LENNOX™



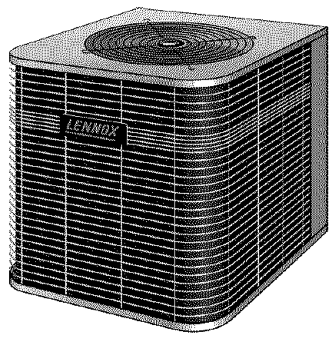
# INSTALLATION INSTRUCTIONS

## SPA Units

### SPA036H4 (3 Ton)
### SPA048H4 (4 Ton)
### SPA060H4 (5 Ton)

S-CLASS™ HEAT PUMP UNITS
504,867M
06/06
Supersedes 03/06

Technical Publications
Litho U.S.A.



## ⚠ WARNING

**Improper installation, adjustment, alteration, service or maintenance can cause personal injury, loss of life, or damage to property. Installation and service must be performed by a qualified installer or service agency.**

## ⚠ IMPORTANT

**This unit must be matched with an indoor coil as specified in Lennox Engineering Handbook. Coils previously charged with R-22 must be flushed.**

## ⚠ CAUTION

**Physical contact with metal edges and corners while applying excessive force or rapid motion can result in personal injury. Be aware of, and use caution when working near these areas during installation or while servicing this equipment.**

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**RETAIN THESE INSTRUCTIONS FOR FUTURE REFERENCE**

## SPA Outdoor Unit

The S-Class™ SPA outdoor units use R-410A HFC refrigerant. This unit must be installed with a matching indoor coil and line set as outlined in the Lennox Engineering Handbook. SPA outdoor units are designed for use in expansion valve (TXV) systems only. They are not designed to be used with other refrigerant flow control devices. The Lennox Engineering Handbook lists indoor TXV kits that must be ordered separately.

## General Information

These instructions are intended as a general guide and do not supersede local codes in any way. Consult authorities who have jurisdiction before installation.

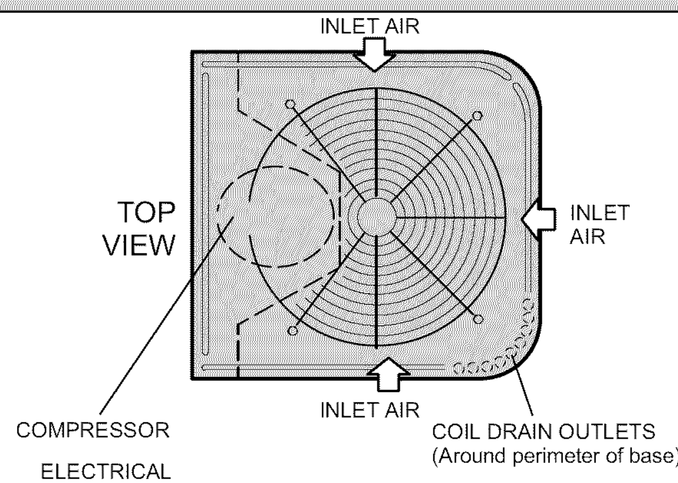
## Shipping and Packing List

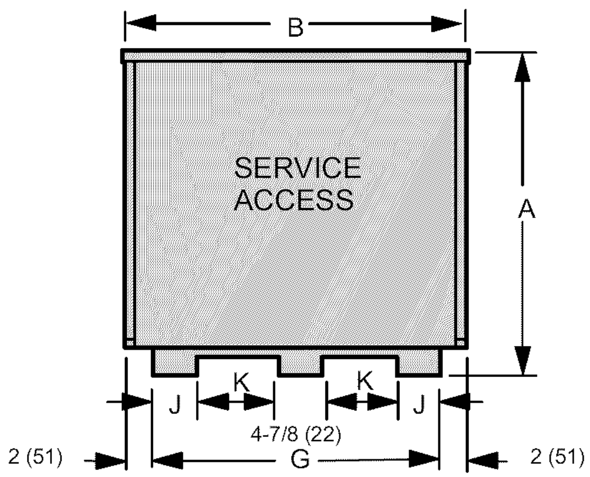
Assembled SPA outdoor unit
Grommets (for liquid and vapor lines)

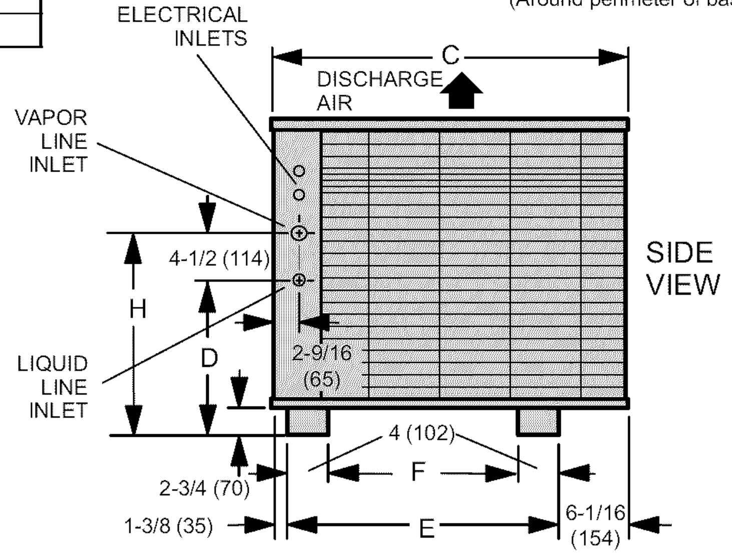
Check equipment for shipping damage. If you find any damage, immediately contact the last carrier.

## Unit Dimensions -- Inches (mm)

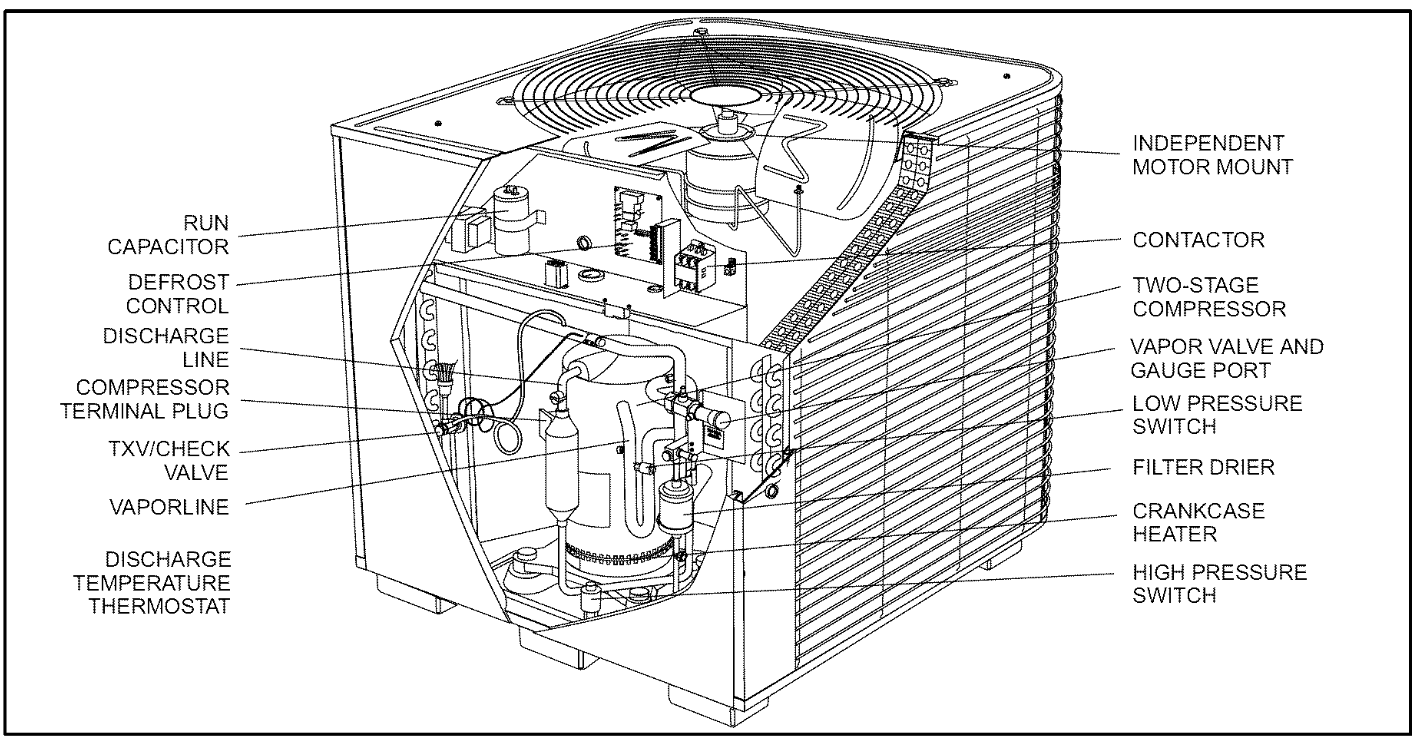
| Dimen-sion | Model | | | |
|---|---|---|---|---|
| | SPA036 | | SPA048/060 | |
| | Inches | mm | Inches | mm |
| A | 30-7/8 | 784 | 44-7/8 | 1140 |
| B | 32-1/8 | 816 | 32-1/8 | 816 |
| C | 34-1/16 | 865 | 34-1/16 | 865 |
| D | 12-3/4 | 324 | 14-1/4 | 362 |
| E | 26-5/8 | 676 | 26-5/8 | 676 |
| F | 18-5/8 | 473 | 18-5/8 | 473 |
| G | 28-1/8 | 718 | 28-1/8 | 718 |
| H | 17-1/4 | 438 | 18-3/4 | 476 |
| J | 3-7/8 | 98 | 3-7/8 | 98 |
| K | 7-1/2 | 191 | 7-1/2 | 191 |




## Parts Arrangement






504867M 06/06

## ⚠ WARNING

**This product and/or the indoor unit it is matched with may contain fiberglass wool. Disturbing the insulation during installation, maintenance, or repair will expose you to fiberglass wool dust. Breathing this may cause lung cancer. (Fiberglass wool is known to the State of California to cause cancer.)**

**Fiberglass wool may also cause respiratory, skin, and eye irritation.**

**To reduce exposure to this substance or for further information, consult material safety data sheets available from address shown below, or contact your supervisor.**

**Lennox Industries Inc.**
**P.O. Box 799900**
**Dallas, TX 75379-9900**

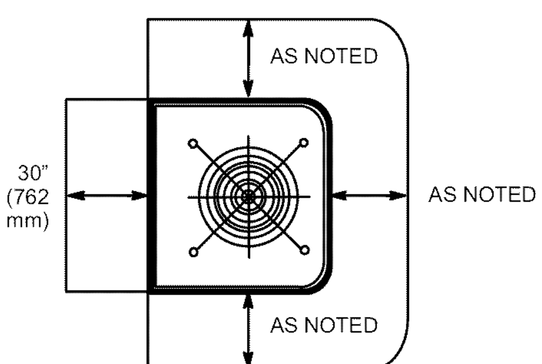
## Setting the Unit

## ⚠ CAUTION

**In order to avoid injury, take proper precaution when lifting heavy objects.**

These units operate under a wide range of weather conditions; therefore, several factors must be considered when positioning the outdoor unit. The unit must be positioned to give adequate clearances for sufficient airflow and servicing. Refer to figure 1 for installation clearances.

### Installation Clearances




*NOTE - A service access clearance of 30" (762 mm) must be maintained in front of the service access panel. Clearance to one side must be 36" (914 mm). Clearance to one of the remaining two sides may be 12" (305 mm) and the final side may be 6" (152 mm).*

*NOTE - A clearance of 24" (610 mm) must be maintained between two units.*

*NOTE - 48" (1219 mm) clearance required on top of unit. Maximum soffit overhang is 36" (914 mm).*

**Figure 1**

1. Place a sound-absorbing material, such as Isomode, under the unit if it will be installed in a location or position that will transmit sound or vibration to the to the conditioned space.
2. Mount unit high enough above ground or roof to allow adequate drainage of defrost water and prevent ice build-up.
3. In heavy snow areas, do not locate unit where drifting will occur. The unit base should be elevated above the depth of average snows.

