

PH7T SPLIT-SYSTEM 2-STAGE HEAT PUMP WITH R-410A REFRIGERANT 2-5 TONS

Installation Instructions

NOTE: Read the entire instruction manual before starting the installation.

SAFETY CONSIDERATIONS

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

Follow all safety codes. Wear safety glasses, protective clothing, and work gloves. Use quenching cloth for brazing operations. Have fire extinguisher available. Read these instructions thoroughly and follow all warnings or cautions included in literature and attached to the unit. Consult local building codes and current editions of the National Electrical Code (NEC) NFPA 70. In Canada, refer to current editions of the Canadian Electrical Code CSA 22.1.

Recognize safety information. This is the safety-alert symbol ⚠. When you see this symbol on the unit and in instructions or manuals, be alert to the potential for personal injury. Understand these signal words; DANGER, WARNING, and CAUTION. These words are used with the safety-alert symbol. **DANGER** identifies the most serious hazards which will result in severe personal injury or death. **WARNING** signifies hazards which could result in personal injury or death. **CAUTION** is used to identify unsafe practices which would result in minor personal injury or product and property damage. **NOTE** is used to highlight suggestions which will result in enhanced installation, reliability, or operation.

⚠ WARNING

ELECTRICAL SHOCK HAZARD

Failure to follow this warning could result in personal injury or death. Before installing, modifying, or servicing system, main electrical disconnect switch must be in the OFF position. There may be more than 1 disconnect switch. Lock out and tag switch with a suitable warning label.

⚠ WARNING

EXPLOSION HAZARD

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

Never use air or any gas containing oxygen for leak testing or operating refrigerant compressors. Never allow compressor suction pressure to operate in a vacuum with service valves closed. See Service Manual for pump-down instructions.



Installation Recommendations

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

1. Locate unit away from windows, patios, decks, etc. where unit operation sound may disturb customer.
2. Ensure that vapor and liquid tube diameters are appropriate for unit capacity.
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 Fig. 1.)
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 which comes in direct contact with tubing. (See Fig. 1.)
8. Ensure that tubing insulation is pliable and completely surrounds vapor tube.
9. When necessary, use hanger straps which are 1 in. (25.4 mm) wide and conform to shape of tubing insulation. (See Fig. 1.)
10. Isolate hanger straps from insulation by using metal sleeves bent to conform to shape of insulation.

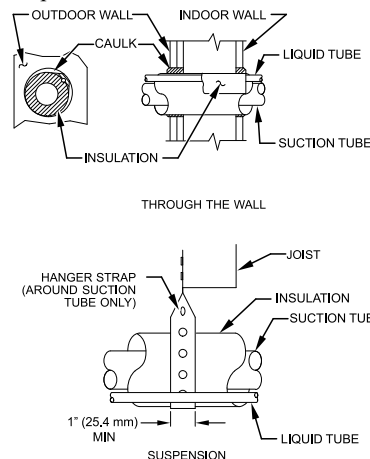


Fig. 1 – Piping Installation

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When outdoor unit is connected to factory-approved indoor unit, outdoor unit contains system refrigerant charge for operation with AHRI rated indoor unit when connected by 15 ft. (4.57 m) of field-supplied or factory accessory tubing. For proper unit operation, check refrigerant charge using charging information located on control box cover and/or in the Check Charge section of this instruction.

IMPORTANT: Maximum liquid-line size is 3/8-in. OD for all residential applications including line line.

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

Installation

CAUTION

CUT HAZARD

Failure to follow this caution may result in personal injury.
Sheet metal parts may have sharp edges or burrs. Use care and wear appropriate protective clothing and gloves when handling parts.

Check Equipment and Job Site

IMPORTANT: All split system and packaged heat pumps must be installed pursuant to applicable regional efficiency standards issued by the Department of Energy.

Unpack Unit

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

Inspect Equipment

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

Install on a Solid, Level Mounting Pad

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

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

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

Roof mounted units exposed to winds above 5 mph (8.05 km/h) may require wind baffles. Consult the Service Manual - Residential Split System Air Conditioners and Heat Pumps for wind baffle construction.

