

**HP13 SERIES UNITS**

The HP13 is a high efficiency residential split-system heat pump unit, which features a scroll compressor. HP13 units are available in sizes ranging from 1-1/2 through 5 tons. The series is designed for use with an indoor unit with an expansion valve. 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.



**⚠ 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).

**⚠ 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**



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.

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## SPECIFICATIONS

General Data		Model No.	HP13-018	HP13-024	HP13-030	HP13-036	HP13-042	HP13-048	HP13-060
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)
<sup>1</sup> Sound Rating Number			76 dB	76 dB	76 dB	76 dB	78 dB	78 dB	78 dB
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)
	Vapor 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)
<sup>2</sup> Refrigerant R-22 charge furnished			6 lbs. 6 oz. (2.89 kg)	6 lbs. 3 oz. (2.81 kg)	8 lbs. 4 oz. (3.74 kg)	8 lbs. 10 oz. (3.91 kg)	10 lbs. 6 oz. (4.71 kg)	11 lbs. 12 oz. (5.33 kg)	14 lbs. 14 oz. (6.75 kg)
Outdoor Coil	Net face area sq. ft. (m <sup>2</sup> )	Outer coil	15.21 (1.41)	15.21 (1.41)	13.30 (1.24)	15.21 (1.41)	18.66 (1.73)	21.11 (1.96)	24.93 (2.32)
		Inner coil	---	---	12.60 (1.17)	14.50 (1.35)	17.95 (1.67)	20.31 (1.89)	24.14 (2.24)
	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)
	No. 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)	22 (559)	22 (559)	26 (660)
	No. of Blades		3	3	4	4	4	4	3
	Motor hp (W)		1/5 (149)	1/5 (149)	1/5 (149)	1/5 (149)	1/3 (249)	1/3 (249)	1/3 (249)
	Cfm (L/s)		2400 (1135)	2400 (1135)	2440 (1150)	2450 (1155)	3890 (1835)	3890 (1835)	4400 (2075)
	Rpm		1130	1130	1095	1100	1080	1085	830
Watts		166	166	194	190	400	375	307	
Shipping Data - lbs. (kg) 1 package			175 (79)	188 (85)	204 (93)	216 (98)	254 (115)	275 (125)	336 (152)

## ELECTRICAL DATA

Line voltage data - 60 hz - 1ph			208/230V	208/230V	208/230V	208/230V	208/230V	208/230V	208/230V
<sup>3</sup> Maximum overcurrent protection (amps)			20	20	30	30	40	45	60
<sup>4</sup> Minimum circuit ampacity			12.3	14.0	18	19.4	22.9	25.7	34.3
Compressor	Rated Load Amps		8.9	10.3	13.5	14.7	17	19.2	26
	Locked Rotor Amps		41	56	72.5	83	95	129	148
	Power Factor		0.98	0.96	0.96	0.96	0.95	0.96	0.96
Outdoor Fan Motor	Full Load Amps		1.1	1.1	1.1	1.1	1.7	1.7	1.8
	Locked Rotor Amps		1.9	1.9	1.9	1.9	4.1	4.1	2.9

## OPTIONAL ACCESSORIES - must be ordered extra

Compressor Crankcase Heater	93M12		•	•	•	•			
Compressor Hard Start Kit	10J42		•						
	88M91			•	•	•	•	•	•
Compressor Low Ambient Cut-Off	45F08		•	•	•	•	•	•	•
Compressor Sound Cover	69J03		•	•	•	•	•	•	•
Freezestat	3/8 in. tubing	93G35	•	•	•	•	•	•	•
	5/8 in. tubing	50A93	•	•	•	•	•	•	•
High Pressure Switch Kit	94J46		•	•	•	•	•	•	
Loss of Charge Kit	84M23		•	•	•	•	•	•	
<sup>5</sup> Low Ambient Kit	27J00		•	•	•	•	•	•	
Mild Weather Kit	33M07		•	•	•	•	•	•	
Monitor Kit - Service Light	76F53		•	•	•	•	•	•	
Outdoor Thermostat Kit	Thermostat	56A87	•	•	•	•	•	•	•
	Mtg. Box - US	31461	•	•	•	•	•	•	•
	Mtg. Box - Cdn	33A09	•	•	•	•	•	•	•
Refrigerant Line Sets	L15-41-20	L15-41-40	•	•	•				
	L15-41-30	L15-41-50							
	L15-65-30	L15-65-40				•	•	•	
		L15-65-50							
	Field Fabricate								•
Time Delay Relay Kit	58M81		•	•	•	•	•	•	•

NOTE - Extremes of operating range are plus 10% and minus 5% of line voltage.

<sup>1</sup> Sound Rating Number rated in accordance with test conditions included in ARI Standard 270.

<sup>2</sup> Refrigerant charge sufficient for 15 ft. (4.6 m) length of refrigerant lines.

<sup>3</sup> HACR type circuit breaker or fuse.

<sup>4</sup> Refer to National or Canadian Electrical Code manual to determine wire, fuse and disconnect size requirements.

<sup>5</sup> Crankcase Heater and Freezestat are recommended with Low Ambient Kit.

## I - GENERAL

### 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.

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. A misapplied system will cause erratic operation and can result in early compressor failure.

#### **⚠ IMPORTANT**

This unit must be matched with an indoor coil as specified in Lennox' Engineering Handbook.

## II - UNIT COMPONENTS

Unit components are illustrated in figure 1.

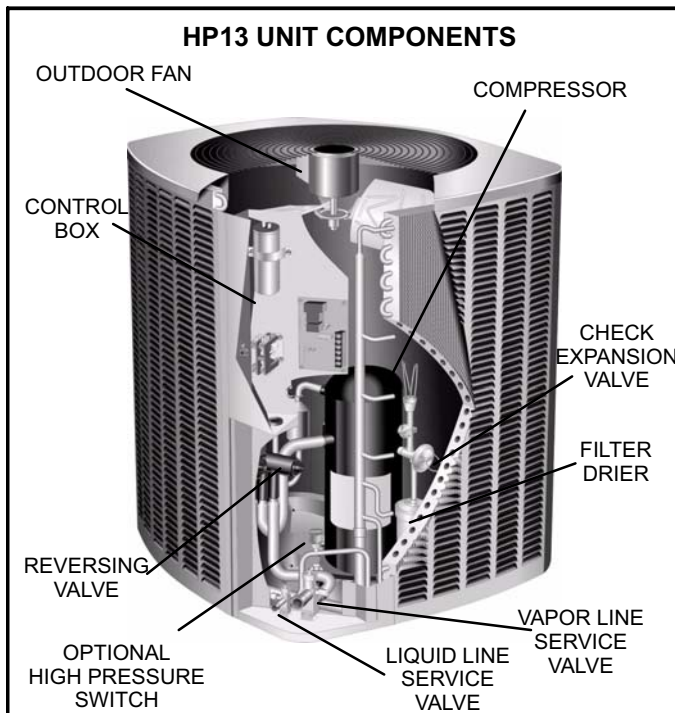


FIGURE 1

## A - Control Box (Figure 2)

HP13 units are not equipped with a 24V transformer. All 24 VAC controls are powered by the indoor unit. Refer to wiring diagram.

