

# INSTALLATION and START-UP INSTRUCTIONS

## Split System Heat Pumps

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

### Safety Labeling and Signal Words

#### DANGER, WARNING, CAUTION, and NOTE

The signal words **DANGER**, **WARNING**, **CAUTION**, and **NOTE** are used to identify levels of hazard seriousness. The signal word **DANGER** is only used on product labels to signify an immediate hazard. The signal words **WARNING**, **CAUTION**, and **NOTE** will be used on product labels and throughout this manual and other manuals that may apply to the product.

**DANGER** – Immediate hazards which **will** result in severe personal injury or death.

**WARNING** – Hazards or unsafe practices which **could** result in severe personal injury or death.

**CAUTION** – Hazards or unsafe practices which **may** result in minor personal injury or product or property damage.

**NOTE** – Used to highlight suggestions which **will** result in enhanced installation, reliability, or operation.

#### Signal Words in Manuals

The signal word **WARNING** is used throughout this manual in the following manner:

 **WARNING**

The signal word **CAUTION** is used throughout this manual in the following manner:

 **CAUTION**


#### Signal Words on Product Labeling

Signal words are used in combination with colors and/or pictures on product labels.

## SAFETY CONSIDERATIONS

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

Follow all safety codes. Wear safety glasses, protective clothing, and work gloves. Use quenching cloth for brazing operations. Have fire extinguisher available. Read these instructions thoroughly and follow all warnings or cautions included in literature and attached to the unit. Consult local building codes and National Electrical Code (NEC) or International Electrotechnical Commission (IEC) for special requirements.

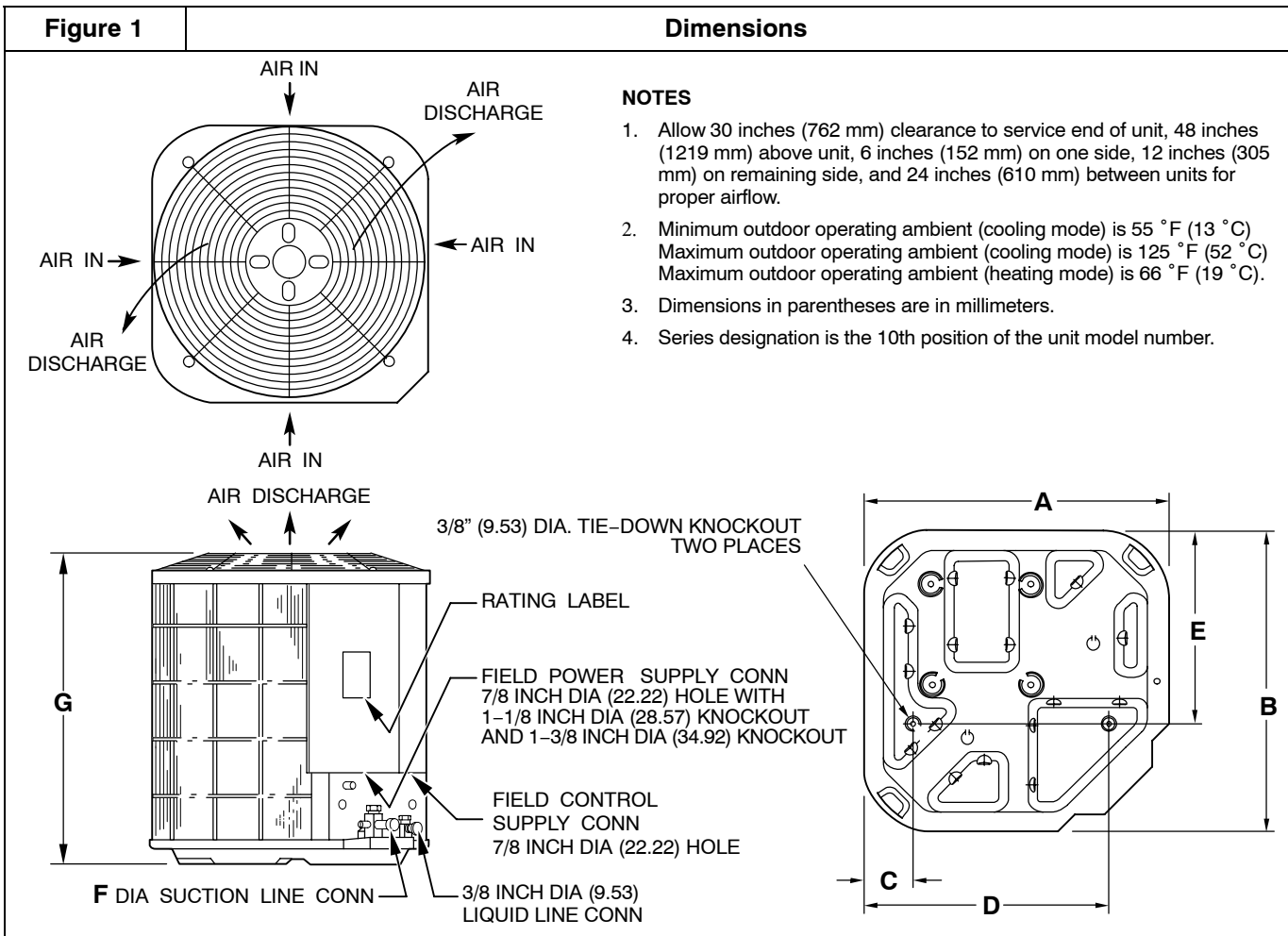
Recognize safety information. This is the safety-alert symbol . When you see this symbol on the unit and in instructions or manuals, be alert to the potential for personal injury.

