LENNOX
Service Literature

UNIT INFORMATION

Corp. 1812-L3
June 25, 2019

ELP
7.5 & 10 TON

ELP SERIES HEAT PUMP UNITS

The ELP090S4S and ELP120S4S 7.5 and 10 (26.4 and 35.2 kW) ton heat pump units are designed for HFC-410A, light commercial applications, with a remotely located blower-coil unit or a furnace with an add-on evaporator coil. ELP model units are equipped with one dual speed scroll compressor. The ELP heat pumps match with the ELA blower-coil units. ELP units are all three-phase.

This manual is divided into sections which discuss the major components, refrigerant system, charging procedure, maintenance and operation sequence.

Information in this manual is intended for qualified service technicians only. All specifications are subject to change. Procedures in this manual are presented as recommendations only and do not supersede or replace local or state codes.

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 licensed professional HVAC installer or equivalent, service agency, or the gas supplier.

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.

WARNING

Electric shock hazard! - Disconnect all power supplies before servicing.

Replace all parts and panels before operating.

Failure to do so can result in death or electrical shock.

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CAUTION

As with any mechanical equipment, contact with sharp sheet metal edges can result in personal injury. Take care while handling this equipment and wear gloves and protective clothing.

SPECIFICATIONS

General Data	Model No.	ELP090S4S	ELP120S4S
	Nominal Size - Tons	7.5	10
Connections (sweat)	Liquid line - in. (o.d)	5/8	5/8
	Vapor line - in. (o.d)	1-1/8	1-1/8
Refrigerant (R-410A)	Factory Charge	R-410A holding charge (2 lbs. per circuit)	
	No. of Circuits	1	1
	[1] Field charge (25 ft. line set)	23 lbs. 4 oz. (includes holding charge)	32 lbs. 8 oz. (includes holding charge)
Compressor		(1) Two Stage Scroll	(1) Two Stage Scroll
Outdoor Coil	Net face area - sq. ft. Outer coil	29.3	34.2
	Inner coil	28.4	33.3
	Tube diameter - in. & no. of rows	3/8 - 2	3/8 - 2
	Fins per inch	20	20
Outdoor Coil Fan(s)	Diameter - in. & no. of blades	(2) 24 - 3	(2) 24 - 4
	Motor hp	(2) 1/3	(2) 1/2
	Total air volume - cfm	8300	10,300
	Rpm	1075	1075
	Motor Input - Watts	830	1130

ELECTRICAL DATA

General Data	Line voltage data - 60 hz - 3 phase	208/230V	460V	575V	208/230V	460V	575V
	[2] Maximum Overcurrent Protection (amps)	60	25	20	80	35	25
	[3] Minimum circuit ampacity	37	17	13	50	21	16
Compressor (1)	Rated load amps	26.9	12	9	34.6	14.8	11.1
	Locked rotor amps	165	94	65	240	130	93.7
Outdoor Coil Fan Motor (2) (1 phase)	Full load amps (total)	1.7 (3.4)	0.8 (1.6)	1 (2)	3 (6)	1.5 (3)	1.2 (2.4)
	Locked rotor amps (total)	4.3 (8.6)	2.4 (4.8)	1.9 (3.8)	6 (12)	3 (6)	2.9 (5.8)

NOTE - Extremes of operating range are plus and minus 10% of line voltage.
NOTE - All units have a minimum Short Circuit Current Rating (SCCR) of 5000 amps.
[1] Refer to the Lennox Refrigerant Piping Manual to determine refrigerant charge required with longer length 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.

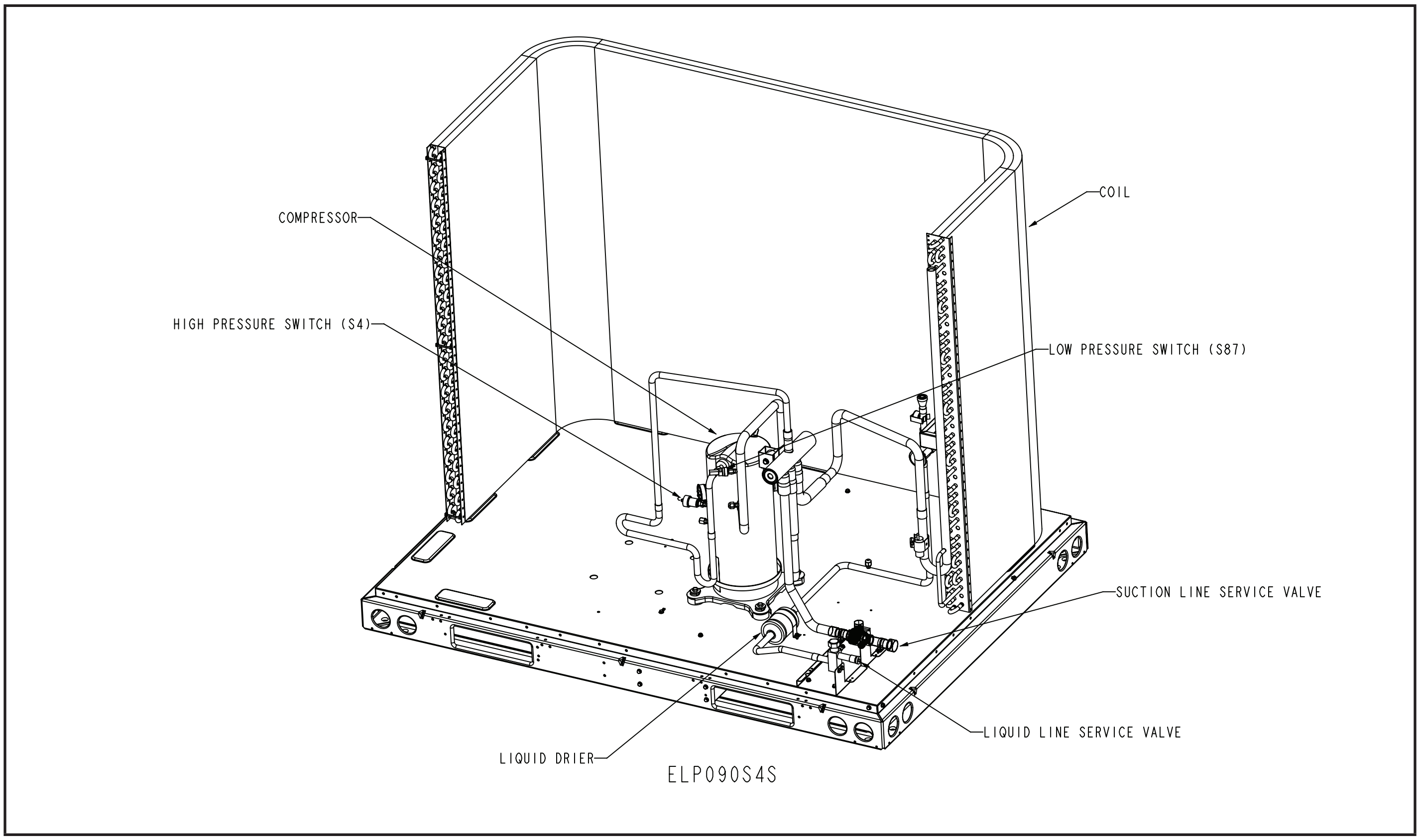
OPTIONS / ACCESSORIES

Item		Catalog No.	ELP090S4S	ELP120S4S
CABINET				
Combined Coil/Hail Guards	T2GARD51M11	**13T30**	X	
	T2GARD51M21	**13T32**		X
Corrosion Protection		Factory	O	O
CONTROLS				
BACnet® Module		**17A08**	X	X
BACnet® Sensor with Display	K0SNSR01FF1	**97W23**	X	X
BACnet® Sensor without Display	K0SNSR00FF1	**97W24**	X	X
Network Thermostat Control (NTC)	C0CTRL07AE1L	**17M10**	X	X
NTC Enclosure Kit (required with NTC Controller)	A0CTRL32LS1	**16H99**	X	X
L Connection® Building Automation System		**- - -**	X	X
Low Ambient Control (0°F)	A2CWKT04M-1-	**16F26**	X	X
ELECTRICAL				
GFI Service Outlets	15 amp non-powered, field-wired (208/230V, 460V only) LTAGFIK10/15/15	**74M70**	X	X
	20 amp non-powered, field-wired (575V only) C1GFCI20FF1	**67E01**	X	X
INDOOR AIR QUALITY				
Sensor - Wall-mount, off-white plastic cover with LCD display	C0SNSR50AE1L	**77N39**	X	X
Sensor - Wall-mount, off-white plastic cover, no display	C0SNSR52AE1L	**87N53**	X	X
Sensor - Black plastic case with LCD display, rated for plenum mounting	C0SNSR51AE1L	**87N52**	X	X
Sensor - Wall-mount, black plastic case, no display, rated for plenum mounting	C0SNSR53AE1L	**87N54**	X	X
CO_2 Sensor Duct Mounting Kit	C0MISC19AE1-	**85L43**	X	X
Aspiration Box - for duct mounting non-plenum rated CO_2 sensor (77N39)	C0MISC16AE1-	**90N43**	X	X

