

## SERVICE MANUAL

# RSG13



This is a safety alert symbol and should never be ignored. When you see this symbol on labels or in manuals, be alert to the potential for personal injury or death.



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### WARNING

Improper installation, adjustment, alteration, service or maintenance can cause property damage, personal injury or loss of life. Installation and service must be performed by a licensed professional HVAC installer (or equivalent), service agency or the gas supplier.

### 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.

### CAUTION

As with any mechanical equipment, contact with sharp sheet metal edges can result in personal injury. Take care while handling this equipment and wear gloves and protective clothing.



(P) 508226-01

# Technical Specifications - RSG13

## MODEL NUMBER GUIDE

<b>R</b>	<b>S</b>	<b>G</b>	<b>13</b>	<b>24</b>	<b>S</b>	<b>1</b>	<b>M</b>
Residential Condenser	Split System	'Green' Gas R-410A	SEER 13, 14, 16	Capacity BTUH x 1000	S = Scroll Compressor	Power 1 = 208/230-1-60	Series/ Revision

## ELECTRICAL AND PHYSICAL DATA

Model	Voltage/ Hz/ Phase	Voltage Range	Min. Circuit (Amps)	Max. Fuse (Amps) <sup>1</sup>	Compressor		Fan Motor			Refrig. Charge (oz.) <sup>2</sup>	Weight (lbs.)	
					Rated Load (Amps)	Locked Rotor (Amps)	Full Load (Amps)	Rated HP	Nom. RPM		Louvered	
RSG1318	208-230/60/1	197-253	10.9	15	8.1	39	0.7	1/10	1010	62	136	
RSG1324	208-230/60/1	197-253	14.1	20	10.7	53	0.7	1/10	1010	63	137	
RSG1330	208-230/60/1	197-253	15.6	25	11.6	59	1.1	1/5	1090	82	147	
RSG1330-1	208-230/60/1	197-253	17.1	25	12.8	68	1.1	1/5	1090	82	147	
RSG1336	208-230/60/1	197-253	20.1	35	15.2	70	1.1	1/5	1090	84	149	
RSG1336-1	208-230/60/1	197-253	20.4	35	15.4	84	1.1	1/5	1090	84	149	
RSG1342	208-230/60/1	197-253	28.1	45	21.1	90	1.7	1/4	825	104	194	
RSG1342-1	208-230/60/1	197-253	25.7	40	19.2	124	1.7	1/4	825	104	194	
RSG1348	208-230/60/1	197-253	31.9	50	24.1	100	1.7	1/4	825	124	192	
RSG1360	208-230/60/1	197-253	29.4	60	22.1	120	1.7	1/4	830	144	205	

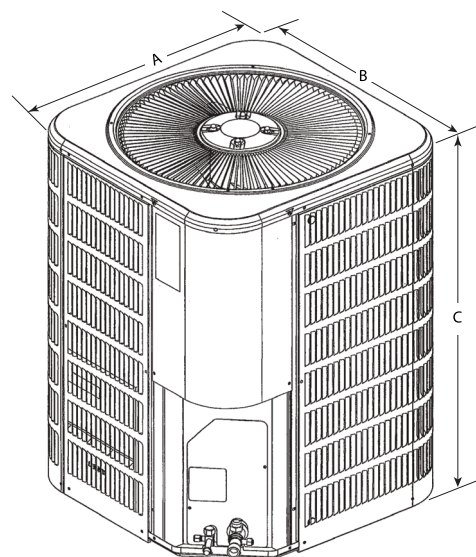
<sup>1</sup> Overcurrent protection device

<sup>2</sup> Factory charge adequate for 15 feet of line set. Adjust per Installation Instructions.

## UNIT DIMENSIONS & SOUND RATINGS

Note: Dimensions listed are unit sizes w/o packaging

Model	Dimensions			Sound Ratings (dBa)
	A - width (in.)	B - depth (in.)	C - height (in.)	
RSG1318	24-1/4	24-1/4	25	74
RSG1324	24-1/4	24-1/4	25	74
RSG1330	24-1/4	24-1/4	29	74
RSG1336	24-1/4	24-1/4	29	74
RSG1342	28-1/4	28-1/4	29	79
RSG1348	28-1/4	28-1/4	33	79
RSG1360	28-1/4	28-1/4	29	80



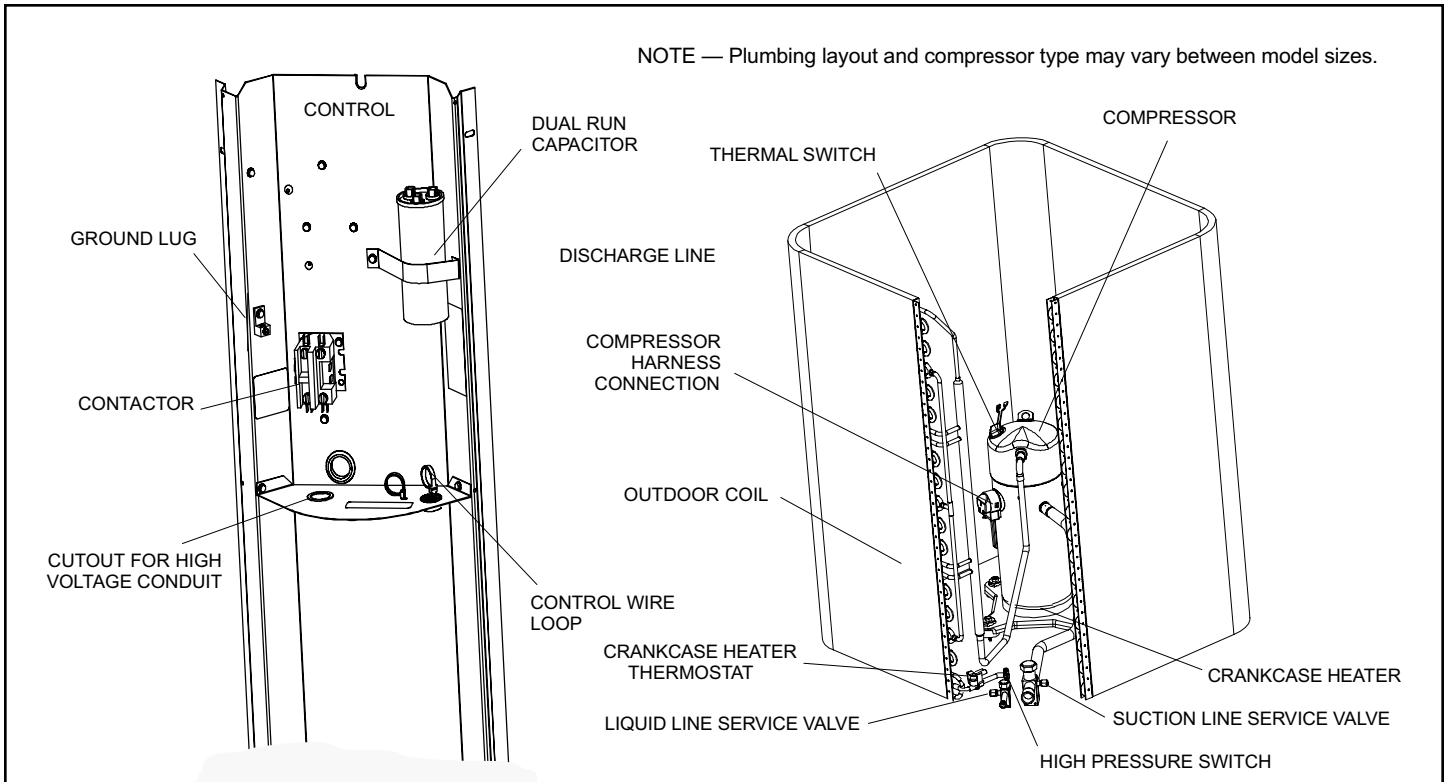
## REFRIGERANT CONNECTION SIZES

Model	Refrigerant Connection	
	Suction	Liquid
RSG1318	5/8"	3/8"
RSG1324	5/8"	3/8"
RSG1330	3/4"	3/8"
RSG1336	3/4"	3/8"
RSG1342	3/4"	3/8"
RSG1348	7/8"	3/8"
RSG1360	7/8"	3/8"

## ACCESSORIES

DESCRIPTION	WHERE USED	CATALOG NUMBER
Crankcase Heater	18, 24, 30, 36	93M04
Crankcase Heater	42, 48, 60	93M05
Hard Start Kit	18	10J42
Hard Start kit	24, 30, 36, 42, 48, 60	88M91
Compressor Low Ambient Kit	18, 24, 30, 36, 42, 48, 60	34M72
Sound Blanket	18, 24, 30, 36	14W00
	42, 48, 60	14W01
Short Cycle Protector	18, 24, 30, 36, 42, 48, 60	47J27
Freezestat	3/8" tubing	93G35
Freezestat	5/8" tubing	50A93
Time Delay Relay	18, 24, 30, 36, 42, 48, 60	58M81
Loss of Charge Kit	18, 24, 30, 36, 42, 48, 60	84M23
TXV Kit	18 - 30	H4TXV01
TXV Kit	36 - 48	H4TXV02
TXV Kit	60	H4TXV03
TXV Kit	18 - 36	4200
TXV Kit	42 - 60	4202

NOTE — Plumbing layout and compressor type may vary between model sizes.



**Figure 1. Typical Parts Arrangement**

## Refrigerant Metering Device - Indoor Coil

For correct metering device, refer to chart below.

Outdoor Model	Orifice Size	Indoor Expansion Device
RSG1318	0.053	A4TXV01
RSG1324	0.057	A4TXV01
RSG1330	0.065	A4TXV01
RSG1336	0.072	A4TXV01
RSG1342	0.074	A4TXV02
RSG1348	0.082	A4TXV02
RSG1360	0.093	A4TXV03

**Table 1.**

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

## Installation

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

- Locate unit away from windows, patios, decks, etc. where unit operation sounds may disturb customer.
- Leave some slack between structure and unit to absorb vibration.
- 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 living area or adjacent buildings.
- In heavy snow areas, do not locate the unit where drifting snow 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.

- When installed in areas where low ambient temperatures exist, locate unit so winter prevailing winds do not blow directly into outdoor coil.
- Locate unit away from overhanging roof lines which would allow water or ice to drop on, or in front of, coil or into unit.

When outdoor unit is connected to factory-approved indoor unit, outdoor unit contains system refrigerant charge for operation with matching indoor unit when connected by 15 ft. of field-supplied tubing. For proper unit operation, check refrigerant charge using charging information located on control box cover.

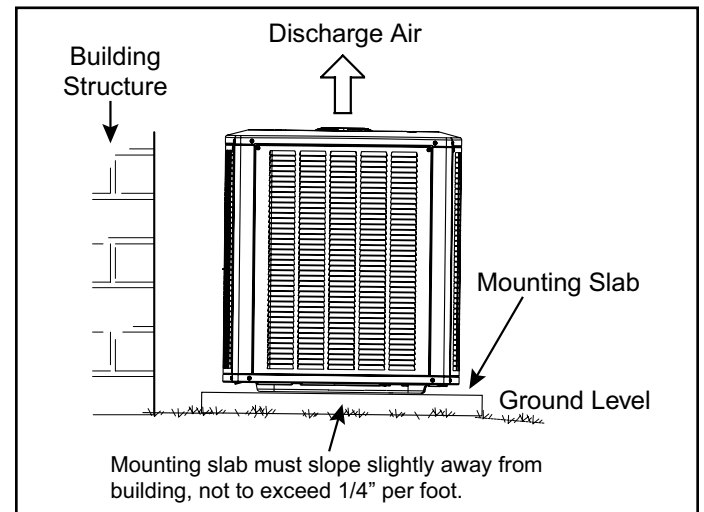
## Outdoor Section

Zoning ordinances may govern the minimum distance the condensing unit can be installed from the property line.

## Install on a Solid, Level Mounting Pad

The outdoor section is to be installed on a solid foundation. This foundation should extend a minimum of 2" (inches) beyond the sides of the outdoor section. To reduce the possibility of noise transmission, the foundation slab should NOT be in contact with or be an integral part of the building foundation. See Figure 2.

If conditions or local codes require the unit be attached to pad or mounting frame, tie down bolts should be used and secured to unit base pan.



**Figure 2. Slab Mounting**

## Elevate Unit

### ⚠ CAUTION

Accumulation of water and ice in base pan may cause equipment damage.