 **WARNING**

#### ELECTRICAL SHOCK HAZARD

**Failure to turn off the main (remote) electrical disconnect device could result in personal injury or death.**

**Before installing, modifying or servicing system, turn OFF the main (remote) electrical disconnect device. There may be more than one disconnect device.**



Hz	Model Size	A & B		C		D		E		F		G	
		inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
50	024	22½	571.5	3¼	93.6	1⅞	460.4	14¾	365.1	⅝	15.9	33⅛	862.0
	036	30	762.0	6½	165.1	2¾	596.9	20	508.0	¾	19.1	39⅛	862.0
	048	30	762.0	6½	165.1	2¾	596.9	20	508.0	⅞	22.2	33⅛	709.6
	060	30	762.0	6½	165.1	2¾	596.9	20	508.0	⅞	22.2	33⅛	1014.4
60	018	22½	571.5	3¼	93.6	1⅞	460.4	14¾	365.1	⅝	15.9	25⅛	658.8
	024	22½	571.5	3¼	93.6	1⅞	460.4	14¾	365.1	⅝	15.9	25⅛	658.8
	036	30	762.0	6½	165.1	2¾	596.9	20	508.0	¾	19.1	27⅛	709.6
	048	30	762.0	6½	165.1	2¾	596.9	20	508.0	¾	19.1	39⅛	862.0
	060	30	762.0	6½	165.1	2¾	596.9	20	508.0	¾	19.1	39⅛	862.0

## INSTALLATION

### STEP 1 - CHECK EQUIPMENT AND JOB SITE

#### UNPACK UNIT

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

#### INSPECT EQUIPMENT

File claim with shipping company prior to installation if shipment is damaged or incomplete. Locate unit rating plate on unit service panel (see Figure 1). It contains information needed to properly install unit. Check rating plate to be sure unit matches job specifications.

### STEP 2 - INSTALL ON A SOLID, LEVEL MOUNTING PAD

If conditions or local codes require the unit be attached to pad, tie-down bolts should be used and fastened through knockouts provided in unit base pan. Refer to unit-mounting pattern in Figure 1 to determine base-pan size and knockout-hole location.

On rooftop applications, mount on level platform or frame. Place unit above a load-bearing wall. Arrange supporting members to adequately support unit and minimize trans-

mission of vibration to building. Consult local codes governing rooftop applications.

Roof mounted units exposed to winds above 5 mph (8 km/h) may require wind baffles to achieve adequate de-frost.

**NOTE:** Unit must be level to within  $\pm 2^\circ$  per compressor manufacturer specifications.

**STEP 3 – CLEARANCE REQUIREMENTS**

When installing, allow sufficient space for airflow clearance, wiring, refrigerant piping, and service. Allow 30 inches (762 mm) clearance to service end of unit and 48 inches (1219 mm) above unit. For proper airflow, a 6 inch (152 mm) clearance on 1 side of unit and 12 inches (305 mm) on all remaining sides must be maintained. Maintain a distance of 24 inches (610 mm) between air conditioners.

On rooftop applications, locate unit 6 inches (152 mm) above roof surface.

**STEP 4 – OPERATING AMBIENTS**

The minimum outdoor operating ambient in cooling mode is 55 °F (13 °C), and the maximum outdoor operating ambient in cooling mode is 125 °F (52 °C). The maximum outdoor operating ambient in heating mode is 66 °F (19 °C).

**STEP 5 – CHECK INDOOR AND OUTDOOR PISTONS**

Check indoor coil piston to see if it matches the required piston shown on outdoor unit rating plate. If it does not match, replace indoor coil piston with piston shipped with the outdoor unit. The piston shipped with outdoor unit is correct for any approved indoor coil combination.

Check outdoor unit piston. Remove retainer on liquid service valve and check piston size with matching number listed on unit rating plate.

**STEP 6 – REFRIGERANT TUBING CONNECTIONS**

Outdoor units may be connected to indoor sections using accessory tubing package or field-supplied refrigerant grade tubing of correct size and condition. For tubing requirements beyond 80 feet (24.4 m), or more than 20 feet (6.1 m) vertical differential, consult Long-Line Application Guideline which is available at your local distributor.