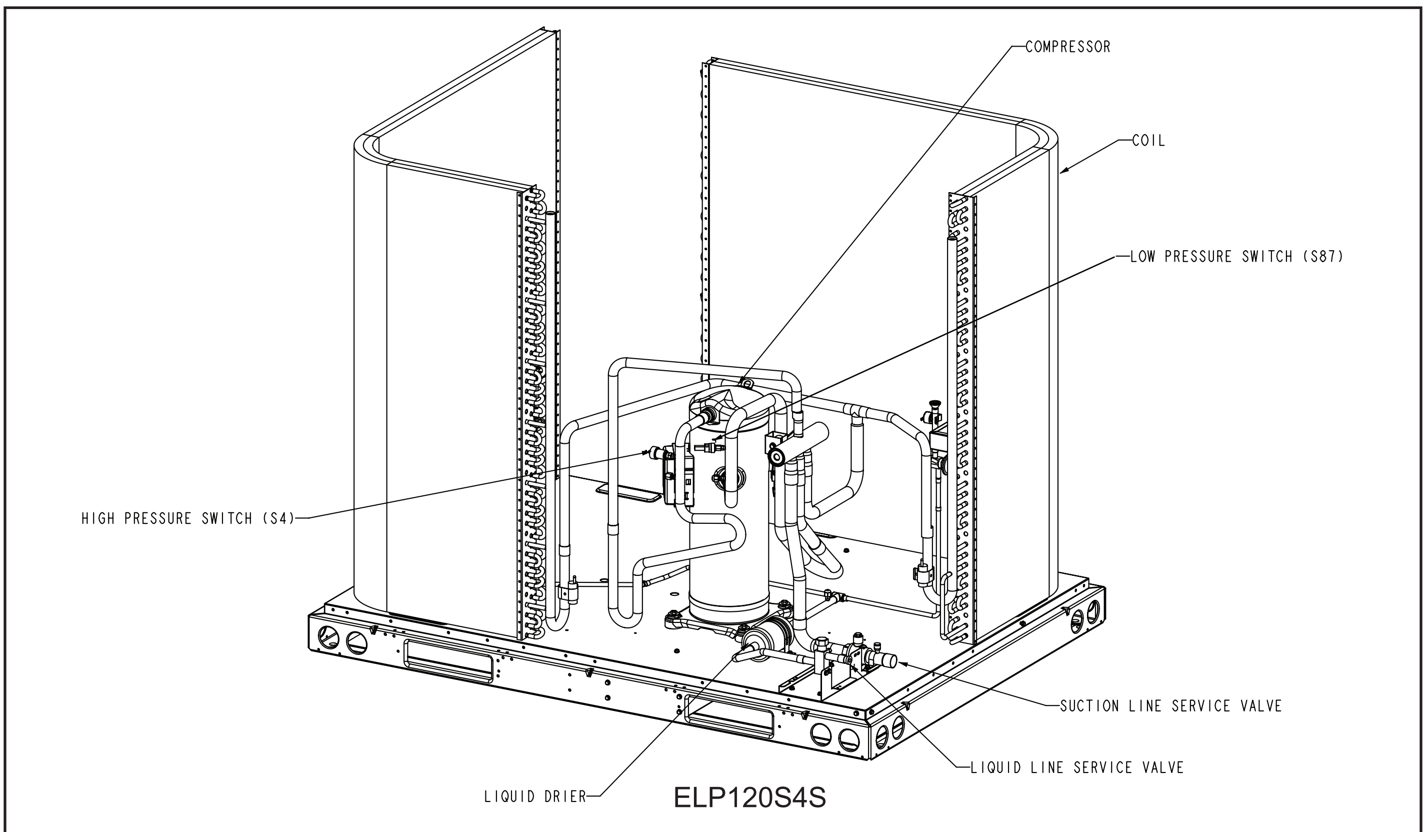
NOTE - The catalog and model numbers that appear here are for ordering field installed accessories only.
O - Factory Installed with extended lead time.
X - Field Installed

Unit Plumbing Parts Arrangement

ELP090S4S



ELP120S4S



I-UNIT COMPONENTS

The ELP090/120 components are shown in figures on page 4.

A-CONTROL BOX COMPONENTS

The ELP090/120 control box components are shown in figure 1.

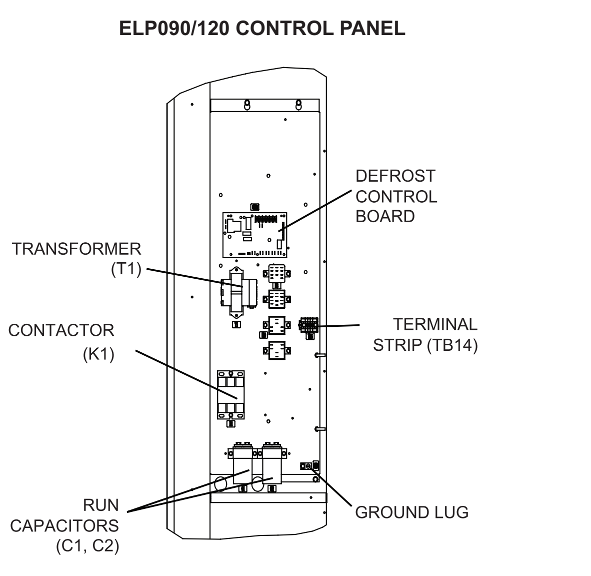


FIGURE 1

1 - Transformer T1

All ELP models use a single line voltage to 24VAC transformer mounted in the control box. Transformer T1 supplies power to control circuits in the ELP unit. The transformer is rated at 70VA and is protected by a 3.5 amp circuit breaker (CB8). CB8 is internal to the transformer. The 208/230 (Y) voltage transformers use two primary voltage taps as shown in figure 2, while 460 (G) and 575 (J) voltage transformers use a single primary voltage tap.

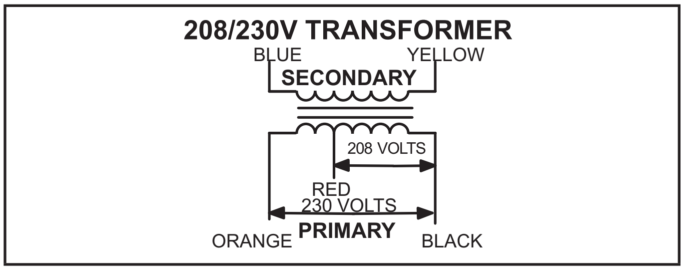


FIGURE 2

***NOTE** – 208 volt units are field wired with the red wire connected to control transformer. 230 volt units are factory wired with the orange wire connected to control transformer primary.*

2 - Outdoor Fan Capacitors C1 and C2

All ELP units use single-phase condenser fan motors. Motors are equipped with a fan run capacitor to maximize motor efficiency. Outdoor fan capacitors C1 and C2 assist in the start up of condenser fan motors B4 and B5. Capacitor ratings are on outdoor fan motor nameplates.

