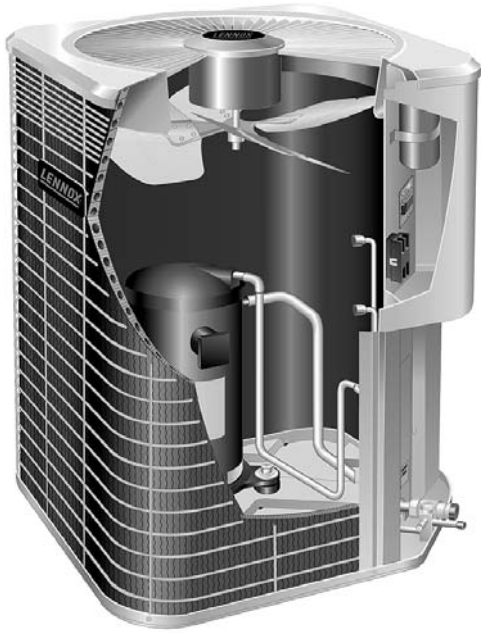
13ACX SERIES UNITS

The 13ACX is a high efficiency residential split-system condensing unit, which features a scroll compressor and designed for R-410A refrigerant. 13ACX units are available in sizes ranging from 1-1/2 through 5 tons. The series is designed for use with an expansion valve in the indoor unit. This manual is divided into sections which discuss the major components, refrigerant system, charging procedure, maintenance and operation sequence.

Information contained in this manual is intended for use by qualified service technicians only. All specifications are subject to change.



⚠ IMPORTANT

Operating pressures of this R-410A unit are higher than pressures in R-22 units. Always use service equipment rated for R-410A.

⚠ WARNING

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

⚠ WARNING

Warranty will be voided if covered equipment is removed from original installation site. Warranty will not cover damage or defect resulting from:
Flood, wind, lightning, or installation and operation in a corrosive atmosphere (chlorine, fluorine, salt, recycled waste water, urine, fertilizers, or other damaging chemicals).

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SPECIFICATIONS

General Data	Model No.	13ACX-018	13ACX-024	13ACX-030	13ACX-036	13ACX-042	13ACX-048	13ACX-060 -2 units
	Nominal Tonnage (kW)	1.5 (5.3)	2 (7.0)	2.5 (8.8)	3 (10.6)	3.5 (12.3)	4 (14.1)	5 (17.6)
Connections (sweat)	Liquid line o.d. - in. (mm)	3/8 (9.5)	3/8 (9.5)	3/8 (9.5)	3/8 (9.5)	3/8 (9.5)	3/8 (9.5)	3/8 (9.5)
	Suction line o.d. - in. (mm)	3/4 (19.1)	3/4 (19.1)	3/4 (19.1)	7/8 (22.2)	7/8 (22.2)	7/8 (22.2)	1-1/8 (28.6)
[1] Refrigerant (R-410A) furnished		4 lbs. 7 oz. (2.01 kg)	4 lbs. 14 oz. (2.21 kg)	6 lbs. 3 oz. (2.81 kg)	6 lbs. 7 oz. (2.92 kg)	8 lbs. 14 oz. (4.03 kg)	8 lbs. 4 oz. (3.74 kg)	**10 lbs. 0 oz. (4.54 kg)
Outdoor Coil	Net face area - sq. ft. (m^2) Outer coil	13.22 (1.23)	15.11 (1.40)	13.22 (1.23)	13.22 (1.23)	15.11 (1.40)	16.33 (1.52)	21.0 (1.95)
	Inner coil	- - -	- - -	12.60 (1.17)	12.60 (1.17)	14.40 (1.34)	15.71 (1.46)	20.25 (1.88)
	Tube diameter - in. (mm)	5/16 (8)	5/16 (8)	5/16 (8)	5/16 (8)	5/16 (8)	5/16 (8)	5/16 (8)
	Number of rows	1	1	2	2	2	2	2
	Fins per inch (m)	22 (866)	22 (866)	22 (866)	22 (866)	22 (866)	22 (866)	22 (866)
Outdoor Fan	Diameter - in. (mm)	18 (457)	18 (457)	18 (457)	18 (457)	18 (457)	22 (559)	22 (559)
	Number of blades	3	3	4	4	4	4	4
	Motor hp (W)	1/5 (149)	1/5 (149)	1/5 (149)	1/5 (149)	1/3 (249)	1/4 (186)	1/4 (186)
	Cfm (L/s)	2500 (1180)	2500 (1180)	2450 (1155)	2450 (1155)	2930 (1385)	3830 (1805)	3830 (1805)
	Rpm	1100	1100	1100	1100	1100	825	825
	Watts	200	200	200	200	310	330	330
Shipping Data - lbs. (kg) 1 package		122 (55)	129 (59)	150 (68)	150 (68)	177 (80)	201 (91)	222 (100)

ELECTRICAL DATA

Line voltage data - 60 hz - 1ph		208/230V	208/230V	208/230V	208/230V	208/230V	208/230V	208/230V
[2] Maximum overcurrent protection (amps)		20	30	30	35	40	50	60
[3] Minimum circuit ampacity		12.3	17.9	18.7	21.9	24.1	28.9	34.5
Compressor	Rated load amps	9.0	13.4	14.1	16.6	17.9	21.8	26.2
	Power factor	.96	.97	.98	.98	.94	.95	.98
	Locked rotor amps	48	58	73	79	112	117	134
Condenser Fan Motor	Full load amps	1.0	1.0	1.0	1.0	1.9	1.7	1.7
	Locked rotor amps	1.9	1.9	1.9	1.9	4.1	3.1	3.1

OPTIONAL ACcESSORIES - must be ordered extra

Compressor Crankcase Heater	**93M05**	•	•	•	•			
	31J20					•	•	Factory
Compressor Hard Start Kit	**10J42**	•						
	88M91		•	•	•	•	•	•
Compressor Low Ambient Cut-Off	**45F08**	•	•	•	•	•	•	•
Compressor Sound Cover	**69J03**	•	•	•	•	•	•	•
Compressor Time-Off Control	**47J27**	•	•	•	•	•	•	•
Freezestat 3/8 in. tubing	**93G35**	•	•	•	•	•	•	•
1/2 in. tubing	**39H29**	•	•	•	•	•	•	•
5/8 in. tubing	**50A93**	•	•	•	•	•	•	•
Hail Guards	**92M88**	•		•	•			
	92M89		•			•		
	45M56						•	
	92M94							•
Loss of Charge Kit	**84M23**	•	•	•	•	•	•	•
Low Ambient Kit	**34M72**	•	•	•	•	•	•	•
Mounting Base	**69J06**	•	•	•	•	•		
	69J07						•	•
Refrigerant Line Sets	L15-41-20, L15-41-30, L15-41-40, L15-41-50	•	•	•				
	L15-65-30, L15-65-40, L15-65-50				•	•	•	
	Field Fabricate							•
Time Delay Relay Kit	**58M81**	•	•	•	•	•	•	•
Unit Stand-Off Kit	**94J45**	•	•	•	•	•	•	•

** Charge for -1 units 11 lbs 2 oz **NOTE** — Extremes of operating range are plus 10% and minus 5% of line voltage. [1] Refrigerant charge sufficient for 15 ft. (4.6 m) length of refrigerant lines.

