

13ACD SPLIT SYSTEM AIR CONDITIONER WITH DRY NITROGEN HOLDING CHARGE INSTALLATION / START-UP INSTRUCTIONS

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

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NOTICE TO INSTALLER

This unit is factory-charged with dry nitrogen. The unit is intended for installation in existing HCFC-22 systems. Carefully follow all installation procedures.

⚠ WARNING

Installation or repairs made by unqualified persons can result in hazards to you and others. Installation MUST conform with local building codes or, in the absence of local codes, with the National Electrical Code NFPA 70/ANSI C1-1993 or current edition and Canadian Electrical Code Part 1 CSA C22.1.

⚠ CAUTION

Improper selection of a matching indoor unit and a matching metering device, improper installation, adjustment, alteration, service or maintenance may void the warranty. The qualified installer or agency must use factory-authorized kits or accessories when modifying this products. Refer to the individual instructions packaged with the kits or accessories when installing.

NOTE

These instructions are intended as a general guide and do not supersede national, state or local codes in any way.
These instructions must be left with the property owner.



General

The 13ACD air conditioner, which will also be referred to in this instruction as the outdoor unit, uses HCFC-22 refrigerant. This outdoor unit is intended as a replacement outdoor component for use in residential systems which include an existing indoor coil which is functioning properly. It is **NOT** intended for new installations.

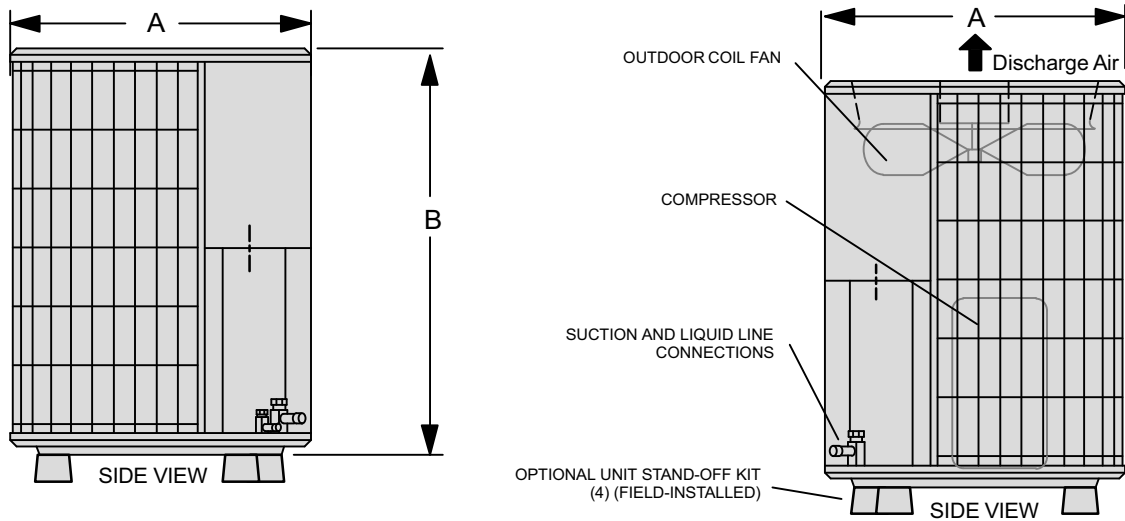
This outdoor unit is:

- shipped from the factory with nitrogen holding charge that must be purged from the unit;

- designed for use with HCFC-22 refrigerant only;
- designed for use in systems that use either a RFC device (orifice) included with outdoor unit or thermal expansion valve (TXV). See the *13ACD product specification sheet* for approved fixed orifice sizes and expansion valve kit match ups.

Important — The air conditioning unit must have properly matched system components including indoor unit and refrigerant metering device. Mismatched equipment may have an impact on the operation, performance, reliability, and warranty of the air conditioning unit.

Unit Dimensions - Inches (mm)



Model Number	A	B
13ACD-018-230	24-1/4 (616)	25-1/4 (641)
13ACD-024-230	24-1/4 (616)	25-1/4 (641)
13ACD-030-230	24-1/4 (616)	33-1/4 (845)
13ACD-036-230	24-1/4 (616)	33-1/4 (845)
13ACD-042-230	28-1/4 (718)	29-1/4 (743)
13ACD-048-230	28-1/4 (718)	37-1/4 (946)
13ACD-060-230	28-1/4 (718)	33-1/4 (845)

Typical Unit Parts Arrangement

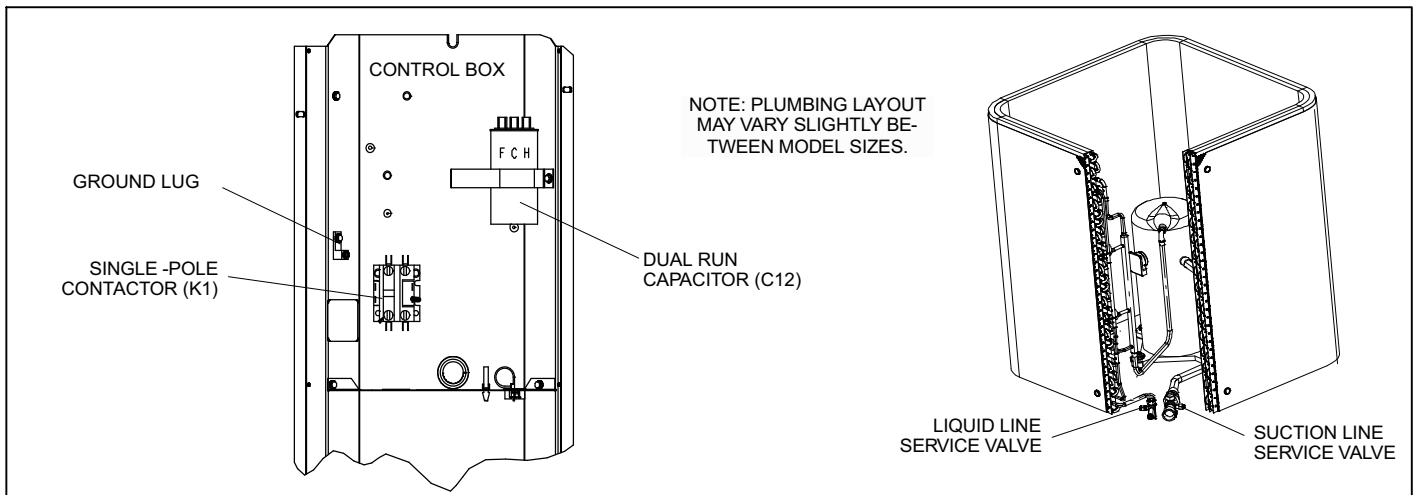


Figure 1. Typical Unit Parts Arrangement

Shipping and Packing List

Check the unit for shipping damage. If damaged, or if parts are missing, immediately contact the last shipping carrier.

1 — Assembled 13ACD unit

1 — Refrigerant flow control (RFC) kit (orifice) (see table 3 on page 12 for a complete list of available fixed orifice kits)

Torque Requirements

When servicing or repairing HVAC components, ensure the fasteners and caps are appropriately tightened. Table 1 lists torque values for fasteners.

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

Operating Gauge Set and Service Valves

USING MANIFOLD GAUGE SET

When checking the system charge, only use a manifold gauge set that features low-loss anti-blow back fittings.

OPERATING SERVICE VALVES

The liquid and vapor line service valves are used for removing refrigerant, flushing, leak testing, evacuating, checking charge and charging.

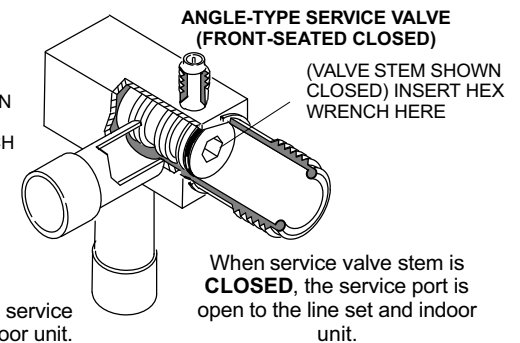
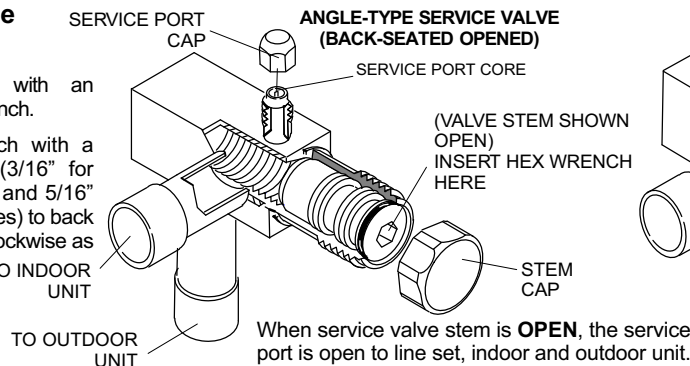
Each valve is equipped with a service port which has a factory-installed valve core. Figure 2 provides information on accessing and operating both angle and ball-type service valves.

