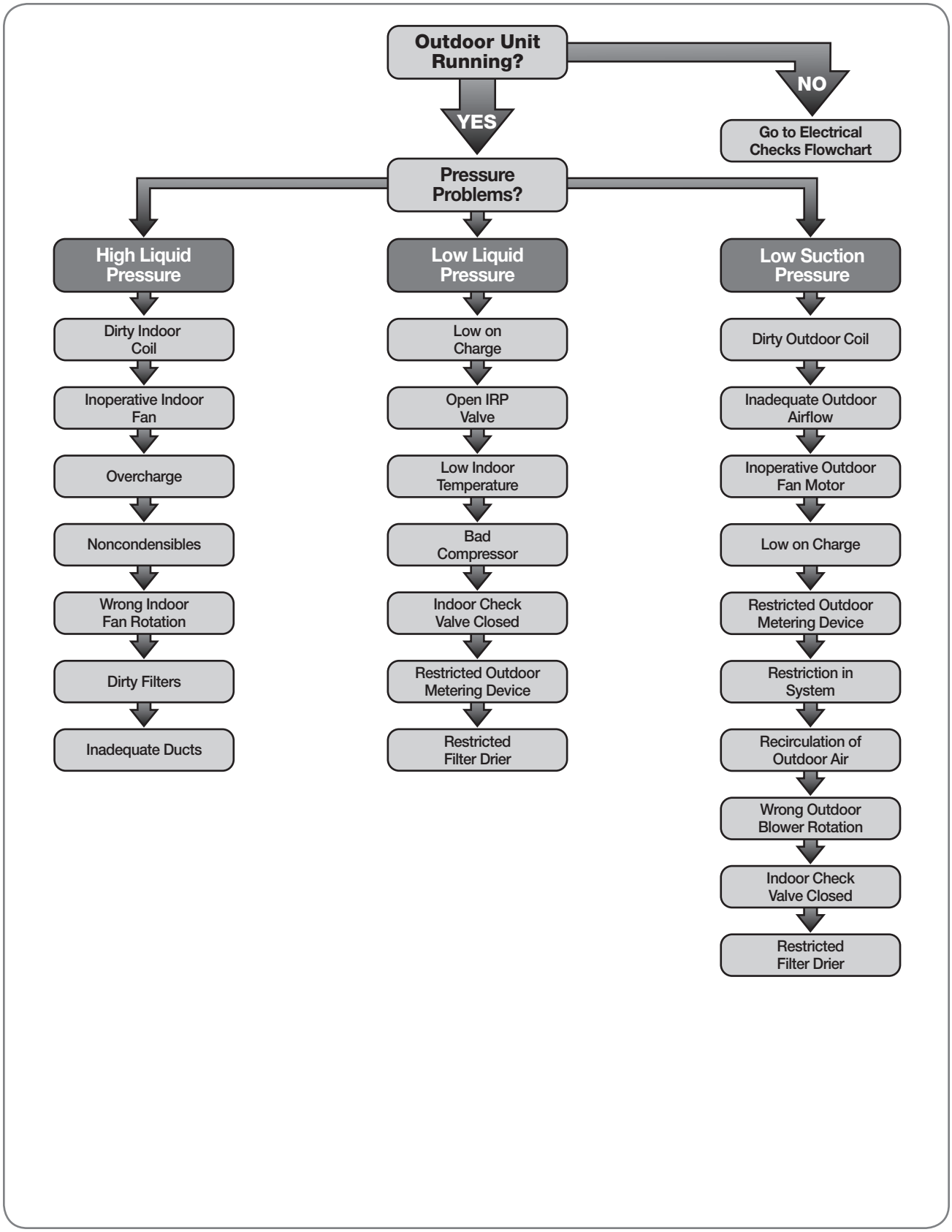
Control in lockout mode.

Check fault history and refer to diagnostic chart.