3 - Compressor Contactor K1 (all units)

All compressor contactors are three-pole-double break contactors with a 24V coil. K1 energizes compressor B1 in both ELP090 and ELP120 units. The contactor is energized from indoor thermostat terminal Y when thermostat demand is present.

4 - Transfer Relay K8

Transfer relay K8 ensures that the indoor blower will operate during all modes of operation. K8 also completes the circuit to Y1 on the defrost control board CMC1. When there is a demand for cooling, K8-1 closes, completing the Y1 circuit to defrost control board CMC1 terminal Y1. K8-2 normally closed contacts ensure an unbroken circuit between indoor thermostat ”G” and indoor blower contactor through terminals ”G” and ”G1” on terminal strip TB14. When there is a heat demand, normally closed K8-1 opens, breaking the Y1 circuit to the defrost control CMC1. Power is sent to the “RESET” coil on K6. K6-1 opens, de-energizing the reversing valve. K8-2 closes, sending voltage from ”G1” to the indoor blower control.

5 - Terminal Strip TB14 (all units)

TB14 terminal strip distributes 24V power from the thermostat to control box components.

6 - CMC1 Defrost System

The defrost system includes a defrost thermostat and a defrost control.

DEFROST THERMOSTAT

The defrost thermostat is located on the liquid line between the check/expansion valve and the distributor. When the defrost thermostat senses 42°F (5.5°C or cooler, its 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, time delay, diagnostic LEDs, and a terminal strip for field wiring connections.

The control provides automatic switching from normal heating operation to defrost mode and back. During compressor cycle (defrost thermostat is closed, calling 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.

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 (T1–30, T2–60, T3–90). The maximum defrost period is 14 minutes and cannot be adjusted.

NOTE – Defrost control part number is listed near the P1 timing pins. Units with defrost control **100269-04** have a factory default setting of 90 minutes.

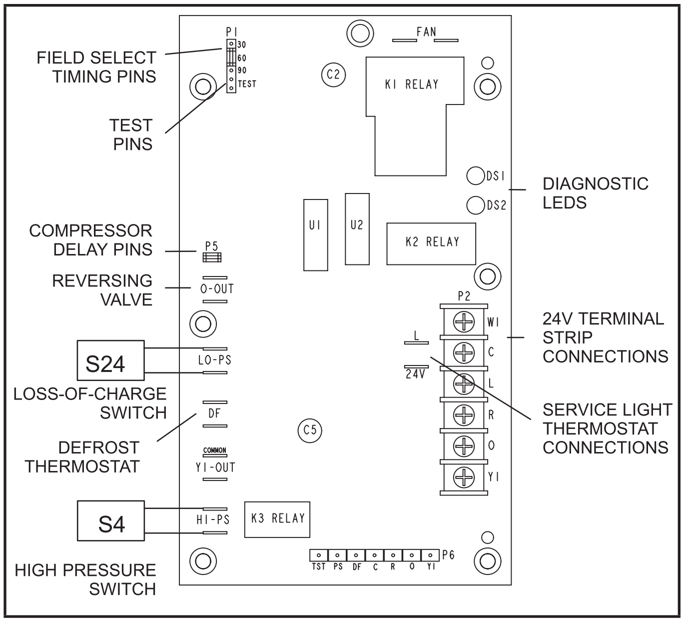


FIGURE 3

A TEST option is provided for troubleshooting. **The TEST mode may be started any time the unit is operating 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 reapplied.

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

***NOTE** – The 30-second compressor feature is ignored when jumper is installed on TEST pins.*

TIME DELAY

The timed-off delay is five minutes long. The delay helps 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.

***NOTE** – The board must have a thermostat demand for the bypass function.*

PRESSURE SWITCH CIRCUITS

The defrost control includes two pressure switch circuits. The factory-installed high pressure switch (S4) wires are connected to the board's HI PS terminals (figure 3). The board also includes LO PS terminals to accommodate a field-provided low (or loss-of-charge) pressure switch.

During a single thermostat cycle, the defrost control will lock out the unit after the fifth time that the circuit is interrupted by any pressure switch that is wired to the control board. In addition, the diagnostic LEDs will indicate a pressure switch lockout after the fifth occurrence of an open pressure switch (see table 1). The unit will remain locked out until power is broken then remade to the control or until the jumper is applied to the TEST pins for 0.5 seconds.

NOTE** – The defrost control board ignores input from the loss_of-charge switch terminals 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.* ***If the TEST pins are jumpered and the 5-minute delay is being bypassed, the LO PS terminal signal is not ignored during the 90-second start-up period.

SERVICE LIGHT CONNECTION

The defrost control board includes terminal connections for a service light thermostat which provides a signal that activates the room thermostat service light during periods of inefficient operation.

⚠ IMPORTANT

After testing has been completed, properly reposition test jumper across desired timing pins

DIAGNOSTIC LEDS

The defrost board uses two LEDs for diagnostics. The LEDs flash a specific sequence according to the diagnosis. See table 1.

TABLE 1

DS2 Green	DS1 Red	Condition
OFF	OFF	Power problem
Simultaneous Slow Flash		Normal operation
Alternating Slow Flash		5-min. anti-short cycle delay
Fault and Lockout Codes		
OFF	Slow Flash	Loss-of-Charge Fault
OFF	ON	Loss-of-Charge Lockout
Slow Flash	OFF	High Pressure Fault
ON	OFF	High Pressure Lockout
Shaded entries apply to demand boards only.		

B-COOLING COMPONENTS

⚠ 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 - Compressor

ALL ELP model units use scroll compressors. Compressor B1 operates during all cooling demand and is energized by contactor K1 upon receiving demand. See ELECTRICAL section or compressor nameplate for compressor specifications.

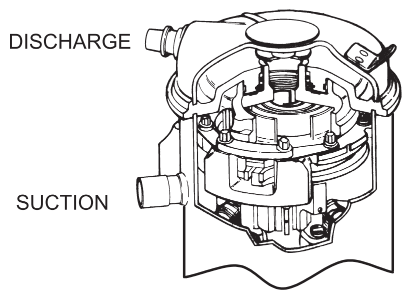


FIGURE 4

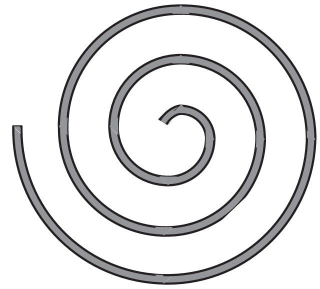


FIGURE 5

The scroll compressor design is simple, efficient and requires few moving parts. A cutaway diagram of the scroll compressor is shown in figure 4. 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 5 shows the basic scroll form. Two identical scrolls are mated together forming concentric spiral shapes (figure 6). One scroll remains stationary, while the other is allowed to "orbit" (figure 7). Note that the orbiting scroll does not rotate or turn but merely orbits the stationary scroll.

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

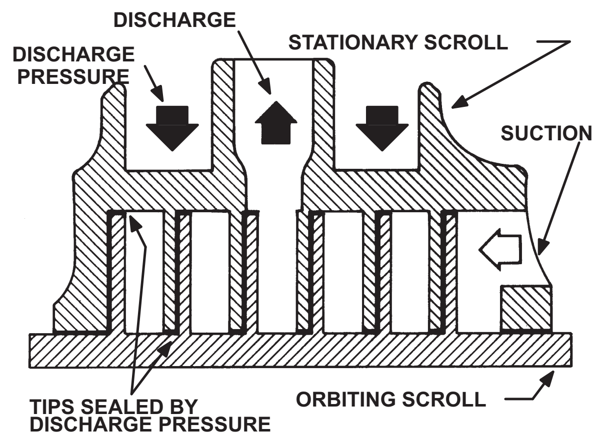


FIGURE 6

⚠ IMPORTANT

Three-phase scroll compressor noise will be significantly higher if phasing is incorrect. Compressor will operate in reverse, so unit will not provide cooling. If phasing is incorrect, disconnect power to unit and reverse any two power leads (L1 and L3 preferred) to unit.