   *NOTE - Elevation of the unit may be accomplished by constructing a frame using suitable materials. If a support frame is constructed, it must not block drain holes in unit base.*
4. When installed in areas where low ambient temperatures exist, locate unit so winter prevailing winds do not blow directly into outdoor coil.
5. Locate unit away from overhanging roof lines which would allow water or ice to drop on, or in front of, coil or into unit.

### Slab Mounting

When installing unit at grade level, top of slab should be high enough above the grade so that water from higher ground will not collect around unit. See figure 2. Slab should have a slope tolerance away from the building of 2 degrees or 2 inches per 5 feet (51 mm per 1.5 m). This will prevent ice build-up under unit during a defrost cycle. Refer to roof mounting section for barrier construction if unit must face prevailing winter winds.

### Slab Mounting

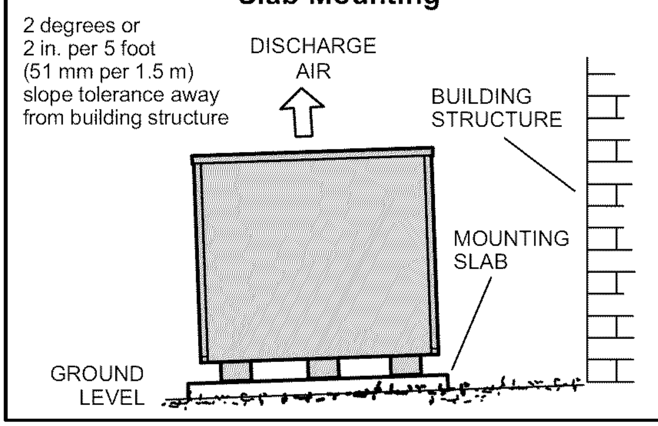



**Figure 2**

### Roof Mounting

Install the unit a minimum of 6 inches (152 mm) above the roof surface to avoid ice build-up around the unit. Locate the unit above a load bearing wall or area of the roof that can adequately support the unit. Consult local codes for rooftop applications.

If unit coil cannot be mounted away from prevailing winter winds, a wind barrier should be constructed. See figure 3. Size barrier at least the same height and width as outdoor unit. Mount barrier 24 inches (610 mm) from the sides of the unit in the direction of prevailing winds.

**Rooftop Application with Wind Barrier**

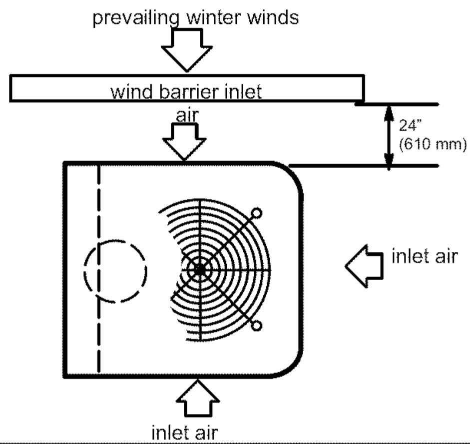



Figure 3

## Electrical

In the U.S.A., wiring must conform with current local codes and the current National Electric Code (NEC). In Canada, wiring must conform with current local codes and the current Canadian Electrical Code (CEC).

**⚠WARNING**

**Electric Shock Hazard. Can cause injury or death.**

**Line voltage is present at all components on units with single-pole contactors, even when unit is not in operation!**

**Unit may have multiple power supplies. Disconnect all remote electric power supplies before opening access panel.**

**Unit must be grounded in accordance with national and local codes.**

Refer to the furnace or blower coil installation instructions for additional wiring application diagrams and refer to unit nameplate for minimum circuit ampacity and maximum overcurrent protection size.

1. Install line voltage power supply to unit from a properly sized disconnect switch.
2. Ground unit at unit disconnect switch or to an earth ground.

   *NOTE - Connect conduit to the unit using a proper conduit fitting.*

   *NOTE - Units are approved for use only with copper conductors.*

Refer to figure 4 for high voltage field wiring diagram.

*NOTE - A complete unit wiring diagram is located inside the unit's access door.*

*NOTE - For proper voltages, select thermostat wire gauge per the following chart:*

| Wire run length | AWG # | Insulation type |
|---|---|---|
| less than 100' (30m) | 18 | color-coded, temperature rating 35°C minimum |
| more than 100' (30m) | 16 | |

3. Install room thermostat (ordered separately) on an inside wall approximately in the center of the conditioned area and 5 feet (1.5 m) from the floor. It should not be installed on an outside wall or where it can be effected by sunlight, drafts or vibrations.
4. Install low voltage wiring from outdoor to indoor unit and from thermostat to indoor unit. See figure 7.

   *NOTE - 24V, Class II circuit connections are made in the low voltage junction box.*

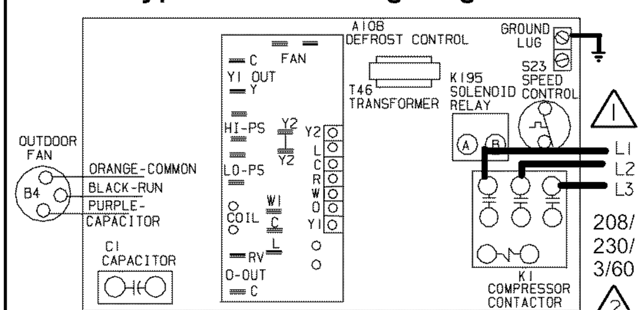
### Three-Phase Scroll Voltage Phasing

Three-phase scroll compressors must be phased sequentially to ensure correct compressor rotation and operation. Incorrect line voltage phasing may cause compressor damage and abnormal unit operation. Power wires are color-coded as follows: Line 1 - red, line 2 - yellow, line 3 - blue.

To test for proper rotation and operation:

1. Install refrigeration gauges on system. Cycle compressor "On" and observe that suction pressure decreases and discharge pressure increases.
2. If pressures do not follow the above conditions, disconnect all power to unit. Reverse any two field-installed main power wires to the line side of the compressor contactor. Make sure connections are tight. Repeat pressure test with system.

**Typical Field Wiring Diagram**




⚠1 For use with copper conductors only. Refer to Unit rating plate for minimum circuit ampacity and maximum overcurrent protection size.

⚠2 **WARNING!** ELECTRIC SHOCK HAZARD! Can cause injury or death. Unit must be grounded in accordance with national and local codes.

Figure 4

## Outdoor Unit, Blower Unit, Thermostat Designations

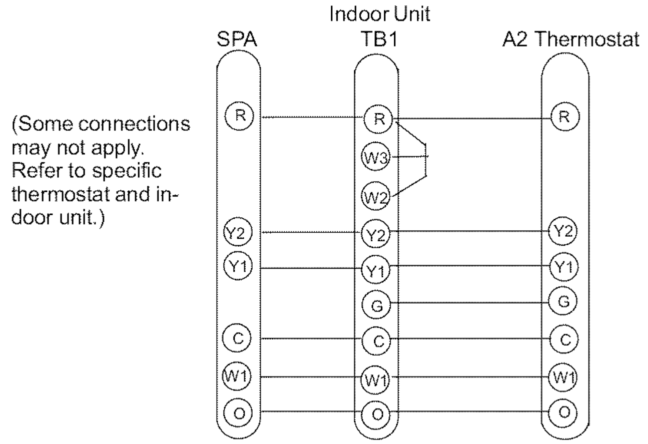



Figure 5

## Outdoor Unit, CB31MV/CB32MV, Thermostat Designations

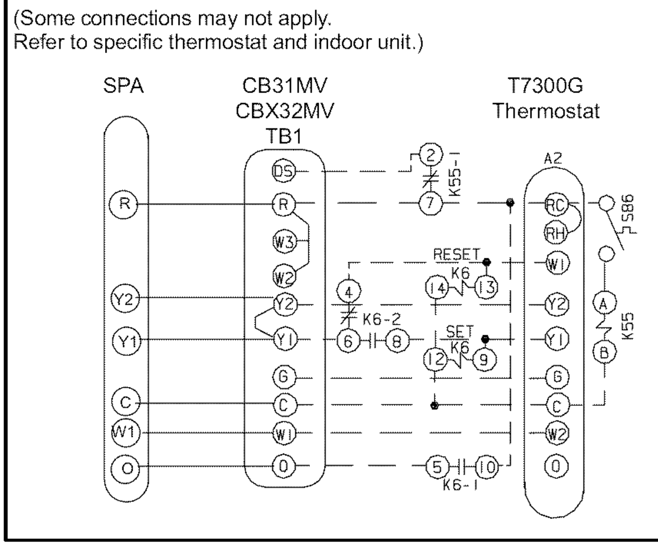



Figure 6

## Typical SPA Wiring

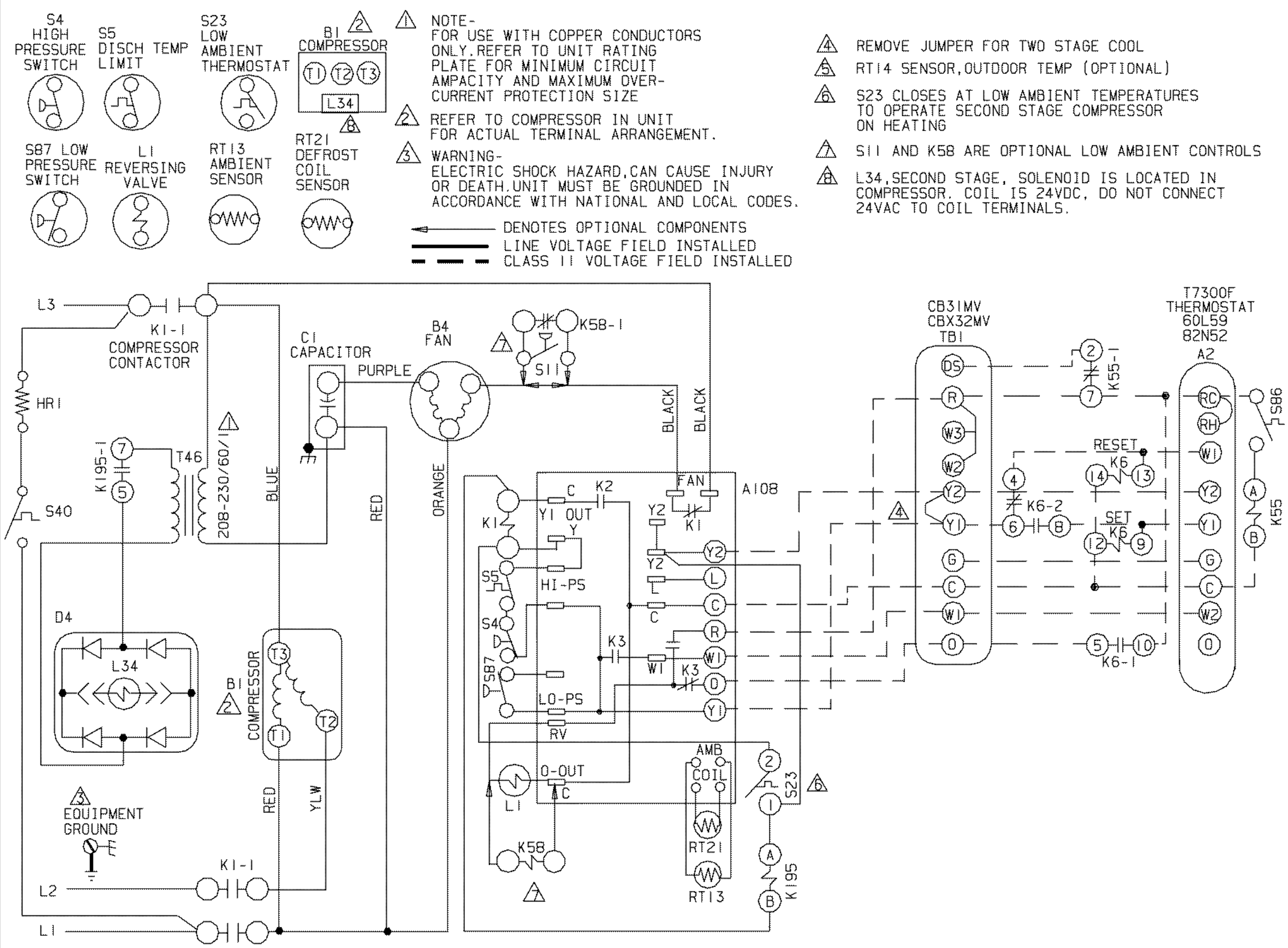



Figure 7

## Refrigerant Piping

If the SPA unit is being installed with a new indoor coil and line set, the refrigerant connections should be made as outlined in this section. If an existing line set and/or indoor coil is going to be used to complete the SPA system, refer to the following section which includes flushing procedures.