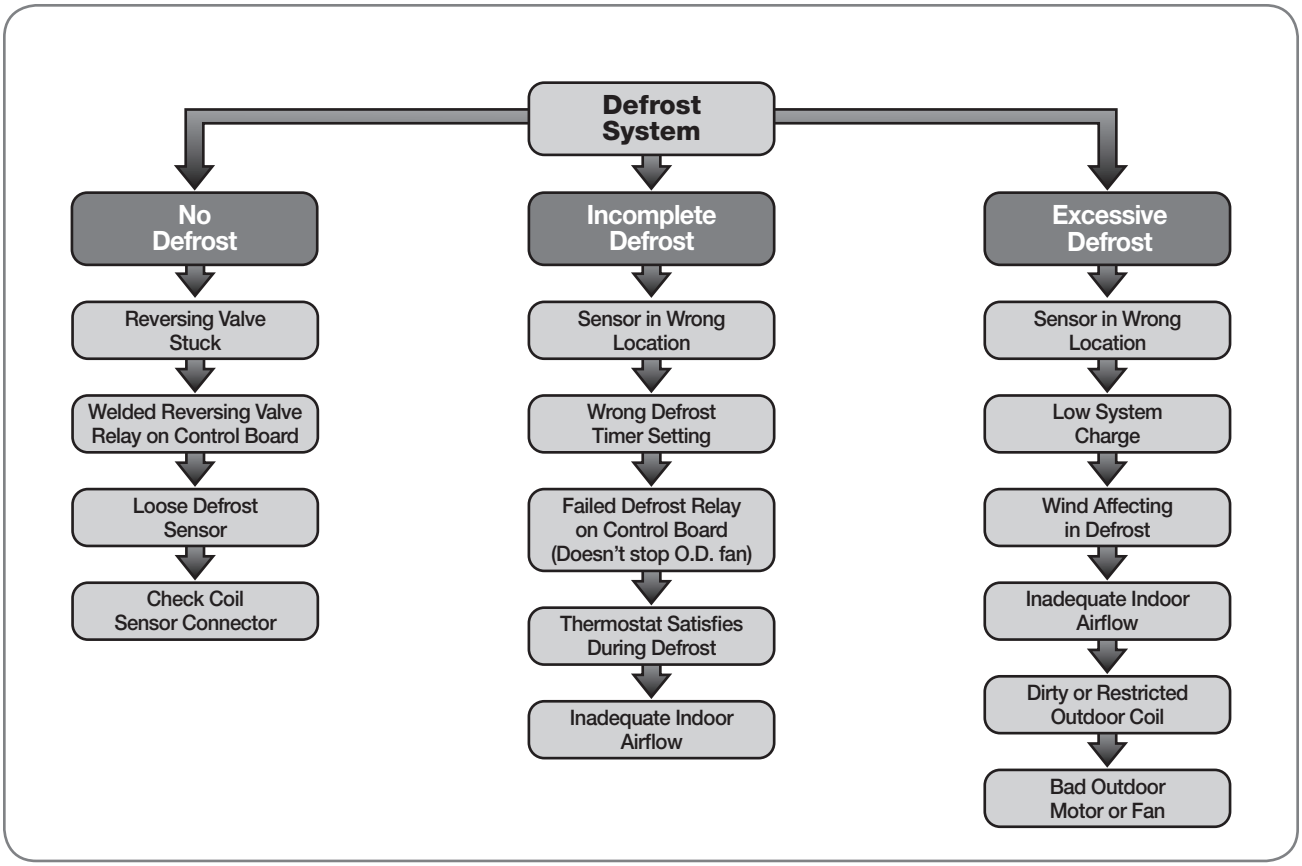
## Cooling Mechanical Checks Flowchart



## Heating Mechanical Checks Flowchart



## Defrost Mechanical Checks Flowchart



## General Troubleshooting Chart

**⚠WARNING:** Disconnect all power to unit before servicing. Contactor may break only one side. Failure to shut off power can cause electrical shock resulting in personal injury or death.