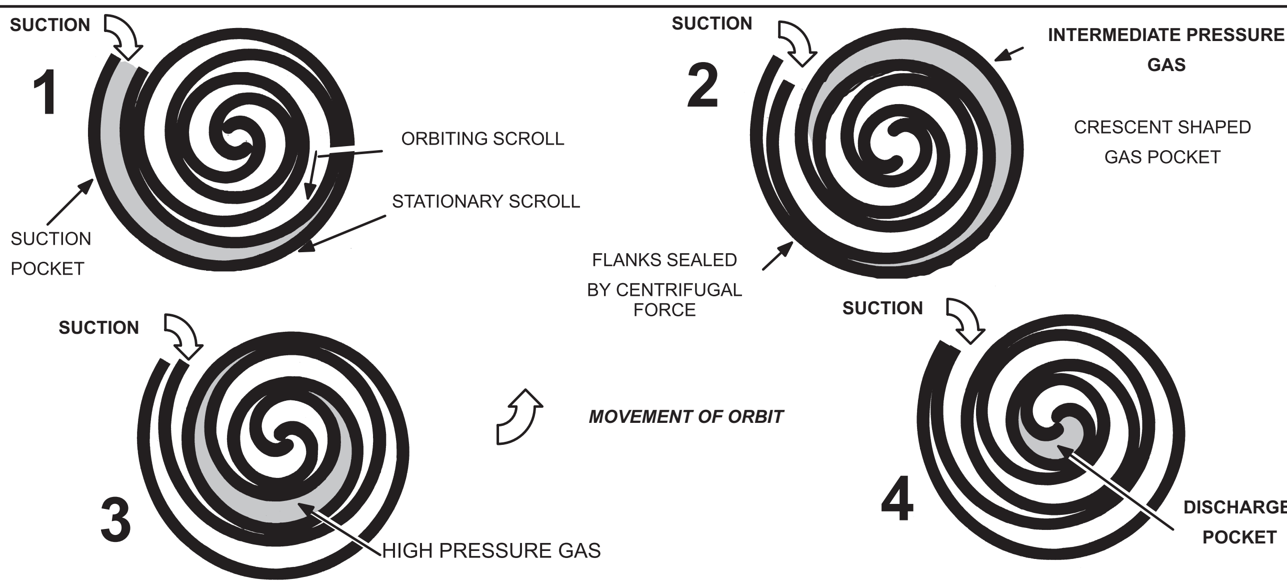


FIGURE 7

The counterclockwise orbiting scroll draws gas into the outer crescent shaped gas pocket created by the two scrolls (figure 7- 1). The centrifugal action of the orbiting scroll seals off the flanks of the scrolls (figure7-2). As the orbiting motion continues, the gas is forced toward the center of the scroll and the gas pocket becomes compressed (figure 7- 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 6). The discharge pressure forcing down on the top scroll helps seal off the upper and lower edges (tips) of the scrolls (figure 6). 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.

A 24-volt DC solenoid valve inside the compressor controls staging. When the 3-way solenoid is energized it moves the lift ring assembly to block the ports and the compressor operates at full-load or 100% capacity. When the solenoid is de-energized the lift ring assembly moves to unblock the compressor ports and the compressor operates at part-load or approximately 67% of its full-load capacity.

The “loading” and “unloading” of the two stage scroll is done “on the fly” without shutting off the single-speed compressor motor between stages.

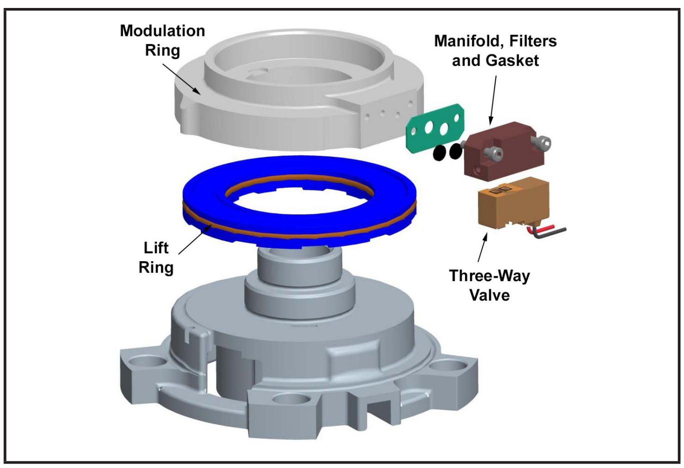


FIGURE 8. Two-Stage Scroll Compressor

2 - Two Stage Compressor Solenoid (L34) Resistance Check

Resistance check: Measure the resistance from the end of one molded plug lead to either of the two female connectors in the plug. One of the connectors should read close to zero ohms while the other should read infinity. Repeat with other wire. The same female connector as before should read zero while the other connector again reads infinity. Reverse polarity on the ohmmeter leads and repeat. The female connector that read infinity previously should now read close to zero ohms. Replace plug if either of these test methods don’t show the desired results.

3 - Crankcase Heater HR1 (all units)

All ELP series units use a belly-band type crankcase heater. Heater HR1 is wrapped around compressor B1. HR1 assures proper compressor lubrication at all times.

4 - High Pressure Switch S4

The high pressure switch is a auto-reset SPST N.C. switch which opens on a pressure rise. The switch is located on the compressor discharge line and is wired to the defrost control board CMC1. When discharge pressure rises to 450 ± 10 psig (3103 ± 69 kPa) the switch opens and the compressor is de-energized through the CMC1. The switch will close when discharge pressure drops to 300 ± 20 psig (2068 ± 138 kPA).

5 - Low Pressure Switch (S87)

The loss-of-charge switch is a auto-reset SPST N.C. switch which opens on a pressure drop. The switch is located on the suction line and is wired to the defrost control board CMC1. When suction line pressure drops to 40 psi the switch opens and the compressor is de-energized through the CMC1. The switch will close when pressure rises to 90 psi.

6 - Filter Drier (all units)

All ELP model units have a filter drier that is located in the liquid line of each refrigerant circuit at the exit of each condenser coil. The drier removes contaminants and moisture from the system.

7 - Reversing Valve L1 (all units)

A reversing valve with an electromechanical solenoid is used to reverse refrigerant flow during unit operation. L1 is energized during cooling demand and defrost. See figures on page 4.

8 - Condensor Fans B4 and B5

See page 2 for the specifications on the condenser fans used in the ELP units. All condenser fans have single-phase motors. The ELP090/120 units are equipped with two condenser fans. The fan assembly may be removed for servicing by removing the motor mounts nuts.

II- REFRIGERANT SYSTEM

A-Plumbing

Field refrigerant piping consists of liquid and vapor lines from the outdoor unit (sweat connections) to the indoor evaporator coil (sweat connections). Refer to table 2 for field-fabricated refrigerant line sizes. Refer to Lennox Refrigerant Piping manual Corp. #9351-L9 for proper size, type and application of field-fabricated lines. Separate discharge and suction service ports are provided at the compressor for connection of gauge manifold during charging procedure.

TABLE 2
REFRIGERANT LINE SIZES

ELP Unit	Liquid Line	Vapor Line
090	5/8" (16mm)	1-1/8" (29mm)
120	5/8" (16mm)	1-1/8" (29mm)

B-Service Valves

When servicing or repairing HVAC components, ensure caps and fasteners are appropriately tightened. Table 3 lists torque values for typical service and repair items.

TABLE 3
Torque Requirements

Part	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 SETS

When checking the system charge, use a manifold gauge set that features low-loss anti-blow back fittings. See figure 9 for a typical manifold gauge connection setup.

Manifold gauge sets 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 on the high side and a low side of 30" vacuum to 250 psi with dampened speed to 500 psi.

Gauge hoses must be rated for use at up to 800 psi of pressure with a 4000 psi burst rating.

OPERATING SERVICE VALVES

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

⚠ 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.

