LENNOX

KITS COMMON TO COOLING
AND HEAT PUMP EQUIPMENT

Technical Publications
LITHO U.S.A.

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COMPRESSOR FIELD REPLACEMENT

GUIDELINES FOR COMPRESSOR FIELD REPLACEMENT

⚠ 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 licensed professional installer (or equivalent) or a service agency.

⚠ WARNING

Electric Shock Hazard. Can cause injury or death. Unit must be grounded in accordance with national and local codes.

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.

Shipping and Packing List

Check unit for shipping damage. Consult last carrier immediately if damage is found.

1 — Compressor

1 — Bag assembly which includes the following:

- 4 — Compressor mounting grommets
- 4 — Metal sleeves

General

This document provides general guidelines on field replacement of outdoor compressors. Typically there are three types of compressor failures. Those failures are:

- Burnout
- Electrical failures
- Mechanical failures

Service Valves

TORQUE REQUIREMENTS

When servicing or repairing heating, ventilating and air conditioning components, ensure the fasteners are appropriately tightened. Table 1 lists torque values for fasteners.

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⚠ IMPORTANT

Only use Allen wrenches of sufficient hardness (50Rc - Rockwell Hardness 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.

See the Lennox Service and Application Notes #C-08-1 for further details and information.

⚠ IMPORTANT

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

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. Figure 1 provides information on how to access and operate both angle- and ball-type service valves.

Table 1. Torque Requirements

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

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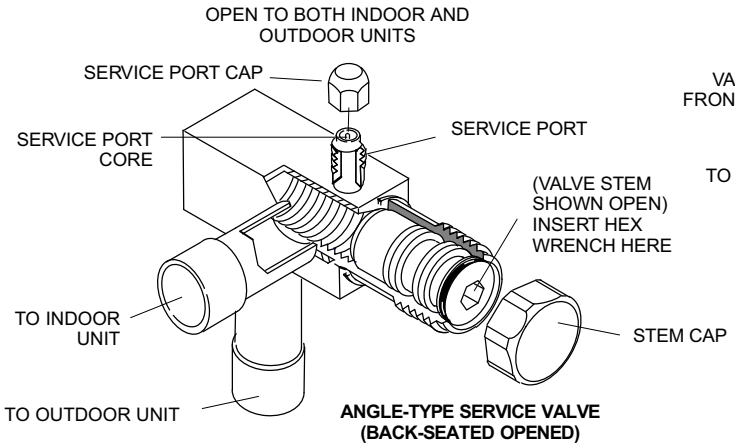
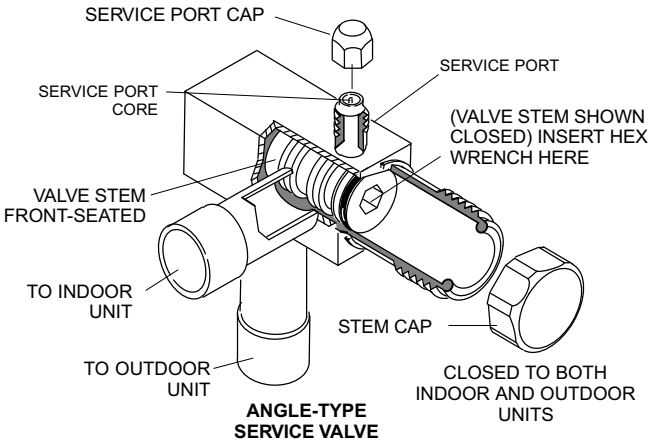
SERVICE VALVES

VARIOUS TYPES



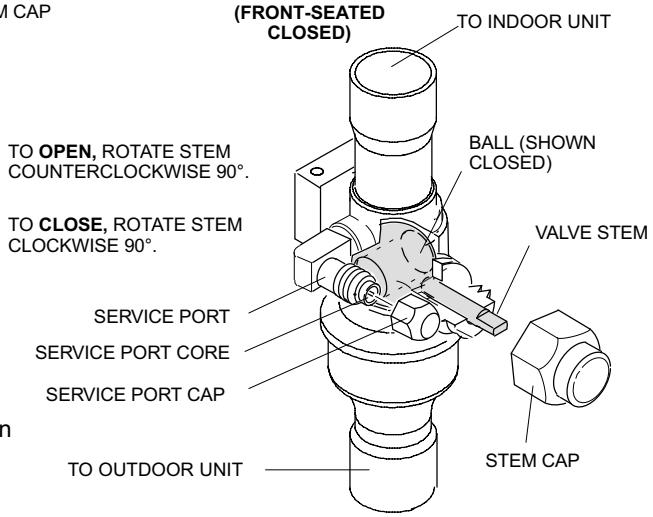
ANGLE-TYPE SERVICE VALVE (BACK-SEATED OPENED)



ANGLE-TYPE SERVICE VALVE (FRONT-SEATED CLOSED)

WHEN SERVICE VALVE IS CLOSED, THE SERVICE PORT IS OPEN TO THE LINE SET AND INDOOR UNIT.

WHEN SERVICE VALVE IS OPEN, THE SERVICE PORT IS OPEN TO LINE SET, INDOOR AND OUTDOOR UNIT.



BALL-TYPE SERVICE VALVE

To Access Service Port:

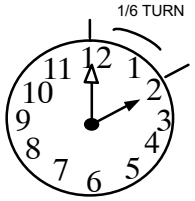
A service port cap protects the service port core from contamination and serves as the primary leak seal.

1 - Remove service port cap with an appropriately sized wrench.

2 - Connect gauge set to service port.

3 - When testing is completed, replace service port cap and tighten as follows:

- With torque wrench, finger tighten and torque cap per table 1.
- Without torque wrench, finger tighten and use an appropriately sized wrench to turn an additional 1/6 turn clockwise.



Operating Angle-Type Service Valve:

1 - Remove stem cap with an appropriately sized wrench.

2 - Use a service wrench with a hex-head extension (3/16” for liquid line valve sizes and 5/16” for vapor line valve sizes) to back the stem out counterclockwise as far as it will go.

Operating Ball-Type Service Valve:

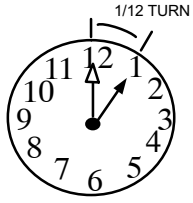
1 - Remove stem cap with an appropriately sized wrench.

2 - Use an appropriately sized wrench to open. To open valve, roate stem counterclockwise 90°. To close, rotate stem clockwise 90°.

