LENNOX® **Service Literature**

UNIT INFORMATION

Corp. 9716-L10
Revised 08-2004

LSA

LSA SERIES UNITS
(072C, 090C, 120C, 180C & 240C)

The LSA units are designed for light commercial applications, with a remotely located blower-coil unit or a furnace with an add-on evaporator coil. Capacities for the series are 6, 7-1/2, 10, 15 and 20 tons (21, 26, 35, 53, and 70 kW). All LSA model units use single-speed compressors. The 15 (53kW) and 20 ton (70kW) units each have two single speed-compressors. The LSA units match with the CB17 blower-coil units. All LSA units are three-phase.

This manual covers LSA072C-1 through 240C-1 and LSA090C-2 and 120C-2 model units. It 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 a recommendation only and do not supersede or replace local or state codes.

LSA120C-2 SHOWN

⚠WARNING

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

⚠ WARNING

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.

⚠ IMPORTANT

ALL major components (indoor blower/coil) must be matched to Lennox recommendations for compressor to be covered under warranty. Refer to Engineering Handbook for approved system matchups.

⚠ 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.

TABLE of CONTENTS

Introduction .... Page 1
Specifications / Electrical .... Page 2
Parts Arrangement .... Page 3-5
I UNIT COMPONENTS .... Page 6-13
II REFRIGERANT SYSYTEM ..... Page 13-14
III CHARGING .... Page 14-19
IV MAINTENANCE .... Page 19
V START UP .... Page 19
VI WIRING & OPERATION SEQUENCE .... Page 20-23

SPECIFICATIONS
LSAC-1

Model No.			LSA072C	LSA090C	LSA120C	LSA180C	LSA240C
Nominal Size - Tons (kW)			6 (21.1)	7.5 (26.4)	10 (35.2)	15 (52.8)	20 (70.3)
Condenser Coil	Net face area — sq. ft. (m^2)	Outer coil	12.92 (1.20)	16.35 (1.52)	29.36 (2.73) total	58.68 (5.45) total	
		Inner coil	12.59 (1.17)	15.70 (1.46)	- - - -		
	Tube diameter — in. (mm) & no. of rows		3/8 (9.5) - 2			3/8 (9.5) - 1	3/8 (9.5) - 2
	Fins per inch (m)		20 (787)		15 (630)	20 (787)	15 (630)
Condenser Fan(s)	Diameter — in. (mm) & no. of blades		(1) 24 (610) - 4		(2) 24 (610) - 3	(4) 24 (610) - 3	
	Motor hp (W)		(1) 1/2 (373)		(2) 1/3 (249)	(4) 1/3 (249)	
	Cfm (L/s) total air volume		4500 (2125)	4800 (2265)	8200 (3870)	16,000 (7550)	
	Rpm		1060		1100	1075	
	Watts		600	450	700 total	1500 total	
Refrigerant charge furnished			dry air				
Liquid line (o.d.) — in. (mm) connection (sweat)			5/8 (15.9)				
Suction line (o.d.) — in. (mm) connection (sweat)			1-1/8 (28.6)	1-3/8 (34.9)			
1 Hot Gas By-Pass (o.d.) — in. (mm) connection (sweat)			5/8 (15.9)	5/8 (15.9)	5/8 (15.9)	- - - -	- - - -
Shipping weight — lbs. (kg) 1 package			374 (170)	427 (193)	555 (251)	968 (439)	1096 (497)

1 Option.

ELECTRICAL DATA
LSAC-1

Model No.		LSA072C			LSA090C			LSA120C		
Line voltage data — 60 hz		208/230v 3ph	460v 3ph	575v 3ph	208/230v 3ph	460v 3ph	575v 3ph	208/230v 3ph	460v 3ph	575v 3ph
Compressors (1)	Rated load amps	18.6	9	7.4	24.7	10.4	8.1	34.4	13.9	11.1
	Locked rotor amps	156	75	54	164	79	63	195	98	78
Condenser Coil Fan Motor (1 phase)	Full load amps (total)	3	1.5	1.2	3	1.5	1.2	2.4 (4.8)	1.3 (2.6)	1 (2)
	Locked rotor amps (total)	6	3	2.9	6	3	2.9	4.7 (9.4)	2.4 (4.8)	1.9 (3.8)
Recommended maximum fuse or 1 circuit breaker size (amps)		40	20	15	50	20	15	80	30	25
†Minimum circuit ampacity		27	13	11	34	15	12	48	20	16

Model No.		LSA180C			LSA240C		
Line voltage data — 60 hz		208/230v 3ph	460v 3ph	575v 3ph	208/230v 3ph	460v 3ph	575v 3ph
Compressors (2)	Rated load amps - each (total)	24.7 (49.4)	10.4 (20.8)	8.1 (16.2)	34.4 (68.8)	13.9 (27.8)	11.1 (22.2)
	Locked rotor amps - each (total)	164 (328)	79 (158)	63 (126)	195 (390)	98 (196)	78 (156)
Condenser Coil Fan Motor (1 phase)	Full load amps - each (total)	2.4 (9.6)	1.3 (5.2)	1 (4)	2.4 (9.6)	1.3 (5.2)	1 (4)
	Locked rotor amps - each (total)	4.7 (18.8)	2.4 (9.6)	1.9 (7.6)	4.7 (18.8)	2.4 (9.6)	1.9 (7.6)
Recommended maximum fuse or 1 circuit breaker size (amps)		80	35	30	110	50	40
†Minimum circuit ampacity		66	29	23	87	37	29

†Refer to National or Canadian Electrical Code manual to determine wire, fuse and disconnect size requirements.
NOTE — Extremes of operating range are plus and minus 10% of line voltage.
1 HACR type (under 100 amps). U.S. only.

SPECIFICATIONS
LSAC-2 Models

Model No.			LSA090C	LSA120C
Nominal Size - Tons (kW)			7.5 (26.4)	10 (35.2)
Liquid line (o.d.) — in. (mm) connection (sweat)			5/8 (15.9)	
Suction line (o.d.) — in. (mm) connection (sweat)			1-3/8 (34.9)	
Condenser Coil	Net face area — sq. ft. (m^2)	Outer coil	16.35 (1.52)	29.36 (2.73) total
		Inner coil	15.70 (1.46)	- - - -
	Tube diameter — in. (mm) & no. of rows		3/8 (9.5) - 2	
	Fins per inch (m)		20 (787)	15 (630)
Condenser Fan(s)	Diameter — in. (mm) & no. of blades		(1) 24 (610) - 4	(2) 24 (610) - 3
	Motor hp (W)		(1) 1/2 (373)	(2) 1/3 (249)
	Cfm (L/s) total air volume		4800 (2265)	8200 (3870)
	Rpm		1060	1100
	Watts		450	700 total
Refrigerant charge			dry air holding charge	
Shipping weight — lbs. (kg) 1 package			397 (181)	516 (234)
Optional Accessories - Must Be Ordered Extra				
Hail Guards			**83K36**	**79K91**
Hot Gas Bypass Kit (hot gas bypass/superheat valve)			**79K90**	**89K84**
Hot Gas Bypass Kit (hot gas bypass valve only)			**93K77**	**93K78**

ELECTRICAL DATA
LSAC-2 Models

Model No.		LSA090C			LSA120C		
Line voltage data - 60 hz - 3 phase		208/230v	460v	575v	208/230v	460v	575v
Recommended maximum fuse or [1]circuit breaker size (amps)		60	30	25	80	40	25
†Minimum circuit ampacity		39	20	15	53	25	18
Compressor	No. of Compressors	1			1		
	Rated load amps (total)	28.8	14.7	10.8	37.8	17.2	12.4
	Locked rotor amps (total)	195	95	80	239	125	80
Condenser Coil Fan Motor (1 phase)	No. of motors	1			2		
	Full load amps (total)	3	1.5	1.2	2.4 (4.8)	1.3 (2.6)	1 (2)
	Locked rotor amps (total)	6	3	2.9	4.7 (9.4)	2.4 (4.8)	1.9 (3.8)

†Refer to National or Canadian Electrical Code manual to determine wire, fuse and disconnect size requirements.
NOTE — Extremes of operating range are plus and minus 10% of line voltage.
[1]HACR type (under 100 amps). U.S. only.