[2] HACR type circuit breaker or fuse.

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

I - APPLICATION

13ACX condensing units are available in 1-1/2, 2, 2 -1/2, 3, 3 -1/2, 4 and 5 ton capacities. All major components (indoor blower and coil) must be matched according to Lennox recommendations for the compressor to be covered under warranty. Refer to the Engineering Handbook for approved system matchups.

II - UNIT COMPONENTS

Unit components are illustrated in figure 1.

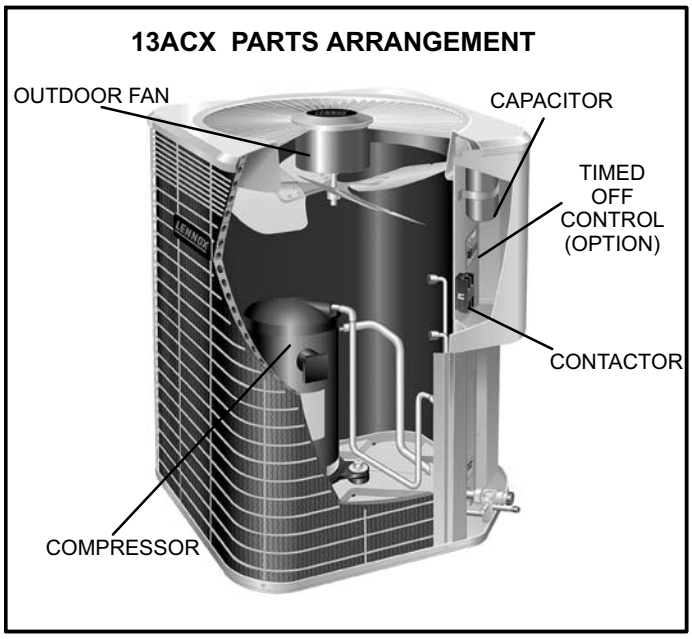


FIGURE 1

A - Control Box (Figure 2)

13ACX units are not equipped with a 24V transformer. All 24 VAC controls are powered by the indoor unit. Refer to wiring diagram.

Electrical openings are provided under the control box cover. Field thermostat wiring is made to color-coded pigtail connections.

ELECTROSTATIC DISCHARGE (ESD)
Precautions and Procedures

⚠ CAUTION

Electrostatic discharge can affect electronic components. Take precautions during unit installation and service to protect the unit's electronic controls. Precautions will help to avoid control exposure to electrostatic discharge by putting the unit, the control and the technician at the same electrostatic potential. Neutralize electrostatic charge by touching hand and all tools on an unpainted unit surface before performing any service procedure.

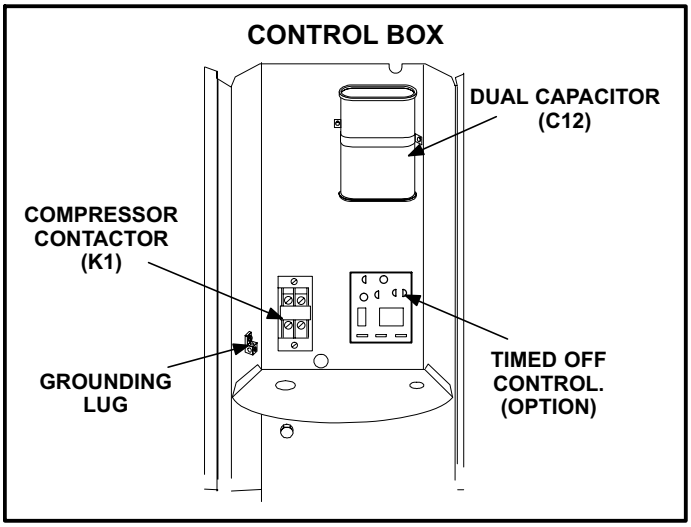


FIGURE 2

1 - Compressor Contactor K1

⚠ DANGER

Shock Hazard

Remove all power at disconnect before removing access panel. Single phase 13ACX units use single-pole contactors. Potential exists for electrical shock resulting in injury or death.

Line voltage exists at all components (even when unit is not in operation).

The compressor is energized by a single-pole contactor located in the control box. See figure 2. K1 is energized by the indoor thermostat terminal Y1 (24V) when thermostat demand is present.

2 - Dual Capacitor C12

The compressor and fan in 13ACX series units use permanent split capacitor motors. The capacitor is located inside the unit control box (see figure 2). A single "dual" capacitor (C12) is used for both the fan motor and the compressor (see unit wiring diagram). The fan side and the compressor side of the capacitor have different MFD ratings. See side of capacitor for ratings.

3 - Timed Off Control TOC (option)

The time delay is electrically connected between thermostat terminal Y and the compressor contactor. Between cycles, the compressor contactor is delayed for 5 minutes ± 2 minutes but may last as long as 8 minutes. At the end of the delay, the compressor is allowed to energize. When thermostat demand is satisfied, the time delay opens the circuit to the compressor contactor coil and the compressor is de-energized.

B - Compressor

The scroll compressor design is simple, efficient and requires few moving parts. A cutaway diagram of the scroll compressor is shown in figure 3. The scrolls are located in the top of the compressor can and the motor is located just below. The oil level is immediately below the motor.

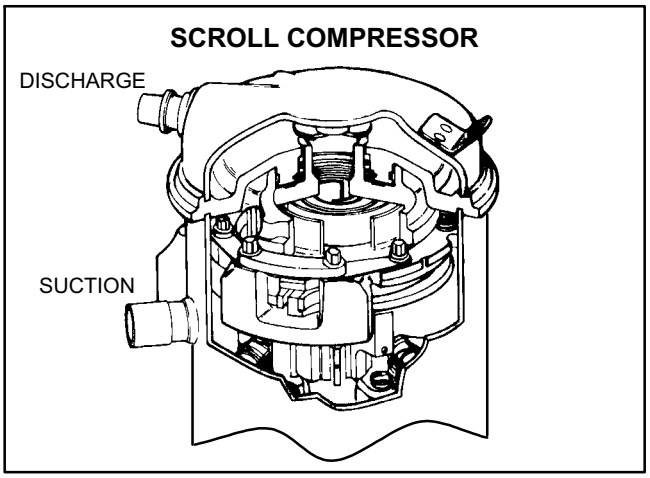


FIGURE 3

The scroll is a simple compression concept centered around the unique spiral shape of the scroll and its inherent properties. Figure 4 shows the basic scroll form. Two identical scrolls are mated together forming concentric spiral shapes (figure 5). One scroll remains stationary, while the other is allowed to "orbit" (figure 6). Note that the orbiting scroll does not rotate or turn but merely orbits the stationary scroll.