Reinstall Stem Cap:

Stem cap protects the valve stem from damage and serves as the primary seal. Replace the stem cap and tighten as follows:

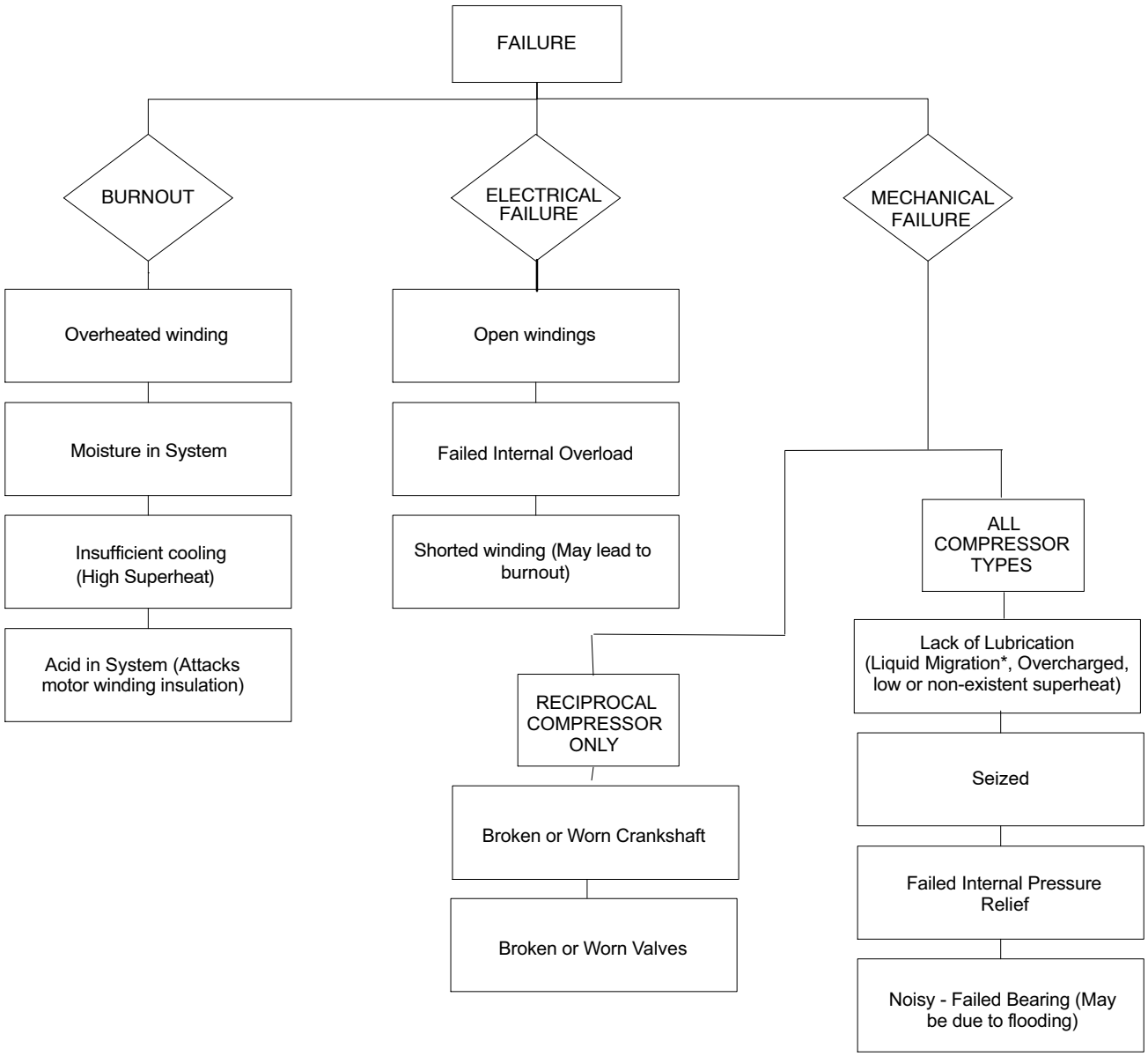
- With torque wrench, finger tighten and then torque cap per table 1.
- Without torque wrench, finger tighten and use an appropriately sized wrench to turn an additional 1/12 turn clockwise.



NOTE - *A label with specific torque requirements may be affixed to the stem cap. If the label is present, use the specified torque.*

FIGURE 1. Angle- and Ball-Type Service Valves

Typical Compressor Failures



NOTE - FAILURES ARE TYPICALLY A DIRECT RESULT OF IMPROPER INSTALLATION AND/ OR SERVICE PRACTICES.

*There are two possibilities for lack of lubrication which are:

- Liquid refrigerant migrated to compressor during shutdown. When the compressor starts, the oil foams because the liquid refrigerant is boiling violently in the compressor. The foaming oil is pumped out of the compressor leaving little or no oil for lubrication.
- During operation, liquid refrigerant is returned to the compressor due to overcharge or low superheat (flooding). The liquid refrigerant foams.

Compressor Troubleshooting Checklist

Will Not Pump	Will Not Start	Noisy
Compressor has internal vacuum protector that will unload scrolls when suction pressure falls below 20 psig. A hissing sound will be heard when the compressor is running unloaded. Protector will reset when low pressure in system rises above 40 psig. **DO NOT CHANGE COMPRESSOR.** Check for restriction in system or low refrigerant charge.	Check run capacitor for capacitance and voltage per capacitor nameplate. All resistance checks must be done at the compressor terminals with the main power plug or wires disconnected from the terminals on the compressor. Check run capacitor for capacitance and voltage. Resistance Check - run to start winding resistance = common to run + common to start resistance.	The compressor and refrigerant line connections must be isolated from the unit and the structure. Installers should follow recommendations in installation instructions to prevent compressor sounds from entering the home.

Reason(s) why the compressor is being removed (Check all that apply)

	Low Suction Pressure		Tripped Breaker / Blower Fuse		Noisy at Start-Up
20 psig or lower		*checked for proper size breaker*		*mechanical sound*	
	Low Suction Pressure		Locked Rotor Amperage		Noisy when Running
Pressure between 20 and 40 psig		*checked voltage and run capacitor*		*outside at unit*	
	Low Discharge Pressure		Windings Electrically Shorted		Noisy when running
140 psig or lower		*checked at compressor terminals*		*inside home*	
	High Discharge Pressure		Windings Electrically Open		Noisy during shut down
140 psig or higher		*checked at compressor terminals*		*mechanical sound*	
	Low suction and Discharge		Windings Grounded		All of the Above
Suction	Discharge	check at compressor terminals			
			Applied Hard Start Kit.		

⚠ WARNING

Compressor is heavy. Take care when removing existing compressor and installing replacement compressor.

Failure to do so may result in injury.

⚠ 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.

⚠ IMPORTANT

Some scroll compressors have internal vacuum protector that will unload scrolls when suction pressure falls below 20 psig. A hissing sound will be heard when the compressor is running unloaded. Protector will reset when low pressure in system rises above 40 psig. DO NOT REPLACE COMPRESSOR.

Compressor Burnout or Mechanical Failure

- Test refrigerant oil using an approved acid test kit (contact Lennox Repair Parts for available acid test kits).
- Treat all burnouts as if each were severe.
- After the refrigerant has been recovered from the system, remove the failed compressor and any driers, filters or strainers.
- Determine the cause of mechanical failure.

Compressor Removal

1 - Disconnect power to the unit from the service disconnect switch (figure 2).

2 - Remove unit access panel. See unit installation instruction for access panel removal procedure.

3 - Remove any exterior/interior panels or controls necessary to gain access to the unit compressor.

4 - Disconnect all electrical connections to the compressor as shown in figure 3.