IMPORTANT

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

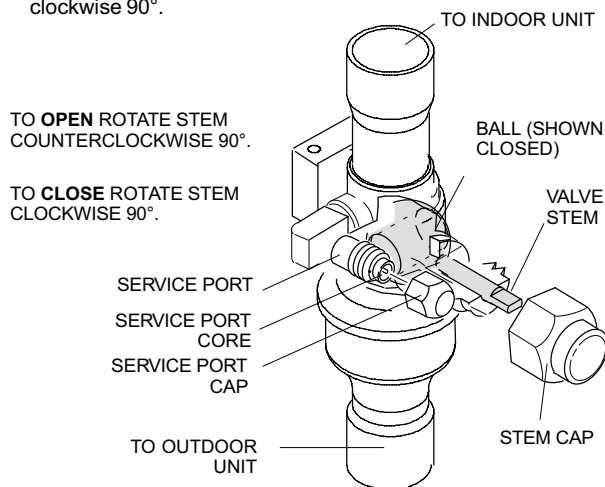
Operating Angle-Type Service Valve:

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:

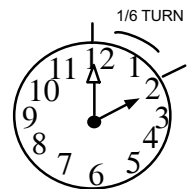
1. Remove stem cap with an appropriately sized wrench.
2. Use an appropriately sized wrench to open. To open valve, rotate stem counterclockwise 90°. To close rotate stem clockwise 90°.



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.



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.

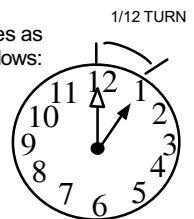


Figure 2. Operating Angle and Ball-Type Service Valves

Recovering Refrigerant from Existing System

▲ IMPORTANT

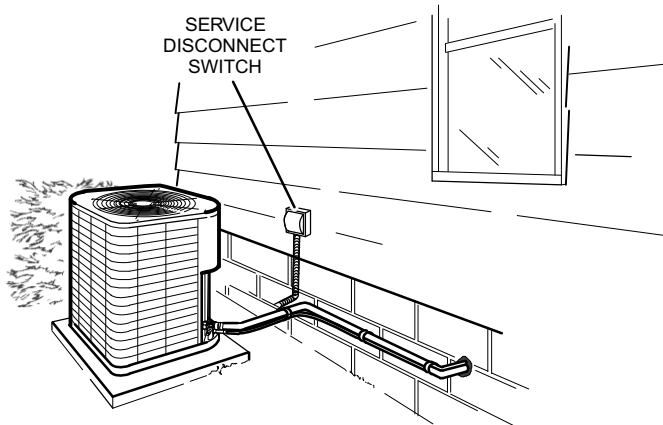
The Clean Air Act of 1990 bans the intentional venting of refrigerant (CFCs, HCFCs AND HFCs) as of July 1, 1992. Approved methods of recovery, recycling or reclaiming must be followed. Fines and/or incarceration may be levied for noncompliance.

RECOVERING

REFRIGERANT FROM SYSTEM

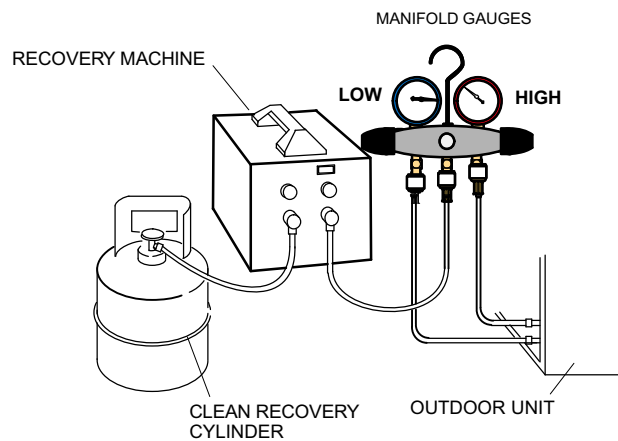
1 DISCONNECT POWER

Disconnect all power to the existing outdoor unit at the service 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:

- Outdoor unit's high or low-pressure switches (if applicable) when tripped 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 result in overheating of the scrolls and permanent damage to the scroll tips, drive bearings and internal seals.)

Once the compressor cannot 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 system in the cooling mode and close the liquid line valve.
- B Use the compressor to pump as much of the existing HCFC-22 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 3. Refrigerant Recovery

New Outdoor Unit Placement

Remove existing outdoor unit prior to placement of new outdoor unit. See *Unit Dimensions* on page 2 for sizing mounting slab, platforms or supports. Refer to figure 4 for mandatory installation clearance requirements.

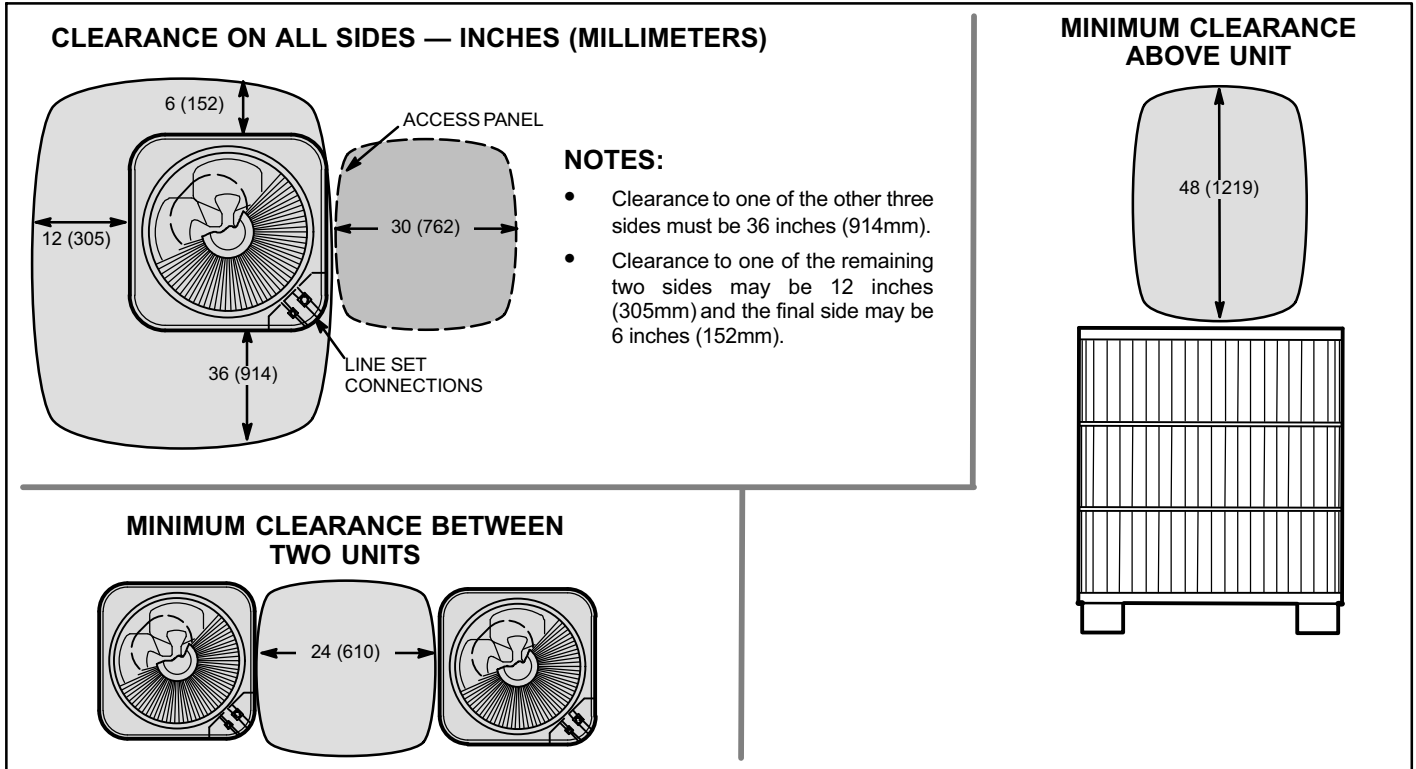


Figure 4. Installation Clearances

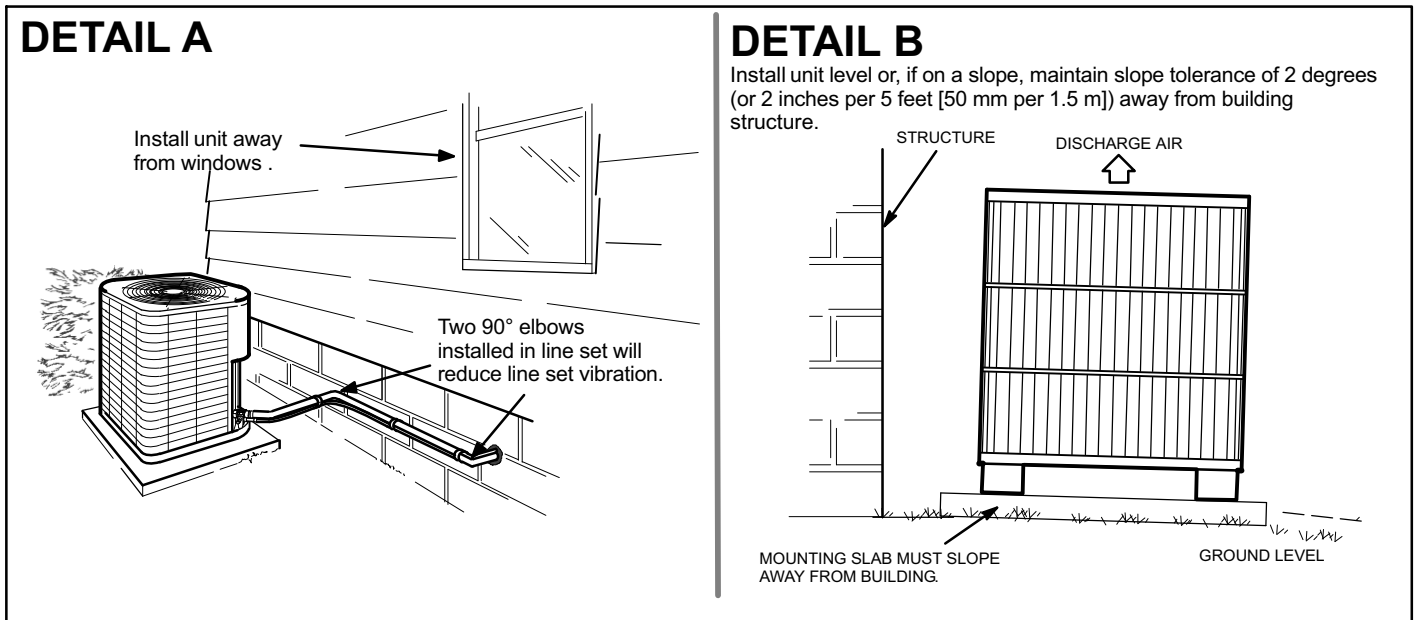


Figure 5. Placement, and Slab Mounting

POSITIONING CONSIDERATIONS

CAUTION

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

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.