Elevate unit per local climate and code requirements to provide clearance above estimated snowfall level and ensure adequate drainage of unit. Use snow stand in areas where prolonged freezing temperatures are encountered.

If conditions or local codes require the unit be attached to pad or mounting frame, tie down bolts should be used and fastened through knockouts provided in unit base pan.

## Clearance Requirements

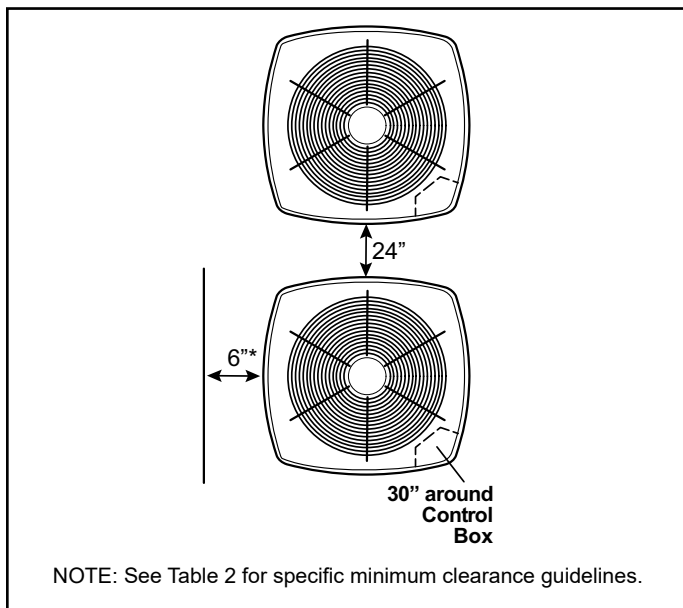
When installing, allow sufficient space for airflow clearance, wiring, refrigerant piping, and service. For proper airflow, quiet operation and maximum efficiency. Position so water, snow, or ice from roof or eaves cannot fall directly on unit. Refer to Table 2 for installation clearances.

Location	Minimum Clearance
Service box	30"
Top of unit*	48"
Between units	24"
Against wall	6"

\* Maximum soffit overhang is 36".

**NOTE:** At least one side should be unobstructed by a wall or other barrier.

**Table 2. Clearances**



**Figure 3.**

### DO LOCATE THE UNIT:

- With proper clearances on sides and top of unit
- On a solid, level foundation or pad (unit must be level to within  $\pm 1/4$  in./ft. per compressor manufacturer specifications)
- To minimize refrigerant line lengths

### DO NOT LOCATE THE UNIT:

- On brick, concrete blocks or unstable surfaces
- Near clothes dryer exhaust vents where debris accumulates
- Near sleeping area or near windows
- Under eaves where water, snow or ice can fall directly on the unit
- With clearance less than 2 ft. from a second unit
- With clearance less than 4 ft. on top of unit

## Rooftop Installations

Install unit at a minimum of 6" above surface of the roof to avoid ice buildup 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 cannot be mounted away from prevailing winds, a wind barrier should be constructed. Due to variation in installation applications, size and locate barrier according to the best judgment of the installer.

## Torque Requirements

When servicing or repairing heating, ventilating, and air conditioning components, ensure the fasteners are appropriately tightened. Table 3 lists torque values for fasteners.

### IMPORTANT

To prevent stripping of the various caps used, the appropriately sized wrench should be used and fitted snugly over the cap before tightening.

When servicing or repairing HVAC components, ensure the fasteners are appropriately tightened. Table 3 provides torque values for fasteners.

### IMPORTANT

Only use Allen wrenches of sufficient hardness (50Rc - Rockwell Harness Scale minimum). Fully insert the wrench into the valve stem recess.

Service valve stems are factory-torqued (from 9 ft-lbs for small valves, to 25 ft-lbs for large valves) to prevent refrigerant loss during shipping and handling. Using an Allen wrench rated at less than 50Rc risks rounding or breaking off the wrench, or stripping the valve stem recess.

Parts	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

**Table 3. Torque Requirements**

## Using Manifold Gauge Set

When checking the system charge, only use a manifold gauge set that features low loss anti-blow back fittings. Manifold gauge set used with HFC-410A refrigerant systems must be capable of handling the higher system operating pressures.

The gauges should be rated for use with pressures of 0 - 800 psig on the high side and a low side of 30" vacuum to 250 psig with dampened speed to 500 psi. Gauge hoses must be rated for use at up to 800 psig of pressure with a 4000 psig burst rating.

### Operating Service Valves

The liquid and vapor line service valves are used for removing refrigerant, flushing, leak testing, evacuating, checking charge and charging. Each valve is equipped with a service port which has a factory-installed valve stem.

### Liquid and Suction Line Service Valves

The liquid line and suction line service valves (see Figure 4) and service ports are used for leak testing, evacuation, 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.

#### To Access the Schrader Port:

1. Remove the service port cap with an adjustable wrench.
2. Connect gauge to the service port.
3. When testing is completed, replace service port cap. Tighten finger tight, then an additional 1/6 turn.

#### To Open Liquid or Suction Line Service Valve:

1. Remove stem cap with an adjustable wrench.
2. Use service wrench with a hex-head extension to back the stem out counterclockwise as far as it will go. Use a 3/16" hex head extension for liquid line service valves and a 5/16" extension for suction line service valves.
3. Replace the stem cap. Tighten finger tight, then tighten an additional 1/6 turn.

#### To Close Liquid or Suction Line Service Valve:

1. Remove the stem cap with an adjustable wrench.
2. Use a service wrench with a hex-head extension to turn the stem clockwise to seat the valve. Tighten firmly.
3. Replace the stem cap. Tighten finger tight, then tighten an additional 1/6 turn.

### Suction Line (Ball Type) Service Valve

Suction line (ball type) service valves function the same way as the other valves; the difference is in the construction (see Figure 5).

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 serves as the primary seal.

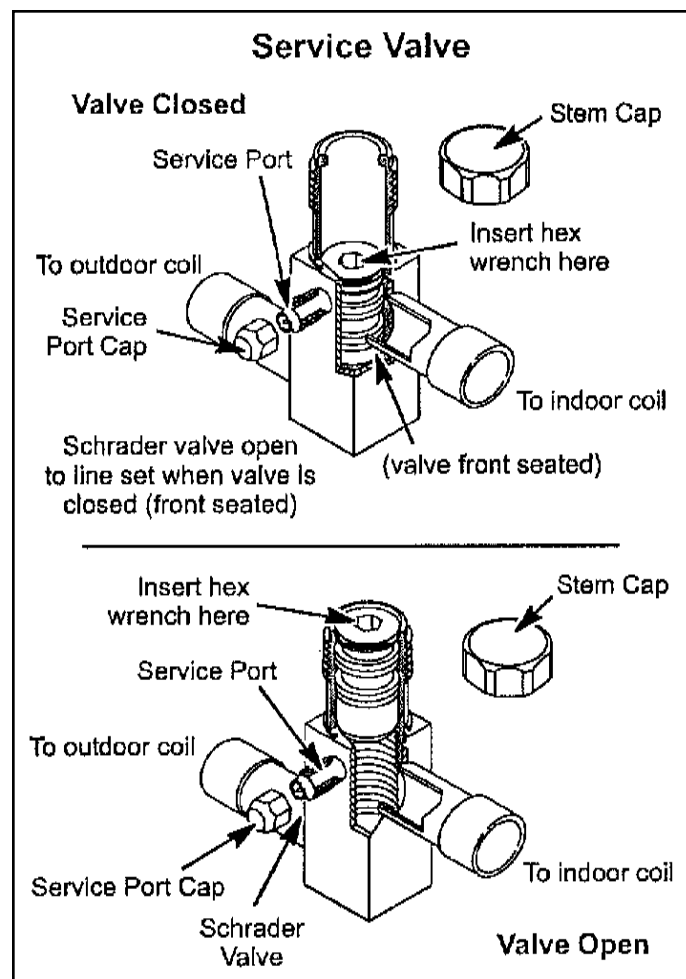


Figure 4.

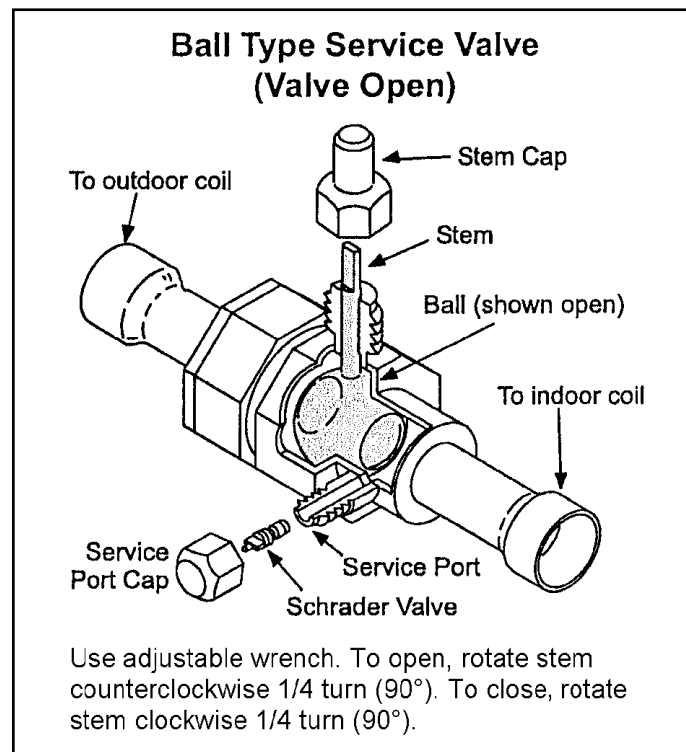


Figure 5.

## Refrigeration Piping

- Use only refrigerant grade copper tubes.
- Split systems may be installed with up to 50 feet of line set (no more than 20 feet vertical) without special consideration (see long line set guidelines).
- Ensure that vapor and liquid tube diameters are appropriate to capacity of unit.
- Run refrigerant tubes as directly as possible by avoiding unnecessary turns and bends.
- When passing refrigerant tubes through the wall, seal opening with RTV or other silicon-based caulk.
- Avoid direct tubing contact with water pipes, duct work, floor joists, wall studs, floors, walls, and any structure.
- Do not suspend refrigerant tubing from joists and studs with a rigid wire or strap that comes in direct contact with tubing.
- Ensure that tubing insulation is pliable and completely surrounds vapor tube.

It is important that no tubing be cut or seals broken until you are ready to actually make connections to the evaporator and to the condenser section. DO NOT remove rubber plugs or copper caps from the tube ends until ready to make connections at evaporator and condenser. Under no circumstances leave the lines open to the atmosphere for any period of time, if so unit requires additional evacuation to remove moisture.

Model	13 SEER	
	Liquid Line	Suction Line
18	3/8 OR 1/4 1	3/4 OR 5/8 2
24	3/8 OR 1/4 1	3/4 OR 5/8 2
30	3/8	3/4
36	3/8	3/4
42	3/8	7/8 OR 3/4 3
48	3/8	7/8
60	3/8	1-1/8 OR 7/8 4

\* Fittings should be supplied by the installer.  
 1: Use 3/8 if over 24 feet of line set  
 2: Use 3/4 if over 24 feet of line set  
 3: Use 7/8 if over 24 feet of line set  
 4: Use 1-1/8 if over 24 feet of line set

**Table 4.**

Be extra careful with sharp bends. Tubing can “kink” very easily, and if this occurs, the entire tube length will have to be replaced. Extra care at this time will eliminate future service problems.

It is recommended that vertical suction risers not be up-sized. Proper oil return to the compressor should be maintained with suction gas velocity.


### Filter Drier

The filter drier is very important for proper system operation and reliability. If the drier is shipped loose, it must be installed by the installer in the field. Unit warranty will be void, if the drier is not installed.

### Installation of Line Sets

**DO NOT** fasten liquid or suction lines in direct contact with the floor or ceiling joist. Use an insulated or suspension type of hanger. Keep both lines separate, and always insulate the suction line. Liquid line runs (30 feet or more) in an attic will require insulation. Route refrigeration line sets to minimize length.

**DO NOT** let refrigerant lines come in direct contact with foundation. When running refrigerant lines through the foundation or wall, openings should allow for a sound and vibration absorbing material to be placed or installed between tubing and foundation. Any gap between foundation or wall and refrigerant lines should be filled with a vibration damping material.