⚠ IMPORTANT

The Clean Air Act of 1990 bans the intentional venting of refrigerant (CFCs, HCFCs and HFCs) as of July 1, 1992. Approved methods of recovery, recycling or reclaiming must be followed. Fines and/or incarceration may be levied for noncompliance.

5 - Recover refrigerant using procedure provided in figure 8.

6 - Either cut or de-braze the suction and discharge lines (figure 3) from the compressor. If debrazing method is used, follow the instructions provided in figure 9.

7 - Remove any driers, filters or strainers.

8 - Remove hardware securing compressor to mounting base. See figure 7.

9 - Remove compressor.

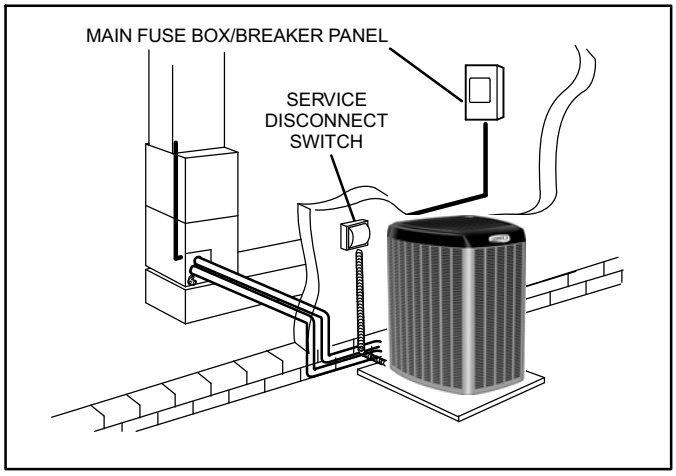
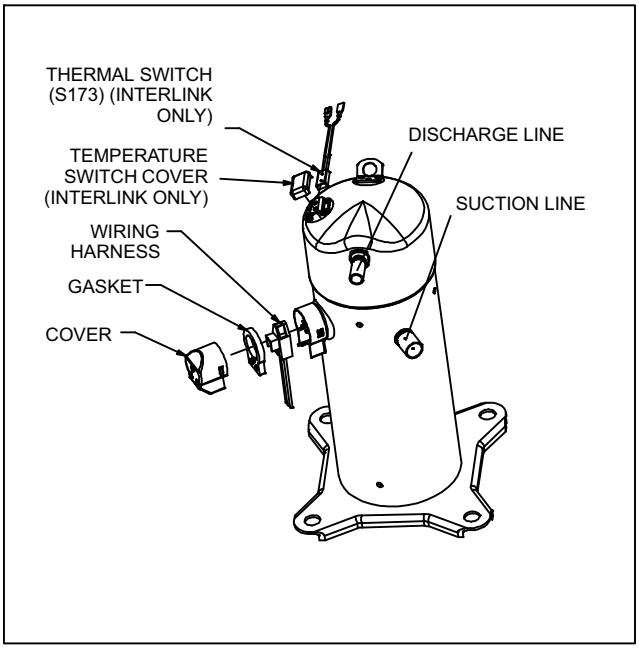
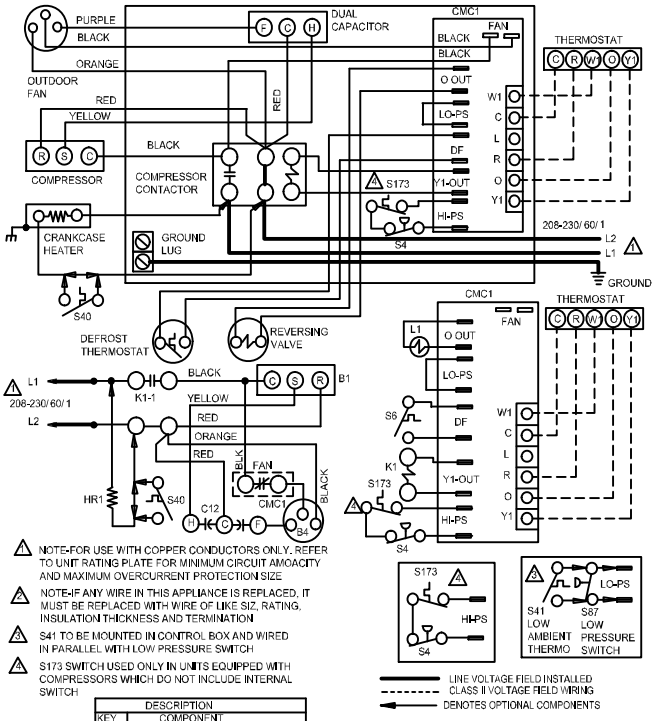


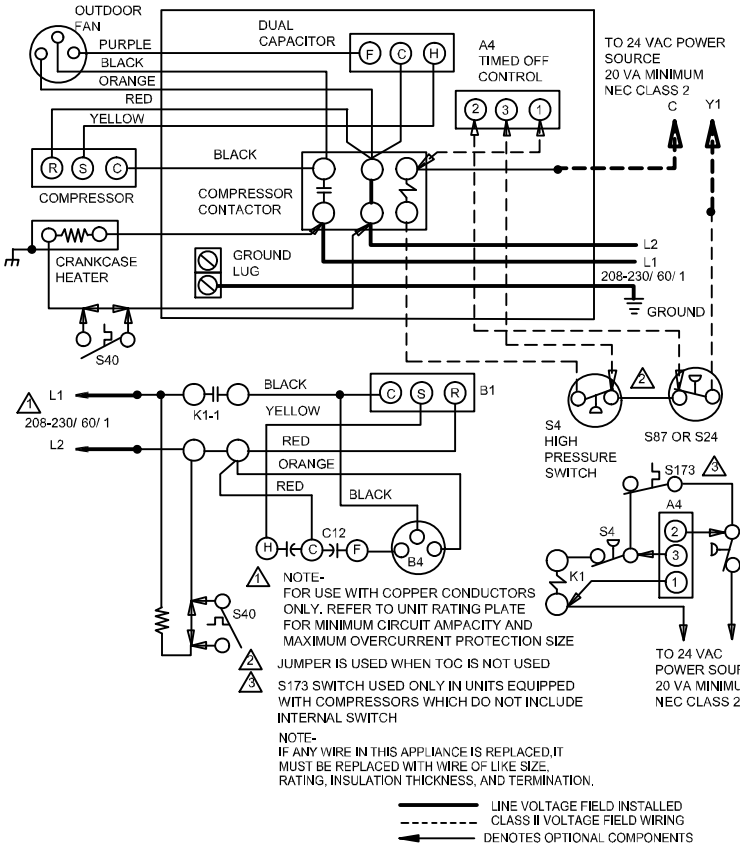
FIGURE 2. Service Disconnect





KEY	DESCRIPTION COMPONENT
B1	COMPRESSOR
B4	MOTOR-OUTDOOR FAN
C12	CAPACITOR-DUAL
CMC1	CONTROL-DEFROST
HR1	HEATER-COMPRESSOR
K1-1	CONTACTOR-COMPRESSOR
L1	VALVE-REVERSING
S4	SWITCH-HIGH PRESSURE
S6	SWITCH-DEFROST
S40	TERMOSTAT-CRANKCASE
S41	THERMOSTAT-LOW AMBIENT
S87	SWITCH-LOW PRESS, COMP 1
S173	SWITCH-THERMAL PROTECTION