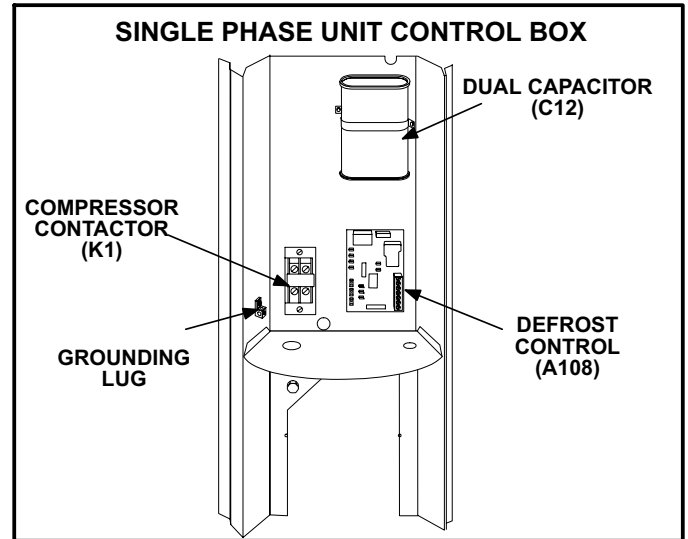


FIGURE 2

Electrical openings are provided under the control box cover. Field thermostat wiring is made to a 24V terminal strip located on the defrost control board located in the control box. See figure 3.

### 24V THERMOSTAT TERMINAL STRIP

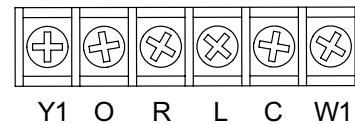


FIGURE 3

## 1 - Compressor Contactor K1

The compressor is energized by a contactor located in the control box. See figure 2. Single-pole contactors are used in all HP13 series units. K1 is energized through the control board by the indoor thermostat terminal Y1 (24V) when thermostat demand is present.

#### **⚠ DANGER**

**Electric Shock Hazard.**  
May cause injury or death.  
Line voltage is present at all components when unit is not in operation on units with single pole contactors.  
Disconnect all remote electrical power supplies before opening unit panel.  
Unit may have multiple power supplies.



## 2 - Dual Capacitor C12

The compressor and fan in HP13 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 - Defrost Control

The HP13 defrost system includes two components: a defrost thermostat and a defrost control.

### Defrost Thermostat (Defrost Switch S6)

The defrost thermostat is located on the liquid line between the check/expansion valve and the distributor. When defrost thermostat senses 42°F (5.5°C) or cooler, the thermostat contacts close and send a signal to the defrost control board to start the defrost timing. It also terminates defrost when the liquid line warms up to 70°F (21°C).

### Defrost Control

The defrost control board includes the combined functions of a time/temperature defrost control, defrost relay, diagnostic LEDs and terminal strip for field wiring connections. The control provides automatic switching from normal heating operation to defrost mode and back. During compressor cycle (call for defrost), the control accumulates compressor run times at 30-, 60-, or 90-minute field-adjustable intervals. If the defrost thermostat is closed when the selected compressor run time interval ends, the defrost relay is energized and defrost begins.

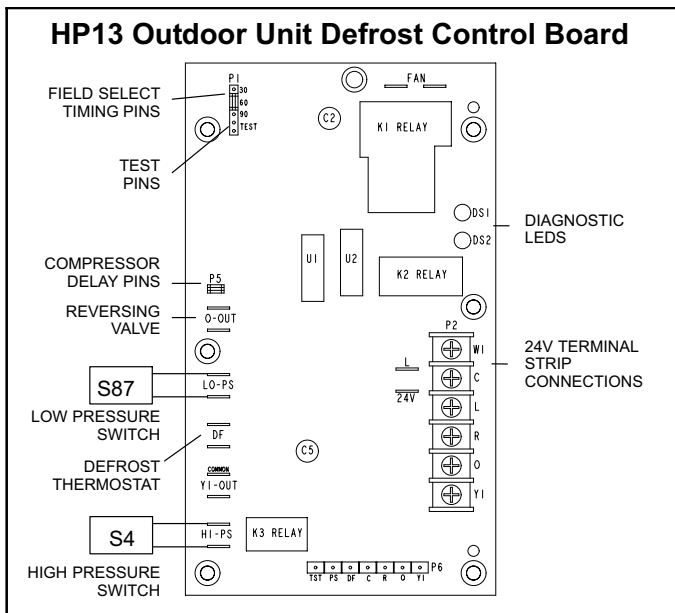


FIGURE 4

### Defrost Control Timing Pins

Each timing pin selection provides a different accumulated compressor run time period for one defrost cycle. This time period must occur before a defrost cycle is initiated. The defrost interval can be adjusted to 30, 60 or 90

minutes (see figure 4). The defrost timing jumper is factory-installed to provide a 60-minute defrost interval. If the timing selector jumper is not in place, the control defaults to a 90-minute defrost interval. The maximum defrost period is 14 minutes and cannot be adjusted.

A TEST option is provided for troubleshooting. **The TEST mode may be started any time the unit is in the heating mode and the defrost thermostat is closed or jumpered.** If the jumper is in the TEST position at power-up, the control will ignore the test pins. When the jumper is placed across the TEST pins for two seconds, the control will enter the defrost mode. If the jumper is removed before an additional 5-second period has elapsed (7 seconds total), the unit will remain in defrost mode until the defrost thermostat opens or 14 minutes have passed. If the jumper is not removed until after the additional 5-second period has elapsed, the defrost will terminate and the test option will not function again until the jumper is removed and re-applied.

### Compressor Delay

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. The compressor will be cycled off for 30 seconds going in and out of the defrost mode when the compressor delay jumper is removed.