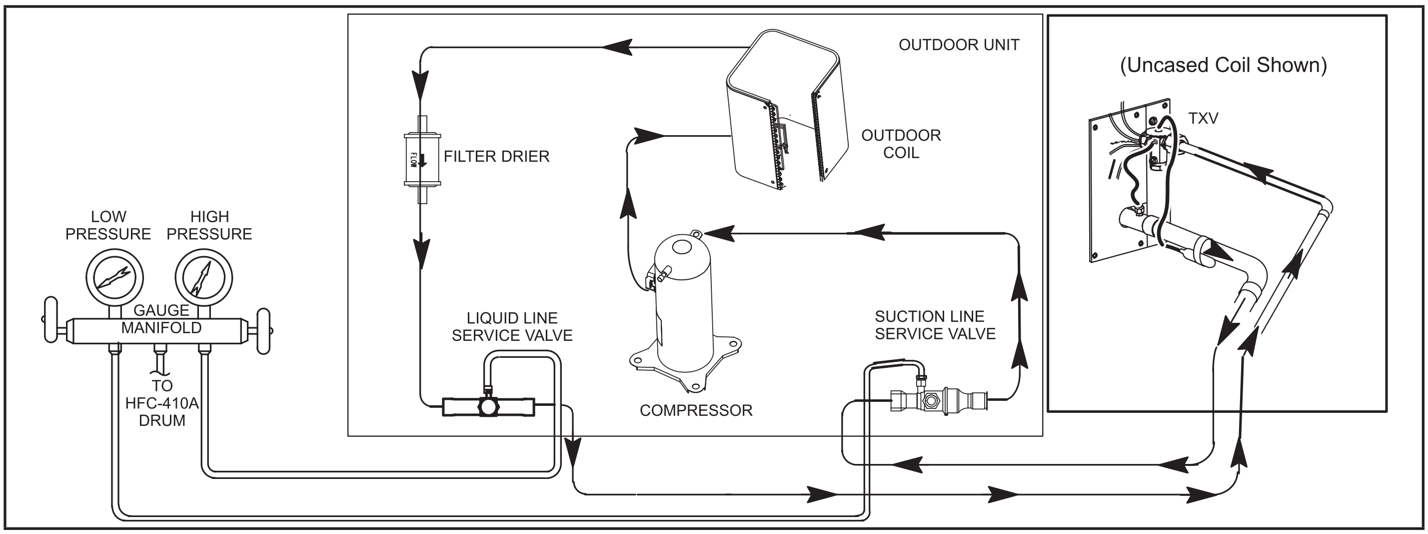


FIGURE 9

Each valve is equipped with a service port which has a factory-installed valve stem.

Cap Tightening Distances

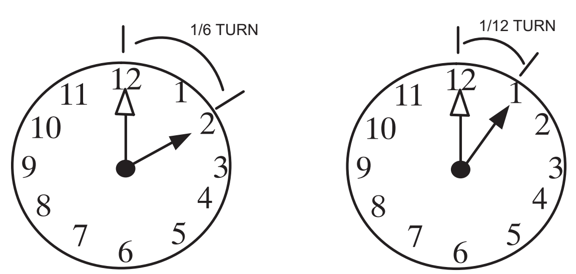


FIGURE 10

⚠ IMPORTANT

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

To Access Angle-Type 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 to the service port.

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

- *With Torque Wrench*: Finger tighten and then tighten per table 3.
- *Without Torque Wrench*: Finger tighten and use an appropriately sized wrench to turn an additional 1/6 turn clockwise as illustrated in figure 2.

To Open Liquid Line Service Valve:

1 - Remove stem cap with an adjustable wrench.

2 - Using service wrench and 5/16" hex head extension if needed (part #49A71) back the stem out counterclockwise until the valve stem just touches the retaining ring.

3 - Replace stem cap. Tighten finger tight, then tighten an additional 1/6 turn. Do not over torque.

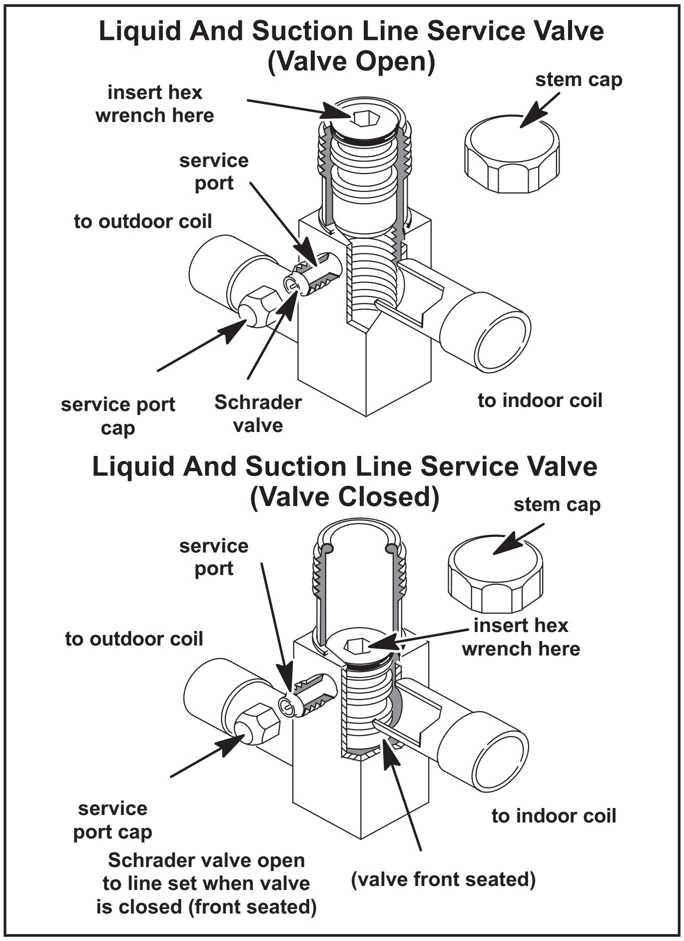


FIGURE 11

To Close Liquid Line Service Valve:

1 - Remove stem cap with an adjustable wrench.

2 - Using service wrench and 5/16" hex head extension if needed (part #49A71), turn stem clockwise to seat the valve. Tighten firmly.

3 - Replace stem cap. Tighten finger tight, then tighten an additional 1/6 turn. Do not over torque.

Service (Ball) Valve

Some ELP units are equipped with a full service ball valve, as shown in figure 12. One service port that contains a valve core is present in this valve. A cap is also provided to seal off the service port. The valve is not rebuildable so it must always be replaced if failure has occurred.

Opening the Suction Line Service Valve

1 - Remove the stem cap with an adjustable wrench.

2 - Using a service wrench, turn the stem counterclockwise for 1/4 of a turn.

3 - Replace the stem cap and tighten it firmly.

Closing the Suction Line Service Valve

1 - Remove the stem cap with an adjustable wrench.

2 - Using a service wrench, turn the stem clockwise for 1/4 of a turn.

3 - Replace the stem cap and tighten firmly.

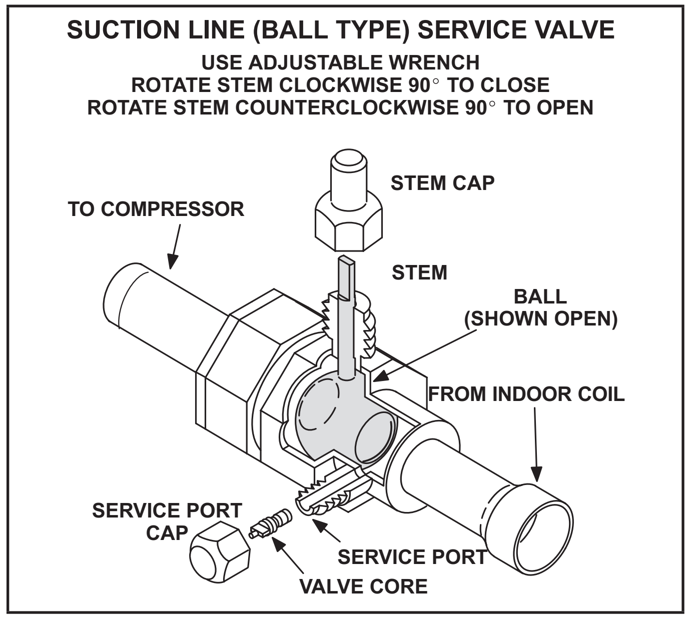


FIGURE 12

III-START-UP

Use the following procedure prior to starting up the unit for the first time.