TYPICAL HEAT PUMP WIRING



TYPICAL AIR CONDITIONER WIRING

KEY	DESCRIPTION COMPONENT
A4	CONTROL-TIMED OFF
B1	COMPRESSOR
B4	MOTOR-OUTDOOR FAN
C12	CAPACITOR-DUAL
HR1	HEATER-COMPRESSOR
K1-1	CONTACTOR-COMPRESSOR
S4	SWITCH-HIGH PRESSURE
S24	SWITCH-LOSS OF CHARGE
S40	TERMOSTAT-CRANKCASE
S87	SWITCH-LOW PRESS, COMP 1
S173	SWITCH-THERMAL PROTECTION

FIGURE 3. Compressor Components and Typical Wiring

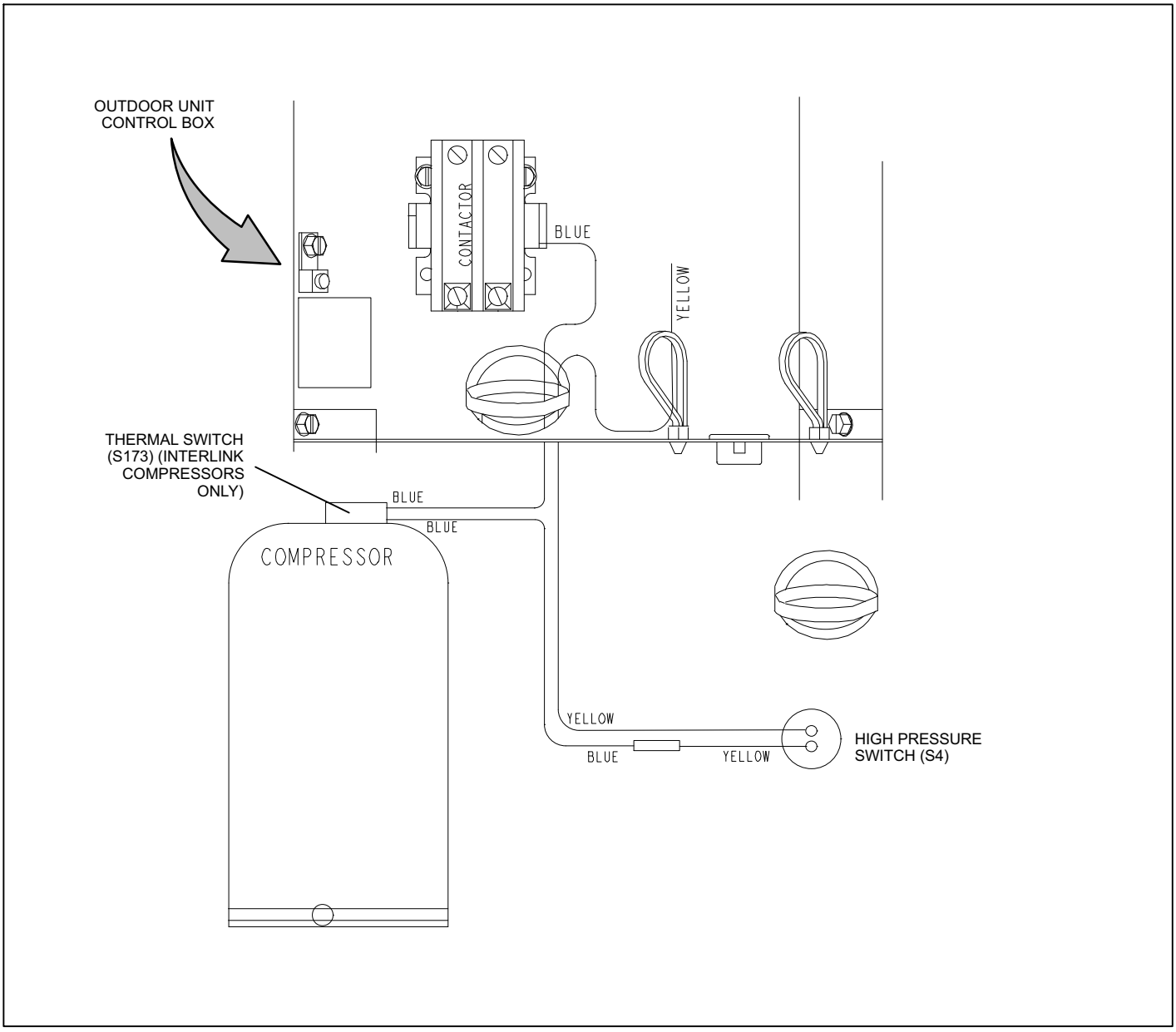


FIGURE 4. Typical Compressor S173 Thermal Switch Wiring (Air Conditioner) Example