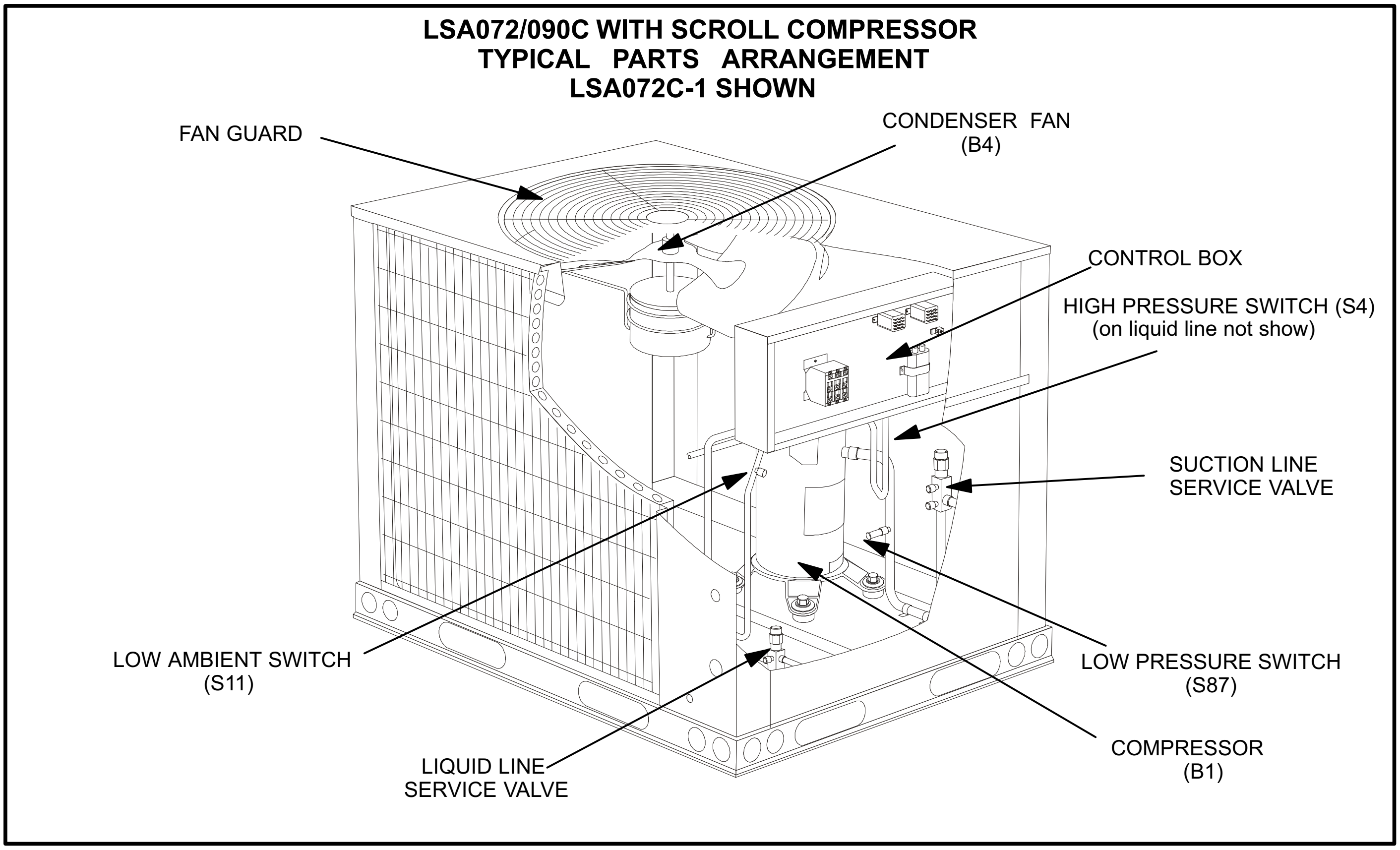


FIGURE 1

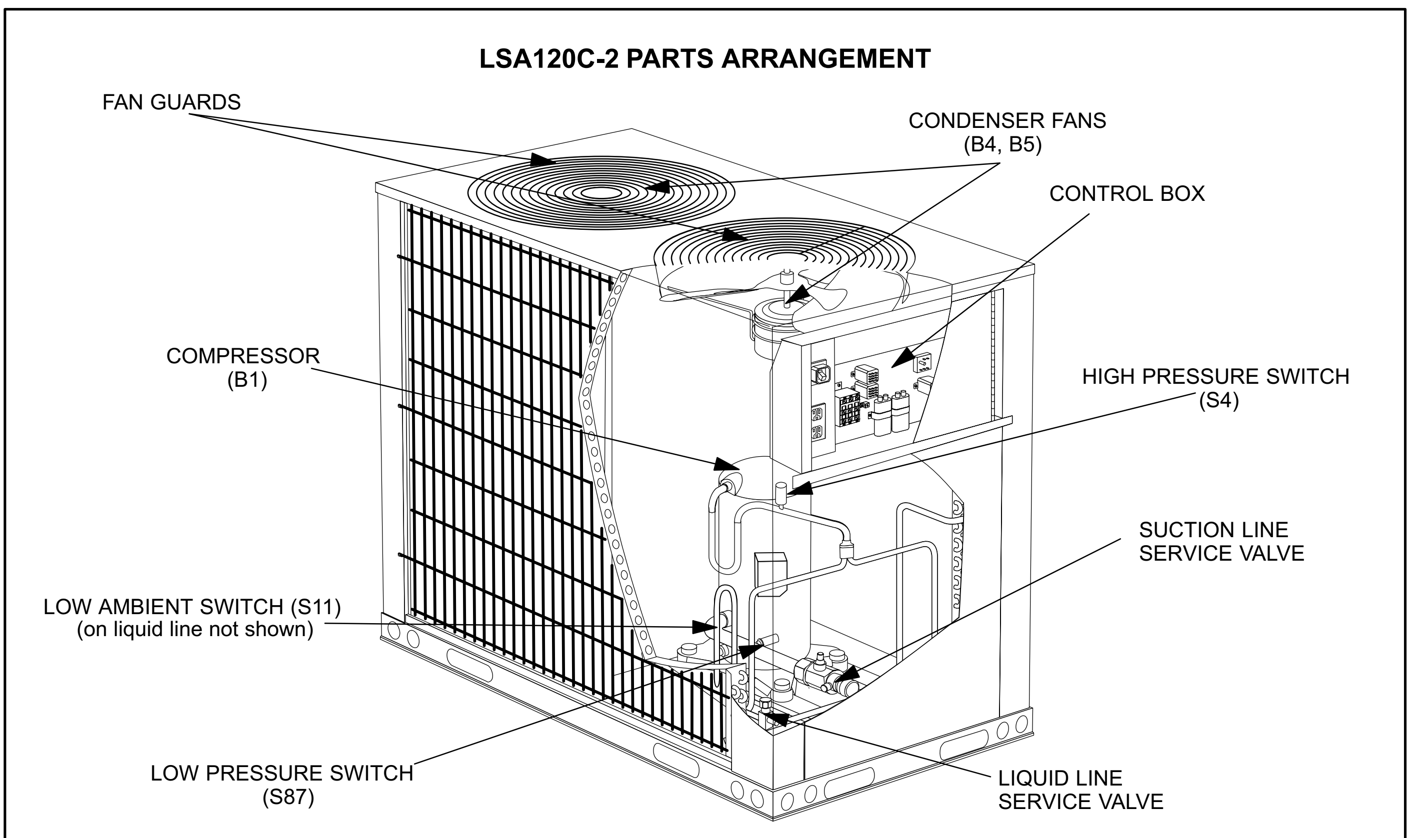


FIGURE 2

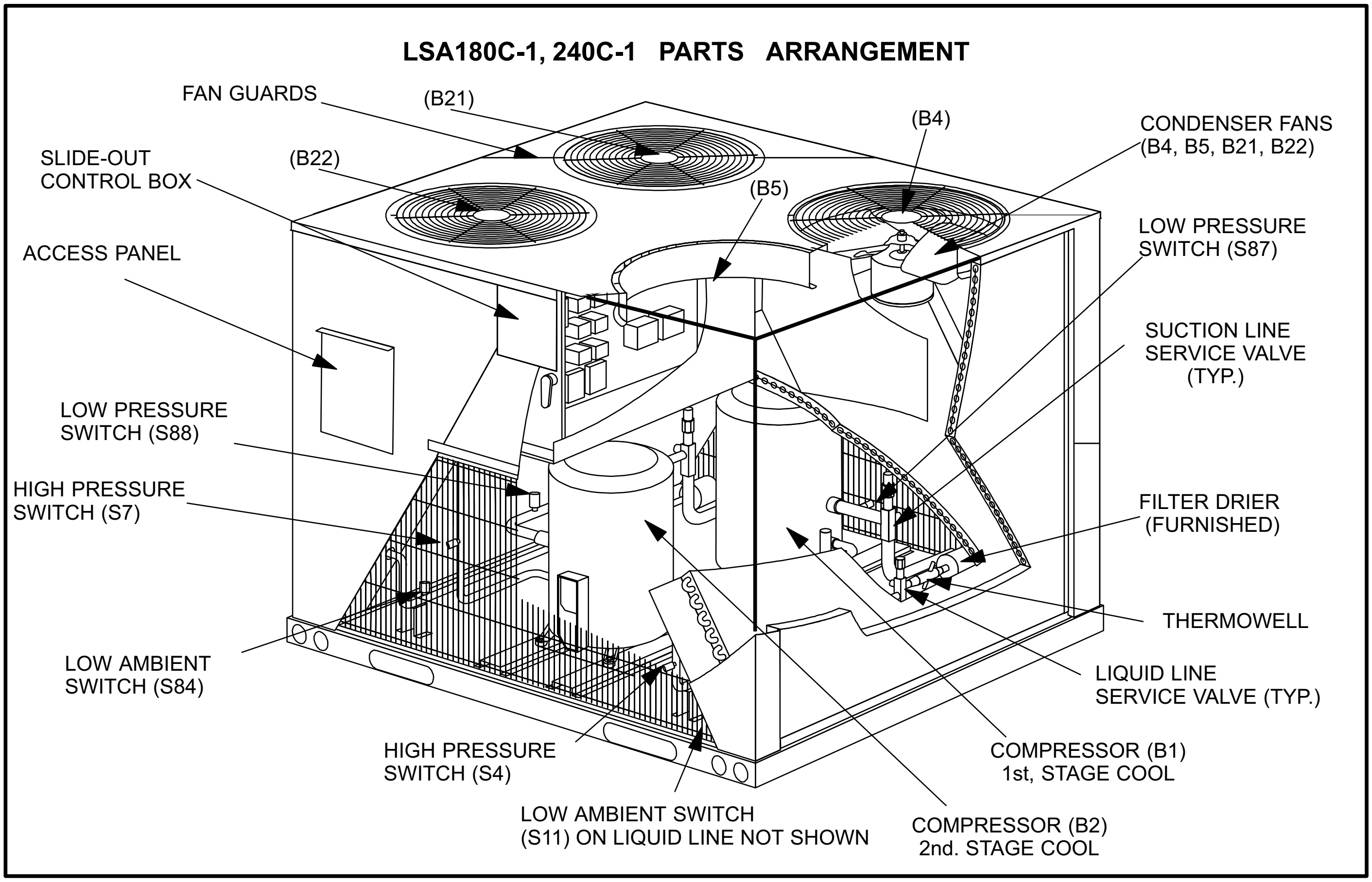


FIGURE 3

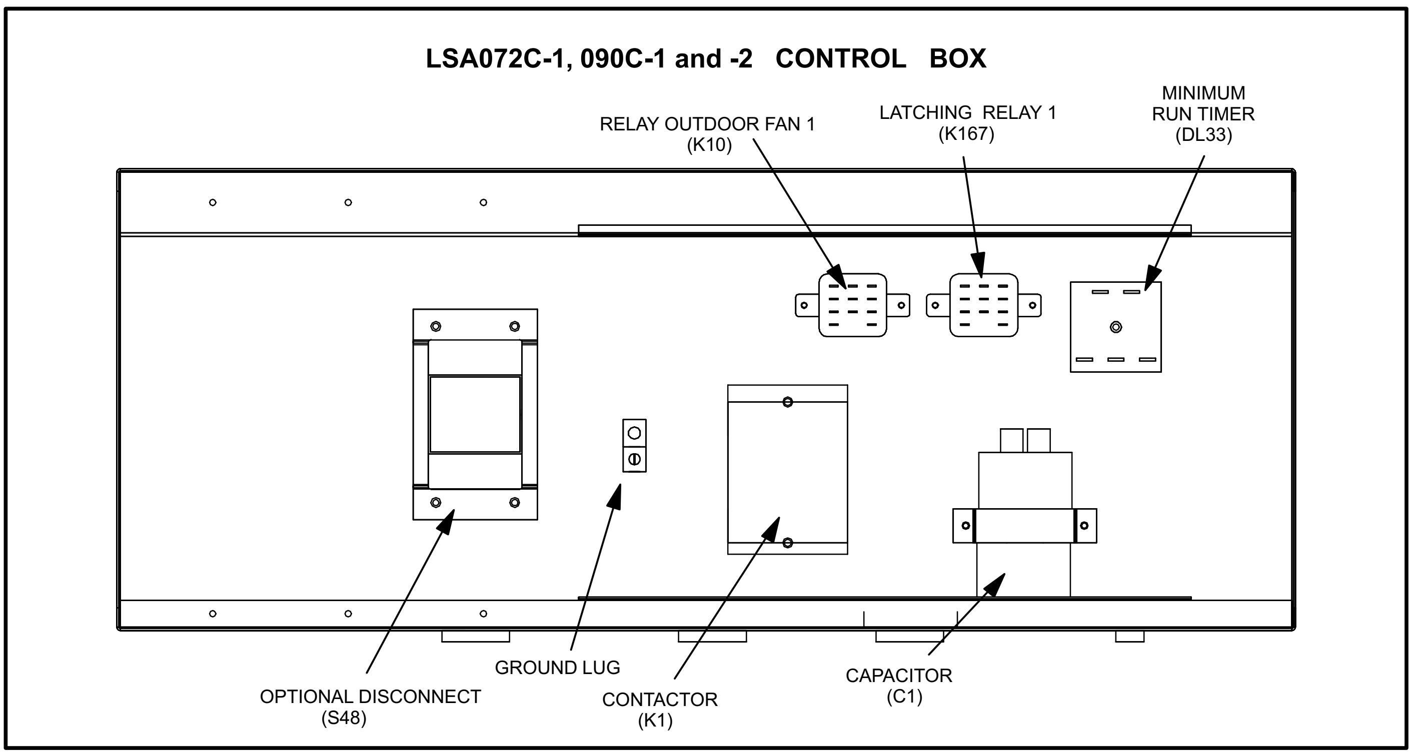


FIGURE 4

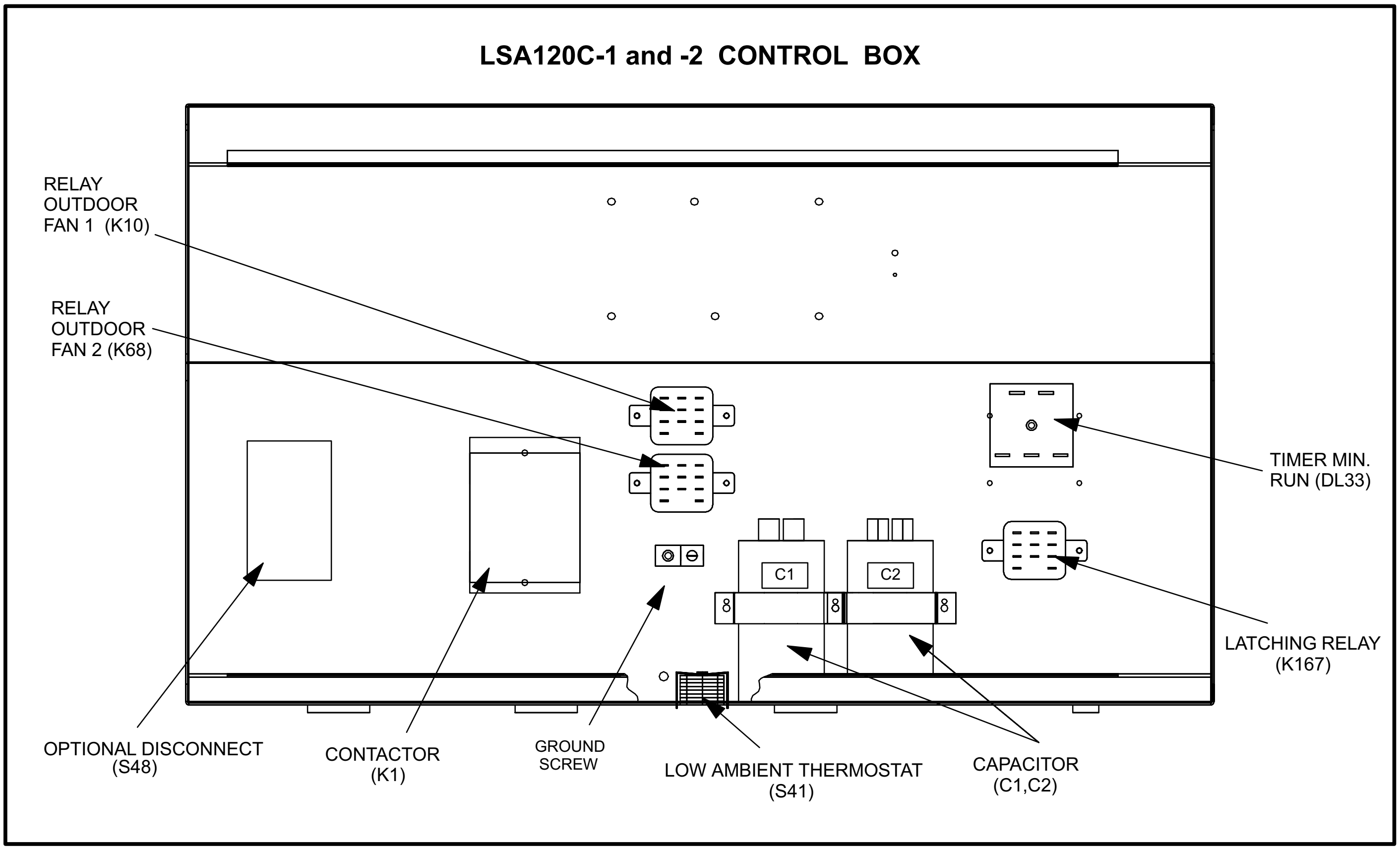


FIGURE 5

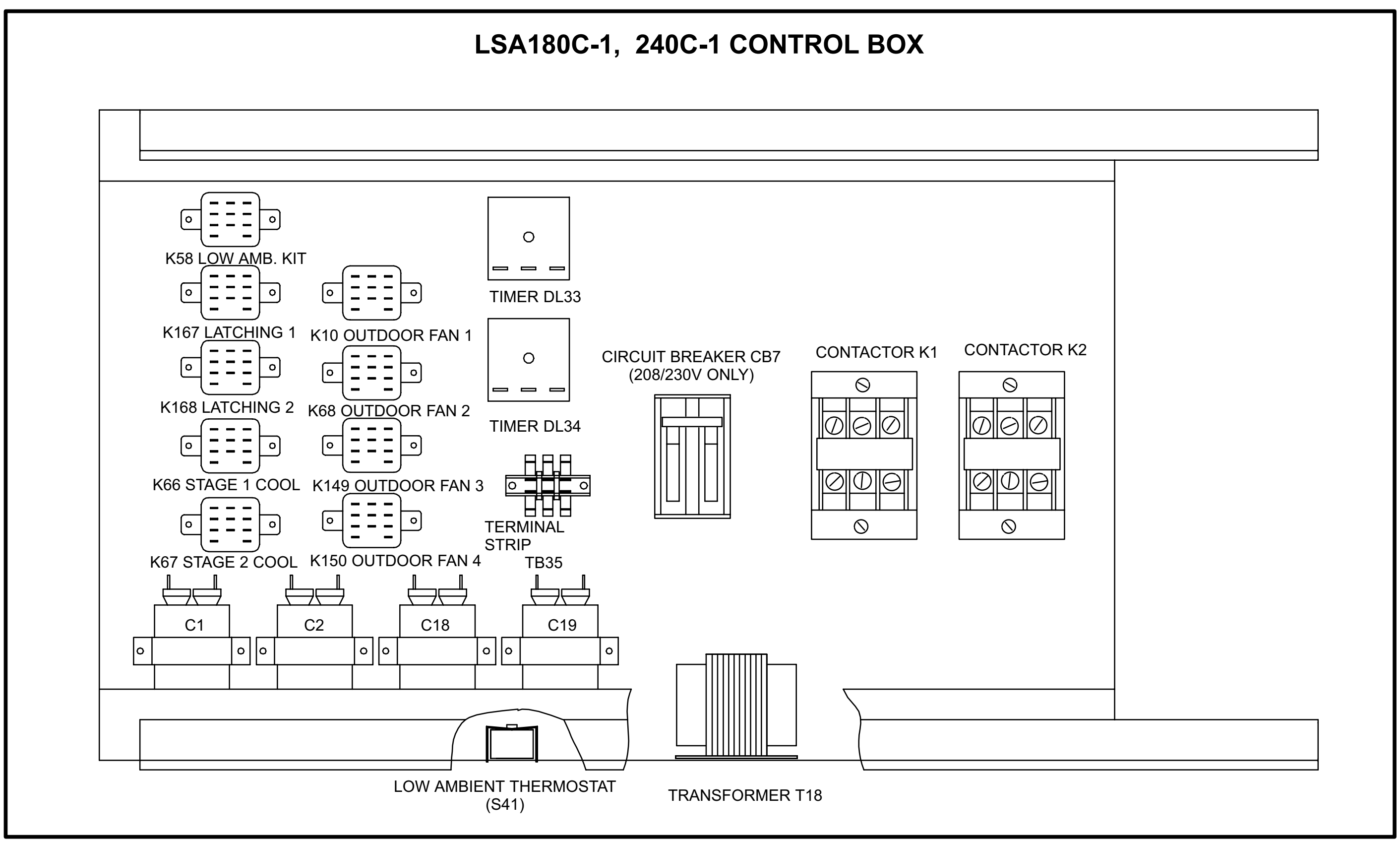


FIGURE 6

I-UNIT COMPONENTS

The LSA072C and 090C components are shown in figure 1. The LSA120C components are shown in figure 2 and the LSA180C/240C components are in figure 3.

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.

A-CONTROL BOX COMPONENTS

The LSA072C and 090C control box components are shown in figure 4. The LSA120C control box components are shown in figure 5 and the LSA180C/240C control box components are in figure 6. The control box for the LSA072C, 090C and 120C units is located in a separate compartment. The LSA180C/240C has a slide-out control box.

1 - Disconnect Switch S48 (Optional all units)

LSA units may be equipped with an optional disconnect switch S48. S48 is a factory-installed toggle switch which can be used to disconnect power to the unit. S48 is located on the opposite side of the unit from the control box on LSA180C/240C units.

2 - Transformer T18 (180C, 240C)

The LSA 15 and 20 ton units use a single line voltage to 24VAC transformer mounted in the control box. Transformer T18 supplies power to control circuits in the LSA unit.The transformer is rated at 70VA and is protected by a 3.5 amp circuit breaker (CB18). CB18 is internal to the transformer. The 208/230 (Y) voltage transformers use two primary voltage taps as shown in figure 7, while 460 (G) and 575 (J) voltage transformers use a single primary voltage tap.