The counterclockwise orbiting scroll draws gas into the outer crescent shaped gas pocket created by the two scrolls (figure 6 - 1). The centrifugal action of the orbiting scroll seals off the flanks of the scrolls (figure 6 - 2). As the orbiting motion continues, the gas is forced toward the center of the scroll and the gas pocket becomes compressed (figure 6 - 3). When the compressed gas reaches the center, it is discharged vertically into a chamber and discharge port in the top of the compressor (figure 5). The discharge pressure forcing down on the top scroll helps seal off the upper and lower edges (tips) of the scrolls (figure 5). During a single orbit, several pockets of gas are compressed simultaneously providing smooth continuous compression.

The scroll compressor is tolerant to the effects of liquid return. If liquid enters the scrolls, the orbiting scroll is allowed to separate from the stationary scroll. The liquid is worked toward the center of the scroll and is discharged. If the compressor is replaced, conventional Lennox cleanup practices must be used.

Due to its efficiency, the scroll compressor is capable of drawing a much deeper vacuum than reciprocating compressors. Deep vacuum operation can cause internal fusite arcing resulting in damaged internal parts and will result in compressor failure. Never use a scroll compressor for evacuating or "pumping-down" the system. This type of damage can be detected and will result in denial of warranty claims.

The scroll compressor is quieter than a reciprocating compressor, however, the two compressors have much different sound characteristics. The sounds made by a scroll compressor do not affect system reliability, performance, or indicate damage.

NOTE - During operation, the head of a scroll compressor may be hot since it is in constant contact with discharge gas.

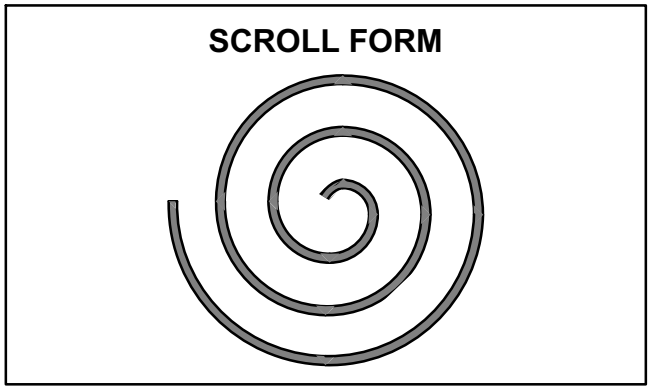


FIGURE 4

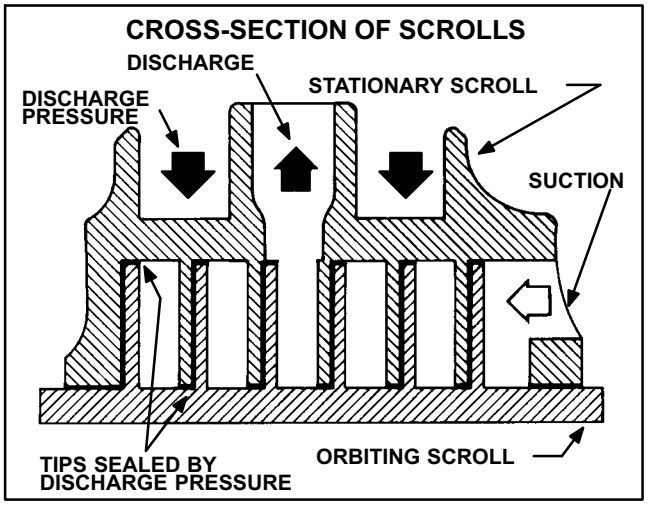


FIGURE 5

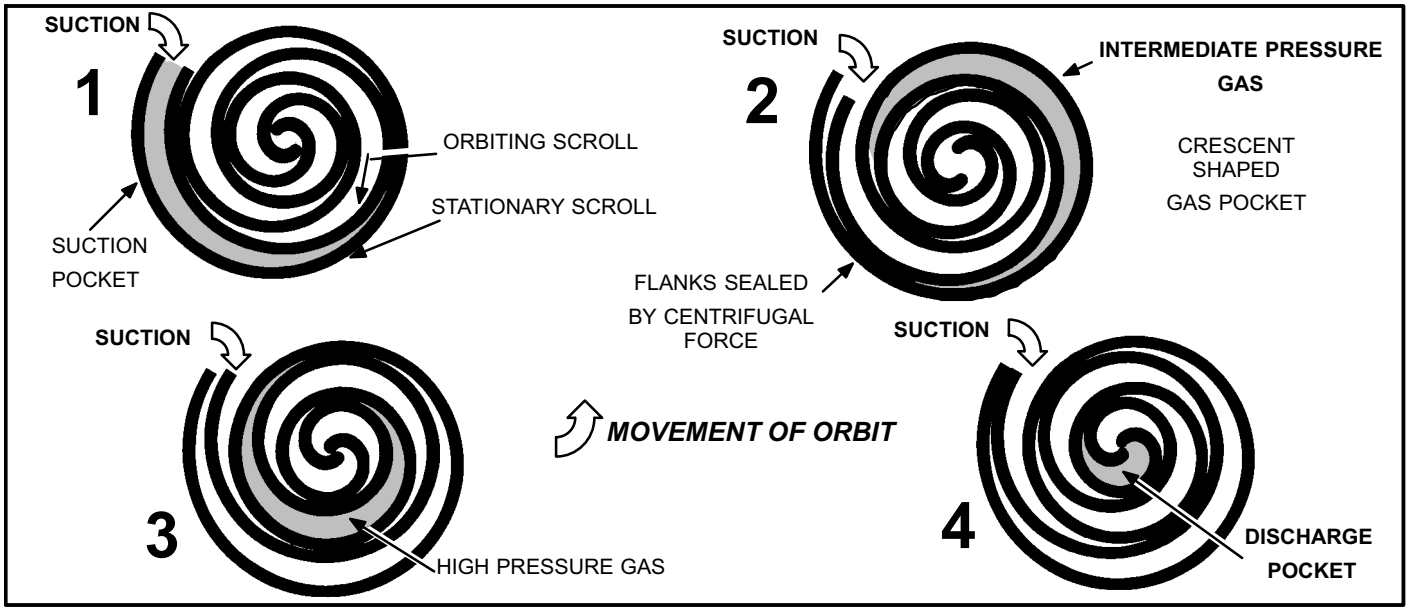


FIGURE 6

C - Condenser Fan Motor

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 13ACX 's.

Access to the condenser fan motor on all units is gained by removing the four screws securing the fan assembly. See figure 7. The grill fan assembly can be removed from the cabinet as one piece. See figure 8. The condenser fan motor is removed from the fan guard by removing the four nuts found on top of the grill. See figure 8 if condenser fan motor replacement is necessary.

⚠ DANGER

Make sure all power is disconnected before beginning electrical service procedures.