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

CAUTION

UNIT OPERATION HAZARD

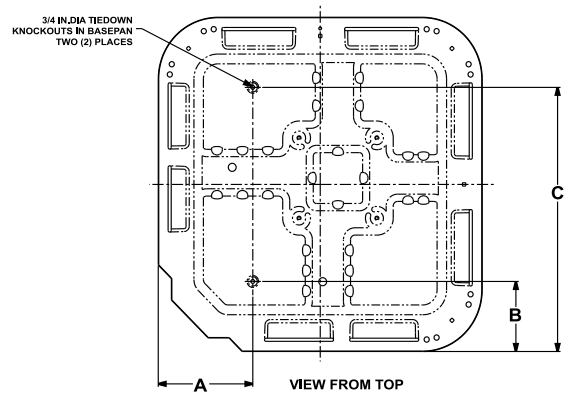
Failure to follow this caution may result in equipment damage or improper operation.

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

Clearance Requirements

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

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



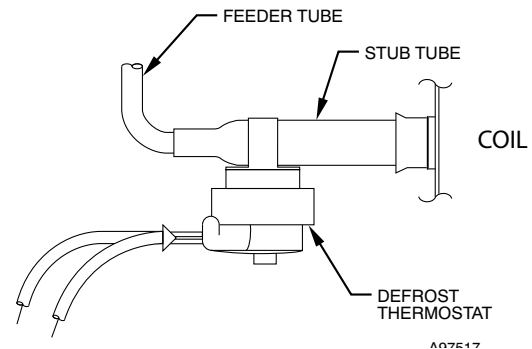
UNIT BASE PAN Dimension in. (mm)	TIEDOWN KNOCKOUT LOCATIONS in. (mm)		
	A	B	C
35 X 35 (889 X 889)	9-1/8 (231.8)	6-9/16 (166.7)	28-7/16 (722.3)

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Fig. 2 – Tiedown Knockout Locations

Check Defrost Thermostat

Check defrost thermostat to ensure it is properly located and securely attached. There is a liquid header with a distributor and feeder tube going into outdoor coil. At the end of the one of the feeder tubes, there is a 3/8 in. O.D. stub tube approximately 2 in. long. (See Fig. 3.) The defrost thermostat should be located on stub tube. Note that there is only one stub tube used with liquid header, and on most units it is the bottom circuit.



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Fig. 3 – Defrost Thermostat Location

Elevate Unit

CAUTION

UNIT OPERATION HAZARD

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

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

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

Table 1 – Accessory Usage

Accessory	Required for Low Ambient Cooling Applications (Below 55°F / 12.8°C)	Required for Long Line Applications	Required for Sea Coast Applications (within 2 miles/3.2 km)
Compressor Start Assist Capacitor and Relay	Yes	Yes	No
Crankcase Heater	Yes (standard)	Yes (standard)	No
Evaporator Freeze Thermostat	Yes	No	No
Hard Shutoff TXV	Yes (standard w/factory approved indoor unit)	Yes (standard w/factory approved indoor unit)	Yes (standard w/factory approved indoor unit)
Isolation Relay	Yes	No	No
Liquid Line Solenoid Valve	No	See Residential Piping and Long Line Guideline	No
Low-Ambient Pressure Switch	Yes	No	No
Support Feet	Recommended	No	Recommended

*. For tubing line sets between 80 and 200 ft. (24.38 and 60.96 m) and/or 20 ft. (6.09 m) vertical differential, refer to Residential Piping and Longline Guideline.

In Long-Line Applications, Install Liquid-Line Solenoid Valve (LSV)

For refrigerant piping arrangements with equivalent lengths greater than 80 ft. (24.38 m) and/or when elevation difference between indoor and outdoor unit is greater than ± 20 ft. (± 6.10 m), follow all requirements of the Residential Piping and Long-Line Guideline. If required by Long-Line Guideline, install LSV kit, part no. KHALS0401LLS, specifically designed for R-410A refrigerant heat pumps. LSV should be installed within 2 ft. (0.61 m) of outdoor unit with flow arrow pointing toward outdoor unit. Follow the Installation Instructions included with accessory kit.

IMPORTANT: Flow arrow must point toward outdoor unit.

Make Piping Connections

! WARNING

PERSONAL INJURY AND ENVIRONMENTAL HAZARD

Failure to follow this warning could result in personal injury or death. Relieve pressure and recover all refrigerant before system repair or final unit disposal.

Use all service ports and open all flow-control devices, including solenoid valves.

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

! CAUTION

UNIT DAMAGE HAZARD

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

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

Outdoor units may be connected to indoor section using accessory tubing package or field-supplied refrigerant grade tubing of correct size and condition. For tubing requirements beyond 80 ft (24.4 m), substantial capacity and performance losses can occur. Following the recommendations in the Residential Piping and Long Line Guideline will reduce these losses. Refer to Table 1 for accessory requirements. Refer to Table 2 for field tubing diameters.