*NOTE - The 30-second compressor feature is ignored when the defrost test pins are jumpered.*

### Time Delay

The timed-off delay is five minutes long. The delay helps to protect the compressor from short-cycling in case the power to the unit is interrupted or a pressure switch opens. The delay is bypassed by placing the timer select jumper across the TEST pins for 0.5 seconds.

### Pressure Switch Circuit

The defrost control incorporates two optional pressure switch circuits. The high pressure switch (S4) is factory-connected to the board’s HI PS terminals (see figure 4). The board also includes a low pressure, or loss-of-charge-pressure, switch (S87). Switches are shown in the unit wiring diagram. During a single demand cycle, the defrost control will lock out the unit after the fifth time that the circuit is interrupted by any pressure switch wired to the control board. In addition, the diagnostic LEDs will indicate a locked-out pressure switch after the fifth occurrence of an open pressure switch (see Table 1). The unit will remain locked out until power to the board is interrupted, then re-established or until the jumper is applied to the TEST pins for 0.5 seconds.

*NOTE - The defrost control board ignores input from the low-pressure switch terminals as follows:*

- during the TEST mode,*
- during the defrost cycle,*
- during the 90-second start-up period,*
- and for the first 90 seconds each time the reversing valve switches heat/cool modes.*

### Diagnostic LEDs

The defrost board uses two LEDs for diagnostics. The LEDs flash a specific sequence according to the condition.

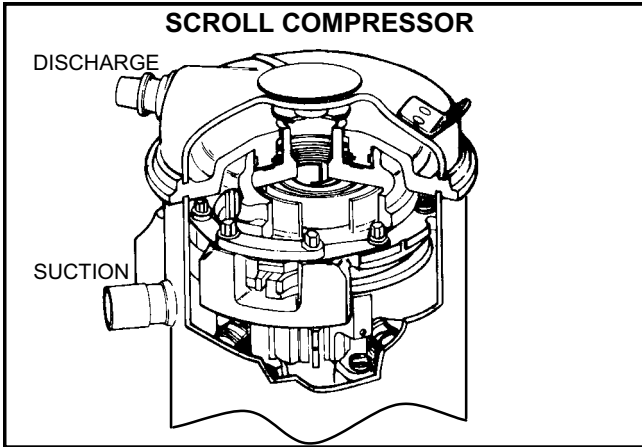
**TABLE 1**

Defrost Control Board Diagnostic LED		
Mode	Green LED (DS2)	Red LED (DS1)
No power to control	OFF	OFF
Normal operation / power to control	Simultaneous Slow FLASH	
Anti-short cycle lockout	Alternating Slow FLASH	
Low pressure switch fault	OFF	Slow FLASH
Low pressure switch lockout	OFF	ON
High pressure switch fault	Slow FLASH	OFF
High pressure switch lockout	ON	OFF

**B - Compressor**

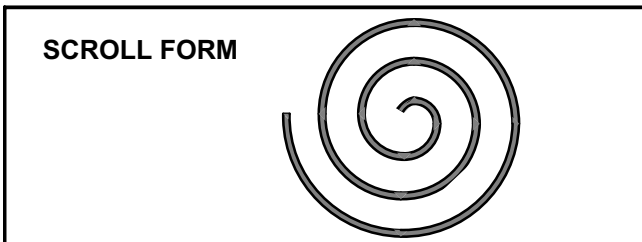
The scroll compressor design is simple, efficient and requires few moving parts. A cutaway diagram of the scroll compressor is shown in figure 5. The scrolls are located in the top of the compressor can and the motor is located just below. The oil level is immediately below the motor.

The scroll is a simple compression concept centered around the unique spiral shape of the scroll and its inherent properties. Figure 6 shows the basic scroll form. Two identical scrolls are mated together forming concentric spiral shapes (figure 7). One scroll remains stationary, while the other is allowed to "orbit" (figure 8). Note that the orbiting scroll does not rotate or turn but merely orbits the stationary scroll.

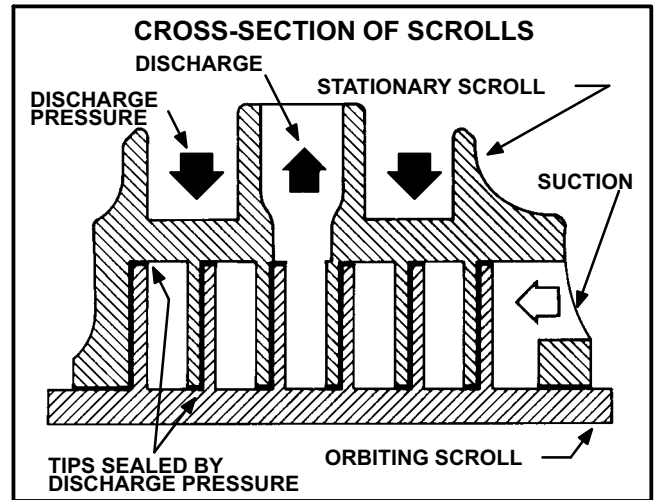


**FIGURE 5**

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



**FIGURE 6**



**FIGURE 7**

The counterclockwise orbiting scroll draws gas into the outer crescent shaped gas pocket created by the two scrolls (figure 8 - 1). The centrifugal action of the orbiting scroll seals off the flanks of the scrolls (figure 8 - 2). As the orbiting motion continues, the gas is forced toward the center of the scroll and the gas pocket becomes compressed (figure 8 - 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 7). The discharge pressure forcing down on the top scroll helps seal off the upper and lower edges (tips) of the scrolls (figure 7). 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.