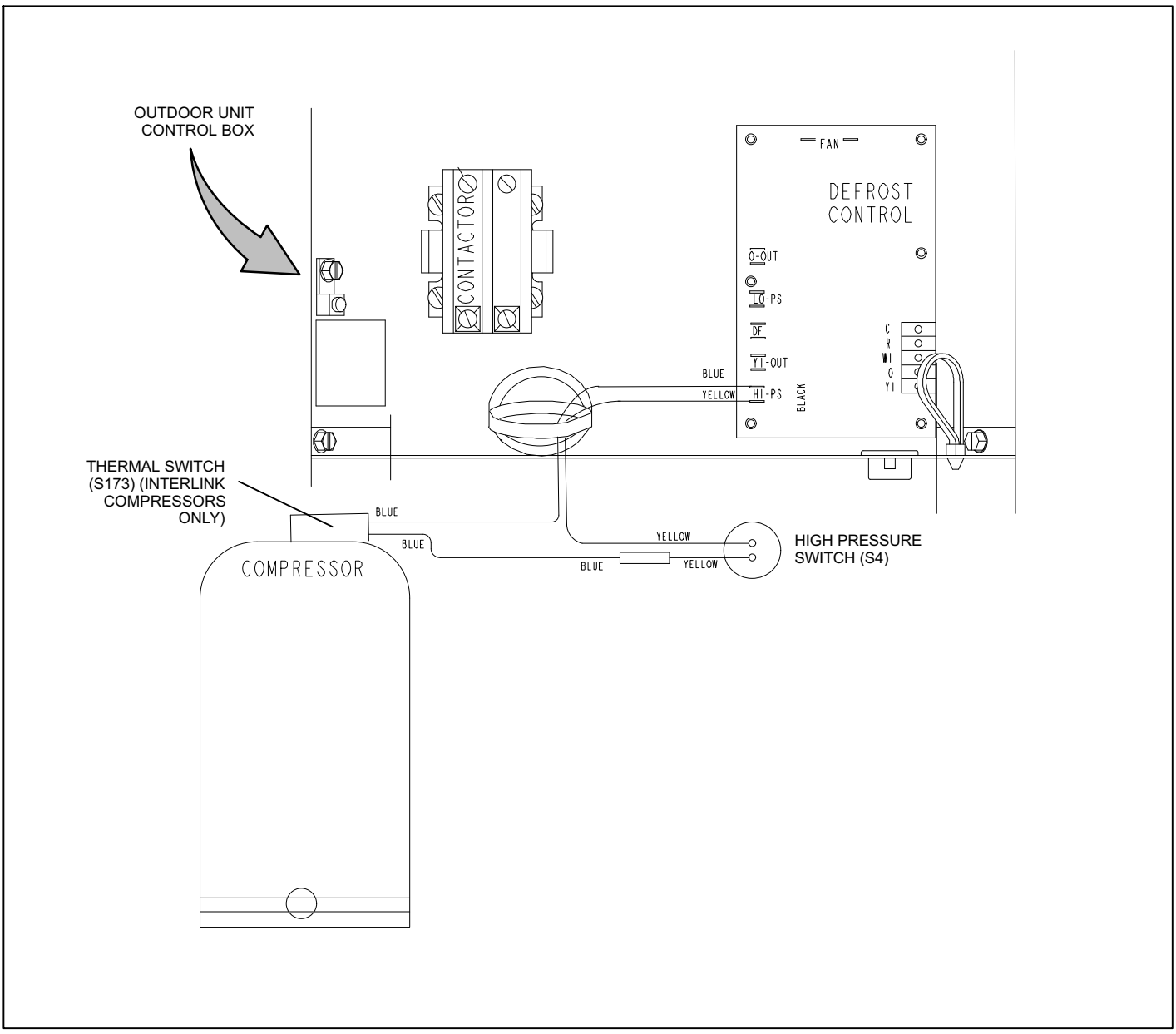


FIGURE 5. Typical Compressor S173 Thermal Switch Wiring (Heat Pump) Example

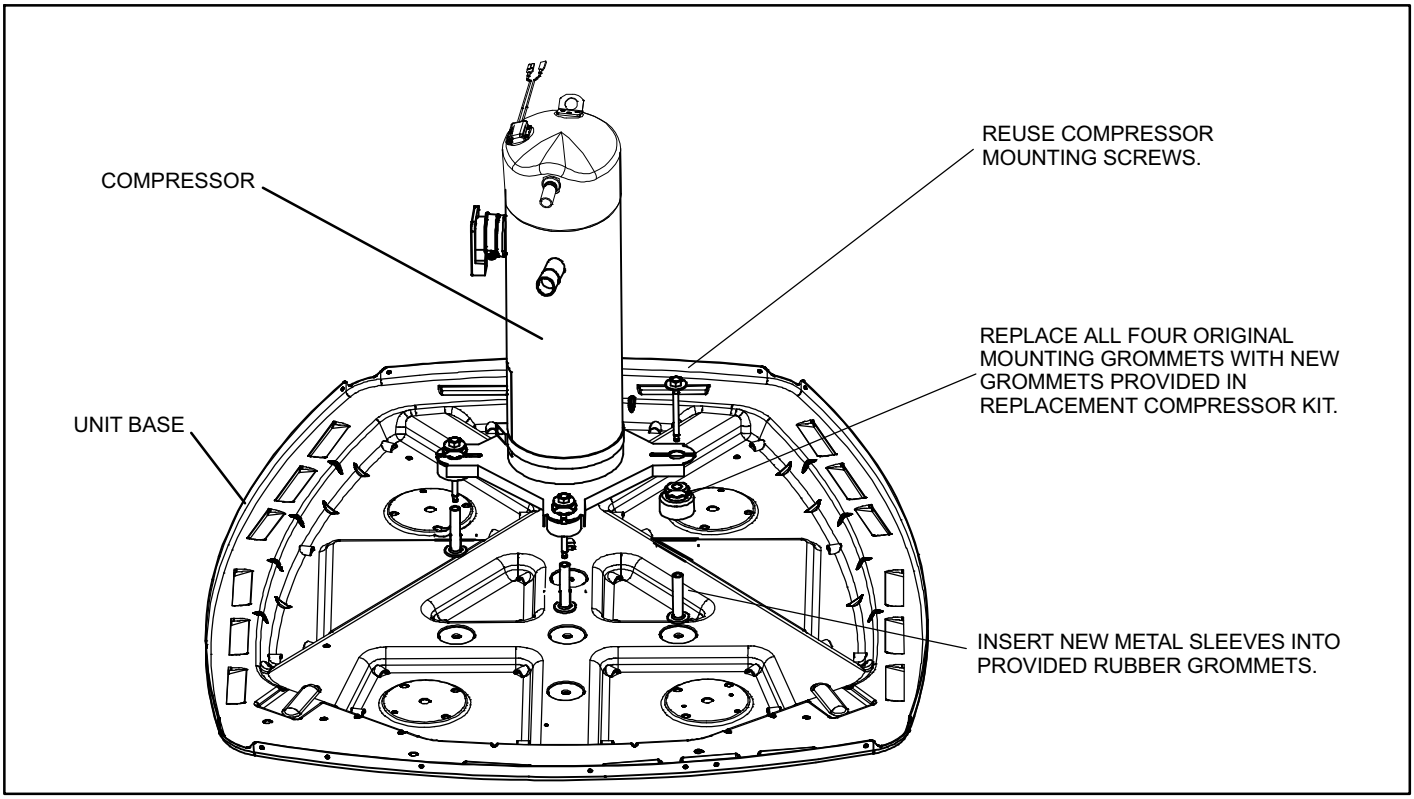
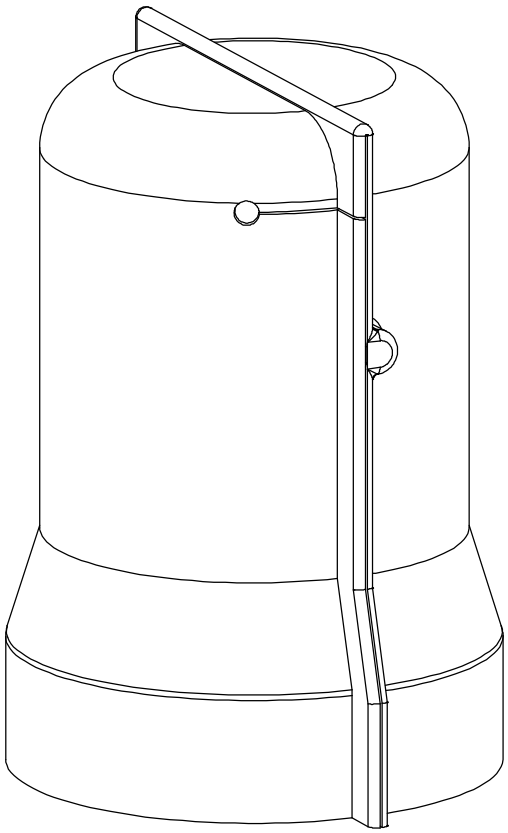


FIGURE 6. Typical Compressor Mounting Hardware

Soft-Shell Cover (one-piece)



NOTE - Soft-shell cover is size-specific.