There are no buried-line applications greater than 36 in. (914.4 mm)

If refrigerant tubes or indoor coil are exposed to atmosphere, they must be evacuated to 500 microns to eliminate contamination and moisture in the system.

Outdoor Unit Connected to Factory Approved Indoor Unit:

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

Service Valves

Service valves are closed and plugged from the factory. Outdoor units are shipped with a refrigerant charge sealed in the unit. Leave the service valves closed until all other refrigerant system work is complete or the charge will be lost. Leave the plugs in place until line set tubing is ready to be inserted.

Heat pumps require a piston metering device in the liquid service valve for proper heating operation. Piston is shipped in the piston body of the liquid service valve, temporarily held in place with a plastic cap. Do not remove the plastic cap until line set tubing is ready to be installed.

Refer to Fig. 4 and follow these steps for piston installation:

1. Remove plastic cap holding piston in piston body of liquid service valve.
2. Check that piston size (stamped on side of piston) matches with number listed on unit rating plate. Return piston to piston body of liquid service valve (either direction).
3. Find plastic bag taped to unit containing copper adapter tube, brass nut, and plastic washer.
4. Install plastic washer in the seat inside piston body.
5. Fit brass nut onto adapter tube and install tube onto liquid service valve. Tighten nut finger tight, then wrench additional $\frac{1}{2}$ turn only [15-ft lbs (20.3 N-m)]. Over tightening may damage the plastic washer and service valve's piston body.

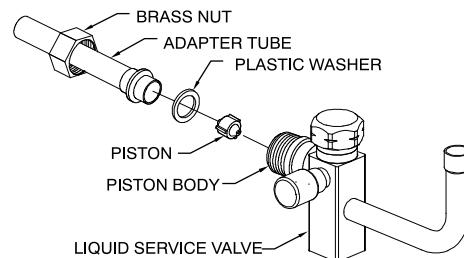


Fig. 4 – Liquid Service Valve with Heating Piston and Adapter Tube

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Brazing Connections**! WARNING****FIRE HAZARD**

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

Refrigerant and oil mixture could ignite and burn as it escapes and contacts brazing torch. Make sure the refrigerant charge is properly removed from both the high and low sides of the system before brazing any component or lines.

Connect vapor tube to fitting on outdoor unit vapor service valves (see [Table 2](#)). Connect liquid tubing to adapter tube on liquid service valve. Use refrigerant grade tubing.

Table 2 – Refrigerant Connections and Recommended Liquid and Vapor Tube Diameters (In.)

UNIT SIZE	LIQUID		RATED VAPOR*	
	Connection Diameter	Tube Diameter	Connection Diameter	Tube Diameter
024	3/8	3/8	3/4	3/4
036	3/8	3/8	7/8	7/8
048, 060	3/8	3/8	7/8	1-1/8

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

Notes:

1. Do not apply capillary tube indoor coils to these units.
2. For Tubing Set lengths between 80 and 200 ft. (24.38 and 60.96 m) horizontal or 20 ft. (6.1 m) vertical differential, refer to the Residential Piping and Longline Guideline.

! CAUTION**UNIT DAMAGE HAZARD**

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

Service valves must be wrapped in a heat-sinking material such as a wet cloth while brazing.

! CAUTION**BURN HAZARD**

Failure to follow this Caution may result in personal injury.

Components will be HOT after brazing. Wear appropriate personal protective equipment and allow to cool before handling parts and equipment

Apply heat absorbing paste or heat sink product between service valve and joint. Wrap service valves with a heat sinking material such as a wet cloth.

After wrapping service valve with a wet cloth, tubing set can be brazed to service valve using either silver bearing or non-silver bearing brazing material. Do not use soft solder (materials which melt below 800°F/427°C). Consult local code requirements.

NOTE: Some outdoor units contain a mechanical fitting at the liquid distributor. This connection is not field serviceable and should not be disturbed.

NOTE: For Liquid Service Valve - Braze lineset to adapter tube BEFORE bolting adapter to valve. This helps prevent overheating and damage to plastic washer or o-ring.

For Vapor Service Valve - remove valve core from schrader port on Service Valve BEFORE brazing. This helps prevent overheating and damage to valve seals (refer to [Fig. 5](#)). Replace valve core when brazing is completed.

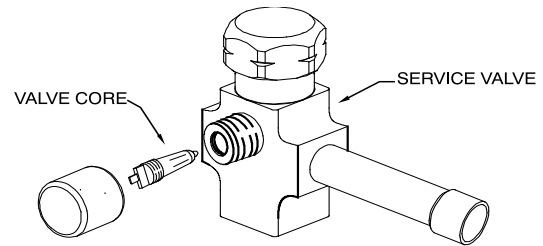


Fig. 5 – Vapor Service Valve

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Clean line set tube ends with emery cloth or steel brush. Remove any grit or debris.