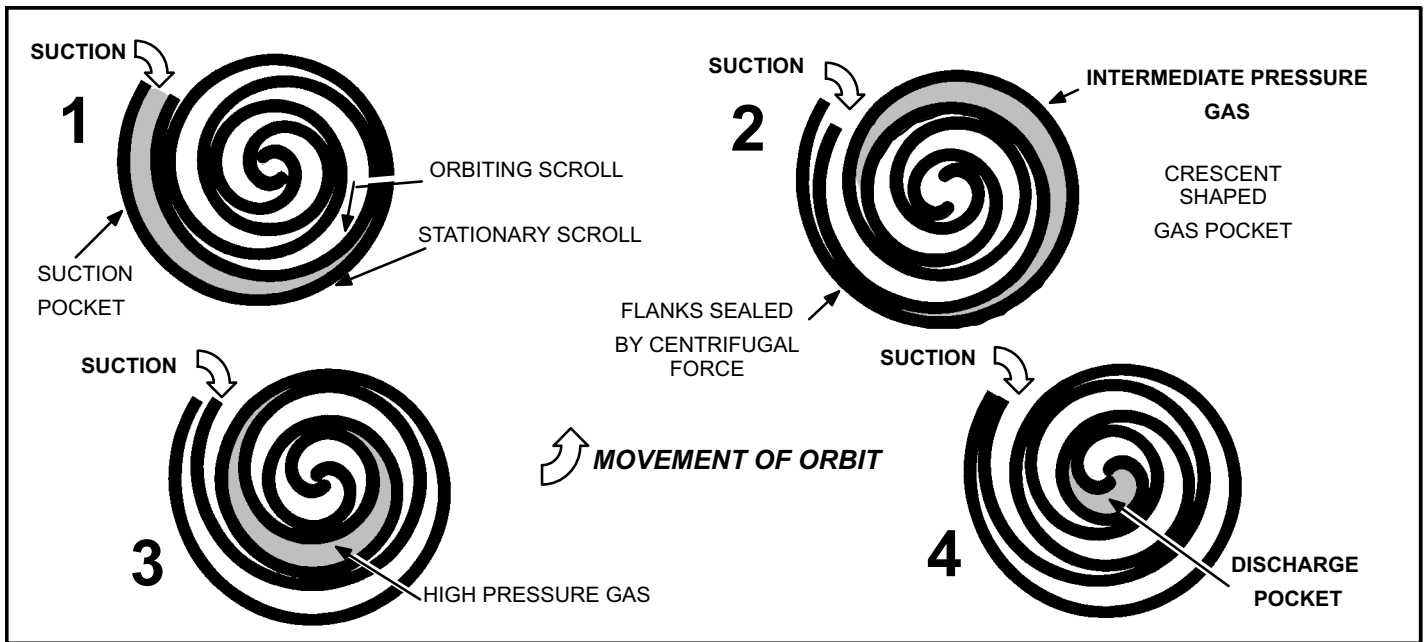


FIGURE 8

### C - Outdoor 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 HP13's.

Access to the condenser fan motor on all units is gained by removing the four screws securing the fan assembly. See figure 10. The grill fan assembly can be removed from the cabinet as one piece. See figure 9. The condenser fan motor is removed from the fan guard by removing the four nuts found on top of the grill. See figure 9 if condenser fan motor replacement is necessary.

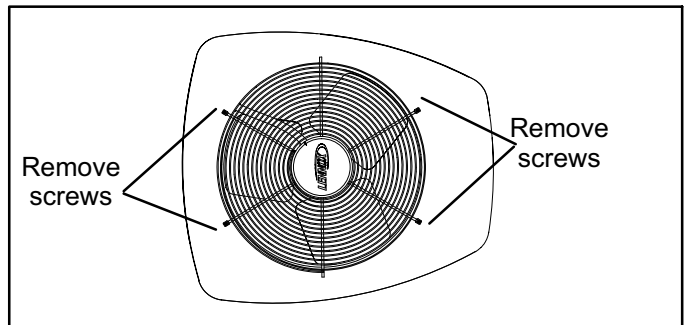


FIGURE 10

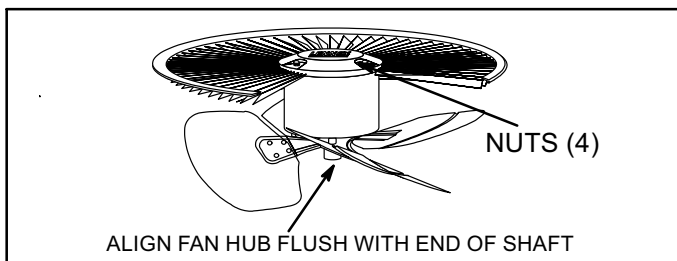


FIGURE 9

### E - Reversing Valve L1 and Solenoid

A refrigerant reversing valve with electromechanical solenoid is used to reverse refrigerant flow during unit operation. The reversing valve requires no maintenance. It is not repairable. If the reversing valve has failed, it must be replaced.

### F - High/Low Pressure Switch (option)

An auto-reset, single-pole/single-throw high pressure switch is located in the liquid line. This switch shuts off the compressor when liquid line pressure rises above the factory setting. The switch is normally closed and is permanently adjusted to trip (open) at  $410 \pm 10$  psi.

An auto-reset, single-pole/single-throw low pressure 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  $25 \pm 5$  psi. The switch automatically resets when suction line pressure rises above  $55 \pm 5$  psi. Under certain conditions the low pressure switch is ignored. See *Pressure Switch Circuit* in the Defrost Control description.