| SYMPTOM | POSSIBLE CAUSE | REMEDY |
|---|---|---|
| Unit will not run | • Power off or loose electrical connection<br>• Thermostat out of calibration – set too high<br>• Defective control board<br>• Blown fuses/tripped breaker<br>• Transformer defective<br>• High-pressure control open<br>• Miswiring of communications (communication light on continuously) | • Check for correct voltage at line voltage connections in condensing unit.<br>• Reset.<br>• Check control board diagnostic codes.<br>• Replace fuses/reset breaker.<br>• Check wiring. Replace transformer.<br>• Reset. Also see high head pressure remedy. The high-pressure control opens at 610 PSIG.<br>• Check communication wiring. |
| Outdoor fan runs, compressor doesn't | • Run or start capacitor defective<br>• Start relay defective<br>• Loose connection<br>• Compressor stuck, grounded or open motor winding, open internal overload.<br>• Low-voltage condition | • Replace.<br>• Replace.<br>• Check for correct voltage at compressor. Check and tighten all connections.<br>• Wait at least 3 hours for overload to reset. If still open, replace the compressor.<br>• Add start kit components. |
| Insufficient cooling | • Improperly sized unit<br>• Improper indoor airflow<br>• Incorrect refrigerant charge<br>• Air, noncondensibles, or moisture in system | • Recalculate load.<br>• Check. Should be approximately 400 CFM per ton.<br>• Charge per procedure attached to unit service panel.<br>• Recover refrigerant. Evacuate and recharge. Add filter drier. |
| Compressor short cycles | • Incorrect voltage<br>• Defective overload protector<br>• Refrigerant undercharge | • At compressor terminals, voltage must be ± 10% of nameplate marking when unit is operating.<br>• Replace. Check for correct voltage.<br>• Add refrigerant. |
| Registers sweat | • Low indoor airflow | • Increase speed of blower or reduce restriction. Replace air filter. |
| High head, low vapor pressures | • Restriction in liquid line, expansion device, or filter drier<br>• Bad TXV | • Remove or replace defective component.<br>• Replace TXV. |
| High head, high or normal vapor pressure – Cooling mode | • Dirty outdoor coil<br>• Refrigerant overcharge<br>• Outdoor fan not running<br>• Air or noncondensibles in system | • Clean coil.<br>• Correct system charge.<br>• Repair or replace.<br>• Recover refrigerant. Evacuate and recharge. |
| Low head, high vapor pressures | • Bad TXV<br>• Bad compressor | • Replace TXV.<br>• Replace compressor. |
| Low vapor, cool compressor, iced indoor coil | • Low indoor airflow<br>• Operating below 65°F outdoors<br>• Moisture in system | • Increase speed of blower or reduce restriction. Replace air filter.<br>• Add Low Ambient Kit.<br>• Recover refrigerant. Evacuate and recharge. Add filter drier. |
| High vapor pressure | • Excessive load<br>• Defective compressor | • Recheck load calculation.<br>• Replace. |
| Fluctuating head and vapor pressures | • TXV hunting<br>• Air or noncondensibles in system | • Check TXV bulb clamp. Check air distribution on coil. Replace TXV.<br>• Recover refrigerant. Evacuate and recharge. |
| Gurgle or pulsing noise at expansion device or liquid line | • Air or noncondensibles in system | • Recover refrigerant. Evacuate and recharge. |

