LENNOX
Service Literature

UNIT INFORMATION

Corp. 0626-L5
Revised October 21, 2010

XP16

XP16 (HFC-410A) SERIES UNITS

⚠ 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.

⚠ 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.

⚠ 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.

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The XP16 is a high efficiency residential split-system two-stage heat pump unit, which features a scroll compressor and HFC-410A refrigerant. XP16 units are available in 2, 3, 4 and 5 tons. tons. XP16 units are rated for 230 volts only. Applications where supply voltage is less requires a hard start kit. The series is designed for use with an indoor unit with an expansion valve approved for HFC-410A.

⚠ 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.

Model Number Identification

X P 16 –036 –230 –5

Refrigerant Type
X = HFC-410A

Unit Type
P = Heat Pump

Series

Nominal Cooling Capacity
024 = 2 tons
036 = 3 tons
048 = 4 tons
060 = 5 tons

Voltage
230 = 208/230V-1ph-60hz

Minor Revision Number

Typical Serial Number Identification

19 09 C 05716

Location Code
19 = Saltillo, Mexico
58 = Marshalltown, IA

Year Code
08 = 2008
09 = 2009
10 = 2010

Month Code
A = January
B = February
C = March

5 (or 6) Digit Unique Number

Specifications

Model Number	Unit		Outdoor Fan	
	Sound Rating Number (dB)[1]	Factory Refrigerant Charge[2]	Number of Blades	Diameter - inches.
XP16-024-230-01	74	9 lbs. 9 oz.	3	18
XP16-024-230-03	74	7 lbs. 13 oz.	3	18
XP16-024-230-04	74	7 lbs. 13 oz.	3	18
XP16-024-230-05	74	8 lbs. 13 oz.	3	18

Model Number	Unit		Outdoor Fan	
	Sound Rating Number (dB)[1]	Factory Refrigerant Charge[2]	Number of Blades	Diameter - inches.
XP16-036-230-01	76	12 lbs. 8 oz.	4	22
XP16-036-230-02	76	12 lbs. 8 oz.	4	22
XP16-036-230-03	76	10 lbs. 4 oz.	4	22
XP16-036-230-04	76	10 lbs. 4 oz.	4	22
XP16-036-230-05	76	10 lbs. 9 oz.	4	22

Model Number	Unit		Outdoor Fan	
	Sound Rating Number (dB)[1]	Factory Refrigerant Charge[2]	Number of Blades	Diameter - inches.
XP16-048-230-01	76	15 lbs. 7 oz.	4	22
XP16-048-230-02	76	15 lbs. 7 oz.	4	22
XP16-048-230-03	76	15 lbs. 7 oz.	4	22
XP16-048-230-04	76	15 lbs. 7 oz.	4	22
XP16-048-230-05	76	11 lbs. 12 oz.	3	26

Model Number	Unit		Outdoor Fan	
	Sound Rating Number (dB)[1]	Factory Refrigerant Charge[2]	Number of Blades	Diameter - inches.
XP16-060-230-01	78	13 lbs. 8 oz.	3	26
XP16-060-230-02	78	13 lbs. 8 oz.	3	26
XP16-060-230-03	78	11 lbs. 7 oz.	3	26
XP16-060-230-04	78	11 lbs. 7 oz.	3	26
XP16-060-230-05	78	12 lbs. 15 oz.	3	26

[1] Tested according to AHRI Standard 270-2008 test conditions.
[2] Refrigerant charge sufficient for 15 feet length of refrigerant lines.

Electrical Data

208/230V-60 Hz-1 Ph

Model Number	Unit		Compressor		Condenser Fan				
	Maximum Over-current Protection (amps)[1]	Minimum Circuity Ampacity[2]	Rated Load Amps (RLA)	Locked Rotor Amps (LRA)	Motor HP	Motor Type	Nominal RPM	Full Load Amps (FLA)	Locked Rotor Amps (LRA)
XP16-024-230-01	20	14.0	10.25	52.0	1/10	PSC	1075	0.7	1.4
XP16-024-230-03	20	14.0	10.25	52.0	1/10	PSC	1075	0.7	1.4
XP16-024-230-04	20	14.0	10.25	52.0	1/10	PSC	1075	0.7	1.4
XP16-024-230-05	20	14.0	10.25	52.0	1/10	PSC	1075	0.7	1.4

208/230V-60 Hz-1 Ph

Model Number	Unit		Compressor		Condenser Fan				
	Maximum Over-current Protection (amps)[1]	Minimum Circuity Ampacity[2]	Rated Load Amps (RLA)	Locked Rotor Amps (LRA)	Motor HP	Motor Type	Nominal RPM	Full Load Amps (FLA)	Locked Rotor Amps (LRA)
XP16-036-230-01	35	22.0	16.67	82.0	1/6	PSC	825	1.1	2.1
XP16-036-230-02	35	22.0	16.67	82.0	1/6	PSC	825	1.1	2.1
XP16-036-230-03	35	22.0	16.67	82.0	1/6	PSC	825	1.1	2.1
XP16-036-230-04	35	22.0	16.67	82.0	1/6	PSC	825	1.1	1.87
XP16-036-230-05	35	22.5	16.67	82.0	1/4	PSC	825	1.7	3.1

208/230V-60 Hz-1 Ph

Model Number	Unit		Compressor		Condenser Fan				
	Maximum Over-current Protection (amps)[1]	Minimum Circuity Ampacity[2]	Rated Load Amps (RLA)	Locked Rotor Amps (LRA)	Motor HP	Motor Type	Nominal RPM	Full Load Amps (FLA)	Locked Rotor Amps (LRA)
XP16-048-230-01	45	28.2	21.15	96.0	1/4	PSC	825	1.7	3.1
XP16-048-230-02	45	28.2	21.15	96.0	1/4	PSC	825	1.7	3.1
XP16-048-230-03	45	28.2	21.15	96.0	1/4	PSC	825	1.7	3.1
XP16-048-230-04	45	28.2	21.15	96.0	1/4	PSC	825	1.7	3.1
XP16-048-230-05	45	28.2	21.15	96.0	1/3	PSC	825	1.8	2.9

208/230V-60 Hz-1 Ph

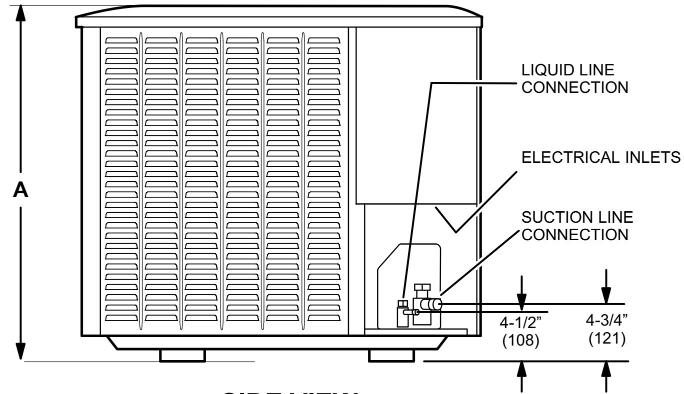
Model Number	Unit		Compressor		Condenser Fan				
	Maximum Over-current Protection (amps)[1]	Minimum Circuity Ampacity[2]	Rated Load Amps (RLA)	Locked Rotor Amps (LRA)	Motor HP	Motor Type[3]	Nominal RPM	Full Load Amps (FLA)	Locked Rotor Amps (LRA)
XP16-060-230-01	55	33.9	25.64	118.0	1/3	PSC	825	1.8	2.9
XP16-060-230-02	60	33.9	25.87	118.0	1/3	PSC	825	1.8	2.9
XP16-060-230-03	60	33.9	25.87	118.0	1/3	PSC	825	1.8	2.9
XP16-060-230-04	60	33.9	25.87	118.0	1/3	PSC	825	1.8	2.9
XP16-060-230-05	60	35.1	25.87	118.0	1/3	VS	700 (1st Stage) 820 (2nd Stage)	2.8	N/A

[1] HACR type circuit breaker or fuse.

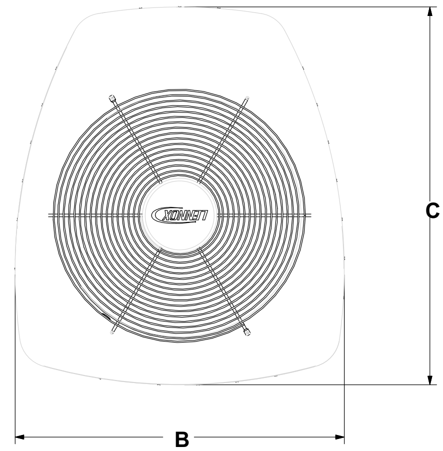
[2] Refer to National or Canadian Electrical Code manual to determine wire, fuse and disconnect size requirements.

[3] PSC = permanent split capacitor motor (single speed); VS = variable speed.

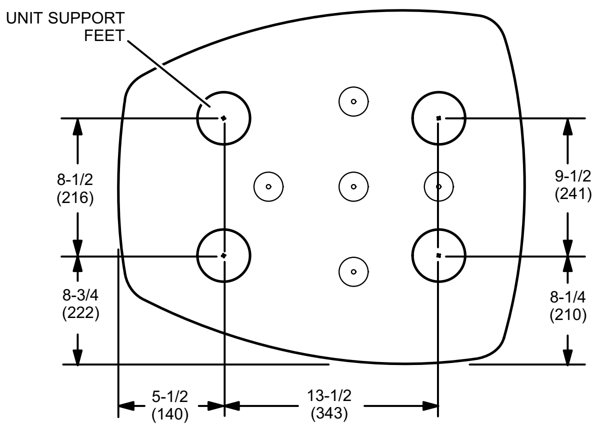
Unit Dimensions - Inches (mm)



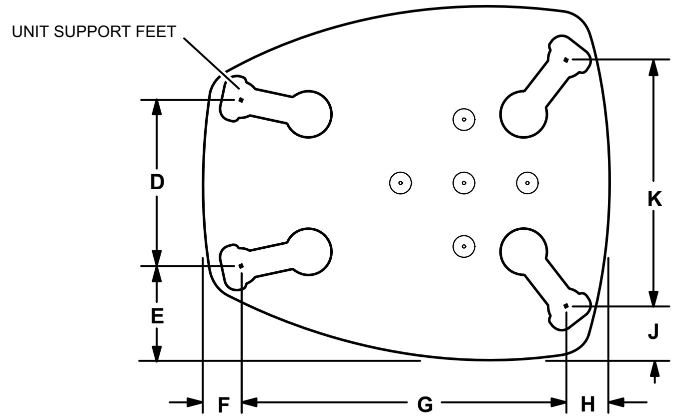
SIDE VIEW



TOP VIEW



XP16-024 BASE SECTION



XP16-036 to -060 BASE WITH LEGS

Model Number	A	B	C	D	E	F	G	H	J	K
XP16-024-01, -02, -03, -04	31 (889)	27 (686)	28 (711)	-	-	-	-	-	-	-
XP16-024-05	35 (889)	27 (686)	28 (711)	-	-	-	-	-	-	-
XP16-036-01, -02, -03, -04	35 (889)	30-1/2 (775)	35 (889)	13-7/8 (352)	7-3/4 (197)	3-1/4 (83)	27-1/8 (689)	3-5/8 (92)	4-1/2 (114)	20-5/8 (524)
XP16-036-05	39 (991)	30-1/2 (775)	35 (889)	13-7/8 (352)	7-3/4 (197)	3-1/4 (83)	27-1/8 (689)	3-5/8 (92)	4-1/2 (114)	20-5/8 (524)
XP16-048-01, -02, -03, -04	45 (1143)	30-1/2 (775)	35 (889))	16-7/8 (429)	8-3/4 (222)	3-1/8 (79)	30-3/4 (781)	4-5/8 (117)	3-3/4 (95)	26-7/8 (683)
XP16-048-05	35 (889)	35-1/2 (902)	39-1/2 (1003)	16-7/8 (429)	8-3/4 (222)	3-1/8 (79)	30-3/4 (781)	4-5/8 (117)	3-3/4 (95)	26-7/8 (683)
XP16-060-01, -02, -03, -04	39 (991)	35-1/2 (902)	39-1/2 (1003)	16-7/8 (429)	8-3/4 (222)	3-1/8 (79)	30-3/4 (781)	4-5/8 (117)	3-3/4 (95)	26-7/8 (683)
XP16-060-05	45 (1143	35-1/2 (902)	39-1/2 (1003)	16-7/8 (429)	8-3/4 (222)	3-1/8 (79)	30-3/4 (781)	4-5/8 (117)	3-3/4 (95)	26-7/8 (683)

Typical Unit Parts Arrangement

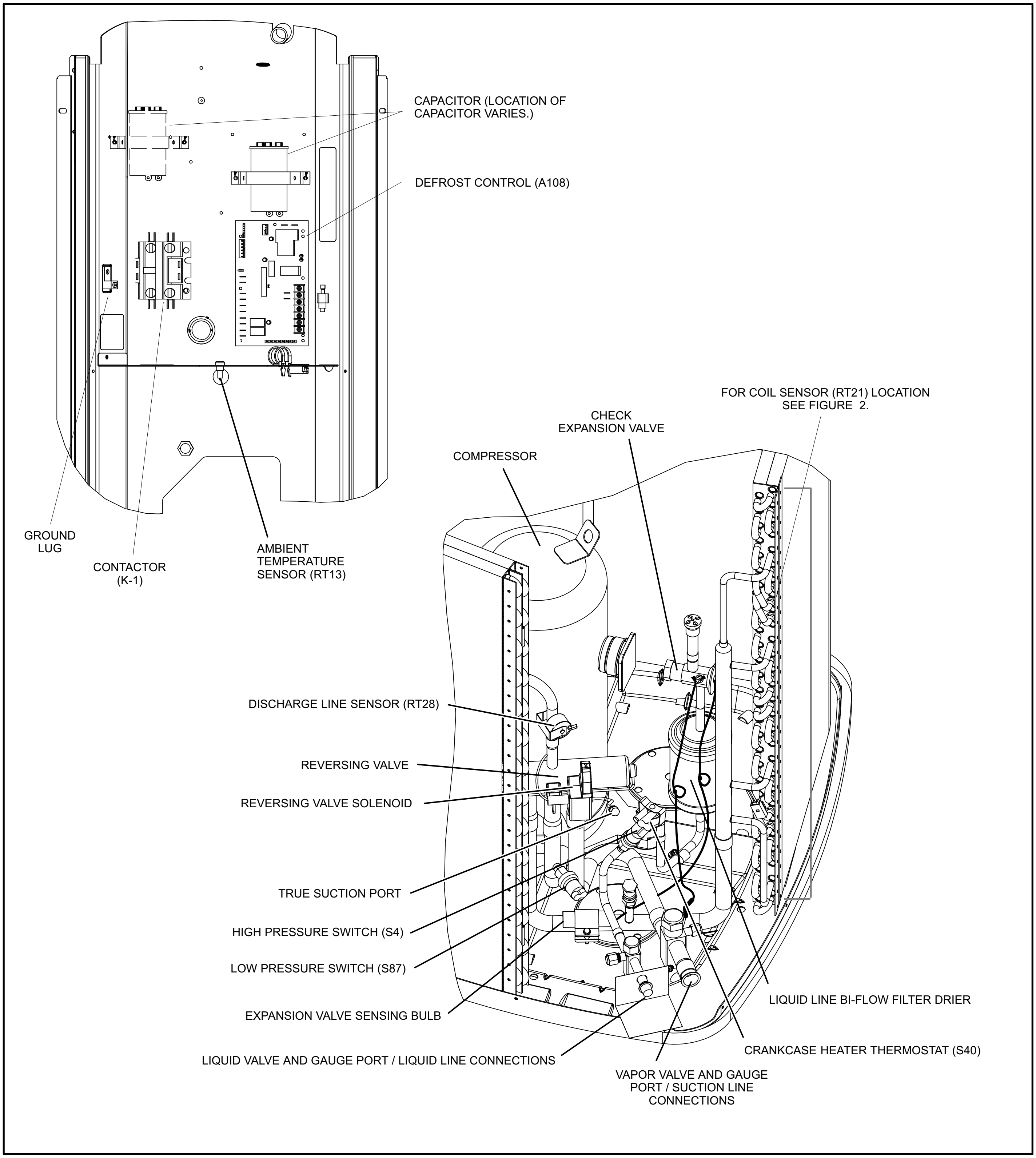


Figure 1. Typical Parts Arrangements

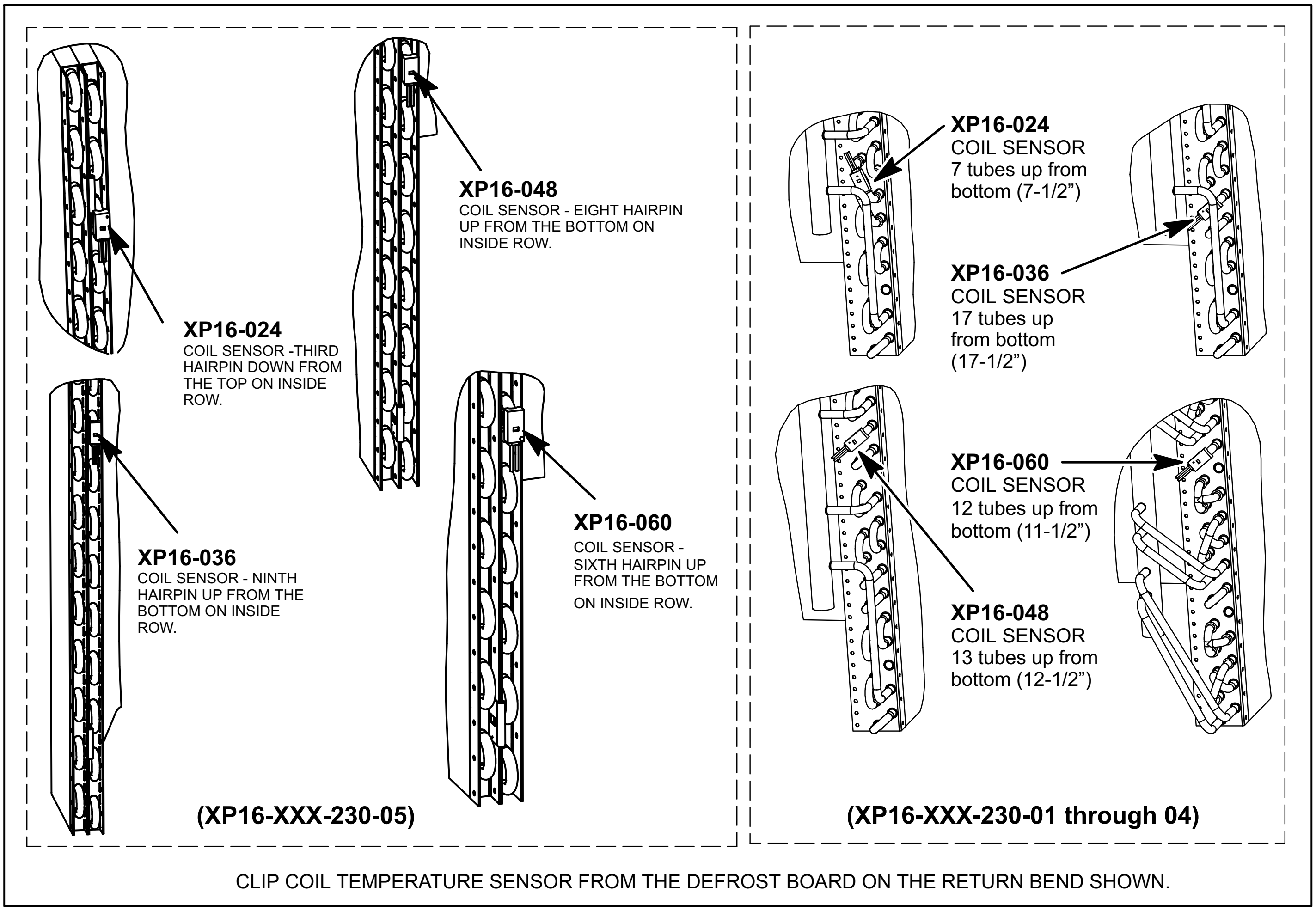


Figure 2. Coil Sensor (RT21) Locations

⚠ WARNING

This product and/or the indoor unit it is matched with may contain fiberglass wool.

Disturbing the insulation during installation, maintenance, or repair will expose you to fiberglass wool dust. Breathing this may cause lung cancer. (Fiberglass wool is known to the State of California to cause cancer.)

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

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

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

Operating Gauge Set and Service Valves

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

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.

⚠ 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.

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.