**CAUTION**

If ANY refrigerant tubing is required to be buried by state or local codes, provide a 6 inch vertical rise at service valve.



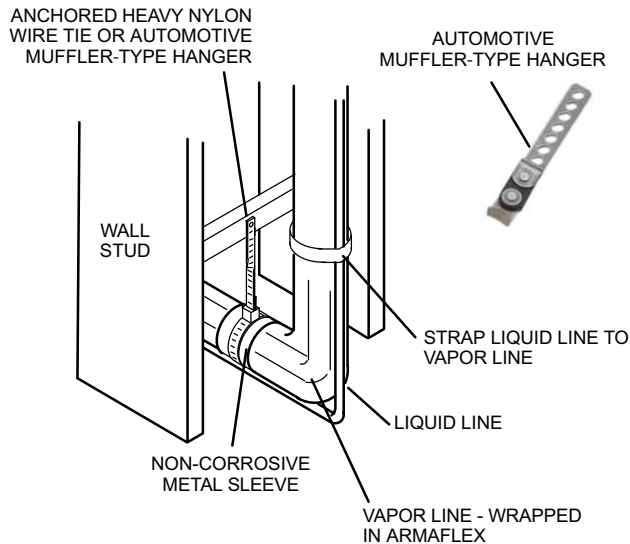
# LINE SET

**IMPORTANT** — Refrigerant lines must not contact structure.

## INSTALLATION

**Line Set Isolation** — The following illustrations are examples of proper refrigerant line set isolation:

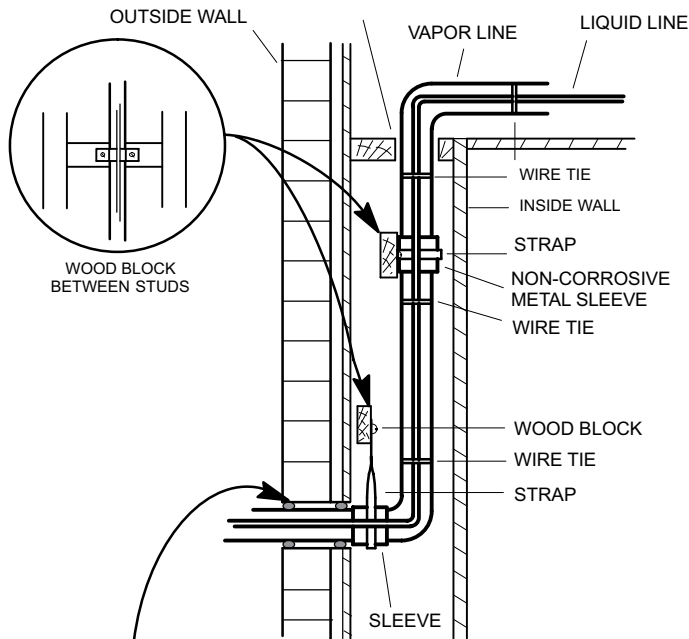
### REFRIGERANT LINE SET — TRANSITION FROM VERTICAL TO HORIZONTAL



### REFRIGERANT LINE SET — INSTALLING VERTICAL RUNS (NEW CONSTRUCTION SHOWN)

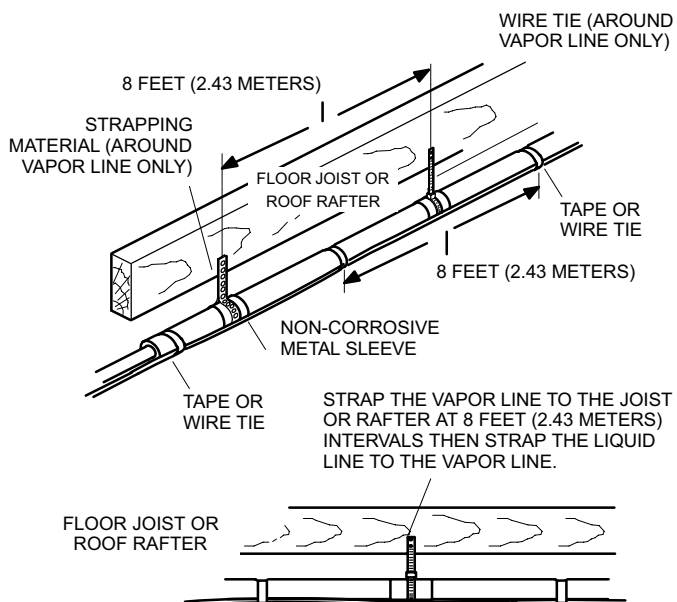
**NOTE** — Insulate liquid line when it is routed through areas where the surrounding ambient temperature could become higher than the temperature of the liquid line or when pressure drop is equal to or greater than 20 psig.

**IMPORTANT** — Refrigerant lines must not contact wall



### REFRIGERANT LINE SET — INSTALLING HORIZONTAL RUNS

To hang line set from joist or rafter, use either metal strapping material or anchored heavy nylon wire ties.



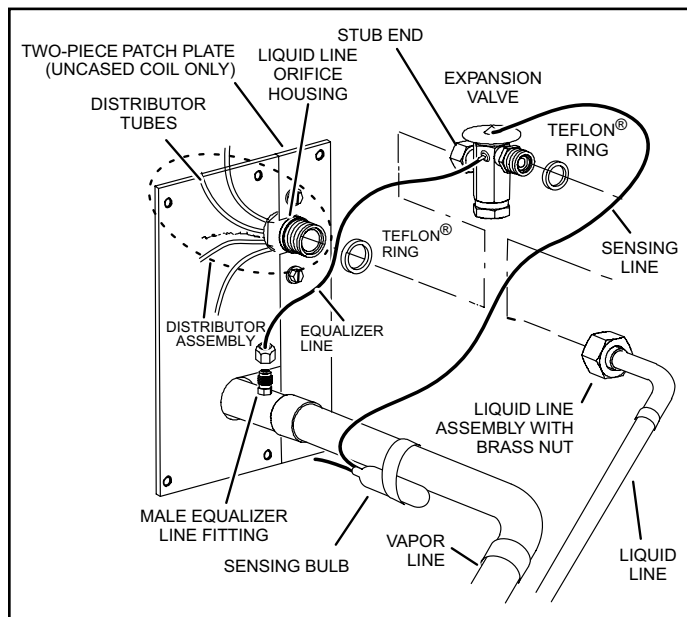
**NOTE** — Similar installation practices should be used if line set is to be installed on exterior of outside wall.

## Installation into an Existing R-22 System

If the unit will be installed in an existing system that uses an indoor unit or line sets charged with R-22 refrigerant, installer must perform the following procedures to convert the system to an R-410A system.

### Remove Existing Expansion Valve

1. On fully cased coils, remove the coil access and plumbing panels.
2. Remove any shipping clamps from the liquid line and distributor assembly.
3. Disconnect the equalizer line from the check expansion valve equalizer line fitting on the vapor line.
4. Remove the vapor line sensing bulb.
5. Disconnect the liquid line from the check expansion valve at the liquid line assembly.
6. Disconnect the check expansion valve from the liquid line orifice housing. Take care not to twist or damage distributor tubes during this process.
7. Remove and discard check expansion valve and the two Teflon® rings (see Figure 6).
8. Use a field-provided fitting to temporarily reconnect the liquid line to the indoor unit's liquid line orifice housing.



**Figure 6. Remove Existing Expansion Valve (uncased coil shown)**

## Flushing Line Sets

If the unit will be installed in an existing system that uses an indoor unit or line sets charged with R-22 refrigerant, installer must perform the following flushing procedure.

**NOTE:** Existing system components (including line set and indoor coil) must be an AHRI match with the unit in order to fulfill unit warranty requirements.

### **⚠ WARNING**

Refrigerant must be reclaimed in accordance with national and local codes.

### **⚠ CAUTION**

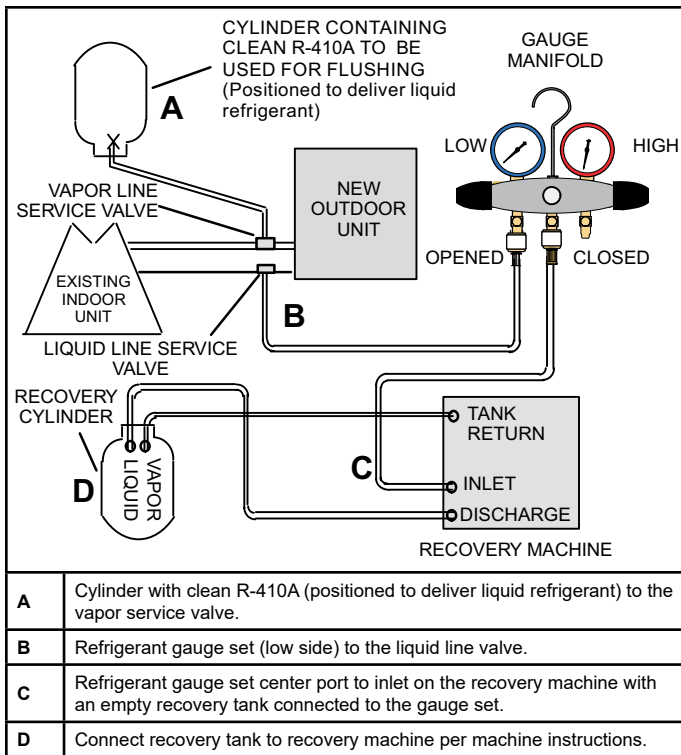
Do **NOT** attempt to flush and re-use existing line sets or indoor coil when the system contains contaminants (i.e., compressor burn out).

### **NOTE**

“Clean refrigerant” is any refrigerant in a system that has not had compressor burnout. If the system has experienced burnout, it is recommended that the existing line set and indoor coil be replaced.

### **NOTE**

In lieu of R-410A, an industry-standard flushing agent may also be used.



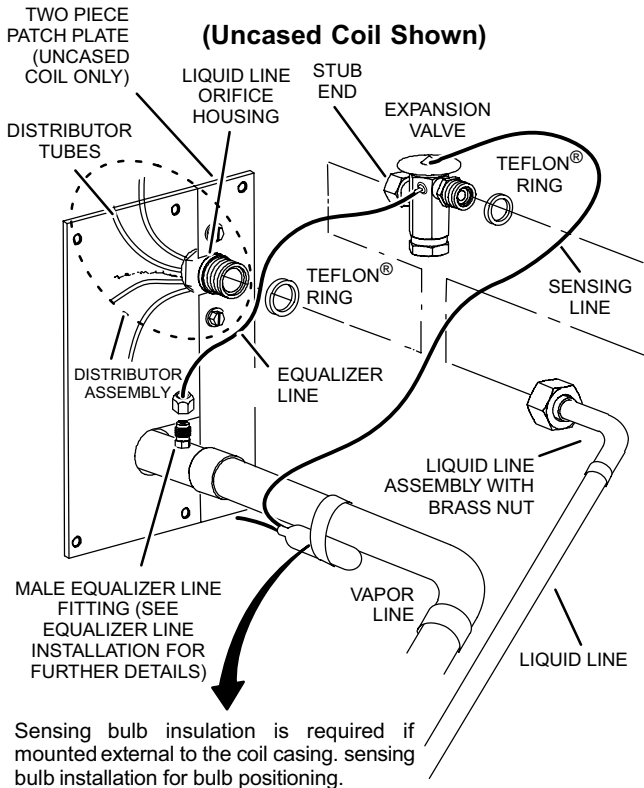
**Figure 7.**

1. Connect gauges and equipment as shown in Figure 7.
2. 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 unit coil.
3. Position the cylinder of clean R-410A for delivery of liquid refrigerant 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 unit coil before it enters the recovery machine.
4. After all of the liquid refrigerant has been recovered, switch the recovery machine to vapor recovery so that all of the R-410A vapor is recovered. Allow the recovery machine to pull the system down to 0.
5. Close the valve on the inverted R-410A drum and the gauge set valves. Pump the remaining refrigerant out of the recovery machine and turn the machine off.

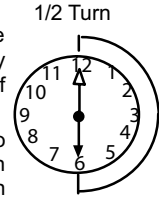
## Refrigerant Piping - Install Indoor Expansion Valve

This outdoor unit is designed for use in systems that include an expansion valve metering device (purchased separately) at the indoor coil. See the Product Specifications for approved expansion valve kit match-ups and application information. The check expansion valve unit can be installed internal or external to the indoor coil. In applications where an uncased coil is being installed in a field-provided plenum, install the check/expansion valve in a manner that will provide access for future field service of the expansion valve. Refer to below illustration for reference during installation of expansion valve unit.