Consider the following when positioning the unit:

- Some localities are adopting sound ordinances based on the unit's sound level registered from the adjacent property, not from the installation property. 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. For proper placement of unit in relation to a window see the provided illustration in figure 5.

PLACING OUTDOOR UNIT ON SLAB

When installing a unit at grade level, the top of the slab should be high enough above the grade so that water from higher ground would not collect around the unit as illustrated in figure 5.

Slab may be level or have a slope tolerance away from the building of not more than two degrees, or 2 inches per 5 feet (51 mm per 1524 mm) as illustrated in figure 5.

INSTALLING OUTDOOR UNIT ON ROOF

Install the unit at a minimum of 4 inches (102 mm) above the surface of the roof. Ensure the weight of the unit is properly distributed over roof joists and rafters. Redwood or steel supports are recommended.

NOTICE

Roof Damage!

This system contains both refrigerant and oil. Some rubber roofing material may absorb oil and cause the rubber to swell when it comes into contact with oil. The rubber will then bubble and could cause leaks. Protect the roof surface to avoid exposure to refrigerant and oil during service and installation. Failure to follow this notice could result in damage to roof surface.

Replacement Line Set

This section provides information on replacement of existing line set. If replacement line set is not required, then proceed to *Brazing Connections* on page 7.

REFRIGERANT LINE SET

Field refrigerant piping consists of liquid and suction lines from the outdoor unit (brazed connections) to the indoor unit coil (flare or braze connections). If replacing line set, use brazed, non-flare line set, or field-fabricated refrigerant lines as listed in table 2.

Existing line set should meet size requirements listed in table 2.

NOTE - When installing refrigerant lines longer than 50 feet, contact technical support for assistance. To obtain the correct information from manufacturer, be sure to communicate the following points:

- Model (13ACD) and size of unit (e.g. -060).
- Line set diameters for the unit being installed as listed in table 2 and total length of installation.
- Number of elbows and if there is a rise or drop of the piping.

Table 2. Refrigerant Line Set — Inches (mm)

Model	Field Connections		Recommended Line Set		
	Liquid Line	Suction Line	Liquid Line	Suction Line	Line Sets
13ACD-018-230	3/8 in. (10 mm)	3/4 in. (19 mm)	3/8 in. (10 mm)	3/4 in. (19 mm)	Field-fabricated brazed, non-flare.
13ACD-024-230					
13ACD-030-230					
13ACD-036-230	3/8 in. (10 mm)	7/8 in. (22 mm)	3/8 in. (10 mm)	7/8 in. (22 mm)	
13ACD-042-230					
13ACD-048-230					
13ACD-060-230	3/8 in. (10 mm)	1-1/8 in. (29 mm)	3/8 in. (10 mm)	1-1/8 in. (29 mm)	

Brazing Connections

Use the procedures outline in figures 6 and 7 for brazing line set connections to service valves.

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



Danger of fire. Bleeding the refrigerant charge from only the high side may result in pressurization of the low side shell and suction tubing. 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.

IMPORTANT

Allow braze joint to cool before removing the wet rag from the service valve. Temperatures above 250°F can damage valve seals.

IMPORTANT

Use silver alloy brazing rods with 5% minimum silver alloy for copper-to-copper brazing. Use 45% minimum alloy for copper-to-brass and copper-to-steel brazing.

WARNING



Danger of fire. Bleeding the refrigerant charge from only the high side may result in pressurization of the low side shell and suction tubing. 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.

CAUTION

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

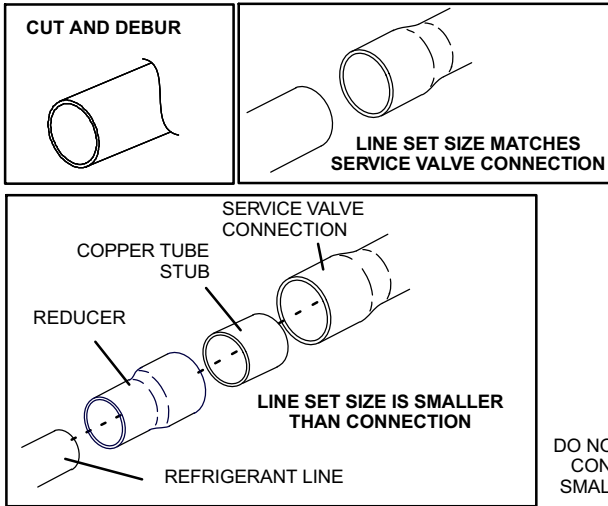
Avoid breathing vapors or fumes from brazing operations. Perform operations only in well-ventilated areas.

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

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

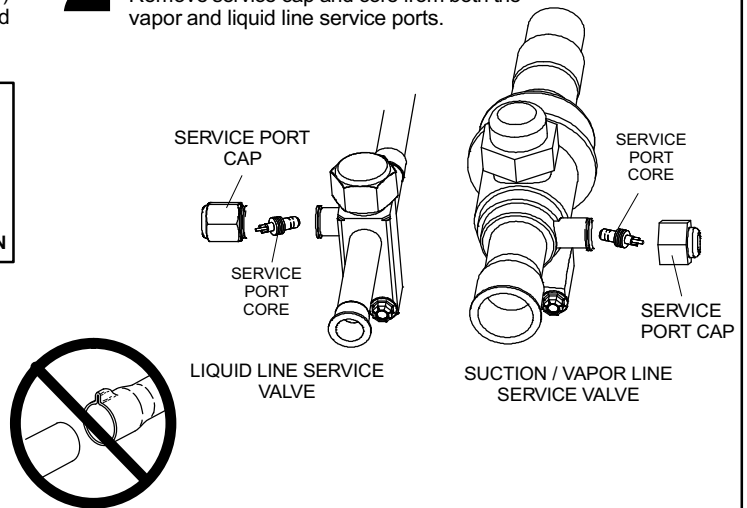
1 CUT AND DEBUR

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 LINE SETS TO LIQUID AND SUCTION / 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 suction / 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 Schrader valve in suction / vapor line service port to allow nitrogen to escape.