Insert line set tube ends into service valve tube stubs.

Apply heat absorbing paste or heat sink product between service valve and joint. Wrap service valves with a heat sinking material such as a wet cloth.

Braze joints using a Sil-Fos or Phos-copper alloy.

Install Liquid Line Filter Drier Indoor**! CAUTION****UNIT DAMAGE HAZARD**

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

1. Installation of filter drier in liquid line is required.
2. Filter drier must be wrapped in a heat-sinking material such as a wet cloth while brazing.

Refer to [Fig. 6](#) and install filter drier as follows:

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

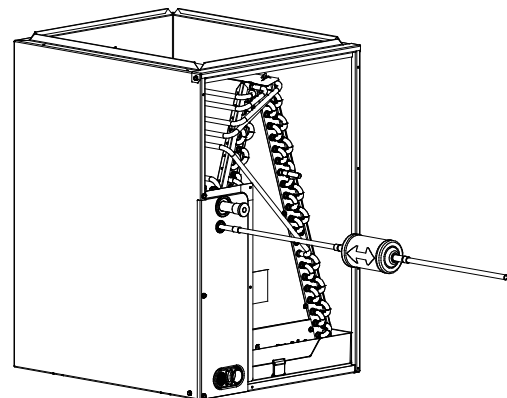


Fig. 6 – Liquid Line Filter Drier

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Refrigerant tubing and indoor coil are now ready for leak testing. This check should include all field and factory joints.

Evacuate Refrigerant Tubing and Indoor Coil

! CAUTION

UNIT DAMAGE HAZARD

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

Never use the system compressor as a vacuum pump.

Refrigerant tubes and indoor coil should be evacuated using the recommended deep vacuum method of 500 microns. The alternate triple evacuation method may be used (see triple evacuation procedure in service manual). Always break a vacuum with dry nitrogen.

Deep Vacuum Method

The deep vacuum method requires a vacuum pump capable of pulling a vacuum of 500 microns and a vacuum gage capable of accurately measuring this vacuum depth. The deep vacuum method is the most positive way of assuring a system is free of air and liquid water. A tight dry system will hold a vacuum of 1000 microns after approximately 7 minutes. See Fig. 7.

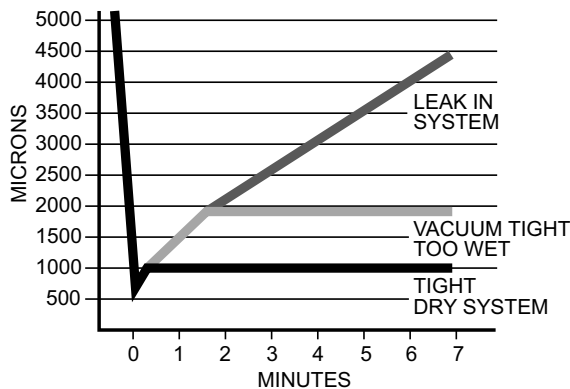


Fig. 7 – Deep Vacuum Graph

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Final Tubing Check

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

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

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

Make Electrical Connections

! WARNING

ELECTRICAL SHOCK HAZARD

Failure to follow this warning could result in personal injury or death. Do not supply power to unit with compressor terminal box cover removed.

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

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

Route Ground and Power Wires

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

Connect Ground and Power Wires

! WARNING

ELECTRICAL SHOCK HAZARD

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

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

Connect ground wire to ground connection in control box for safety. Connect power wiring to contactor as shown in Fig. 8.

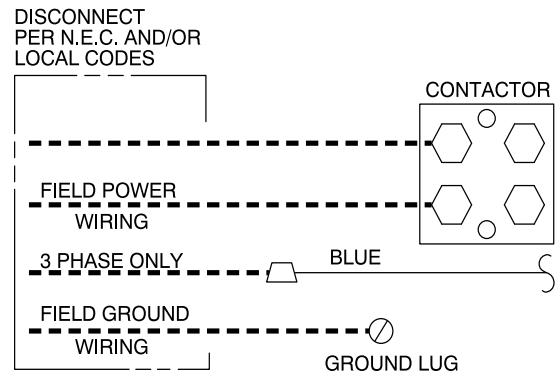


Fig. 8 – Line Connections

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Connect Control Wiring

Route 24v control wires through control wiring grommet and connect leads to control wiring. See Thermostat Installation Instructions for wiring specific unit combinations. (See Fig. 9 and Fig. 10.)