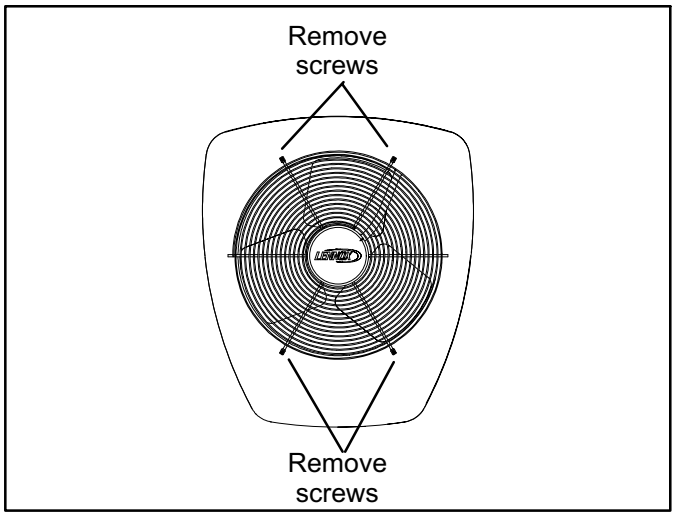


FIGURE 7

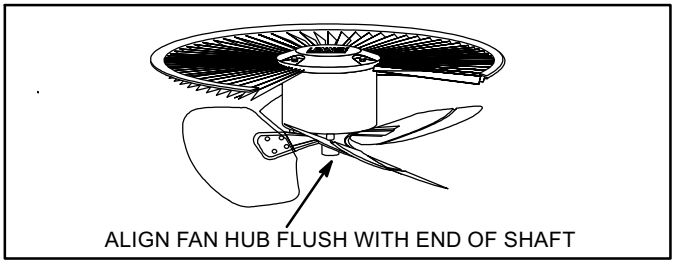


FIGURE 8

D - Loss of Charge Switch (option)

An auto-reset, single-pole/single-throw low loss of charge switch is located in the suction line. This switch shuts off the compressor when suction pressure drops below the factory setting. The switch is closed during normal operating pressure conditions and is permanently adjusted to trip (open) at 25 ± 5 psi. The switch automatically resets when suction line pressure rises above 55 ± 5 psi.

E - High Pressure Switch

13ACX units are equipped with a high pressure switch that is located in the liquid line. The switch (SPST, manual reset, normally closed) removes power from the compressor contactor control circuit when discharge pressure rises above factory setting at 590 ± 10 psi.

III - REFRIGERANT SYSTEM

A - Plumbing

Field refrigerant piping consists of liquid and suction lines from the condensing unit (sweat connections) to the indoor evaporator coil (sweat connections). Use Lennox L15 (sweat) series line sets as shown in table 1.

TABLE 1

Unit	Liquid Line	Suction Line	L15 Line Sets
-018 -024 -030	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)	L15-65 15 ft. - 50 ft. (4.6 m - 15 m)
-060	3/8 in. (10 mm)	1-1/8 in. (29 mm)	Field Fabricated

The liquid line and vapor line service valves (figures 9 and 10) and gauge ports are accessible from the outside of the unit. Use the service ports for leak testing, evacuating, charging and checking charge.

Each valve is equipped with a service port which has a factory-installed Schrader valve. A service port cap protects the Schrader valve from contamination and serves as the primary leak seal. *Service valves are not rebuildable. If a valve has failed, you must replace it.*

To Access Schrader Port:

1 - Remove service port cap with an adjustable wrench.

2 - Connect gauge to the service port.

3 - When testing is complete, replace service port cap. Tighten finger tight, then an additional 1/6 turn.

To Open Service Valve:

1 - Remove the stem cap with an adjustable wrench.

2 - Using the adjustable wrench to keep the valve stationary, use a service wrench with a hex-head extension to back the stem out counterclockwise as far as it will go.

NOTE - Use a 3/16" hex head extension for 3/8" line sizes or a 5/16" extension for large line sizes.

3 - Replace the stem cap. Tighten finger tight, then tighten an additional 1/6 turn.

To Close Service Valve:

1 - Remove the stem cap with an adjustable wrench.

2 - Using the adjustable wrench to keep the valve stationary, use a service wrench with a hex-head extension to turn the stem clockwise to seat the valve. Tighten the stem firmly.

NOTE - Use a 3/16" hex head extension for 3/8" line sizes or a 5/16" extension for large line sizes.

3 - Replace the stem cap. Tighten finger tight, then tighten an additional 1/6 turn.

NOTE - Stem cap must be replaced to help prevent valve leakage.

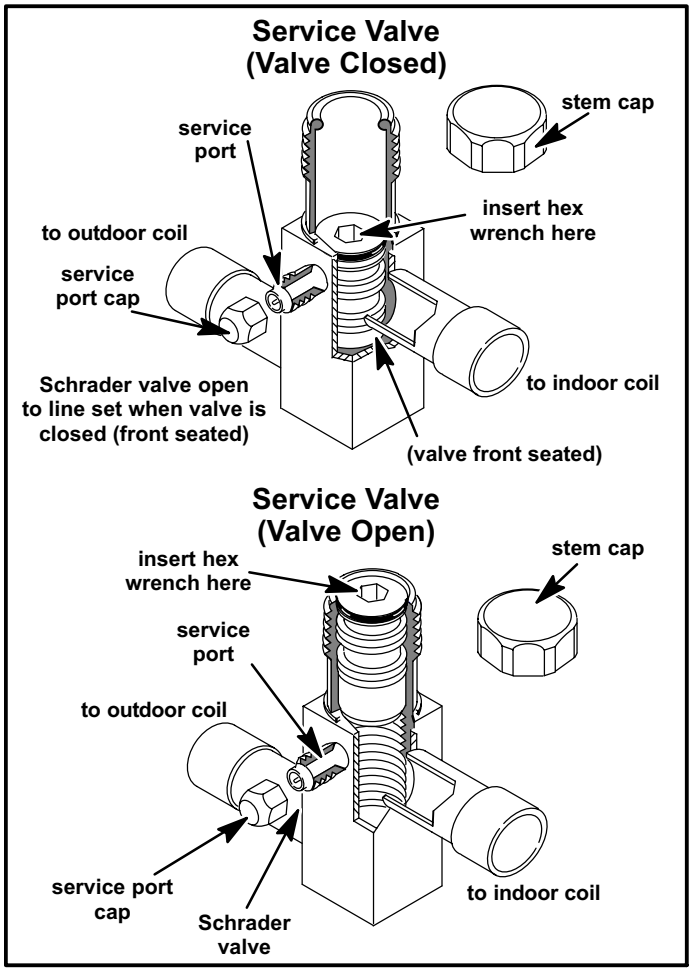


FIGURE 9

Vapor Line Ball Valve – 5 Ton Units Only

Vapor line service valves function the same way as the other valves, the difference is in the construction. A ball valve is illustrated in figure 10.

The ball valve is equipped with a service port with a factory-installed Schrader valve. A service port cap protects the Schrader valve from contamination and assures a leak-free seal.