Field refrigerant piping consists of liquid and vapor lines from the outdoor unit (sweat connections) to the indoor coil (flare or sweat connections). Use Lennox L15 (sweat, non-flare) series line sets as shown in table 1 or use field-fabricated refrigerant lines. Valve sizes are also listed in table 1.

**Table 1**

**Refrigerant Line Sets**

| Model | Valve Field Size Connections | | Recommended Line Set | | |
|---|---|---|---|---|---|
| | Liquid Line | Vapor Line | Liquid Line | Vapor Line | L15 Line Sets |
| 036 | 3/8 in. 10 mm | 7/8 in. 22 mm | 3/8 in. 10 mm | 7/8 in. 22 mm | L15-65 15 - 50 ft. 4.6 - 15 m |
| 048 | 3/8 in. 10 mm | 7/8 in. 22 mm | 3/8 in. 10 mm | 7/8 in. 22 mm | |
| 060 | 3/8 in. 10 mm | 1-1/8 in. 29 mm | 3/8 in. 10 mm | 1-1/8 in. 29 mm | Field Fabricated |

### Refrigerant Line Set Connections - SPA Matched with New Indoor Coil and Line Set

If an existing indoor coil which was equipped with an RFCI metering device is being replaced, the liquid line must also be replaced prior to the installation of the SPA unit.

*NOTE - Units are designed for line sets of up to 50 feet (15 m).*

### Installing Refrigerant Line

During the installation of any heat pump system, it is important to properly isolate the refrigerant lines to prevent unnecessary vibration. Line set contact with the structure (wall, ceiling or floor) causes some objectionable noise when vibration is translated into sound. As a result, more energy or vibration can be expected. Closer attention to line set isolation must be observed.

Following are some points to consider when placing and installing a high-efficiency outdoor unit:

1. **Placement -** Be aware some localities are adopting sound ordinances based on how noisy the unit is from the adjacent property not at the original installation. Install the unit as far as possible from the property line. When possible, do not install the unit directly outside a window. Glass has a very high level of sound transmission.
2. **Line Set Isolation -** The following illustrations demonstrate procedures which ensure proper refrigerant line set isolation. Figure 8 shows how to place the outdoor unit and line set. Figure 9 shows how to install line sets on horizontal runs. Figure 10 shows how to make a transition from horizontal to vertical. Figure 11 shows how to install line sets on vertical runs.