Use No. 18 AWG color-coded, insulated (35°C minimum) wire. If thermostat is located more than 100 ft (30.5 m) from unit, as measured along the control voltage wires, use No. 16 AWG color-coded wire to avoid excessive voltage drop.

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

Use furnace transformer, fan coil transformer, or accessory transformer for control power, 24v/40va minimum.

NOTE: Use of available 24v accessories may exceed the minimum 40va power requirement. Determine total transformer loading and increase the transformer capacity or split the load with an accessory transformer as required.

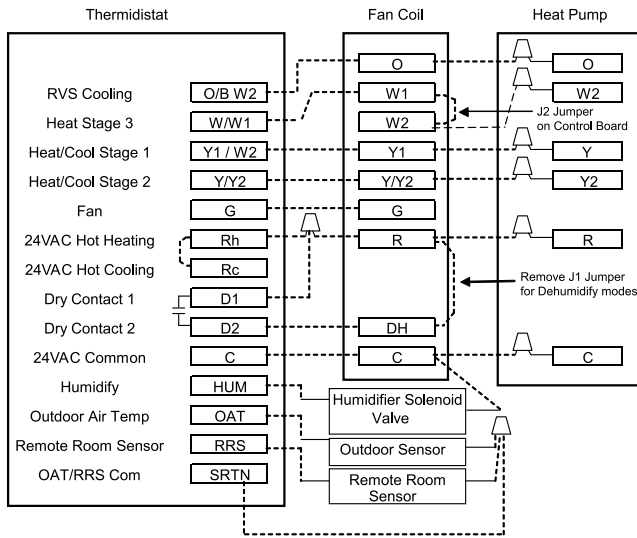


Fig. 9 – Thermostat Wiring with Fan Coil and 2-Stage Heat Pump

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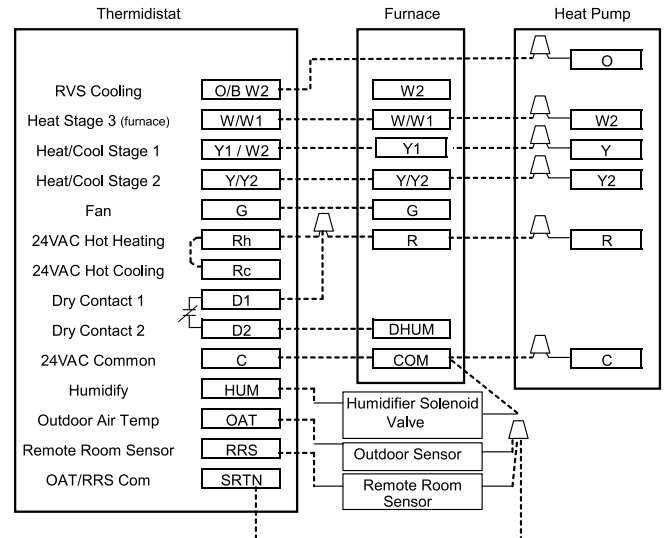
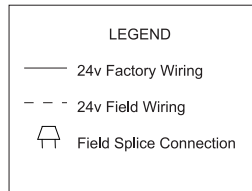


Fig. 10 – Thermostat with Variable Speed Furnace and 2-Stage Heat Pump

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Final Wiring Check

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

Compressor Crankcase Heater

All sizes are equipped with a crankcase heater. Furnish power to heater a minimum of 24 hours before starting unit. To furnish power to heater only, set thermostat to OFF and close electrical disconnect to outdoor unit.

A crankcase heater is required if refrigerant tubing is longer than 80 ft. (24.4 m), or when outdoor unit is 20 ft. (6.1 m) below the indoor unit. Refer to the Residential Piping and Long Line Guideline.

Install Electrical Accessories

Refer to the individual instructions packaged with kits or accessories when installing.

Airflow Selections (ECM Furnaces)

The ECM Furnaces provide blower operation to match the capacities of the compressor during high and low stage cooling operation. Tap selections on the furnace control board enable the installing technician to select the proper airflows for each stage of cooling. Below is a brief summary of the furnace airflow configurations

1. The Y2 call for high stage cooling energizes the “Cool” tap on the control board. The grey wire from cool tap is connected to tap 5 on the motor. Refer to the furnace Product Data to find the corresponding airflow. If the airflow setting for high cooling needs to be switched from tap 5 to a different tap, jumper a connection from the cool tap to the desired tap so that the Y2 signal is communicated via the cool tap to the desired speed tap.
2. The Y1 call for low stage cooling energizes the “Fan” tap on the control board. The red wire from the fan tap is connected to tap 1 on the motor. Refer to the furnace Product Data to find the

corresponding airflow. If the airflow setting for low cooling needs to be switched from tap 1 to a different tap, jumper a connection from the Fan tap to the desired tap so that the Y1 signal is communicated via the Fan tap to the desired speed tap. The Y1 setting will also govern the continuous fan airflow for the furnace.