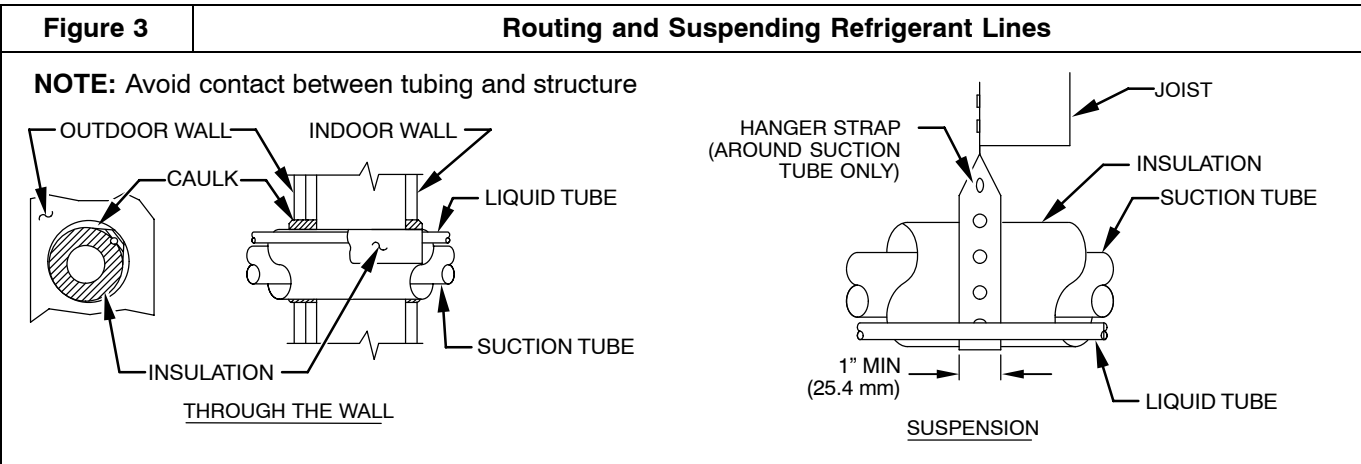
**NOTE:** In some cases, noise in the living area has been traced to gas pulsations from improper installation of equipment.

INSTALLATION RECOMMENDATIONS

1. Locate unit away from windows.
2. Ensure that vapor and liquid-tube diameters are appropriate to capacity of unit (see Figure 2).
3. Run refrigerant tubes as directly as possible by avoiding unnecessary turns and bends.
4. Leave some slack between structure and unit to absorb vibration.
5. When passing refrigerant tubes through the wall, seal opening with RTV or other pliable silicon-based caulk (see Figure 3).
6. Avoid direct tubing contact with water pipes, duct work, floor joists, wall studs, floors, and walls.
7. Do not suspend refrigerant tubing from joists and studs with a rigid wire or strap that comes in direct contact with tubing (see Figure 3).
8. Ensure that tubing insulation is pliable and completely surrounds vapor tube.
9. When necessary, use hanger straps which are 1 inch (25.4 mm) wide and conform to shape of tubing insulation (see Figure 3).
10. Isolate hanger straps from insulation by using metal sleeves bent to conform to shape of insulation.

Figure 2 Model Size	Service Valve Fittings inches (mm)		Line Set Tube Diameter, inches (mm) Liquid Tube Always $\frac{3}{8}$ (9.53) dia.
	Liquid	Suction	Suction Line Diameter
018 (1½ ton), 24 (2 ton)	$\frac{3}{8}$ (9.53)	$\frac{5}{8}$ (15.88)	$\frac{5}{8}$ (15.88)
030 (2½ ton)	$\frac{3}{8}$ (9.53)	$\frac{3}{4}$ (19.05)	$\frac{3}{4}$ (19.05)
036 (3 ton)	$\frac{3}{8}$ (9.53)	$\frac{3}{4}$ (19.05)	$\frac{3}{4}$ (19.05)
048 (4 ton)	$\frac{3}{8}$ (9.53)	$\frac{7}{8}$ (22.23)	$\frac{7}{8}$ (22.23)
060 (5 ton)	$\frac{3}{8}$ (9.53)	$\frac{7}{8}$ (22.23)	$1\frac{1}{8}$ (28.58)

Notes: 1. For tube line sets over 80 feet (24.4 m), consult Long-Line Application Guideline.  
 2. Do not apply capillary tube indoor coils to these units.



**⚠ CAUTION**

**UNIT OPERATION HAZARD**

Failure to follow this caution may result in improper product operation.

Do not bury more than 36" (910 mm) of line set underground. Refrigerant may migrate to cooler buried section during extended periods of unit shut-down, causing refrigerant slugging and possible compressor damage at start-up. If ANY section of the line set is buried underground, provide a minimum 6" (150 mm) vertical rise at the service valve.