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

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

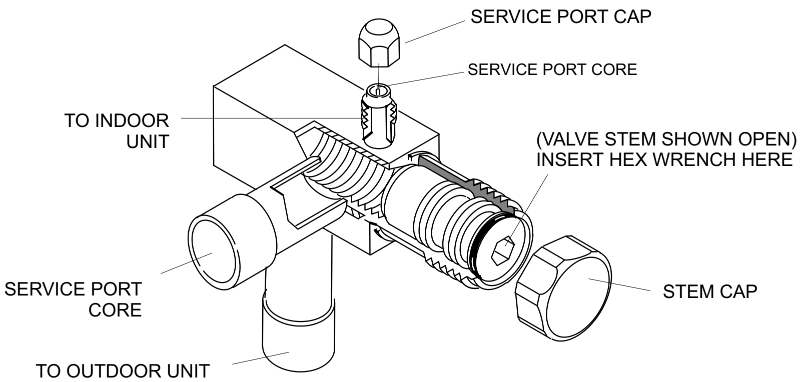
The liquid and vapor line service valves are used for removing refrigerant, flushing, leak testing, evacuating, checking charge and charging.

Each valve is equipped with a service port which has a factory-installed valve stem. Figure 3 provides information on how to access and operating both angle and ball service valves.

SERVICE VALVES ANGLE AND BALL

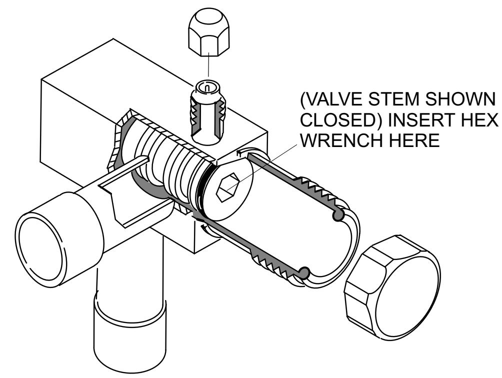
Operating Angle Type Service Valve:

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.



ANGLE-TYPE SERVICE VALVE (BACK-SEATED OPENED)

When service valve is **OPEN**, the service port is open to linE set, indoor and outdoor unit.

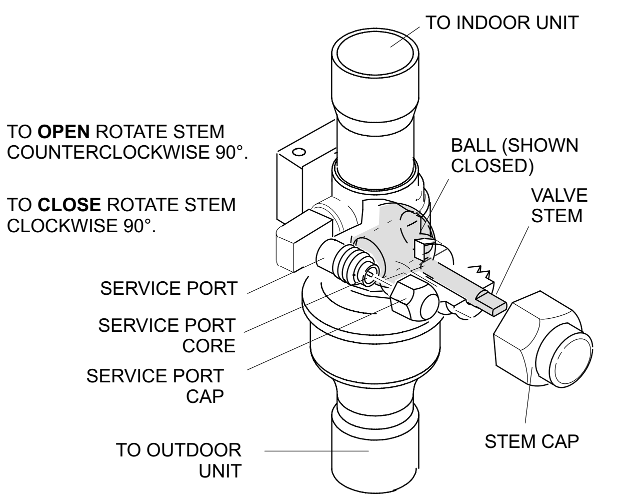


ANGLE-TYPE SERVICE VALVE (FRONT-SEATED CLOSED)

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

Operating Ball Type Service Valve:

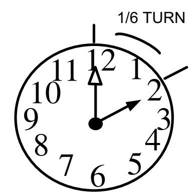
1. Remove stem cap with an appropriately sized wrench.
2. Use an appropriately sized wrenched to open. To open valve, roate stem counterclockwise 90°. To close rotate stem clockwise 90°.



To Access Service Port:

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

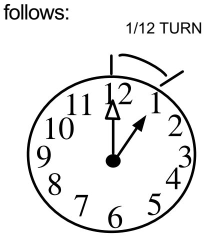
1. Remove service port cap with an appropriately sized wrench.
2. Connect gauge set to service port.
3. When testing is completed, replace service port cap and tighten as follows:
   - With torque wrench: Finger tighten and torque cap per table 1.
   - Without torque wrench: Finger tighten and use an 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.



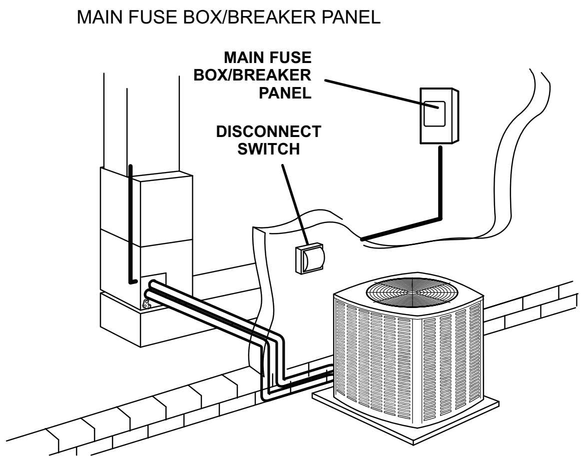
NOTE — A label with specific torque requirements may be affixed to the stem cap. If the label is present, use the specified torque.

Figure 3. Angle and Ball Service Valves

Recovering Refrigerant from System

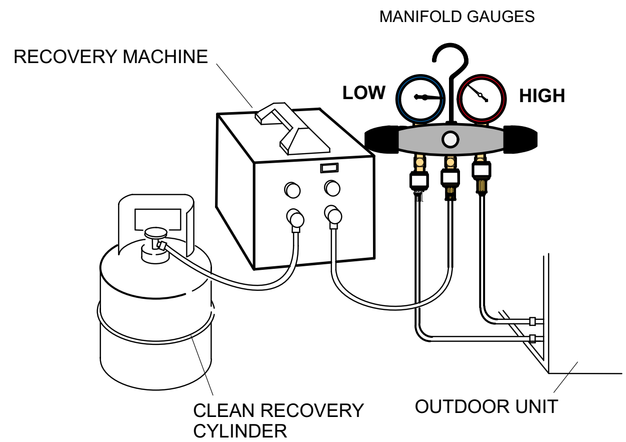
1 DISCONNECT POWER

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 HCFC-22 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:

Us 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 HCFC-22 to flush the system.

Remove all HCFC-22 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 HCFC-22 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 can not 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 HCFC-22 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 4. Refrigerant Recovery

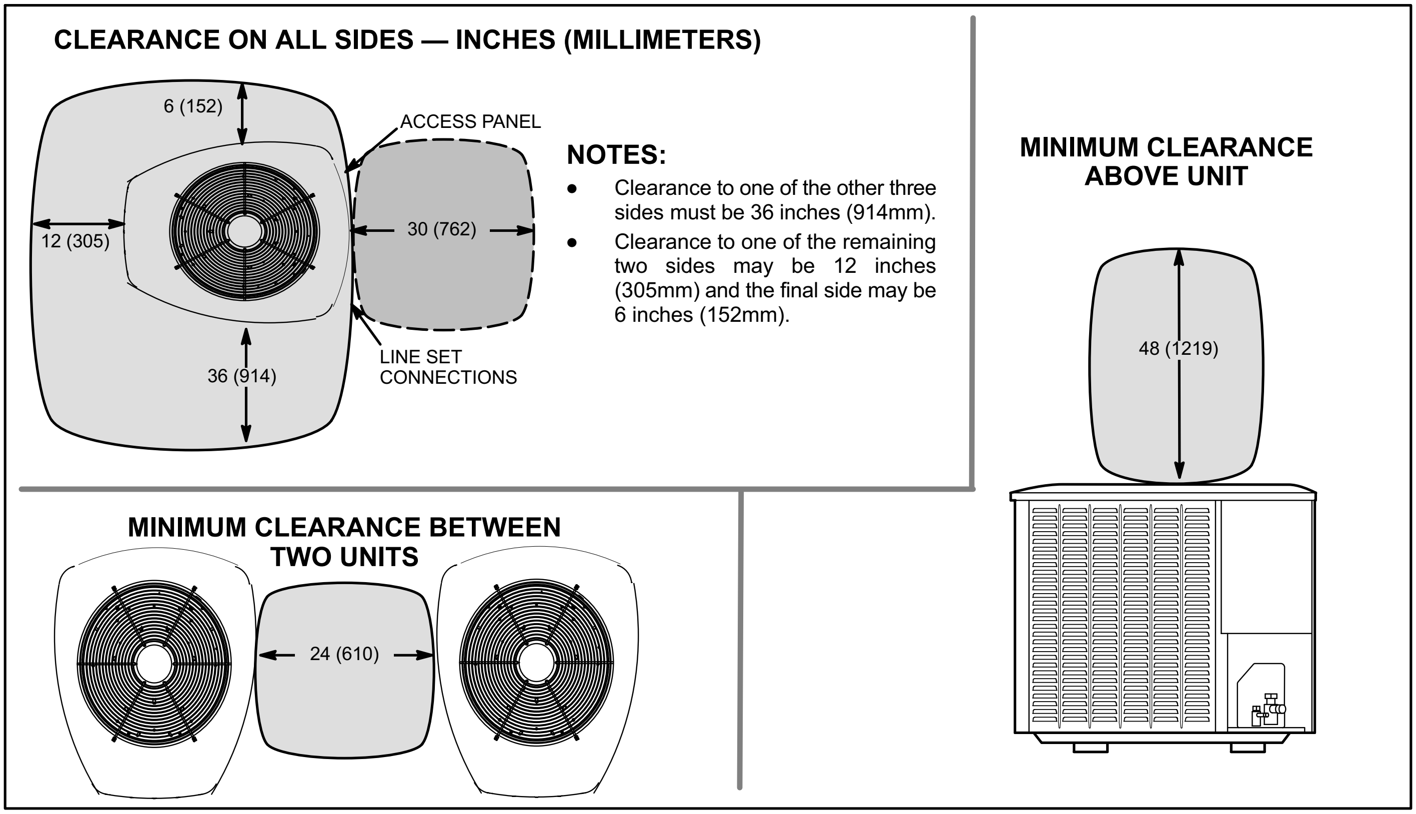


Figure 5. Installation Clearances

Unit Placement

⚠ CAUTION

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

See *Unit Dimensions* on page 3 for sizing mounting slab, platforms or supports. Refer to figure 5 for mandatory installation clearance requirements.

POSITIONING CONSIDERATIONS

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 6, detail A.

PLACING UNIT ON SLAB

When installing unit at grade level, the top of the slab should be high enough above grade so that water from higher ground will not collect around the unit. The slab should have a slope tolerance as described in figure 6, detail B.

NOTE — If necessary for stability, anchor unit to slab as described in figure 6, detail D.

ELEVATING THE UNIT

Units are outfitted with elongated support feet as illustrated in figure 6, detail C.

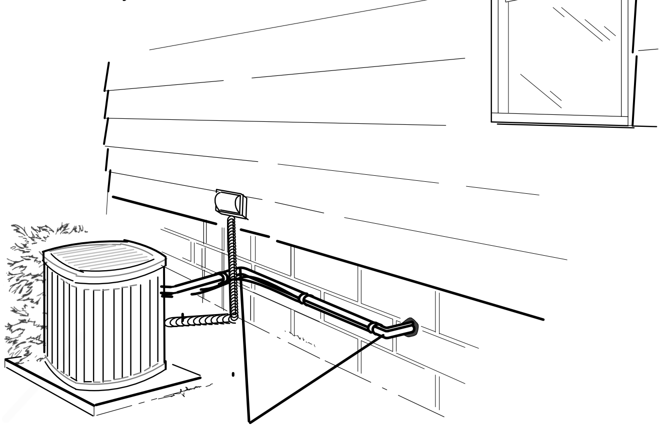
If additional elevation is necessary, raise the unit by extending the height of the unit support feet. This may be achieved by using a 2 inch (50.8mm) Schedule 40 female threaded adapter.

The specified coupling will fit snuggly into the recessed portion of the feet. Use additional 2 inch (50.8mm) Schedule 40 male threaded adaptors which can be threaded into the female threaded adaptors to make additional adjustments to the level of the unit.

NOTE — Keep the height of extenders short enough to ensure a sturdy installation. If it is necessary to extend further, consider a different type of field-fabricated framework that is sturdy enough for greater heights.

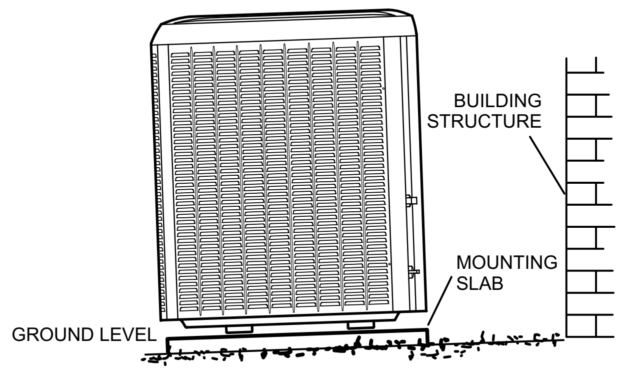
DETAIL A — Outside Unit Placement

Install unit away from windows.

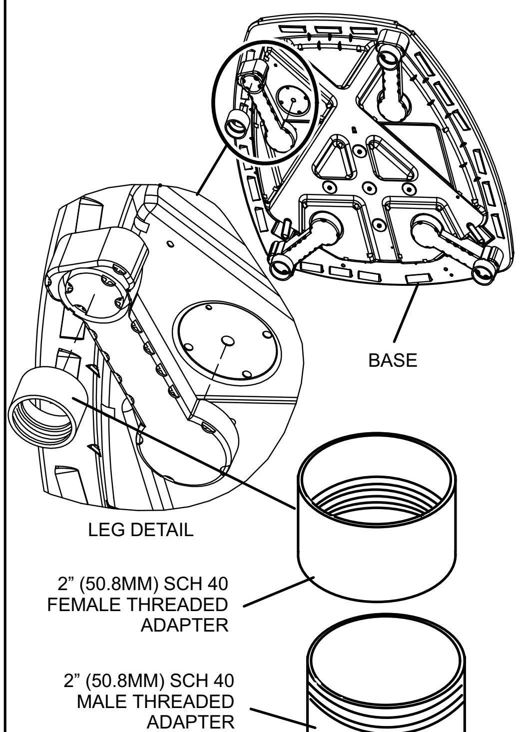


DETAIL B — Slab Mounting at Ground Level

Install unit level or, if on a slope, maintain slope tolerance of two (2) degrees (or two inches per five feet [50 mm per 1.5 m]) away from building structure.



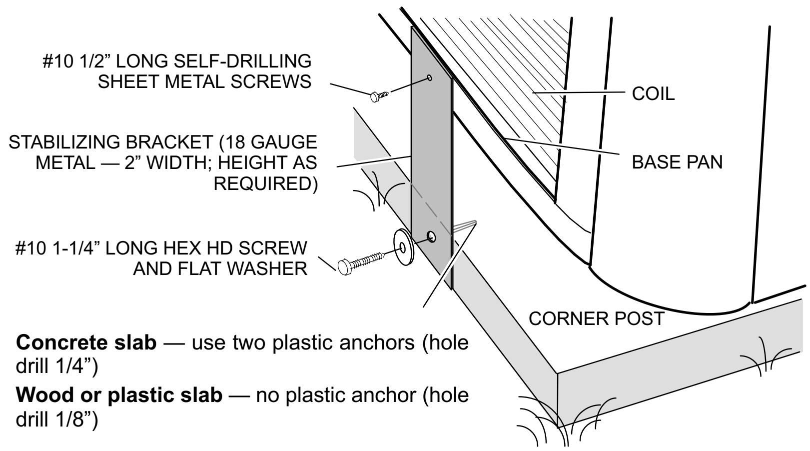
DETAIL C — Elevated Slab Mounting using Feet Extenders



Use additional 2” SCH 40 male threaded adapters which can be threaded into the female threaded adapters to make additional adjustments to the level of the unit.

STABILIZING UNIT ON UNEVEN SURFACES

DETAIL D — Slab Side Mounting

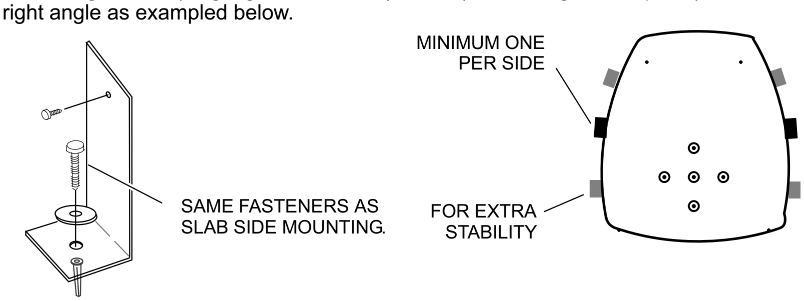


Concrete slab — use two plastic anchors (hole drill 1/4”)

Wood or plastic slab — no plastic anchor (hole drill 1/8”)

DETAIL E — Deck Top Mounting

Stabilizing bracket (18 gauge metal — 2” (50.8mm) width; height as required); bend to form right angle as exampled below.



One bracket per side (minimum). For extra stability, two brackets per side, two inches (51mm) from each corner.

IMPORTANT — To help stabilize an outdoor unit, some installations may require strapping the unit to the pad using brackets and anchors commonly available in the marketplace.

Figure 6. Placement, Slab Mounting and Stabilizing Unit

STABILIZING UNIT ON UNEVEN SURFACES

⚠ IMPORTANT

Unit Stabilizer Bracket Use (field-provided):

Always use stabilizers when unit is raised above the factory height. (Elevated units could become unstable in gusty wind conditions).

Stabilizers may be used on factory height units when mounted on unstable an uneven surface.

With unit positioned at installation site, perform the following:

1. Remove two side louvered panels to expose the unit base.
2. Install the brackets as illustrated in figure 6, detail D or E using conventional practices.
3. Replace the panels after installation is complete.

ROOF MOUNTING

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

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

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.

Removing and Installing Panels

⚠ IMPORTANT

Do not allow panels to hang on unit by top tab. Tab is for alignment and not designed to support weight of panel.

⚠ IMPORTANT

To help stabilize an outdoor unit, some installations may require strapping the unit to the pad using brackets and anchors commonly available in the marketplace.

⚠ 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.

LOUVERED PANEL REMOVAL

Remove the louvered panels as follows:

1. Remove two screws, allowing the panel to swing open slightly.

2. Hold the panel firmly throughout this procedure. Rotate bottom corner of panel away from hinged corner post until lower three tabs clear the slots as illustrated in **detail B.**

3. Move panel down until lip of upper tab clears the top slot in corner post as illustrated in **detail A**.

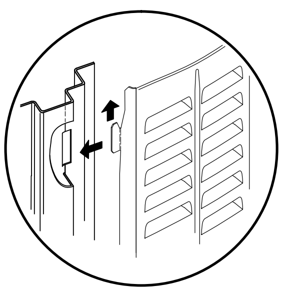
LOUVERED PANEL INSTALLATION

Position the panel almost parallel with the unit as illustrated in **detail D** with the screw side as close to the unit as possible. Then, in a continuous motion:

1. Slightly rotate and guide the lip of top tab inward as illustrated in **detail A** and **C**; then upward into the top slot of the hinge corner post.
2. Rotate panel to vertical to fully engage all tabs.
3. Holding the panel's hinged side firmly in place, close the right-hand side of the panel, aligning the screw holes.
4. When panel is correctly positioned and aligned, insert the screws and tighten.

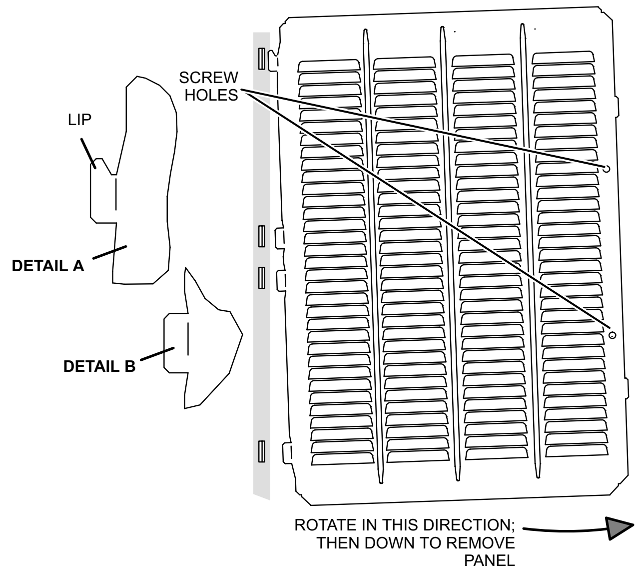
Detail C

MAINTAIN MINIMUM PANEL ANGLE (AS CLOSE TO PARALLEL WITH THE UNIT AS POSSIBLE) WHILE INSTALLING PANEL.