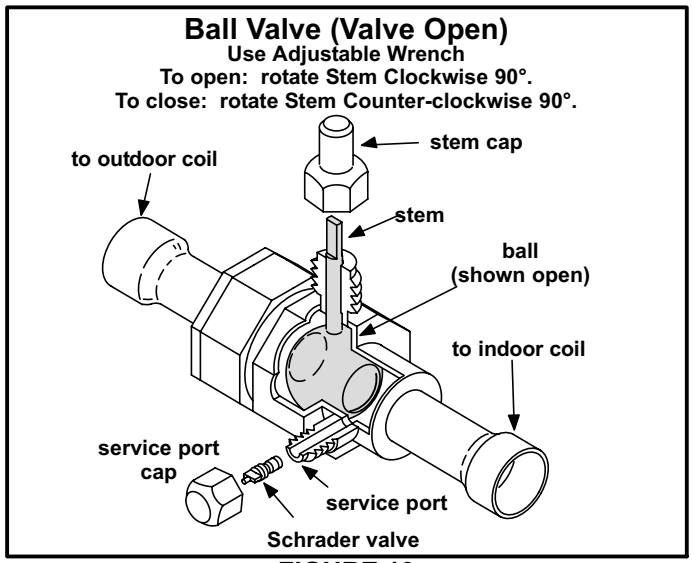


FIGURE 10

IV - CHARGING

⚠ WARNING

R-410A refrigerant can be harmful if it is inhaled. R-410A refrigerant must be used and recovered responsibly.

Failure to follow this warning may result in personal injury or death.

A - Leak Testing

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

⚠ IMPORTANT

The Clean Air Act of 1990 bans the intentional venting of (CFC's and HFC's) as of July 1, 1992. Approved methods of recovery, recycling or reclaiming must be followed. Fines and/or incarceration my be levied for noncompliance.

⚠ WARNING

Fire, Explosion and Personal Safety Hazard.
Failure to follow this warning could result in damage, personal injury or death.
Never use oxygen to pressurize or purge refrigeration lines. Oxygen, when exposed to a spark or open flame, can cause damage by fire and / or an explosion, that can result in personal injury or death.

⚠ WARNING

Danger of explosion!
When using a high pressure gas such as dry nitrogen to pressurize a refrigerant or air conditioning system, use a regulator that can control the pressure down to 1 or 2 psig (6.9 to 13.8 kPa).

Using an Electronic Leak Detector

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

B - Evacuating

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

NOTE - This evacuation process is adequate for a new installation with clean and dry lines. If excessive moisture is present, the evacuation process may be required more than once.

⚠ IMPORTANT

Use a thermocouple or thermistor electronic vacuum gauge that is calibrated in microns. Use an instrument that reads from 50 microns to at least 20,000 microns.

1 - Connect manifold gauge set to the service valve ports :
- low pressure gauge to *vapor* line service valve
- high pressure gauge to *liquid* line service valve

2 - Connect micron gauge.
3 - Connect the vacuum pump (with vacuum gauge) to the center port of the manifold gauge set.
4 - Open both manifold valves and start the vacuum pump.

5 - Evacuate the line set and indoor unit to an **absolute pressure** of 23,000 microns (29.01 inches of mercury). During the early stages of evacuation, it is desirable to close the manifold gauge valve at least once to determine if there is a rapid rise in **absolute pressure**. A rapid rise in pressure indicates a relatively large leak. If this occurs, repeat the leak testing procedure.

*NOTE - 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.*

6 - When the absolute pressure reaches 23,000 microns (29.01 inches of mercury), close the manifold gauge valves, turn off the vacuum pump and disconnect the manifold gauge center port hose from vacuum pump. Attach the manifold center port hose to a nitrogen cylinder with pressure regulator set to 150 psig (1034 kPa) and purge the air from the hose with nitrogen. Open the manifold gauge valves to break the vacuum in the line set and indoor unit. Close the manifold gauge valves.

⚠ CAUTION

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

7 - Shut off the nitrogen cylinder and remove the manifold gauge hose from the cylinder. Open the manifold gauge valves to release the nitrogen from the line set and indoor unit.

8 - Reconnect the manifold gauge to the vacuum pump, turn the pump on, and continue to evacuate the line set and indoor unit until the absolute pressure does not rise above 500 microns (29.9 inches of mercury) within a 20-minute period after shutting off the vacuum pump and closing the manifold gauge valves.

9 - When the absolute pressure requirement above has been met, disconnect the manifold hose from the vacuum pump and connect it to an upright cylinder of R-410A refrigerant. Open the manifold gauge valves to break the vacuum from 1 to 2 psig positive pressure in the line set and indoor unit. Close manifold gauge valves and shut off the R-410A cylinder and remove the manifold gauge set.

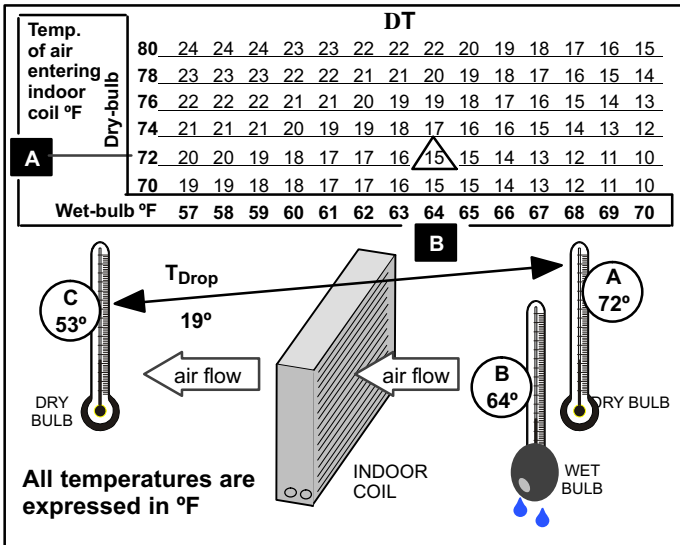
C - Charging

This system is charged with R-410A refrigerant which operates at much higher pressures than HCFC-22. The recommended check expansion valve is approved for use with R-410A. Do not replace it with a valve that is designed to be used with HCFC-22. This unit is NOT approved for use with coils that include metering orifices or capillary tubes.

Check Indoor Airflow before Charging

NOTE - Be sure that filters and indoor and outdoor coils are clean before testing.

Check indoor airflow using the step procedures as illustrated in figure 11.



Step 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).

Step 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**.

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

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

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

FIGURE 11

Pre-Charge Maintenance Checks

TABLE 2
Normal Operating Pressures (TXV)

⚠ IMPORTANT

Use this table to perform maintenance checks; it is not a procedure for charging the system. Minor variations in these pressures may be due to differences in installations. Significant deviations could mean that the system is not properly charged or that a problem exists with some component in the system.