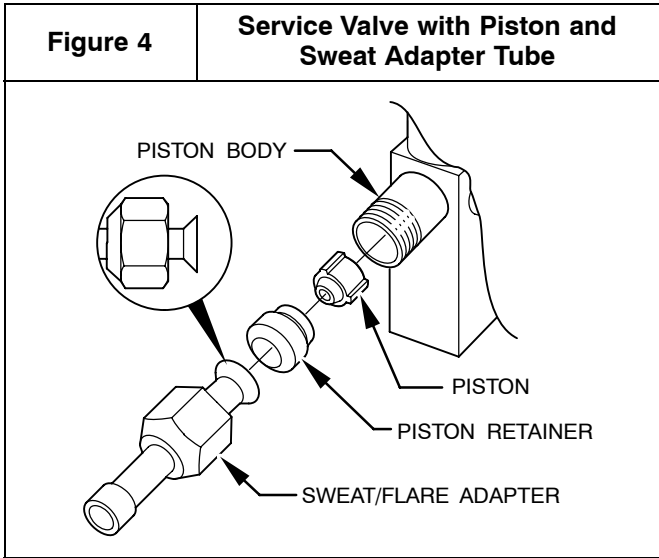
**OUTDOOR UNITS CONNECTED TO FACTORY APPROVED INDOOR UNITS**

Outdoor unit contains correct system refrigerant charge for operation with indoor unit of same size when connected by 15 feet (4.55 m) of field-supplied or factory-accessory tubing. Check refrigerant charge for maximum efficiency.

**REFRIGERANT TUBING**

Connect tubing to fittings on outdoor unit vapor and liquid service valves (see Figures 1 and 4).

If refrigerant tubes or indoor coil is exposed to atmospheric conditions, it must be evacuated to 500 microns to eliminate contamination and moisture in the system.



**⚠ WARNING**

**PERSONAL INJURY AND/OR PROPERTY DAMAGE HAZARD**

Failure to relieve system pressure could result in personal injury and/or property damage.

Relieve pressure and recover all refrigerant before servicing existing equipment, and before final unit disposal. Use all service ports and open all flow-control devices, including solenoid valves.

**⚠ CAUTION**

**PRODUCT DAMAGE HAZARD**

Failure to follow this caution may result in product damage.

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

SWEAT CONNECTION

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

**NOTE:** Check factory tubing on both indoor and outdoor unit to ensure tubes are not rubbing against each other or any sheet metal. Pay close attention to feeder tubes, making sure wire ties on feeder tubes are secure and tight.

**NOTE:** Always install a liquid line filter drier. Refer to Product Specification literature for appropriate part number.

**STEP 7 – MAKE ELECTRICAL CONNECTIONS**

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

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

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

**NOTE:** Install branch circuit disconnect per local codes of adequate size to handle unit starting current. Locate disconnect within sight from and readily accessible from unit per local codes.

**⚠ WARNING**

**ELECTRICAL SHOCK HAZARD**

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

**Before supplying power to the unit, insure that the terminal box cover is in place on the compressor.**

ROUTE GROUND AND POWER WIRES

Remove access panel and control box cover to gain access to unit wiring. Extend wires from disconnect through power wiring hole provided and into unit control box (see Figure 1). Size wires per local codes, but not smaller than minimum wire size shown on unit rating plate.

CONNECT GROUND AND POWER WIRES

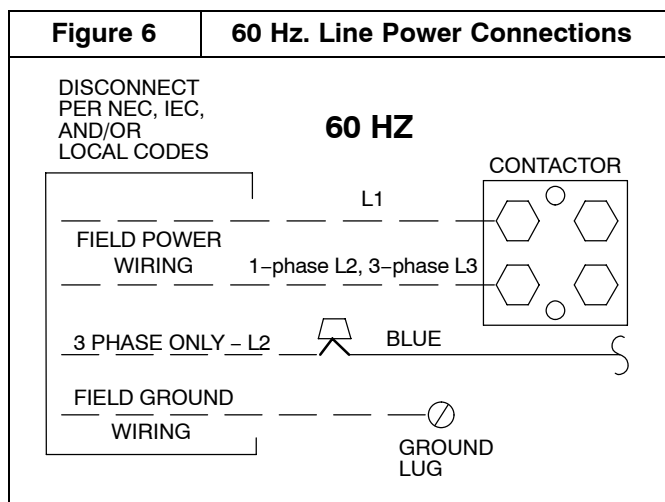
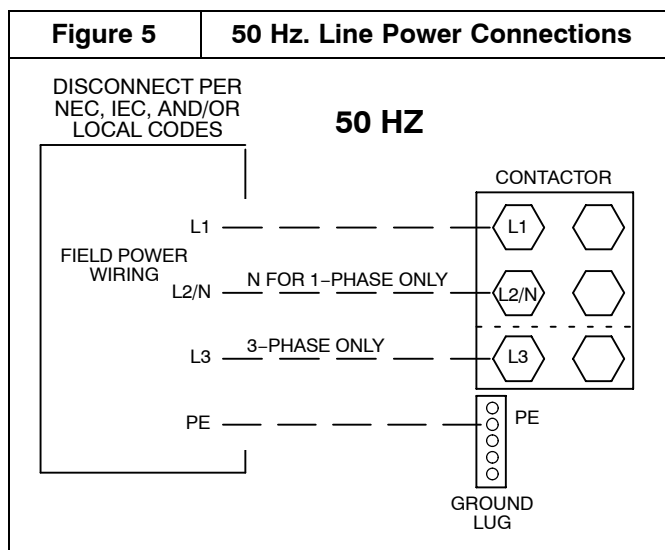
Connect ground wire to ground connection in control box for safety. Connect power wiring to contactor as shown in Figure 5 (50 Hz.) or Figure 6 (60 Hz.).