**Outside Unit Placement and Installation**

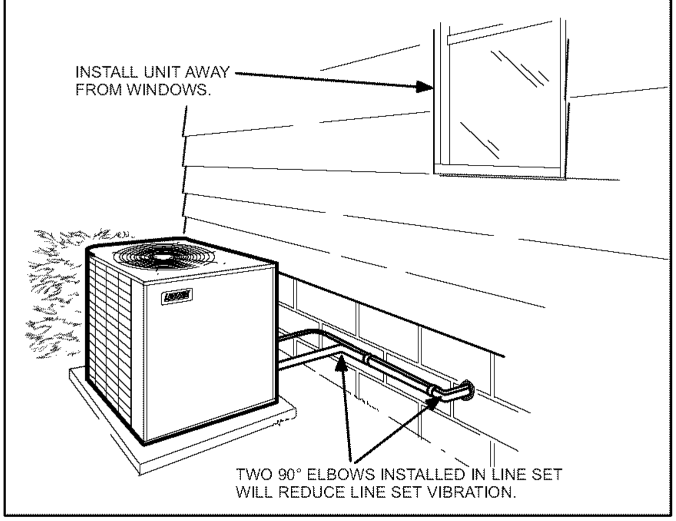



**Figure 8**

**Refrigerant Line Sets: Installing Horizontal Runs**

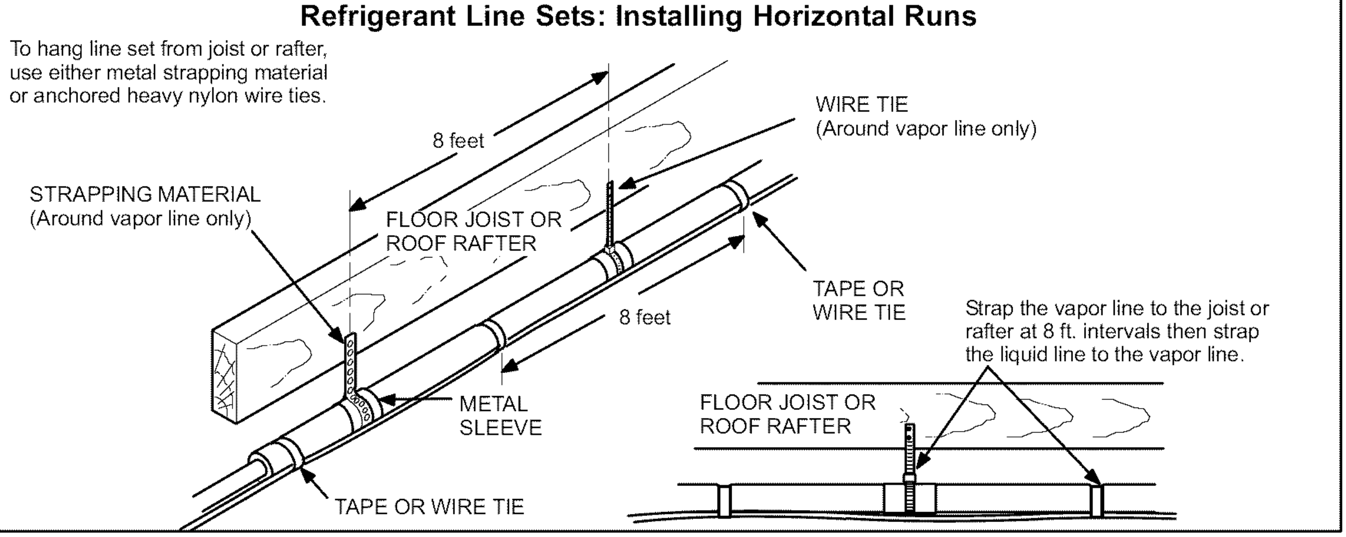



**Figure 9**

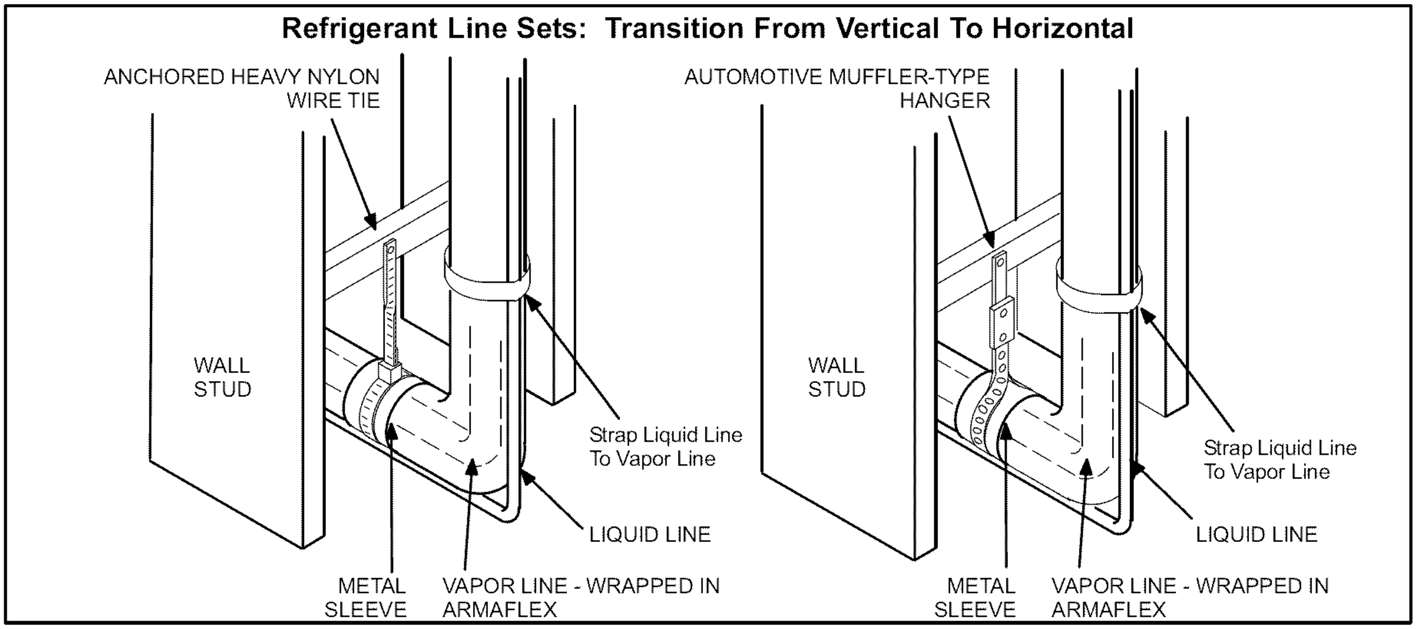



**Figure 10**

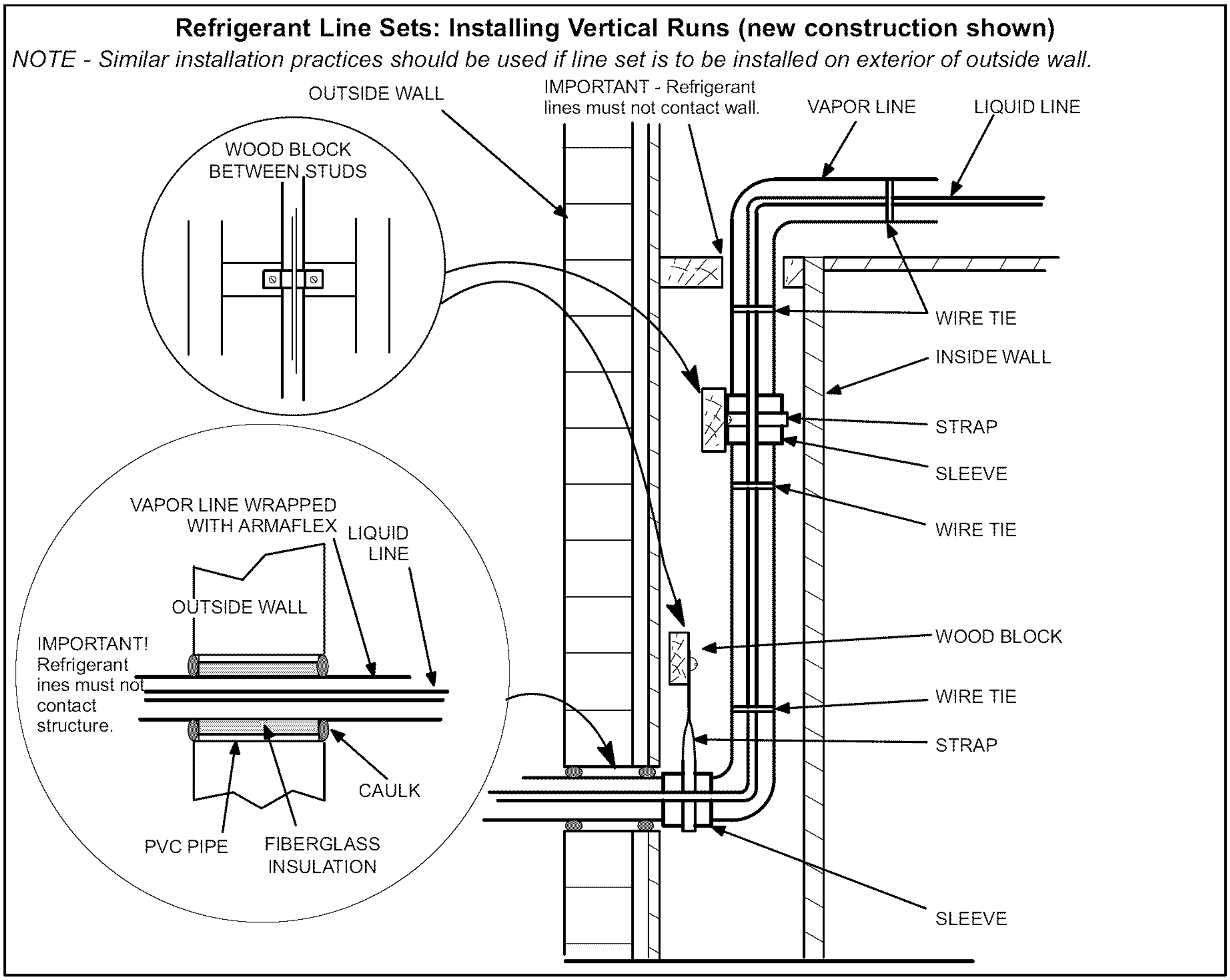



**Figure 11**

### Isolation Grommets

Locate the provided isolation grommets. Use a knife to slit the webbing on each grommet. Slide larger grommet onto vapor line and smaller grommet onto liquid line. Insert grommets into mullion to isolate refrigerant lines from sheet metal edges.

**⚠ WARNING**

**Polyol ester (POE) oils used with R-410A refrigerant absorb moisture very quickly. It is very important that the refrigerant system be kept closed as much as possible. DO NOT remove line set caps or service valve stub caps until you are ready to make connections.**

### Brazing Connection Procedure

1. Cut the end of the refrigerant line squarely; its internal shape must remain round. Debur the inside and outside diameter and be sure line is free of nicks or dents.
2. Before making line set connections, use dry nitrogen to purge the refrigerant piping. This helps prevent oxidation and introduction of moisture into the system.
3. Use silver alloy brazing rods (5 or 6 percent ***minimum*** silver alloy for copper-to-copper brazing or 45 percent silver alloy for copper-to-brass or copper-to-steel brazing). Wrap a wet cloth around the valve body and the copper tube stub. Remove light maroon washers from service valves and shield light maroon stickers in order to protect them during brazing. Braze the line set to the service valve.
4. Quench the joint with water or a wet cloth to prevent heat damage to the valve core and opening port.

**⚠ IMPORTANT**

**The tube end must stay bottomed in the fitting during final assembly to ensure proper seating, sealing and rigidity.**

## Refrigerant Metering Device

SPA units are used in check expansion valve systems only. See the Lennox Engineering Handbook for approved TXV match-ups and application information.

Check expansion valves equipped with Chatleff fittings are available from Lennox. Refer to the Engineering Handbook for applicable expansion valves for use with specific match-ups.

*If installing a check expansion valve with an indoor coil that includes a fixed orifice, remove the orifice before installing the check expansion valve.*

See figure 12 for indoor check expansion valve installation.

**Metering Device Installation**

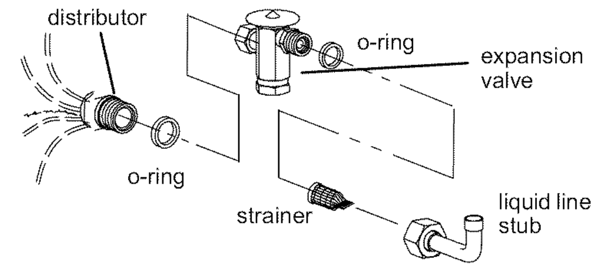



**Figure 12**

**⚠ IMPORTANT**

**Failure to remove RFC orifice when installing an expansion valve on the indoor coil will result in improper operation and damage to the system.**

## Flushing Existing Line Set & Indoor Coil

**⚠ WARNING**

**Danger of fire. Bleeding the refrigerant charge from only the high side may result in the low side shell and suction tubing being pressurized. Application of a brazing torch while pressurized may result in ignition of the refrigerant and oil mixture - check the high and low pressures before unbrazing.**

*NOTE - If the indoor unit line and set are new, skip this section and go on to the Manifold Gauge Set section.*

**⚠ IMPORTANT**

**If this unit is being matched with an approved line set or indoor coil that was previously charged with R-22 refrigerant, or if it is being matched with a coil that was manufactured before January of 1999, the coil and line set must be flushed prior to installation. Take care to empty all existing traps. Polyol ester (POE) oils are used in Lennox units charged with R-410A refrigerant. Residual mineral oil can act as an insulator, preventing proper heat transfer. It can also clog the thermal expansion valve, reducing system performance and capacity.**

**Failure to properly flush the system per the instructions below will void the warranty.**

**The Environmental Protection Agency prohibits the intentional venting of HFC refrigerants during maintenance, service, repair and disposal of appliance. Approved methods of recovery, recycling or reclaiming must be followed.**

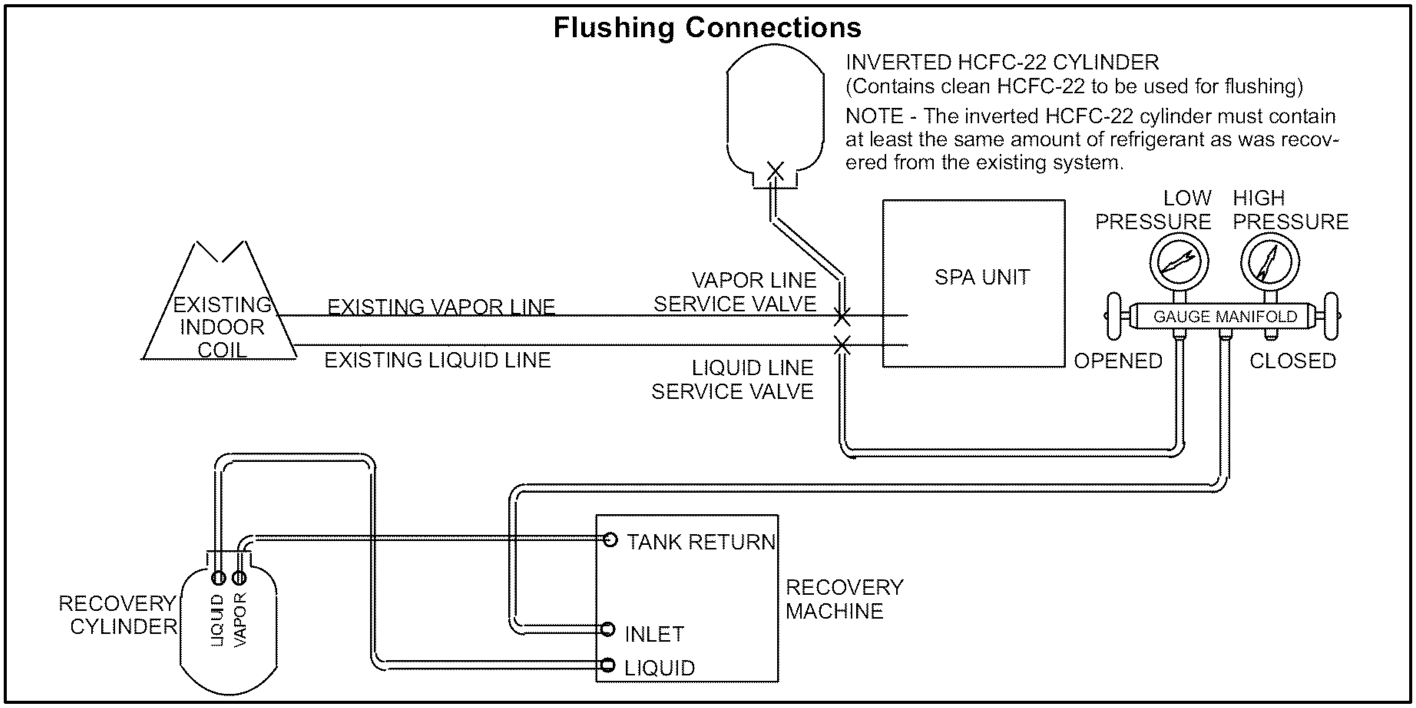



Figure 13

## ⚠ CAUTION

**This procedure should not be performed on systems which contain contaminants (Example: compressor burn out).**

### Required Equipment

You will need the following equipment in order to flush the existing line set and indoor coil: two clean R-22 recovery bottles, an oilless recovery machine with a pump down feature, and two sets of gauges (one for use with R-22 and one for use with R-410A).

### Flushing Procedure

1. Remove existing R-22 refrigerant using the appropriate procedure below.

   ***If the existing outdoor unit is not equipped with shut-off valves, or if the unit is not operational AND you plan to use the existing R-22 refrigerant to flush the system --*** Disconnect all power to the existing outdoor unit. Connect the existing unit, a **clean** recovery cylinder and the recovery machine according to the instructions provided with the recovery machine. Remove all R-22 refrigerant from the existing system. Refer to gauges after shutdown to confirm that the entire system is completely void of refrigerant. Disconnect the liquid and vapor lines from the existing outdoor unit.

   ***If the existing outdoor unit is equipped with manual shut-off valves AND you plan to use NEW R-22 refrigerant to flush the system --*** Start the existing R-22 system in the cooling mode and close the liquid line valve. Pump all of the existing R-22 refrigerant back into the outdoor unit. (It may be necessary to bypass the low pressure switches to ensure complete refrigerant evacuation.) When the low side system pressures reach 0 psig, close the vapor line valve. Disconnect all power to the existing outdoor unit. Refer to gauges after shutdown to confirm that the valves are not allowing refrigerant to flow back into the low side of the system. Disconnect the liquid and vapor lines from the existing outdoor unit.

2. Remove the existing outdoor unit. Set the new R-410A unit and follow the brazing connection procedure which begins on the previous page to make line set connections. DO NOT install metering device at this time.

   Make low voltage and line voltage connections to the new outdoor unit. **DO NOT turn on power to the unit or open the outdoor unit service valves at this time.**

## ⚠ IMPORTANT

**The line set and indoor coil must be flushed with at least the same amount of clean refrigerant that previously charged the system. Check the charge in the flushing cylinder before proceeding.**

3. Remove the existing refrigerant flow control orifice or thermal expansion/check valve before continuing with flushing procedures. The existing devices are not approved for use with R-410A refrigerant and may prevent proper flushing. Use a field-provided fitting to reconnect the lines.
4. Remove the pressure tap valve cores from the SPA unit's service valves. Connect an R-22 cylinder with clean refrigerant to the vapor service valve. Connect the R-22 gauge set to the liquid line valve and connect a recovery machine with an empty recovery tank to the gauge set.

5. Set the recovery machine for liquid recovery and start the recovery machine. Open the gauge set valves to allow the recovery machine to pull a vacuum on the existing system line set and indoor coil.
6. Invert the cylinder of clean R-22 and open its valve to allow liquid refrigerant to flow into the system through the vapor line valve. Allow the refrigerant to pass from the cylinder and through the line set and the indoor coil before it enters the recovery machine.
7. After all of the liquid refrigerant has been recovered, switch the recovery machine to vapor recovery so that all of the R-22 vapor is recovered.