Refer to the literature for the furnace for further details.

Airflow Selection for Variable Speed Furnaces (non-communicating)

The variable speed furnaces provide blower operation to match the capacities of the compressor during high and low stage cooling operation. The furnace control board allows the installing technician to select the proper airflows for each stage of cooling. Below is a summary of required adjustments. See furnace installation instructions for more details:

1. Turn SW1-5 ON for 400 CFM/ton airflow or OFF for 350 CFM/ton airflow. Factory default is OFF.
2. The A/C DIP switch setting determines airflow during high stage cooling operation. Select the A/C DIP switch setting corresponding to the available airflow shown in the furnace Installation Instructions that most closely matches the required airflow shown in the air conditioning Product Data for HIGH speed.
3. The CF DIP switch setting determines airflow during low stage cooling operation. Select the CF DIP switch setting corresponding to the available airflow shown in the furnace installation instructions that most closely matches the required airflow shown in the air conditioning Product Data for LOW speed. If a higher or lower continuous fan speed is desired, the continuous fan speed can be changed using the fan switch on the thermostat. Refer to the furnace Installation Instructions for details of how to use this feature.

Airflow Selection for FV4C Fan Coils (non-communicating)

The FV4C provides high- and low-stage blower operation to match the capacities of the compressor at high- and low-stage.

To select recommended airflow, refer to the FV4C Installation Instructions. The FV4C utilizes an Easy Select control board that allows the installing technician to select proper airflows. This fan coil has an adjustable blower-off delay factory set at 90 sec. for high- and low-stage blower operation.

Start-Up

CAUTION

PERSONAL INJURY HAZARD

Failure to follow this caution may result in personal injury.

Wear safety glasses, protective clothing, and gloves when handling refrigerant and observe the following:

- Front seating service valves are equipped with Schrader valves.

CAUTION

ENVIRONMENTAL HAZARD

Failure to follow this caution may result in environmental damage.

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

CAUTION

UNIT OPERATION AND SAFETY HAZARD

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

- 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.
- Compressor dome temperatures may be hot.

Follow these steps to properly start up system:

1. After system is evacuated, fully open liquid and vapor service valves.
2. Unit is shipped with valve stem(s) front seated (closed) and caps installed. Replace stem caps after system is opened to refrigerant flow (back seated). Replace caps finger-tight and tighten with wrench an additional 1/12 turn.
3. Close electrical disconnects to energize system.
4. Set room thermostat at desired temperature. Be sure set point is below indoor ambient temperature.
5. Set room thermostat to HEAT or COOL and fan control to ON or AUTO mode, as desired. Operate unit for 15 minutes. Check system refrigerant charge.

Sequence of Operation

NOTE: Defrost control board is equipped with 5 minute lockout timer that is initiated upon any interruption of power.

Turn on power to indoor and outdoor units. Transformer is energized.

These models utilize a 2-stage indoor thermostat. With a call for first (low) stage cooling or heating, the outdoor fan and low-stage compressor are energized. If low-stage cannot satisfy cooling or heating demand, high-stage is energized by the second (high) stage of the indoor thermostat. After the second stage is satisfied, the unit returns to

low-stage operation until second stage is required again. When both, first and second stage cooling or heating are satisfied, the compressor will shut off.

Cooling

With first stage cooling, Y1 and O are powered on; and with second stage cooling, Y2, Y1 and O are powered on. The O energizes the reversing valve, switching it to cooling position. The Y1 signal sends low voltage through the safeties and energizes the T1 terminal on the circuit board. If the compressor has been off for 5 minutes, or power has not been cycled for 5 minutes, the OF2 relay and T2 terminal will energize. This will close the contactor and start the outdoor fan motor and compressor. When the cycle is complete, Y1 is turned off, stopping the compressor and outdoor fan. The 5 minute time guard begins counting. Compressor will not come on until this delay expires. In the event of a power interruption, the time guard will not allow another cycle for 5 minutes.