<u>IMPORTANT</u>! DO NOT ALLOW PANELS TO HANG ON UNIT BY TOP TAB. TAB IS FOR ALIGNMENT AND NOT DESIGNED TO SUPPORT WEIGHT OF PANEL.

PANEL SHOWN SLIGHTLY ROTATED TO ALLOW TOP TAB TO EXIT (OR ENTER) TOP SLOT FOR REMOVING (OR INSTALLING) PANEL.



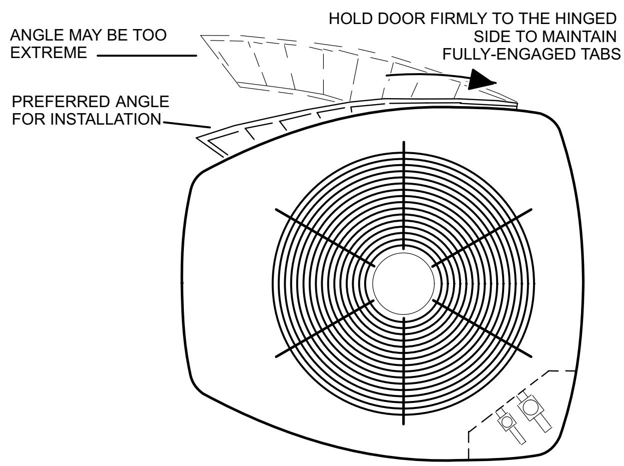


Figure 7. Removing and Installing Panels

New or Replacement Line Set

REFRIGERANT LINE SET

This section provides information on installation or replacement of existing line set. If new or replacement line set is not being installed then proceed to *Brazing Connections* on page 16.

IMPORTANT

Lennox highly recommends changing line set when converting the existing system from HCFC-22 to HFC-410A If that is not possible and the line set is the proper size as reference in table 2, use the procedure outlined under Flushing the System on page 13.

If refrigerant lines are routed through a wall, then seal and isolate the opening so vibration is not transmitted to the building. Pay close attention to line set isolation during installation of any HVAC system. When properly isolated from building structures (walls, ceilings. floors), the refrigerant lines will not create unnecessary vibration and subsequent sounds. See figure 8 for recommended installation practices. Also, consider the following when placing and installing a high-efficiency outdoor unit.

Liquid lines that meter the refrigerant, such as RFC1 liquid lines, must not be used in this application. Existing line set of proper size as listed in table 2 may be reused. If system was previously charged with HCFC-22 refrigerant, then existing line set must be flushed (see *Flushing the System* on page 19).

Field refrigerant piping consists of liquid and vapor lines from the outdoor unit to the indoor unit coil (braze connections). Use Lennox L15 (sweat, non-flare) series line set, or field-fabricated refrigerant line sizes as listed in table 2.

Table 2. Refrigerant Line Set — Inches (mm)

Model	Valve Field Connections		Recommended Line Set		
	Liquid Line	Vapor Line	Liquid Line	Vapor Line	L15 Line Sets
-018 -024 -030	3/8 in. (10 mm)	3/4 in (19 mm)	3/8 in. (10 mm)	3/4 in (19 mm)	L15-41 15 ft. - 50 ft. (4.6 m - 15 m)
-036 -042 -048	3/8 in. (10 mm)	7/8 in (22 mm)	3/8 in. (10 mm)	7/8 in (22 mm)	L15-65 15 ft. - 50 ft. (4.6 m - 15 m)
-060	3/8 in. (10 mm)	1-1/8 in. (29 mm)	3/8 in. (10 mm)	1-1/8 in. (29 mm)	Field Fabricated

NOTE — When installing refrigerant lines longer than 50 feet, see the Lennox Refrigerant Piping Design and Fabrication Guidelines, CORP. 9351-L9, or contact Lennox Technical Support Product Applications for assistance.

To obtain the correct information from Lennox, be sure to communicate the following information:

- Model (XP16) and size of unit (e.g. -036).
- Line set diameters for the unit being installed as listed in table 2 and total length of installation.
- Number of elbows vertical rise or drop in the piping.

The compressor is charged with sufficient Polyol ester oil for line set lengths up to 50 feet. Recommend adding oil to system based on the amount of refrigerant charge in the system. No need to add oil in system with 20 pounds of refrigerant or less. For systems over 20 pounds - add one ounce of every five pounds of refrigerant.

Recommended topping-off POE oils are Mobil EAL ARCTIC 22 CC or ICI EMKARATE™ RL32CF.

WARNING

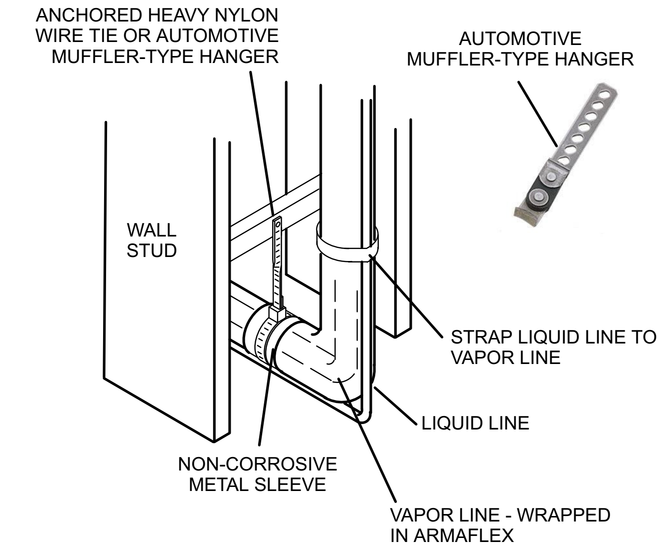
Polyol Ester (POE) oils used with HFC-410A refrigerant absorb moisture very quickly. It is very important that the refrigerant system be kept closed as much as possible. DO NOT remove line set caps or service valve stub caps until you are ready to make connections.

IMPORTANT

Mineral oils are not compatible with HFC-410A If oil must be added, it must be a Polyol Ester oil.

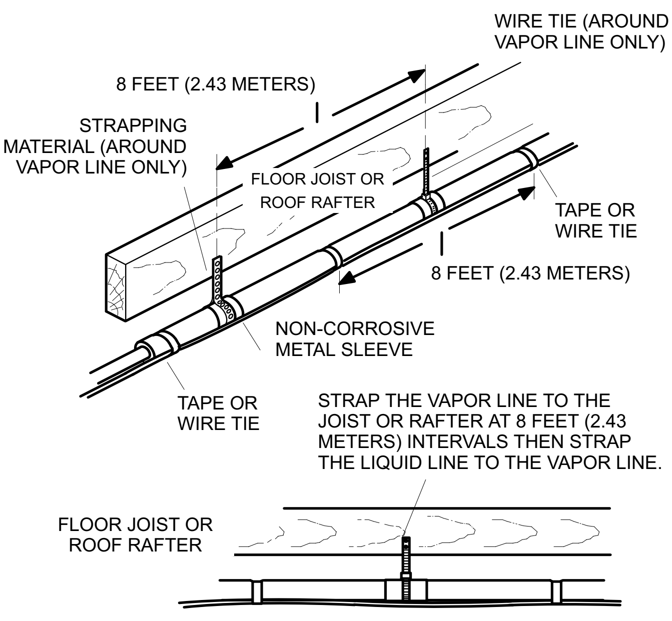
Line Set Isolation — The following illustrations are examples of proper refrigerant line set isolation:

REFRIGERANT LINE SET — TRANSITION FROM VERTICAL TO HORIZONTAL



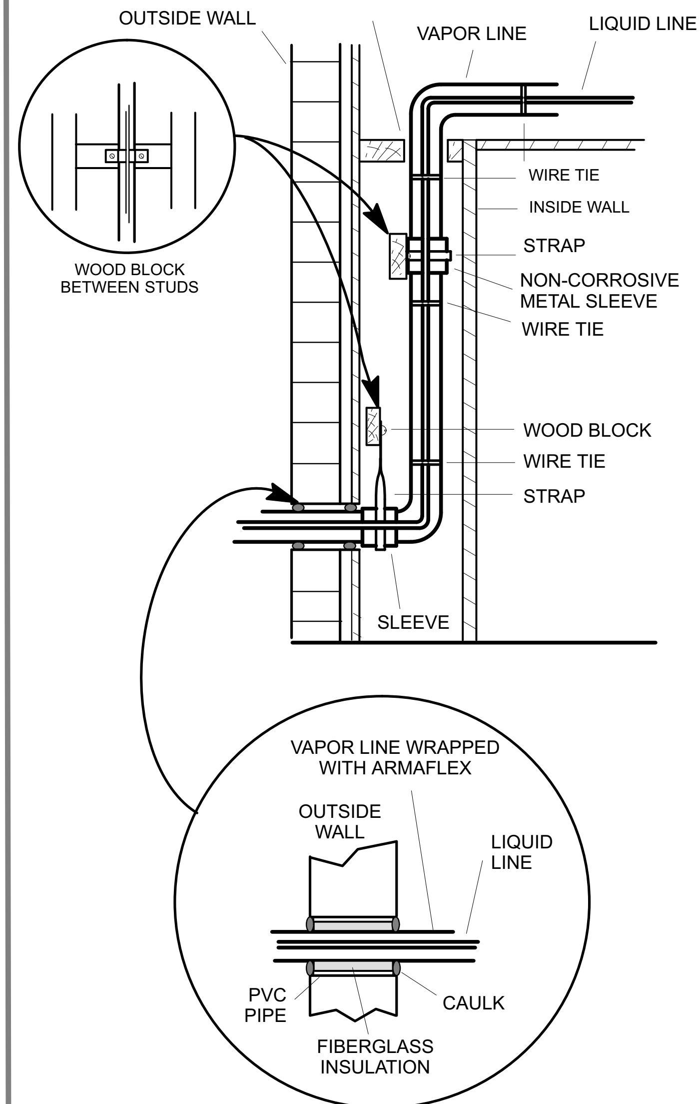
REFRIGERANT LINE SET — INSTALLING HORIZONTAL RUNS

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



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.



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

Figure 8. Line Set Installation

Brazing Connections

Use the procedures outline in figures 9 and 10 for brazing line set connections to service valves.

⚠ 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.

⚠ 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).

⚠ 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.

⚠ IMPORTANT

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

⚠ IMPORTANT

Allow braze joint to cool before removing the wet rag from the service valve. Temperatures above 250ºF 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

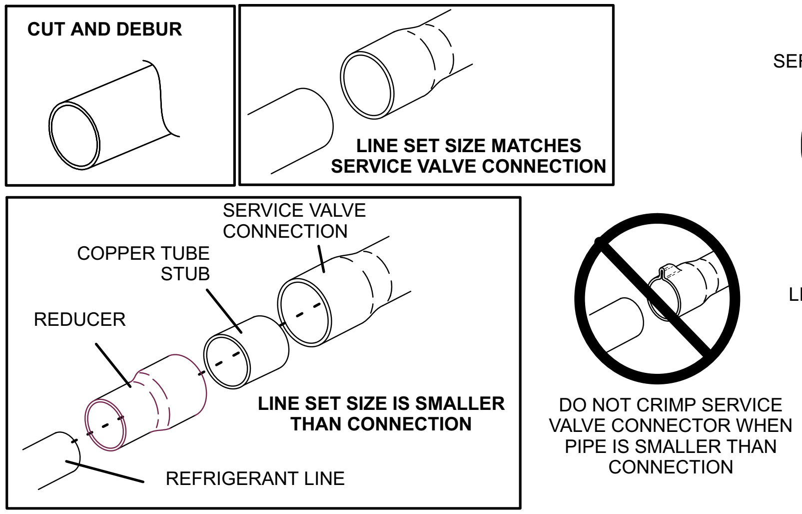
Fire, Explosion and Personal Safety Hazard.

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 fire and/or an explosion, that could result in property damage, personal injury or death.

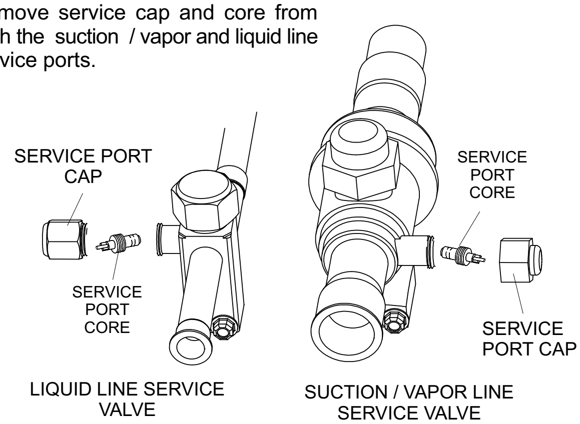
1 CUT AND DEBUR

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 suction / vapor and liquid line service ports.



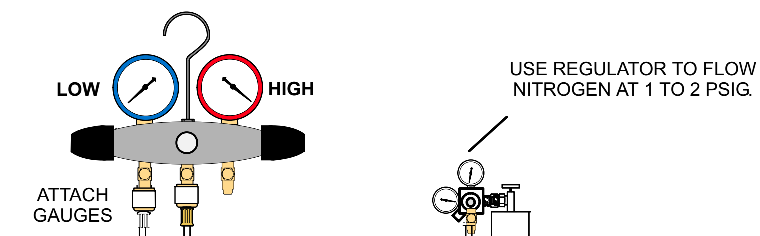
3 ATTACH THE MANIFOLD GAUGE SET FOR BRAZING LIQUID AND SUCTION / VAPOR LINE SERVICE VALVES

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 core from valve in suction / vapor line service port to allow nitrogen to escape.



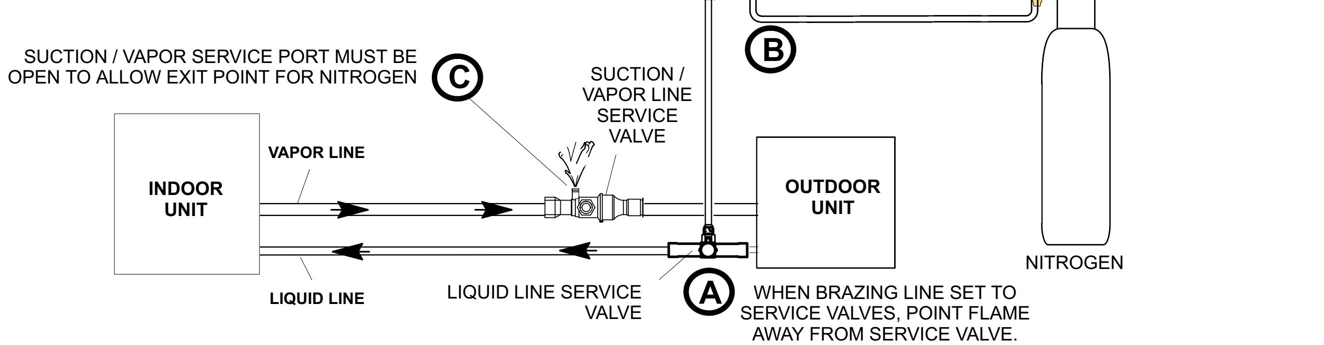


Figure 9. Brazing Procedures

4 WRAP SERVICE VALVES

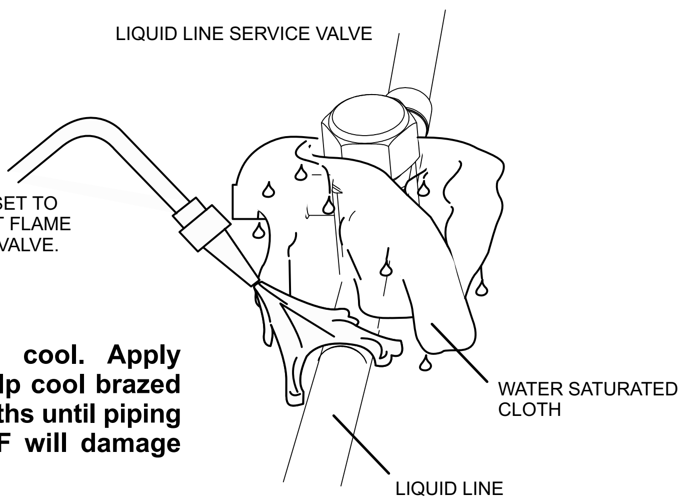
To help protect service valve seals during brazing, wrap water saturated cloths around service valve bodies and copper tube stubs. Use additional water saturated cloths underneath the valve body to protect the base paint.

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

6 BRAZE LINE SET

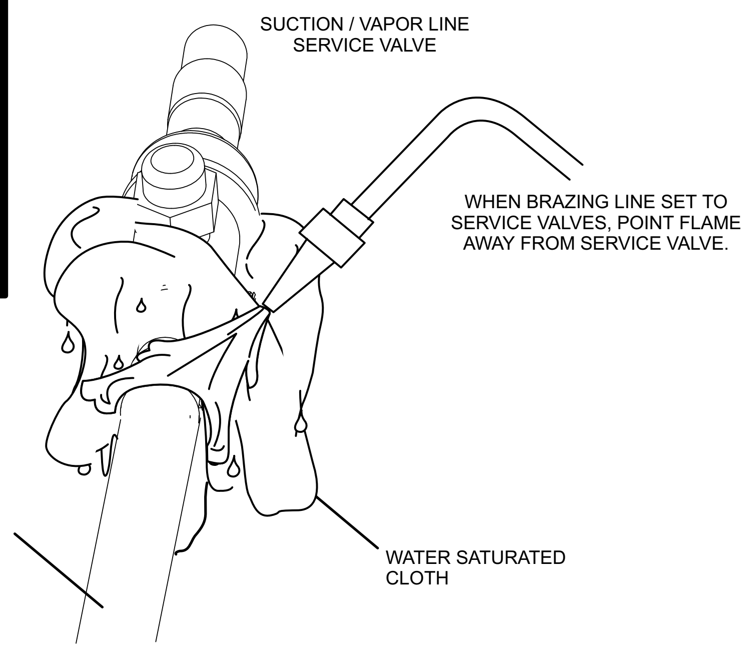
Wrap both service valves with water saturated cloths as illustrated here and as mentioned in step 4, before brazing to line set. Water saturated cloths must remain water saturated throughout the brazing and cool-down process.



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

WARNING

1. **FIRE, PERSONAL INJURY, OR PROPERTY DAMAGE** will 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 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.



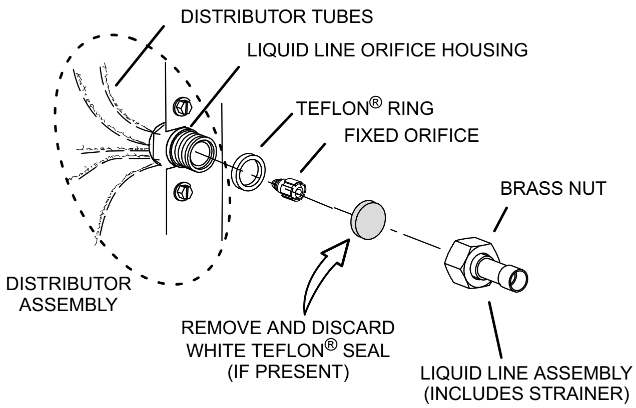
7 PREPARATION FOR NEXT STEP

After all connections have been brazed, disconnect manifold gauge set from service ports. Apply additional water saturated cloths to both services valves to cool piping. Once piping is cool, remove all water saturated cloths. Refer to the unit installation instructions for the next step in preparing the unit.

Figure 10. Brazing Procedures (continued)

Flushing Line Set and Indoor Coil

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.

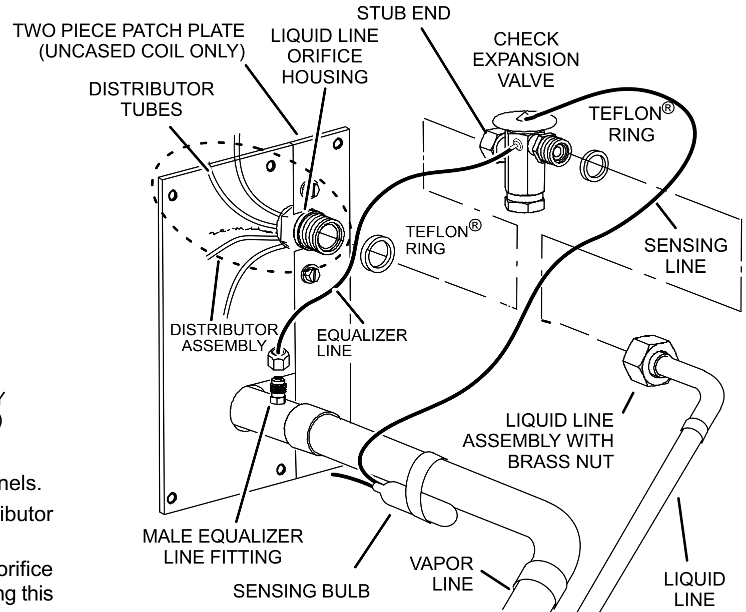
C Using two wrenches, disconnect liquid line from liquid line orifice housing. Take care not to twist or damage distributor tubes during this process.