### INDOOR EXPANSION VALVE INSTALLATION



- 3 - Install one of the provided Teflon® rings around the stubbed end of the check expansion valve and lightly lubricate the connector threads and expose surface of the Teflon® ring with refrigerant oil.
- 4 - Attach the stubbed end of the check expansion valve to the liquid line orifice housing. Finger tighten and use an appropriately sized wrench to turn an additional 1/2 turn clockwise as illustrated in the figure above, or tighten to 20 ft-lb.
- 5 - Place the remaining Teflon® washer around the other end of the check expansion valve. Lightly lubricate connector threads and expose surface of the Teflon® ring with refrigerant oil.
- 6 - Attach the liquid line assembly to the check expansion valve. Finger tighten and use an appropriately sized wrench to turn an additional 1/2 turn clockwise as illustrated in the figure above or tighten to 20 ft-lb.



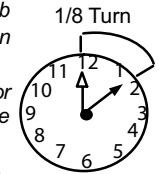
### SENSING BULB INSTALLATION

- 1 - Attach the vapor line sensing bulb in the proper orientation as illustrated to the right using the clamp and screws provided.

**NOTE** - Though it is preferred to have the sensing bulb installed on a horizontal run of the vapor line, installation on a vertical run of piping is acceptable if necessary.

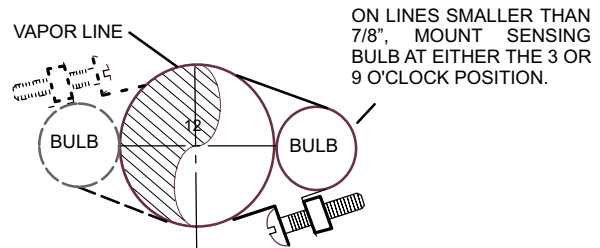
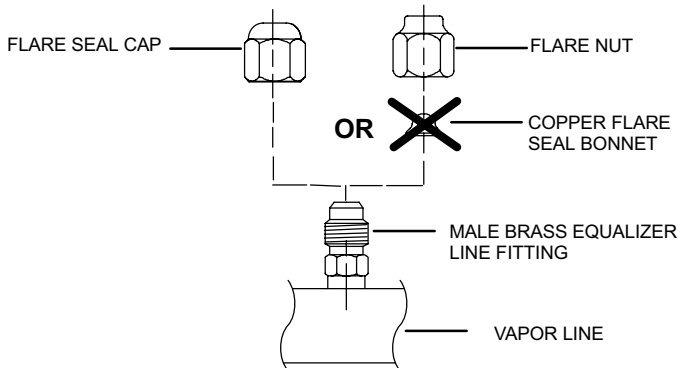
**NOTE** - Confirm proper thermal contact between vapor line and check/expansion bulb before insulating the sensing bulb once installed.

- 2 - Connect the equalizer line from the check expansion valve to the equalizer vapor port on the vapor line. Finger tighten the flare nut plus 1/8 turn (7 ft-lbs) as illustrated below.

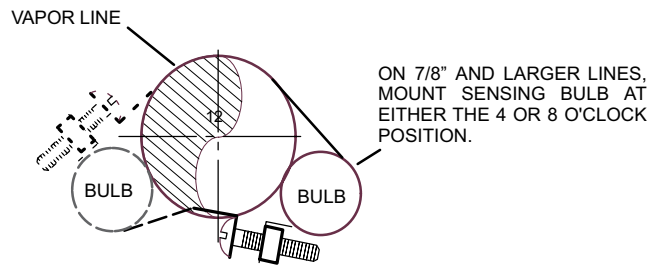


### EQUALIZER LINE INSTALLATION

- 1 - Remove and discard either the flare seal cap or flare nut with copper flare seal bonnet from the equalizer line port on the vapor line as illustrated in the figure below.
- 2 - Remove the field-provided fitting that temporarily reconnected the liquid line to the indoor unit's distributor assembly.



ON LINES SMALLER THAN 7/8", MOUNT SENSING BULB AT EITHER THE 3 OR 9 O'CLOCK POSITION.



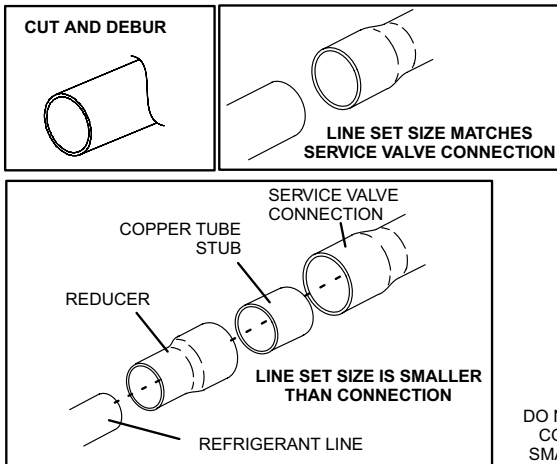
ON 7/8" AND LARGER LINES, MOUNT SENSING BULB AT EITHER THE 4 OR 8 O'CLOCK POSITION.

**NOTE** - NEVER MOUNT THE SENSING BULB ON BOTTOM OF LINE.

# Refrigerant Piping - Brazing Procedures

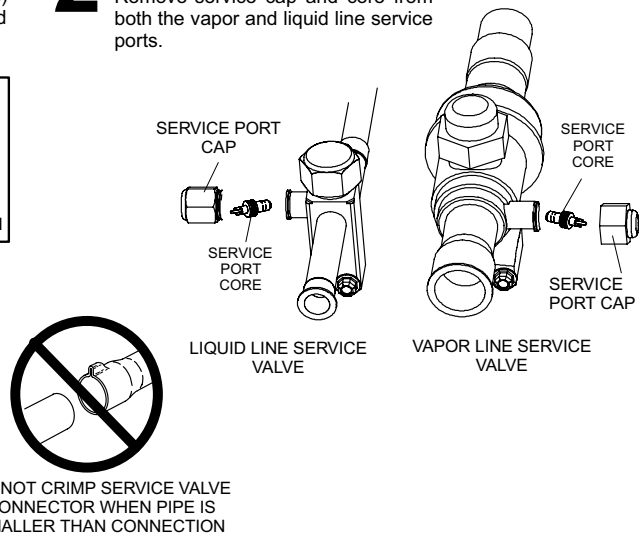
## 1 CUT AND DEBUR

Cut ends of the refrigerant lines square (free from nicks or dents) and debur the ends. The pipe must remain round. Do not crimp end of the line.



## 2 CAP AND CORE REMOVAL

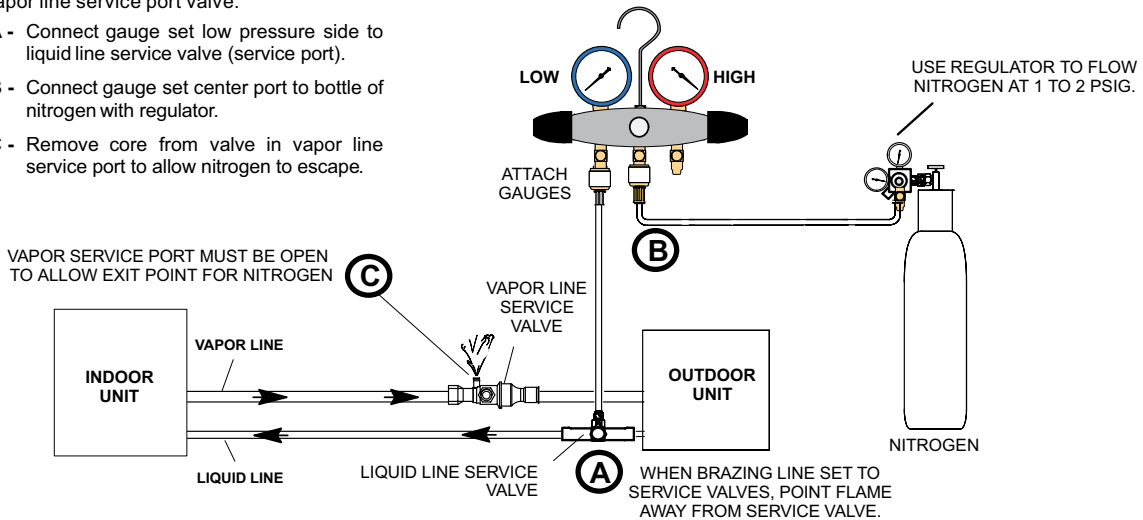
Remove service cap and core from both the vapor and liquid line service ports.



## 3 ATTACH THE MANIFOLD GAUGE SET FOR BRAZING LIQUID AND VAPOR LINE SERVICE VALVES

Flow regulated nitrogen (at 1 to 2 psig) through the low-side refrigeration gauge set into the liquid line service port valve, and out of the vapor line service port valve.

- A - Connect gauge set low pressure side to liquid line service valve (service port).
- B - Connect gauge set center port to bottle of nitrogen with regulator.
- C - Remove core from valve in vapor line service port to allow nitrogen to escape.



### NOTE

Use a manifold gauge set designed for use on R-410A refrigerant systems.

### WARNING

Before brazing, ensure the system is fully recovered of all refrigerant. Application of a brazing torch to a pressurized system may result in ignition of the refrigerant and oil mixture. Check the high and low pressures before applying heat.



### WARNING

Brazing alloys and flux contain materials which are hazardous to your health.

Avoid breathing vapors or fumes from brazing operations. Perform operations only in well-ventilated areas.

Wear gloves and protective goggles or face shield to protect against burns.

Wash hands with soap and water after handling brazing alloys and flux.

## 4 WRAP SERVICE VALVES

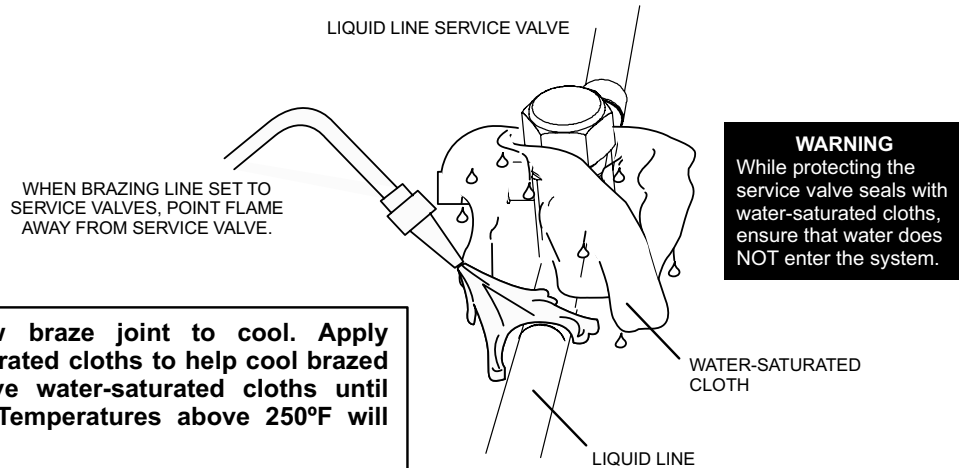
To help protect service valve seals during brazing, wrap water-saturated cloths around service valve bodies and copper tube stubs. Use additional water-saturated cloths underneath the valve body to protect the base paint.

## 5 FLOW NITROGEN

Flow regulated nitrogen (at 1 to 2 psig) through the refrigeration gauge set into the valve stem port connection on the liquid service valve and out of the vapor valve stem port. See steps **3A**, **3B** and **3C** on manifold gauge set connections.