13ACX	-018	-024	-030	-036	-042	-048	-060-1	-060-2
°F (°C)*	Liquid / Vapor	Liquid / Vapor	Liquid / Vapor	Liquid / Vapor	Liquid / Vapor	Liquid / Vapor	Liquid / Vapor	Liquid / Vapor
Expansion Valve (TXV)								
65 (18)	244 / 135	249 / 137	241 / 134	253 / 134	250 / 135	240 / 130	247 / 129	242 / 130
70 (21)	262 / 136	268 / 138	259 / 135	274 / 135	268 / 137	257 / 131	265 / 130	266 / 131
75 (24)	281 / 137	288 / 138	279 / 136	293 / 136	288 / 138	278 / 132	286 / 131	286 / 132
80 (27)	302 / 138	309 / 140	300 / 137	315 / 137	310 / 139	299 / 133	310 / 132	309 / 133
85 (29)	323 / 139	331 / 140	322 / 138	338 / 139	332 / 140	323 / 134	330 / 132	332 / 134
90 (32)	346 / 141	355 / 142	345 / 140	361 / 139	356 / 140	344 / 135	353 / 133	357 / 135
95 (35)	369 / 142	379 / 143	369 / 141	385 / 141	381 / 141	369 / 136	375 / 134	381 / 136
100 (38)	394 / 143	402 / 144	393 / 142	410 / 142	406 / 143	394 / 137	400 / 136	407 / 137
105 (41)	417 / 145	430 / 145	418 / 143	436 / 143	432 / 143	418 / 139	426 / 137	433 / 138
110 (43)	445 / 146	457 / 146	445 / 144	463 / 145	459 / 145	446 / 140	451 / 139	459 / 140
115 (45)	476 / 148	485 / 147	474 / 145	491 / 146	490 / 145	477 / 141	482 / 141	488 / 141
Fixed Orifice (RFC)								
65 (18)	244 / 135	244 / 125	243 / 116	252 / 129	250 / 135	248 / 127	248 / 123	255 / 126
70 (21)	262 / 136	263 / 128	262 / 120	271 / 131	268 / 137	266 / 130	269 / 127	274 / 128
75 (24)	281 / 137	282 / 131	283 / 124	290 / 133	288 / 138	284 / 132	295 / 131	294 / 131
80 (27)	302 / 138	303 / 134	305 / 128	312 / 136	310 / 139	305 / 134	315 / 133	317 / 134
85 (29)	323 / 139	326 / 137	328 / 132	334 / 139	332 / 140	325 / 137	334 / 135	339 / 136
90 (32)	346 / 141	347 / 138	351 / 135	356 / 141	356 / 140	347 / 139	359 / 138	362 / 138
95 (35)	369 / 142	372 / 141	376 / 139	380 / 143	381 / 141	371 / 141	384 / 140	386 / 140
100 (38)	394 / 143	396 / 143	401 / 142	405 / 145	406 / 143	394 / 143	409 / 142	413 / 142
105 (41)	417 / 145	421 / 145	427 / 145	429 / 147	432 / 143	418 / 144	434 / 144	435 / 144
110 (43)	445 / 146	449 / 147	454 / 147	456 / 148	459 / 145	445 / 146	462 / 145	462 / 146
115 (46)	476 / 148	479 / 149	482 / 149	483 / 151	490 / 145	472 / 147	489 / 146	490 / 148

**Values shown are typical pressures; indoor unit match up, indoor air quality equipment, and indoor load will cause the pressures to vary.*
***Temperature of the air entering the outside coil.*

Determining Charge Method

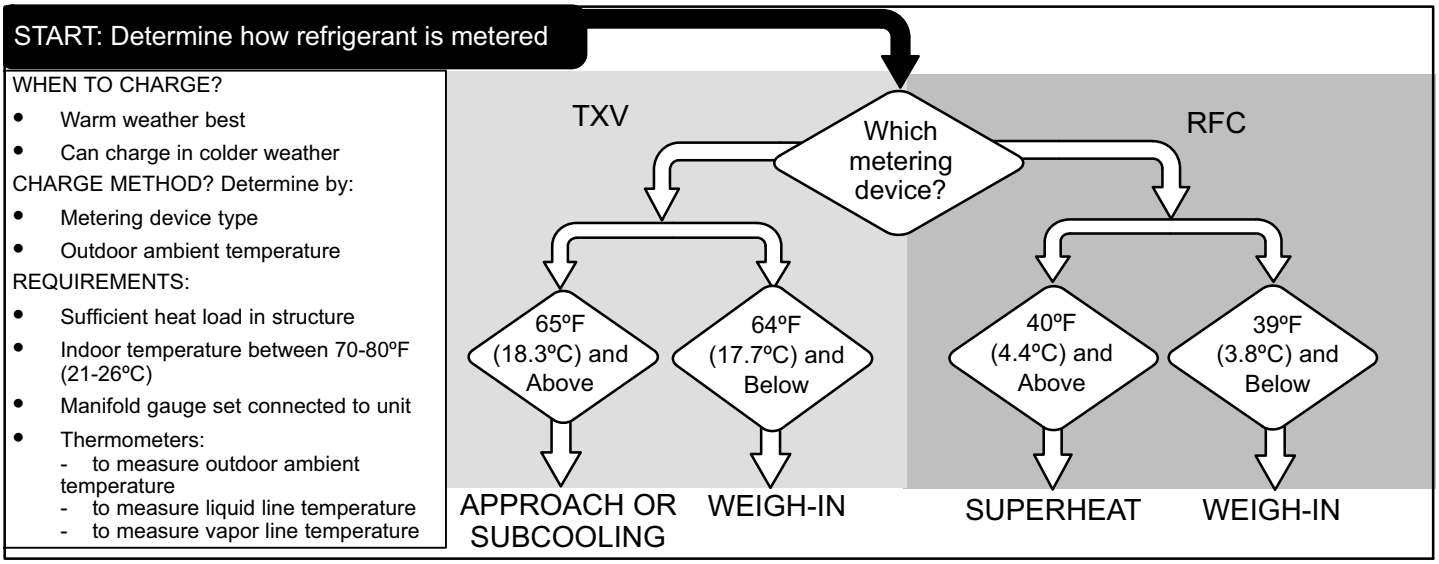


FIGURE 12

Weigh in Charge

1.Recover the refrigerant from the unit.