## Service Analyzer Charts

| COMPRESSOR OVERHEATING | | |
|---|---|---|
| **SYMPTOM** | **POSSIBLE CAUSE** | **CHECK/REMEDY** |
| High superheat (greater than 15°F [-9°C] at coil) | Low charge | Check system charge. |
| | Faulty metering device | Restricted cap tube, TEV (TXV) |
| | | Power element superheat out of adjustment internally |
| | | Foreign matter stopping flow |
| | High internal load | Hot air (attic) entering return |
| | | Heat source on; miswired or faulty control |
| | Restriction in liquid line | Drier plugged. |
| | | Line kinked. |
| | Low head pressure | Low charge |
| | | Operating in low ambient temperatures |
| | Suction or liquid line subjected to high heat source | Hot attic |
| | | Hot water line |
| Low line voltage | Loose wire connections | Check wiring. |
| | Power company problem, transformer | Have problem corrected before diagnosis continues. |
| | Undersized wire feeding unit | Correct and complete diagnosis. |
| High line voltage | Power company problem | Have problem corrected. |
| High head pressure | Overcharge | Check system charge. |
| | Dirty heat pump coil | Clean coil. |
| | Faulty or wrong size heat pump fan motor | Replace fan motor. |
| | Faulty fan blade or wrong rotation | Replace fan blade. |
| | | Replace with correct rotation motor. |
| | Recirculation of air | Correct installation. |
| | Additional heat source | Check for dryer vent near unit. |
| | | Check for recirculation from other equipment. |
| | Noncondensibles | Recover refrigerant. Evacuate and recharge system. |
| | Equipment not matched | Correct mismatch. |
| Short cycling of compressor | Faulty pressure control | Replace pressure control. |
| | Loose wiring | Check unit wiring. |
| | Thermostat | Located in supply air stream |
| | | Differential setting too close |
| | | Customer misuse |
| | TEV | Internal foreign matter |
| | | Power element failure |
| | | Valve too small |
| | | Distributor tube/tubes restricted |
| | Distributor tube | Restricted with foreign matter |
| | | Kinked |
| | | I.D. reduced from previous compressor failure |

## Service Analyzer Charts

| COMPRESSOR OVERHEATING (cont.) | | |
|---|---|---|
| **SYMPTOM** | **POSSIBLE CAUSE** | **CHECK OR REMEDIES** |
| Short cycling of compressor (cont.) | Low charge | Check system charge. |
| | Low evaporator airflow | Dirty coil |
| | | Dirty filter |
| | | Duct too small or restricted |
| | Faulty run capacitor | Replace. |
| | Faulty internal overload | Replace compressor. |
| Faulty Compressor Valves | Fast equalization/Low pressure difference | Replace compressor and examine system to locate reason. |

| ELECTRICAL | | |
|---|---|---|
| **SYMPTOM** | **POSSIBLE CAUSE** | **CHECK OR REMEDIES** |
| Voltage present on load side of compressor contactor and compressor won't run | Compressor start components | Check start capacitor. |
| | | Check potential relay. |
| | Run capacitor | Check with ohmmeter |
| | Internal overload | Allow time to reset. |
| | Compressor windings | Check for correct ohms. |
| Voltage present on line side of compressor contactor only | Thermostat | Check for control voltage to contactor coil. |
| | Compressor control circuit | High-pressure switch |
| | | Low-pressure switch |
| | | Ambient thermostat |
| | | Solid-state protection control or internal thermal sensors |
| | | Compressor timed off/on control or interlock |
| No voltage on line side of compressor contactor | Blown fuses or tripped circuit breaker | Check for short in wiring or unit. |
| | Improper wiring | Recheck wiring diagram. |
| Improper voltage | High voltage | Wrong unit |
| | | Power supply problem |
| | Low voltage | Wrong unit |
| | | Power supply problem |
| | | Wiring undersized |
| | | Loose connections |
| | Single Phasing (3 phase) | Check incoming power and fusing. |

| FLOODED STARTS | | |
|---|---|---|
| **SYMPTOM** | **POSSIBLE CAUSE** | **CHECK OR REMEDIES** |
| Liquid in the compressor shell | Faulty or missing crankcase heater | Replace crankcase heater. |
| Too much liquid in system | Incorrect piping | Check piping guidelines. |
| | Overcharge | Check and adjust charge. |