**⚠ WARNING**

**ELECTRICAL SHOCK HAZARD**

**Failure to establish uninterrupted or unbroken ground could result in personal injury or death.**

**According to NEC, IEC, ANSI/NFPA 70, and local codes, the cabinet must have an uninterrupted or unbroken ground to minimize personal injury if an electrical fault should occur. The ground may consist of electrical wire or metal conduit when installed in accordance with existing electrical codes. If conduit connection uses reducing washers, a separate ground wire must be used.**



CONNECT CONTROL WIRING

Route 24V control wires through control wiring grommet and connect leads to control wiring pigtails from terminal board (see Figure 7). Use furnace transformer, fan-coil transformer, or accessory transformer for control power, 24V, 40-VA minimum.

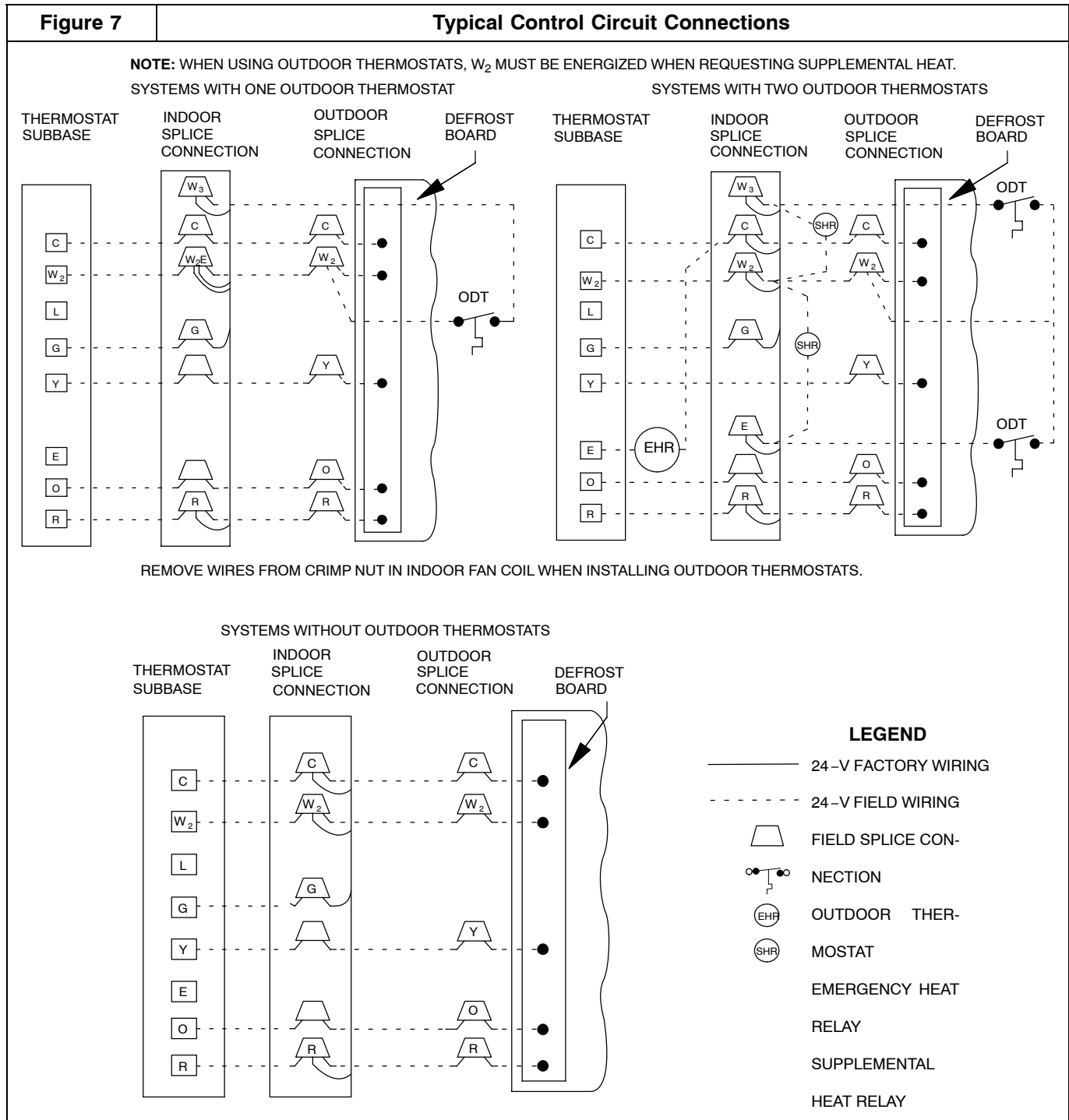
**NOTE:** Use No. 18 AWG (American Wire Gage) color-coded, insulated (35 °C minimum) wire. If thermostat is located more than 100 feet (30.5 m) from unit as mea-

sured along the control voltage wires, use No. 16 AWG color-coded wires to avoid excessive voltage drop.