1 - Rotate fan to check for binding.

2 - Inspect all factory- and field-installed wiring for loose connections.

3 - Open the liquid line and suction line service valves to release the refrigerant charge (contained in outdoor unit) into the system.

4 - Replace the stem caps and secure finger tight, then tighten an additional one-sixth (1/6) of a turn as illustrated in figure 9.

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 the power company and the voltage condition has been corrected.

IMPORTANT

If unit is equipped with a crankcase heater and the outdoor ambient air is 50ºF (10ºC) or below, it should be energized 24 hours before unit start-up to prevent compressor damage as a result of slugging.

6 - Set the thermostat for a cooling demand. Turn on power to the indoor blower 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 using the procedures outlined Section IV- subsection C-.

IV-CHARGING

CAUTION

ANY NITROGEN CYLINDER CONNECTED TO SYSTEM MUST HAVE A 150 PSIG MAXIMUM SETTING REGULATOR. NEVER INTRODUCE PRESSURES GREATER THAN 150 PSIG TO ANY REFRIGERANT SYSTEM.

A-Leak Testing

IMPORTANT

Leak detector must be capable of sensing HFC refrigerant.

WARNING

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

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

WARNING

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 - Connect an HFC-410A manifold gauge set as illustrated in figure 13.

2 - Open the valve on the HFC-410A cylinder (suction only).

3 - 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].*

4 - Close the valve on the HFC-410A cylinder and the valve on the high pressure side of the manifold gauge set.

5 - Disconnect the HFC-410A cylinder.

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

7 - 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.

8 - 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.

NOTE *- Amounts of refrigerant will vary with line lengths.*

9 - Check all joints for leaks.

10 - Purge dry nitrogen and HFC-410A mixture.

11 - Correct any leaks and recheck.

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

A Connect an HFC-410A manifold gauge set high pressure hose to the suction valve service port.

B With both manifold valves closed, connect the cylinder of HFC-410A refrigerant to the center port of the manifold gauge set.

C After the line set has been connected to both the indoor and outdoor units, check the line set connections and indoor unit for leaks. Use the following procedure to test for leaks:

NOTE - LATER IN THE PROCEDURE, THE HFC-410A CONTAINER WILL BE REPLACE BY THE NITROGEN CONTAINER.

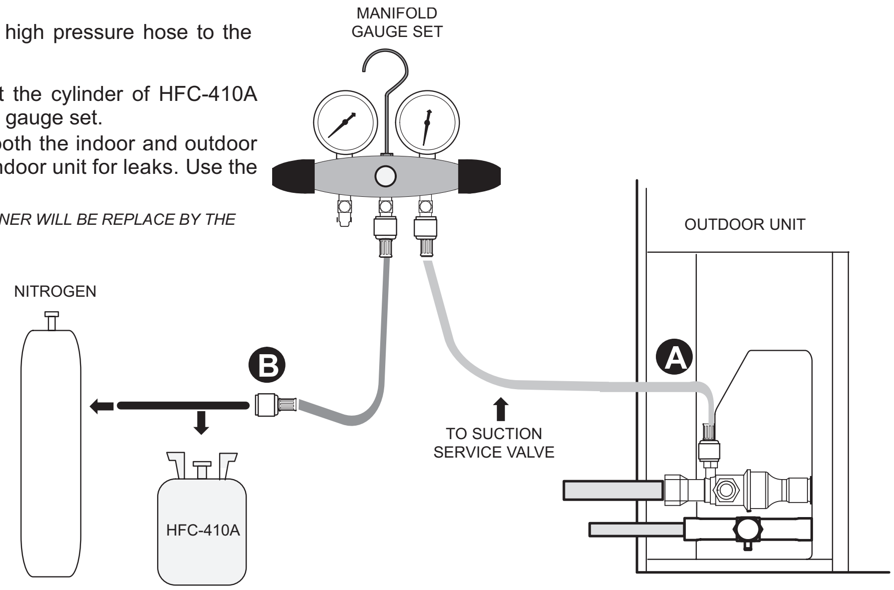


FIGURE 13

B-Evacuating the System

⚠ WARNING

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

⚠ 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.

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.

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

1 - Connect an HFC-410A manifold gauge set as illustrated in figure 14.

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

3 - Evacuate the line set and indoor unit to an **absolute pressure** of 23,000 microns (29 inches of mercury).

NOTE *- 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 pressure this 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.*

4 - When the absolute pressure reaches 23,000 microns (29 inches of mercury), close the manifold gauge valves, turn off the vacuum pump and disconnect the manifold gauge center port hose from vacuum pump. Attach the manifold center port hose to a dry nitrogen cylinder with pressure regulator set to 150 psig (1034 kPa) and purge the hose. Open the manifold gauge valves to break the vacuum in the line set and indoor unit. Close the manifold gauge valves.

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

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

7 - 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 pressure line set to break vacuum with 2 to 5 psi.

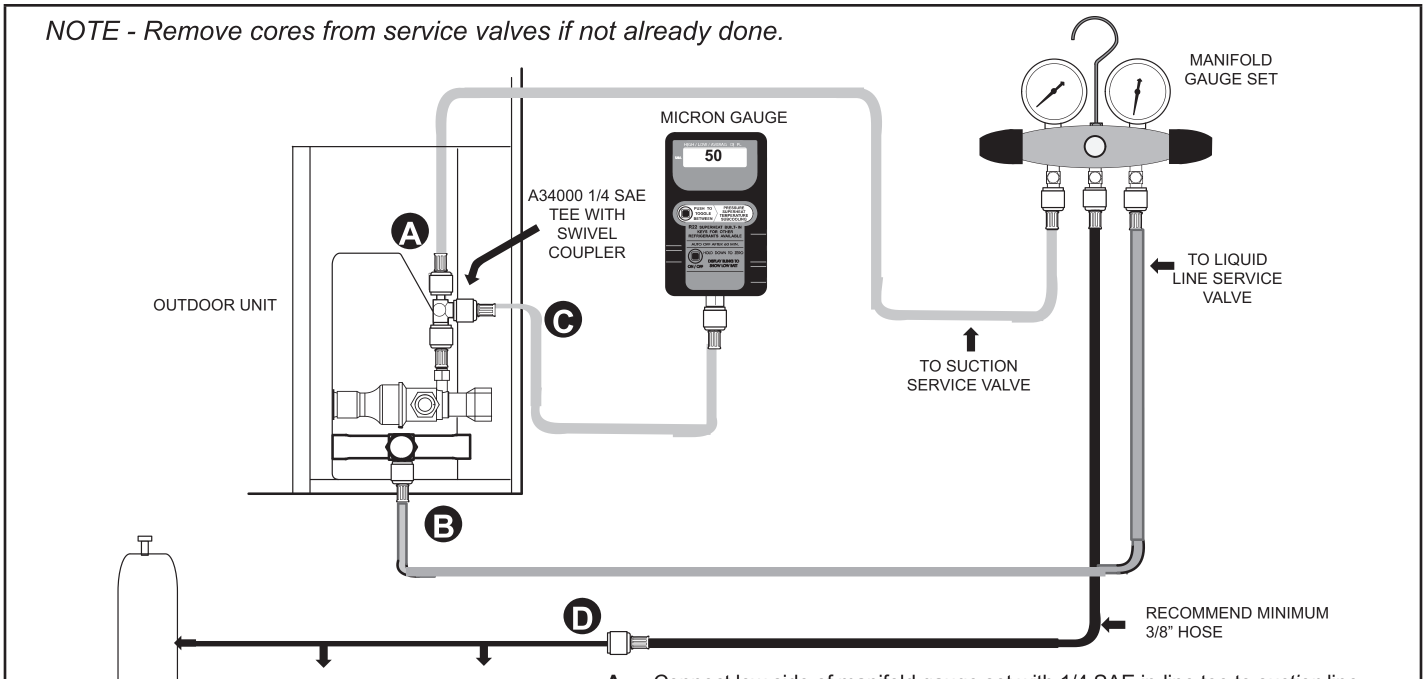
8 - Perform the following:

A - Close manifold gauge valves

B - Shut off HFC-410A cylinder

C - Reinstall service valve cores by removing manifold hose from service valve. Quickly install cores with core tool while maintaining a positive system pressure.