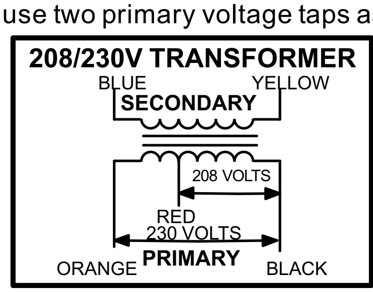


FIGURE 7

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 transfomer primary.

3 - Terminal Strip TB35 (180C, 240C)

TB35 terminal strip distributes 24V power and common from the transformer T18 to the control box components.

4 - Circuit Breaker CB7 (180C, 240C-Y only)

Circuit breaker CB7 is a manual reset switch that provides overcurrent protection to condenser fans B4, B5, B21 and B22. The breaker is rated at 15 amps.

5 - Condenser Fan Capacitors C1, C2, C18, C19

All LSA units use single-phase condenser fan motors. Motors are equipped with a fan run capacitor to maximize motor efficiency. Condenser fan capacitors C1, C2, C18 and C19 assist in the start up of condenser fan motors B4, B5, B21 and B22. Capacitor ratings will be on condenser fan motor nameplate.

6 - Compressor Contactor K1 (all units) K2 (180C/240C)

All compressor contactors are three-pole double- break contactors with a 24V coil. In LSA072, 090C and the LSA120C units, K1 energizes compressor B1. In LSA180 and 240C units, K1 and K2 energize compressors B1 and B2.

7 - Minimum Run Timer DL33 (all units) DL34 (180C/240C)

All LSA units have a minimum run time control which prevents the compressor from short cycling. The timer allows the compressor to run approximately 5 minutes before shut-down, to prevent short cycling due to irregular or rapid on-off selection at the indoor thermostat mode. This 5 minute run time also allows oil circulation back to the compressor. DL33 and DL34 are one component of an integral two component run time circuit. The timer is activated by an input from the latching relay. Do not bypass the control.