**NOTE:** Use of available 24V accessories may exceed the minimum 40-va power requirement. Determine total transformer loading and increase the transformer capac-

ity or split the load with an accessory transformer as required.

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



**STEP 8 – COMPRESSOR CRANKCASE HEATER**

When equipped with a crankcase heater, energize heater a minimum of 24 hours before starting unit. To energize heater only, set thermostat to OFF and close electrical disconnect to outdoor unit. A crankcase heater is required if the refrigerant tubing is longer than 50 feet (15.24 m).

**STEP 9 – INSTALL ELECTRICAL ACCESSORIES**

Refer to the individual instructions packaged with the kit or accessory when installing.

## STEP 10 – START-UP

**WARNING****PERSONAL INJURY HAZARD**

Failure to follow this warning could result in personal injury.

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

Observe the following:

Back seating service valves are not equipped with Schrader valves. Fully back seat (counter clockwise) valve stem before removing gage port cap. Front seating service valves are equipped with Schrader valves.

**CAUTION****PROPERTY DAMAGE HAZARD**

Failure to follow this caution may result in property damage

Do not overcharge system with refrigerant.

Do not operate unit in a vacuum or at negative pressure.

Do not disable low-pressure switch.

In scroll compressor applications: dome temperatures may be hot.

**NOTE:** Do not vent refrigerant to atmosphere. Recover during system repair or final unit disposal.

1. If equipped with a crankcase heater, energize a minimum of 24 hours before starting unit. To energize heater only, set thermostat OFF and close electrical disconnect to outdoor unit.
2. Fully back seat (open) liquid and vapor tube service valves.
3. Unit is shipped with valve stem(s) front seated and caps installed. Replace stem caps after system is opened to refrigerant flow (back seated). Replace

**SEQUENCE OF OPERATION**

With power supplied to indoor and outdoor units, transformer is energized. Defrost control board is equipped with 5-minute lockout timer which is initiated upon any interruption of power.

**COOLING**

On a call for cooling, the thermostat makes circuits R-O, R-Y, and R-G. Circuit R-O energizes reversing valve, switching it to cooling position. Circuit R-Y energizes contactor, starting outdoor fan motor and compressor circuit. Circuit R-G energizes indoor unit blower relay, starting indoor blower motor.

When thermostat is satisfied, its contacts open, de-energizing contactor and blower relay. Compressor and motors stop.

caps finger-tight and tighten additional ¼ turn with wrench.

4. Close electrical disconnects to energize system.
5. Set room thermostat at desired temperature. Be sure set point is below indoor ambient temperature.
6. Set room thermostat to HEAT or COOL and fan to ON or AUTO mode, as desired. Operate unit for 15 minutes. Check system refrigerant charge.

**STEP 11 – CHECK CHARGE**

Factory charge is shown on unit rating plate. To check charge in cooling mode, refer to Cooling-Only Procedure on unit wiring and charging label.

**COOLING-ONLY PROCEDURE**

**NOTE:** If superheat or subcooling charging conditions are not favorable, charge must be weighed in accordance with unit rating plate  $\pm 0.6$  oz/ft ( $\pm 1.97$  oz/m) of ⅜ inch (9.53 mm) liquid line above or below 15 feet (4.6 m) respectively.

**EXAMPLE:**

To calculate additional charge required for a 25 foot (7.6 m) line set:

25 ft – 15 ft = 10 ft X 0.6 oz/ft = 6 oz of additional charge

7.6 m – 4.6 m = 3 m X 1.97 oz/m = 6 oz of additional charge

**HEATING CHECK CHART PROCEDURE**

To check system operation during heating cycle, refer to the Heating Check Chart on outdoor unit. This chart indicates whether a correct relationship exists between system operating pressure and air temperature entering indoor and outdoor units. If pressure and temperature do not match on chart, system refrigerant charge may not be correct. Do not use chart to adjust refrigerant charge.

**NOTE:** When charging is necessary during heating season, charge must be weighed in accordance with unit rating plate  $\pm 0.6$  oz/ft ( $\pm 1.97$  oz/m) of ⅜ inch (9.53 mm) liquid line above or below 15 feet (4.6 m) respectively.

**NOTE:** If indoor unit is equipped with a time-delay relay circuit, the blower runs an additional length of time to increase system efficiency.