D - Replace the stem caps and secure finger tight, then tighten an additional one-sixth (1/6) of a turn as illustrated in figure 10.



A Connect low side of manifold gauge set with 1/4 SAE in-line tee to *suction* 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.

FIGURE 14

C-Charging

ELP units have a factory holding charge of 2 pounds of HFC-410A. Additional refrigerant will need to be added during installation (table 4).

TABLE 4. Adding Refrigerant

Models	Total lbs – Stage 1 with 25 ft line set	Liquid line diameter (inches)	Ounces adjustment per ft of liquid line	Suction line diameter (inches)	Ounces adjustment per ft of suction line
ELP090S4S	23.25	5/8	1.5	1-1/8	0.2
ELP120S4S	32.5	5/8	1.5	1-1/8	0.2

To charge the system, use the following procedure:

1 - Measure actual length of liquid and vapor lines for each circuit.

2 - Add refrigerant to each circuit based on measured liquid and suction line lengths.

A - If the measured line length is greater than 25 feet, add refrigerant (refer to table 2).

B - If the measured line length is less than 25 feet, remove refrigerant (refer to table 2).

3 - Check normal operating pressures:

A - Connect a manifold gauge set to the service valves:

- Low pressure gauge to vapor valve service port
- High pressure gauge to liquid valve service port

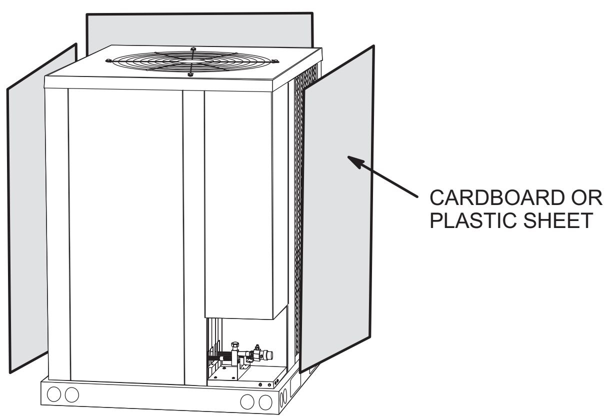
B - Operate the system until pressures and temperatures stabilize (5 minutes minimum).

C - Use a thermometer to measure the outdoor ambient temperature.

D - If the outdoor temperature is greater than 65ºF (18ºC):

- Apply the outdoor ambient temperature to tables 4 or 5 to determine normal operating pressures. Compare the normal operating pressures to the pressures obtained from the connected gauges. If liquid pressure is high, remove refrigerant from the system. If liquid pressure is low, add refrigerant to the system.
- Add or remove charge in increments.
- Allow the system to stabilize at least 5 minutes each time refrigerant is added or removed.
- 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.

4 - If the outdoor ambient temperature is below 65ºF (18ºC) it may be necessary to restrict the air flow through the outdoor coil to achieve liquid pressures in the 325-375 psig (2240-2585 kPa) range. These higher pressures are necessary for checking the charge. Block equal sections of the outdoor coil on all coil sides until the liquid pressure is in the 325-375 psig range (figure 10).



OUTDOOR COIL SHOULD BE BLOCKED ONE SIDE AT A TIME WITH CARDBOARD OR PLASTIC SHEET UNTIL PROPER TESTING PRESSURES ARE REACHED.

FIGURE 15. Blocking Outdoor Coil

A - Charge the unit using the approach method in the next section:

- Using the same thermometer, compare liquid temperature at service valve to outdoor ambient temperature.

Approach Temperature = Liquid temperature minus ambient temperature

- Approach temperature should be as indicated in tables 3 or 6 for each stage. An approach temperature greater than this value indicates an undercharge. An approach temperature less than this value indicates an overcharge.
- Add or remove charge in increments.
- Allow system to stabilize at least 5 minutes each time refrigerant is added or removed.
- Do not use the approach method if system pressures do not match pressures in table 4, 5, or 7 except when the outdoor ambient temperature is below 65ºF (18ºC).
- The approach method is not valid for grossly over or undercharged systems.

TABLE 5. HFC-410A Approach Temperatures*

Models	Approach Temperature (ºF) (+/-1)	Approach Temperature (ºC) (+/-.05)
ELP090S4S / ELA090	7.0	3.9
ELP120S4S / ELA120	6.0	3.3

*Approach temperature method valid at full load.

TABLE 6. HFC-410A Normal Operating Pressures – Cooling Mode (Liquid ±10 and Suction ±5 psig)*

Outdoor Air Temp	ELP090 / ELA090		ELP120 / ELA120		(2) ELP090 + ELA240			
	Liquid	Suction	Liquid	Suction	Stg 1 Liquid	Stg 1 Suction	Stg 2 Liquid	Stg 2 Suction
65º F (18º C)	226	119	247	132	221	137	223	134
75º F (24º C)	261	125	291	136	260	140	261	136
85º F (29º C)	303	129	333	138	304	142	305	138
95º F (35º C)	349	133	370	140	354	145	357	141
105º F (41º C)	404	135	437	142	403	147	406	143
115º F (46º C)	462	137	495	144	462	150	469	146
125º F (52º C)	525	136	562	146	526	152	538	150
SCFM	2760		4000		6125			

*pressures at 80°F dry bulb and 67°F wet bulb.

TABLE 7. HFC-410A Normal Operating Pressures – Heating Mode (Liquid ±10 and Suction ±5 psig)*

Outdoor Air Temp	ELP090 / ELA090		ELP120 / ELA120		(2) ELP090 + ELA240			
	Liquid	Suction	Liquid	Suction	Stg 1 Liquid	Stg 1 Suction	Stg 2 Liquid	Stg 2 Suction
60º F (15º C)	364	121	335	115	370	119	370	119
50º F (10º C)	343	100	322	101	350	100	350	100
40º F (4º C)	324	83	308	86	338	82	338	82
30º F (-1º C)	311	72	294	72	322	64	322	64
20º F (-6º C)	297	57	280	58	311	50	311	50
10º F (-12º C)	280	44	266	44	299	37	299	37
SCFM	2760		4000		6125			

*pressures at 70°F dry bulb entering indoor air temperature.

TABLE 8. HFC-410A Temperature (ºF) – 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		

V-MAINTENANCE

At the beginning of each cooling season, the system should be checked as follows:

⚠ WARNING

Electric Shock Hazard. Can cause injury or death. Unit must be properly 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.

OUTDOOR UNIT

1 - Clean and inspect the condensor 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 and not operating).

6 - Check amp draw on outdoor fan motor:

UNIT NAMEPLATE: _________ ACTUAL: __________

7 - Check amp draw of the compressor:

UNIT NAMEPLATE: _________ ACTUAL: __________

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

INDOOR COIL

1 - Clean coil if necessary.

2 - Check connecting lines, joints and coil for evidence of oil leaks.

3 - Check condensate line and clean if necessary.

INDOOR UNIT

1 - Clean or change filters.

2 - Adjust the blower speed for cooling. Refer to the unit information service manual for pressure drop tables and procedure.

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.