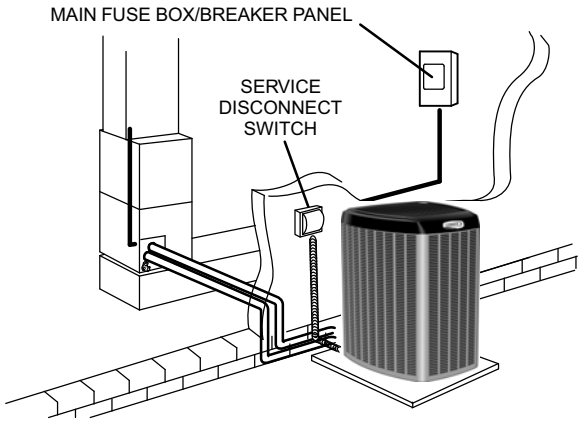
FIGURE 7. Typical Compressor Sound Cover Used by Lennox

RECOVERING

REFRIGERANT FROM SYSTEM

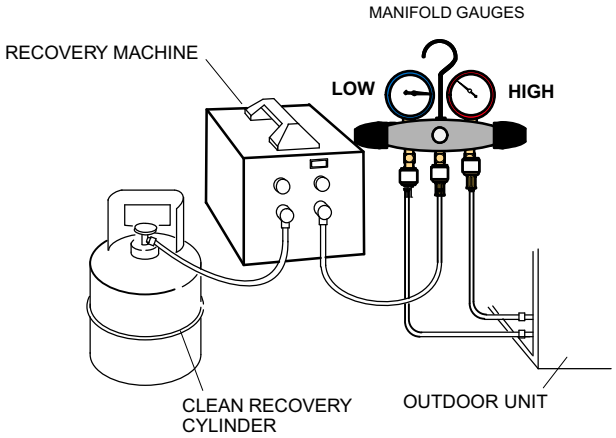
1 DISCONNECT POWER

Disconnect all power to the existing outdoor unit at the disconnect switch or main fuse box/breaker panel.



2 CONNECT MANIFOLD GAUGE SET

Connect a gauge set, clean recovery cylinder and a recovery machine to the service ports of the existing unit. Use the instructions provided with the recovery machine to make the connections.



3 RECOVERING REFRIGERANT

Remove existing refrigerant using one of the following procedures:

IMPORTANT — Some system configurations may contain higher than normal refrigerant charge due to either large internal coil volumes, and/or long line sets.

METHOD 1:

Use this method 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 refrigerant to flush the system.

Remove all refrigerant from the existing system. Check gauges after shutdown to confirm that the entire system is completely void of refrigerant.

METHOD 2:

Use this method if the existing outdoor unit is equipped with manual shut-off valves, and you plan to use new refrigerant to flush the system.

The following devices could prevent full system charge recovery into the outdoor unit:

- When tripped, the outdoor unit's high or low-pressure switches (if applicable) can cycle the compressor **OFF**.
- Compressor can stop pumping due to tripped internal pressure relief valve.
- Compressor has internal vacuum protection that is designed to unload the scrolls (compressor stops pumping) when the pressure ratio meets a certain value or when the suction pressure is as high as 20 psig. (Compressor suction pressures should never be allowed to go into a vacuum. Prolonged operation at low suction pressures will overheat the scrolls and cause permanent damage to the scroll tips, drive bearings and internal seals.)

  Once the compressor is unable to pump down to a lower pressure due to one of the above system conditions, shut off the vapor valve. Turn OFF the main power to unit and use a recovery machine to recover any refrigerant left in the indoor coil and line set.

Perform the following task:

A - Start the existing refrigerant system in the cooling mode and close the liquid line valve.

B - Use the compressor to pump as much of the existing refrigerant into the outdoor unit until the outdoor system is full. Turn the outdoor unit main power OFF and use a recovery machine to remove the remaining refrigerant from the system.

NOTE — *It may be necessary to bypass the low pressure switches (if equipped) to ensure complete refrigerant evacuation.*

C - When the low side system pressures reach 0 psig, close the vapor line valve.

D - Check gauges after shutdown to confirm that the valves are not allowing refrigerant to flow back into the low side of the system.

FIGURE 8. Refrigerant Recovery

BRAZING

NOTE - *Use silver alloy brazing rods with five or six percent minimum silver alloy for copper-to-copper brazing, 45 percent alloy for copper-to-brass and copper-to-steel brazing.*

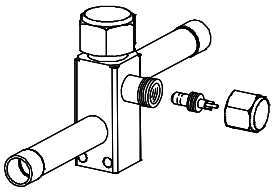
CONNECTIONS

1 CUT AND DEBUR

Cut and debur both lines to the compressor.

2 CAP AND CORE REMOVAL

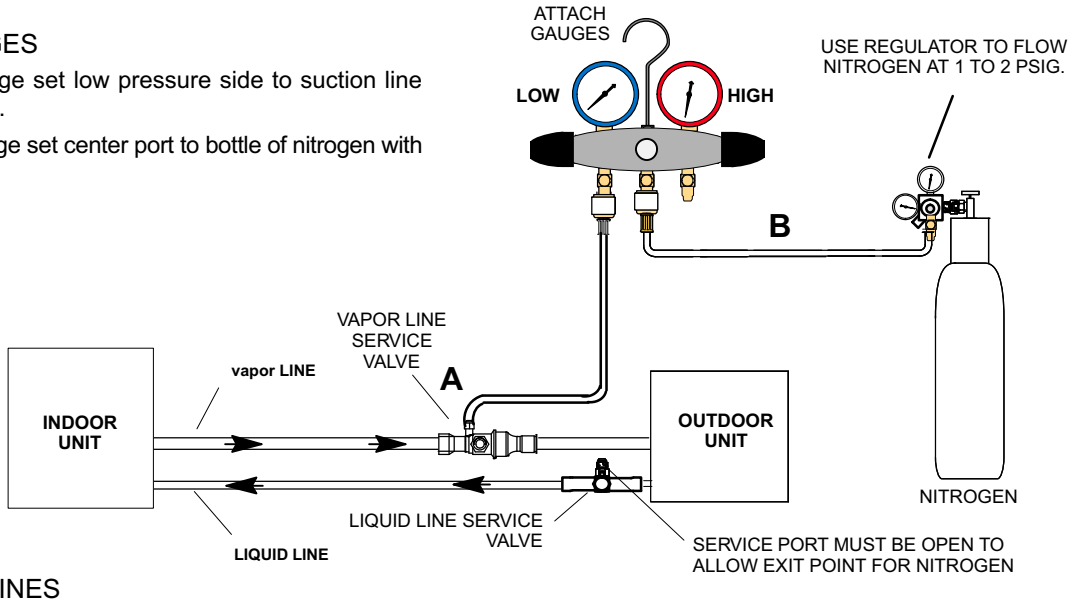
Remove service cap and core from both the vapor and liquid line service ports.