8 - Latching Relay K167 (all units) & K168 (180C, 240C)

Latching relays K167(1st stage) and K168 (2nd stage) are N.O. 3PDT relays used in all units. Units with a single compressor will use DPDT relays. When there is demand from the indoor thermostat, K167 closes energizing timer DL33 which begins a 5 minute minimum run time. If thermostat demand is satisfied or low pressure switch S87 opens within the 5 minute run time, DL33 will maintain input to the latch relay to keep the system operating. In the LSA180C/240C units, K167 and K168 close energizing timers DL33 and DL34.

9 - Low Ambient Thermostat S41 (120C,180C/240C) & Relay K58 (180C/240C)

LSA120C and LSA180C, 240C units have a low ambient thermostat. S41 is a N.C. switch which opens on temperature fall at 55$\pm$ 5°F. The switch resets when temperature rises to 65$\pm$ 6°F. On the LSA120C, S41 opens and de-energizes K68 which de-energizes outdoor fan B5. On the LSA180C/240C S41 opens and de-energizes low ambient DPDT relay K58. This, in turn, de-energizes fan relays K68 and K150 which de-energize outdoor fans B5 and B22. When S41 closes, fans are re-energized on all units.This intermittent fan operation increases indoor evaporator coil temperature to prevent icing.

10 - Condenser Fan Relay K10 (all units) K68 (120C,180C,240C) K149, K150 (180C, 240C)

Condenser fan relays K10 and K149 are DPDT and relays K68 and K150 are SPDT with a 24V coil. In all units K10 energizes condenser fan B4 (fan 1) in response to thermostat demand. In the LSA120C,180C and 240C, K68 energizes condenser fan B5 (fan 2) in response to thermostat demand. In the LSA180C, 240C, K149 and K150 energize condenser fans B21 (fan 3) and B22 (fan 4), in response to thermostat demand.

GFI- J11 (Optional, Factory Installed)

All LSA units may be equipped with a 110v ground fault interrupter (GFI) receptacle. The GFI is located on the control box panel on the LSA072C, 090C and 120C. The GFI is located in a separate box on the opposite side of unit form the control box on the LSA180C/240C. Separate wiring must be run for the 110v receptacle.

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 B1 (all units) B2 (180C/240C)

Reciprocating

LSA090C-1, LSA120C-1 and LSA180C/240C-1 model units use reciprocating compressors. Compressor B1 operates during all cooling demand and is energized by contactor K1 upon receiving first stage demand. Compressor B2 operates only during second stage cooling demand, and is energized by contactor K2. See ELECTRICAL section or compressor nameplate for compressor specifications.

SCROLL COMPRESSOR

LSA072C-1, LSA090C-2 and LSA120C-2 model units use scroll compressors. Compressor B1 operates during all cooling demand and is energized by contactor K1 upon receiving first stage demand. Compressor B2 operates only during second stage cooling demand, and is energized by contactor K2. See ELECTRICAL section or compressor nameplate for compressor specifications.

SCROLL COMPRESSOR

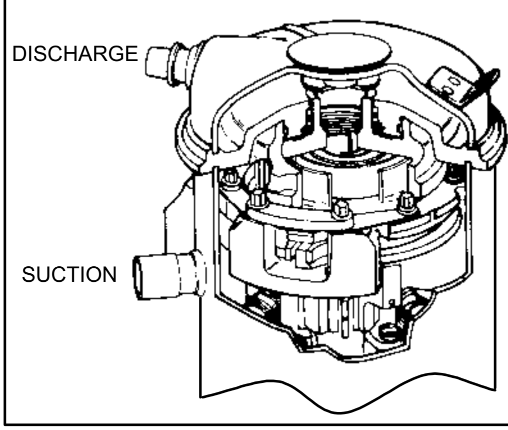


FIGURE 8

The scroll compressor design is simple, efficient and requires few moving parts. A cutaway diagram of the scroll compressor is shown in figure 8. 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 9 shows the basic scroll form. Two identical scrolls are mated together forming concentric spiral shapes (figure 10). One scroll remains stationary, while the other is allowed to ”orbit” (figure 11). 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.

⚠ IMPORTANT

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

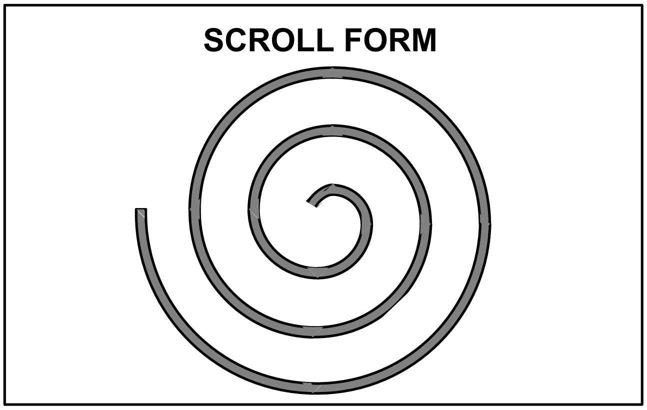


FIGURE 9

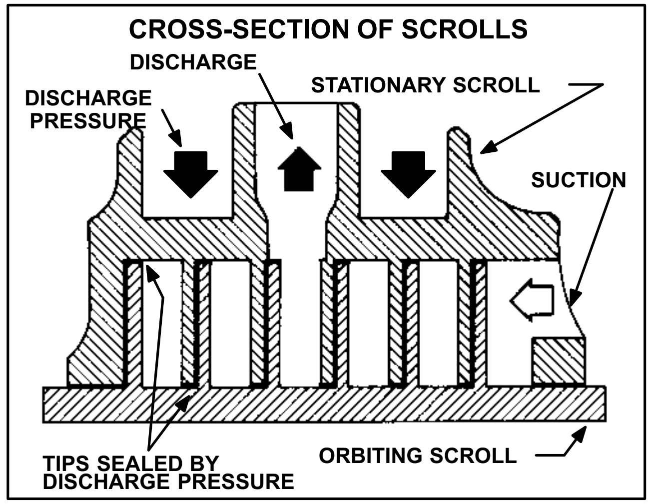


FIGURE 10

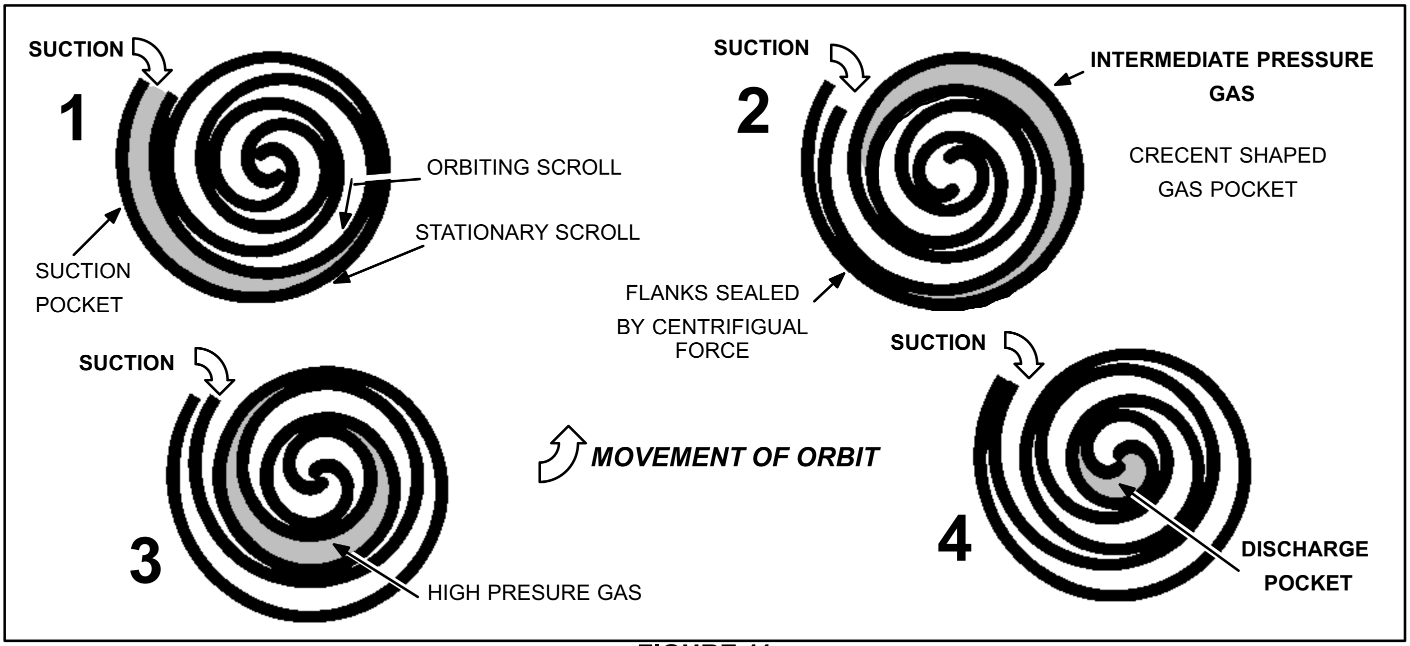


FIGURE 11

The counterclockwise orbiting scroll draws gas into the outer crescent shaped gas pocket created by the two scrolls (figure 11- 1). The centrifugal action of the orbiting scroll seals off the flanks of the scrolls (figure11-2). As the orbiting motion continues, the gas is forced toward the center of the scroll and the gas pocket becomes compressed (figure 11- 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 10). The discharge pressure forcing down on the top scroll helps seal off the upper and lower edges (tips) of the scrolls (figure 10). 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.

2 - Cooling Relays K66 & K67 (180C/240C only)

Cooling relays K66 and K67 are N.O. 3PDT relays used in the LSA180C and 240C. K66 is energized from "Y1" (1st stage cool), which in turn energizes latching relay K167. K67 is energized by "Y2" (2nd stage cool), which in turn energizes latching relay K168. This sequence is the start up of compressors B1 and B2.

3 - Crankcase Heaters HR1 (all units) & HR2 (180C/240C)

All LSA series units use a belly-band type crankcase heater. Heater HR1 is wrapped around compressor B1 and heater HR2 is wrapped around compressor B2. HR1 and HR2 assure proper compressor lubrication at all times.

4 - High Pressure Switch S4 (all units) & S7 (120C, 180C/240C)

The high pressure switch is a manual-reset SPST N.C. switch which opens on a pressure rise. The switch is located in the compressor liquid line and is wired in series with the compressor contactor coil. When discharge pressure rises to 450 ± 10 psig (3101 ± 69 kP) the switch opens and the compressor is de-energized.

5 - Low Ambient Switch S11 (all units) & S84 (180C, 240C)

The low ambient switch is an auto-reset SPST N.O. pressure switch, which allows for mechanical cooling operation at low outdoor temperatures. All LSA units are equipped with S11. LSA180C and 240C units are equipped with both S11 and S84. A switch is located in each liquid line. In all LSA units, S11 is wired in series with fan relay K10. In the LSA 180C and 240C, S84 is wired in series with fan relay K149. When liquid pressure rises to 275 ± 10 psig (1896 ± 69 kPa), the switch closes and the condenser fan is energized. When the liquid pressure drops to 150 ± 10 psig (1034 ± 69 kPa) the switch opens and the condenser fan in that refrigerant circuit is de-energized. This intermittent fan operation results in higher evaporating temperature, allowing the system to operate without icing the evaporator coil and losing capacity.