**HEATING**

On a call for heating, the thermostat makes circuits R-Y and R-G. Circuit R-Y energizes contactor, starting outdoor fan motor and compressor. Circuit R-G energizes indoor blower relay, starting blower motor. Should the temperature continue to fall, R-W2 is made through the second-stage room thermostat bulb. Circuit R-W2 energizes a sequencer, bringing on the first bank supplemental electric heat and providing electrical potential to the second heater sequencer (if used). If outdoor temperature falls below the setting of the outdoor thermostat (field-installed option), contacts close to complete the cir-

cuit and bring on the second bank of supplemental electric heat.

When the thermostat is satisfied, its contacts open, de-energizing contactor and sequencer. Compressor, motors, and heaters stop.

**THREE PHASE ROTATION**

On three phase models with scroll compressors, it is important that the compressor rotate in the proper direction. To determine whether or not compressor is rotating in the proper direction:

1. Connect service gages to suction and discharge pressure fittings.
2. Energize the compressor.
3. The suction pressure should drop and the discharge pressure should rise, as is normal on any start-up. This indicates correct rotation.

If the suction pressure does not drop and the discharge pressure does not rise to normal level:

1. Turn off power to the unit.
2. Reverse any two of the unit power leads.
3. Re-apply power to the compressor, verify correct suction and discharge pressures.

**QUIET SHIFT (some models)**

Quiet Shift is a field-selectable defrost mode, which will eliminate occasional noise that could be heard at the start of the defrost cycle and restarting of heating cycle. It is selected by placing DIP switch 3 (on defrost board) in ON position (refer to Figure 7). When Quiet Shift switch is placed in ON position, and a defrost is initiated, the following sequence of operation will occur. Reversing valve will energize, compressor will turn off for 30 sec, then turn back on to complete defrost. At the start of heating cycle after conclusion of defrost mode, reversing valve will de-energize, the compressor will turn off for another 30 sec, and the fan will turn off for 40 sec, before starting in the heating mode.

**DEFROST - 50 Hz models**

The defrost control is a time/temperature control which includes a field-selectable (DIP switch 1 and 2 on the defrost board) time period between defrost cycles of 30, 60, 90, or 120 minutes (factory set at 90 minutes). Refer to Figure 7.

To initiate a forced defrost, two options are available depending on the status of the defrost thermostat.

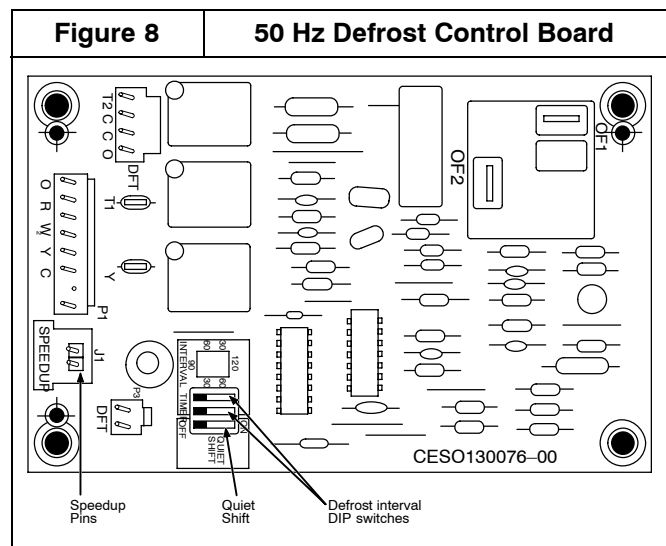
If defrost thermostat is closed, speedup pins (J1) must be shorted by placing a flat head screwdriver in between for 5 sec and releasing, to observe a complete defrost cycle. When the Quiet Shift switch is selected, compressor will be turned off for two 30 second intervals during this complete defrost cycle as explained previously. When Quiet Shift switch is in factory default OFF position, a normal and complete defrost cycle will be observed.

If defrost thermostat is in open position, and speedup pins are shorted (with a flat head screwdriver) for 5 seconds

and released, a short defrost cycle will be observed. When Quiet Shift switch is in ON position, the length of defrost is 1 minute (30 second compressor off period followed by 30 seconds defrost with compressor operation). On return to heating operation, compressor will again turn off for an additional 30 seconds and the fan for 40 seconds. When the Quiet Shift is in OFF position, only a brief 30 second cycle will be observed.

If it is desirable to observe a complete defrost when the defrost thermostat is open (in warmer weather, for example), the thermostat must be closed as follows:

1. Turn off power to outdoor unit.
2. Disconnect outdoor fan motor lead from OF2 on control board (see Figure 8). Tape to prevent grounding.
3. Restart unit in heating mode, allowing frost to accumulate on outdoor coil.
4. After a few minutes in heating mode, liquid line temperature should drop below closing point of defrost thermostat (approximately 30 °F or -1.1 °C). **NOTE:** Unit will remain in defrost until defrost thermostat reopens at approximately 80 °F (26.7 °C) coil temperature at liquid line or remainder of defrost cycle time.
5. Turn off power to outdoor and reconnect fan motor lead to OF2 on control board after above forced defrost cycle.