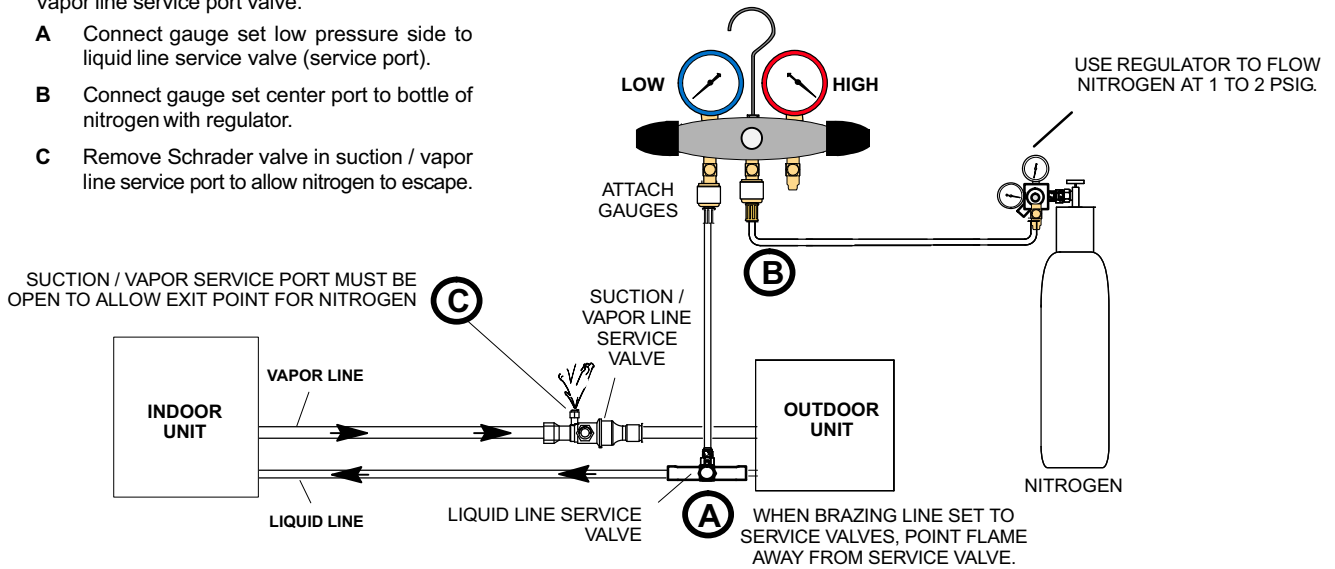


Figure 6. Brazing Procedures

4 WRAP SERVICE VALVES

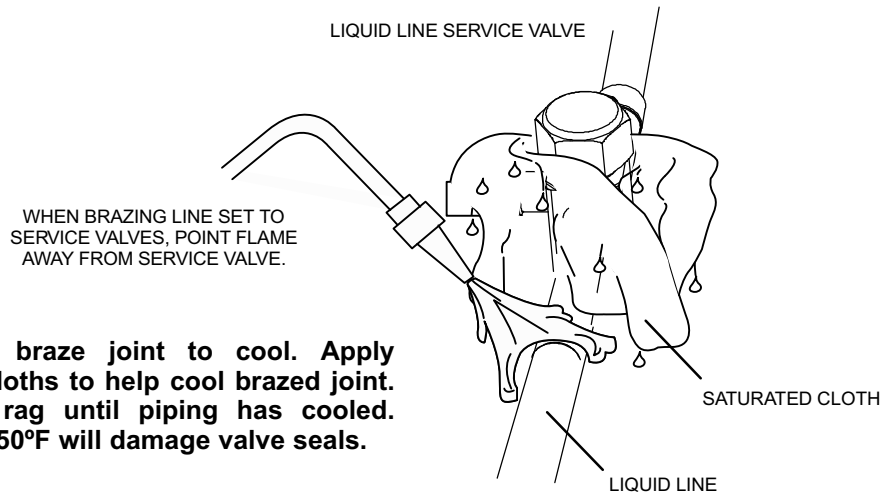
To help protect service valve seals during brazing, wrap a saturated cloth around service valve bodies and copper tube stub. Use another saturated cloth underneath the valve body to protect the base paint.

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 suction / vapor valve stem port. See steps **3A**, **3B** and **3C** on manifold gauge set connections.

6 BRAZE LINE SET

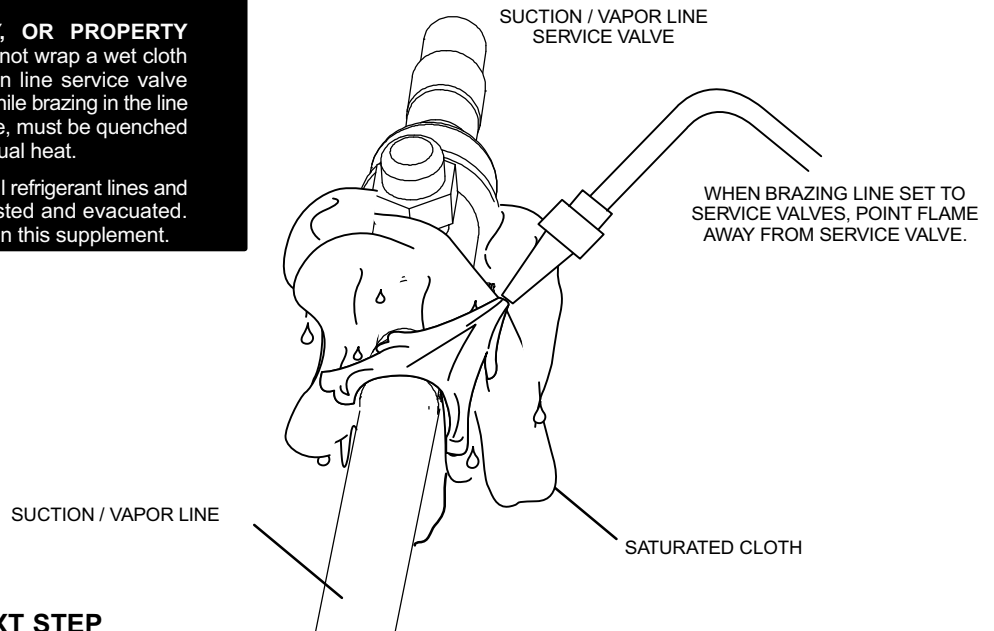
Wrap both service valves with a saturated cloth as illustrated here before brazing to line set.



IMPORTANT — Allow braze joint to cool. Apply additional saturated cloths to help cool brazed joint. Do not remove wet rag until piping has cooled. Temperatures above 250°F will damage valve seals.

WARNING

- 1. FIRE, PERSONAL INJURY, OR PROPERTY DAMAGE** will result if you do not wrap a wet cloth around both liquid and suction line service valve bodies and copper tube stub while brazing in the line set! The braze, when complete, must be quenched with water to absorb any residual heat.
- 2. Do not open service valves until refrigerant lines and indoor coil have been leak-tested and evacuated.** Refer to procedures provided in this supplement.



7 PREPARATION FOR NEXT STEP

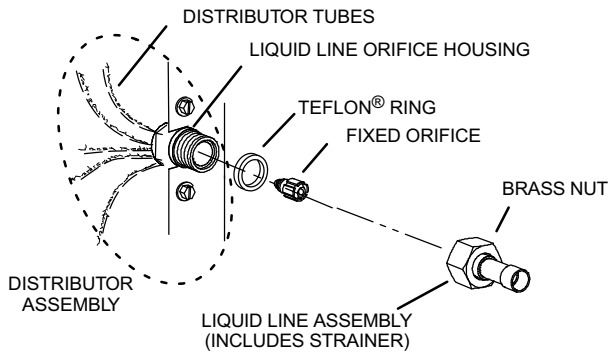
After all connections have been brazed, disconnect manifold gauge set from service ports. Apply saturated rags to both service valves to cool piping. Once piping is cool, remove all wet cloths.

Figure 7. Brazing Procedures (continued)

Removing Existing Metering Device and Flushing Line Set and Indoor Coil

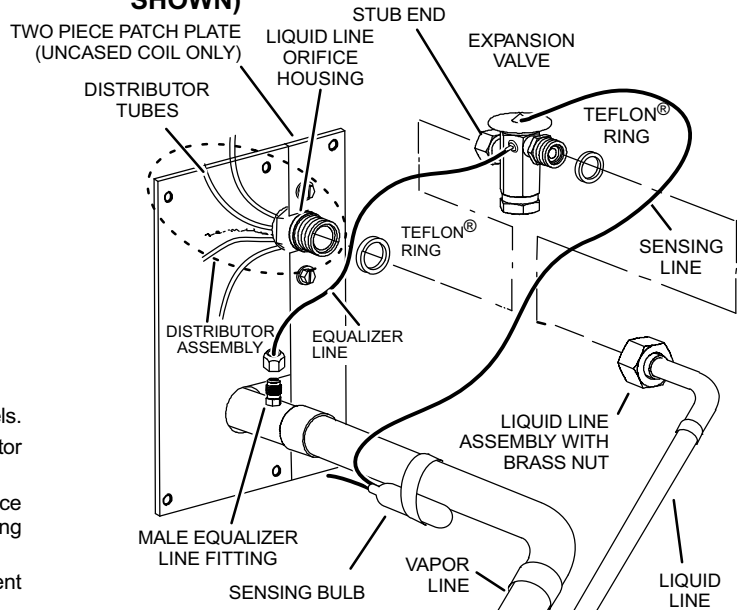
Flushing is only recommended if existing indoor coil and line set are to be used. Otherwise proceed to *Installing Indoor Metering Device* on page 11.

1A TYPICAL EXISTING FIXED ORIFICE REMOVAL PROCEDURE (UNCASED COIL SHOWN)



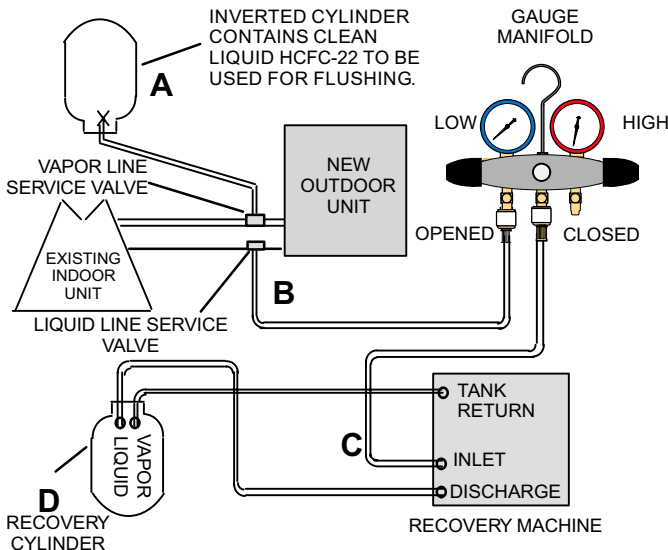
- A** On fully cased coils, remove the coil access and plumbing panels.
- B** Remove any shipping clamps holding the liquid line and distributor assembly.
- C** Using two wrenches, disconnect liquid line from liquid line orifice housing. Take care not to twist or damage distributor tubes during this process.
- D** Remove and discard fixed orifice, valve stem assembly if present and Teflon® washer as illustrated above.
- E** Use a field-provided fitting to temporarily reconnect the liquid line to the indoor unit's liquid line orifice housing.

1B TYPICAL EXISTING EXPANSION VALVE REMOVAL PROCEDURE (UNCASED COIL SHOWN)



- A** On fully cased coils, remove the coil access and plumbing panels.
- B** Remove any shipping clamps holding the liquid line and distributor assembly.
- C** Disconnect the equalizer line from the expansion valve equalizer line fitting on the vapor line.
- D** Remove the vapor line sensing bulb.
- E** Disconnect the liquid line from the expansion valve at the liquid line assembly.
- F** Disconnect the expansion valve from the liquid line orifice housing. Take care not to twist or damage distributor tubes during this process.
- G** Remove and discard expansion valve and the two Teflon® rings.
- H** Use a field-provided fitting to temporarily reconnect the liquid line to the indoor unit's liquid line orifice housing.