   *NOTE - A single system flush should remove all of the mineral oil from the existing refrigerant lines and indoor coil. A second flushing may be done (using clean refrigerant) if insufficient amounts of mineral oil were removed during the first flush.* ***Each time the system is flushed, you must allow the recovery machine to pull a vacuum on the system at the end of the procedure.***
8. Close the valve on the inverted R-22 drum and the gauge set valves. Pump the remaining refrigerant out of the recovery machine and turn the machine off.
9. Use nitrogen to break the vacuum on the refrigerant lines and indoor coil before removing the recovery machine, gauges and R-22 refrigerant drum. Reinstall pressure tap valve cores into SPA service valves.
10. Install the provided check/expansion valve (approved for use with R-410A refrigerant) in the liquid line at the indoor coil.

## Manifold Gauge Set

### ⚠ IMPORTANT

**Manifold gauge sets used with systems charged with R-410A refrigerant must be capable of handling the higher system operating pressures. The gauges should be rated for use with pressures of 0 - 800 on the high side and a low side of 30" vacuum to 250 psi with dampened speed to 500 psi. Gauge hoses must be rated for use at up to 800 psi of pressure with a 4000 psi burst rating.**

## Service Valves

The service valves (liquid line - figure 14, vapor line - figures 15 and 16) and gauge ports are used for leak testing, evacuating, charging and checking charge. Each valve is equipped with a service port which has a factory-installed Schrader valve. A service port cap protects the Schrader valve from contamination and serves as the primary leak seal.

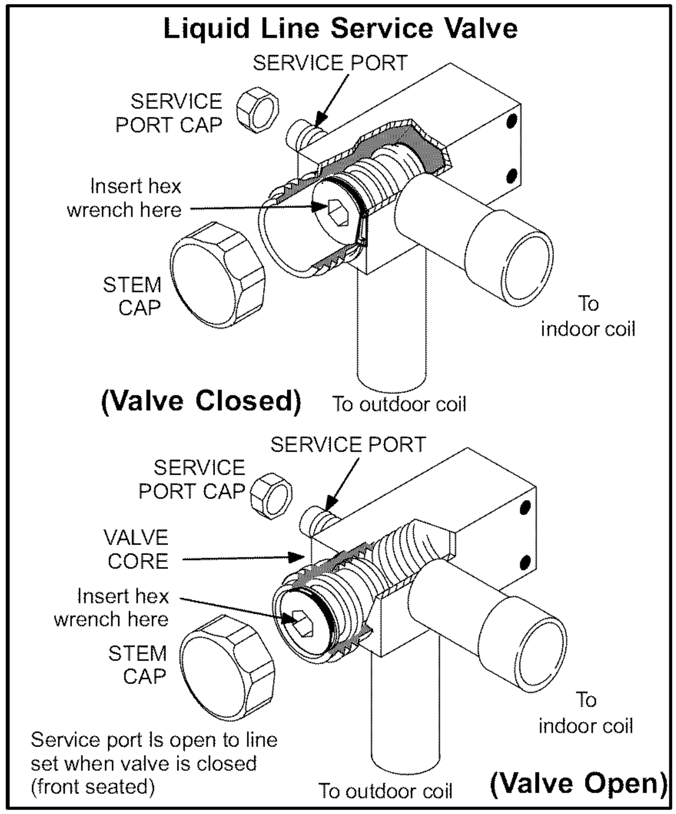



**Figure 14**

**Table 2**

| Torque Requirements | | |
|---|---|---|
| **Part** | **Recommended Torque** | |
| Service valve cap | 8 ft.- lb. | 11 NM |
| Sheet metal screws | 16 in.- lb. | 2 NM |
| Machine screws #10 | 28 in.- lb. | 3 NM |
| Compressor bolts | 90 in.- lb. | 10 NM |
| Gauge port seal cap | 8 ft.- lb. | 11 NM |

### ⚠ IMPORTANT

**Service valves are closed to the outdoor unit and open to line set connections. Do not open the valves until refrigerant lines have been leak tested and evacuated. All precautions should be exercised to keep the system free from dirt, moisture and air.**

### To Access Schrader Port:

1. Remove service port cap with an adjustable wrench.
2. Connect gauge to the service port.
3. When testing is complete, replace service port cap. Tighten finger tight; then tighten per table 2.

### To Open and Close Service Valve:

1. Remove stem cap with an adjustable wrench.
2. Using service wrench and hex head extension *(3/16" extension for liquid line sizes)*, back the stem out counterclockwise as far as it will go.
3. Replace stem cap and tighten it firmly. Tighten finger tight; then tighten per table 2.

### To Close Service Valve:

1. Remove stem cap with an adjustable wrench.
2. Using service wrench and hex head extension *(3/16" extension for liquid line sizes)*, turn stem clockwise to seat valve. Tighten it firmly.
3. Replace stem cap. Tighten finger tight; then tighten per table 2.

### Vapor Line Ball Valve

Ball-type service valves (figures 15 and 16) function the same way as the other valves but cannot be rebuilt; if one fails, replace with a new valve. The ball valve is equipped with a service port with a factory-installed Schrader valve. A service port cap protects the Schrader valve from contamination and assures a leak-free seal.

**Ball-Type Vapor Valve (Valve Open)**

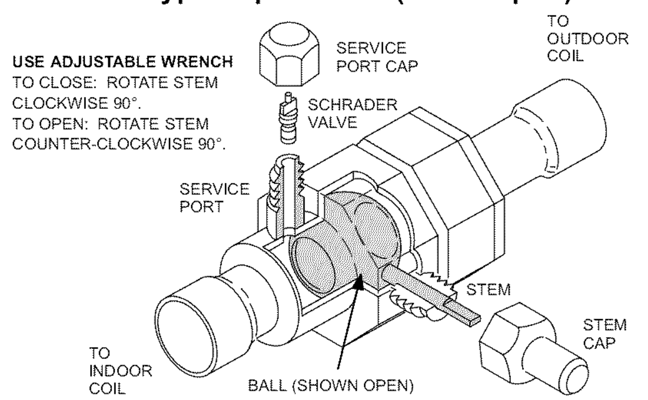



**Figure 15**

**Ball-Type Vapor Valve (Valve Closed)**

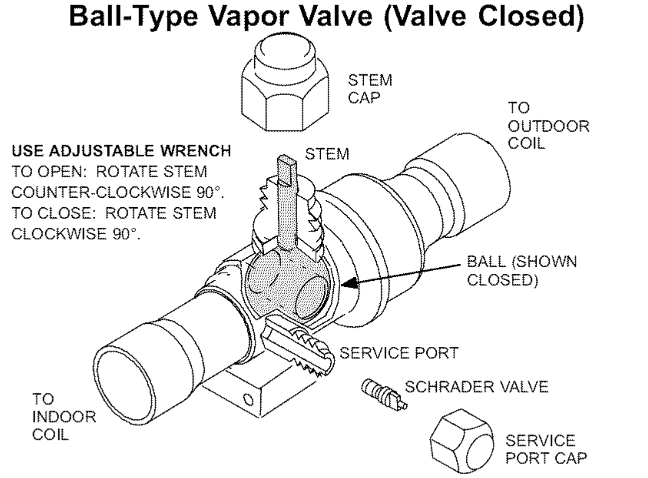



**Figure 16**

## Leak Testing

After the line set has been connected to the indoor and outdoor units, the line set connections and indoor unit must be checked for leaks.

**⚠ WARNING**

**Refrigerant can be harmful if it is inhaled. Refrigerant must be used and recovered responsibly. Failure to follow this warning may result in personal injury or death.**

**⚠ WARNING**

**Danger of explosion: Can cause equipment damage, injury or death. Never use oxygen to pressurize a refrigeration or air conditioning system. Oxygen will explode on contact with oil and could cause personal injury.**

**⚠ WARNING**

**Danger of explosion: Can cause equipment damage, injury or death. When using a high pressure gas such as dry nitrogen to pressurize a refrigeration or air conditioning system, use a regulator that can control the pressure down to 1 or 2 psig (6.9 to 13.8 kPa).**

### Using an Electronic Leak Detector

1. Connect a cylinder of R-410A to the center port of the manifold gauge set.
2. With both manifold valves closed, open the valve on the R-410A cylinder (vapor only).
3. Open the high pressure side of the manifold to allow the R-410A into the line set and indoor unit. Weigh in a trace amount of R-410A. [A trace amount is a maximum of 2 ounces (57 g) or 3 pounds (31 kPa) pressure.] Close the valve on the R-410A cylinder and the valve on the high pressure side of the manifold gauge set. Disconnect the R-410A cylinder.
4. Connect a cylinder of nitrogen with a pressure regulating valve to the center port of the manifold gauge set.
5. Connect the manifold gauge set high pressure hose to the vapor valve service port. *(Normally, the high pressure hose is connected to the liquid line port; however, connecting it to the vapor port better protects the manifold gauge set from high pressure damage.)*
6. Adjust the nitrogen pressure to 150 psig (1034 kPa). Open the valve on the high side of the manifold gauge set which will pressurize line set and indoor unit.
7. After a few minutes, open a refrigerant port to ensure the refrigerant you added is adequate to be detected. (Amounts of refrigerant will vary with line lengths.) Check all joints for leaks. Purge nitrogen and R-410A mixture. Correct any leaks and recheck.

**⚠ IMPORTANT**

**Leak detector must be capable of sensing HFC refrigerant.**

## Evacuation

Evacuating the system of noncondensables is critical for proper operation of the unit. Noncondensables are defined as any gas that will not condense under temperatures and pressures present during operation of an air conditioning system. Noncondensables and water vapor combine with refrigerant to produce substances that corrode copper piping and compressor parts.

**⚠ IMPORTANT**

**Use a thermocouple or thermistor electronic vacuum gauge that is calibrated in microns. Use an instrument that reads from 50 microns to at least 23,000 microns.**

1. Connect the manifold gauge set to the service valve ports as follows:
   - low pressure gauge to *vapor* line service valve
   - high pressure gauge to *liquid* line service valve
2. Connect micron gauge.
3. Connect the vacuum pump (with vacuum gauge) to the center port of the manifold gauge set.
4. Open both manifold valves and start vacuum pump.
5. Evacuate the line set and indoor unit to an **absolute pressure** of 23,000 microns (29.01 inches of mercury). During the early stages of evacuation, it is desirable to close the manifold gauge valve at least once to determine if there is a rapid rise in absolute pressure. A rapid rise in pressure indicates a relatively large leak. If this occurs, repeat the leak testing procedure.

   *NOTE - "Absolute pressure" means the total actual pressure within a given volume or system, above the absolute zero of pressure. Absolute pressure in a vacuum is equal to atmospheric pressure minus vacuum pressure.*
6. When the absolute pressure reaches 23,000 microns (29.01 inches of mercury), close the manifold gauge valves, turn off the vacuum pump and disconnect the manifold gauge center port hose from vacuum pump. Attach the manifold center port hose to a nitrogen cylinder with pressure regulator set to 150 psig (1034 kPa) and purge the hose. Open the manifold gauge valves to break the vacuum in the line set and indoor unit. Close the manifold gauge valves.

**⚠ WARNING**

**Danger of Equipment Damage. Avoid deep vacuum operation. Do not use compressors to evacuate a system.**

**Extremely low vacuums can cause internal arcing and compressor failure. Damage caused by deep vacuum operation will void warranty.**

7. Shut off the nitrogen cylinder and remove the manifold gauge hose from the cylinder. Open the manifold gauge valves to release the nitrogen from the line set and indoor unit.
8. Reconnect the manifold gauge to the vacuum pump, turn the pump on, and continue to evacuate the line set and indoor unit until the absolute pressure does not rise above 500 microns (29.9 inches of mercury) within a 20-minute period after shutting off the vacuum pump and closing the manifold gauge valves.
9. When the absolute pressure requirement above has been met, disconnect the manifold hose from the vacuum pump and connect it to an upright cylinder of R-410A refrigerant. Open the manifold gauge valves to break the vacuum from 1 to 2 psig positive pressure in the line set and indoor unit. Close manifold gauge valves and shut off the R-410A cylinder and remove the manifold gauge set.