D Remove and discard fixed orifice, valve stem assembly if present and Teflon® washer as illustrated above.

E Use a field-provided fitting to temporary reconnect the liquid line to the indoor unit's liquid line orifice housing.

OR

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 check expansion valve equalizer line fitting on the vapor line.

D Remove the vapor line sensing bulb.

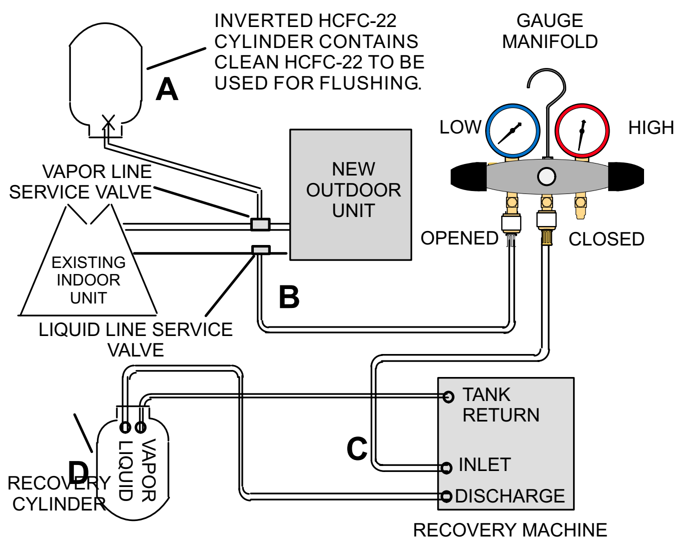
E Disconnect the liquid line from the check expansion valve at the liquid line assembly.

F Disconnect the check expansion valve from the liquid line orifice housing. Take care not to twist or damage distributor tubes during this process.

G Remove and discard check expansion valve and the two Teflon® rings.

H Use a field-provided fitting to temporary 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 machines 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 HCFC-22 and open its valve to allow liquid refrigerant to flow into the system through the vapor line valve. Allow the refrigerant to pass from the cylinder and through the line set and the indoor 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 down to 0 the system.

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 11. Installing Indoor Expansion Valve

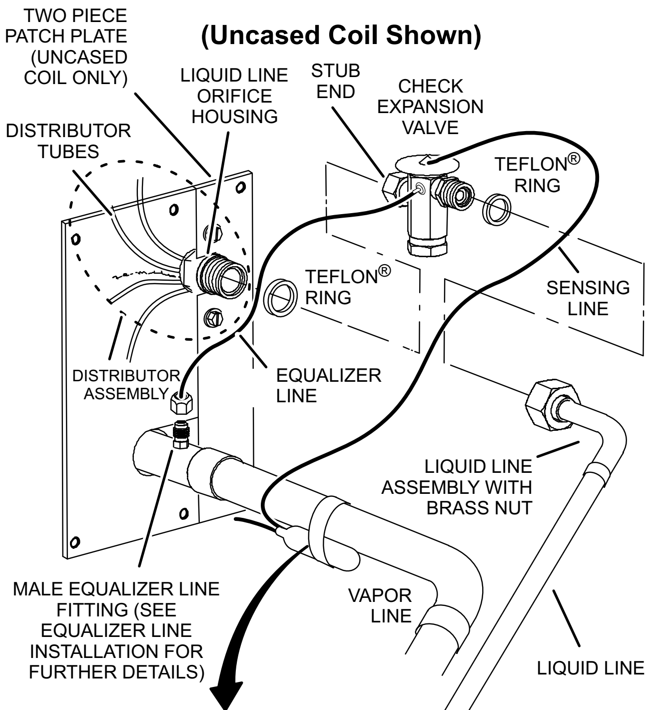
Installing Indoor Metering Device

This outdoor unit is designed for use in systems that use check expansion valve metering devices at the indoor coil.

See the *Lennox XP16 Engineering Handbook* for approved expansion valve kit match-ups. The 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 expansion valve in a manner that will provide access for field servicing of the expansion valve. Refer to below illustration for reference during installation of expansion valve unit.

INDOOR EXPANSION VALVE INSTALLATION

(Uncased Coil Shown)



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 temporary reconnected the liquid line to the indoor unit's distributor assembly.

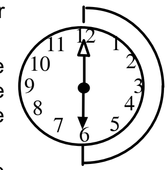
B Install one of the provided Teflon® rings around the stubbed end of the expansion valve and lightly lubricate the connector threads and expose surface of the Teflon® ring with refrigerant oil.

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



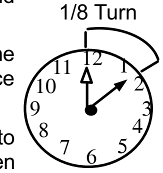
SENSING BULB INSTALLATION

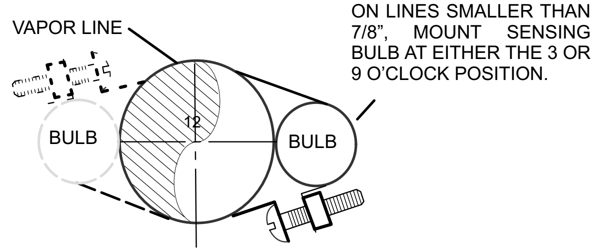
A Attach the vapor line sensing bulb in the proper orientation as illustrated to the right using the clamp and screws provided.

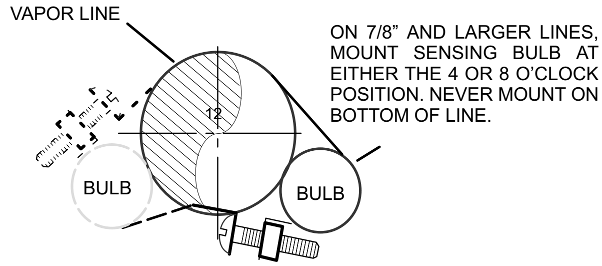
NOTE — Confirm proper thermal contact between vapor line and expansion bulb before insulating the sensing bulb once installed.

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.

1/8 Turn







NOTE — NEVER MOUNT ON BOTTOM OF LINE.

EQUALIZER LINE INSTALLATION

A 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 to the right.

B 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 to the right.

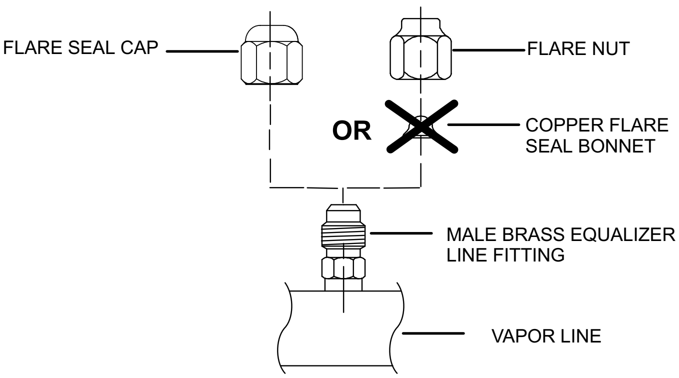


Figure 12. Installing Indoor Expansion Valve

⚠ 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

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

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

Leak Test Line Set and Indoor Coil

⚠ 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).

⚠ 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.

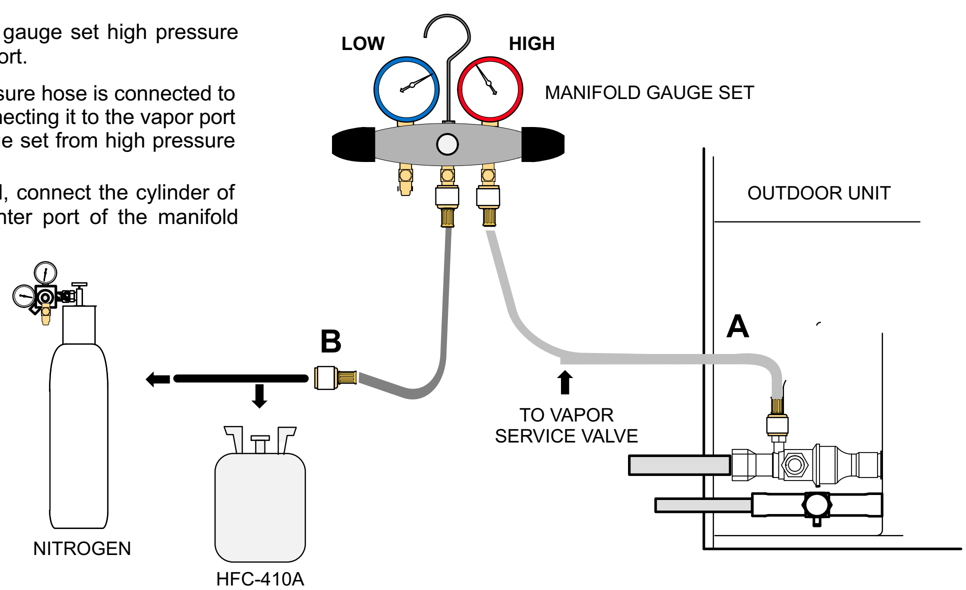
1 CONNECT GAUGE SET

A Connect an HFC-410A 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 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 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 13. Leak Test

Evacuating Line Set and Indoor Coil

1 CONNECT GAUGE SET

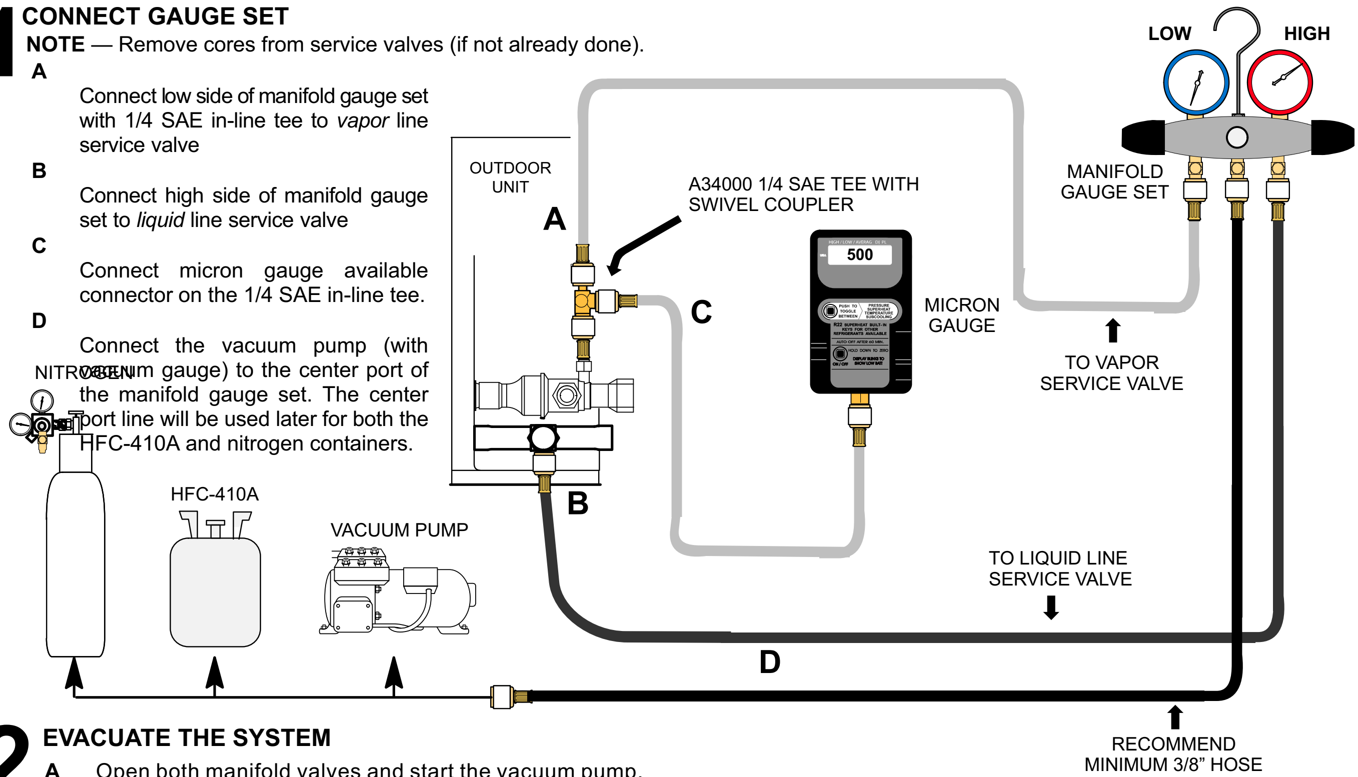
NOTE — Remove cores from service valves (if not already done).

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 HFC-410A 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), 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.

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 HFC-410A 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 secure finger tight, then tighten an additional one-sixth (1/6) of a turn as illustrated.

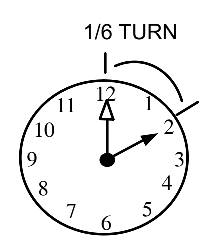


Figure 14. Evacuating System

⚠ 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.

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

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).

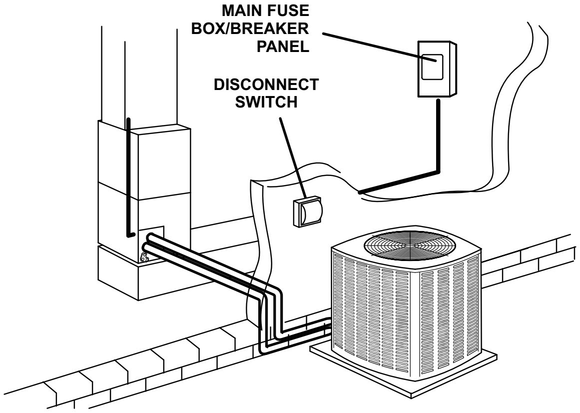
Refer to the furnace or air handler installation instructions for additional wiring application diagrams and refer to unit nameplate for minimum circuit ampacity and maximum overcurrent protection size.

24VAC TRANSFORMER

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

1 SIZE CIRCUIT AND INSTALL DISCONNECT SWITCH

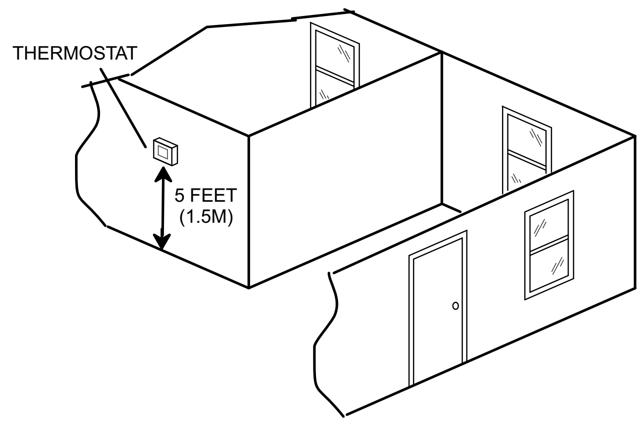
Refer to the unit nameplate for minimum circuit ampacity, and maximum fuse or circuit breaker (HACR per NEC). Install power wiring and properly sized disconnect switch.



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

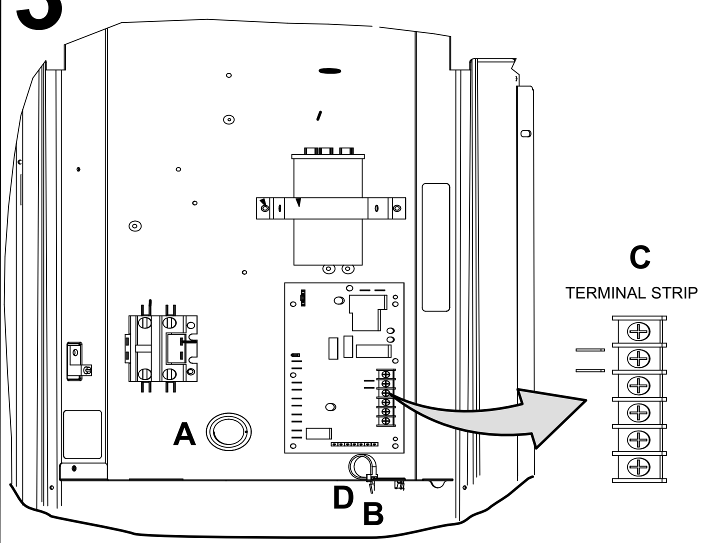
2 INSTALL THERMOSTAT

Install room thermostat (ordered separately) 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.

3 UNIT LOW VOLTAGE CONNECTIONS



HIGH VOLTAGE FIELD WIRING
FACTORY WIRING
LOW VOLTAGE (24V) FIELD WIRING

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

- **A** Run 24VAC control wires through cutout with grommet.
- **B** Run 24VAC control wires through wire tie.
- **C** Make 24VAC control wire connections defrost control terminal strip.
- **D** Tighten wire tie to security 24V control wiring.

NOTE - FOR PROPER VOLTAGES, SELECT THERMOSTAT WIRE (CONTROL WIRES) GAUGE PER TABLE ABOVE.

NOTE - WIRE TIE PROVIDES LOW VOLTAGE WIRE STRAIN RELIEF AND TO MAINTAIN SEPARATION OF FIELD INSTALLED LOW AND HIGH VOLTAGE CIRCUITS.

NOTE - DO NOT BUNDLE ANY EXCESS 24VAC CONTROL WIRES INSIDE CONTROL BOX.

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 21.
2. Evacuate the system using procedure outlined on page 22.
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 22.
5. Weigh in refrigerant using procedure outlined in figure 18.
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

IMPORTANT

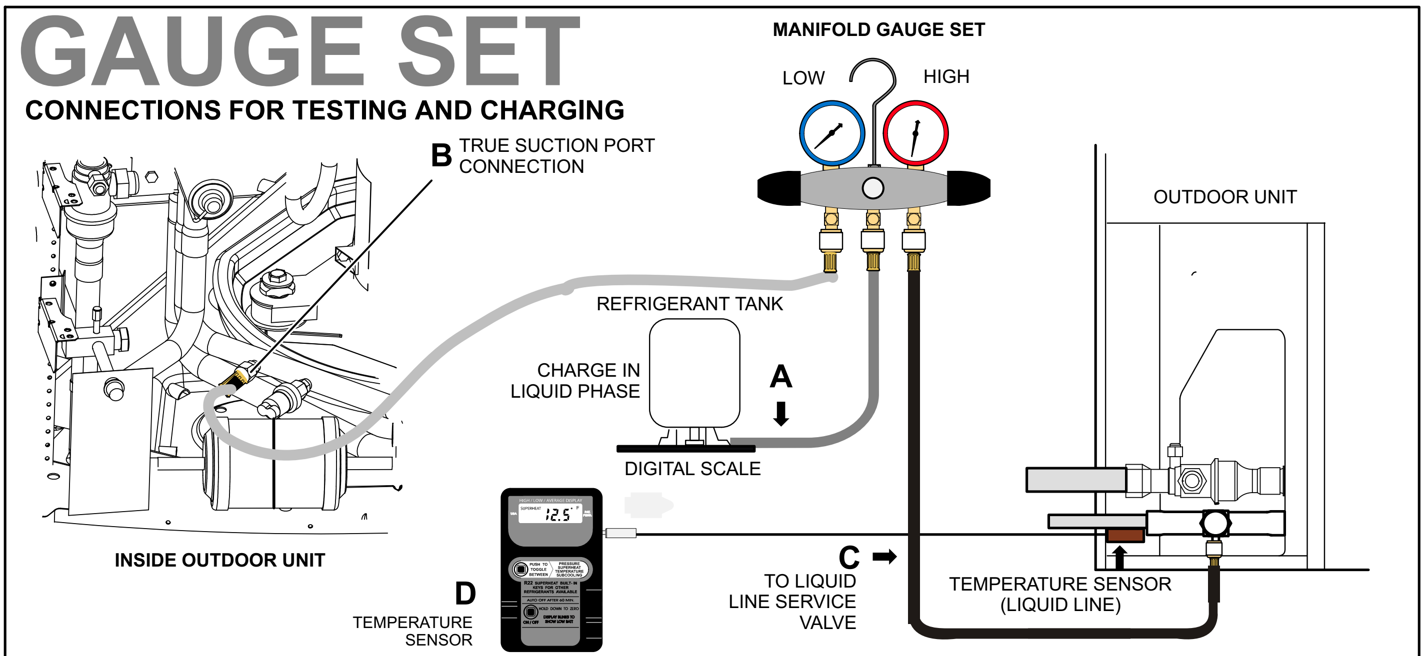
If unit is equipped with a crankcase heater, it should be energized 24 hours before unit start-up to prevent compressor damage as a result of slugging.