6 - Low Pressure Switches S87(all units) S88 (180C, 240C)

The low pressure switch is an auto-reset SPST N.O. switch which opens on pressure drop. All LSA units are equipped with S87. LSA180C and 240C units are equipped with both, S87 and S88. The switch is located on the suction line and is wired in series with the thermostat. S87 is wired in series with Y1 and S88 is wired in series with Y2. When suction pressure drops to 25 ± 5 psig (172 ± 34 k Pa), the switch opens and the compressor is de-energized. The switch automatically resets when pressure in the suction line rises to 55 ± 5 psig (379 ± 34 kPa).

7 - Low Ambient Kit (Hoffman Control)A46 Optional (072C-1 ,090C-1)

The low ambient kit consisits of a control, A46 and sensor, RT13. Control A46 is located on the outside of the unit near the compressor section. Sensor RT13 is located on the liquid line near the evaporator coil. Control A6 allows operation of the LSA072C and 090C units down to 0°F (18°C) outdoor ambient. As liquid line temperature falls, the control reduces fan RPM. As liquid line temperature increases, the control increases outdoor fan RPM. This operation, like Low Ambient Switch S11, results in higher evaporator temperature allowing the system to operate without icing in the evaporator coil and losing capacity.

8 - Filter Drier (all units)

All LSA 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. The drier is field installed.

9 - Condenser Fan B4 (all units) B5 (120C,180C, 240C) B21 & B22 (180C, 240C)

See page 2 for the specifications on the condenser fans used in the LSA units. All condenser fans have single-phase motors. The LSA072C and 090C units are equipped with a single condenser fan. The LSA120C is equipped with two fans. LSA180C and 240C units have four fans. The fan assembly may be removed for servicing by removing the fan grill and turning the assembly until the motor brackets line up with the notches in the top panel. Lift the assembly out of the unit and disconnect the jack plug on the motor.

10 - Thermowell LSAC (-1 Models)

LSA-1 model units are equipped with a thermowell (figure 12) for charging the unit. The well is used to accurately measure the temperature of the liquid line. The liquid temperature is used to calculate the approach temperature. Approach temperatures are compared to tables printed in the charging section of this manual to determine correct charge. Thermowells are equipped with a gauge port for high pressure gauge connection. The well should be filled with light mineral oil before using. This will ensure good heat transfer to the thermometer.

THERMOWELL

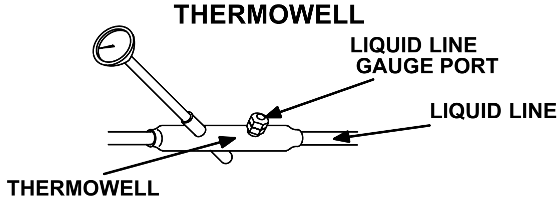


FIGURE 12

11 - Hot Gas By-Pass Kit Optional (072C, 090C, 120C)

The hot gas bypass kit is used with split system units requiring capacity reduction in order to prevent evaparator coil icing due to abnormally low suction pressure. The kit consists of : De-superheating valve (bypass to the suction line only), hot gas by-pass valve and service valve. The desuperheating valve is pressure compensated/temperature activated. The hot gas bypass valve is pressure activated. The kit will redirect hot gas to the evaporator where applications call for a single indoor unit matched with a single outdoor unit and are installed close together, or into the suction line which is preferred in applications with multiple evaporators or long refrigerant lines.

BYPASS TO EVAPORATOR FIGURE 13

The discharge bypass valve is factory-set to begin opening at a suction pressure of 57.5 psig [32°F (0°C) saturation temperature]. The valve should reach its fully open position at a suction pressure of 50 psig [26°F (-3°C) saturation temperature].

The hot gas is then bypassed into the evaporator coil through the side-connection distributor. The coil's thermal expansion valve responds to the increased superheat of the vapor by opening to supply liquid refrigerant to cool the hot gas to the desired temperature. Also, since the evaporator is an excellent mixing chamber, a dry vapor going into the compressor suction line is ensured. For flow diagram see figure 16.

This method improves oil return from the evaporator, since the hot gas keeps velocities higher. Refer to Refrigerant Piping Guideline manual (Corp. 9351-L9).

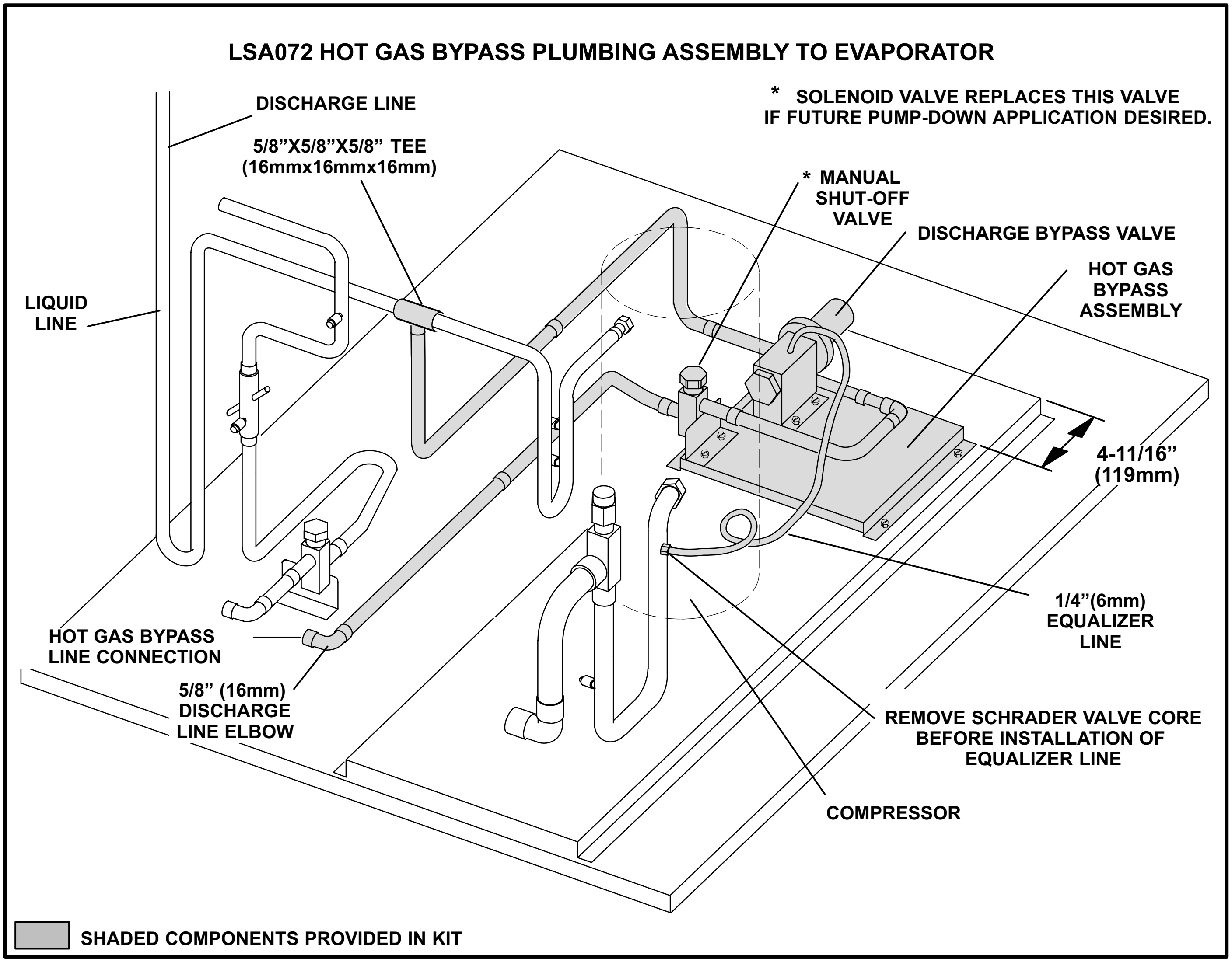


FIGURE 13

BYPASS TO SUCTION LINE FIGURE 14

The discharge bypass valve is factory-set to begin opening at a suction pressure of 57.5 psig (32°F (0°C) saturation temperature). The valve should reach its fully open position at a suction pressure of 50 psig (26°F (-3°C) saturation temperature).

The hot gas is then bypassed into the suction line upstream of the thermal sensing bulb. The de-superheating thermal expansion valve then opens to supply liquid refrigerant to cool the hot gas to the desired suction temperature.

This method reduces flow through the evaporator and suction lines. Special handling of suction risers is required. Refer to Refrigerant Piping Guideline manual (Corp. 9351-L9). For flow diagram see figure15.

a - De-Superheat Valve (TXV)

The de-superheat valve, together with the hot gas bypass valve, de-super heats the vapor going back to the compressor. In order to maintain proper compressor operating temperatures, the de-superheat valve will add liquid refrigerant to cool the vapor to acceptable temperatures for the compressor. Superheat is the difference between the temperature of the refrigerant vapor and its saturation temperature.

b - Hot Gas Bypass Valve

The hot gas bypass valve responds to changes downstream of the hot gas injection into the suction line, or suction pressure. When the evaporating pressure is above the valve setting, the valve remains closed. As the suction pressure drops below the valve setting the valve responds and begins to open. As the suction pressure continues to drop, the valve continues to open farther until limit of valve stroke is reached.

c - Service Valve

All hot gas by-pass kits are equipped with a service valve located in the mixing line. The service valve is manually operated valve. The service port is used for leak testing and evacuating.