## 6 BRAZE LINE SET

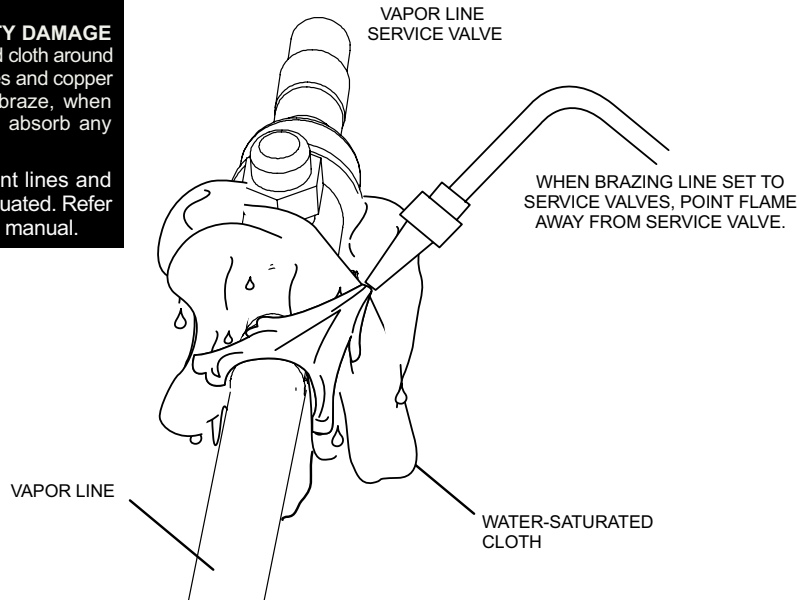
Wrap both service valves with water-saturated cloths as illustrated here and as mentioned in step 4, before brazing to line set. Cloths must remain water-saturated throughout the brazing and cool-down process.



### WARNING

**FIRE, PERSONAL INJURY, OR PROPERTY DAMAGE** may result if you do not wrap a water-saturated cloth around both liquid and suction line service valve bodies and copper tube stub while brazing the line set! The braze, when complete, must be quenched with water to absorb any residual heat.

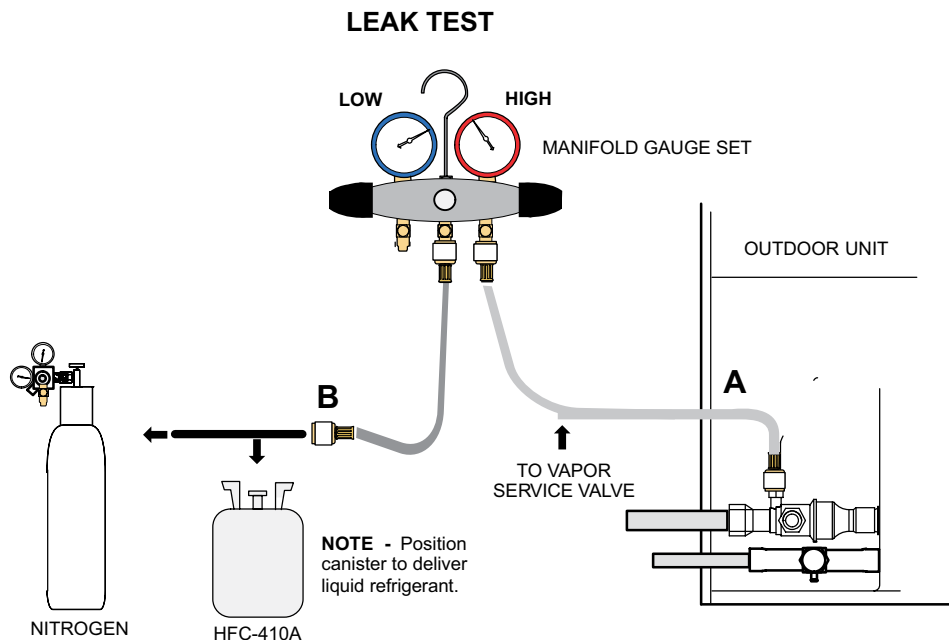
Do not open service valves until refrigerant lines and indoor coil have been leak-tested and evacuated. Refer to Leak Test and Evacuation section of this manual.



## 7 PREPARATION FOR NEXT STEP

After all connections have been brazed, disconnect manifold gauge set from service ports. Apply additional water-saturated cloths to both services valves to cool piping. Once piping is cool, remove all water-saturated cloths.

## Leak Test and Evacuation



### 1 CONNECT GAUGE SET

- A** - Connect the high pressure hose of an HFC-410A manifold gauge set to the vapor valve service port.  
**NOTE** - 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.
- B** - With both manifold valves closed, connect the cylinder of HFC-410A refrigerant to the center port of the manifold gauge set.  
**NOTE** - Later in the procedure, the HFC-410A container will be replaced by the nitrogen container.

### 2 TEST FOR LEAKS

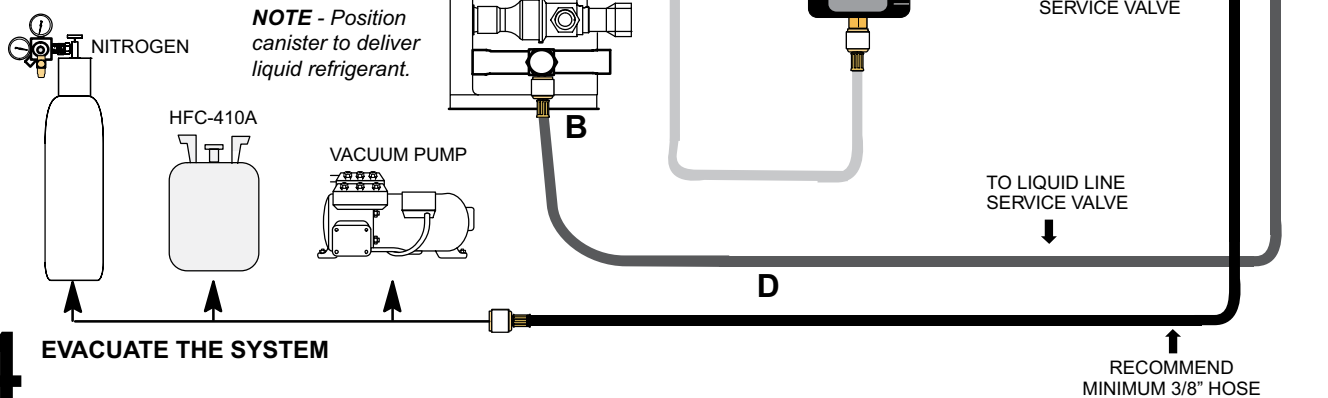
After the line set has been connected to the indoor and outdoor units, check the line set connections and indoor unit for leaks. Use the following procedure to test for leaks:

- A** - With both manifold valves closed, connect the cylinder of HFC-410A refrigerant to the center port of the manifold gauge set. Open the valve on the HFC-410A cylinder (vapor only).
- B** - Open the high pressure side of the manifold to allow HFC-410A into the line set and indoor unit. Weigh in a trace amount of HFC-410A. [A trace amount is a maximum of two ounces (57 g) refrigerant or three pounds (31 kPa) pressure.] Close the valve on the HFC-410A cylinder and the valve on the high pressure side of the manifold gauge set. Disconnect the HFC-410A cylinder.
- C** - Connect a cylinder of nitrogen with a pressure regulating valve to the center port of the manifold gauge set.
- D** - Adjust nitrogen pressure to 150 psig (1034 kPa). Open the valve on the high side of the manifold gauge set in order to pressurize the line set and the indoor unit.
- E** - After a few minutes, open one of the service valve ports and verify that the refrigerant added to the system earlier is measurable with a leak detector.
- F** - After leak testing, disconnect gauges from service ports.  
**NOTE** - Service valve cores remain removed for the following evacuation procedure.

### 3 CONNECT GAUGE SET

**NOTE** - Remove cores from service valves (if not already done).

- A - Connect low side of manifold gauge set with 1/4 SAE in-line tee to vapor line service valve
- B - Connect high side of manifold gauge set to liquid line service valve
- C - Connect available micron gauge connector on the 1/4 SAE in-line tee.
- D - Connect the vacuum pump (with vacuum gauge) to the center port of the manifold gauge set. The center port line will be used later for both the HFC-410A and nitrogen containers.



**NOTE** - Position canister to deliver liquid refrigerant.

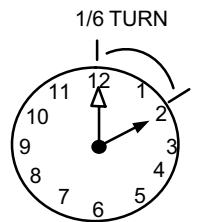
### 4 EVACUATE THE SYSTEM

- A - Open both manifold valves and start the vacuum pump.
- B - Evacuate the line set and indoor unit until a slight vacuum is indicated on the micron gauge (approximately 23,000 microns or 29.01 inches of mercury).
  - NOTE** - During the early stages of evacuation, it is desirable to close the manifold gauge valve at least once. A rapid rise in pressure indicates a relatively large leak. If this occurs, **repeat the leak testing procedure**.
  - NOTE** - The term **absolute pressure** means the total actual pressure above absolute zero within a given volume or system. Absolute pressure in a vacuum is equal to atmospheric pressure minus vacuum pressure.
- C - When the absolute pressure reaches 23,000 microns (29.01 inches of mercury), perform the following:
  - Close manifold gauge valves.
  - Close valve on vacuum pump.
  - Turn off vacuum pump.
  - Disconnect manifold gauge center port hose from vacuum pump.
  - Attach manifold center port hose to a nitrogen cylinder with pressure regulator set to 150 psig (1034 kPa) and purge the hose.
  - Open manifold gauge valves to break the vacuum in the line set and indoor unit.
  - Close manifold gauge valves.
- D - 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.
- E - 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.
- F - When the absolute pressure requirement above has been met, disconnect the manifold hose from the vacuum pump and connect it to a cylinder of HFC-410A positioned to deliver liquid refrigerant. Open the manifold gauge valve 1 to 2 psig in order to release the vacuum in the line set and indoor unit.
- G - Perform the following:
  - Close manifold gauge valves.
  - Shut off HFC-410A cylinder.
  - Reinstall service valve cores by removing manifold hose from service valve. Quickly install cores with core tool while maintaining a positive system pressure.
  - Replace stem caps and finger tighten them, then tighten an additional one-sixth (1/6) of a turn as illustrated.
- H - Open suction service valve first before liquid valve to release the unit charge into the system. Replace valve caps and tighten (8 ft. lb.). Caps are the primary seal.

**WARNING !**

**Possible equipment damage.**

**Avoid deep vacuum operation. Do not use compressors to evacuate a system. Extremely low vacuum can cause internal arcing and compressor failure. Damage caused by deep vacuum operation will void warranty.**





## Electrical Wiring

All field wiring must be done in accordance with the National Electrical Code (NEC) recommendations, Canadian Electrical Code (CEC) and CSA Standards, or local codes, where applicable.

### **⚠ WARNING**

#### **Electrical Shock Hazard!**



Turn OFF electric power before connecting unit, performing any maintenance or removing panels or doors. More than one disconnect may be required to turn off all power.

**FAILURE TO DO SO COULD RESULT IN BODILY INJURY OR DEATH.**

### **⚠ WARNING**

Unit must be grounded in accordance with national and local codes. Failure to ground unit properly can result in personal injury or death.

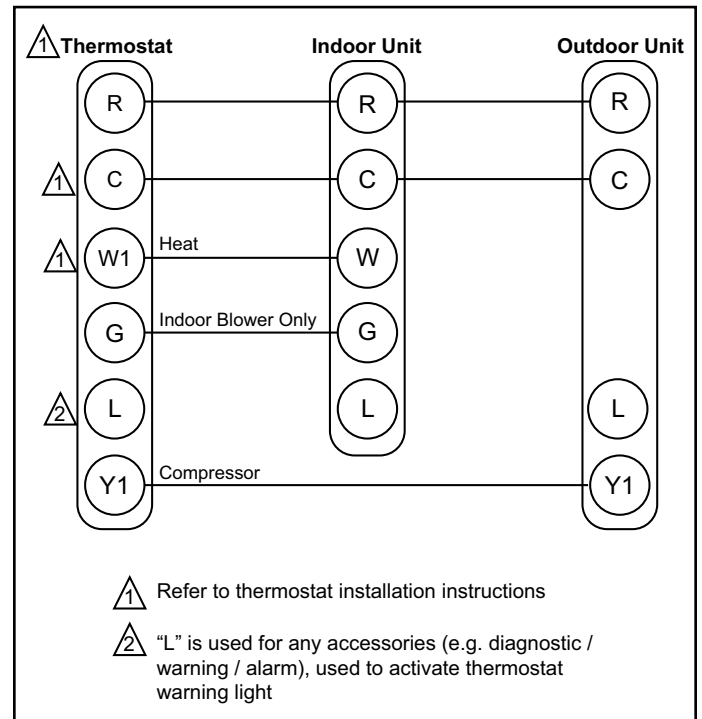
### **⚠ WARNING**

Line voltage is present at all components when unit is not in operation on units with single pole contactors. Disconnect all remote electric power supplies before opening access panel. Unit may have multiple power supplies. Failure to disconnect all power supplies could result in personal injury or death.