1. Rotate fan to check for binding.
2. Inspect all factory- and field-installed wiring for loose connections.
3. After evacuation is complete, open both the liquid and vapor line service valves to release the refrigerant charge contained in outdoor unit into the system.
4. Replace the stem caps and tighten to the value listed in table 1.
5. 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.
6. Set the thermostat for a cooling demand. Turn on power to the indoor indoor unit and close the outdoor unit disconnect switch to start the unit.
7. Recheck voltage while the unit is running. Power must be within range shown on the nameplate.
8. Check system for sufficient refrigerant by using the procedures listed under *System 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.



A Close manifold gauge set valves and connect the center hose to a cylinder of HFC-410A. Set for liquid phase charging.

B Connect the manifold gauge set's low pressure side to the true suction port. See figure 1 for approximate location of the true suction port.

C Connect the manifold gauge set's high pressure side to the liquid line service port.

D Position temperature sensor on liquid line near liquid line service port.

Figure 15. Gauge Set Setup and Connections

If the system is low on charge, follow the appropriate procedure outlined below. Charging should be done with unit operating in the cooling mode, if possible.

Charge Using The Weigh-in Method—*Outdoor Temperature < 65ºF (18ºC(*

If the system is void of refrigerant, or if the outdoor ambient temperature is cool, the refrigerant charge should be weighed into 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 unit nameplate charge. If weighing facilities are not available or if you are charging the unit during warm weather, follow one of the other procedures outlined below.

Charge Using The Subcooling Method—*Outdoor Temperature < 65ºF (18ºC)*

When the outdoor ambient temperature is below 65ºF (18ºC), use the subcooling method to charge the unit. It may be necessary to restrict the air flow through the outdoor coil to achieve pressures in the 325-375 psig (2240-2585 kPa) range. These higher pressures are necessary for checking the charge. Block equal sections of air intake panels and move obstructions sideways until the liquid pressure is in the 325-375 psig (2240-2585 kPa) range. See figure 16.

Block coil one side at a time with cardboard/plastic until proper testing pressures are reached.

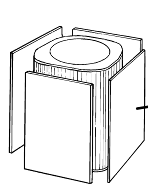


Figure 16. Blocking Outdoor Coil

1. With manifold gauge hose still on the liquid service port and unit operating stably, use a digital thermometer to record the liquid line temperature. At the same time, record the liquid line pressure reading.
2. Use a temperature/pressure chart for HFC-410A to determine the saturation temperature for the liquid line pressure reading.
3. Subtract the liquid line temperature from the saturation temperature (according to the chart) to determine subcooling. **(Saturation temperature - Liquid line temperature = Subcooling)**
4. Compare subcooling values with those in table 1; if subcooling is greater than shown, recover some refrigerant. If subcooling is less than shown, add some refrigerant.

Charge Using Normal Operating Pressures/Approach Method—*Outdoor Temperature >65ºF (18ºC)*

When outdoor ambient temperature is above 65°F (18°C), use approach charge method. For best results, indoor temperature should be 70°F (21°C) to 80°F (26°C). Monitor system pressures while charging.

1. Record outdoor ambient temperature using a digital thermometer.
2. Attach high pressure gauge set; operate unit for several minutes; allow system pressures to stabilize.
3. Compare stabilized pressures with those provided in table 3. Minor variations in these pressures may be expected due to differences in installations. Significant differences could mean that the system is not properly charged or that a problem exists with some component in the system. Pressures higher than those listed indicate that the system is overcharged. Pressures lower than those listed indicate that the system is undercharged. Verify adjusted charge using the approach method.

Use the same digital thermometer to check both outdoor ambient temperature and liquid line temperature. Verify the unit charge using the approach method.

4. The difference between the ambient and liquid temperatures should match values given in table 2. If values do not agree with the those in table 2, add refrigerant to lower the approach temperature or recover refrigerant from the system to increase the approach temperature.

Using the Normal Operating Pressures Table

Use table 3 as a general guide when performing maintenance checks. This is not a procedure for charging the unit (see Charging/Checking Charge section). Minor variations in normal operating pressures may be expected due to differences in installations. Significant differences could mean that the system is not properly charged or that a problem exists with some component in the system.

Table 3 - Indoor Units Matchups and Subcooling Charge Levels (XP16-XXX-230-05)

Charging Temperatures and Pressures								
XP16 Model	**-024**		**-036**		**-048**		**-060**	
Table 1 - Subcooling Values *Saturation Temperature minus Liquid Line Temperature °F (ºC) ± 1ºF (0.5ºC)*								
Temp. °F (°C)	8 (4.4)		7 (3.9)		9 (5)		8 (4.4)	
Table 2 - Approach Values *Liquid Line Temperature minus Outdoor Ambient Temperature ºF (ºC) ± 1ºF (0.5ºC)*								
Temp. °F (°C)	8 (4.4)		9 (5)		8 (4.4)		8 (4.4)	
Table 3 - Normal Operating Pressures (Liq. ±10 & Vap. ±5 psig) **								
Temp. °F (°C)*	**Liquid**	**Vapor**	**Liquid**	**Vapor**	**Liquid**	**Vapor**	**Liquid**	**Vapor**
Cooling - First Stage (Low Capacity)								
65 (18.3)	232	146	225	144	235	144	225	138
75 (23.9)	264	148	261	147	268	145	264	141
85 (29.4)	307	149	302	149	310	147	305	142
95 (35.0)	353	151	349	151	356	148	352	146
105 (40.6)	403	153	397	153	407	150	405	148
115 (46.1)	460	155	461	157	466	152	459	150
Cooling - Second Stage (High Capacity)								
65 (18.3)	240	143	239	139	244	140	241	134
75 (23.9)	279	145	278	141	283	141	280	136
85 (29.4)	322	147	322	143	326	144	324	137
95 (35.0)	371	149	367	146	374	147	373	138
105 (40.6)	423	151	426	148	427	148	425	142
115 (46.1)	485	154	489	151	491	151	486	146
Heating - First Stage (Low Capacity)								
40 (4.4)	337	93	328	98	369	75	351	63
50 (10)	322	117	333	118	366	114	335	92
Heating - Second Stage (High Capacity)								
20 (-7.0)	279	62	296	62	311	58	308	59
30 (-1.0)	288	76	309	75	334	72	323	70
40 (4.4)	302	93	322	92	354	89	318	69
50 (10)	306	112	336	113	381	108	329	82

* Outdoor Coil Entering Air Temp. °F (°C)

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

CHARGING INFORMATION FOR MODEL XP16-XXX-230-03, XP16-XXX-230-04 and XP16-XXX-230-05

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.

COOLING MODE INDOOR AIRFLOW CHECK

Check airflow using the Delta-T (DT) process using the illustration in Figure 17.

HEATING MODE INDOOR AIRFLOW CHECK

Blower airflow (CFM) may be calculated by energizing electric heat and measuring:

- Temperature rise between the return air and supply air temperatures at the indoor coil blower unit,
- Measuring voltage supplied to the unit,
- Measuring amperage being drawn by the heat unit(s).

Then, apply the measurements taken in following formula to determine CFM:

$$\text{CFM} = \frac{\text{Amps x Volts x 3.41}}{\text{1.08 x Temperature rise (F)}}$$

AIRFLOW

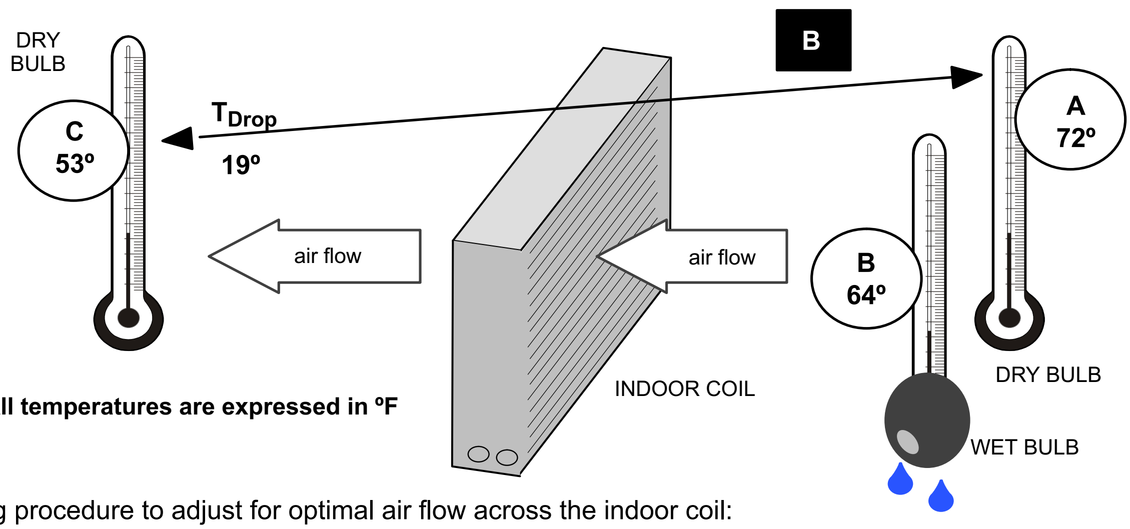
INDOOR COIL

Temperature of air entering indoor coil ºF — **A**

DT

Dry-bulb														
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	15	14	13	12	11	10
Wet-bulb ºF	**57**	**58**	**59**	**60**	**61**	**62**	**63**	**64**	**65**	**66**	**67**	**68**	**69**	**70**

B



All temperatures are expressed in ºF

Use the following procedure to adjust for optimal air flow across the indoor coil:

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 $\pm$3º, no adjustment is needed. See example below:

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

Cº	T_{Drop} –	DT	=	ºF	*ACTION*
53º	19	– 15	=	4	*Increase the airflow*
58º	14	– 15	=	-1	*(within $\pm$3º range) no change*
62º	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$3º.

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

Figure 17. Checking Indoor Airflow over Evaporator Coil using Delta-T Chart Formula

Use **WEIGH IN** method for adding initial refrigerant charge, and then use **SUBCOOLING** method for verifying refrigerant charge.

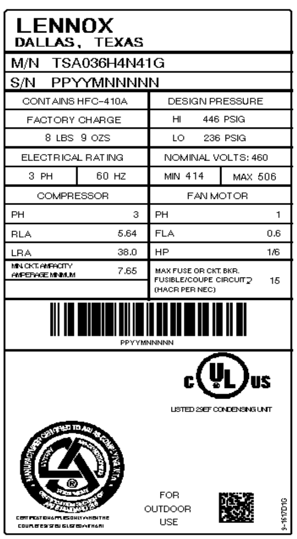
WEIGH IN

CHARGING METHOD

CALCULATING SYSTEM CHARGE FOR OUTDOOR UNIT VOID OF CHARGE

If the system is void of refrigerant, first, locate and repair any leaks and then weigh in the refrigerant charge into the unit. To calculate the total refrigerant charge:

Amount specified on nameplate		Adjust amount. for variation in line set length listed on line set length table below.		Additional charge specified per indoor unit match-ups		Total charge
________	±	________	+	________	=	________



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)

*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.

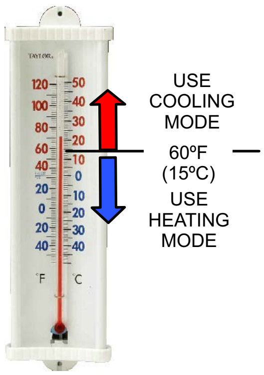
NOTE — Insulate liquid line when it is routed through areas where the surrounding ambient temperature could become higher than the temperature of the liquid line or when pressure drop is equal to or greater than 20 psig.

NOTE — The above nameplate is for illustration purposes only. Go to actual nameplate on outdoor unit for charge information.

Figure 18. Using HFC-410A Weigh In Method

SUBCOOLING

CHARGING METHOD



SATº ________
LIQº – ________
SCº = ________

1. Check the airflow as illustrated in figure 17 to be sure the indoor airflow is as required. (Make any air flow adjustments before continuing with the following procedure.)
2. Measure outdoor ambient temperature; determine whether to use **cooling mode** or **heating mode** to check charge.
3. Connect gauge set.
4. Check liquid and vapor line pressures. Compare pressures with either heat or cooling mode normal operating pressures in the Normal Operating Pressures Tables, Second Stage — High Capacity.

   NOTE — The reference table is a general guide. Expect minor pressure variations. Significant differences may mean improper charge or other system problem.

5. Set thermostat for heat/cool demand, depending on mode being used:

   USING COOLING MODE — When the outdoor ambient temperature is 60°F (15°C) and above. Target subcooling values (second stage - high capacity) in the Normal Operating Pressures Tables are based on 70 to 80°F (21-27°C) indoor return air temperature; if necessary, operate heating to reach that temperature range; then set thermostat to cooling mode setpoint to 68ºF (20ºC) which should call for second-stage (high capacity) cooling. When pressures have stabilized, continue with Step 6.

   USING HEATING MODE — When the outdoor ambient temperature is below 60°F (15°C). Target subcooling values (second-stage - high capacity) in the Normal Operating Pressures Tables are based on 65-75°F (18-24°C) indoor return air temperature; if necessary, operate cooling to reach that temperature range; then set thermostat to heating mode setpoint to 77ºF (25ºC) which should call for second-stage (high capacity) heating. When pressures have stabilized, continue with Step 6.

6. Read the liquid line temperature; record in the LIQº space.
7. Read the liquid line pressure; then find its corresponding temperature in the temperature/ pressure chart listed in table 2 and record it in the SATº space.
8. Subtract LIQº temperature from SATº temperature to determine subcooling; record it in SCº space.
9. Compare SCº results with tables under Indoor unit match ups, being sure to note any additional charge for line set and/or match-up.
10. If subcooling value is greater than shown in tables under indoor unit matchups for the applicable unit, remove refrigerant; if less than shown, add refrigerant.
11. If refrigerant is added or removed, repeat steps 5 through 6 to verify charge.
12. Disconnect gauge set and re-install both the liquid and suction service valve caps.

Figure 19. Using HFC-410A Subcooling Method — Second Stage (High Capacity)

CHARGING INFORMATION FOR MODEL XP16-XXX-230-03
Unit Charging Sticker - 401233S, dated 01/08

Table 4 - Indoor Units Matchups and Subcooling Charge Levels (XP16-XXX-230-05)

INDOOR MATCH UPS HEAT PUMP	Target Subcooling Heat (±5ºF)	Target Subcooling Cool (±1ºF)	**Add charge		INDOOR MATCH UPS HEAT PUMP	Target Subcooling Heat (±5ºF)	Target Subcooling Cool (±1ºF)	**Add charge		INDOOR MATCH UPS HEAT PUMP	Target Subcooling Heat (±5ºF)	Target Subcooling Cool (±1ºF)	**Add charge	
XP16–024			lb	oz	**XP16–036**			lb	oz	**XP16–048**			lb	oz
CBX26UH–018	20	8	1	5	CH23–51	17	7	0	13	CH23–68	15	13	0	7
CBX26UH–024	20	8	1	5	CH23–65	12	8	1	10	CB27UH-048	17	7	0	0
CB27UH-024	12	6	0	12	CBX26UH–030	25	8	1	14	CB27UH-060	17	7	0	0
CB27UH-030	13	9	1	12	CBX26UH–036	25	8	1	14	CB30U–51, –65	17	7	0	0
CB30U–21/26	12	6	0	12	CB27UH-036	17	8	2	4	CBX32M–048, –060	17	7	0	0
CB30U–31	13	9	1	12	CB27UH-042	17	8	2	4	CBX32MV–068	16	10	0	3
CBX32M–018/024	12	6	0	12	CB30U–31	17	6	0	0	CH33–60D–2F	18	4	0	2
CBX32M–030	13	9	1	12	CB30U–41/46	17	8	2	4	CH33–62D–2F	15	10	0	4
CBX32MV–024/030	13	9	1	12	CBX32M–030	17	6	0	0	CR33–60	40	4	0	2
CBX32MV–036	12	9	0	10	CBX32M–036	17	8	2	4	CX34–60D–6F	18	4	0	2
CH33–25B	17	4	0	0	CBX32MV–024/030	17	6	0	0	CX34–62D–6F	16	8	0	2
CH33–36A–2F	12	6	0	10	CBX32MV–036	17	8	2	4	**XP16XP16–060**			**lb**	**oz**
CH33–36B–2F	17	4	0	0	C33–44C	17	8	1	14	CH23–68	13	14	3	3
CH33–36C–2F	12	7	1	2	CH33–42B–2F	17	7	0	13	CH23–65	18	2	0	0
CR33–24A/B–F	20	4	0	0	CH33–44/48B–2F	12	8	1	8	CBX26UH–060	13	14	3	5
CR33–30/36A/B/C–F	20	8	1	6	CH33–48C–2F	10	8	1	6	CB27UH-060	13	10	2	1
CR33–48	21	9	0	3	CH33–43B	9	10	1	6	CBX32M–060	13	10	2	1
CX34–25A/B–6F	12	6	0	12	CH33–49C	9	10	1	6	CBX32MV–068	13	12	2	9
CX34–31A/B–6F	20	9	1	12	CR33–48B/C–F	25	8	2	0	CH33–60D–2F	15	6	1	3
CX34–36A/B/C–6F	17	5	0	5	CR33–50/60C–F	25	9	0	14	CH33–62D–2F	13	12	2	10
CX34–38A/B–6F *Serial No# before 6007K*	31	7	0	8	CX34–38A/B–6F *Serial No# before 6007K*	31	7	1	5	CR33–50/60C–F	30	6	1	3
CX34–38A/B–6F *Serial No# 6007K and after*	10	8	0	11	CX34–38A/B–6F *Serial No# 6007K and after*	10	8	1	12	CR33–60D–F	30	6	1	3
CX34–19	18	4	0	1	CX34–43B/C–6F	10	8	1	6	CX34–49C–6F	13	9	1	14
					CX34–60D	9	9	0	14	CX34–60D–6F	15	6	1	3
										CX34–62C–6F	13	11	2	6
										CX34–62D–6F	13	11	2	5

**Amount of charge required in additional to charge shown on unit nameplate. (Remember to consider line set length difference.)