LSA072 HOT GAS BYPASS PLUMBING ASSEMBLY TO SUCTION LINE

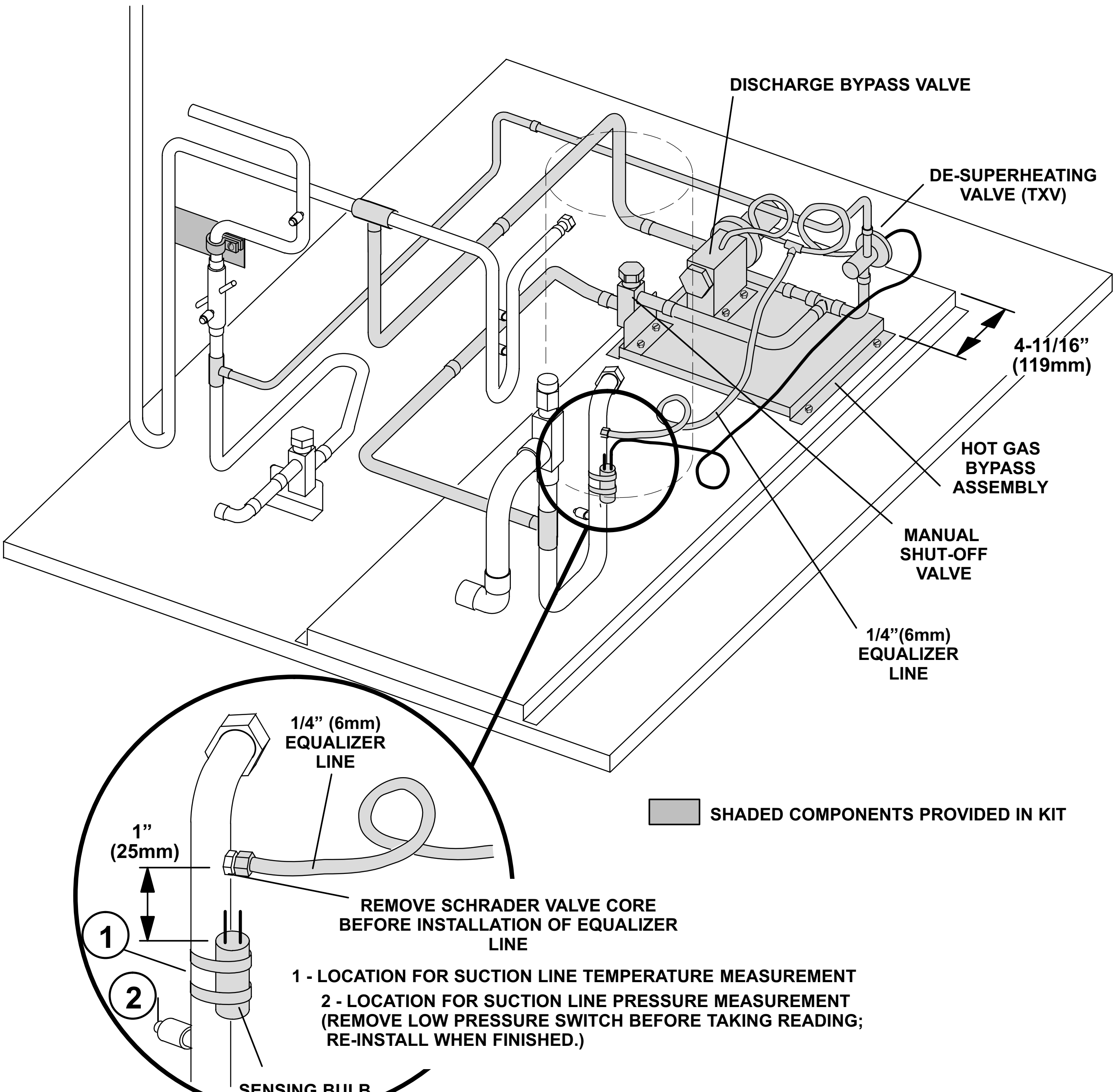


FIGURE 14

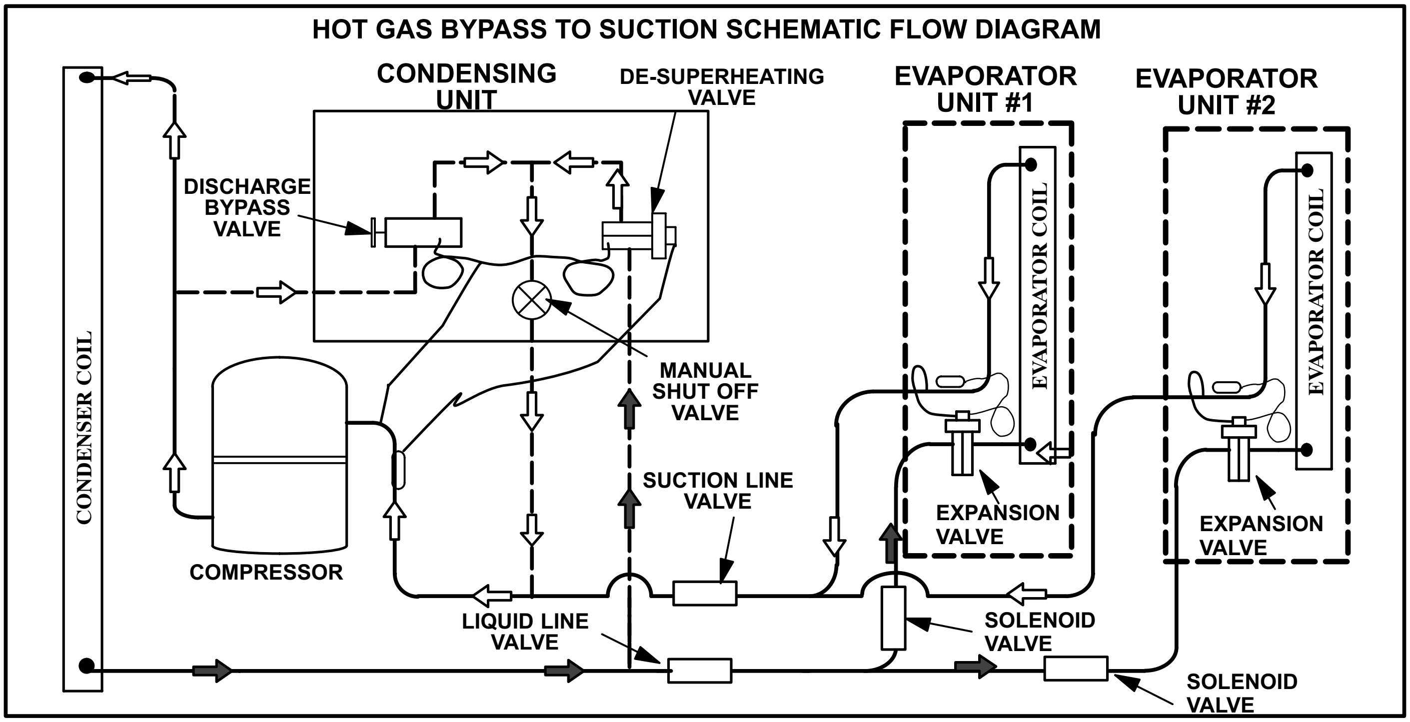


FIGURE 15

Hot Gas By-Pass Performance Check

1. Start unit. After unit operating conditions have stabilized, check unit volts and amps. These must be within range shown on unit nameplate.
2. Remove unit access panel. Determine whether or not unit is operating normally in hot gas bypass mode. The unit is operating normally in hot gas bypass mode **to the suction line** if suction line superheat temperatures range from 35°F (19.5°C) to 45°F (25°C) with suction line pressures less than 57.5 psig (32°F (0°C) saturated temperature). The unit is operating normally without hot gas bypass if suction line superheat temperatures range from 10°F (5.5°C) to 20°F (11°C) with suction line pressures greater than 57.5psig (32°F (0°C) saturated temperature). The unit is operating normally in hot gas bypass mode **to the evaporator** if suction line superheat temperatures are greater than 20°F (11°C) with suction line pressures greater than or equal to 57.5 psig (32°F (0°C) saturated temperature). The unit is operating normally without hot gas bypass if suction line superheat temperatures range from 10°F (5.5°C) to 20°F (11°C) with suction line and discharge pressures occurring within the range listed in table 4 on page18 .

Note - See figure 14 for location of pressure/temperature measurement for by pass to the suction line. (Remove low pressure switch during pressure measurement, then re-install upon completion.) For by pass to the evaporator take pressure/temperature measurement close to compressor.

Note - Superheat values are calculated as follows:

a - measure suction line pressure - for example 57.5 psig

b - convert 57.5 psig via pressure/temperature chart for HCFC-22 to 32°F (0°C) saturation temperature.

c - measure suction line temperature - for example 77°F (25°C).

d - then superheat = 77°F(25°C) - 32°F(0°C) = 45°F(25°C).

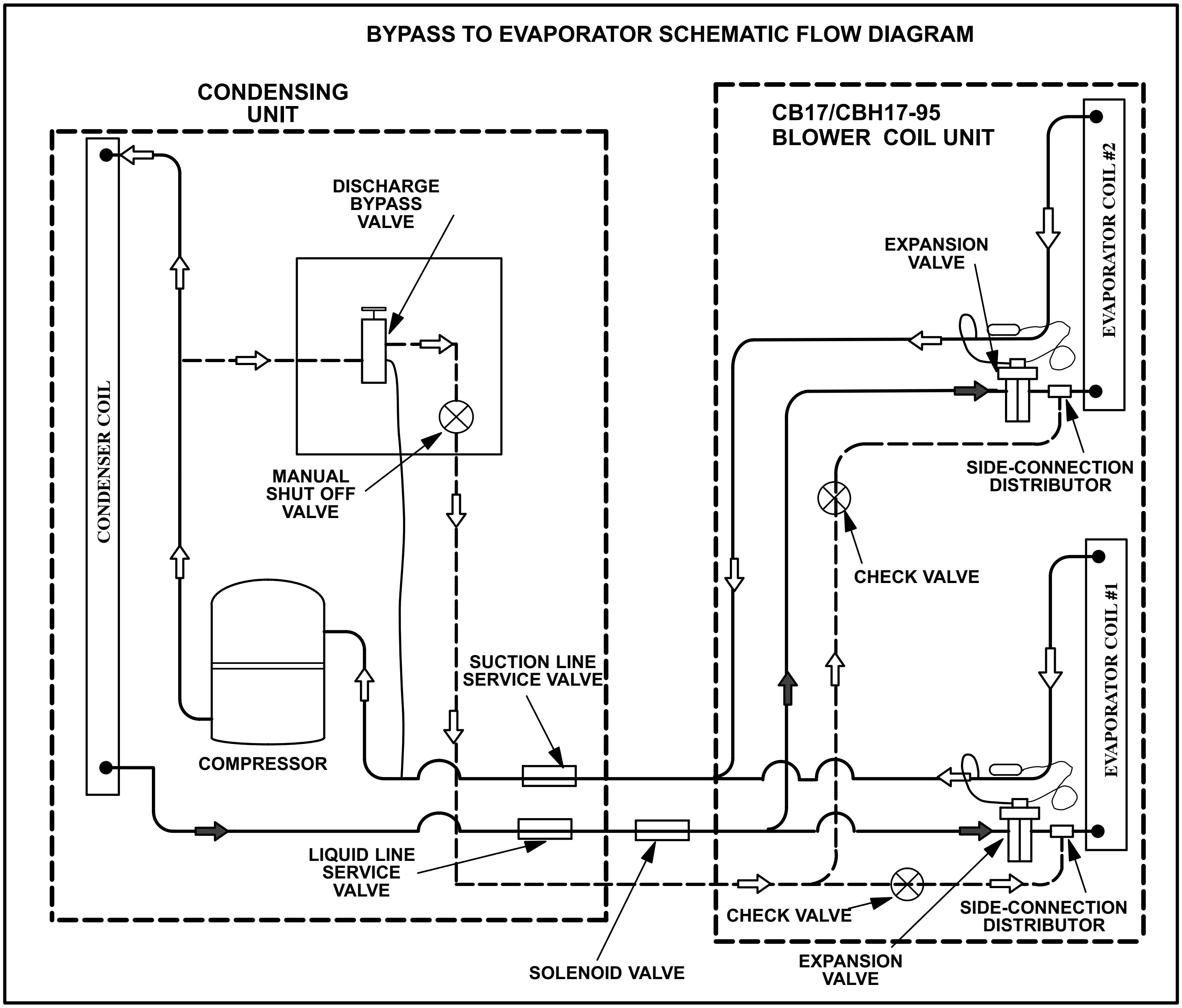


FIGURE 16

3. If unit is operating normally without hot gas bypass, initiate hot gas bypass by either gradually closing liquid line service valve, reducing air flow to evaporator(s), or, in multi-evaporator units, by shutting off an evaporator(s).
4. If normal hot gas bypass suction line superheat and pressures are not obtained check the following:
   a - **Pressures are less than 57.5 psig for both by pass to the suction line or evaporator. For by pass to the evaporator superheat values are less than 20°f (11°C)-**
   The manual shut-off valve may be closed. Open it.
   The discharge bypass valve may not be opening the correct amount. Check to make sure that the schrader valve has been removed from the suction line pressure tap fitting.
   The hot gas bypass circuit may be operating with an evaporator load of less than the 2 ton minimum.
   b - **For by pass to the suction line superheat values are greater than 45°F (25°C) -**
   The de-superheating valve may not be opening the correct amount. Check to make sure the sensing bulb has adequate thermal contact with the suction line.
5. Re-install unit access panel.