## **⚠ DANGER**

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

### D - Filter Drier

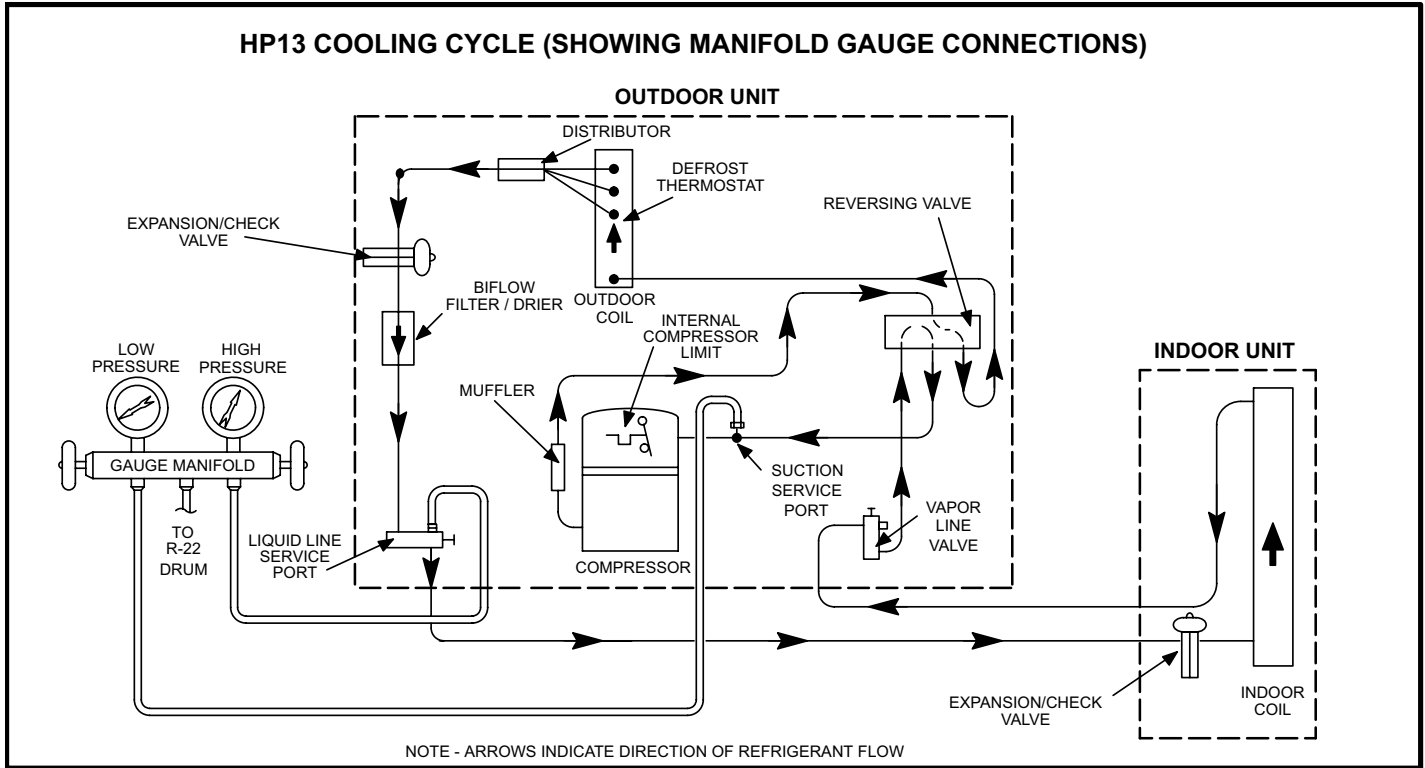
A biflow filter drier designed for all HP13 model units is factory installed in the liquid line. The filter drier is designed to remove moisture and foreign matter, which can lead to compressor failure.

### G - Crankcase Heater

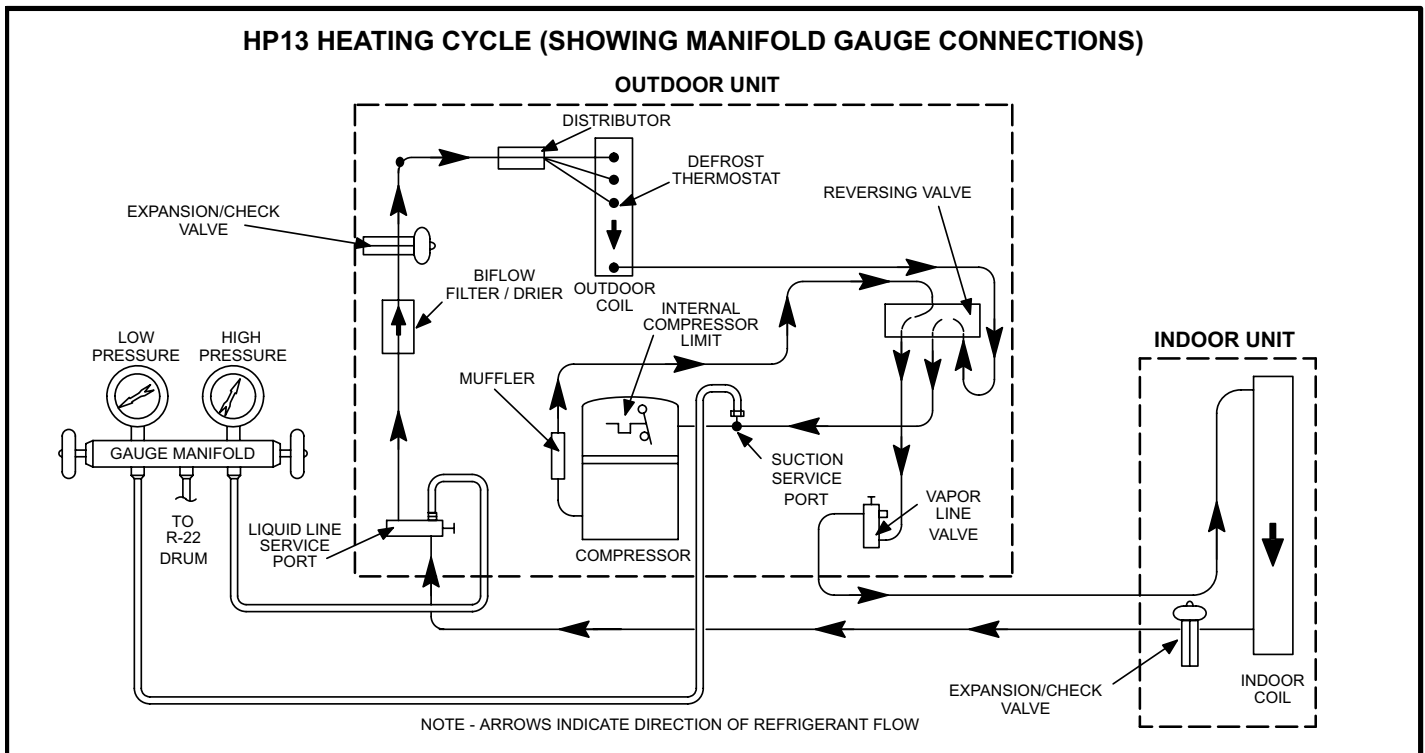
Crankcase heater prevents migration of liquid refrigerant into compressor and ensures proper compressor lubrication. The heaters are standard on the XP-042, -048 and -060 and an option for all other models.

### III - REFRIGERANT SYSTEM

Refer to figure 11 and 12 for refrigerant flow in the heating and cooling modes. The reversing valve is energized during cooling demand and during defrost.



**FIGURE 11**



**FIGURE 12**

## A - Plumbing

Field refrigerant piping consists of liquid and vapor lines from the outdoor unit (sweat connections). Use Lennox L15 (sweat) series line sets as shown in table 2.

**TABLE 2**

Refrigerant Line Sets					
Model	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

## B - Service Valves

### ⚠ IMPORTANT

Only use Allen wrenches of sufficient hardness (50Rc - Rockwell Harness Scale min). 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.

Service valves (figures 13 and 14) 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.