3 ATTACH GAUGES

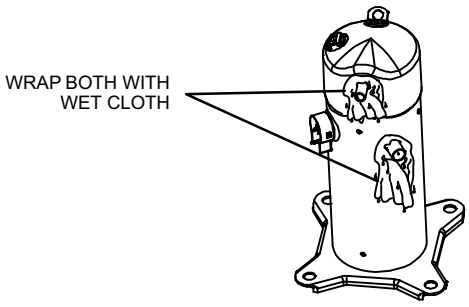
A - Connect gauge set low pressure side to suction line service valve.

B - Connect gauge set center port to bottle of nitrogen with regulator.



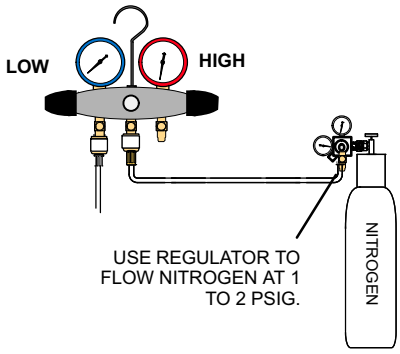
4 WRAP BOTH LINES

To protect components during brazing, wrap a wet cloth around the suction and discharge lines copper tube stubs.

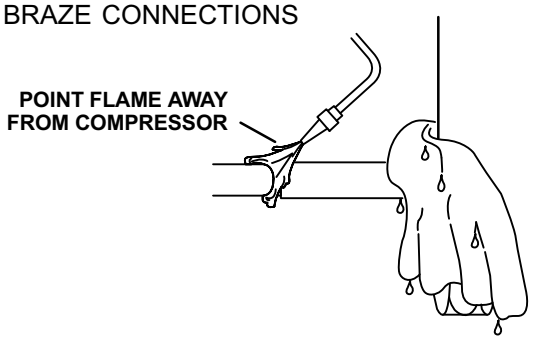


5 FLOW NITROGEN

Flow regulated nitrogen (at 1 to 2 psig) through the refrigeration gauge set into the valve stem port connection on the vapor line service valve and out of the valve stem port connection on the vapor service valve.



6 BRAZE CONNECTIONS



WARNING — Allow braze joint to cool before removing the wet rag from the service valve. (TEMPERATURES ABOVE 250ºF CAN DAMAGE VALVE SEALS).

IMPORTANT — Connect gauge set low pressure side to vapor line service valve and repeat procedure starting at step 4 for brazing the liquid line to service port valve.

FIGURE 9. Brazing Connections

Compressor Installation

Prepare the new compressor and oversized driers for installation.

1 - Install new compressor.

2 - Fasten compressor to base (see figure 6).

3 - Install oversized liquid and suction line driers (Contact Lennox Repair Parts for unit-specific driers). Use brazing procedures outlined in figure 9.

⚠ IMPORTANT

Limit the time that the compressor and driers are open to the atmosphere to prevent the introduction of moisture into the new system.

NOTE - *If the replacement compressor requires a start kit, it must be ordered separately and installed. Do not use the existing start kit components.*

4 - Leak test the system using procedures in figure 10.

5 - Evacuate the system using procedures in figure 11.

6 - Connect all electrical connections to the compressor as illustrated in figures 3 through 5.

7 - Turn power on to the unit at the service disconnect switch (see figure 2).

8 - Charge the system using the outdoor unit's charging sticker located on the unit access panel.

9 - System must be rechecked after operating for two weeks. Check filter driers and perform an acid test. If acid is still present, replace driers. If no acid is present, remove drier and suction filter. Install a new liquid line drier before evacuating and recharging the systems using the procedures provided in this instruction.

10 - If you have any other questions about unit operation or these procedures, contact Lennox Technical Support at 800.453.6669.

⚠ IMPORTANT

The Environmental Protection Agency (EPA) 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.

⚠ IMPORTANT

Leak detector must be capable of sensing HFC refrigerant.

⚠ 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

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).

⚠ WARNING

Fire, Explosion and Personal Safety Hazard.

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

Never use oxygen to pressurize or purge refrigeration lines. Oxygen, when exposed to a spark or open flame, can cause damage by fire and/or an explosion, that could result in personal injury or death.

LEAK TEST

COMPLETE SYSTEM

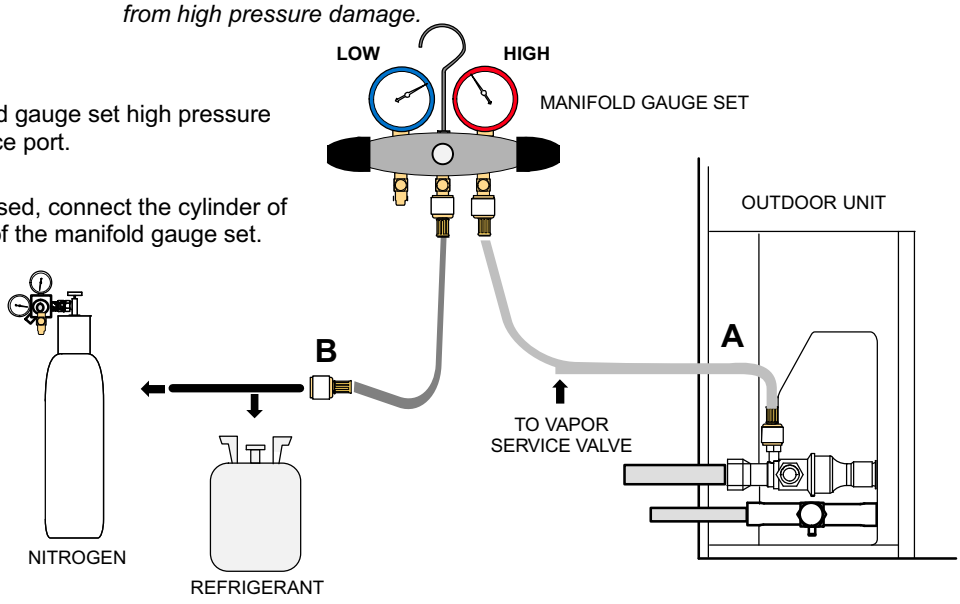
NOTE - *Normally, the high pressure hose is connected to the liquid line port. However, connecting it to the vapor port better protects the manifold gauge set from high pressure damage.*

1 CONNECT GAUGE SET

A - Connect a refrigerant manifold gauge set high pressure hose to the vapor valve service port.

B - With both manifold valves closed, connect the cylinder of refrigerant to the center port of the manifold gauge set.

NOTE - *Later in the procedure, the refrigerant container will be replaced by the nitrogen container.*



2 TEST FOR LEAKS

After the line set has been connected to the indoor unit and air conditioner, 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 refrigerant to the center port of the manifold gauge set. Open the valve on the refrigerant cylinder (vapor only).

B - Open the high pressure side of the manifold to allow refrigerant into the line set and indoor unit. Weigh in a trace amount of refrigerant. *[A trace amount is a maximum of two ounces (57 g) refrigerant or three pounds (31 kPa) pressure].* Close the valve on the refrigerant cylinder and the valve on the high pressure side of the manifold gauge set. Disconnect the refrigerant cylinder.