II- 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). Refer to table 1 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 1
REFRIGERANT LINE SIZES

LSA UNIT	LIQUID LINE	SUCTION LINE
072C	5/8 in (16 mm)	1-1/8 in (29 mm)
090C,120C, 180C, 240C	5/8 in (16 mm)	1-3/8 in (35 mm)

B-Service Valves

All LSA units are equipped with service valves located in the suction and liquid lines. The service valves are manually operated. See figures 17, 18 and 19 . The service ports are used for leak testing, evacuating, charging and checking charge.

1 - Liquid Line Service Valve (-1 and -2 models)

The liquid line valve made by one of several manufacturers may be used. All liquid line service valves function the same way, differences are in construction. Valves are not rebuildable. If a valve has failed it must be replaced. LSA072C/090C and LSA120C units use valves shown in figure 17. LSA180C/240C units use valves shown in figure 18. A schrader valve is factory installed. A service port is supplied to protect the schrader valve from contamination and to serve as the primary leak seal.

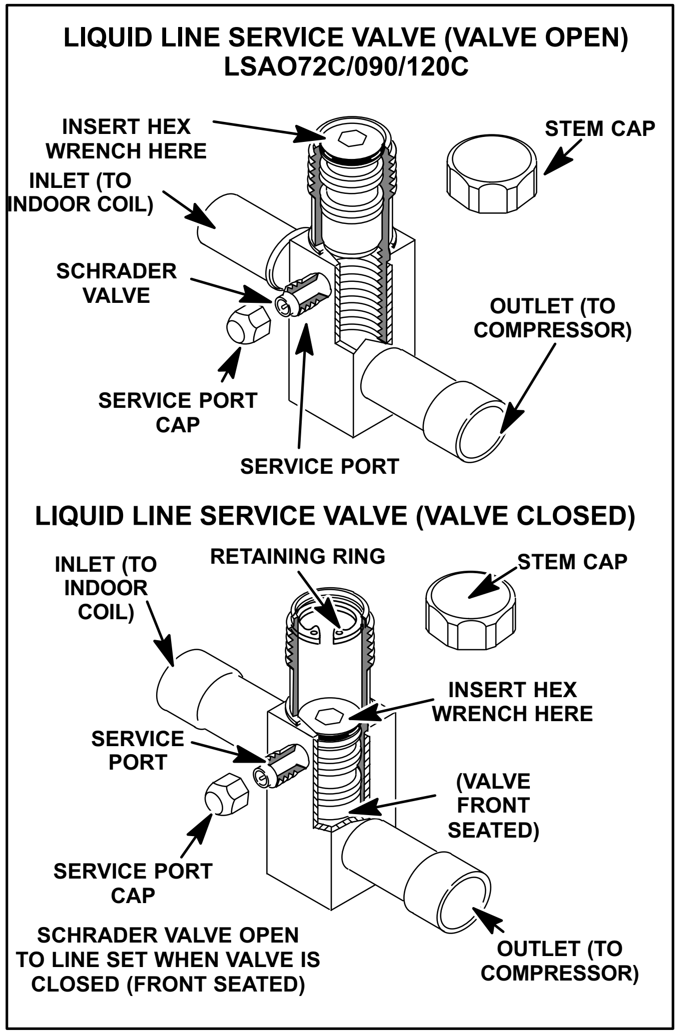


FIGURE 17

To Access Schrader Port:

1 - Remove service port cap with an adjustable wrench.
2 - Connect gauge to the service port.
3 - When testing is completed, replace service port cap. Tighten finger tight, then an additional 1/6 turn. Do not over torque.

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.

⚠ DANGER

Do not attempt to backseat this valve past the retaining ring. Attempts to backseat this valve past the retaining ring will cause snap ring to explode from valve body under pressure of refrigerant. Personal injury and unit damage will result.

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.

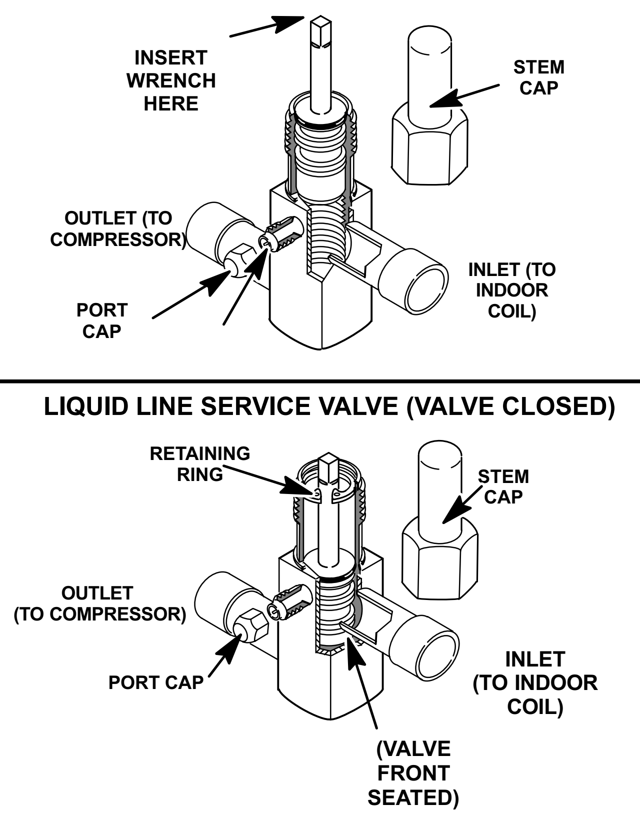


FIGURE 18

2 - Suction Line Service Valve LSAC-1 Models

A full service front and back seating suction line service valve is used on all LSAC-1 series units. Different manufacturers of valves may be used. All suction line service valves function the same way, differences are in construction.

Valves manufactured by Parker are forged assemblies. Primore and Aeroquip valves are brazed together. Valves are not rebuildable. If a valve has failed, it must be replaced. The suction line service valve is illustrated in figure 19.**(Service valve will differ between LSA072C and the other models.)**

The valve is equipped with a service port. There is no schrader valve installed in the suction line service port. A service port cap is supplied to seal off the port.

To Access Schrader Port:

1 - Remove service port cap with an adjustable wrench.

2 - Connect gauge to the service port.

3 - When testing is completed, replace service port cap. Tighten finger tight, then tighten an additional 1/6 turn. Do not over torque.

To Open Suction Line Service Valve:

1 - Remove stem cap with an adjustable wrench.

2 - Using service wrench back the stem out counterclockwise until the valve stem just touches the retaining ring.

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

To Close Suction Line Service Valve:

1 - Remove stem cap with an adjustable wrench.

2 - Using service wrench and turn stem in 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.

3 - Suction Line Service Valve LSAC-2 Models

The LSA090C/120C-2 model units are equipped with a full service ball valve, as shown in figure 20. One service port that contains a Schrader 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

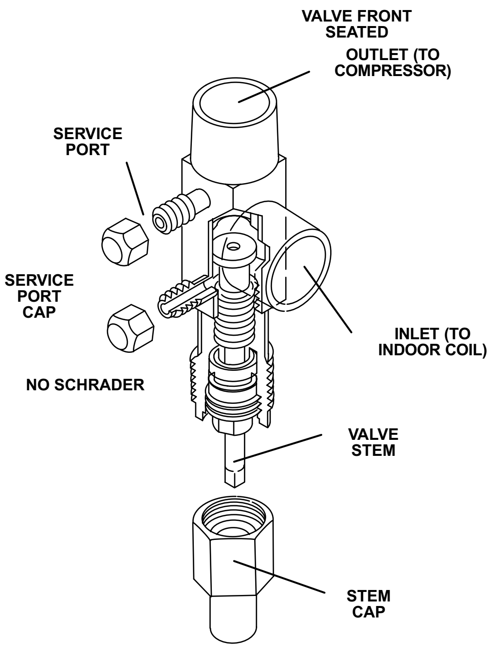
1 - Remove the stem cap with an adjustable wrench.

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

3 - Replace the stem cap and tighten firmly.

SUCTION LINE SERVICE VALVE (VALVE OPEN)

LSA072C-1



NOTE: WHEN VALVE IS FRONT SEATED, SERVICE PORT IS NOT ISOLATED (BLOCKED OFF) FROM SYSTEM

LSA090/120/180/240C-1 MODELS

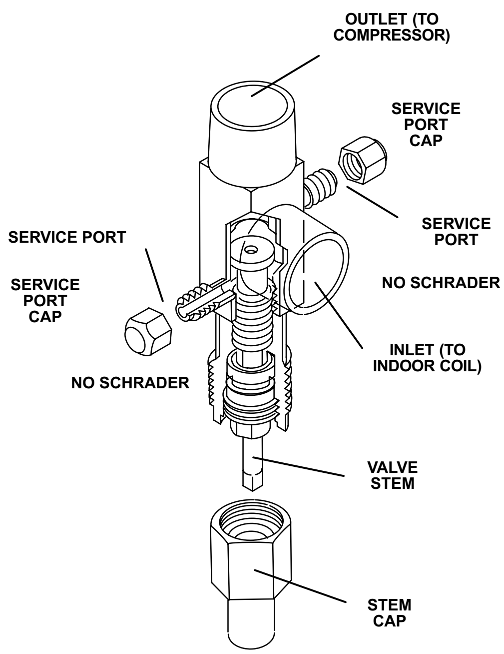


FIGURE 19

SUCTION LINE (BALL TYPE) SERVICE VALVE (VALVE OPEN)

USE ADJUSTABLE WRENCH
ROTATE STEM CLOCKWISE 90° TO CLOSE
ROTATE STEM COUNTERCLOCKWISE 90° TO OPEN

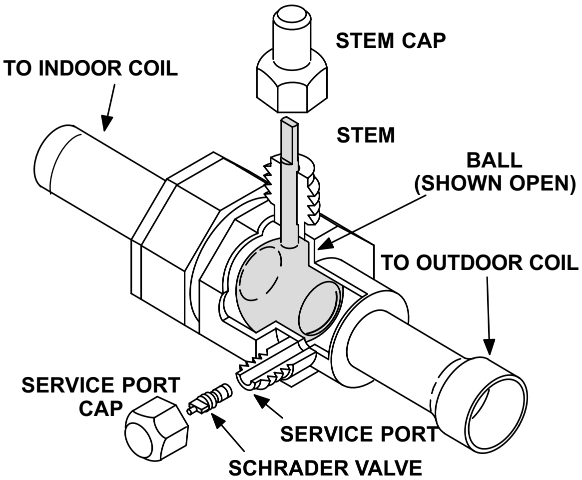


FIGURE 20

III- CHARGING

LSAC units are **field charged** with the amount of HCFC-22 refrigerant indicated on the unit nameplate. This charge is based on a matching indoor coil and outdoor coil with a 25 foot (7.6 m) line set. For varying lengths of line set and refrigerant charge, refer to table 2 for LSA072C, 090C and 120C series units and table 3 for LSA180C/240C units. A blank space is provided on the unit rating plate to list actual field charge. Units are designed for line sets up to 50ft. (15.2m). Consult Lennox Refrigerant Piping Manual for line sets over 50ft. (51.2m).