### 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 - 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.*

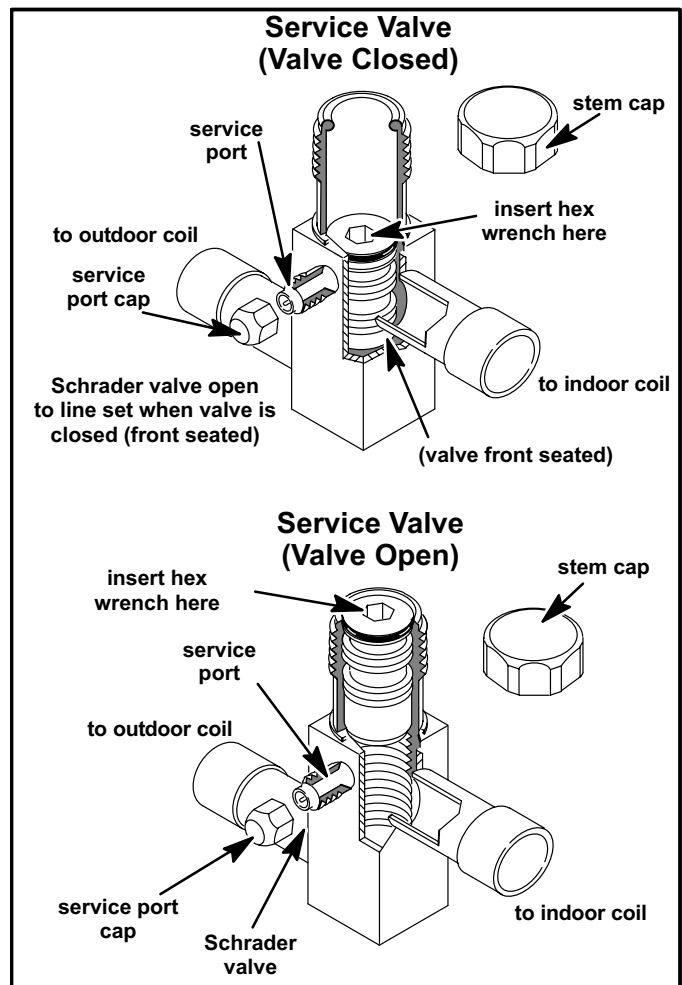
- 3 - Replace the stem cap. Tighten finger tight, then tighten an additional 1/6 turn.

### To Close Service Valve:

- 1 - Remove the stem cap with an adjustable wrench.
- 2 - 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.



**FIGURE 13**

### Vapor Line Ball Valve – 5 Ton Only

Vapor line service valves function the same way as the other valves, the difference is in the construction. If a valve has failed, you must replace it. A ball valve is illustrated in figure 14.

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.

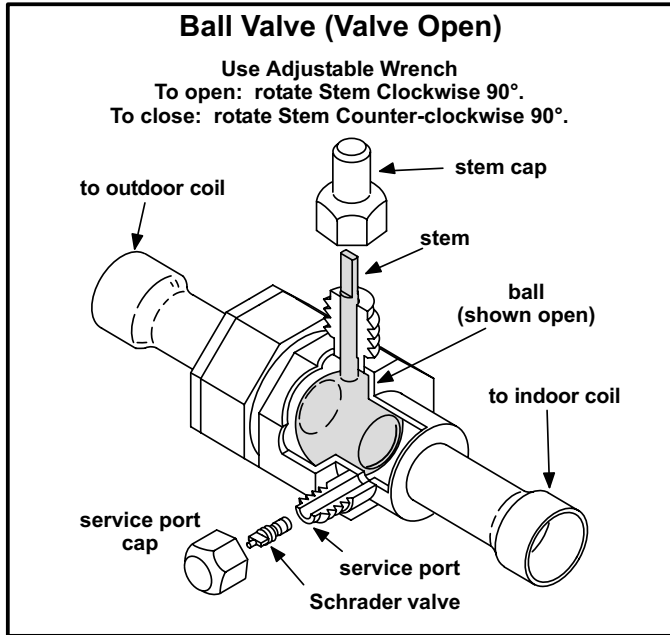


FIGURE 14

## IV - CHARGING

### 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.

## ⚠ WARNING

Refrigerant can be harmful if it is inhaled. Refrigerant must be used and recovered responsibly.

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

## ⚠ WARNING



**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 or Halide

- 1 - Connect a cylinder of R-22 to the center port of the manifold gauge set.
- 2 - With both manifold valves closed, open the valve on the R-22 cylinder (vapor only).
- 3 - Open the high pressure side of the manifold to allow the R-22 into the line set and indoor unit. Weigh in a trace amount of R-22. [A trace amount is a maximum of 2 ounces (57 g) or 3 pounds (31 kPa) pressure.] Close the valve on the R-22 cylinder and the valve on the high pressure side of the manifold gauge set. Disconnect the R-22 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-22 mixture. Correct any leaks and recheck.

### B - Evacuating the System

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 10,000 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 hose. Open the manifold gauge valves to break the vacuum in the line set and indoor unit. Close the manifold gauge valves.

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-22 cylinder and remove the manifold gauge set.

## 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-22 refrigerant. Open the manifold gauge valves to break

## C - Charging

The unit is factory charged with the amount of HCFC-22 refrigerant indicated on the unit rating plate. This charge is based on a matching indoor coil and outdoor coil with a 15 foot (4.6 m) line set. For varying lengths of line set, refer to table 3 for refrigerant charge adjustment.

**TABLE 3**

Refrigerant Charge per Line Set Lengths	
Liquid Line Set Diameter	Oz. per 5 ft. (g per 1.5m) adjust from 15 ft. (4.6m) line set*
3/8 in. (9.5mm)	3 ounce per 5 ft. (85g per 1.5m)
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.	

The outdoor unit should be charged during warm weather. However, applications arise in which charging must occur in the colder months. *The method of charging is determined by the unit's refrigerant metering device and the outdoor ambient temperature.*

Measure the liquid line temperature and the outdoor ambient temperature as outlined below:

1. Close manifold gauge set valves. Connect the manifold gauge set to the service valves.
  - low pressure gauge to *vapor* valve service port

- high pressure gauge to *liquid* valve service port
2. Connect the center manifold hose to an upright cylinder of HCFC-22.
  3. Set the room thermostat to call for heat. This will create the necessary load for properly charging the system in the cooling cycle.
  4. Use a digital thermometer to record the outdoor ambient temperature.
  5. When the heating demand has been satisfied, switch the thermostat to cooling mode with a set point of 68°F (20°C). When pressures have stabilized, use a digital thermometer to record the liquid line temperature.
  6. The outdoor temperature will determine which charging method to use. Proceed with the appropriate charging procedure.