## Start-Up

**⚠ IMPORTANT**

**If unit is equipped with crankcase heater, it should be energized 24 hours before unit start-up to prevent compressor damage as a result of slugging.**

1. Rotate fan to check for frozen bearings or binding.
2. Inspect all factory- and field-installed wiring for loose connections.
3. After evacuation is complete, open the liquid line and vapor line service valves (ccw) to release refrigerant charge (contained in outdoor unit) into the system.
4. Replace stem caps and secure finger tight, then tighten an additional (1/6) one-sixth of a turn.
5. Check voltage supply at the disconnect switch. The voltage must be within the range listed on the unit nameplate. If not, do not start the equipment until the power company has been consulted and the voltage condition has been corrected.
6. Set the thermostat for a cooling demand, turn on power to indoor blower unit and close the outdoor unit disconnect to start the unit.
7. Recheck voltage while the unit is running. Power must be within range shown on the nameplate.

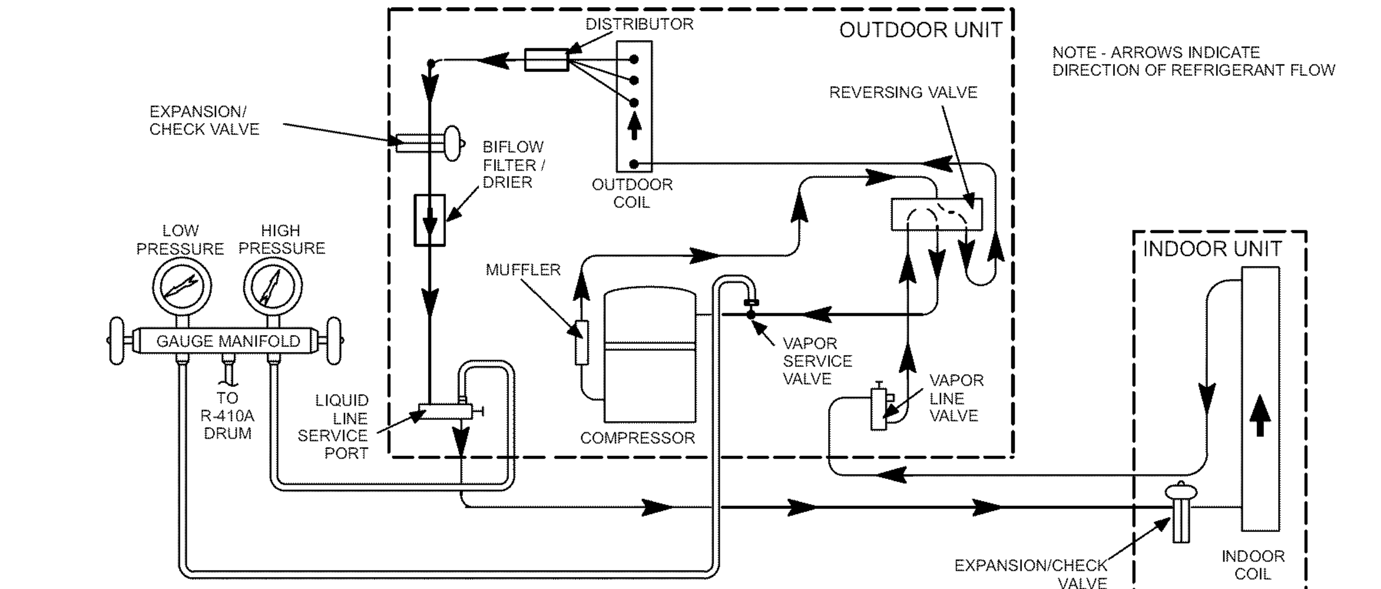
### Three-Phase Compressor Rotation

Three-phase scroll compressors must be phased sequentially to ensure correct compressor rotation and operation. At compressor start-up, a rise in discharge and drop in vapor pressures indicate proper compressor phasing and operation. If discharge and vapors pressures do not perform normally, follow these steps to correctly phase in the unit:

1. Disconnect power to the unit.
2. Reverse any two field power leads to the unit.
3. Reapply power to the unit.

Discharge and vapor pressures should operate at their normal start-up ranges.

## SPA Cooling Cycle (Showing Gauge Manifold Connections)




NOTE - Use gauge ports on vapor line valve and liquid valve for evacuating refrigerant lines and indoor coil. Use vapor gauge port to measure vapor pressure during charging.

**Figure 17**

## ⚠ IMPORTANT

**Compressor noise level will be significantly higher when phasing is incorrect and the unit will not provide cooling when compressor is operating backwards. Continued backward operation will cause the compressor to cycle on internal protector.**

## Refrigerant Charging

System is charged with R-410A refrigerant and operates at much higher pressures than R-22. The field-provided check/expansion valve for indoor unit must be approved for use with R-410A. This unit is NOT approved for use with coils which include metering orifices or capillary tubes.

### Processing Procedure

The unit is factory-charged with the amount of R-410A refrigerant indicated on the unit rating plate. This charge is based on a matching indoor coil and outdoor coil with a 15 foot (4.6 m) line set. For varying lengths of line set, refer to table 3 for refrigerant charge adjustment.

**Table 3**

**Refrigerant Charge per Line Set Lengths**

| Liquid Line Set Diameter | Oz. per 5 ft. (g per 1.5 m) adjust from 15 ft. (4.6 m) line set* |
|---|---|
| 3/8 in. (9.5 mm) | 3 ounce per 5 ft. (85 g per 1.5 m) |

*NOTE - *If line length is greater than 15 ft. (4.6 m), add this amount; if less than 15 ft. (4.6 m), subtract this amount.*

## ⚠ IMPORTANT

**Mineral oils are not compatible with R-410A. If oil must be added, it must be a polyol ester oil.**

The compressor is charged with sufficient polyol ester oil for line set lengths up to 50 ft. The outdoor unit should be charged during warm weather. However, applications arise in which charging must occur in the colder months. *The method of charging is determined by the outdoor ambient temperature.* Measure the liquid line temperature and the outdoor ambient temperature as outlined below:

1. Connect manifold gauge set to service valves as shown in figure 17:
   - low pressure gauge to *vapor* valve service port
   - high pressure gauge to *liquid* valve service port

   Connect the center manifold hose to an upright cylinder of R-410A. Close manifold gauge set valves.
2. Set the room thermostat to call for heat. This will create the necessary load for properly charging the system in the cooling cycle.
3. Use a digital thermometer to record the outdoor ambient temperature.
4. When the heating demand has been satisfied, switch the thermostat to cooling mode with a set point of 68°F (20°C). When pressures have stabilized, use a digital thermometer to record the liquid line temperature.
5. The outdoor temperature will determine which charging method to use. Proceed with the appropriate charging procedure.

### Weighing in the Charge – Outdoor Temperature < 65°F (18°C)

If system is void of refrigerant, or if the outdoor ambient temperature is cool, the refrigerant charge should be weighed into the unit after any leaks are repaired:

1. Recover the refrigerant from the unit.
2. Conduct a leak check, then evacuate as previously outlined.
3. Weigh in the unit nameplate charge.

If weighing facilities are not available or if you are charging the unit during warm weather, follow one of the other procedures outlined below.

## Subcooling Method - Outdoor Temperature < 65°F (18°C)

When the outdoor ambient temperature is below 65°F (18°C), use the subcooling method to charge the unit. It may be necessary to restrict air flow through the outdoor coil to achieve pressures in the 325-375 psig (2240-2585 kPa) range—higher pressures are necessary for checking the charge. Block equal sections of air intake panels and move obstructions sideways until the liquid pressure is in the 325-375 psig (2240-2585 kPa) range. See figure 18.

**Blocking Outdoor Coil**

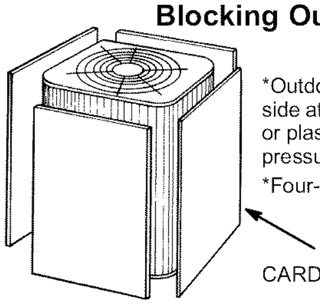



**Figure 18**

1. With the manifold gauge hose still on the liquid service port and the unit operating stably, use a digital thermometer to record the liquid line temperature.
2. At the same time, record the liquid line pressure reading.
3. Use a temperature/pressure chart for R-410A (table 4) to determine saturation temperature for the liquid line pressure reading.
4. Subtract the liquid line temperature from the saturation temperature (from table 4) to determine subcooling. (Saturation temp. - Liquid line temp. = Subcooling)
5. Compare the subcooling value with those in table 5. If subcooling is greater than shown, recover some refrigerant. If subcooling is less than shown, add some refrigerant. Be aware of the R-410A refrigerant cylinder. It will be light maroon-colored. Refrigerant should be added through the vapor line valve in the liquid state.

   *NOTE - Some R-410A cylinders are equipped with a dip tube that allows you to draw liquid refrigerant from the bottom of the cylinder without turning the cylinder upside-down. The cylinder will be marked if it is equipped with a dip tube.*

**Table 4**

**R-410A Temp. (°F) - Pressure (Psig) Chart**

| °F | Psig | °F | Psig | °F | Psig | °F | Psig |
|---|---|---|---|---|---|---|---|
| 32 | 100.8 | 63 | 178.5 | 94 | 290.8 | 125 | 445.9 |
| 33 | 102.9 | 64 | 181.6 | 95 | 295.1 | 126 | 451.8 |
| 34 | 105.0 | 65 | 184.3 | 96 | 299.4 | 127 | 457.6 |
| 35 | 107.1 | 66 | 187.7 | 97 | 303.8 | 128 | 463.5 |
| 36 | 109.2 | 67 | 190.9 | 98 | 308.2 | 129 | 469.5 |
| 37 | 111.4 | 68 | 194.1 | 99 | 312.7 | 130 | 475.6 |
| 38 | 113.6 | 69 | 197.3 | 100 | 317.2 | 131 | 481.6 |
| 39 | 115.8 | 70 | 200.6 | 101 | 321.8 | 132 | 487.8 |
| 40 | 118.0 | 71 | 203.9 | 102 | 326.4 | 133 | 494.0 |
| 41 | 120.3 | 72 | 207.2 | 103 | 331.0 | 134 | 500.2 |
| 42 | 122.6 | 73 | 210.6 | 104 | 335.7 | 135 | 506.5 |
| 43 | 125.0 | 74 | 214.0 | 105 | 340.5 | 136 | 512.9 |
| 44 | 127.3 | 75 | 217.4 | 106 | 345.3 | 137 | 519.3 |
| 45 | 129.7 | 76 | 220.9 | 107 | 350.1 | 138 | 525.8 |
| 46 | 132.2 | 77 | 224.4 | 108 | 355.0 | 139 | 532.4 |
| 47 | 134.6 | 78 | 228.0 | 109 | 360.0 | 140 | 539.0 |
| 48 | 137.1 | 79 | 231.6 | 110 | 365.0 | 141 | 545.6 |
| 49 | 139.6 | 80 | 235.3 | 111 | 370.0 | 142 | 552.3 |
| 50 | 142.2 | 81 | 239.0 | 112 | 375.1 | 143 | 559.1 |
| 51 | 144.8 | 82 | 242.7 | 113 | 380.2 | 144 | 565.9 |
| 52 | 147.4 | 83 | 246.5 | 114 | 385.4 | 145 | 572.8 |
| 53 | 150.1 | 84 | 250.3 | 115 | 390.7 | 146 | 579.8 |
| 54 | 152.8 | 85 | 254.1 | 116 | 396.0 | 147 | 586.8 |
| 55 | 155.5 | 86 | 258.0 | 117 | 401.3 | 148 | 593.8 |
| 56 | 158.2 | 87 | 262.0 | 118 | 406.7 | 149 | 601.0 |
| 57 | 161.0 | 88 | 266.0 | 119 | 412.2 | 150 | 608.1 |
| 58 | 163.9 | 89 | 270.0 | 120 | 417.7 | 151 | 615.4 |
| 59 | 166.7 | 90 | 274.1 | 121 | 423.2 | 152 | 622.7 |
| 60 | 169.6 | 91 | 278.2 | 122 | 428.8 | 153 | 630.1 |
| 61 | 172.6 | 92 | 282.3 | 123 | 434.5 | 154 | 637.5 |
| 62 | 175.4 | 93 | 286.5 | 124 | 440.2 | 155 | 645.0 |

**Table 5**

**Subcooling Values for Charging**

| Model Number | Second Stage (High Capacity) Subcooling Values Conversion Temp. - Liquid Line Temp. °F (°C) |
|---|---|
| SPA036 | 8.5 ± 1 (4.7 ± .5) |
| SPA048 | 7.5 ± 1 (4.1 ± .5) |
| SPA060 | 7.0 ± 1 (3.9 ± .5) |



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## Charging Using Normal Operating Pressures & Approach Method - Outdoor Temp. ≥65°F (18°C)

The following procedure is intended as a general guide and is for use on expansion valve systems only. For best results, indoor temperature should be 70°F (21°C) to 80°F (26°C). Monitor system pressures while charging.