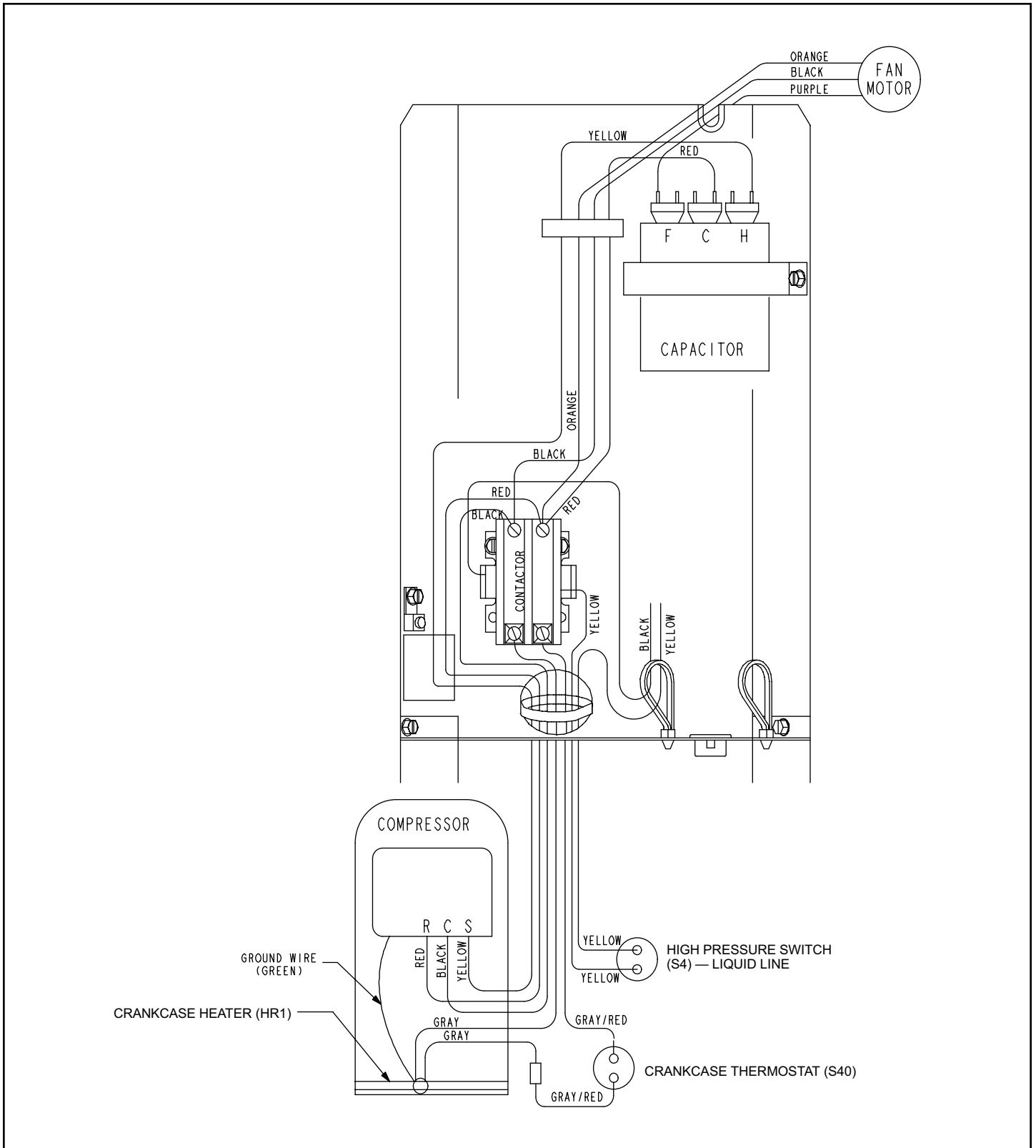
Refer to the furnace or blower coil Installation Instructions for additional wiring application diagrams and refer to unit rating plate for minimum circuit ampacity and maximum overcurrent protection size.

1. Install line voltage power supply to unit from a properly sized disconnect switch. Any excess high voltage field wiring should be trimmed or secured away from the low voltage field wiring.
2. High voltage power connections to 3-phase models is made to "Pig Tail" leads with field supplied splice connectors.

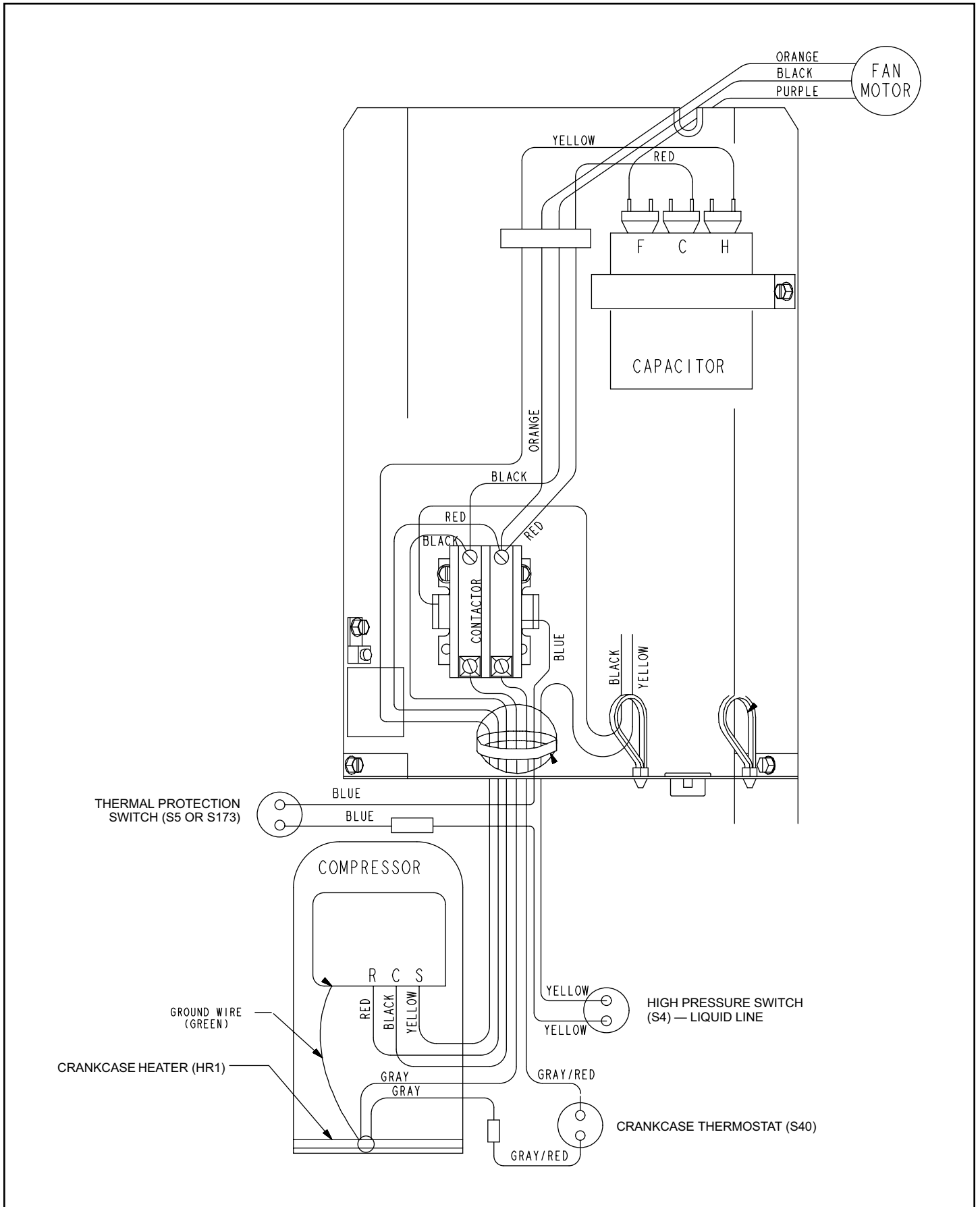
3. Ground unit at unit disconnect switch or to an earth ground. To facilitate conduit, a hole is in the bottom of the control box. Connect conduit to the control box using a proper conduit fitting. Units are approved for use only with copper conductors. 24V Class II circuit connections are made in the low voltage junction box. A complete unit wiring diagram is located inside the unit control box cover.
4. Install room thermostat according to thermostat installation instruction and on an inside wall that is not subject to drafts, direct sunshine, or other heat sources.
5. Install low voltage wiring from outdoor to indoor unit and from thermostat to indoor unit (see Figure 8).
6. Do not bundle any excess 24V control wire inside control box. Run control wire through installed wire tie and tighten wire tie to provide low voltage strain relief and to maintain separation of field-installed low and high voltage circuits.



**Figure 8. Thermostat Designations - Non-Communicating**



**Figure 9. Typical Factory Wiring Diagram (Copeland Compressor)**



**Figure 10. Typical Factory Wiring Diagram (Interlink Compressor)**

## Sequence of Operation

**NOTE:** The thermostat used may be electromechanical or electronic.

**NOTE:** Transformer in indoor unit supplies power (24 VAC) to the thermostat and outdoor unit controls.

### Cooling:

1. Cooling demand initiates at Y1 in the thermostat.
2. 24VAC from indoor unit (Y1) energizes the TOC timed off control (if used) which energizes contactor K1 (provided S4 high pressure switch is closed).
3. K1-1 N.O. closes, energizing compressor (B1) and outdoor fan motor (B4).
4. Compressor (B1) and outdoor fan motor (B4) begin immediate operation..

### End of Cooling Demand:

5. Cooling demand is satisfied. Terminal Y1 is de-energized.
6. Compressor contactor K1 is de-energized.
7. K1-1 opens and compressor (B1) and outdoor fan motor (B4) are de-energized and stop immediately.

## Start-Up

### CAUTION

If unit is equipped with a 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 liquid line and suction line service valves to release refrigerant charge (contained in outdoor unit) into system.
4. Replace the stem caps and secure finger tight, then tighten an additional 1/6 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 equipment until the power company has been consulted and the voltage condition corrected.
6. Set thermostat for cooling demand, turn on power to indoor blower, and close the outdoor unit disconnect switch to start the unit.
7. Recheck unit voltage with unit running. Power must be within range shown on unit nameplate.

## Refrigerant Charging

### CAUTION

Excessive amounts of liquid refrigerant entering the suction line can damage the compressor. When adding refrigerant, precautions must be taken to control the flow of liquid into the system. This can be done by using a liquid vaporizing adapter or manual control using a sight glass as indicator.

Units are 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 15' line set. For varying lengths of line set, refer to Table 5 for refrigerant charge adjustment. A blank space is provided on the unit rating plate to list the actual field charge.

Liquid Line Set Diameter	Oz. Per 5 ft. adjust from 15 ft. line set*
3/8 in.	3 oz. per 5 ft. or 0.6 oz. per 1 ft.
* If line length is greater than 15 ft., add this amount. If line length is less than 15 ft., remove this amount.	

**Table 5. Refrigerant Charge Adjustment**

### IMPORTANT

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

**NOTE:** Both airflow and refrigerant charge must be monitored for proper system set-up. It may be necessary to alternately check and adjust the airflow and the refrigerant charge.

If the system is void of refrigerant, or if the outdoor ambient temperature is cool, use the weigh-in method to charge the unit. Do this after any leaks have been repaired.

1. Recover the refrigerant from the unit.
2. Conduct a leak check, then evacuate as previously outlined.
3. Weigh in the charge according to the total amount shown on the unit nameplate.

If weighing facilities are not available or if unit is being charged during warm weather, use one of the following procedures.

- **For systems using a fixed orifice on the indoor evaporator and outdoor temperatures above 65°F** – charge using the superheat method and table provided on the unit access panel.
- **For systems using a TXV on the indoor evaporator and outdoor temperature above 60°F** – charge in

cooling mode using the subcooling method and table provided on the unit access panel.

- **For systems below 60°F** – charge in heating mode using the subcooling method and table provided on the unit access panel. Attach low pressure gauge hose to auxiliary service port to access suction side in heating mode.

**NOTE:** All unit table values are based on 70 to 80°F indoor return air temperature for cooling mode, and 65°F to 75°F return air temperature for heat mode.