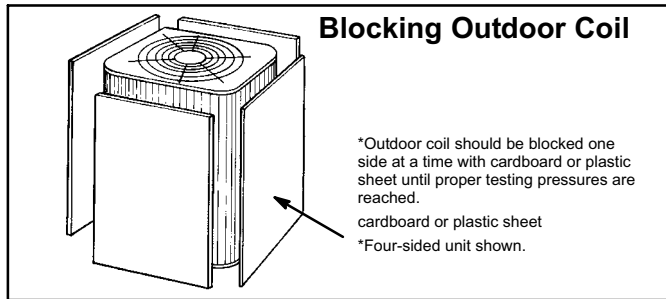
### Charge using the Weigh-In Method - Outdoor Temperature < 65°F (18°C)

If the system is void of refrigerant, or if the outdoor ambient temperature is cool, first, locate and repair any leaks and then weigh in the refrigerant charge into the unit.

1. Recover the refrigerant from the unit.
2. Conduct leak check; evacuate as previously outlined.
3. Weigh in the unit nameplate charge. If weighing facilities are not available or if charging the unit during warm weather, use one of the following procedures.

### Charge using the Subcooling Method - Outdoor Temperature < 65°F (18°C)

When the outdoor ambient temperature is below 65°F (18°C), 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 200-250 psig (1379-1724 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 200-250 psig (1379-1724 kPa) range. See figure 15.



**FIGURE 15**

1. With the manifold gauge hose still on the liquid service port and the unit's pressure stabilized, use a digital thermometer to record the liquid line temperature.
2. At the same time, record the liquid line pressure reading.
3. Use a temperature/pressure chart for HCFC-22 to determine the saturation temperature for the liquid line pressure reading.
4. Subtract the liquid line temperature from the saturation temperature (according to the chart) to determine subcooling.
5. Compare the subcooling value results with those in table 4. If subcooling is greater than shown, recover some refrigerant. If subcooling is less than shown, add some refrigerant.

**TABLE 4**

HP13 Subcooling Values								
—	—	—	—	—	—	—	—	
—	—	—	—	—	—	—	—	
=	—	—	—	—	—	—	—	
	°	°	°	°	°	°	°	
	Saturation Temperature	Liquid Line Temperature	Subcooling Value					
	°F (°C)							
Model	-018	-024	-030	-036	-042	-048	-060	
°F (°C)*	6 (3.3)	11 (6)	8 (4.4)	6 (3.3)	6 (3.3)	4 (2.2)	9 (5)	
NOTE - For best results, use the same electronic thermometer to check both outdoor-ambient and liquid-line temperatures. *F: +/-1.0°; C: +/-0.5°								

### Charge using the Approach Method - Outdoor Temperature ≥ 65°F (18°C)

The following procedure is intended as a general guide and is for use on expansion valve systems only. 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 and operate unit for several minutes to allow system pressures to stabilize.
3. Compare stabilized pressures with those provided in table 6, "Normal Operating Pressures." 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.
4. Use the same digital thermometer used to check outdoor ambient temperature to check liquid line temperature. Verify the unit charge using the approach method.
5. The difference between the ambient and liquid temperatures should match the approach values given in table 5. If the values do not agree with the those in table 5, add refrigerant to lower the approach temperature or recover refrigerant from the system to increase the approach temperature.

**TABLE 5**

HP13 Approach Values								
—	—	—	—	—	—	—	—	
—	—	—	—	—	—	—	—	
=	—	—	—	—	—	—	—	
	°	°	°	°	°	°	°	
	Liquid Line Temperature	Outdoor Temperature	Approach Temperature					
	°F (°C)							
Model	-018	-024	-030	-036	-042	-048	-060	
°F (°C)*	7 (3.9)	8 (4.4)	9 (5)	13 (7.2)	7 (3.9)	9 (5)	6 (3.3)	
NOTE - For best results, use the same electronic thermometer to check both outdoor-ambient and liquid-line temperatures. *F: +/-1.0°; C: +/-0.5°								

**⚠ IMPORTANT**

**Use table 6 as a general guide when performing maintenance checks. This is not a procedure for charging the unit (Refer to Charging / Checking Charge section). 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.**

TABLE 6

HP13 Normal Operating Pressures - Liquid $\pm 10$ & Vapor $\pm 5$ PSIG*							
	HP13-018	HP13-024	HP13-030	HP13-036	HP13-042	HP13-048	HP13-060
$^{\circ}\text{F}$ ( $^{\circ}\text{C}$ )**	Liquid / Vapor	Liquid / Vapor	Liquid / Vapor	Liquid / Vapor	Liquid / Vapor	Liquid / Vapor	Liquid / Vapor
<b>Cooling</b>							
65 (18)	141 / 81	148 / 80	146 / 78	154 / 78	139 / 67	146 / 75	139 / 74
75 (24)	163 / 82	176 / 82	171 / 79	180 / 80	163 / 74	171 / 77	164 / 77
85 (29)	191 / 84	206 / 83	201 / 80	216 / 81	191 / 81	198 / 78	193 / 78
95 (35)	222 / 85	240 / 84	233 / 81	246 / 81	220 / 84	229 / 79	230 / 79
105 (41)	256 / 87	277 / 86	271 / 81	284 / 82	256 / 85	268 / 81	262 / 82
115 (45)	296 / 89	322 / 87	313 / 83	328 / 85	294 / 87	308 / 81	300 / 84
<b>Heating</b>							
50(10)	192 / 64	185 / 60	198 / 58	196 / 58	204 / 59	197 / 39	213 / 58
40 (4)	180 / 53	176 / 50	188 / 47	185 / 47	195 / 49	189 / 31	200 / 46
30 (-1)	172 / 43	165 / 49	175 / 35	176 / 37	184 / 39	181 / 25	189 / 37
20 (-7)	164 / 34	162 / 31	163 / 26	170 / 30	178 / 32	175 / 18	177 / 32
*These are most-popular-match-up pressures. Indoor match up, indoor air quality, and indoor load cause pressures to vary.							
**Temperature of the air entering the outside coil.							

**V - MAINTENANCE**

In order to maintain the warranty on this equipment, the HP13 system must be serviced annually and a record of service maintained. The following should be checked between annual maintenance:

**A - Outdoor Unit**

- 1 - Clean and inspect the outdoor coil. The coil may be flushed with a water hose. Ensure the power is turned off before you clean the coil.
- 2 - Condenser 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 condenser fan motor.

Unit nameplate \_\_\_\_\_ Actual \_\_\_\_\_ .