1. Record outdoor ambient temperature using a digital thermometer.
2. Attach high pressure gauge set and operate unit for several minutes to allow system pressures to stabilize.
3. Compare stabilized pressures with those provided in tables 7 and 8, "Normal Operating Pressures."

> **⚠ IMPORTANT**
>
> **Use tables 7 & 8 as a general guide when performing maintenance checks. This is not a procedure for charging the unit.**
>
> **Minor variations in these pressures may be expected due to differences in installations. Significant differences could mean that the system is not properly charged or that a problem exists with some component in the system.**
>
> **Pressures higher than those listed indicate that the system is overcharged. Pressures lower than those listed indicate that the system is undercharged. Verify adjusted charge using the approach method.**

4. Use the digital thermometer used to check outdoor ambient temperature to check liquid line temperature. Verify the unit charge using the approach method.
5. The difference between the ambient and liquid temperatures should match values given in table 6—if not, add refrigerant to lower the approach temperature or recover refrigerant from the system to increase the approach temperature.

### Table 6

**Approach Values for Charging**

| Model Number | Second Stage (High Capacity) Approach Temperature Liquid Line Temp. - Outdoor Ambient °F (°C) |
|---|---|
| SPA036 | 7.0 ± 1 (3.9 ± .5) |
| SPA048 | 8.0 ± 1 (4.4 ± .5) |
| SPA060 | 10.0 ± 1 (5.6 ± .5) |

### Table 7

**Normal Operating Pressures - Cooling Operation (Liquid ±10 and Vapor ±5 psig)***

| | SPA036 | | SPA048 | | SPA060 | |
|---|---|---|---|---|---|---|
| °F (°C)** | Liquid | Vapor | Liquid | Vapor | Liquid | Vapor |
| **First Stage (Low Capacity)** | | | | | | |
| 65 (18.3) | 227 | 142 | 222 | 140 | 225 | 140 |
| 75 (23.9) | 262 | 145 | 258 | 143 | 259 | 142 |
| 85 (29.4) | 305 | 146 | 298 | 145 | 293 | 146 |
| 95 (35.0) | 352 | 148 | 343 | 147 | 356 | 147 |
| 105 (40.6) | 403 | 152 | 402 | 147 | 408 | 147 |
| 115 (46.1) | 458 | 155 | 452 | 152 | 455 | 151 |
| **Second Stage (High Capacity)** | | | | | | |
| 65 (18.3) | 244 | 136 | 232 | 134 | 249 | 126 |
| 75 (23.9) | 282 | 139 | 266 | 136 | 289 | 134 |
| 85 (29.4) | 325 | 142 | 309 | 139 | 330 | 140 |
| 95 (35.0) | 377 | 144 | 359 | 142 | 378 | 143 |
| 105 (40.6) | 428 | 146 | 410 | 144 | 433 | 146 |
| 115 (49.0) | 488 | 148 | 468 | 147 | 492 | 149 |

**These are most-popular-match-up pressures. Indoor match up, indoor air quality, and indoor load cause pressures to vary.*

***Temperature of the air entering the outside coil.*

### Table 8

**Normal Operating Pressures: Heating Operation (Liquid ±10 and Vapor ±5 psig)***

| | SPA036 | | SPA048 | | SPA060 | |
|---|---|---|---|---|---|---|
| °F (°C)** | Liquid | Vapor | Liquid | Vapor | Liquid | Vapor |
| **First Stage (Low Capacity)** | | | | | | |
| 40 (4.4) | 296 | 95 | 315 | 97 | 319 | 93 |
| 50 (10.0) | 310 | 112 | 330 | 114 | 335 | 111 |
| **Second Stage (High Capacity)** | | | | | | |
| 20 (-6.6) | 277 | 60 | 294 | 60 | 300 | 57 |
| 30 (-1.1) | 296 | 74 | 303 | 75 | 312 | 70 |
| 40 (4.4) | 321 | 88 | 314 | 90 | 323 | 83 |
| 50 (10.0) | 341 | 104 | 325 | 106 | 339 | 97 |

**These are most-popular-match-up pressures. Indoor match up, indoor air quality, and indoor load cause pressures to vary.*

***Temperature of the air entering the outside coil.*

## Emergency Heat (Amber Light)

An emergency heat function is designed into some room thermostats. This feature is applicable when isolation of the outdoor unit is required, or when auxiliary electric heat is staged by outdoor thermostats. When the room thermostat is placed in the emergency heat position, the outdoor unit control circuit is isolated from power and field-provided relays bypass the outdoor thermostats. An amber indicating light simultaneously comes on to remind the homeowner that he is operating in the emergency heat mode.

Emergency heat is usually used during an outdoor unit shutdown, but it should also be used following a power outage if power has been off for over an hour and the outdoor temperature is below 50°F (10°C). System should be left in the emergency heat mode at least six hours to allow the crankcase heater sufficient time to prevent compressor slugging.

## Filter Drier

The unit is equipped with a large-capacity biflow filter drier which keeps the system clean and dry. If replacement is necessary, order another of like design and capacity. The replacement filter drier must be suitable for use with R-410A refrigerant.

## Low Ambient Thermostat (second stage) S23

The low ambient thermostat S23 (figure 19) is a SPST thermostat and is located in the unit control box. The cap-tube sensor is coiled adjacent to the control.

**Low Ambient Thermostat S23**

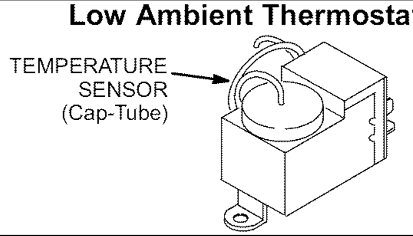



**Figure 19**

# System Operation

The outdoor unit and indoor blower cycle on demand from the room thermostat. When the thermostat blower switch is in the **ON** position, the indoor blower operates continuously.

## Thermostat Operation

Some indoor thermostats incorporate isolating contacts and an emergency heat function (which includes an amber indicating light). The thermostat is not included with the unit and must be purchased separately.

The S23 thermostat continually monitors the temperature inside the control box. When the control box temperature drops below the control setpoint, the control closes. When the control closes, the contacts shunt across Y1 and Y2 inside the unit. When heating demand is present and the S23 is closed, the compressor will run in two-stage mode.

The S23 has field-adjustable setpoints. Temperature differential (difference between cut-in/cut-out) is fixed (not adjustable). Table 9 shows S23 thermostat setpoints. The factory-set thermostat closes at 40±2°F on a temperature drop and resets at 50±2°F on a temperature rise.

Regional climatic conditions may require the control to be adjusted to a different setting. The adjustment screw is located on the bottom of the control box. A hole cut into the bottom shelf of the control box provides access to the second stage control adjustment screw from the compressor compartment. See figure 20.

**Adjusting Low Ambient Thermostat**

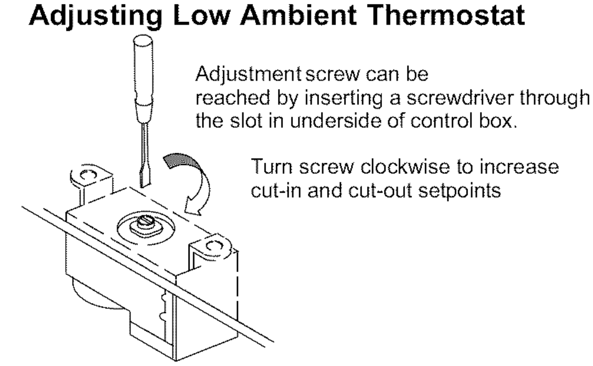



**Figure 20**

**Table 9**

| Low Ambient Thermostat Setpoints | | | |
|---|---|---|---|
| **Low Ambient Thermostat Adjustable Range** | **Factory Setting** | **Min.** | **Max.** |
| Cut-In (Close on Temperature Drop) | 40±2°F | 37±2°F | 55±2°F |
| Cut-Out (Open on Temperature Rise) | 50±2°F | 47±2°F | 65±2°F |

Figure 21 shows the adjustment range of the control. Turn adjustment screw clockwise to raise the switchover temperature and counterclockwise to lower the switchover temperature.

**Low Ambient Thermostat**

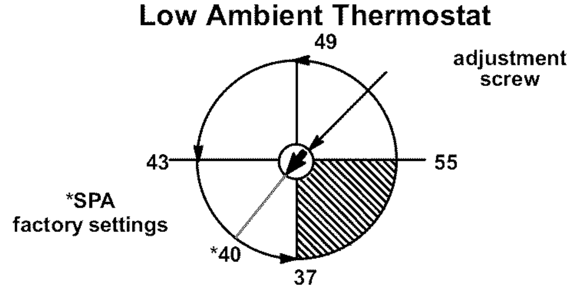



**Figure 21**

*NOTE - This control is located in the compressor compartment. The ambient temperature sensed may be 10 °F to 15°F higher than the outdoor ambient. The temperature sensed may vary because of long compressor run times, continuous crankcase heater operation, or direct sunlight.*

If this condition exists it can prevent the S23 from closing and restrict the unit to low capacity heating when there is a requirement for high capacity heat.

## Ambient Compensation Adjustments

In order to overcome this potential situation, there are two possible adjustments:

- The factory setting of the S23 can be reset to a higher temperature. This allows the controller to compensate for the ambient temperature differences. (Control setting 65ºF, compartment 65ºF - outdoor ambient 55ºF).
- Secondly, the capillary tube on the control can be routed with the low voltage thermostat wires. Because the capillary tube senses at its coldest point, temperature variation will be reduced between the control and the outdoor ambient temperature. (Keep capillary tube away from direct sunlight).

## Single-Stage Heating Application

In single-stage heat applications, the low ambient thermostat can be set to the highest setting. The system will operate in second-stage heating when the temperature drops below 55 ± 2°F, and returns to first-stage when the temperature rises above 65 ± 2°F. The low-stage heating capacity is approximates 70% of the high-stage heating capacity.

# Defrost System

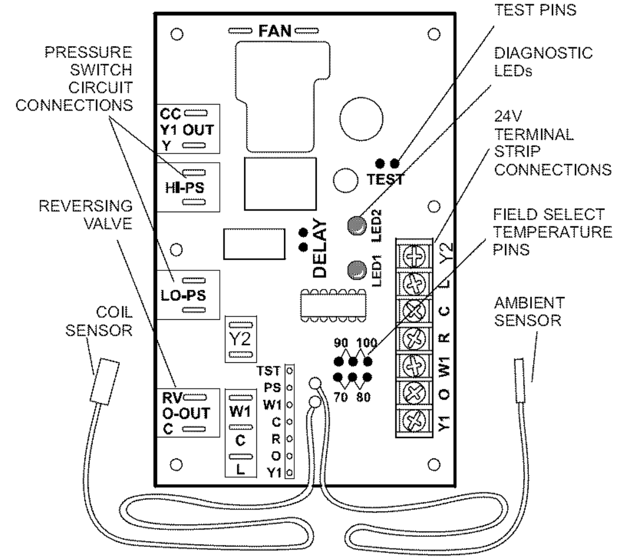
## Discharge Temperature Thermostat

Units are equipped with a discharge temperature thermostat that is located on the discharge line just below the muffler. The switch shuts off the compressor when the discharge line temperature rises above 250°F ± 5 (121°C ± -2.8) and resets at 200°F ± 11 (93°C ± -6.1).