C - Connect a cylinder of dry nitrogen with a pressure regulating valve to the center port of the manifold gauge set.

D - Adjust dry 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. Verify that the refrigerant added to the system earlier can be measured using a leak detector.

F - After leak testing, disconnect gauges from service ports.

FIGURE 10. Leak Test the System

EVACUATING COMPLETE SYSTEM

1 CONNECT GAUGE SET

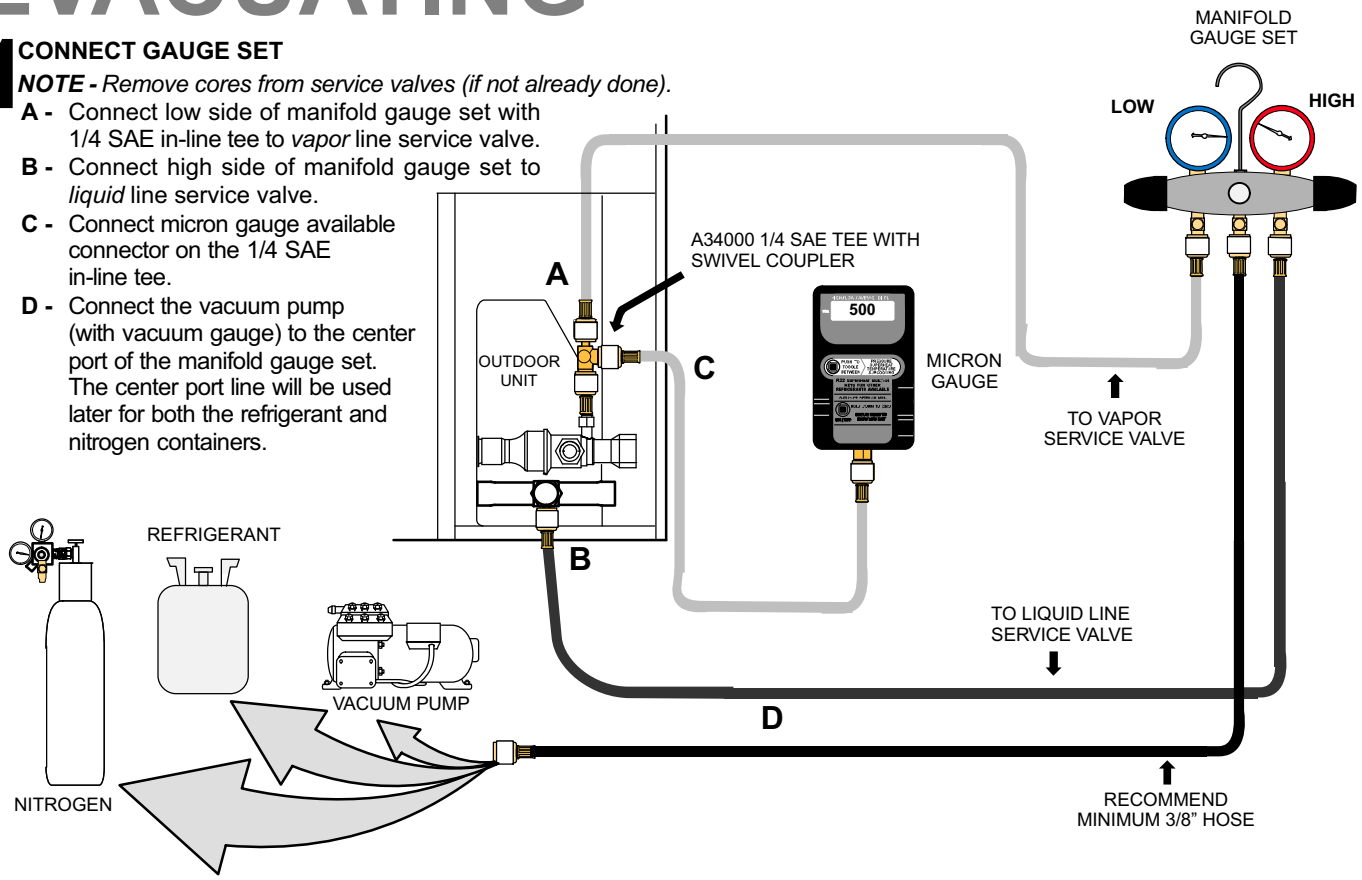
NOTE - *Remove cores from service valves (if not already done).*

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 micron gauge available 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 refrigerant and nitrogen containers.



2 EVACUATE THE SYSTEM

A - Open both manifold valves and start the vacuum pump.

B - Evacuate the line set and indoor unit to an **absolute pressure** of 23,000 microns (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 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.*

C - 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 dry 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.

D - Shut off the dry nitrogen cylinder and remove the manifold gauge hose from the cylinder. Open the manifold gauge valves to release the dry 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 an upright cylinder of 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 refrigerant 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 the stem caps and secure finger tight, then tighten an additional one-sixth (1/6) turn clockwise.

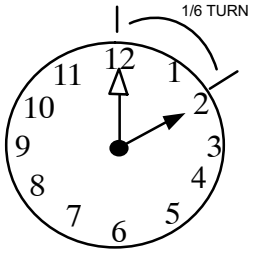


FIGURE 11. Evacuating the System

⚠ IMPORTANT

Use a thermocouple or thermistor electronic vacuum gauge that is calibrated in microns. Use an instrument capable of accurately measuring down to 50 microns.

⚠ 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.

Sealing Old Compressor for Shipping

To prevent damage to the suction and discharge connections of the compressor, copper pipe stubs must be BRAZED into these connections. This will prevent moisture and debris from getting into the compressor. The stubs will also prevent oil from escaping from the compressor and causing environmental issues during return shipment back to Lennox.

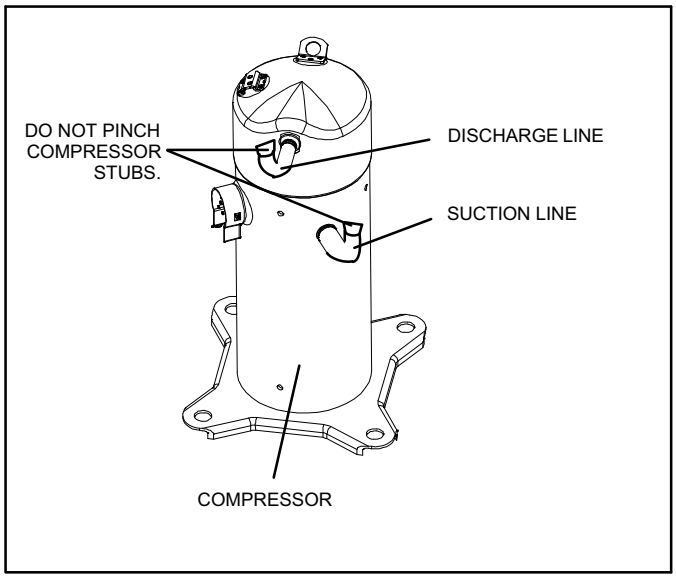


FIGURE 12. Shipping Compressor