## Maintenance

### Regular Maintenance Requirements

Your system should be regularly inspected by a qualified service technician. These regular visits may include (among other things) checks for:

- Motor operation
- Ductwork air leaks
- Coil & drain pan cleanliness (indoor & outdoor)
- Electrical component operation & wiring check
- Proper refrigerant level & refrigerant leaks
- Proper airflow
- Drainage of condensate
- Air filter(s) performance
- Blower wheel alignment, balance & cleaning
- Primary & secondary drain line cleanliness

### Air Filter

Inspect air filters at least monthly and replace or clean as required. Disposable filters should be replaced. Washable filters may be cleaned by soaking in mild detergent and rinsing with cold water. Allow filter to dry before reinstalling. Replace filters with the arrows pointing in the direction of airflow. Dirty filters are the most common cause of poor heating / cooling performance and compressor failures.

### Indoor Coil

If the system has been operated with a clean filter in place, it should require minimal cleaning. If cleaning is needed, call your dealer for service.

### Condensate Drain

During cooling season check at least monthly for free flow of drainage and clean if necessary.

### Condenser Coils

Grass cuttings, leaves, dirt, dust, lint from clothes dryers, and foliage from trees can be drawn into coils by movement of the air. Clogged condenser coils will lower the efficiency of your unit and could cause damage to the condenser.

Periodically, debris should be brushed from the condenser coils. Use a soft bristle brush with light pressure only. DO NOT damage or bend condenser coil fins. Damaged or bent fins may affect unit operation.

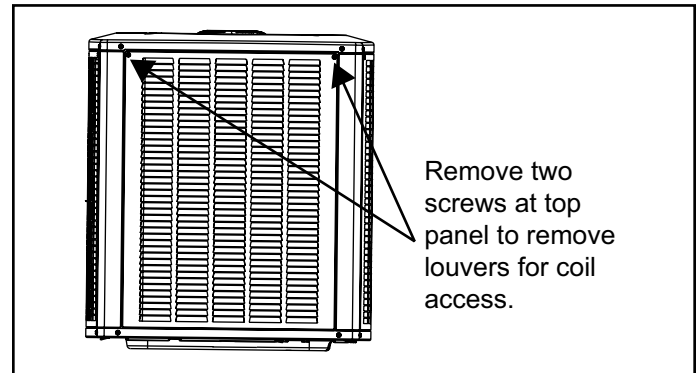


Figure 11. Removing Louvers

### **⚠ WARNING**

#### **SHARP OBJECT HAZARD!**

Condenser coils have sharp edges. Wear adequate body protection on body extremities (e.g. gloves).

**FAILURE TO FOLLOW THIS WARNING COULD RESULT IN BODILY INJURY.**

### Painted Surfaces

For maximum protection of the unit's finish, a good grade of automobile wax should be applied every year. In geographical areas where water has a high concentration of minerals (calcium, iron, sulfur, etc.), it is recommended that lawn sprinklers not be allowed to spray the unit. In such applications, the sprinklers should be directed away from the unit. Failure to follow this precaution may result in premature deterioration of the unit finish and metal components.

In sea coast areas, special maintenance is required due to the corrosive atmosphere provided by the high salt concentration in ocean mists and the air. Periodic washing of all exposed surfaces and coil will add additional life to your unit. Please consult your installing dealer for proper procedures in your geographic area.



## WARNING

To prevent personal injury, or damage to panels, unit or structure, be sure to observe the following:

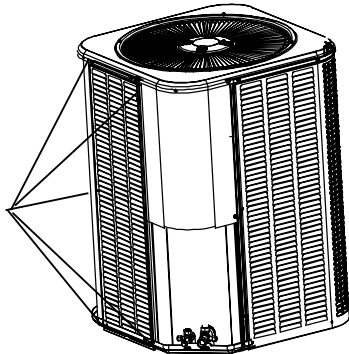
While installing or servicing this unit, carefully stow all removed panels out of the way, so that the panels will not cause injury to personnel, nor cause damage to objects or structures nearby, nor will the panels be subjected to damage (e.g., being bent or scratched).

While handling or stowing the panels, consider any weather conditions, especially windy conditions, that may cause panels to be blown around and battered.

## REMOVAL

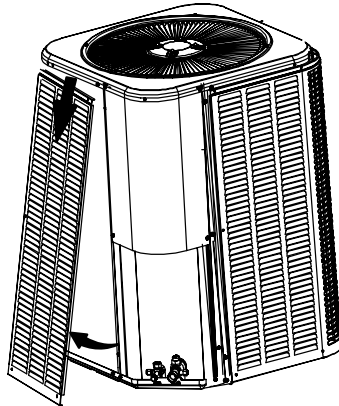
### STEP 1

TO REMOVE PANEL, REMOVE MOUNTING SCREWS SECURING PANEL TO THE UNIT.



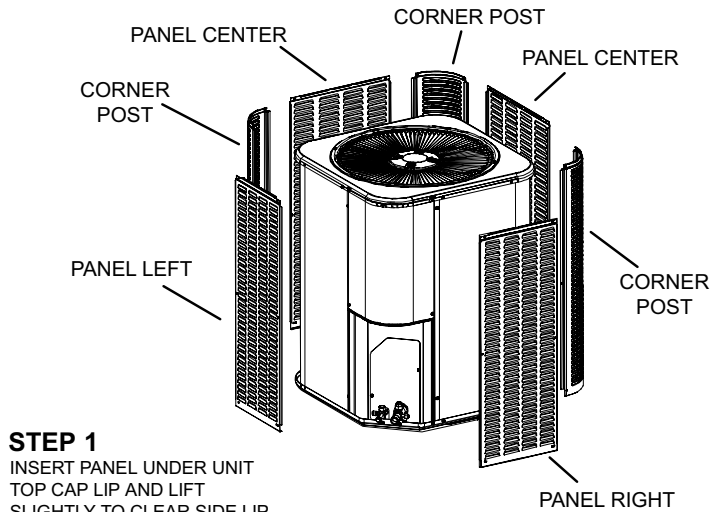
### STEP 2

SLIGHTLY LIFT PANEL IN ORDER TO CLEAR SIDE LIPS OF PANEL FROM BASE OF UNIT.



### STEP 3

TILT PANEL OUT SLIGHTLY AND PULL DOWNWARD TO REMOVE.



### STEP 1

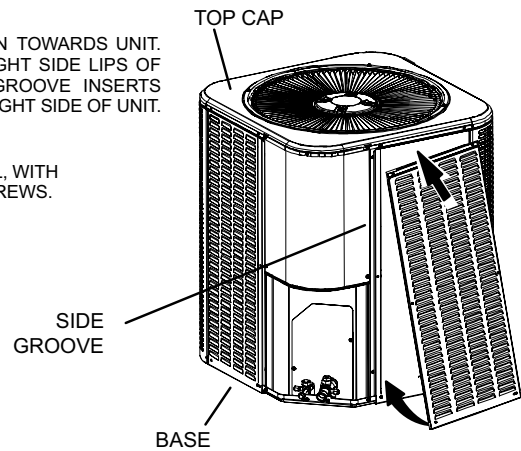
INSERT PANEL UNDER UNIT TOP CAP LIP AND LIFT SLIGHTLY TO CLEAR SIDE LIP OF PANEL FROM BASE.

### STEP 2

MOVE PANEL IN TOWARDS UNIT. ALIGN LEFT/RIGHT SIDE LIPS OF PANEL WITH GROOVE INSERTS ALONG LEFT/RIGHT SIDE OF UNIT.

### STEP 3

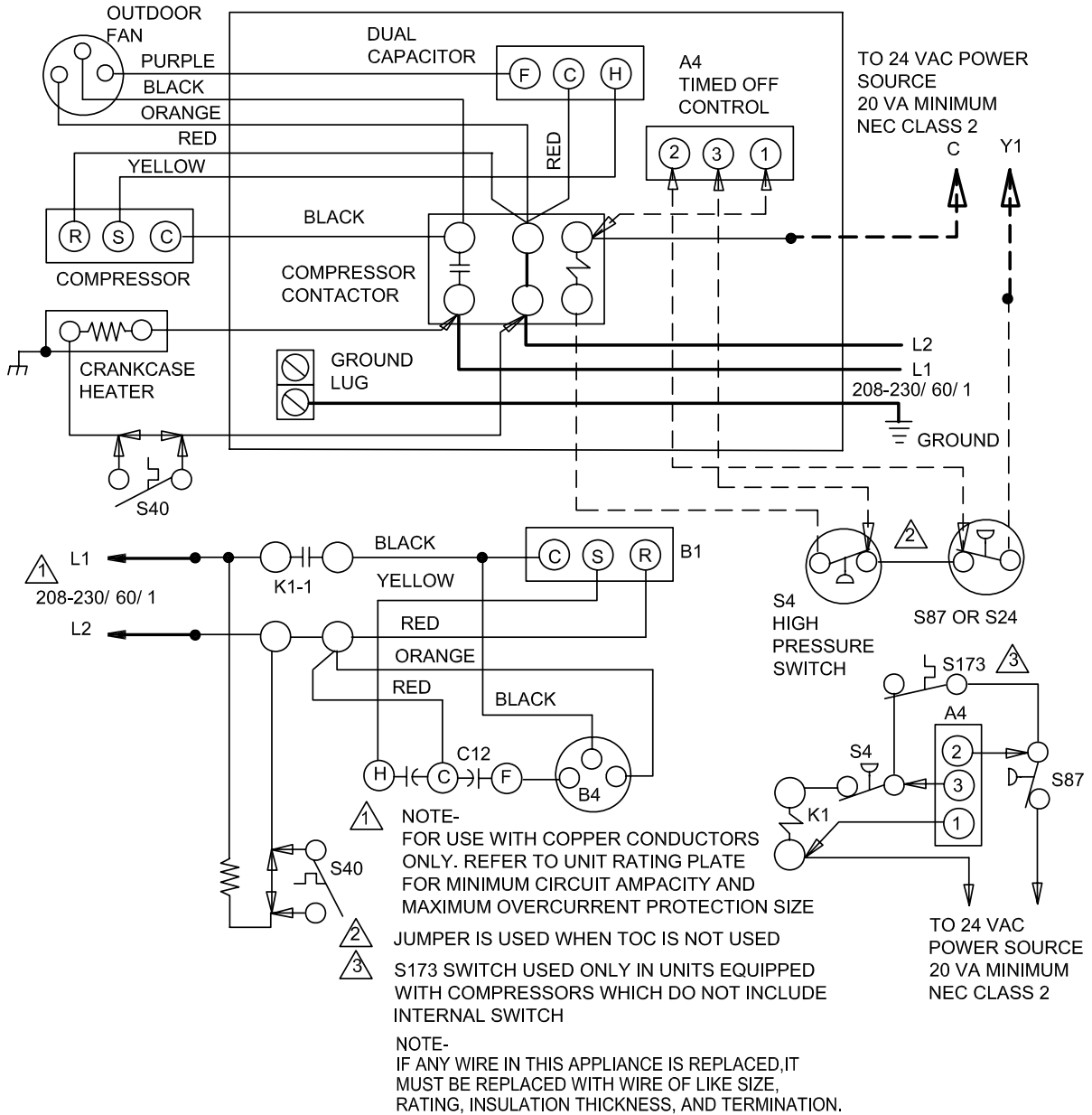
SECURE PANEL, WITH MOUNTING SCREWS.



## PANEL INSTALLATION

Figure 12.