Heating

With first stage heating, Y1 is powered on; with second stage heating, Y2 and Y1 are powered on. The Y1 signal sends low voltage through the safeties and energizes the T1 terminal on the circuit board. If the compressor has been off for 5 minutes or power has not been cycled for 5 minutes, the OF2 relay and T2 terminal will energize. This will close the contactor and start the outdoor fan motor and compressor.

When the cycle is complete, Y1 is turned off, stopping the compressor and outdoor fan. The 5 minute time guard begins counting. Compressor will not come on until this delay expires. In the event of a power interruption, the time guard will not allow another cycle for 5 minutes.

Compressor Operation

The basic scroll design has been modified with the addition of an internal unloading mechanism that opens a by-pass port in the first compression pocket, effectively reducing the displacement of the scroll. The opening and closing of the by-pass port is controlled by an internal electrically operated solenoid. The modulated scroll uses a single step of unloading to go from full capacity to approximately 67% capacity.

A single speed, high efficiency motor continues to run while the scroll modulates between the two capacity steps. Modulation is achieved by venting a portion of the gas in the first suction pocket back to the low side of the compressor, thereby reducing the effective displacement of the compressor.

Full capacity is achieved by blocking these vents, thus increasing the displacement to 100%. A DC solenoid in the compressor controlled by a rectified 24 volt AC signal in the external solenoid plug moves the slider ring that covers and uncovers these vents.

The vent covers are arranged in such a manner that the compressor operates at approximately 67% capacity when the solenoid is not energized and 100% capacity when the solenoid is energized. The loading and unloading of the two step scroll is done "on the fly" without shutting off the motor between steps.

NOTE: 67% compressor capacity translates to approximately 75% cooling or heating capacity at the indoor coil.

The compressor will always start unloaded and stay unloaded for five seconds even when the thermostat is calling for high stage capacity.

Quiet Shift-2

Quiet shift- 2 is a field selectable defrost mode (factory set to OFF), which will reduce the occasional noise that could be heard at the start of defrost cycle and restarting of heating cycle. It is selected by placing DIP switch 3 on defrost board in the ON position. When Quiet Shift- 2 switch is placed in ON position, and defrost is initiated, the following sequence of operation will occur: The compressor will be de- energized for approximately 1 minute, then the reversing valve will be energized. A few seconds later, the compressor will be re- energized and the normal defrost cycle starts.

Once defrost termination conditions have been met, the following sequence will occur: The compressor will be de- energized for approximately 1 minute, then the reversing valve will be de- energized. A few seconds later, the compressor will be re- energized and the normal heating cycle starts.

Defrost

The defrost control is a time/temperature control which has field selectable settings of 30, 60, 90, or 120 minutes, factory set to 60 minutes. These settings represent the initial time period that must pass after closure of the defrost thermostat before the defrost sequence begins, after which the defrost period varies with defrost length. If Quiet Shift 2 is enabled, the variable defrost intervals will be disabled to provide options where using a specific setting is desired. In this case the 30, 60, 90, or 120 minutes setting will not change unless the dipswitch is changed and power is cycled.

The defrost thermostat senses coil temperature throughout the heating cycle. When the coil temperature reaches the defrost thermostat setting of approximately 32°F (0°C), it will close, which energizes the DFT terminal and begins the defrost timing sequence. When the DFT has been energized for the selected time, the defrost cycle begins. Defrost cycle is terminated when defrost thermostat opens, or automatically after 10 minutes.

Defrost Speedup

To initiate a forced defrost, speedup pins (J1) must be shorted with a flat head screwdriver for 5 seconds and RELEASED. If the defrost thermostat is open, a short defrost cycle will be observed (actual length depends on Quiet Shift- 2 switch position). When Quiet Shift- 2 is off, only a short 30 second defrost cycle is observed. With Quiet Shift- 2 ON, the speedup sequence is approximately 3 minutes; 1 minute compressor off period followed by 30 seconds of defrost with compressor operation. When returning to heating mode, the compressor will turn off for an additional 1 minute.

If the defrost thermostat is closed, a complete defrost cycle is initiated. If the Quiet Shift- 2 switch is turned on, the compressor will be turned off for two 1 minute intervals as explained previously.