## Service Analyzer Charts

| CONTAMINATION | | |
|---|---|---|
| **SYMPTOM** | **POSSIBLE CAUSE** | **REMEDY** |
| Moisture | Poor evacuation on installation or during service | In each case, the cure is the same. Recover refrigerant. Add filter drier, evacuate, and recharge. |
| High head pressure | Noncondensibles air | |
| Unusual head and suction readings | Wrong refrigerant or mixed refrigerants | |
| Foreign matter – copper filings | Copper tubing cuttings | |
| Copper oxide | Dirty copper piping or nitrogen not used when brazing | |
| Welding scale | Nitrogen not used during brazing | |
| Soldering flux | Adding flux before seating copper partway | |
| Excess soft solder | Wrong solder material | |

| LOSS OF LUBRICATION | | |
|---|---|---|
| **SYMPTOM** | **POSSIBLE CAUSE** | **REMEDY** |
| Compressor failures | Line tubing too large | Reduce pipe size to improve oil return. |
| Low suction pressure | Low charge | Check system charge. |
| | Refrigerant leaks | Repair and recharge. |
| Cold, noisy compressor – Slugging | Dilution of oil with refrigerant | Observe piping guidelines. |
| Noisy compressor | Migration | Check crankcase heater. |
| Cold, sweating compressor | Flooding | Check system charge. |
| Low load | Reduced airflow | Dirty filter |
| | | Dirty coil |
| | | Wrong duct size |
| | | Restricted duct |
| | Thermostat setting | Advise customer. |
| Short cycling of compressor | Faulty high- or low-pressure control | Replace control. |
| | Loose wiring | Check all control wires. |
| | Thermostat | In supply air stream, out of calibration |
| | | Customer misuse |

| SLUGGING | | |
|---|---|---|
| **SYMPTOM** | **POSSIBLE CAUSE** | **REMEDY** |
| On start-up | Incorrect piping | Review pipe size guidelines. |
| TEV hunting when running | Faulty TEV | Replace TEV. |

## Service Analyzer Charts

| FLOODING | | |
|---|---|---|
| **SYMPTOM** | **POSSIBLE CAUSE** | **REMEDY** |
| Poor system control using a TEV | Loose sensing bulb | Secure the bulb and insulate. |
| | Bulb in wrong location | Relocate bulb. |
| | Wrong size TEV | Use correct replacement. |
| | Improper superheat setting (less than 5°F [-15°C]) | Replace TEV. |

| THERMOSTATIC EXPANSION VALVES | | |
|---|---|---|
| **SYMPTOM** | **POSSIBLE CAUSE** | **REMEDY** |
| High Superheat, Low Suction Pressure (superheat over 15°F [-9°C]) | Moisture freezing and blocking valve | Recover charge, install filter-drier, evacuate system, recharge. |
| | Dirt or foreign material blocking valve | Recover charge, install filter-drier, evacuate system, recharge. |
| | Low refrigerant charge | Correct the charge. |
| | Vapor bubbles in liquid line | Remove restriction in liquid line. Correct the refrigerant charge. |
| | | Remove noncondensible gases. |
| | | Size liquid line correctly. |
| | Misapplication of internally equalized valve | Use correct TEV. |
| | Plugged external equalizer line | Remove external equalizer line restriction. |
| | Undersized TEV | Replace with correct valve. |
| | Loss of charge from power head sensing bulb | Replace power head or complete TEV. |
| | Charge migration from sensing bulb to power head (Warm power head with warm, wet cloth. Does valve operate correctly now?) | Ensure TEV is warmer than sensing bulb. |
| Valve feeds too much refrigerant, with low superheat and higher than normal suction pressure | Moisture causing valve to stick open. | Recover refrigerant, replace filter-drier, evacuate system, and recharge. |
| | Dirt or foreign material causing valve to stick open | Recover refrigerant, replace filter drier, evacuate system, and recharge. |
| | TEV seat leak (a gurgling or hissing sound is heard AT THE TEV during the off cycle, if this is the cause). NOT APPLICABLE TO BLEED PORT VALVES. | Replace the TEV. |
| | Oversized TEV | Install correct TEV. |
| | Incorrect sensing bulb location | Install bulb with two mounting straps, in 2:00 or 4:00 position on suction line, with insulation. |
| | Low superheat adjustment | Replace TEV. |
| | Incorrectly installed, or restricted external equalizer line | Remove restriction, or relocate external equalizer. |