2 CONNECT GAUGES AND EQUIPMENT FOR FLUSHING PROCEDURE



- A** Inverted HCFC-22 cylinder with clean refrigerant to the vapor service valve.
- B** HCFC-22 gauge set (low side) to the liquid line valve.
- C** HCFC-22 gauge set center port to inlet on the recovery machine with an empty recovery tank to the gauge set.
- D** Connect recovery tank to recovery machine per machine instructions.

3 FLUSHING LINE SET

The line set and indoor unit 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.

- A** 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.
- B** Invert the cylinder of clean 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.
- C** After all of the liquid refrigerant has been recovered, switch the recovery machine to vapor recovery so that all of the HCFC-22 vapor is recovered. Allow the recovery machine to pull the system down to zero.
- D** Close the valve on the inverted HCFC-22 drum and the gauge set valves. Pump the remaining refrigerant out of the recovery machine and turn the machine off.

Figure 8. Removing Metering Device and Flushing

Installing New Indoor Metering Device

This outdoor unit is designed for use in existing HCFC-22 systems that use either a fixed orifice (RFC) or expansion valve metering device (purchased separately) at the indoor coil.

See the 13ACD product specification sheet for approved fixed orifice sizes and expansion valve kit match ups. The expansion valve unit can be installed internal or external to the indoor coil.

1A INDOOR EXPANSION VALVE INSTALLATION (Uncased Coil Shown)

Labels in diagram: TWO PIECE PATCH PLATE (UNCASED COIL ONLY), DISTRIBUTOR TUBES, LIQUID LINE ORIFICE HOUSING, STUB END, EXPANSION VALVE, TEFLON® RING, SENSING LINE, TEFLON® RING, EQUALIZER LINE, LIQUID LINE ASSEMBLY WITH BRASS NUT, VAPOR LINE, LIQUID LINE, MALE EQUALIZER LINE FITTING (SEE EQUALIZER LINE INSTALLATION FOR FURTHER DETAILS).

Sensing bulb insulation is required if mounted external to the coil casing. sensing bulb installation for bulb positioning.

- A Remove the field-provided fitting that temporarily reconnected the liquid line to the indoor unit's distributor assembly.
- B Install one of the provided Teflon® rings around the stubbed end of the expansion valve and lightly lubricate the connector threads and expose surface of the Teflon® ring with refrigerant oil.
- C Attach the stubbed end of the 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 20 ft-lb.
- D Place the remaining Teflon® washer around the other end of the expansion valve. Lightly lubricate connector threads and expose surface of the Teflon® ring with refrigerant oil.
- E Attach the liquid line assembly to the 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 20 ft-lb.

1/2 Turn

EQUALIZER LINE INSTALLATION

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.

Labels: FLARE SEAL CAP, FLARE NUT, COPPER FLARE SEAL BONNET, MALE BRASS EQUALIZER LINE FITTING, VAPOR LINE.

SENSING BULB INSTALLATION

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

NOTE — Confirm proper thermal contact between vapor line and expansion bulb before insulating the sensing bulb once installed.

- B Connect the equalizer line from the 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.

Labels: VAPOR LINE, BULB, BULB.

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

NOTE — NEVER MOUNT ON BOTTOM OF LINE.

ON 7/8" AND LARGER LINES, MOUNT SENSING BULB AT EITHER THE 4 OR 8 O'CLOCK POSITION. NEVER MOUNT ON BOTTOM OF LINE.

1B FIXED ORIFICE (RFC) DEVICE INSTALLATION

Labels: DISTRIBUTOR TUBES, LIQUID LINE ORIFICE HOUSING, TEFLON® RING, FIXED ORIFICE, BRASS NUT.

REMOVE AND DISCARD WHITE TEFLON® SEAL (IF PRESENT)

SEE TABLE 3 FOR INDOOR FIXED ORIFICE KITS CATALOG NUMBERS.

Figure 9. Installing Indoor Metering Device

Table 3. Indoor Fixed Orifice Kits

Model	Catalog Number	Part Number	Drill Size
018	10W95	100484-07	0.055
024	98M12	100484-12	0.062
030	11W00	100484-16	0.067
036	98M78	100484-24	0.076
042	10W86	100484-28	0.080
048	98M14	100484-36	0.089
060	98M15	100484-45	0.099

! IMPORTANT

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

! WARNING

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

Leak Test Line Set and Indoor Coil

After completing the leak testing of the line set and indoor coil as outlined in figure 10, proceed to *Evacuating Line Set and Indoor Coil* on page 13.

1 CONNECT GAUGE SET

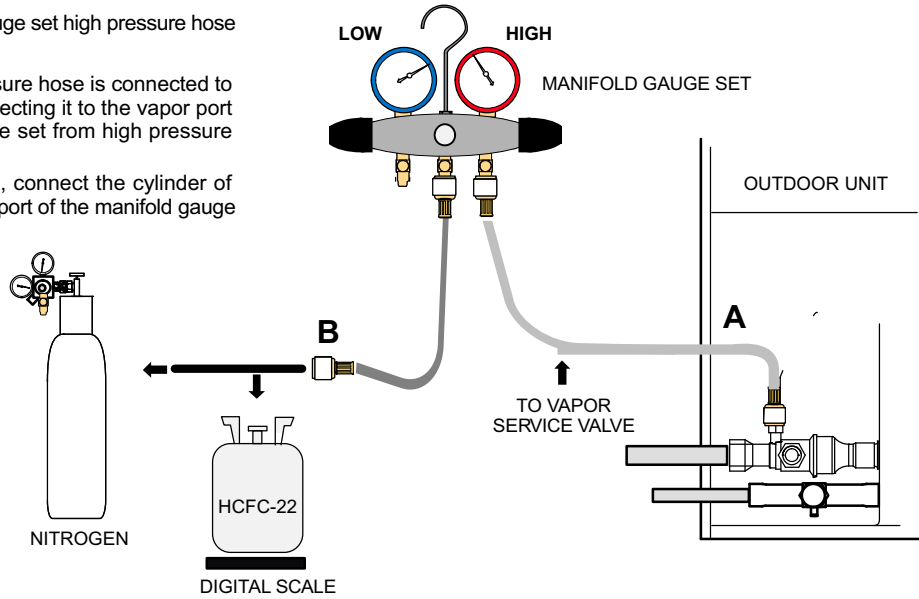
A Connect an HCFC-22 manifold gauge set high pressure hose to the vapor valve service port.

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 HCFC-22 refrigerant to the center port of the manifold gauge set.

NOTE — Later in the procedure, the HCFC-22 container will be replaced by the nitrogen container.

IMPORTANT — Leak detector must be capable of sensing HCFC-22 refrigerant.



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 HCFC-22 refrigerant to the center port of the manifold gauge set. Open the valve on the HCFC-22 cylinder (vapor only).
- B** Open the high pressure side of the manifold to weigh in a trace amount of HCFC-22 into the line set and indoor unit. A trace amount is a maximum of two ounces (57 g) refrigerant or three pounds (31 kPa) pressure. Close the valve on the HCFC-22 cylinder and the valve on the high pressure side of the manifold gauge set. Disconnect the HCFC-22 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 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.

Figure 10. Leak Test

! IMPORTANT

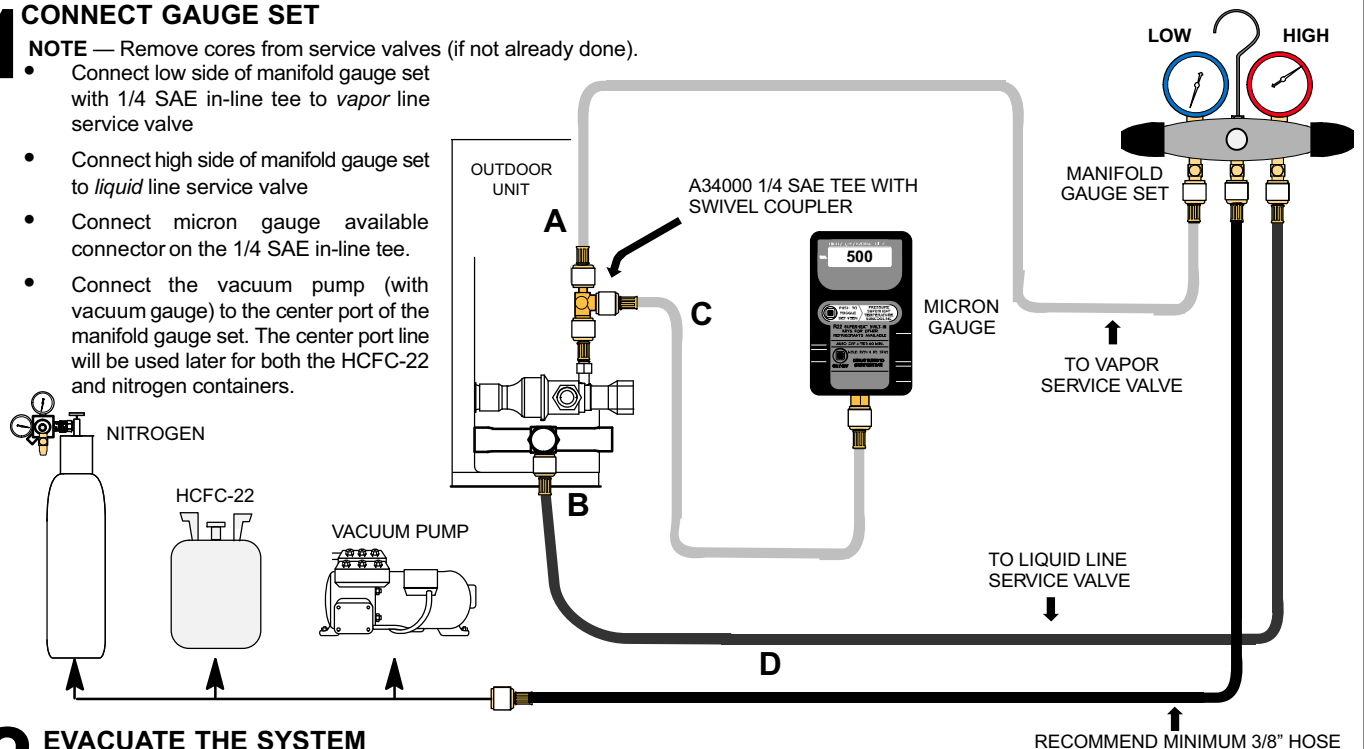
Leak detector must be capable of sensing HCFC-22 refrigerant.