**DEFROST - 60 Hz models**

The defrost control is a time/temperature control which includes a field-selectable (quick-connects located at board edge) time period between defrost cycles of 30, 60, or 90 minutes (factory set at 90 minutes).

Defrost mode is identical to cooling mode except that outdoor-fan motor stops and second-stage heat is turned on to continue warming conditioned space.

Initially, the defrost cycle timer starts when the contactor is energized and a 24V signal is present on the T1 terminal. Then the defrost cycle begins when the defrost thermostat is closed and the cycle timer times out (30, 60, 90 or minutes).

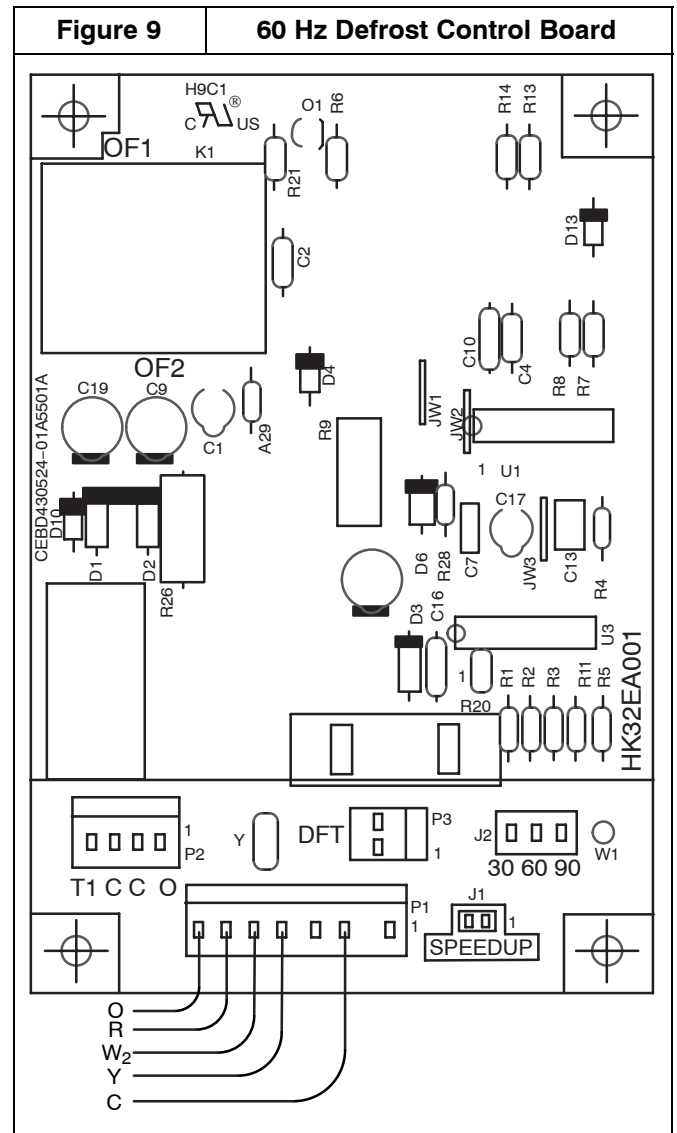


To initiate a forced defrost cycle, the defrost thermostat must be closed. This can be accomplished as follows:

1. Turn off power to outdoor unit.
2. Disconnect outdoor-fan motor lead from OF2 on control board (see Figure 9). Tape lead to prevent grounding.
3. Restart unit in heating mode, allowing frost to accumulate on outdoor coil.
4. After a few minutes in heating mode, liquid line temperature should drop below closing point of defrost thermostat (approximately 30 °F or -1.1 °C).
5. Short between speed-up terminals with a flat-bladed screwdriver (see Figure 9). This reduces the timing sequence to 7, 14, or 21 seconds (30, 60, or 90 minute defrost selection, respectively).
6. When you hear reversing valve change position, remove screwdriver immediately; otherwise, control will terminate normal 10-minute defrost cycle in approximately 2 seconds.

**NOTE:** Length of defrost cycle is dependent upon length of time it takes to remove screwdriver from test pins after reversing valve has shifted.

7. Unit will remain in defrost for remainder of defrost-cycle time or until defrost thermostat reopens at approximately 80 °F (26.7 °C) coil temperature of liquid line.
8. Turn off power to outdoor unit and reconnect fan-motor lead to OF2 on control board (see Figure 9).



## FINAL CHECKS

Before leaving job, be sure to do the following:

1. Securely fasten all panels and covers.
2. Tighten service valve stem caps to 1/12 turn past finger tight.

3. Leave this document with owner. Explain system operation and periodic maintenance requirements outlined in manual.

## CARE AND MAINTENANCE

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

Explain system operation and periodic maintenance requirements with owner. Frequency of maintenance may vary depending on geographic areas, such as coastal applications which require more frequent maintenance.