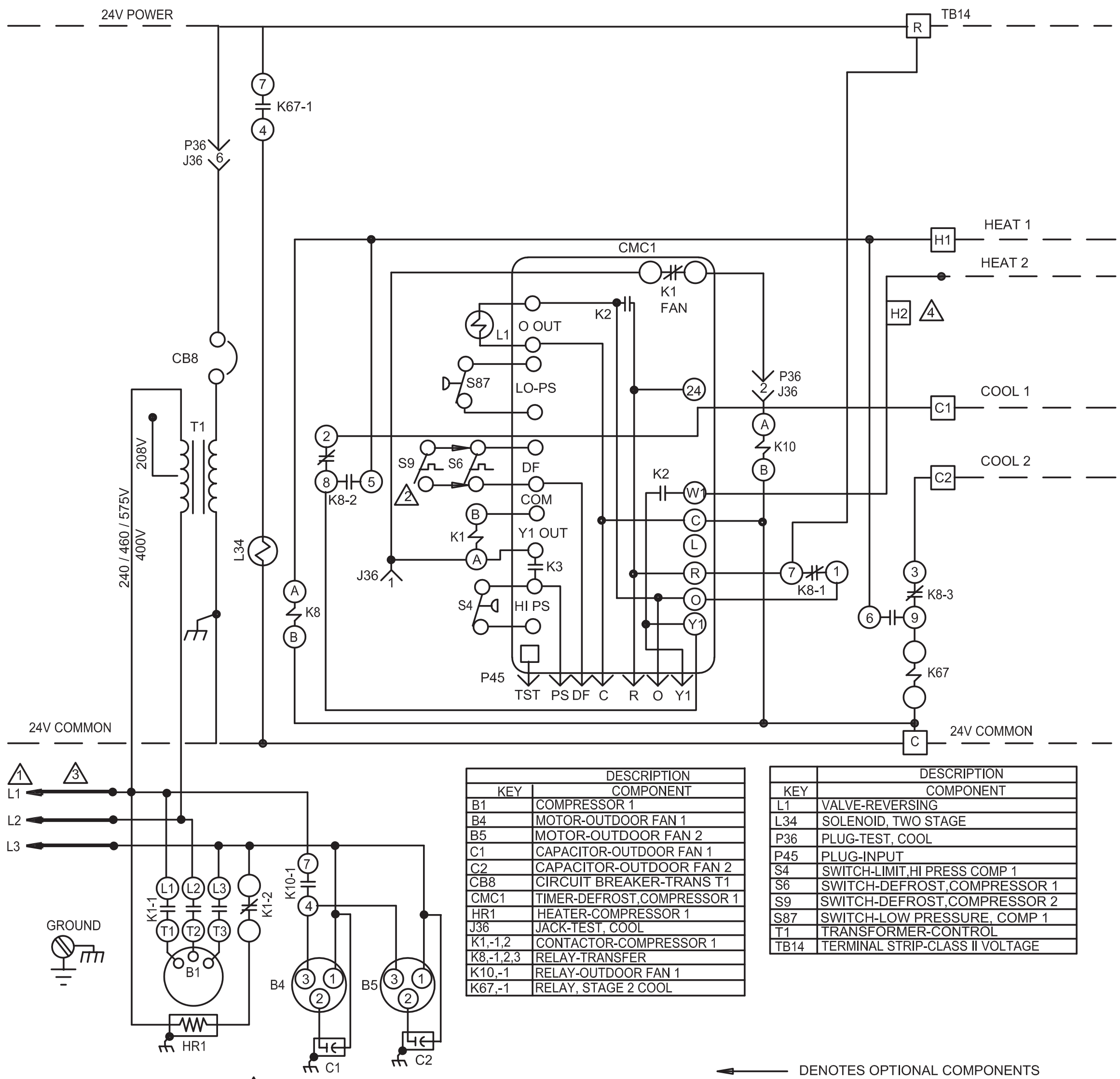
5 - Check all wiring for loose connections.

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

7 - Check amp draw on blower motor.

UNIT NAMEPLATE: _________ ACTUAL: __________

VI-Wiring Diagram and Sequence of Operation



DESCRIPTION	
KEY	COMPONENT
B1	COMPRESSOR 1
B4	MOTOR-OUTDOOR FAN 1
B5	MOTOR-OUTDOOR FAN 2
C1	CAPACITOR-OUTDOOR FAN 1
C2	CAPACITOR-OUTDOOR FAN 2
CB8	CIRCUIT BREAKER-TRANS T1
CMC1	TIMER-DEFROST,COMPRESSOR 1
HR1	HEATER-COMPRESSOR 1
J36	JACK-TEST, COOL
K1,-1,2	CONTACTOR-COMPRESSOR 1
K8,-1,2,3	RELAY-TRANSFER
K10,-1	RELAY-OUTDOOR FAN 1
K67,-1	RELAY, STAGE 2 COOL

DESCRIPTION	
KEY	COMPONENT
L1	VALVE-REVERSING
L34	SOLENOID, TWO STAGE
P36	PLUG-TEST, COOL
P45	PLUG-INPUT
S4	SWITCH-LIMIT,HI PRESS COMP 1
S6	SWITCH-DEFROST,COMPRESSOR 1
S9	SWITCH-DEFROST,COMPRESSOR 2
S87	SWITCH-LOW PRESSURE, COMP 1
T1	TRANSFORMER-CONTROL
TB14	TERMINAL STRIP-CLASS II VOLTAGE

DENOTES OPTIONAL COMPONENTS
LINE VOLTAGE, FIELD INSTALLED
CLASS II FIELD WIRING

1. REFER TO UNIT RATING PLATE FOR MINIMUM CIRCUIT AMPACITY AND MAXIMUM OVERCURRENT PROTECTION SIZE.
2. S9 IS USED ON ELP120 ONLY
3. FOR USE WITH COPPER CONDUCTORS ONLY

IF ANY WIRE IN THIS APPLIANCE IS REPLACED, IT MUST BE REPLACED WITH WIRE OF LIKE SIZE, RATING,INSULATION THICKNESS AND TERMINATION

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

DISCONNECT ALL POWER BEFORE SERVICING

4. HEAT 2 FIELD WIRING TO BE CONNECTED TO WIRE STAMPED H2 COMING FROM DEFROST CONTROL CMC1-W1

2019/03	WIRING DIAGRAM 537912-03	03/19
DUAL SPEED COMPRESSOR		
ELP-090,120-G,J,M,Y		
SECTION A5	REV. 0	
Supersedes 537912-02	New Form No. 537912-03	

SEQUENCE OF OPERATION – ELP 90 / 120

COOLING

1 - Cooling demand energizes through terminal Y1 at the indoor thermostat.

2 - Voltage passes through N.C. K8-1 to CMCI defrost control.

3 - L1 reversing valve is energized.

4 - Voltage passes through N.C. low pressure switch S87 and N.C. high pressure switch S4.

5 - Compressor contactor K1 is energized. N.O. K1-1 contacts close, energizing compressor B1.

6 - K1-1 closes energizing compressor B1 on low speed and K10-1 closes energizing outdoor fan B4 and B5 in ELS120S. K1-2 opens to de-energize crankcase heater HR1.

7 - On two speed systems, voltage passes through K67-1, energizes compressor solenoid L34, switching compressor to high speed.

HEATING

1 - Heating demand energizes through terminal W1 at the indoor thermostat.

2 - K8 transfer relay is energized. N.C. K8-1 contacts open and N.O. K8-2 contacts close, sending voltage to CMCI defrost control.

3 - L1 reversing valve is de-energized.

4 - K10 outdoor fan relay is energized. N.O. K10-1 contacts close, energizing outdoor fans B4 and B5, N.C.

5 - Compressor contactor K1 is energized. N.O. K1-1 contacts close, energizing compressor B1.K1-2 opens to de-energize crankcase heater HR1.

DEFROST MODE

During heating operation, when outdoor coil drops below 42º F, the defrost thermostat closes. If defrost thermostat remains closed at the end of 30, 60, or 90 minutes, defrost control energizes and defrost begins.

When defrost control energizes, reversing valve L1 and indoor heat relay are energized. Outdoor fan is deenergized.

Defrost continues until 14 ± 1 minutes have elapsed or until defrost pressure switch opens. When defrost pressure switch opens to terminate defrost, the defrost timer loses power and resets. Defrost timing is stopped until the next call for defrost (when defrost thermostat closes).