## Service Analyzer Charts

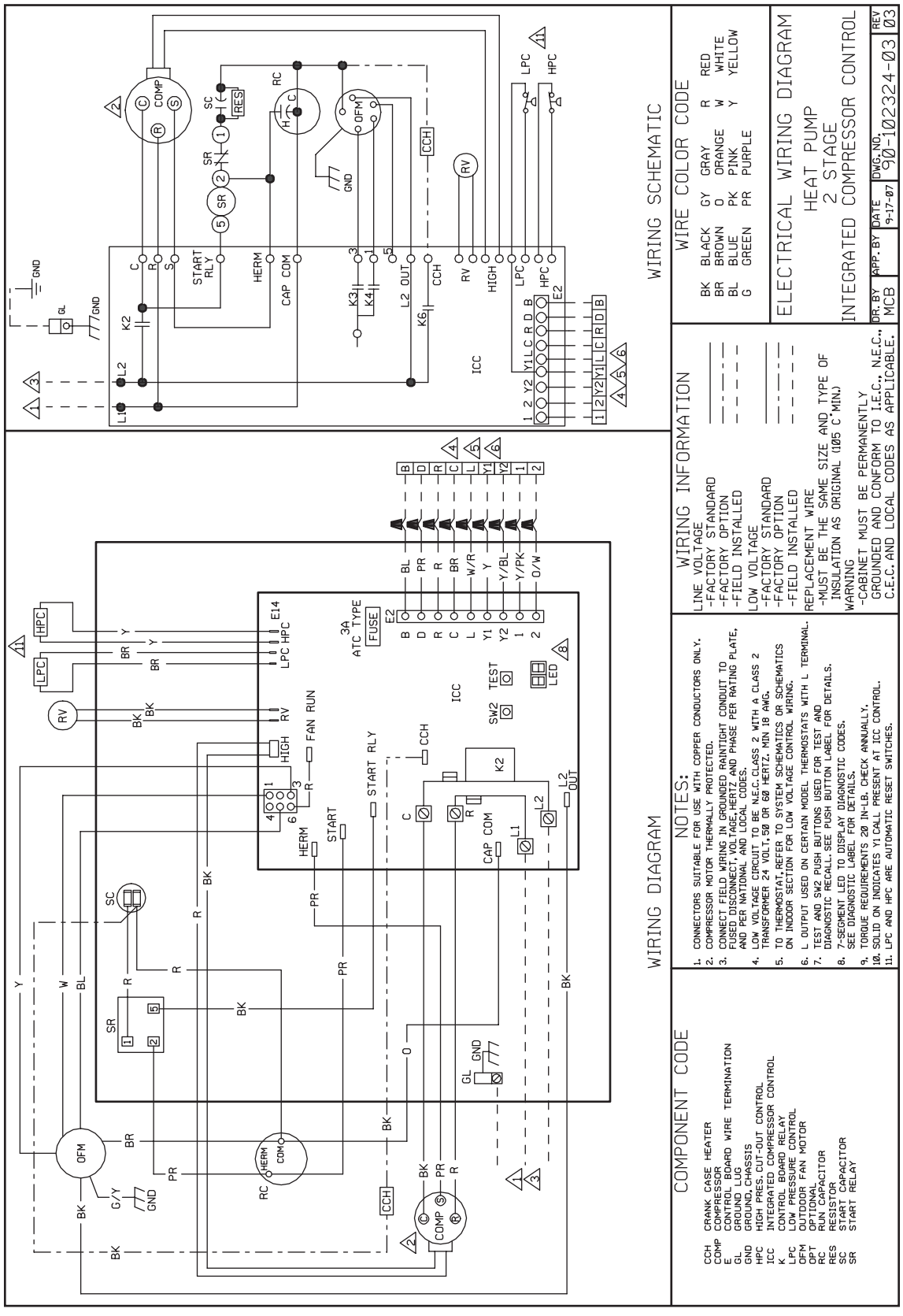
| THERMOSTATIC EXPANSION VALVES (cont.) | | |
|---|---|---|
| **SYMPTOM** | **POSSIBLE CAUSE** | **REMEDY** |
| Compressor flood back upon start-up | Refrigerant drainage from flooded evaporator | Install trap riser to the top of the evaporator coil. |
| | Inoperable crankcase heater or crankcase heater needed | Replace or add crankcase heater. |
| | Any of the causes listed under symptoms of Electrical problems on page 45 | Any of the solutions listed under solutions of Electrical problems on page 45 |
| Superheat is low to normal with low suction pressure | Unequal evaporator circuit loading | Ensure airflow is equally distributed through evaporator. |
| | | Check for blocked distributor tubes. |
| | Low load or airflow entering evaporator coil | Ensure blower is moving proper air CFM. |
| | | Remove/Correct any airflow restriction. |
| Superheat and suction pressure fluctuate (valve is hunting) | Expansion valve is oversized | Install correct TEV. |
| | Sensing bulb is affected by liquid refrigerant or refrigerant oil flowing through suction line | Relocate sensing bulb in another position around the circumference of the suction line. |
| | Unequal refrigerant flow through evaporator circuits | Ensure sensing bulb is located properly. |
| | | Check for blocked distributor tubes. |
| | Moisture freezing and partially blocking TEV | Recover refrigerant, change filter-drier, evacuate system, and recharge. |
| Valve does not regulate at all | External equalizer line not connected or line plugged | Connect equalizer line in proper location, or remove any blockage. |
| | Sensing bulb lost its operating charge | Replace TEV. |
| | Valve body damaged during soldering or by improper installation | Replace TEV. |