# Wiring Diagram



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New Form No.	
537157-01	



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Figure 13. Wiring Diagram

## Servicing Units Void of Charge

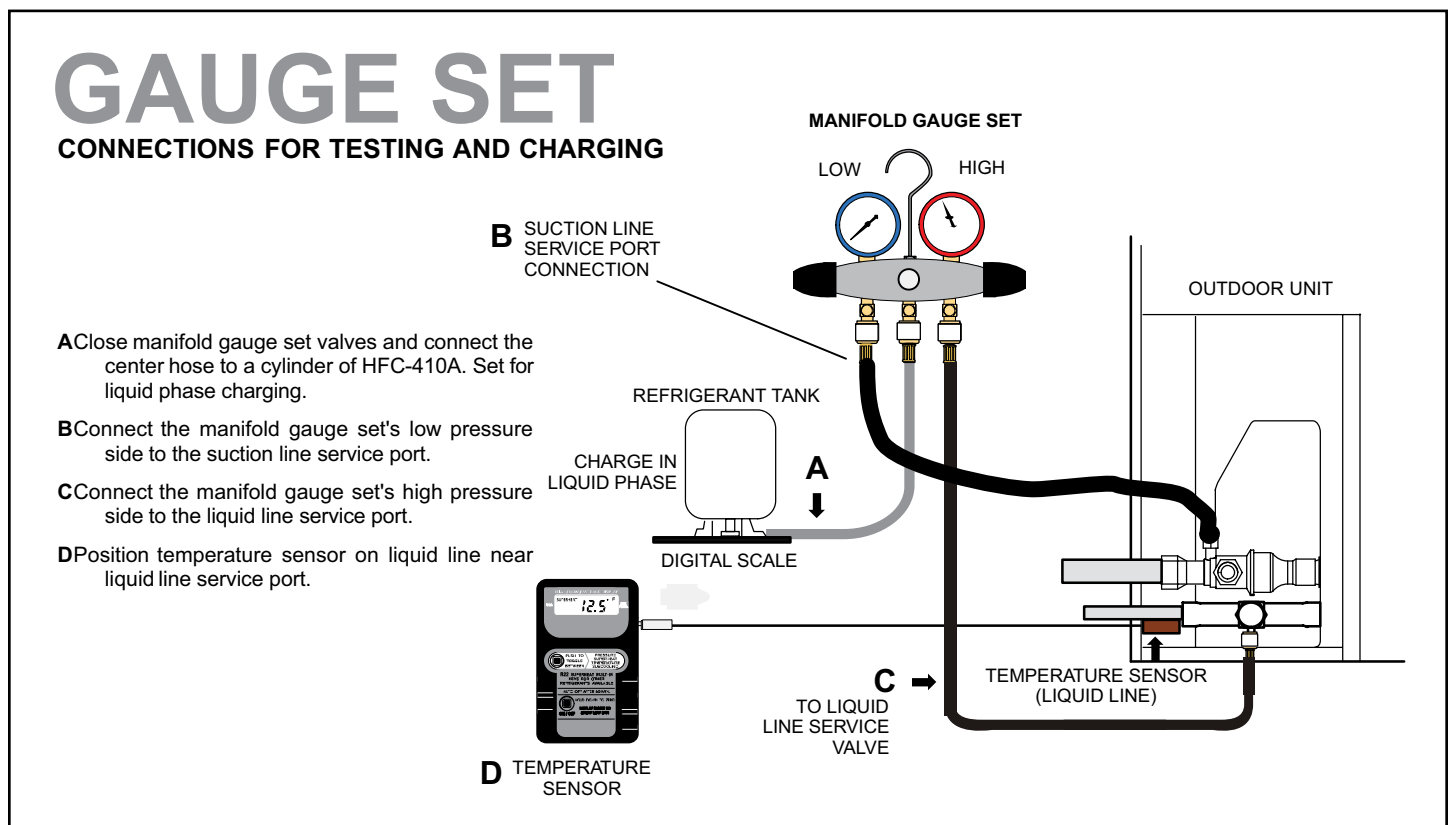
If the outdoor unit is void of refrigerant, clean the system using the procedure described below.

1. Leak check system using procedure outlined on Page 23.
2. Evacuate the system using procedure outlined on Page 23.
3. Use nitrogen to break the vacuum and install a new filter drier in the system.
4. Evacuate the system again using procedure outlined on Page 23.
5. Weigh in refrigerant. Refer to data plate and line set length for proper charge.

## System Refrigerant

This section outlines procedures for:

1. Connecting gauge set for testing and charging;
2. Checking and adjusting indoor airflow;
3. Adding or removing refrigerant.





## Adding or Removing Refrigerant

This system uses HFC-410A refrigerant which operates at much higher pressures than HCFC-22. The pre-installed liquid line filter drier is approved for use with HFC-410A only. Do not replace it with components designed for use with HCFC-22. This unit is NOT approved for use with coils which use capillary tubes or fixed orifices as a refrigerant metering device. Check airflow using the Delta-T (DT) process shown below..

# AIRFLOW

### INDOOR COIL

**Temperature of air entering indoor coil °F**

**A**

Dry-bulb	DT															
	80	24	24	24	23	23	22	22	22	22	20	19	18	17	16	15
78	23	23	23	22	22	21	21	21	20	19	18	17	16	15	14	
76	22	22	22	21	21	20	19	19	18	17	16	15	14	13		
74	21	21	21	20	19	19	18	17	16	16	15	14	13	12		
72	20	20	19	18	17	17	16	15	15	14	13	12	11	10		
70	19	19	18	18	17	17	16	15	15	14	13	12	11	10		
Wet-bulb °F	57	58	59	60	61	62	63	64	65	66	67	68	69	70		

DRY BULB

**C**

53°

$T_{Drop}$

19°

**B**

64°

WET BULB

**A**

72°

DRY BULB

air flow ← INDOOR COIL → air flow

All temperatures are expressed in °F

Assume DT = 15 and A temp. = 72°, these C temperatures would necessitate stated actions:

C°	$T_{Drop}$	-	DT	=	°F	ACTION
53°	19	-	15	=	4	Increase the airflow
58°	14	-	15	=	-1	(within $\pm 3^\circ$ range) no change
62°	10	-	15	=	-5	Decrease the airflow

Changing air flow affects all temperatures; recheck temperatures to confirm that the temperature drop and DT are within  $\pm 3^\circ$ .

°F	°C	Psig	°F	°C	Psig
-40	-40.0	11.6	60	15.6	170.0
-35	-37.2	14.9	65	18.3	185.0
-30	-34.4	18.5	70	21.1	201.0
-25	-31.7	22.5	75	23.9	217.0
-20	-28.9	26.9	80	26.7	235.0
-15	-26.1	31.7	85	29.4	254.0
-10	-23.3	36.8	90	32.2	274.0
-5	-20.6	42.5	95	35.0	295.0
0	-17.8	48.6	100	37.8	317.0
5	-15.0	55.2	105	40.6	340.0
10	-12.2	62.3	110	43.3	365.0
15	-9.4	70.0	115	46.1	391.0
20	-6.7	78.3	120	48.9	418.0
25	-3.9	87.3	125	51.7	446.0
30	-1.1	96.8	130	54.4	476.0
35	1.7	107.0	135	57.2	507.0
40	4.4	118.0	140	60.0	539.0
45	7.2	130.0	145	62.8	573.0
50	10.0	142.0	150	65.6	608.0
55	12.8	155.0			

**Table 6. HFC-410A Temperature - Pressure (Psig)**

## 13 SEER R-410A CONDENSOR CHARGING PROCEDURE

1. CHARGE THE SYSTEM BY WEIGHT, IF OUTDOOR TEMPERATURE IS BELOW 65°F:

OUTDOOR UNITS ARE FACTORY CHARGED WITH R410A FOR 15 FT. OF LINE SET. ADD OR REMOVE 0.6 OZ. FOR EVERY FOOT OF LINE SET DIFFERENT THAN 15 FT. FINAL CHARGE ADJUSTMENT MUST BE MADE PER ITEM (2) BELOW, ONCE THE OUTDOOR TEMPERATURE RISE ABOVE 65 °F.

2. IF OUTDOOR TEMPERATURE IS ABOVE 65°F, ADJUST CHARGE AS FOLLOWS:

- A. CHECK FOR PROPER AIR FLOW AND RUN THE SYSTEM FOR 20 MINUTES FOR STABILIZATION
- B. USE SUPERHEAT FOR ORIFICE COILS (SEE TABLE BELOW)
- C. USE SUBCOOLING FOR TXV COILS (SEE TABLE BELOW), PROVIDED THAT SUPERHEAT IS WITHIN 8-16 °F AT OUTDOOR UNIT AND THE REFERENCED PRESSURES BELOW ARE WITHIN ± 3 PSI FOR LOW SIDE AND ± 10 PSI FOR HIGH SIDE
- D. CONTACT TECHNICAL SERVICE, IF MEASURED VALUES ARE OUTSIDE THE RANGE OF THE LISTED DATA

CHARGING TEMPERATURES AND PRESSURES							
MODELS	-18	-24	-30	-36	-42	-48	-60
<b>TABLE 1 - SUBCOOLING VALUES</b>							
<b>OUTSIDE TEMP. °F (°C)</b>	<i>SATURATION TEMPERATURE MINUS LIQUID LINE TEMPERATURE °F (°C) ± 1°F (0.5°C)</i>						
65 (18)	12 (6.7)	12 (6.7)	11 (6)	15 (8.3)	14 (7.7)	12 (6.7)	11 (6)
75 (24)	11 (6)	11 (6)	10 (5.5)	13 (7.2)	12 (6.7)	11 (6)	10 (5.5)
85 (29)	10 (5.5)	10 (5.5)	9 (5)	12 (6.7)	11 (6)	10 (5.5)	9 (5)
95 (35)	9 (5)	9 (5)	8 (4.4)	11 (6)	10 (5.5)	9 (5)	7 (4)
105 (41)	7 (4)	7 (4)	5 (2.7)	9 (5)	8 (4.4)	7 (4)	5 (2.7)
115 (45)	6 (3.3)	6 (3.3)	4 (2.2)	7 (4)	7 (4)	6 (3.3)	3 (1.7)
<b>TABLE 2 - APPROACH VALUES - FOR REFERENCE ONLY</b>							
<i>LIQUID LINE TEMPERATURE MINUS OUTDOOR AMBIENT TEMPERATURE °F (°C) ± 1°F (0.5°C)</i>							
<b>TEMP. °F (°C)</b>	4 (2.2)	8 (4.4)	8 (4.4)	11 (6)	10 (5.5)	8 (4.4)	9 (5)
<b>TABLE 3 - NORMAL OPERATING PRESSURES</b>							
<i>THE VALUES BELOW ARE TYPICAL PRESSURES; INDOOR EVAPORATOR MATCH UP, INDOOR AIR QUALITY, AND EVAPORATOR LOAD WILL CAUSE THE PRESSURES TO VARY.</i>							
<b>*TEMP. °F (°C)</b>	<b>LIQUID LINE PRESSURE / VAPOR LINE PRESSURE</b>						
<b>EXPANSION VALVE (TXV) SYSTEMS</b>							
65 (18)	233/132	244/137	248/127	263/135	250/135	240/130	242/130
75 (24)	265/133	285/139	284/132	302/140	288/138	278/132	286/132
85 (29)	314/136	329/141	330/135	349/142	332/140	323/134	332/134
95 (35)	362/138	379/143	380/137	404/144	381/141	369/136	381/136
105 (41)	415/141	438/145	434/139	462/147	432/143	418/139	433/138
115 (45)	475/143	495/148	497/142	527/150	490/145	477/141	488/141
<b>FIXED ORIFICE (RFC) SYSTEMS</b>							
65 (18)	233/121	246/126	245/123	261/134	250/135	248/127	255/126
75 (24)	270/128	286/132	286/129	301/138	288/138	284/132	294/131
85 (29)	313/134	330/137	331/135	346/142	332/140	325/137	339/136
95 (35)	359/138	378/142	380/140	396/146	381/141	371/141	386/140
105 (41)	409/142	428/145	431/144	448/150	432/143	418/144	435/144
115 (45)	464/147	486/149	487/148	506/153	490/145	472/147	490/148
*TEMPERATURE OF AIR ENTERING OUTSIDE COIL.							

SUPERHEAT CHARGING METHOD FOR FIXED METERING DEVICES										
OUTDOOR AMBIENT	65	70	75	80	85	90	95	100	105	105
REQUIRED SUPERHEAT	35	30	25	22	18	12	8	5	5	5

ALL MEASUREMENTS ARE AT THE SERVICE VALVES AND ARE BASED ON 80db/67wb INDOOR TEMPERATURE.

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**Figure 15. RSG13**

## Start-Up and Performance Checklist

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 _____	Outdoor Fan _____
Maximum Fuse or Circuit Breaker _____		
Electrical Connections Tight? <input type="checkbox"/>	Indoor Filter Clean? <input type="checkbox"/>	Supply Voltage (Unit Off) _____
Indoor Blower RPM _____	S.P. Drop Over Indoor (Dry) _____	Outdoor Coil Entering Air Temp. _____
Discharge Pressure _____	Vapor Pressure _____	Refrigerant Charge Checked? <input type="checkbox"/>
Refrigerant Lines: Leak Checked? <input type="checkbox"/>	Properly Insulated? <input type="checkbox"/>	Outdoor Fan Checked? <input type="checkbox"/>
Services Valve: Fully Opened? <input type="checkbox"/>	Caps Tight? <input type="checkbox"/>	Thermostat
Voltage with Compressor Operating _____	Calibrated? <input type="checkbox"/>	Properly Set? <input type="checkbox"/> Level? <input type="checkbox"/>