Table 1 - Normal Operating Pressures (Liquid ±10 & Suction ±5 psig) (XP16-XXX-230-03)

*Temperature of the air entering the outdoor coil.	Model	-024	-036	-048	-060
	°F (°C)*	Liquid Line Pressure/Vapor Line Pressure			
Cooling First Stage (Low Capacity)	65 (18)	232 / 146	225 / 144	235 / 144	225 / 138
	75 (24)	264 / 148	261 / 147	268 / 145	264 / 141
	85 (29)	307 / 149	302 / 149	310 / 147	305 / 142
	95 (35)	353 / 151	349 / 151	356 / 148	352 / 146
	105 (41)	403 / 153	397 / 153	407 / 150	405 / 148
	115 (45)	460 / 155	461 / 157	466 / 152	459 / 150
Cooling Second Stage (High Capacity)	65 (18)	240 / 143	239 / 139	244 / 140	241 / 134
	75 (24)	279 / 145	278 / 141	283 / 141	280 / 136
	85 (29)	322 / 147	322 / 143	326 / 144	324 / 137
	95 (35)	371 / 149	367 / 146	374 / 147	373 / 138
	105 (41)	423 / 151	426 / 148	427 / 148	425 / 142
	115 (45)	485 / 154	489 / 151	491 / 151	486 / 146
Heating First Stage (Low Capacity)	50 (10)	322 / 117	333 / 118	366 / 114	335 / 92
	40 (4.5)	337 / 93	328 / 98	369 / 75	351 / 63
Heating Second Stage (High Capac-ity)	50 (10)	306 / 112	336 / 113	381 / 108	329 / 82
	40 (4.5)	302 / 93	322 / 92	354 / 89	318 / 69
	30 (-1)	288 / 76	309 / 75	334 / 72	323 / 70
	20 (-7)	279 / 62	296 / 62	311 / 58	308 / 59

CHARGING INFORMATION FOR MODEL XP16-XXX-230-04
Unit Charging Sticker - 580094-01, dated 05/09

Table 2 - Indoor Units Matchups and Subcooling Charge Levels (XP16-XXX-230-05)

INDOOR MATCHUP / HEAT PUMP	Target Subcooling		*Add charge	
	Heat ±5ºF	Cool ±1ºF	lb	oz
XP16–024				
CB30U–21/26	12	6	0	12
CB30U–31	13	9	1	12
CBX26UH–018	20	8	1	5
CBX26UH–024	20	8	1	5
CB27UH-024	12	6	0	12
CB27UH-030	13	9	1	12
CBX32M–018/024	12	6	0	12
CBX32M–030	13	9	1	12
CBX32MV–024/030	13	9	1	12
CBX32MV–036	12	9	0	10
CBX40UHV–024, -030	13	9	1	12
CBX40UHV–036	12	9	0	10
CH33–25B	17	4	0	0
CH33–36A–2F	12	6	0	10
CH33–36B–2F	17	4	0	0
CH33–36C–2F	12	7	1	2
CR33–24A/B–F	20	4	0	0
CR33–30/36A/B/C–F	20	8	1	6
CR33–48	21	9	0	3
CX34–25A/B–6F	12	6	0	12
CX34–31A/B–6F	20	9	1	12
CX34–36A/B/C–6F	17	5	0	5
CX34–38A/B–6F *SN before 6007K*	31	7	0	8
CX34–38A/B–6F *SN 6007K and after*	10	8	0	11
CX34–19	18	4	0	1

INDOOR MATCHUP / HEAT PUMP	Target Subcooling		*Add charge	
	Heat ±5ºF	Cool ±1ºF	lb	oz
XP16–036				
C33–44C	17	8	1	14
CB27UH-036	17	8	2	4
CB27UH-042	17	8	2	4
CB30U–31	17	6	0	0
CB30U–41/46	17	8	2	4
CBX26UH–030	25	8	1	14
CBX26UH–036	25	8	1	14
CBX32M–030	17	6	0	0
CBX32M–036	17	8	2	4
CBX32MV–024/030	17	6	0	0
CBX32MV–036	17	8	2	4
CBX40UHV–024, -030	17	6	0	0
CBX40UHV–036, -042	17	8	2	4
CH23–51	17	7	0	13
CH23–65	12	8	1	10
CH33–42B–2F	17	7	0	13
CH33–44/48B–2F	12	8	1	8
CH33–48C–2F	10	8	1	6
CH33–43B	9	10	1	6
CH33–49C	9	10	1	6
CR33–48B/C–F	25	8	2	0
CR33–50/60C–F	25	9	0	14
CX34–38A/B–6F *SN before 6007K*	31	7	1	5
CX34–38A/B–6F *SN 6007K and after*	10	8	1	12
CX34–43B/C–6F	10	8	1	6
CX34–60D	9	9	0	14

INDOOR MATCHUP / HEAT PUMP	Target Subcooling		*Add charge	
	Heat ±5ºF	Cool ±1ºF	lb	oz
XP16–048				
CB27UH-048	17	7	0	0
CB27UH-060	17	7	0	0
CB30U–51, –65	17	7	0	0
CBX32M–048, –060	17	7	0	0
CBX32MV–048, –060	17	7	0	0
CBX32MV–068	16	10	0	3
CH23–68	15	13	0	7
CH33–60D–2F	18	4	0	2
CH33–62D–2F	15	10	0	4
CR33–60	40	4	0	2
CX34–60D–6F	18	4	0	2
CX34–62D–6F	16	8	0	2
XP16–060				
CB27UH-060	13	10	2	1
CBX26UH–060	13	14	3	5
CBX32M–060	13	10	2	1
CBX32MV–060	13	10	2	1
CBX32MV–068	13	12	2	9
CH23–68	13	14	3	3
CH23–65	18	2	0	0
CH33–60D–2F	15	6	1	3
CH33–62D–2F	13	12	2	10
CR33–50/60C–F	30	6	1	3
CR33–60D–F	30	6	1	3
CX34–49C–6F	13	9	1	14
CX34–60D–6F	15	6	1	3
CX34–62C–6F	13	11	2	6
CX34–62D–6F	13	11	2	5

SN indicates coil serial number.

***Amount of charge required in additional to charge shown on unit nameplate. (Remember to consider line set length difference.)**

Table 1 - HFC-410A Normal Operating Pressures (Liquid ±10 & Suction ±5 psig) (XP16-XXX-230-04)

*Temperature of the air entering the outdoor coil.	Model	-024	-036	-048	-060
	°F (°C)*	Liquid Line Pressure/Vapor Line Pressure			
Cooling First Stage (Low Capacity)	65 (18)	232 / 146	225 / 144	235 / 144	225 / 138
	75 (24)	264 / 148	261 / 147	268 / 145	264 / 141
	85 (29)	307 / 149	302 / 149	310 / 147	305 / 142
	95 (35)	353 / 151	349 / 151	356 / 148	352 / 146
	105 (41)	403 / 153	397 / 153	407 / 150	405 / 148
	115 (45)	460 / 155	461 / 157	466 / 152	459 / 150
Cooling Second Stage (High Capacity)	65 (18)	240 / 143	239 / 139	244 / 140	241 / 134
	75 (24)	279 / 145	278 / 141	283 / 141	280 / 136
	85 (29)	322 / 147	322 / 143	326 / 144	324 / 137
	95 (35)	371 / 149	367 / 146	374 / 147	373 / 138
	105 (41)	423 / 151	426 / 148	427 / 148	425 / 142
	115 (45)	485 / 154	489 / 151	491 / 151	486 / 146
Heating First Stage (Low Capacity)	50 (10)	333 / 116	318 / 116	354 / 115	365/ 113
	40 (4.5)	314 / 88	304 / 89	324 / 92	341 / 89
Heating Second Stage (High Capacity)	50 (10)	346 / 109	333 / 110	370 / 110	369 / 107
	40 (4.5)	321 / 89	314 / 88	345 / 92	348 / 86
	30 (-1)	303 / 74	303 / 77	322 / 70	335 / 73
	20 (-7)	286 / 59	289 / 63	305 / 61	318 / 59

CHARGING INFORMATION FOR MODEL XP16-XXX-230-05

Unit Charging Sticker - 580275-01, dated 12/09

Table 2 - Indoor Units Matchups and Subcooling Charge Levels (XP16-XXX-230-05)

INDOOR MATCHUP HEAT PUMP	Target Subcooling Heat ±5ºF	Target Subcooling Cool ±1ºF	*Add charge		INDOOR MATCHUP HEAT PUMP	Target Subcooling Heat ±5ºF	Target Subcooling Cool ±1ºF	*Add charge		INDOOR MATCHUP HEAT PUMP	Target Subcooling Heat ±5ºF	Target Subcooling Cool ±1ºF	*Add charge	
XP16-024					CBX40UHV-042	24	11	3	0	CH33-60D	13	8	0	0
CBX26UH-024	45	6	0	15	CBX40UHV-048	24	11	3	0	CH33-62D	11	9	1	4
CBX27UH-024-230	20	7	0	9	CH33-43B	13	10	2	7	CR33-50/60C	15	7	0	10
CBX27UH-030-230	17	7	1	3	CH33-48C	37	11	2	11	CR33-60D	16	7	0	10
CBX32MV-024/030	20	7	0	9	CH33-43C	37	11	2	11	CX34-60D	14	8	1	0
CBX32MV-036	17	7	1	3	CR33-48B/C	49	7	0	9	CX34-62D	9	9	1	6
CBX40UHV-024	17	7	1	3	CX34-43B/C	29	9	2	11	CX34-62C	8	9	1	9
CBX40UHV-030	17	7	1	3	CX34-50/60C	29	9	2	11	**XP16-060**				
CBX40UHV-036	17	7	1	3	**XP16-048**					CBX26UH-060	20	9	4	13
CH33-31B	31	8	1	12	CBX26UH-048	10	8	1	4	CBX27UH-060-230	10	6	2	3
CR33-30/36A/B/C	45	4	0	0	CBX27UH-048	19	9	1	4	CBX32M-060	17	6	1	12
CX34-31A/B	24	7	1	11	CBX27UH-060	13	14	3	3	CBX32MV-060	17	6	1	12
CX34-38A/B	18	8	1	10	CBX32M-048	19	9	1	4	CBX32MV-068	15	7	2	1
XP16-036					CBX32M-060	14	9	1	11	CBX40UHV-060	17	6	1	12
CBX26UH-036	50	5	0	0	CBX32MV-048	19	9	1	4	CH23-68	37	9	2	10
CBX27UH-036-230	22	7	0	9	CBX32MV-060	14	9	1	11	CH33-50/60C	33	8	1	0
CBX27UH-042-230	24	11	3	0	CBX32MV-068	9	8	1	11	CH33-62D	16	7	1	4
CBX32M-036	22	7	0	9	CBX40UHV-048	19	9	1	4	CR33-50/60C	24	7	0	0
CBX32MV-036	22	7	0	9	CBX40UHV-060	14	9	1	11	CR33-60D	24	7	0	0
CBX32MV-048	24	11	3	0	CH23-68	24	10	1	12	CX34-62C	21	9	2	16
CBX40UHV-030	22	7	0	9	CH33-49C	19	9	2	5	CX34-62D	13	7	1	4
CBX40UHV-036	22	7	0	9	CH33-50/60C	19	9	2	5	*Amount of charge required in additional to charge shown on unit nameplate. (Remember to consider line set length difference.)				

Table 1 - HFC-410A Normal Operating Pressures (Liquid ±10 & Suction ±5 psig) (XP16-XXX-230-05)

	Size	-024		-036		-048		-060	
	Model	XP16 Only		XP16 and SPB*H4					
	°F (°C)	Liq	Vap	Liq	Vap	Liq	Vap	Liq	Vap
Normal Operating Pressures - Cooling									
First Stage (Low Capacity) Pressure	65 (18.3)	226	144	220	141	224	143	230	137
	75 (23.9)	260	145	254	144	259	143	267	139
	85 (29.4)	301	148	295	148	302	147	311	141
	95 (35.0)	346	151	340	150	346	149	357	144
	105 (40.6)	396	153	389	153	396	152	398	147
	115 (46.1)	451	156	444	156	450	155	453	149
Second Stage (High Capacity) Pressure	65 (18.3)	241	140	232	129	238	138	232	131
	75 (23.9)	279	142	269	136	278	140	276	133
	85 (29.4)	321	144	312	140	321	142	320	136
	95 (35.0)	369	146	346	142	372	144	367	138
	105 (40.6)	421	148	409	145	424	147	421	141
	115 (46.1)	480	151	465	148	481	149	479	144
Normal Operating Pressures - Heating									
First Stage (Low Capacity) Pressure	50 (10)	312	112	350	115	336	114	385	108
	60 (15.5)	330	130	372	136	363	135	414	126
Second Stage (High Capacity) Pressure	20 (-7.0)	299	64	321	61	289	57	332	59
	30 (-1.0)	312	79	347	74	294	69	349	67
	40 (4.4)	325	93	367	90	321	80	361	75
	50 (10)	344	110	387	110	341	110	383	85
	60 (15.5)	358	128	395	131	361	128	425	122

Table 2. HFC-410A Temperature (°F) - Pressure (Psig)

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

System Operation

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

SECOND-STAGE OPERATION

If the board receives a call for second-stage compressor operation Y2 in heating or cooling mode and the first-stage compressor output is active, the second-stage compressor solenoid output will be energized.

If first-stage compressor output is active in heating mode and the outdoor ambient temperature is below the selected compressor lock-in temperature, the second-stage compressor solenoid output will be energized without the Y2 input. If the jumper is not connected to one of the temperature selection pins on P3 (40, 45, 50, 55°F), the default lock-in temperature of 40°F (4.5°C) will be used.

The board de-energizes the second-stage compressor solenoid output immediately when the Y2 signal is removed or the outdoor ambient temperature is 5°F above the selected compressor lock-in temperature, or the first-stage compressor output is de-energized for any reason.

THERMOSTAT OPERATION

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

EMERGENCY HEAT (AMBER LIGHT)

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

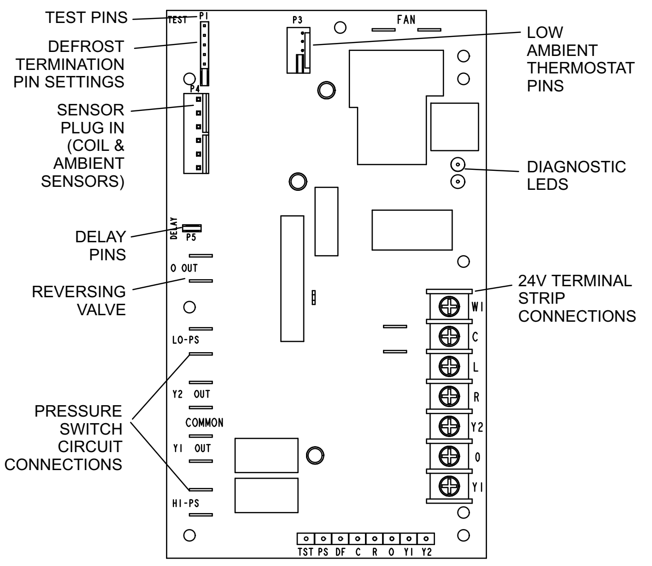
Emergency heat is usually used during an outdoor unit shutdown, but it should also be used following a power outage if power has been off for over an hour and the outdoor temperature is below 50°F (10°C). System should be left in the emergency heat mode at least six hours to allow the crankcase heater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

FILTER DRIER

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

Defrost System

DEFROST SYSTEM DESCRIPTION



Note - Component locations vary by board manufacturer.

Figure 20. Defrost Control Board

The demand defrost controller measures differential temperatures to detect when the system is performing poorly because of ice build-up on the outdoor coil. The controller *self-calibrates* when the defrost system starts and after each system defrost cycle. The defrost control board components are shown in figure 20.

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

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

DEFROST BOARD PRESSURE SWITCH CONNECTIONS

The unit's automatic reset pressure switches (LO PS - S87 and HI PS - S4) are factory-wired into the defrost board on the LO-PS and HI-PS terminals, respectively.

Low Pressure Switch (LO-PS)—When the low pressure switch trips, the defrost board will cycle off the compressor, and the strike counter in the board will count one strike. The low pressure switch is ignored under the following conditions:

- During the defrost cycle and 90 seconds after the termination of defrost
- When the average ambient sensor temperature is below 15° F (-9°C)
- For 90 seconds following the start up of the compressor
- During *test* mode

High Pressure Switch (HI-PS)—When the high pressure switch trips, the defrost board will cycle off the compressor, and the strike counter in the board will count one strike.

DEFROST BOARD PRESSURE SWITCH SETTINGS

High Pressure (auto reset) - trip at 590 psig, reset at 418.

Low Pressure (auto reset) - trip at 25 psig; reset at 40.

PRESSURE SWITCH 5-STRIKE LOCKOUT

The internal control logic of the board counts the pressure switch trips only while the Y1 (Input) line is active. If a pressure switch opens and closes four times during a Y1 (Input), the control logic will reset the pressure switch trip counter to zero at the end of the Y1 (Input). If the pressure switch opens for a fifth time during the current Y1 (Input), the control will enter a lockout condition.

The 5-strike pressure switch lockout condition can be reset by cycling OFF the 24-volt power to the control board or by shorting the TEST pins between 1 to 2 seconds. All timer functions (run times) will also be reset.

If a pressure switch opens while the Y1 Out line is engaged, a 5-minute short cycle will occur after the switch closes.

UNIT TEMPERATURE SENSORS

Sensors connect to the defrost board through a field-replaceable harness assembly that plugs into the board as illustrated in figure 20. Through the sensors, the board detects outdoor ambient, coil, and discharge temperature fault conditions. As the detected temperature changes, the resistance across the sensor changes. Sensor resistance values can be checked by ohming across pins shown in table 3.

Table 3. Sensor Temperature /Resistance Range

Sensor	Temperature Range °F (°C)	Resistance values range (ohms)	Pins/Wire Color
Outdoor	-35 (-37) to 120 (48)	280,000 to 3750	3 & 4 (Black)
Coil	-35 (-37) to 120 (48)	280,000 to 3750	5 & 6 (Brown)
Discharge (if applicable)	24 (-4) to 350 (176)	41,000 to 103	1 & 2 (Yellow)
Note: Sensor resistance increases as sensed temperature decreases.			

Figure 21 shows how the resistance varies as the temperature changes for both type of sensors.

NOTE - When checking the ohms across a sensor, be aware that a sensor showing a resistance value that is <u>not</u> within the range shown in table 3, may be performing as designed. However, if a shorted or open circuit is detected, then the sensor may be faulty and the sensor harness will need to be replaced.

Ambient Sensor—The ambient sensor considers outdoor temperatures below -35°F (-37°C) or above 120°F (48°C) as a fault. If the ambient sensor is detected as being open, shorted or out of the temperature range of the sensor, the board will not perform demand defrost operation. The board will revert to time/temperature defrost operation and will display the appropriate fault code. Heating and cooling operation will be allowed in this fault condition.

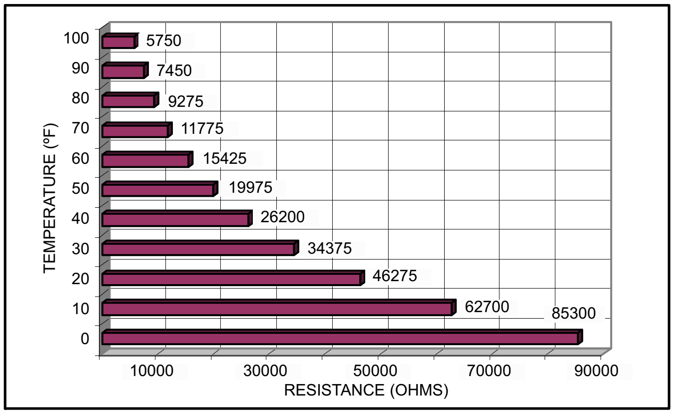


Figure 21. Temperature/Resistance Chart (Ambient and Coil Sensors)

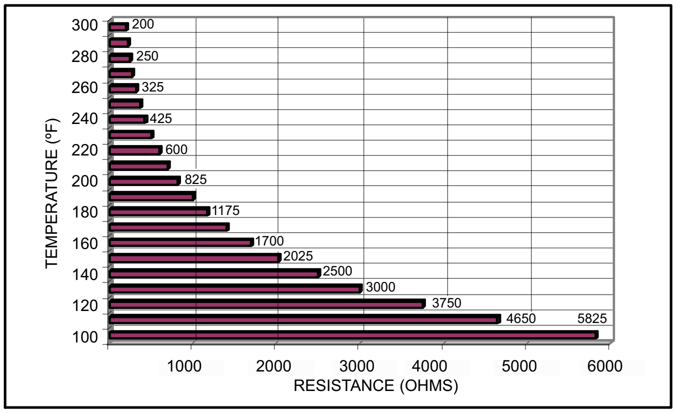


Figure 22. Temperature/Resistance Chart (Discharge Sensor)

Coil Sensor—The coil temperature sensor considers outdoor temperatures below -35°F (-37°C) or above 120°F (48°C) as a fault. If the coil temperature sensor is detected as being open, shorted or out of the temperature range of the sensor, the board will not perform demand or time/temperature defrost operation and will display the appropriate fault code. Heating and cooling operation will be allowed in this fault condition.

High Discharge Line Sensor—If the discharge line temperature exceeds a temperature of 285°F (140°C) during compressor operation, the board will de-energize the compressor contactor output (and the defrost output, if active). The compressor will remain off until the discharge temperature has dropped below 225°F (107°C) and the 5-minute anti-short cycle delay has been satisfied. This sensor has two fault and lockout codes:

1. If the board recognizes five high discharge line temperature faults during a single (Y1) compressor demand, it reverts to a lockout mode and displays the appropriate code. This code detects shorted sensor or high discharge temperatures. Code on board is *Discharge Line Temperature Fault and Lockout*.
2. If the board recognizes five temperature sensor range faults during a single (Y1) compressor demand, it reverts to a lockout mode and displays the appropriate code. The board detects open sensor or out-of-temperature sensor range. This fault is detected by allowing the unit to run for 90 seconds before checking sensor resistance. If the sensor resistance is not within range after 90 seconds, the board will count one fault. After five faults, the board will lockout. Code on board is *Discharge Sensor Fault and Lockout*.

The discharge line sensor, which covers a range of 150°F (65°C) to 350°F (176°C), is designed to mount on a ½" refrigerant discharge line.

NOTE - Within a single room thermostat demand, if 5-strikes occur, the board will lockout the unit. Defrost board 24 volt power R must be cycled OFF or the TEST pins on board must be shorted between 1 to 2 seconds to reset the board.

Defrost Temperature Termination Shunt (Jumper) Pins—The defrost board selections are: 50, 70, 90, and 100°F (10, 21, 32 and 38°C). The shunt termination pin is factory set at 50°F (10°C). If temperature shunt is not installed, default termination temperature is 90°F (32°C).

DELAY MODE

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

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

OPERATIONAL DESCRIPTION

The defrost control board has three basic operational modes: normal, defrost, and calibration.