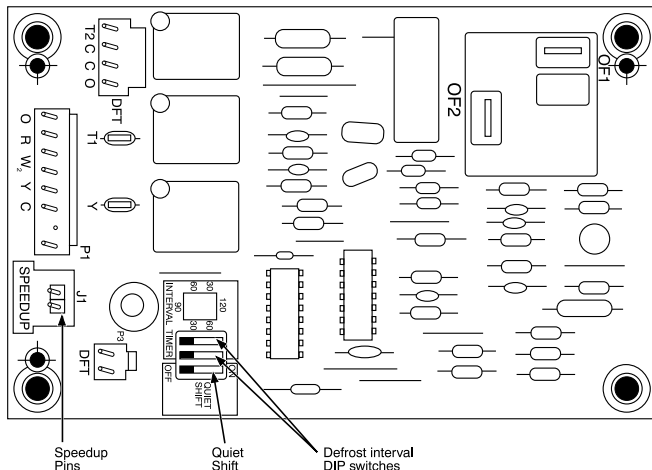


Fig. 11 – Defrost Control

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Check Charge

NOTE: CHARGE IN HIGH STAGE ONLY.

Factory charge amount and desired subcooling are shown on unit rating plate. Charging method is shown on information plate inside unit. To properly check or adjust charge, conditions must be favorable for subcooling charging. Favorable conditions exist when the outdoor temperature is between 70°F and 100°F (21.11°C and 37.78°C), and the indoor temperature is between 70°F and 80°F (21.11°C and 26.67°C). Follow the procedure below:

Unit is factory charged for 15ft (4.57 m) of lineset. Adjust charge by adding or removing 0.6 oz/ft (.018 kg/m) of 3/8 liquid line above or below 15ft (4.57 m) respectively.

For standard refrigerant line lengths (80 ft/24.38 m or less), allow system to operate in cooling mode at least 15 minutes. If conditions are favorable, check system charge by subcooling method. If any adjustment is necessary, adjust charge slowly and allow system to operate for 15 minutes to stabilize before declaring a properly charged system.

If the indoor temperature is above 80°F (26.67°C), and the outdoor temperature is in the favorable range, adjust system charge by weight based on line length and allow the indoor temperature to drop to 80°F (26.67°C) before attempting to check system charge by subcooling method as described above.

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

NOTE: If line length is beyond 80 ft (24.38 m) or greater than 20 ft (6.10 m) vertical separation, See Long Line Guideline for special charging requirements.

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.

Verify units for proper switching between low & high stages

Check the suction pressures at the service valves. Suction pressure should be reduced by 3-10% when switching from low to high capacity.

Compressor current should increase 20-45% when switching from low to high stage. The compressor solenoid when energized in high stage, should measure 24vac at leads inside control box.

When the compressor is operating in low stage the 24v DC compressor solenoid coil is de-energized. When the compressor is operating in high stage, the 24v DC solenoid coil is energized. The solenoid plug harness that is connected to the compressor HAS an internal rectifier that converts the 24v AC signal to 24v DC. **DO NOT INSTALL A PLUG WITHOUT AN INTERNAL RECTIFIER.**

Unloader Test Procedure

The unloader is the compressor internal mechanism, controlled by the DC solenoid, that modulates between high and low stage. If it is suspected that the unloader is not working, the following methods may be used to verify operation.

1. Operate the system and measure compressor amperage. Cycle the unloader on and off at 30 second plus intervals at the thermostat (from low to high stage and back to low stage). Wait 5 seconds after staging to high before taking a reading. The compressor amperage should go up or down at least 20 percent.
2. If the expected result is not achieved, remove the solenoid plug from the compressor and with the unit running and the thermostat calling for high stage, test the voltage output at the plug with a DC voltmeter. The reading should be 24 volts DC.
3. If the correct DC voltage is at the control circuit molded plug, measure the compressor unloader coil resistance. The resistance should be approximately 1640 milliohms. If the coil resistance is infinite or is grounded, the compressor must be replaced.

Final Checks

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

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

Troubleshooting

If the compressor fails to operate with a cooling call, the table below (Resistance table) can be used to verify if there is any damage to the compressor windings causing system malfunction.

Table 3 – Winding Resistance

Winding	Winding resistance at 70°F +/- 20°F (21.11°C +/- 11.11°C)			
	Unit Size			
	024	036	048	060
Start (S-C)	1.652	1.587	1.299	1.203
Run (R-C)	1.065	0.751	0.477	0.383

Major Components

2-Stage Compressor

The 2-stage compressor contains motor windings that provide 2-pole (3500 RPM) operation.

Compressor Internal Relief

The compressor is protected by an internal pressure relief (IPR) which relieves discharge gas into compressor shell when differential between suction and discharge pressures exceeds and 550 - 625 psi. The compressor is also protected by an internal overload attached to motor windings.

Compressor Control Contactor

The contactor has a 24 volt coil and is controlled by Y1 input from the thermostat

Low Pressure Switch

Low pressure switch is provided in line with the Y1 signal to the contactor for protection.

Care and Maintenance

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

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



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