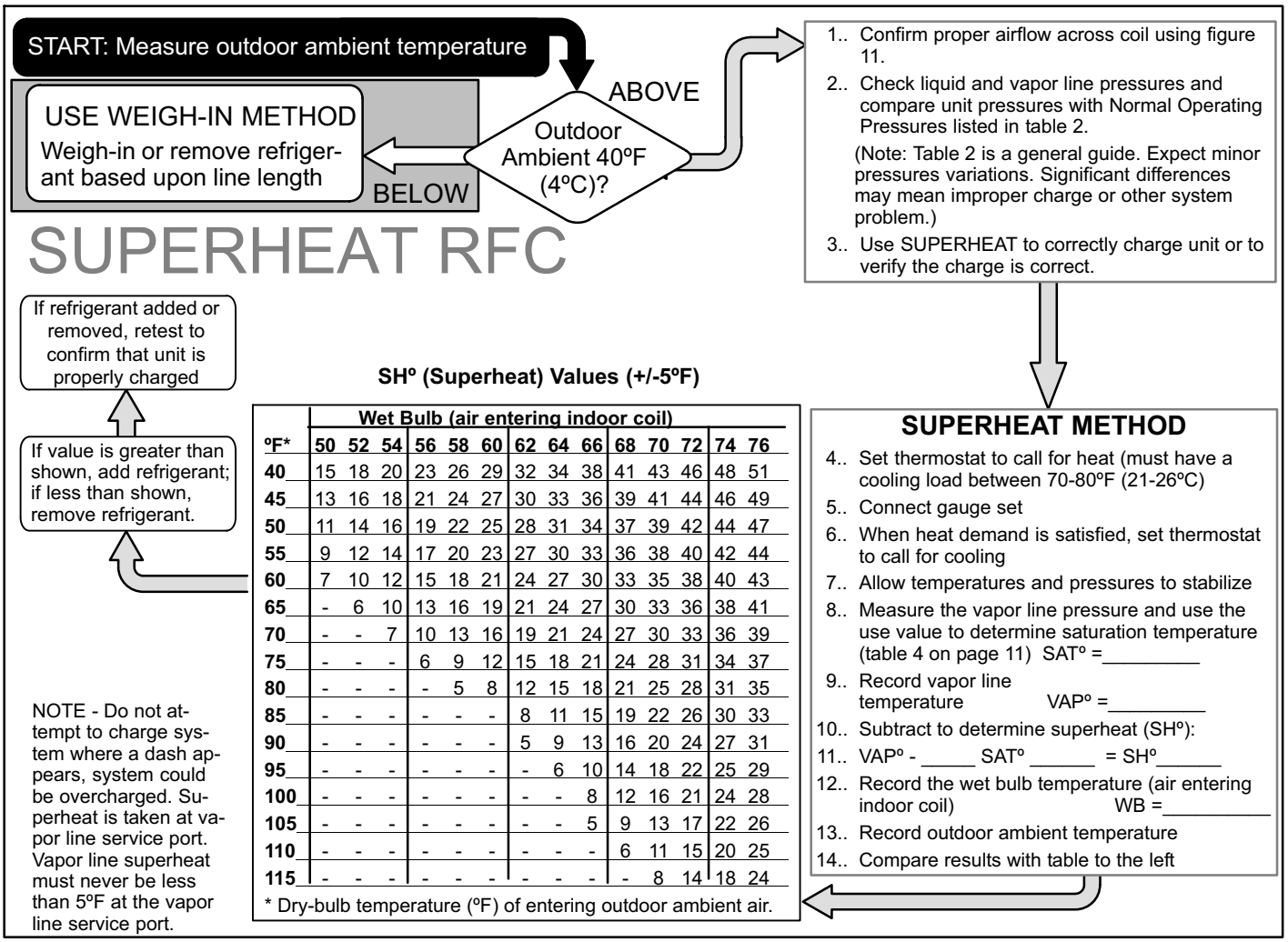
2.Conduct leak check; evacuate as previously outlined.

3.Weigh in the unit nameplate charge plus any charge required for linesets differences from 15 feet. (If weighing facilities are not available, use the subcooling method.)

TABLE 3
Refrigerant Charge per Line Set Lengths

Liquid Line Set Diameter	Ounces per 5 feet (g per 1.5 m) adjust from 15 feet (4.6 m) line set*
3/8 in. (9.5 mm)	3 ounce per 5 ft. (85 g per 1.5 m)
*NOTE - *If line length is greater than 15 ft. (4.6 m), add this amount. If line length is less than 15 ft. (4.6 m), subtract this amount.*	

Superheat RFC Charge



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

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

Table 4
HFC-410A Temperature (°F) - Pressure (Psig)

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

Approach TXV Charge

START: Measure outdoor ambient temperature

Outdoor Ambient 65ºF (18ºC)?

ABOVE

BELOW

USE WEIGH-IN METHOD
Weigh-in or remove refrigerant based upon line length

APPROACH TXV

1.. Confirm proper airflow across coil using figure 11.
2.. Check liquid and vapor line pressures and compare unit pressures with Normal Operating Pressures listed in table 2 on page 9.
(Table 2 is a general guide. Expect minor pressures variations. Significant differences may mean improper charge or other system problem.)
3.. Use APPROACH to correctly charge unit or to verify the charge is correct.

APPROACH METHOD

4.. Set thermostat to call for heat (must have a cooling load between 70-80ºF (21-26ºC)
5.. Connect gauge set
6.. When heat demand is satisfied, set thermostat to call for cooling
7.. Allow temperatures and pressures to stabilize
8.. Record outdoor ambient temperature AMBº =_____
9.. Record line temp. LIQº = _____
10.. Subtract to determine approach (APPº):
11.. LIQº_____ - AMBº _____ = APPº_____
12.. Compare results with table to the left

If value is greater than shown (high approach), add refrigerant; if less than shown (liquid temp too close to ambient temp, low approach), remove refrigerant.

If refrigerant added or removed, retest to confirm that unit is properly charged

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

ºF (ºC)*	-018	-024	-030	-036	-042	-048	-060
Any	8 (4.4)	8 (4.5)	9 (5.0)	15 (8.3)	10 (5.6)	6 (3.3)	9 (5.0)

*Temperature of air entering outdoor coil

Subcooling TXV Charge

START: Measure outdoor ambient temperature

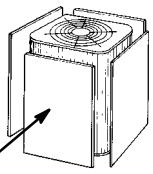
Outdoor Ambient 65ºF (18ºC)?

ABOVE

BELOW

USE WEIGH-IN METHOD
Weigh-in or remove refrigerant based upon line length

SUBCOOLING TXV



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

1.. Confirm proper airflow across coil using figure 11.
2.. Check liquid and vapor line pressures and compare unit pressures with Normal Operating Pressures listed in table 2.
(Table 2 is a general guide. Expect minor pressures variations. Significant differences may mean improper charge or other system problem.)
3.. Use SUBCOOLING to correctly charge unit or to verify the charge is correct.

SUBCOOLING METHOD

4.. Set thermostat to call for heat (must have a cooling load between 70-80ºF (21-26ºC)
5.. Connect gauge set
6.. Measure outdoor ambient temperature
7.. When heat demand is satisfied, set thermostat to call for cooling
8.. Allow temperatures and pressures to stabilize [NOTE - IF NECESSARY, block outdoor coil to maintain 325 - 375 psig]
9.. Record line temp. LIQº = _____
10.. Measure liquid line pressure and use the value to determine saturation temperature (table 4 on page 11) SATº = _____
11.. Subtract to determine subcooling (SCº):
12.. SATº_____ - LIQº _____ = SCº _____
13.. Compare results with table to the left.

If refrigerant added or removed, verify charge using the approach method

If value is greater than shown, remove refrigerant; if less than shown, add refrigerant

SCº (Subcooling) Values (F:+/-1.0°; [C: +/-0.6°])

ºF (ºC)*	-018	-024	-030	-036	-042	-048	-060
Any	8 (4.4)	8 (4.4)	7 (3.8)	4 (2.2)	8 (4.4)	10 (5.6)	7 (3.9)

*Temperature of air entering outdoor coil

+

V - 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.

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:

1.Make sure power is off before cleaning. Clean and inspect outdoor coil. The coil may be flushed with a water hose.

The outdoor coil is protected by an inner mesh screen and a wire cage (see figure 13). If debris has collected between the mesh screen and the coil and cannot be dislodged by spraying unpressurized water from inside coil surface to the outside, the mesh may be removed by first removing the top of the unit which will allow for removal of the wire cage.

Then, using pliers to grip the head of the push pins, pull straight out to extract the push pins along one side of the coil. If necessary, remove the push pins along the back of the unit; it is usually unnecessary to fully remove the inner mesh screen.