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

  Calibration of the board occurs after a defrost cycle to ensure that there is no ice on the coil. During calibration, the temperature of both the coil and the ambient sensor are measured to establish the temperature differential which is required to allow a defrost cycle.
- **Defrost Mode**—The following paragraphs provide a detailed description of the defrost system operation.
- **Test Mode**— See Figure 23.

Each test pin shorting will result in one test event. For each TEST the shunt (jumper) must be removed for at least one second and reapplied. Refer to flow chart (figure 23) for TEST operation.

Note: The Y1 input must be active (ON) and the O room thermostat terminal into board must be inactive.

DETAILED DEFROST SYSTEM OPERATION

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

Frost Detection—If the compressor runs longer than 30 minutes and the actual difference between the clear coil and frosted coil temperatures exceeds the maximum difference allowed by the control, a defrost cycle will be initiated.

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

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

Actuation—When the reversing valve is de-energized, the Y1 circuit is energized, and the coil temperature is below 35°F (2°C), the board logs the compressor run time. If the board is not calibrated, a defrost cycle will be initiated after 30 minutes of heating mode compressor run time. The control will attempt to self-calibrate after this (and all other) defrost cycle(s).

Calibration success depends on stable system temperatures during the 20-minute calibration period. If the board fails to calibrate, another defrost cycle will be initiated after 45 minutes of heating mode compressor run time. Once the defrost board is calibrated, it initiates a demand defrost cycle when the difference between the clear coil and frosted coil temperatures exceeds the maximum difference allowed by the control or after six hours of heating mode compressor run time has been logged since the last defrost cycle.

Termination—The defrost cycle ends when the coil temperature exceeds the termination temperature or after 14 minutes of defrost operation. If the defrost is terminated by the 14-minute timer, another defrost cycle will be initiated after 30 minutes of run time.

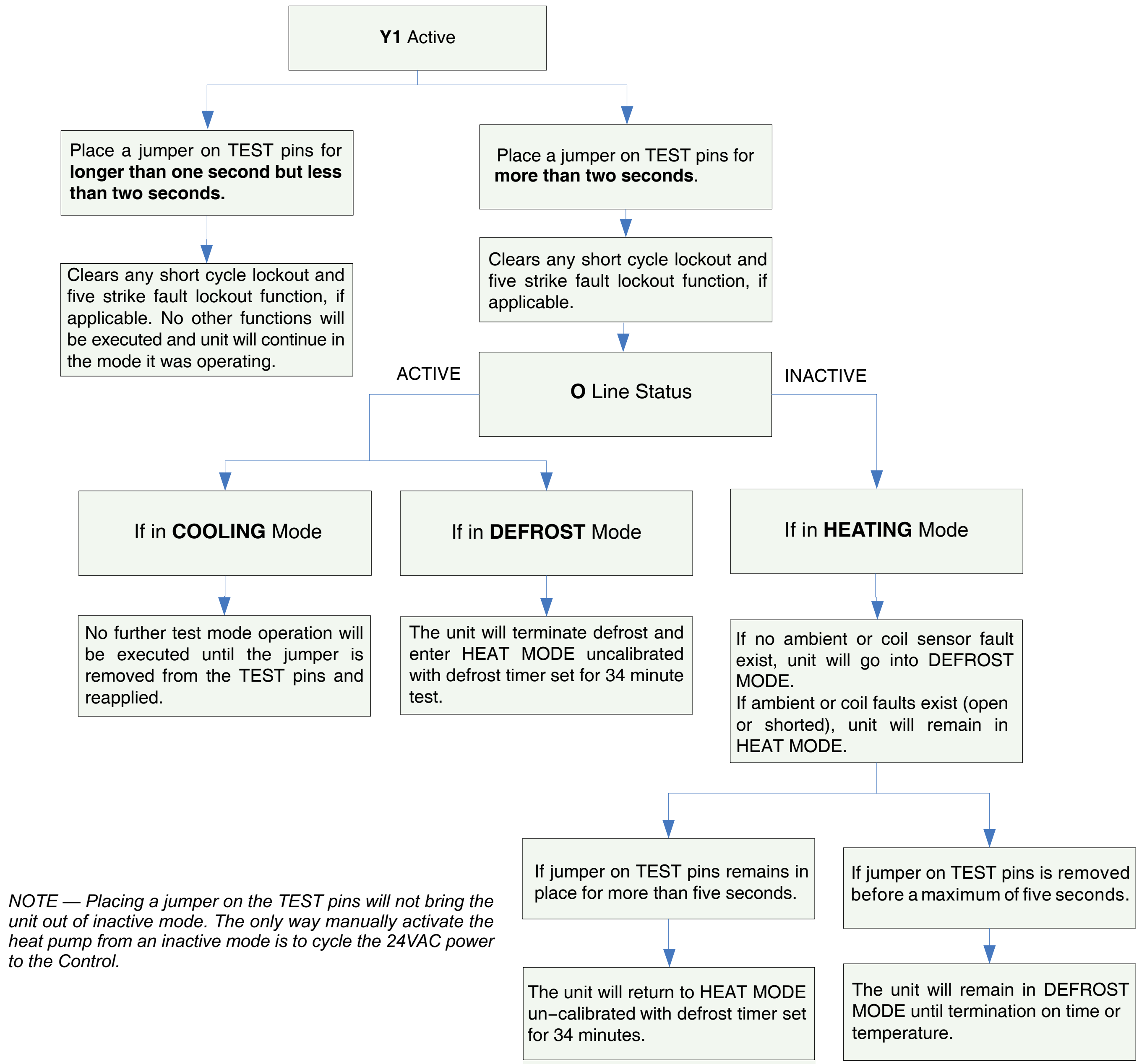
TEST

Placing the jumper on the field test pins (E33) allows the technician to:

- Clear short cycle lockout
- Clear five-strike fault lockout
- Cycle the unit in and out of defrost mode
- Place the unit in defrost mode to clear the coil

When **Y1** is energized and 24V power is being applied to the Control, a test cycle can be initiated by placing a jumper on the Control's **TEST** pins for 2 to 5 seconds. If the jumper remains on the **TEST** pins for longer than five seconds, the Control will ignore the jumpered TEST pins and revert to normal operation.

The Control will initiate one test event each time a jumper is placed on the TEST pins. For each TEST the jumper must be removed for at least one second and then reapplied.



NOTE — Placing a jumper on the TEST pins will not bring the unit out of inactive mode. The only way manually activate the heat pump from an inactive mode is to cycle the 24VAC power to the Control.

Figure 23. Test Mode

DEFROST BOARD DIAGNOSTIC LEDS

The state (Off, On, Flashing) of two LEDs on the defrost board (DS1 [Red] and DS2 [Green]) indicate diagnostics conditions that are described in table 4.

Table 4. Defrost Control Board Diagnostic LEDs

DS2 Green	DS1 Red	Condition/Code	Possible Cause(s)	Solution
OFF	OFF	Power problem	No power (24V) to board terminals R and C or board failure.	1 Check control transformer power (24V). 2 If power is available to board and LED(s) do not light, replace board.
Simultaneous SLOW Flash		Normal operation	Unit operating normally or in standby mode.	None required.
Alternating SLOW Flash		5-minute anti-short cycle delay	Initial power up, safety trip, end of room thermostat demand.	None required (Jumper TEST pins to override)
Simultaneous FAST Flash		Ambient Sensor Problem	Sensor being detected open or shorted or out of temperature range. Board will revert to time/temperature defrost operation. (System will still heat or cool).	
Alternating FAST Flash		Coil Sensor Problem	Sensor being detected open or shorted or out of temperature range. Board will not perform demand or time/temperature defrost operation. (System will still heat or cool).	
ON	ON	Circuit Board Failure	Indicates that board has internal component failure. Cycle 24VAC power to board. If code does not clear, replace board.	

Table 5. Defrost Control Board Diagnostic Fault and Lockout Codes

DS2 Green	DS1 Red	Condition/Code	Possible Cause(s)	Solution
(Each fault adds 1 strike to that code's counter; 5 strikes per code = LOCKOUT)				
OFF	SLOW Flash	Low Pressure Fault	1 Restricted air flow over indoor or outdoor coil. 2 Improper refrigerant charge in system. 3 Improper metering device installed or incorrect operation of metering device. 4 Incorrect or improper sensor location or connection to system.	1 Remove any blockages or restrictions from coils and/or fans. Check indoor and outdoor fan motor for proper current draws. 2 Check system charge using approach and subcooling temperatures. 3 Check system operating pressures and compare to unit charging charts. 4 Make sure all pressure switches and sensors have secure connections to system to prevent refrigerant leaks or errors in pressure and temperature measurements.
OFF	ON	Low Pressure ***LOCKOUT***		
SLOW Flash	OFF	High Pressure Fault		
ON	OFF	High Pressure ***LOCKOUT***		
SLOW Flash	ON	Discharge Line Temperature Fault	This code detects shorted sensor or high discharge temperatures. If the discharge line temperature exceeds a temperature of 285ºF (140ºC) during compressor operation, the board will de-energize the compressor contactor output (and the defrost output if active). The compressor will remain off until the discharge temperature has dropped below 225ºF (107ºC).	
FAST Flash	ON	Discharge Line Temperature ***LOCKOUT***		
OFF	Fast Flash	Discharge Sensor Fault	The board detects open sensor or out of temperature sensor range. This fault is detected by allowing the unit to run for 90 seconds before checking sensor resistance. If the sensor resistance is not within range after 90 seconds, the board will count one fault. After 5 faults, the board will lockout.	
Fast Flash	OFF	Discharge Sensor ***LOCKOUT***		

OUTDOOR FAN MOTOR

XP16-XXX-230-01 through 05, except XP16-060-230-05)

All units use single-phase PSC fan motors which require a run capacitor. In all units, the condenser fan is controlled by the compressor contactor.

ELECTRICAL DATA tables in this manual show specifications for condenser fans used in XP16's.

Access to the condenser fan motor on all units is gained by removing the four screws securing the fan assembly. See figure 24. The grill fan assembly can be removed from the cabinet as one piece. The condenser fan motor is removed from the fan guard by removing the four nuts found on top of the grill.

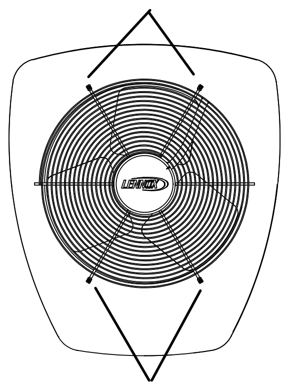


Figure 24. Removing Fan Grille

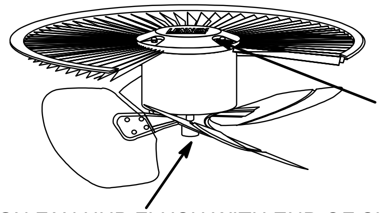


Figure 25. Aligning Fan Hub

XP16-060-230-05 Only

The variable speed condenser fan motor (figure 26) used in all units is a three-phase, electronically controlled d.c. brushless motor (controller converts single phase a.c. to three phase D.C.), with a permanent-magnet-type rotor, manufactured by GE. Because this motor has a permanent magnet rotor it does not need brushes like conventional D.C. motors. The motors consist of a control module and motor. Internal components are shown in figure 26. The stator windings are split into three poles which are electrically connected to the controller. This arrangement allows motor windings to be turned on and off in sequence by the controller.

The controller is primarily an A. C. to D. C. converter. Converted D. C. power is used to drive the motor. The controller contains a microprocessor which monitors varying conditions inside the motor (such as motor workload).

The controller uses sensing devices to know what position the rotor is in at any given time. By sensing the position of the rotor and then switching the motor windings on and off in sequence, the rotor shaft turns the blower.

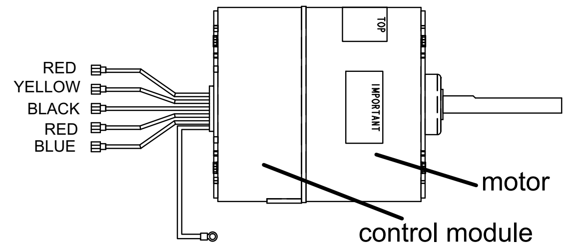


Figure 26. Variable Speed Fan Motor (XP16-060-230-05 only)

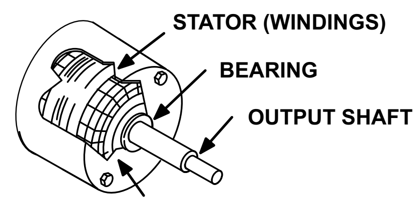


Figure 27. Fan Motor Components

Internal Operation

The condenser fan motor is a variable speed motor with RPM settings at 700 (Y1) and 820 (Y2). The variation in speed is accomplished each time the controller switches a stator winding (figure 27) on and off, it is called a "pulse." The length of time each pulse stays on is called the "pulse width." By varying the pulse width the controller varies motor speed (called "pulse-width modulation"). This allows for precise control of motor speed and allows the motor to compensate for varying load conditions as sensed by the controller. In this case, the controller monitors the static workload on the motor and varies motor rpm in order to maintain constant airflow (cfm).

Motor rpm is continually adjusted internally to maintain constant static pressure against the fan blade. The controller monitors the static work load on the motor and motor amp-draw to determine the amount of rpm adjustment. Blower rpm is adjusted internally to maintain a constant cfm. The amount of adjustment is determined by the incremental taps which are used and the amount of motor loading sensed internally. The motor constantly adjusts rpm to maintain a specified cfm.

Initial Power Up

When line voltage is applied to the motor, there will be a large inrush of power lasting less than 1/4 second. This inrush charges a bank of DC filter capacitors inside the controller. If the disconnect switch is bounced when the disconnect is closed, the disconnect contacts may become welded. Try not to bounce the disconnect switch when applying power to the unit.

The DC filter capacitors inside the controller are connected electrically to the speed tap wires. The capacitors take approximately 5 minutes to discharge when the disconnect is opened. For this reason it is necessary to wait at least 5 minutes after turning off power to the unit before attempting to service motor.

⚠ DANGER

Disconnect power from unit and wait at least five minutes to allow capacitors to discharge before attempting to service motor. Failure to wait may cause personal injury or death.

Motor Start-Up

At start-up, the motor may gently rock back and forth for a moment. This is normal. During this time the electronic controller is determining the exact position of the rotor. Once the motor begins turning, the controller slowly eases the motor up to speed (this is called “soft-start”). The motor may take as long as 10-15 seconds to reach full speed. If the motor does not reach 200 rpm within 13 seconds, the motor shuts down. Then the motor will immediately attempt a restart. The shutdown feature provides protection in case of a frozen bearing or blocked fan blade. The motor may attempt to start eight times. If the motor does not start after the eighth try, the controller locks out. Reset controller by momentarily turning off power to unit.

Troubleshooting

If first or second stage thermostat call for cool is present and the variable speed condenser fan motor does not energize, check voltage at the breaker box. If voltage is present perfrom the following steps and refer to figure 28.

1. Check for 240 volts between the compressor RED wires.
2. nitiate a first stage call for cool. Check for 24 volts between the fan motor YELLOW wire and fan motor BLACK wire.
3. Initiate a second stage call for cool. Check for 24 volts between the fan motor YELLOW wire and fan motor BLACK wire, then check for 24 volts between the fan motor BLUE wire and fan motor BLACK.
4. Repeat steps 1 and 2 with a HEAT call.

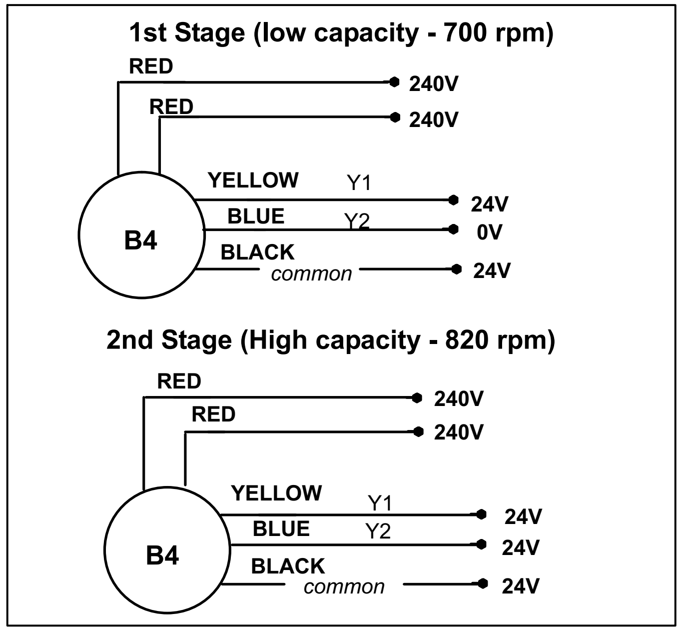


Figure 28. Speed Taps for PSC Fan Motors

Replacement

Flush mounting indicates to mount it at the end of the shaft so that the bottom of the fan blade hub is flush with the end of the motor shaft. Dimension A would be 0 (flush). Torque set screw between 137 - 150 in. lbs (approximately 1/8th turn using a standard socket and wrench).

Table 6. Mounting on Shaft

XP16 UNIT	”A” DIM. ± 1/8”
-024, -036	3/4” (19mm)
-048, -060	Flush
-060*	1-7/8” (47.5mm)

**XP16-060-230-05 only*

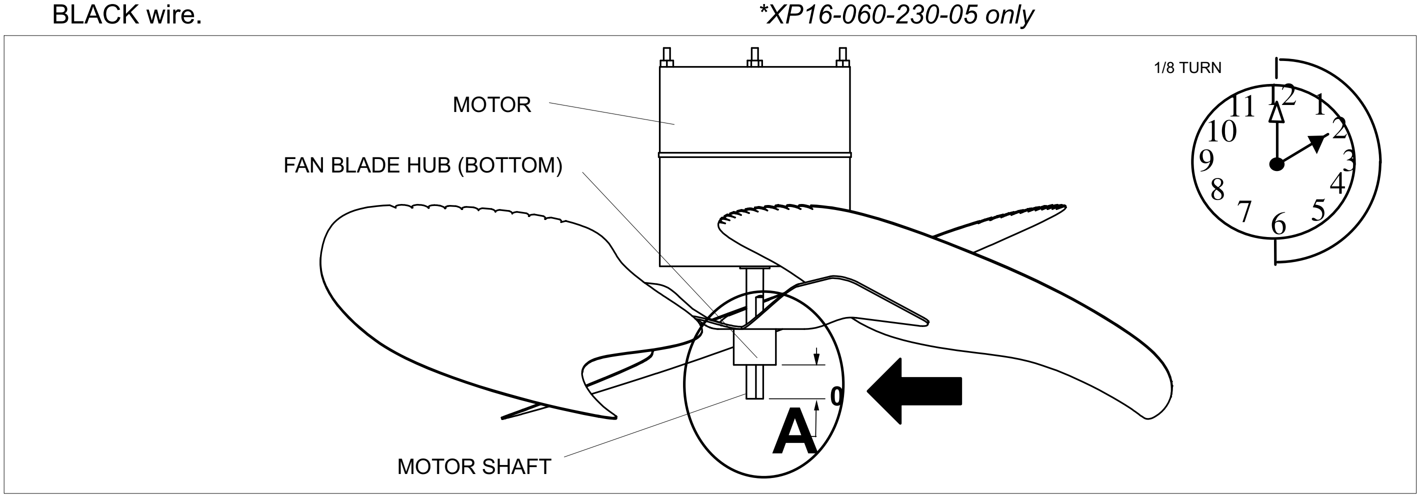


Figure 29. Fan Blade Mounting Position on Motor Shaft

TWO-STAGE MODULATION COMPRESSOR CHECKS

⚠ IMPORTANT

This performance check is ONLY valid on systems that have clean indoor and outdoor coils, proper airflow over coils, and correct system refrigerant charge. All components in the system must be functioning proper to correctly perform compressor modulation operational check. (Accurate measurements are critical to this test as indoor system loading and outdoor ambient can affect variations between low and high capacity readings).

Use this checklist on page to verify part-load and full-load capacity operation of two-stage modulation compressors.

TOOLS REQUIRED

- Refrigeration gauge set
- Digital volt/amp meter
- Electronic temperature thermometer
- On-off toggle switch

PROCEDURE

NOTE - Block outdoor coil to maintain a minimum of 375 psig during testing).

1. Turn main power OFF to outdoor unit.
2. Adjust room thermostat set point 5ºF above the room temperature.
3. Remove control access panel. Install refrigeration gauges on unit. Attach the amp meter to the common (black wire) wire of the compressor harness. Attach thermometer to discharge line as close as possible to the compressor.
4. Turn toggle switch OFF and install switch in series with Y2 wire from room thermostat.
5. Cycle main power ON.
6. Allow pressures and temperatures to stabilize before taking measurements (may take up to 10 minutes).
7. Record all of the readings for the Y1 demand.
8. Close switch to energize Y2 demand. Verify power is going to compressor solenoid.
9. Allow pressures and temperatures to stabilize before taking measurements (may take up to 10 minutes).
10. Record all of the readings with the Y1 and Y2 demand.
11. If temperatures and pressures change in the direction noted in Two-Stage Modulation Compressor Field Operational Checklist on page , the compressor is properly modulating from low to high capacity. (If no amperage, pressures or temperature readings change when this test is performed, the compressor is not modulating between low and high capacity and replacement is necessary).
12. After testing is complete, return unit to original set up.