| COOLING MODE<br>TROUBLESHOOTING TIPS | | | | | |
|---|---|---|---|---|---|
| SYSTEM PROBLEM | INDICATORS | | | | |
| | DISCHARGE PRESSURE | SUCTION PRESSURE | SUPERHEAT Normal: 5°–15°F [-15° – -9°C] | SUBCOOLING Normal: See Charging Chart | COMPRESSOR AMPS |
| Overcharge | High | High | Low | High | High |
| Undercharge | Low | Low | High | Low | Low |
| Liquid Restriction (Drier) | Low | Low | High | High | Low |
| Low Indoor Airflow | Low | Low | Low | Low | Low |
| Dirty Outdoor Coil | High | High | Low | Low | High |
| Low Outdoor Ambient Temperature | Low | Low | High | High | Low |
| Inefficient Compressor | Low | High | High | High | Low |
| Indoor TXV Feeler Bulb Charge Lost | Low | Low | High | High | Low |
| Poorly Insulated Indoor Sensing Bulb | High | High | Low | Low | High |

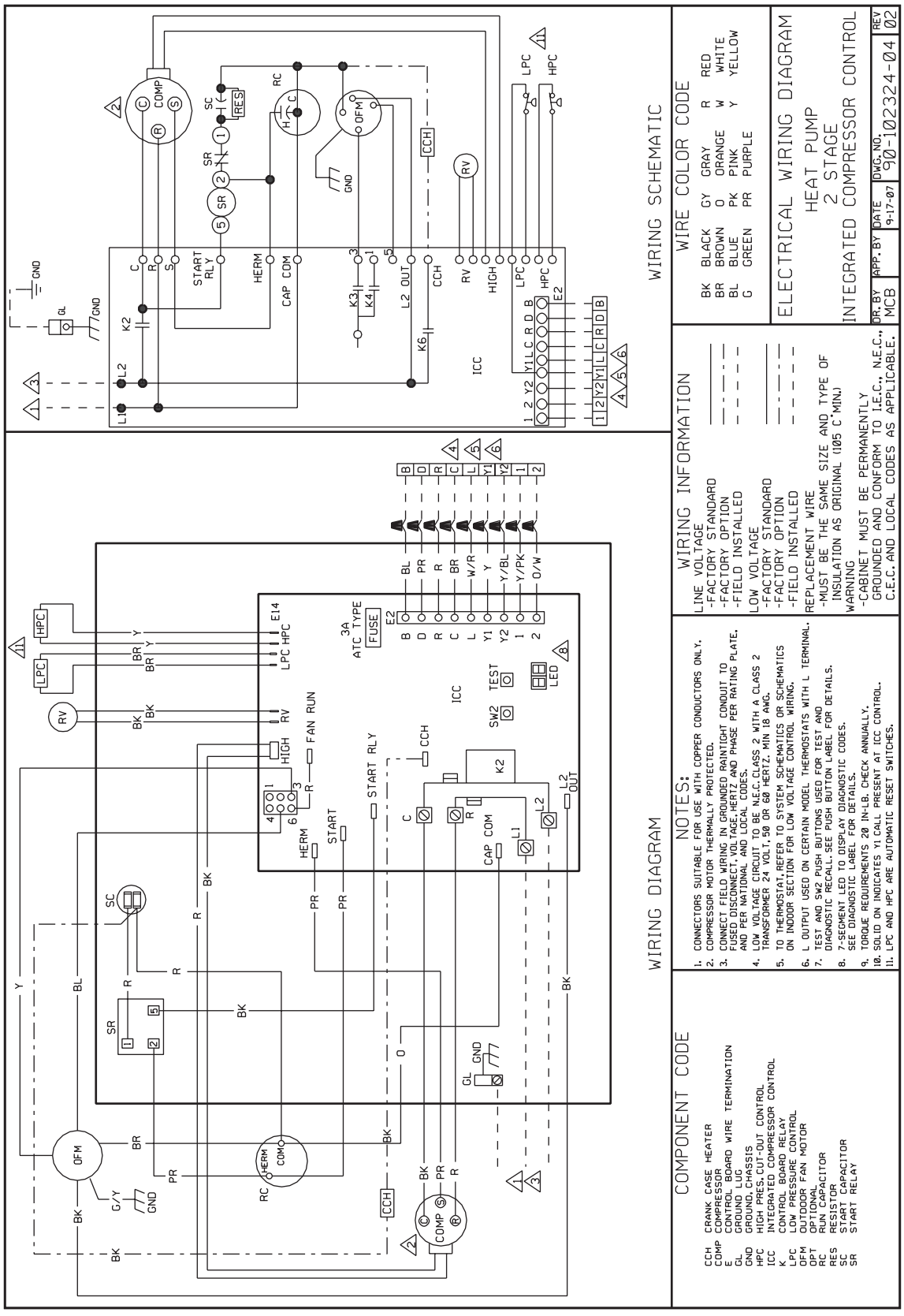
| HEATING MODE<br>TROUBLESHOOTING TIPS | | | | | |
|---|---|---|---|---|---|
| SYSTEM PROBLEM | INDICATORS | | | | |
| | DISCHARGE PRESSURE | SUCTION PRESSURE | SUPERHEAT Normal: 5°–15°F [-15° – -9°C] | SUBCOOLING Normal: See Charging Chart | COMPRESSOR AMPS |
| Overcharge | High | High | OK | High | High |
| Undercharge | Low | Low | OK or High | Low | Low |
| Liquid Restriction (Drier) | Low | Low | High | High | Low |
| Low Outdoor Airflow | Low | Low | Low | Low | Low |
| Dirty Indoor Coil | High | High | Low | Low | High |
| Low Indoor Ambient Temperature | Low | Low | OK | High | Low |
| Inefficient Compressor | Low | High | High | High | Low |
| Outdoor TXV Feeler Bulb Charge Lost | Low | Low | High | High | Low |
| Poorly Insulated Outdoor Sensing Bulb | High | High | Low | Low | High |

# WIRING DIAGRAMS

**For 2-, 3-, and 4-Ton Models**



**For 5-Ton Models**



# NOTES