*NOTE - If owner complains of insufficient cooling, the unit should be gauged and refrigerant charge checked. Refer to section on refrigerant charging in this instruction.*

- 1 - Clean and inspect condenser coil. (Coil may be flushed with a water hose after disconnecting power).
- 2 - Visually inspect all connecting lines, joints and coils for evidence of oil leaks.

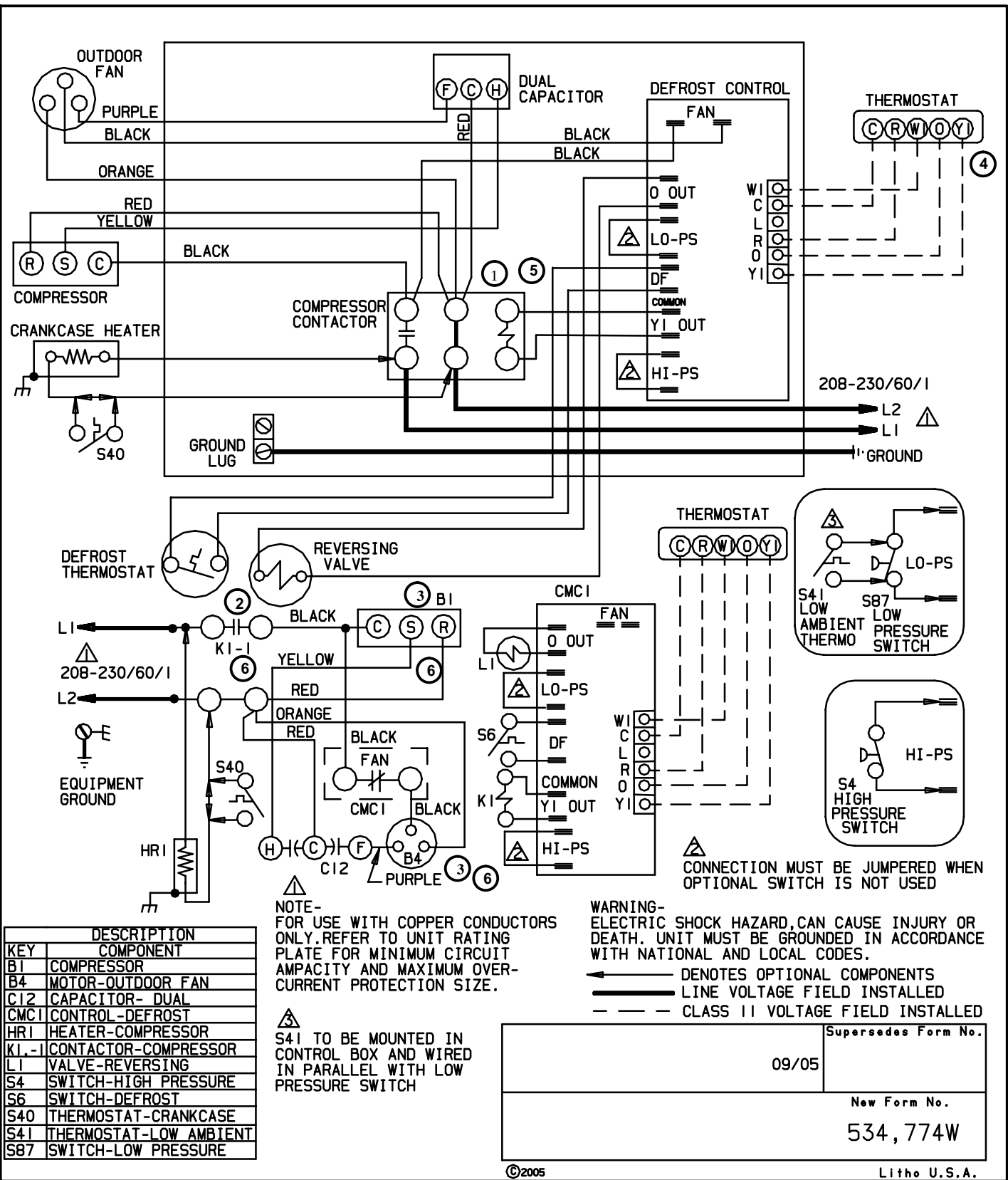
**B - Indoor Coil**

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

**C - Indoor Unit**

- 1 - Clean or change filters.
- 2 - 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.
- 3 - *Belt Drive Blowers* - Check belt for wear and proper tension.
- 4 - Check all wiring for loose connections
- 5 - Check for correct voltage at unit (blower operating).
- 6 - Check amp-draw on blower motor  
Unit nameplate \_\_\_\_\_ Actual \_\_\_\_\_ .

# VI - WIRING DIAGRAM AND SEQUENCE OF OPERATION



## HP13 OPERATING SEQUENCE

This is the sequence of operation for HP13 series units. The sequence is outlined by numbered steps which correspond to circled numbers on the adjacent diagram.

*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:

Indoor room thermostat wiring energizes terminal O by cooling mode selection, energizing the reversing valve L1. Cooling demand initiates at Y1 in the thermostat.

- 1 - 24VAC energizes compressor contactor K1 (assuming the 5 minute delay built in the defrost board is complete).
- 2 - K1-1 N.O. closes, energizing compressor (B1) and outdoor fan motor (B4).
- 3 - Compressor (B1) and outdoor fan motor (B4) begin immediate operation.

### END OF COOLING DEMAND:

- 4 - Cooling demand is satisfied. Terminal Y1 is de-energized. .
- 5 - Compressor contactor K1 is de-energized. The defrost board 5 minute time delay cycle begins.
- 6 - K1-1 opens and compressor (B1) and outdoor fan motor (B4) are de-energized and stop immediately. Terminal O is de-energized when indoor room thermostat is out of cooling mode, de-energizing the reversing valve L1.

Heating demand initiates at Y1 in the thermostat.

### FIRST STAGE HEATING:

See steps 1, 2 and 3.

### END OF HEATING DEMAND:

See steps 4, 5, and 6.

### DEFROST MODE:

- 7 - 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 defrost thermostat (S6) temperature is above the termination temperature of 70°, the defrost time of 14 minutes has been completed, or the room thermostat demand cycle has been satisfied. If the room thermostat demand cycle terminates the cycle, the defrost cycle will be held until the next room thermostat demand cycle. If the defrost thermostat (S6) temperature is still below the termination temperature, the control will continue the defrost cycle until the cycle is terminated in one of the methods mentioned above.