Evacuating Line Set, Indoor Coil and Outdoor Unit

1 CONNECT GAUGE SET

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

- Connect low side of manifold gauge set with 1/4 SAE in-line tee to vapor line service valve
- Connect high side of manifold gauge set to liquid line service valve
- Connect micron gauge available connector on the 1/4 SAE in-line tee.
- 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 HCFC-22 and nitrogen containers.



2 EVACUATE THE SYSTEM

- A** Open the liquid and vapor line service valves (counterclockwise) to release the factory nitrogen charge (contained in outdoor unit) into the system.
- B** Open both manifold valves and start the vacuum pump.
- C** Evacuate the line set, indoor unit and outdoor 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.
- D** 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 dry 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.
- E** 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.
- F** 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.
- G** 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 HCFC-22 refrigerant. Open the manifold gauge valve 1 to 2 psig in order to release the vacuum in the line set and indoor unit.
- H** Perform the following:
- Close manifold gauge valves.
 - Shut off HCFC-22 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 secure finger tight, then tighten an additional one-sixth (1/6) of a turn as illustrated.

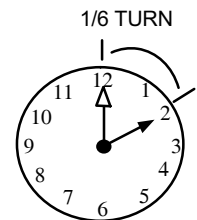


Figure 11. Evacuating System

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).

Refer to the furnace or air handler installation instructions for additional wiring application diagrams and refer to unit

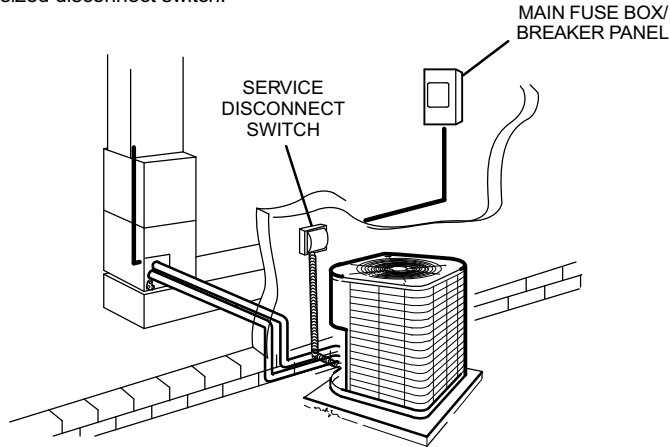
nameplate for minimum circuit ampacity and maximum overcurrent protection size.

24VAC TRANSFORMER

Use the transformer provided with the furnace or air handler for low-voltage control power (24VAC - 40 VA minimum)

SIZE CIRCUIT AND INSTALL DISCONNECT SWITCH

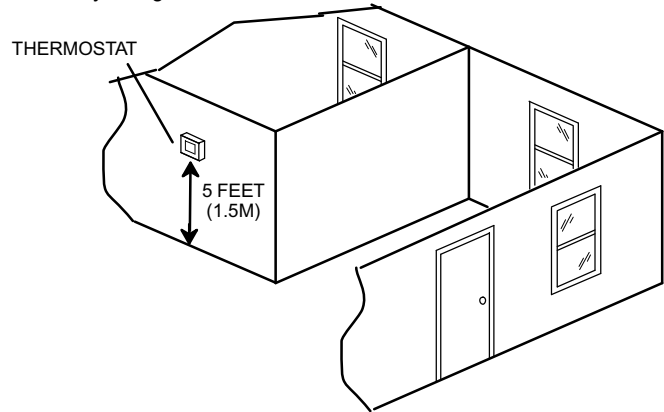
Refer to the unit nameplate for minimum circuit ampacity, and maximum fuse or circuit breaker (HACR per NEC). Install power wiring and properly sized disconnect switch.



NOTE — Units are approved for use only with copper conductors. Ground unit at disconnect switch or to an earth ground.

CHECK EXISTING ROOM THERMOSTAT

Ensure that existing room thermostat is installed on an inside wall approximately in the center of the conditioned area and 5 feet (1.5m) from the floor. It should not be installed on an outside wall or where it can be affected by sunlight or drafts.



NOTE — 24VAC, Class II circuit connections are made in the control panel.

HIGH VOLTAGE / GROUND WIRES

Any excess high voltage field wiring should be trimmed and secured away from any low voltage field wiring. To facilitate a conduit, a cutout is located in the bottom of the control panel. Connect conduit to the control panel using a proper conduit fitting.

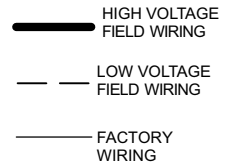
CONTROL WIRING

Use existing or replace low voltage wiring from outdoor to indoor unit and from thermostat to indoor unit as illustrated.

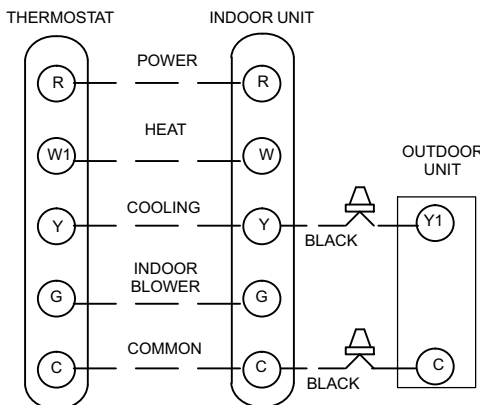
- A** Run 24VAC control wires through hole with grommet and secure with provided wire tie.
- B** Make 24VAC thermostat wire connections. Locate the two wires from the contactor and make connection using field provided wire nuts:
 - Black to Y1
 - Black to C (common)

NOTE — For proper voltages, select thermostat wire (control wires) gauge per table below.

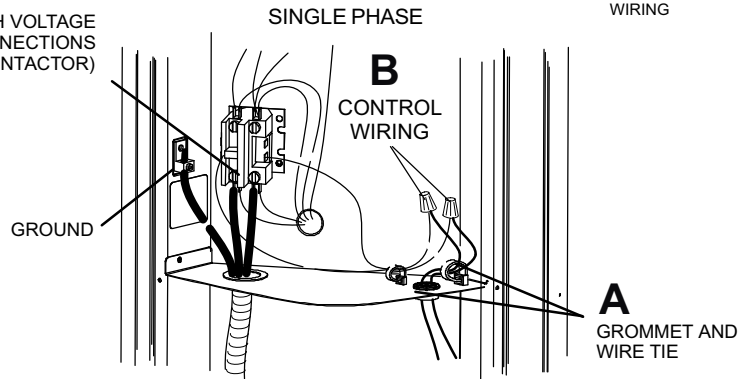
NOTE — Do not bundle any excess 24VAC control wires inside control panel.



TYPICAL LOW VOLTAGE CONTROL WIRING



HIGH VOLTAGE CONNECTIONS (CONTACTOR)



NOTE — Wire tie provides low voltage control wire strain relief and to maintain separation of field installed low and high voltage circuits.

WIRE RUN LENGTH	AWG#	INSULATION TYPE
LESS THAN 100' (30 METERS)	18	TEMPERATURE RATING
MORE THAN 100' (30 METERS)	16	35°C MINIMUM.

⚠ 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.

KEY	DESCRIPTION
	COMPONENT
A4	CONTROL-TIMED OFF
B1	COMPRESSOR
B4	MOTOR-OUTDOOR FAN
C12	CAPACITOR-DUAL
HRI	HEATER-COMPRESSOR
K1-1	CONTACTOR-COMPRESSOR
S4	SWITCH-HIGH PRESSURE
S24	SWITCH-LOSS OF CHARGE
S40	THERMOSTAT-CRANKCASE
S87	SWITCH-LOW PRESS. COMP

← INDICATES OPTIONAL COMPONENTS

⚠ FOR USE WITH COPPER CONDUCTORS ONLY. REFER TO UNIT RATING PLATE FOR MINIMUM CIRCUIT AMPACITY AND MAXIMUM OVERCURRENT PROTECTION SIZE.

⚠ JUMPER IS USED WHEN TOC IS NOT USED

WARNING-ELECTRIC SHOCK HAZARD, CAN CAUSE INJURY OR DEATH. UNIT MUST BE GROUNDED IN ACCORDANCE WITH NATIONAL AND LOCAL CODES.