## Demand Defrost System

The demand defrost controller uses basic differential temperature means to detect when the system performs poorly because of ice build-up on the outdoor coil. The controller also uses "self-calibrating" principles to calibrate itself when the system starts and after every time the system defrosts. The control board has the following components: defrost relays, anti-short cycle timed-off control, pressure switch/safety control, 5-trip lockout circuit, manufacturing test mode, ambient and coil temperature sensors, field selectable termination temperature pins, and a field low voltage connection terminal strip. See figure 22.

**SPA Defrost Control Board**




*NOTE - Component Locations Will Vary With Board Manufacturer*

**Figure 22**

The control monitors ambient temperature, outdoor coil temperature and total run time to determine when a defrost cycle is required. Two temperature probes are permanently attached to the control. The coil temperature probe is designed with a spring clip to allow mounting to the outside coil tubing. The location of the coil sensor is important for proper defrost operation.

*NOTE - The demand defrost board accurately measures the performance of the system as frost accumulates on the outdoor coil. This typically will translate into longer running time between defrost cycles as more frost accumulates on the outdoor coil before the board initiates defrost cycles.*

Temperature probes cannot be removed from the control. The control and the attached probes MUST be replaced as a unit. Do not attempt to cut or splice probe wires.

## Diagnostic LEDs

The defrost board uses two LEDs for diagnostics. The LEDs flash a specific sequence according to the diagnostic condition. See table 10.

### Low Pressure Switch (LO-PS)

The unit's automatic reset low pressure switch (S87) is factory-wired into the defrost board on the LO-PS terminals. When the low pressure switch trips, the defrost board will cycle off the compressor, and the strike counter in the board will count one strike. (S87) is ignored under the following conditions:

- during the defrost cycle and 90 seconds after the termination of defrost
- when the average ambient sensor temperature is below 15° F (-9°C)
- for 90 seconds following the start up of the compressor
- during "test" mode

### High Pressure Switch (HI-PS)

The unit's automatic reset high pressure switch (S4) is factory-wired into the defrost board on the HI-PS terminals. When the high pressure switch trips, the defrost board will cycle off the compressor, and the strike counter in the board will count one strike.

### 5-Strike Lockout Feature

- Internal control logic of the board counts the pressure switch trips only while the Y1 (Input) line is active. If a pressure switch opens and closes four times during a Y1 (Input), the control logic resets the pressure switch trip counter to zero at the end of the Y1 (Input). If the pressure switch opens for a fifth time during the current Y1 (Input), the control enters a lockout condition.
- The 5-strike pressure switch lockout condition can be reset by cycling OFF the 24-volt power to the control board or by shorting the TEST pins. All timer functions (run times) will also be reset.
- If a pressure switch opens while the Y1 Out line is engaged, a 5-minute short cycle will occur after the switch closes.

### Delay Mode

The defrost board has a field-selectable function to reduce occasional sounds that may occur while the unit is cycling in and out of the defrost mode. When a jumper is installed on the DELAY pins, the compressor will be cycled off for 30 seconds going in and out of the defrost mode. Units are shipped with jumper installed on DELAY pins.

*NOTE - The 30 second off cycle is not functional when jumpering the TEST pins.*

### Operational Description

The defrost control board has three operational modes:

1. Normal Mode - The demand defrost board monitors the O line, to determine the system operating mode (heat/cool), outdoor ambient temperature, coil temperature (outdoor coil) and compressor run time to determine when a defrost cycle is required.
2. Defrost Mode - See table 10 for defrost mode and demand defrost operation.
3. Calibration Mode - The board is considered uncalibrated when power is applied to the board, after cool mode operation, or if the coil temperature exceeds the termination temperature when it is in heat mode.

Calibration of the board occurs after a defrost cycle to ensure that there is no ice on the coil. During calibration, the temperature of both the coil and the ambient sensor are measured to establish the temperature differential which is required to allow a defrost cycle.

## Maintenance

Before the start of each heating and cooling season, the following service checks should be performed by a qualified service technician.

- **TURN OFF electrical power to the unit prior to unit maintenance.**

**⚠WARNING**

**Electric shock hazard. Can cause injury or death. Before attempting to perform any service or maintenance, turn the electrical power to unit OFF at disconnect switch(es). Unit may have multiple power supplies.**

- Inspect and clean the outdoor and indoor coils. The outdoor coil may be flushed with a water hose.

  *NOTE - It may be necessary to flush the outdoor coil more frequently if it is exposed to substances which are corrosive or which block airflow across the coil (e.g., pet urine, cottonwood seeds, etc.).*
- Visually inspect refrigerant lines and coils for leaks.
- Check wiring for loose connections.
- Check voltage at indoor and outdoor units during operation.
- Check the amp-draw at the outdoor fan motor, compressor, and indoor blower motor. Compare readings with values given on unit nameplate.
- Clean or replace indoor unit filters.
- Check refrigerant charge and system pressures.
- Check condensate drain line for free and unobstructed flow; clean if necessary.

  *Outdoor unit fan motor is prelubricated and sealed. No further lubrication is needed.*

  *NOTE - If owner reports insufficient cooling, the unit should be gauged and refrigerant charge checked. (See Refrigerant Charging on Page 13.)*

## Optional Accessories

Refer to the Engineering Handbook for optional accessories that may apply to this unit, e.g.:

- Loss of Charge Kit
- Compressor Monitor
- Hail Guards
- Mounting Bases
- Timed Off Control
- Stand-off Kit
- Sound Cover
- Low Ambient Kit
- Monitor Kit

## Table 10

<table>
<tr><th colspan="5">Defrost Control Board Diagnostic Led (5-Strike)</th></tr>
<tr><th>LED 1</th><th>LED 2</th><th>Condition</th><th>Possible Cause(s)</th><th>Solution</th></tr>
<tr><td>OFF</td><td>OFF</td><td>Power problem</td><td>1. No power (24V) to board terminals R & C.<br>2. Board failure.</td><td>1. Check control transformer power (24V).<br>2. If power is available and LED(s) are unlit, replace board and all sensors.</td></tr>
<tr><td>ON</td><td>ON</td><td>Coil sensor problem</td><td>1. Coil temperature outside of sensor range.<br>2. Faulty sensor wiring connections at board or poor sensor contact on coil.<br>3. Sensor failure.</td><td>1. Sensor function will resume when coil temperature is between -20°F and 110°F.<br>2. Check sensor wiring connections at board and sensor contact on coil.<br>3. Replace board and all sensors.</td></tr>
<tr><td>OFF</td><td>ON</td><td>Ambient sensor problem</td><td>1. Ambient temperature outside of sensor range.<br>2. Faulty sensor wiring connections at board or sensor.<br>3. Sensor failure.</td><td>1. Sensor function will resume when coil temperature is between -20°F and 110°F.<br>2. Check sensor wiring connections at board and sensor.<br>3. Replace board and all sensors.</td></tr>
<tr><td>Flash</td><td>Flash</td><td colspan="2">Normal operation or unit operating in standby mode.</td><td>(No action required.)</td></tr>
<tr><td>ON</td><td>OFF</td><td>5-Strike pressure lockout (Short test pins or reset 24V power to board to override lockout)</td><td rowspan="3">1. Restricted air flow over indoor or outdoor coil.<br>2. Improper refrigerant charge.<br>3. Improper metering device operation.<br>4. Poor contact between coil sensor and coil.</td><td rowspan="3">1. Remove blockages or restrictions. Check outdoor fan motor for proper operation.<br>2. Check approach, superheat & subcooling temperatures.<br>3. Check system pressures. Repair leaks. Replace metering device.<br>4. Be sure sensor is properly positioned on coil and that firm contact is established. Refer to service manual for proper placement.</td></tr>
<tr><td>ON</td><td>Flash</td><td>Low pressure switch circuit open during Y1 demand</td></tr>
<tr><td>Flash</td><td>ON</td><td>High pressure switch and/or discharge temp. thermostat circuit open during Y1 demand</td></tr>
<tr><td>Alternating Flash</td><td>Alternating Flash</td><td>5-minute delay (Jumper test pins to override delay)</td><td>Thermostat demand for cooling or heat pump operation. Unit operating in 5-minute anti-short-cycle mode.</td><td>None required.</td></tr>
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### Demand Defrost Operation

The demand defrost control board initiates a defrost cycle based on either frost detection or time.

**Frost Detection** - If the compressor runs longer than 34 minutes and the actual difference between the clear coil and frosted coil temperatures exceeds the maximum difference allowed by the control, a defrost cycle will be initiated.

***IMPORTANT:*** *The demand defrost control board will allow a greater accumulation of frost and will initiate fewer defrost cycles than a time/temperature defrost system.*

**Time** - If 6 hours of heating mode compressor run time has elapsed since the last defrost cycle while the coil temperature remains below 35°F (2°C), the demand defrost control will initiate a defrost cycle.

**Actuation** - When reversing valve is de-energized, the Y1 circuit is energized, and the coil temperature is below 35°F (2°C), the board logs the compressor run time. If the board is not calibrated, a defrost cycle will be initiated after 34 minutes of heating mode compressor run time. The control will attempt to self-calibrate after this (and all other) defrost cycle(s). Calibration success depends on stable system temperatures during the 20-minute calibration period. If the board fails to calibrate, another defrost cycle will be initiated after 90 minutes of heating mode compressor run time. Once the defrost board is calibrated, it will use demand defrost logic to initiate a defrost cycle. A demand defrost system initiates defrost when the difference between the clear coil and frosted coil temperatures exceeds the maximum difference allowed by the control OR after 6 hours of heating mode compressor run time has been logged since the last defrost cycle.

**Termination** - The defrost cycle ends when the coil temperature exceeds the termination temperature or after 14 minutes of defrost operation. If the defrost is terminated by the 14-minute timer, another defrost cycle will be initiated after 34 minutes of run time.

**Test Mode** - When Y1 is energized and 24V power is being applied to the board, a test cycle can be initiated by placing the termination temperature jumper across the “Test” pins for 2 to 5 seconds. If the jumper remains across the “Test” pins longer than 5 seconds, the control will ignore the test pins and revert to normal operation. The jumper will initiate one cycle per test.

## Start-Up and Performance Check List

Job Name ____________________ Job no. __________ Date __________

Job Location ____________________ City __________ State __________

Installer ____________________ City __________ State __________

Unit Model No. __________ Serial No. __________ Service Technician __________

Nameplate Voltage ____________________

Rated Load Ampacity __________ Compressor Amperage: 1st Stage__________ 2nd Stage: __________

Maximum Fuse or Circuit Breaker ____________________

Electrical Connections Tight? ❑ Indoor Filter clean? ❑ Supply Voltage (Unit Off) __________

Indoor Blower RPM ______ S.P. Drop Over Indoor (Dry) ________ Outdoor Coil Entering Air Temp. __________

**COOLING (2ND STAGE)**

Liquid Line Pressure:__________ Vapor Pressure: __________ Refrigerant Charge Checked? ❑

**HEATING (2ND STAGE)**

Liquid Line Pressure:__________ Vapor Pressure: __________ Refrigerant Charge Checked? ❑

Vapor Pressure; 1st Stage:________ 2nd Stage: __________

**Refrigerant Lines: -** Leak Checked? ❑ Properly Insulated? ❑ Outdoor Fan Checked? ❑

**Service Valves:** --- Fully Opened? ❑ Caps Tight? ❑ Voltage With Compressor Operating__________

**SEQUENCE OF OPERATION**

**Heating Correct**? ❑ Cooling Correct? ❑

**THERMOSTAT**

Calibrated? ❑ Properly Set? ❑ Level? ❑



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