Drape the mesh screen back and wash the coil. When all the debris has been removed from the coil, reinstall the mesh screen by positioning it in its original position and reinserting the push pin. No tool is required to push the pin back into the same slot in the fins.

If the push pin is loose and tends not to stay in place, brush the fins with a fin brush (22 fins/in). Line up the push pin a couple fins to the right or left of the original hole and re-insert the pin.

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

3.Visually inspect connecting lines and coils for evidence of oil leaks.

4.Check wiring for loose connections.

5.Check for correct voltage at unit (unit operating).

6.Check amp-draw outdoor fan motor.

Unit nameplate _____ Actual _____ .

NOTE - If owner reports insufficient cooling, the unit should be gauged and refrigerant charge checked. See refrigerant charging section.

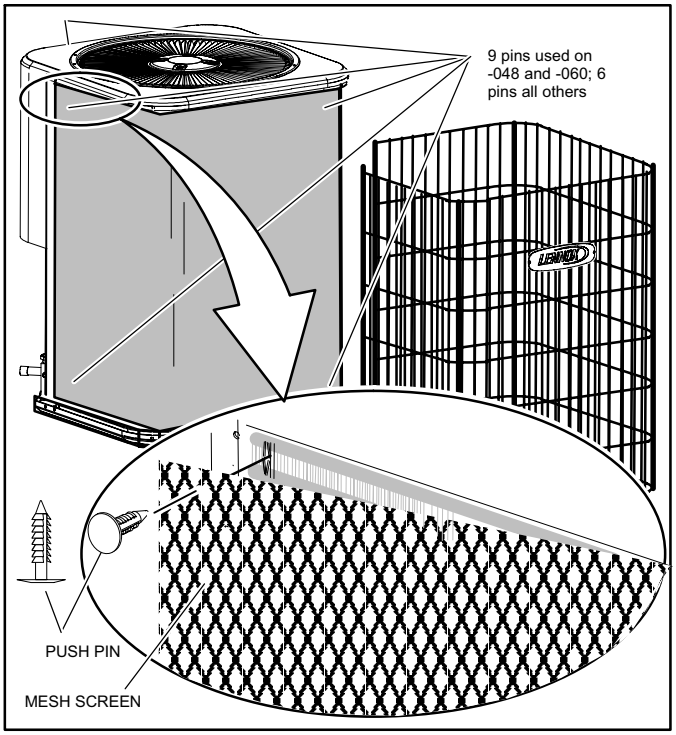


Figure 13

Indoor Coil

1.Clean coil, if necessary.

2.Check connecting lines and coils for signs of oil leaks.

3.Check the condensate pan line and clean if necessary.

Indoor Unit

1.Clean or change filters.

2.Adjust blower speed for cooling. The pressure drop over the coil should be measured to determine the correct blower CFM. Refer to the unit information service manual for pressure drop tables and procedure.

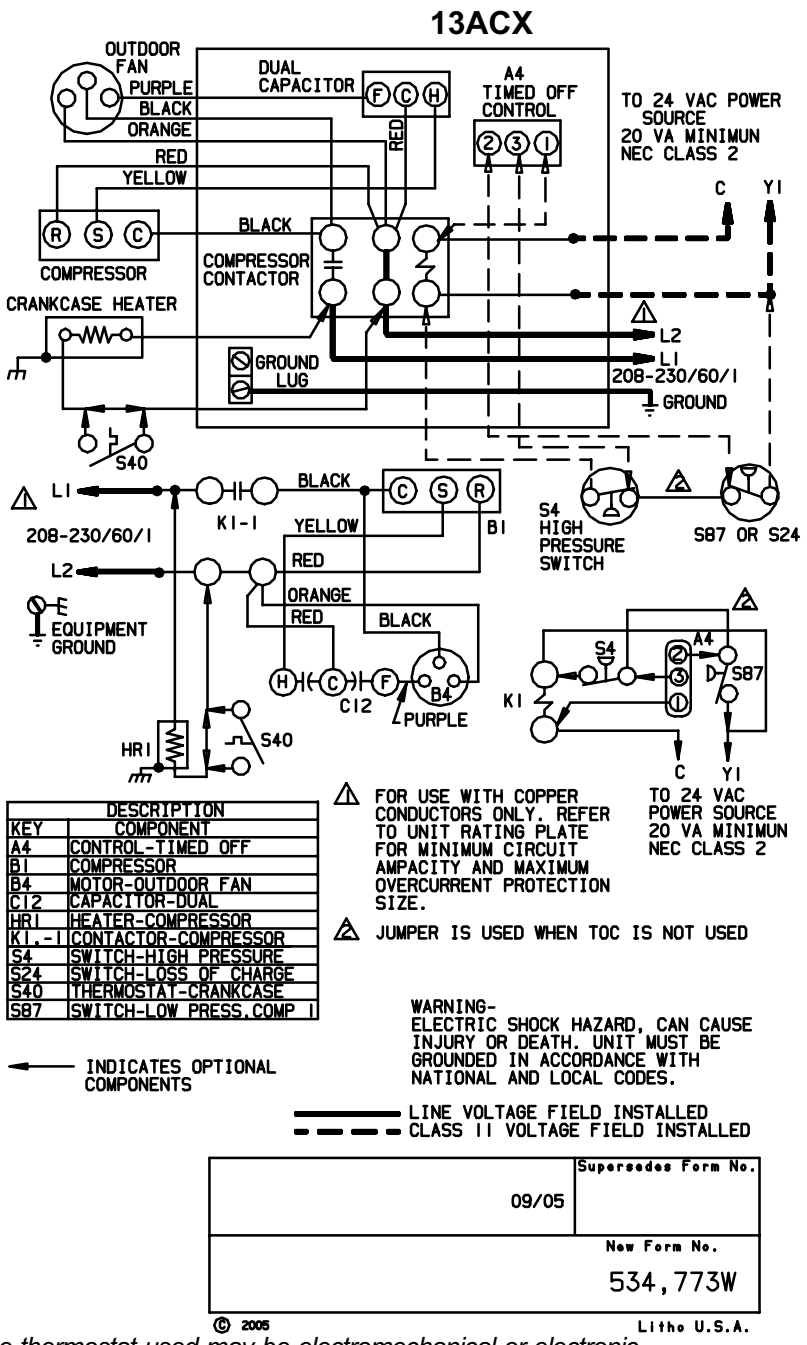
3.Check all wiring for loose connections

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

5.Check amp-draw on blower motor.

Unit nameplate_____ Actual _____.

VI - WIRING DIAGRAMS AND SEQUENCE OF OPERATION



NOTE- The thermostat used may be electromechanical or electronic.

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

COOLING:

1- Cooling demand initiates at Y1 in the thermostat.

2- 24VAC from indoor unit (Y1) energizes the TOC timed off control (if used) which energizes contactor K1.

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

4- Compressor (B1) and outdoor fan motor (B4) begin immediate operation..

END OF COOLING DEMAND:

5- Cooling demand is satisfied. Terminal Y1 is de-energized and the TOC(if used) begins its off cycle timing.

6- Compressor contactor K1 is de-energized.

7- K1-1 opens and compressor (B1) and outdoor fan motor (B4) are de-energized and stop immediately.