— LINE VOLTAGE FIELD INSTALLED
 - - - CLASS 11 VOLTAGE FIELD INSTALLED

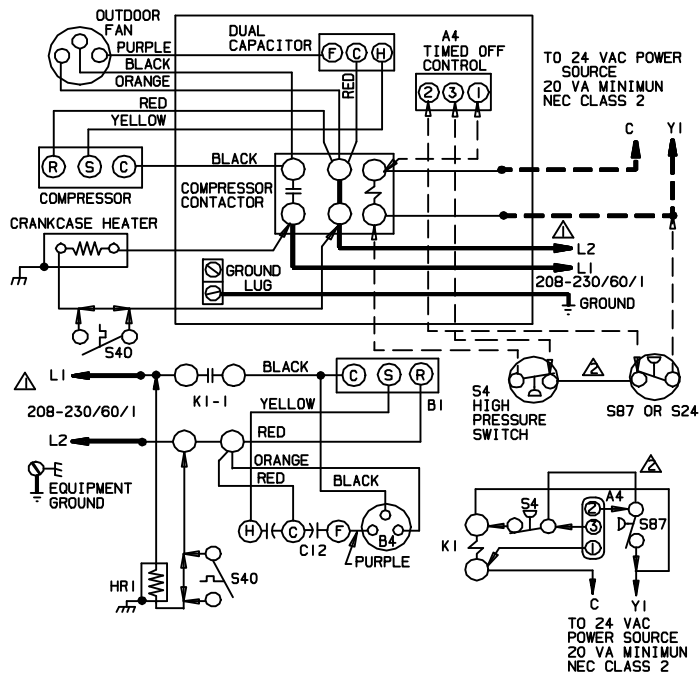


Figure 12. Typical Unit Wiring Diagram

⚠ IMPORTANT

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.

Servicing Outdoor Unit Delivered Void of Nitrogen Charge

If the outdoor unit is void of factory nitrogen charge, clean the system using the procedure described below.

1. Use nitrogen to repressurize system and check for leaks.
2. Evacuate the system using evacuating procedure provided in this instruction.
3. Use nitrogen to break the vacuum and install a new filter drier in the system.
4. Evacuate the system again using evacuating procedure provided in this instruction.
5. Weigh in refrigerant using procedure outlined under *Unit Start-Up and Weigh-In Charging*.

6. Monitor the system to determine the amount of moisture remaining in the oil. It may be necessary to replace the filter drier several times to achieve the required dryness level. **If system dryness is not verified, the compressor will fail in the future.**

Unit Start-Up and Weigh-In Charging

1. Check that fan rotates freely.
2. Inspect all factory- and field-installed wiring for loose connections.
3. After evacuation of the outdoor unit, line set, and indoor unit are complete, close the manifold gauge set valves. Disconnect vacuum pump from center hose of gauge set.
4. Connect the center hose of the gauge set to a cylinder of HCFC-22 and purge the hose. Then, place the cylinder upside down on a scale (see figure 14).
5. Open the high side manifold gauge valve and weigh in liquid refrigerant. Refer to unit nameplate to determine correct weigh-in charge (see figure 13).
6. Close manifold gauge valves.

WEIGH-IN CHARGING


ADD AMOUNT OF HCFC-22
REFRIGERANT AS SPECIFIED ON UNIT
NAMEPLATE

ADJUST AMOUNT FOR VARIATION IN
LINE SET LENGTH AS LISTED BELOW

TOTAL CHARGE

$\underline{\hspace{2cm}} \quad + \quad \underline{\hspace{2cm}} \quad = \quad \underline{\hspace{2cm}}$

↓



↓

Refrigerant Charge per Line Set Length	
Liquid Line Set Diameter	Ounces per 5 feet (g per 1.5 m) adjust from 15 feet (4.6 m) line set*
3/8" (9.5 mm)	3 ounce per 5' (85 g per 1.5 m)

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

Figure 13. Gauge Set Charge Setup and Weigh In

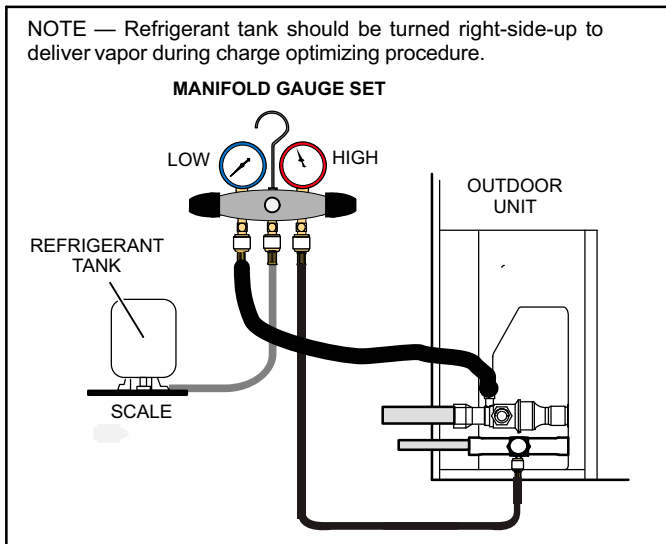


Figure 14. Gauge Set Charge Setup

Optimizing System Charge

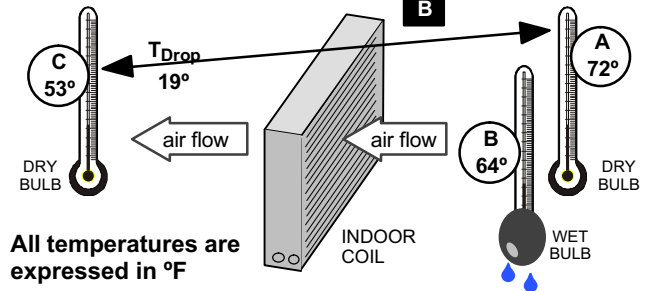
This section outlines procedures for optimizing the system charge.

NOTE — Gauge set should be connected as illustrated in figure 14; however, refrigerant tank should be turned right-side-up to deliver refrigerant gas during charge optimizing procedure.

1. Check voltage supply at the disconnect switch. The voltage must be within the range listed on the unit's nameplate. If not, do not start the equipment until you have consulted with the power company and the voltage condition has been corrected.
2. **Make sure the refrigerant cylinder is right-side-up so that it will deliver gas during the charge optimizing procedure.**
3. Set the thermostat for a cooling demand. Turn on power to the indoor unit and close the outdoor unit disconnect switch to start the unit.
4. Allow unit to run for five minutes to allow pressures to stabilize.
5. Check and adjust indoor airflow using procedure in figure 15.
6. Use either **approach, subcooling or superheat** method (see figures 16 and 17 for TXV system or figure 18 for RFC system) to optimize system charge. Adjust charge as necessary.
7. Close gauge set valves and disconnect gauge set.
8. Replace the stem and service port caps and tighten as specified in *Operating Service Valves* on page 3.
9. Recheck voltage while the unit is running. Power must be within range shown on the nameplate.

AIRFLOW

Temp. of air entering indoor coil °F	DT														
	80	78	76	74	72	70	68	66	64	62	60	58	56	54	52
80	24	24	24	23	23	22	22	22	20	19	18	17	16	15	
78	23	23	23	22	22	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	14	13	12	11	10		
Wet-bulb °F	57	58	59	60	61	62	63	64	65	66	67	68	69	70	



1. **Determine the desired DT** — Measure entering air temperature using dry bulb (A) and wet bulb (B). DT is the intersecting value of A and B in the table (see triangle).

2. **Find temperature drop across coil** — Measure the coil's dry bulb entering and leaving air temperatures (A and C). Temperature Drop Formula: (T_{Drop}) = A minus C.

3. **Determine if fan needs adjustment** — If the difference between the measured T_{Drop} and the desired DT (T_{Drop}-DT) is within ±3°, no adjustment is needed. See examples: 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 ±3° range) no change
62°	10	-	15	=	-5	Decrease the airflow

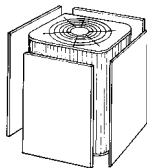
4. **Adjust the fan speed** — See indoor unit instructions to increase/decrease fan speed.

Changing air flow affects all temperatures; recheck temperatures to confirm that the temperature drop and DT are within ±3°.

Figure 15. Checking Indoor Airflow over Evaporator Coil Using Delta-T Chart

SUBCOOLING TXV

Outdoor Ambient Temperature is 65°F (18.3°C) or **BELOW**



BLOCK OUTDOOR COIL: [sometimes necessary with lower temperatures] Use cardboard or plastic sheet to restrict the airflow through the outdoor coil to achieve pressures from 325-375 psig (2240-2585 kPa). Higher pressures are needed to check charge. Block equal sections of air intake panels and move coverings sideways until the liquid pressure is in the above noted ranges.

1. Confirm proper airflow across coil using figure 15.
2. Compare unit pressures with table 4, *Normal Operating Pressures*.
3. Set thermostat to call for heat (must have a cooling load between 70-80°F (21-26°C)).
4. Connect gauge set.
5. Measure outdoor ambient temperature.
6. When heat demand is satisfied, set thermostat to call for cooling.
7. Allow temperatures and pressures to stabilize.

NOTE - If necessary, block outdoor coil to maintain 200-250 psig.

8. Record liquid line temperature (*Position temperature sensor on liquid line near liquid line service port.*):

LIQ° = _____

9. Measure liquid line pressure and use the value to determine saturation temperature:

SAT° = _____

10. Subtract to determine subcooling (SC°):

SAT° _____ - LIQ° _____ = SC° _____

11. Compare results with table below.
12. If value is **greater** than shown, **remove** refrigerant; if **less** than shown, **add** refrigerant.
13. If refrigerant is added or removed, retest using approach method.