Maintenance

⚠ WARNING

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

⚠ 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.

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. Clean and inspect outdoor coil (may be flushed with a water hose). Ensure power is off before cleaning.
2. Outdoor unit fan motor is pre-lubricated and sealed. No further lubrication is needed.
3. Visually inspect all connecting lines, joints and coils for evidence of oil leaks.
4. Check all wiring for loose connections.
5. Check for correct voltage at unit (unit operating).
6. Check amp draw on outdoor fan motor.

   Motor Nameplate:_________ **Actual**:__________.
7. Inspect drain holes in coil compartment base and clean if necessary.

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

Outdoor Coil

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)

- Outdoor Coil — The outdoor coil may be flushed with a water hose.
- Outdoor Coil (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. Lennox 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.

   Motor Nameplate:_________ **Actual**:__________.

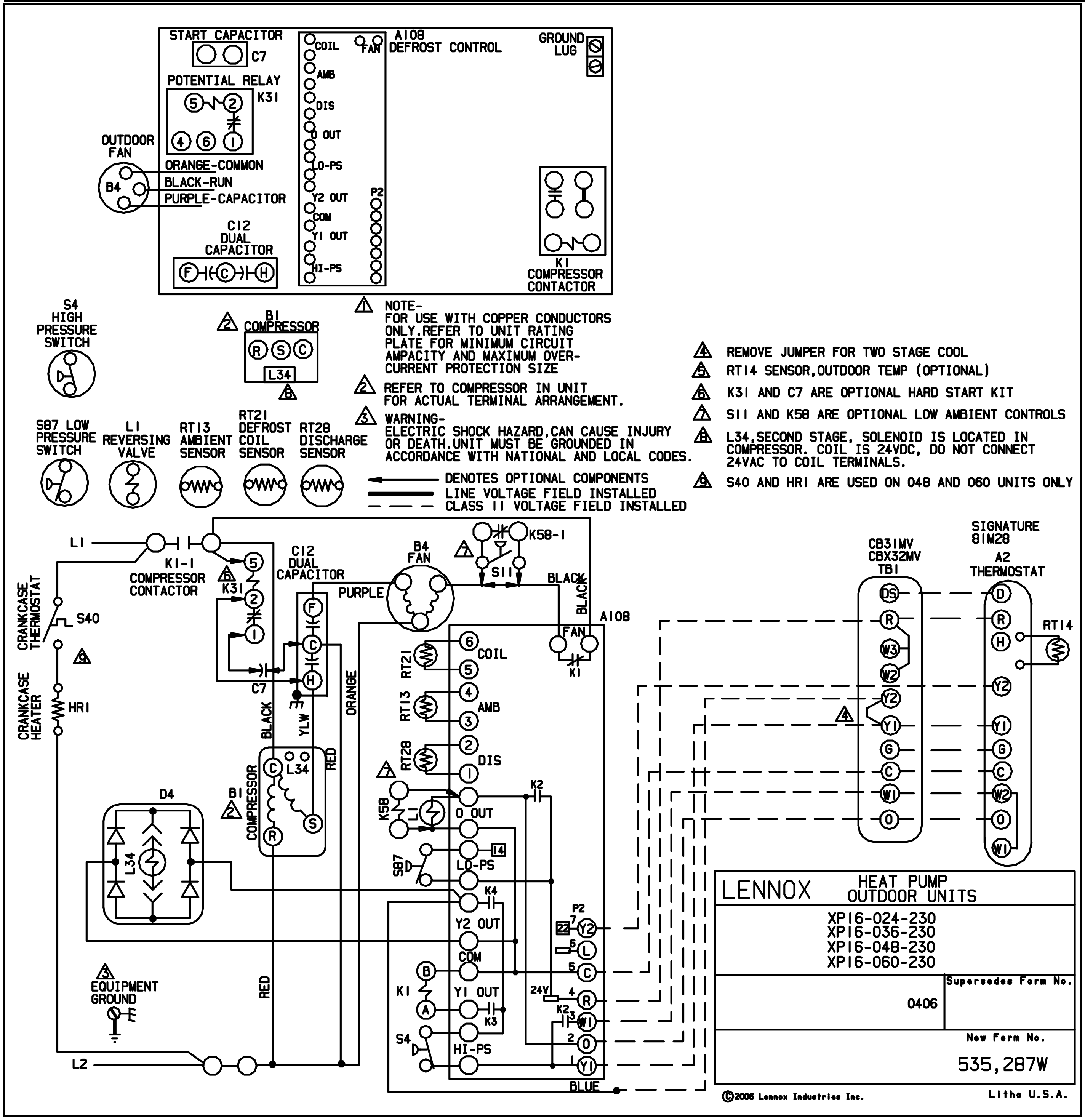


Figure 30. Unit Wiring Diagram (All Sizes) — XP16−XXX−230−01 through 04)

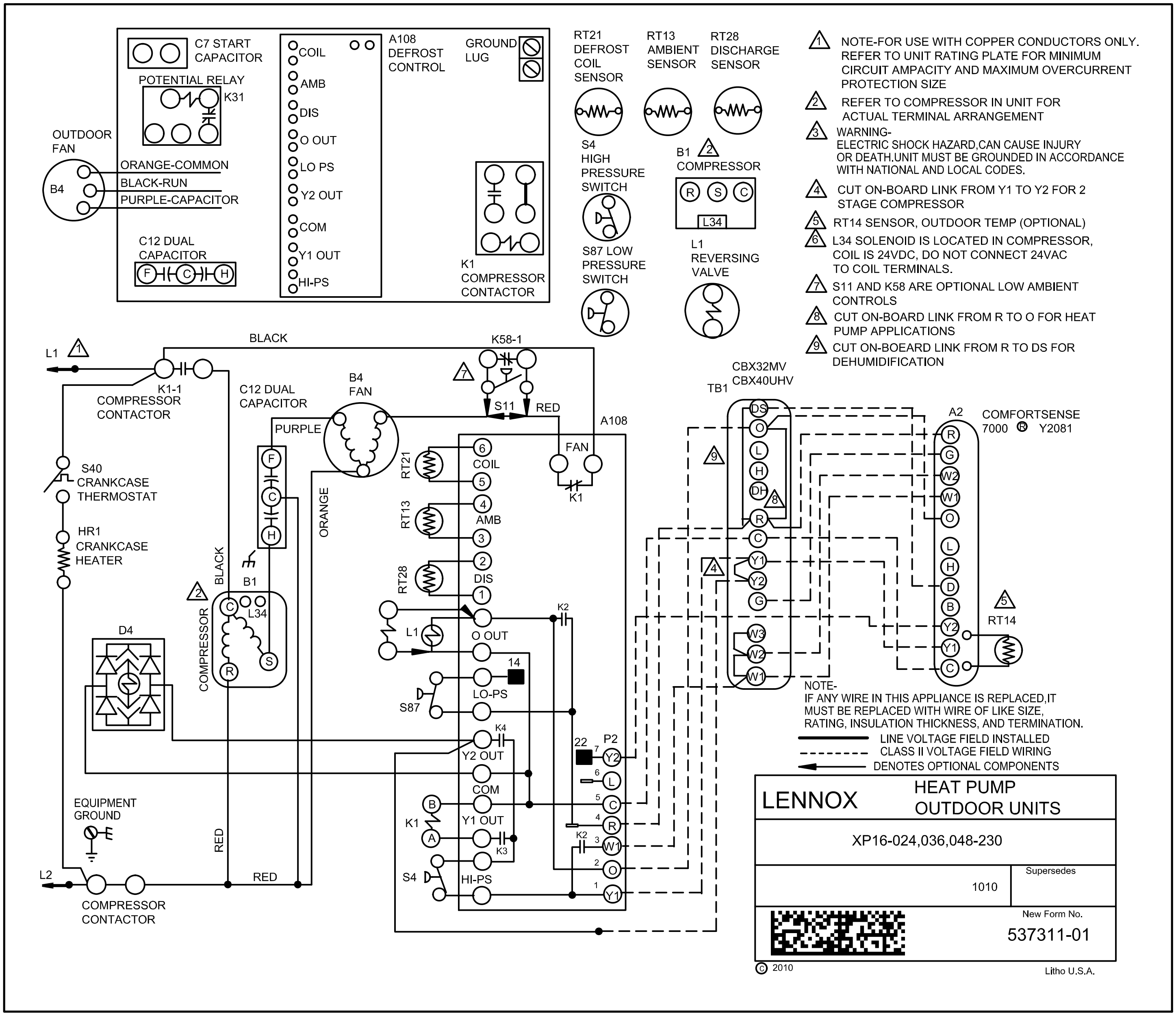


Figure 31. Unit Wiring Diagram (-024, -036 and -048 Sizes) — XP16−XXX−230−05

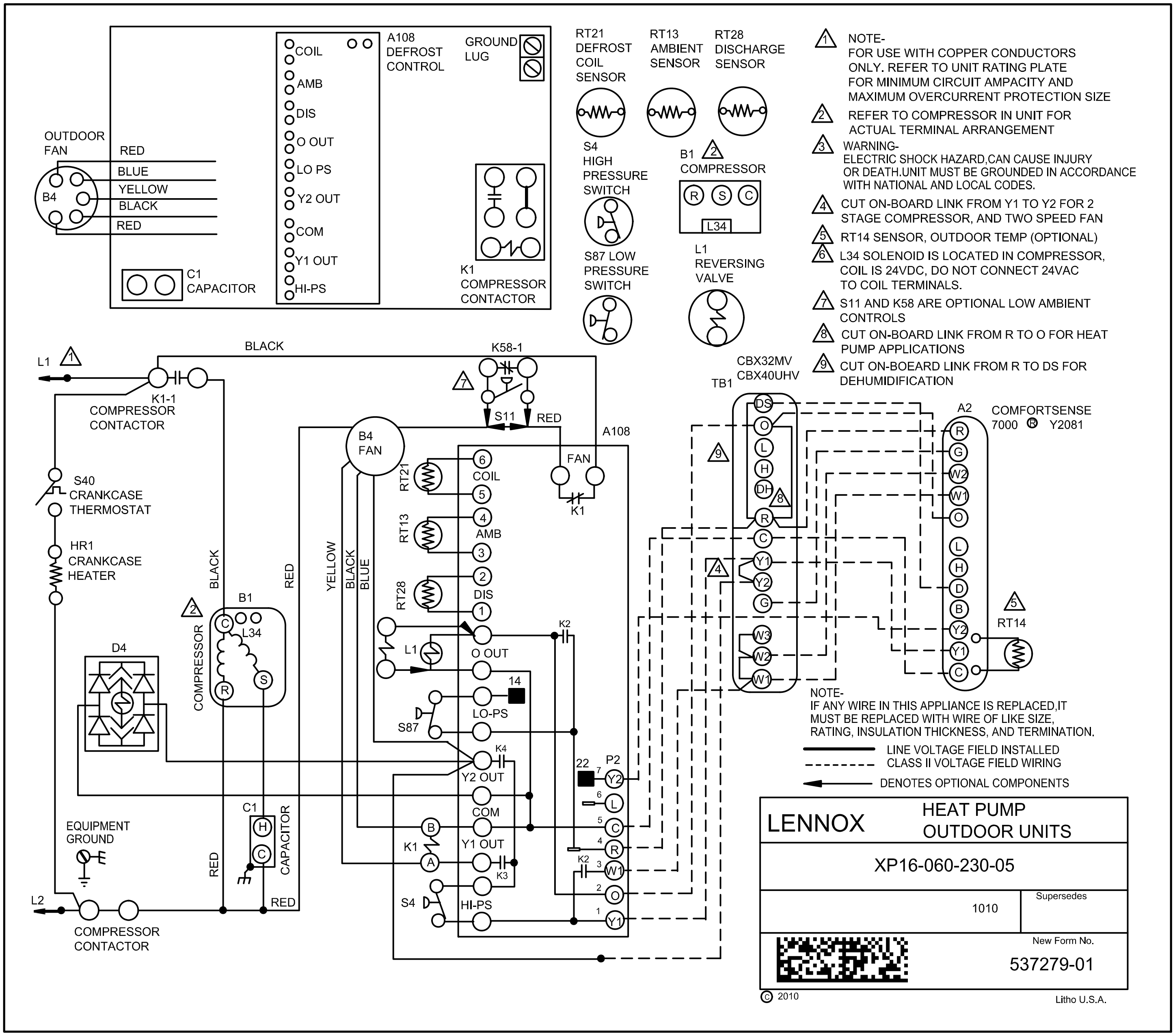


Figure 32. Unit Wiring Diagram (-060 Size Only) — XP16–XXX–230–05

Sequence of Operation XP16-024/060

Cooling

A – First Stage Low Capacity

Transformer from indoor unit supplies 24VAC power to the thermostat and outdoor unit controls.

1- Internal wiring energizes terminal O by cooling mode selection, energizing the reversing valve. Cooling demand initiates at Y1 in the thermostat.

2 - The defrost board checks for open low or high-pressure switches and proper coil, ambient and discharge sensor readings.

- If checks show no issues, the defrost board sends 24 volts through Y1 OUT signal to the K1 compressor contactor coil.
- **XP16-060-05 only** - defrost board sends 24 volts through Y1 OUT signal to the yellow wire to the outdoor fan motor.

HARD START KIT IF USED - Compressor begins start up. Relay K31 remains closed during start up and capacitor C7 remains in the circuit. As compressor speeds up K31 is energized, de-energizing capacitor C7.

3- K1-1 N.O. closes energizing compressor B1 and outdoor fan motor B4.

4- Solenoid L34 is NOT energized.

- The slider ring remains open limiting compressor to low capacity.
- **XP16-060-05 only** - The 24 volt input on the yellow wire to the outdoor fan motor will allow it to run on low speed.

B – Second Stage High Capacity

5- Second stage thermostat demand goes through Y2 on the defrost board and energizes rectifier plug D4. D4 converts the AC voltage to DC voltage and energizes L34 unloader solenoid.

- L34 then closes the slider ring, allowing the compressor to operate at high capacity.
- **XP16-060-05 only** - The 24 volt input to the yellow and blue wires of the outdoor fan will provide high speed operation.

Heating

A – Low Capacity

1- Internal wiring de-energizes terminal O by heating mode selection, de-energizing the reversing valve. Heating demand initiates at Y1 in the thermostat.

2 - The defrost board checks for open low or high-pressure switches and proper coil, ambient and discharge sensor readings.

- If checks show no issues, the defrost board sends 24 volts through Y1 OUT signal to the K1 compressor contactor coil.
- **XP16-060-05 only** - defrost board sends 24 volts through Y1 OUT signal to the yellow wire to the outdoor fan motor.

HARD START KIT IF USED - Compressor begins start up. Relay K31 remains closed during start up and capacitor C7 remains in the circuit. As compressor speeds up K31 is energized, de-energizing capacitor C7.

3- K1-1 closes, energizing the compressor and outdoor fan motor.

4- Solenoid L34 is NOT energized. The slider ring remains open limiting compressor to low capacity.

B – High Capacity (Ambient temperature above defrost board Y2 lock-in temperature)

1- Room thermostat in heating mode. Room thermostat outputs Y1 and Y2 (if applicable to that room thermostat) signal to the defrost board in the heat pump and to the indoor unit.

2- The defrost board checks for open low or high-pressure switches and proper coil, ambient and discharge sensor readings.

- If checks show no issues, the defrost board sends 24 volts through Y1 OUT signal to the K1 compressor contactor coil.
- **XP16-060-05 only** - defrost board sends 24 volts through Y1 OUT signal to the yellow wire to the outdoor fan motor.

3 - The defrost board sends:

- 24 volts through Y2 OUT to the L34 compressor solenoid plug.
- **XP16-060-05 only** - 24 volts through Y2 OUT to the blue wire to the outdoor fan motor.

The 2- wire compressor solenoid plug converts the 24volt AC outputs to a 24volt DC signal input to the L34 internal high capacity solenoid valve in the compressor.

4 - K1-1 closes, energizing the compressor and outdoor fan motor through the normally closed fan relay contacts on the defrost board.

- The compressor runs high capacity.
- **XP16-060-05 only** - The 24 volt input to the The compressor runs high capacity yellow and blue wires of the outdoor fan will provide high speed operation.

B – High Capacity (Ambient temperature below defrost board Y2 lock-in temperature)

1 - Room thermostat in heating mode. Room thermostat outputs Y1 signal to the defrost board in the heat pump and to the indoor unit.

2 - The defrost board checks for open low or high-pressure switches and proper coil, ambient and discharge sensor readings.

- If checks show no issues, the defrost board sends 24 volts through Y1 OUT signal to the K1 compressor contactor coil.
- **XP16-060-05 only** - defrost board sends 24 volts through Y1 OUT signal to the yellow wire to the outdoor fan motor.

3 - The defrost board **Y2 locks in** sends:

- 24 volts through Y2 OUT to the L34 compressor solenoid plug.
- **XP16-060-05 only** - 24 volts through Y2 OUT to the blue wire to the outdoor fan motor.

The plug converts the 24volt AC outputs to a 24volt DC signal input to the L34 internal high capacity solenoid valve in the compressor.

4 - K1-1 closes, energizing the compressor and outdoor fan motor through the normally closed fan relay contacts on the defrost board.

- The compressor runs on high capacity.
- **XP16-060-05 only** - The 24 volt input to the yellow and blue wires of the outdoor fan will provide high speed operation.

Defrost Mode

When a defrost cycle is initiated, the control energizes the reversing valve solenoid and turns off the condenser fan. The control will also put 24VAC on the “W1” (auxiliary heat) line. The unit will stay in this mode until either the coil sensor temperature is above the selected termination temperature, the defrost time of 14 minutes has been completed, or the room thermostat demand cycle has been satisfied. (If the temperature select shunt is not installed, the default termination temperature will be 90°F.) If the room thermostat demand cycle terminates the cycle, the defrost cycle will be held until the next room thermostat demand cycle. If the coil sensor temperature is still below the selected termination temperature, the control will continue the defrost cycle until the cycle is terminated in one of the methods mentioned above. If a defrost is terminated by time and the coil temperature did not remain above 35°F (2°C) for 4 minutes the control will go to the 30-minute Time/Temperature mode.

Checklists

Two-Stage Modulation Compressors Field Operational Checklist

Unit Readings	Y1 - First-Stage	Expected results during Y2 demand (Toggle switch On)	Y2 - Second-Stage
COMPRESSOR			
Voltage		Same	
Amperage		Higher	
OUTDOOR UNIT FAN MOTOR			
Amperage		Same or Higher	
TEMPERATURE			
Ambient		Same	
Outdoor Coil Discharge Air		Higher	
Compressor Discharge Line		Higher	
Indoor Return Air		Same	
Indoor Coil Discharge Air		Lower	
PRESSURES			
Suction (Vapor)		Lower	
Liquid		Higher	

XP16 Start-Up and Performance

Customer ______________________ Address ______________________

Indoor Unit Model ______________________ Serial ______________________

Outdoor Unit Model ______________________ Serial ______________________

Notes: ____

____

START UP CHECKS

Refrigerant Type: ______________________

1st Stage: Rated Load Amps ________ Actual Amps ________ Rated Volts ________ Actual Volts ________

2nd Stage: Rated Load Amps ________ Actual Amps ________ Rated Volts ________ Actual Volts ________

Outdoor Unit Fan Full Load Amps _____ Actual Amps: 1st Stage ________ 2nd Stage ________

COOLING MODE

Suction Pressure: 1st Stage: ____________ 2nd Stage: ____________

Liquid Pressure: 1st Stage: ____________ 2nd Stage: ____________

Supply Air Temperature: 1st Stage: ____________ 2nd Stage: ____________

Temperature: Ambient: ____________ Return Air: ____________

System Refrigerant Charge (Refer to manufacturer's information on unit or installation instructions for required subcooling and approach temperatures.)

	A		B		
Subcooling: Saturated Condensing Temperature (A) *minus* Liquid Line Temperature (B)		—		=	SUBCOOLING
Approach: Liquid Line Temperature (A) *minus* Outdoor Air Temperature (B)		—		=	APPROACH
Indoor Coil Temperature Drop (18 to 22°F) Return Air Temperature (A) *minus* Supply Air Temperature (B)		—		=	COIL TEMP DROP