SC° (Subcooling) Values (F:±/1.0° [C: ±/0.6°])

Model	-018	-024	-030	-036	-042	-048	-060
°F (°C)*	7 (3.8)	12 (6.7)	9 (5.0)	10 (5.6)	14 (8.0)	10 (5.6)	13 (7.2)

Figure 16. Subcooling Method (TXV)

APPROACH TXV

Outdoor Ambient Temperature 66°F (18.9°C) or **ABOVE**.

1. Confirm proper airflow across coil using figure 15.
2. Compare unit pressures with table 4, *Normal Operating Pressures*.
3. Connect gauge set.
4. When heat demand is satisfied, set thermostat to call for cooling.
5. Allow temperatures and pressures to stabilize.
6. Record outdoor ambient temperature:
AMB° = _____
7. Record line temperature:
LIQ° = _____
8. Subtract to determine approach (APP°):
LIQ° _____ - AMB° _____ = APP° _____
9. Compare results with table below.
10. If value is **greater** than shown (high approach), **add** refrigerant; if **less** than shown (liquid temperature too close to ambient temperature, low approach), **remove** refrigerant.
11. If refrigerant is added or removed, retest to confirm that unit is properly charged.

APP° (Approach) Values(F: +/-1.0° [C: +/-0.6°])

Model	-018	-024	-030	-036	-042	-048	-060
°F (°C)*	6 (3.3)	6 (3.3)	8 (4.4)	12 (6.7)	5 (2.8)	6 (3.3)	7 (3.8)

Figure 17. Approach Method (TXV)

SUPERHEAT RFC

ABOVE Outdoor Ambient 40°F (4.4°C)

SH° (Superheat) Values (+/-5°F)

°F*	Wet Bulb (air entering indoor coil)															
	50	52	54	56	58	60	62	64	66	68	70	72	74	76		
40	15	18	20	23	26	29	32	34	38	41	43	46	48	51		
45	13	16	18	21	24	27	30	33	36	39	41	44	46	49		
50	11	14	16	19	22	25	28	31	34	37	39	42	44	47		
55	9	12	14	17	20	23	27	30	33	36	38	40	42	44		
60	7	10	12	15	18	21	24	27	30	33	35	38	40	43		
65	-	6	10	13	16	19	21	24	27	30	33	36	38	41		
70	-	-	7	10	13	16	19	21	24	27	30	33	36	39		
75	-	-	-	6	9	12	15	18	21	24	28	31	34	37		
80	-	-	-	-	5	8	12	15	18	21	25	28	31	35		
85	-	-	-	-	-	-	8	11	15	19	22	26	30	33		
90	-	-	-	-	-	-	5	9	13	16	20	24	27	31		
95	-	-	-	-	-	-	-	6	10	14	18	22	25	29		
100	-	-	-	-	-	-	-	-	8	12	16	21	24	28		
105	-	-	-	-	-	-	-	-	5	9	13	17	22	26		
110	-	-	-	-	-	-	-	-	-	6	11	15	20	25		
115	-	-	-	-	-	-	-	-	-	-	8	14	18	24		

* Dry-bulb temperature (°F) of entering outdoor ambient air.

1. Confirm proper airflow across coil using figure 15.
2. Compare unit pressures with table 4, *Normal Operating Pressures*.
3. Set thermostat to call for heat (must have a cooling load between 70-80°F (21-26°C)).
4. Connect gauge set.
5. When heat demand is satisfied, set thermostat to call for cooling.
6. Allow temperatures and pressures to stabilize.
7. Measure the suction line pressure and use the value to determine saturation temperature :
SAT° = _____
8. Record suction line temperature. (*Position temperature sensor on suction line near suction line service port.*)
VAP° = _____
9. Subtract to determine superheat (SH°):
VAP° - _____ SAT° _____ = SH° _____
10. Record the wet bulb temperature (air entering indoor coil):
WB = _____
11. Record outdoor ambient temperature.
12. Compare results with table to the left.
13. If value is greater than shown, add refrigerant; if less than shown, remove refrigerant.
14. If refrigerant is added or removed, retest to confirm that unit is properly charged

NOTE - Do not attempt to charge system where a dash appears in the table, system could be overcharged. Superheat is taken at suction line service port. Suction line superheat must never be less than 5°F at the suction line service port.

Figure 18. Superheat Method (RFC)

Table 4. Normal Operating Pressures (Liquid +10 and Suction +5 psig)

! IMPORTANT		Use this table to perform maintenance checks; it is not a procedure for charging the system. Minor variations in these pressures may be due to differences in installations. Significant deviations could mean that the system is not properly charged or that a problem exists with some component in the system.					
13ACD	-018	-024	-030	-036	-042	-048	-060
°F (°C)*	Liquid / Suction	Liquid / Suction	Liquid / Suction	Liquid / Suction	Liquid / Suction	Liquid / Suction	Liquid / Suction
Expansion Valve (TXV)							
65 (18)	138 / 79	148 / 79	147 / 75	155 / 79	147 / 78	144 / 77	152 / 73
70 (21)	148 / 80	160 / 79	159 / 75	169 / 80	158 / 78	152 / 77	164 / 75
75 (24)	160 / 80	174 / 80	172 / 76	183 / 81	172 / 79	163 / 78	177 / 77
80 (27)	174 / 81	188 / 81	186 / 77	199 / 81	189 / 79	179 / 78	192 / 78
85 (29)	188 / 81	203 / 81	201 / 77	215 / 82	205 / 80	195 / 79	208 / 79
90 (32)	204 / 81	220 / 82	216 / 78	233 / 82	222 / 81	212 / 80	225 / 80
95 (35)	219 / 82	236 / 83	233 / 79	252 / 83	241 / 81	229 / 80	243 / 80
100 (38)	236 / 82	253 / 83	250 / 80	271 / 83	259 / 82	245 / 81	261 / 81
105 (41)	253 / 83	272 / 84	268 / 80	291 / 84	279 / 82	265 / 81	280 / 82
110 (43)	272 / 84	291 / 85	287 / 81	311 / 85	299 / 83	287 / 82	299 / 83
115 (45)	291 / 84	311 / 85	306 / 82	331 / 86	320 / 84	309 / 83	320 / 83
Fixed Orifice (RFC)							
65 (18)	139 / 67	147 / 71	148 / 65	162 / 75	158 / 72	151 / 71	152 / 68
70 (21)	149 / 70	159 / 73	161 / 67	174 / 76	170 / 75	161 / 73	165 / 71
75 (24)	161 / 74	172 / 75	175 / 70	187 / 78	182 / 76	172 / 75	178 / 73
80 (27)	175 / 77	186 / 77	190 / 73	201 / 79	195 / 78	185 / 76	193 / 76
85 (29)	189 / 79	200 / 79	205 / 75	215 / 81	209 / 80	198 / 77	208 / 78
90 (32)	203 / 81	216 / 81	221 / 77	231 / 82	224 / 81	213 / 79	224 / 80
95 (35)	218 / 82	232 / 82	237 / 79	247 / 83	240 / 82	227 / 80	239 / 81
100 (38)	234 / 83	247 / 83	254 / 80	265 / 84	256 / 84	243 / 81	258 / 82
105 (41)	251 / 85	264 / 85	271 / 81	283 / 85	273 / 85	259 / 82	276 / 83
110 (43)	269 / 86	285 / 86	289 / 82	302 / 86	290 / 86	276 / 84	294 / 85
115 (45)	287 / 87	302 / 87	308 / 83	321 / 87	310 / 87	293 / 85	313 / 86

Maintenance

Maintenance and service must be performed by a qualified installer or service agency. At the beginning of each cooling season, the system should be checked as follows:

Outdoor Unit

1. Outdoor unit fan motor is pre-lubricated and sealed. No further lubrication is needed.
2. Visually inspect all connecting lines, joints and coils for evidence of oil leaks.
3. Check all wiring for loose connections.
4. Check for correct voltage at unit (unit operating).
5. Check amp draw on outdoor fan motor.

Motor Nameplate: _____ **Actual:** _____.

6. Inspect drain holes in coil compartment base and clean if necessary.

NOTE - If insufficient cooling occurs, the unit should be gauged and refrigerant charge should be checked.

Outdoor Coil

Clean and inspect outdoor coil (may be flushed with a water hose). Ensure power is off before cleaning.

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, fertilizers, fluids that may contain high levels of corrosive chemicals such as salts)

Sea Coast — Moist air in ocean locations can carry salt, which is corrosive to most metal. Units that are located near the ocean require frequent inspections and maintenance. These inspections will determine the necessary need to wash the unit including the outdoor coil. Consult your installing contractor for proper intervals/procedures for your geographic area or service contract.

Indoor Unit

1. Clean or change filters.
2. Some blower motors are prelubricated and permanently sealed. No more lubrication is needed.
3. Adjust blower speed for cooling. Measure the pressure drop over the coil to determine the correct blower CFM. Refer to the unit information service manual for pressure drop tables and procedure.
4. *Belt Drive Blowers* - Check belt for wear and proper tension.
5. Check all wiring for loose connections.

6. Check for correct voltage at unit. (blower operating)

7. Check amp draw on blower motor.

Indoor Coil

- 1. Clean coil if necessary.
- 2. Check connecting lines, joints and coil for evidence of oil leaks.
- 3. Check condensate line and clean if necessary.

Motor Nameplate: _____ **Actual:** _____.

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 _____	Suction 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"/>
Service Valves: --- 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"/>