TABLE 2

UNIT	HCFC-22 FOR 25 FT. (7.6M) LINE SET	Adjust per 1ft (.3m) *
LSA072C-1	12 lbs. 8 ozs. (5.67kg)	2 ozs. (57g)
LSA090C-1	16 lbs. 8 ozs. (7.48 kg)	2 ozs. (57g)
LSA120C-1	23 lbs 8 ozs. (10.54 kg)	2 ozs. (57g)
LSA090C-2	16 lbs. 0 ozs. (7.26kg)	2 ozs. (57g)
LSA120C-2	23 lbs 8 ozs. (10.66kg)	2 ozs. (57g)

**If line set is greater than 25 ft. (7.6m) add this amount. If line set is less than 25 ft. (7.6m) subtract this amount.*

TABLE 3

HCFC-22 per 25 ft (7.6m)			Adjust per 1 ft (.3m) **
LSA UNIT	Circuit 1	Circuit 2	Each Circuit
180C-1	15 lbs (6.8kg)	15 lbs (6.8kg)	2 ozs. (57g)
240C-1	24 lbs. (11Kg)	24 lbs. (11kg)	2 ozs. (57g)

***If line set is greater than 25 ft. (7.6m) add this amount. If line set is less than 25 ft. (7.6m) subtract this amount.*

WARNING

Never use oxygen to pressurize refrigeration or air conditioning system. Oxygen will explode on contact with oil and could cause personal injury.

A-Leak Testing

Using an Electronic or Halide Leak Detector

1 - Connect a cylinder of HCFC-22 with a pressure regulating valve to the center port of the manifold gauge set.

2 - Connect the high pressure hose of the manifold gauge set to the service port of the suction valve. *(Normally, the high pressure hose is connected to the liquid line port; however, connecting it to the suction port better protects the manifold gauge set from high pressure damage.)*

3 - With both manifold valves closed, open the valve on the HCFC-22 bottle (vapor only).

4 - Open the high pressure side of the manifold to allow HCFC-22 into the line set and indoor unit. Weigh in a trace amount of HCFC-22. *[A trace amount is enough to equal 3 pounds (31 kPa) pressure].* Close the valve on the HCFC-22 bottle and the valve on the high pressure side of the manifold gauge set. Disconnect HCFC-22 bottle.

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

6 - Adjust nitrogen pressure to a maximum 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 short period of time, open a refrigerant port to make sure the refrigerant added is adequate to be detected. (Amounts of refrigerant will vary with line lengths.) Check all joints for leaks. Purge nitrogen and HCFC-22 mixture. Correct any leaks and recheck.

8 - If brazing is necessary for repair, bleed enough nitrogen through the system to ensure all oxygen is displaced. Brazing with oxygen in the system will create copper oxides which may cause restrictions, the failure of components, and will affect the dielectric of refrigerant oil causing premature compressor failure.

B-Evacuating the System

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 such as water vapor, nitrogen, helium and air combined with refrigerant to produce substances that corrode copper piping and compressor parts.

NOTE-The compressor should never be used to evacuate a refrigeration or air conditioning system.

1 - Slowly open service valves to purge unit of factory holding charge of air and helium to the atmosphere.

2 - Connect manifold gauge set to the service valve ports as follows: low pressure gauge to suction line service valve; high pressure gauge to liquid line service valve.

CAUTION

A temperature vacuum gauge, mercury vacuum (U-tube), or thermocouple gauge should be used. The usual Bourdon tube gauges are not accurate enough in the vacuum range.

3 - Connect the vacuum pump (with vacuum gauge) to the center port of the manifold gauge set.

4 - Open both manifold valves and start vacuum pump.

5 - Evacuate the LSA unit, the line set and indoor unit to an **absolute pressure** of 23mm (23,000m) of mercury or approximately 1 inch 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, the leak testing procedure must be repeated after the leak is repaired.

*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 23mm 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 , indoor unit and outdoor 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, indoor unit and outdoor 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 .5mm of mercury within a 20 minute period after shutting off the vacuum pump and closing the manifold gauge valves. Depending on the equipment used to determine the vacuum level, absolute pressure of .5mm of mercury is equal to 500 microns.

C-Charging

If the system is completely void of refrigerant, the recommended and most accurate method of charging is to weigh the refrigerant into the unit according to the total amount shown on the unit nameplate. Also refer to tables 2 and 3. Follow the procedure below.

1 - Disconnect the manifold hose from the vacuum pump and connect it to an upright bottle of HCFC-22 refrigerant.

2 - Open the manifold gauge valves to break the vacuum in the line set and indoor unit.

3- Close manifold gauge valves and shut off HCFC-22 bottle and remove manifold gauge set.

If weighing facilities are not available or if unit is just low on charge, the following procedure applies.

The following procedures are intended as a general guide for use with **expansion valve systems only.** For best results, indoor temperature should be between 70°F(21°C) and 80 °F (26°C). Outdoor temperature should be 60 °F (16°C) or above. Slight variations in charging temperature and pressure should be expected. Large variations may indicate a need for further servicing.

NOTE-System charging is not recommended below 60°F (16°C). If outdoor temperature is less than 60°F, air flow to the unit must be restricted to achieve the operating pressures of tables 4, 5 and 6. These higher pressures are necessary for verifying the unit charge. To raise the system pressures, block part of the outdoor unit coil from top to bottom. Weighing in the charge when the outdoor temperature is less than 60°F is the most accurate method of charging.

IMPORTANT

Use tables 4, 5 and 6 as a general guide for performing maintenance checks. These tables are not a procedure for charging the system. Minor variations in these pressures may be expected 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. Used prudently, these tables could serve as a useful service guide.

1 - If unit is equipped with a hot gas bypass kit, close manual shut-off valve. Attach gauge manifolds and operate unit in cooling mode until system stabilizes (approximately 5 minutes).

2 - On LSA180/240C only, check each system separately with all stages operating.

3 - Use a temperature probe to accurately measure the outdoor ambient temperature.

4 - Apply the outdoor temperature to table 4, 5 or 6 to determine normal operating pressures.

5 - Compare the normal operating pressures to the pressures obtained from the gauges. 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. Correct any system problems before proceeding.

6 - If discharge pressure is high, remove refrigerant from the system. If discharge pressure is low, add refrigerant to the system.
- Add or remove charge in increments.
- Allow the system to stabilize each time refrigerant is added or removed.

7 - Use the following approach method along with the normal operating pressures to confirm readings.

IMPORTANT

The following procedure requires accurate readings of ambient (outdoor) temperature, liquid temperature and liquid pressure for proper charging. Use a temperature probe with accuracy of ±2 °F and a pressure gauge with accuracy of ±5 PSIG.

APPROACH METHOD [60°F (16°C) or above]
ALL LSAC-1 and LSA072/090/120C-2 MODELS

8 - Using the same probe, compare liquid temperature to outdoor ambient temperature.
Approach temperature equals liquid temperature minus ambient temperature.

9 - Approach temperature should match values in table 7, 8, or 9. An approach temperature greater than value shown indicates an undercharge. An approach temperature less than value shown indicates an overcharge.

10- Do not use the approach method if system pressures do not match pressures in tables 4, 5 and 6. The approach method is not valid for grossly over or undercharged systems.

⚠ IMPORTANT

If unit is equipped with a hot gas bypass kit, manual shut-off valve must be closed when checking system charge. Re-open valve when check is complete.

Applications using multiple evaporator units

1 - With the condensing unit off, weigh in approximately 80% of required refrigerant charge. Use the information in tables 2 and 3 for this calculation.

2 - If total system evaporator capacity is greater than condenser capacity, adjust the evaporator operating tonnage to that of the condenser.

3 - Start the system and add enough HCFC-22 refrigerant at suction line service valve to just clear the liquid line sight glass. **DO NOT OVER CHARGE.**

4 - Shut down all evaporators and allow the system to pump-down.

5 - On pump-down, check that head pressure does not rise appreciably. This should be done before low pressure switches open.

TABLE 4
NORMAL OPERATING PRESSURES LSAC-1 MODELS

Outdoor Coil Entering Air Temperature	LSA072C* Discharge ± 10 psig	LSA072C* Suction ± 5 psig	LSA072C** Discharge ± 10 psig	LSA072C** Suction ± 5 psig	LSA090C** Discharge ± 10 psig	LSA090C** Suction ± 5 psig	LSA120C*** Discharge ± 10 psig	LSA120C*** Suction ± 5 psig
65°F (18°C)	173	61	180	73	198	71	192	66
75°F (24°C)	199	63	207	75	225	74	204	69
85°F (29°C)	229	65	238	77	256	77	233	72
95°F (35°C)	261	67	271	79	290	80	263	75
105°F (40°C)	298	71	308	82	317	80	294	76
115°F (46°C)	333	72	342	83	354	83	330	79

* *LSA072C tested with CB30U-65. Pressure shown is with typical 5-ton indoor coil match-up.*

** *LSA072C and LSA090C tested with CB17/CBH17-95V.*

*** *LSA120C tested with CB17/CBH17-135V.*

TABLE 5
NORMAL OPERATING PRESSURES LSA180C-1 and 240C-1 MODELS

Outdoor Coil Entering Air Temp.	LSA180C*				LSA240C**			
	CIRCUIT 1		CIRCUIT 2		CIRCUIT 1		CIRCUIT 2	
	Discharge ± 10 psig	Suction ± 5 psig	Discharge ± 10 psig	Suction ± 5 psig	Discharge ± 10 psig	Suction ± 5 psig	Discharge ± 10 psig	Suction ± 5 psig
65°F (18°C)	181	68	178	66	181	71	188	71
75°F (24°C)	208	70	205	70	206	73	213	73
85°F (29°C)	235	73	232	72	236	76	241	74
95°F (35°C)	268	75	264	74	268	78	271	77
105°F (41°C)	299	76	294	75	305	79	308	79
115° F (46°C)	320	80	325	79	335	82	334	82

**LSA180C tested with CB17/CBH17-185V.*

***LSA240C tested with CB17/CBH17-275V.*

TABLE 6
NORMAL OPERATING PRESSURES LSAC-2 MODEL UNITS

Outdoor Coil Entering Air Temperature	LSA090C** Discharge ± 10 psig	LSA090C** Suction ± 5 psig	LSA120C*** Discharge ± 10 psig	LSA120C*** Suction ± 5 psig
65°F (18°C)	196	71	181	66
75°F (24°C)	224	72	206	68
85°F (29°C)	254	73	234	69
95°F (35°C)	288	74	265	70
105°F (40°C)	323	76	300	72
115°F (46°C)	363	77	335	73

*** LSA090C tested with CB17/CBH17-95V.*
**** LSA120C tested with CB17/CBH17-135V.*

TABLE 7
LSAC-1 MODELS

MODEL NO.	APPROACH TEMPERATURE LIQUID TEMP. MINUS AMBIENT TEMP.	
	Circuit 1	Circuit 2
LSA180C*	**16°F ± 1 (8.9°C ± 0.5)**	**11°F ± 1 (6.1°C± 0.5)**
LSA240C**	**17°F ± 1 (9.5°C± 0.5)**	**18°F ± 1 (10°C ± 0.5)**

NOTE - For best results, the same temperature probe should be used to check both outdoor ambient and liquid temperatures.
**LSA180C tested with CB17/CBH17-185V.*
***LSA240C tested with CB17/CBH17-275V.*

TABLE 8
LSAC-1 MODELS

MODEL NO.	APPROACH TEMPERATURE LIQUID TEMP. MINUS AMBIENT TEMP. °F (°C)
LSA072C*	12 ± 1 (6.7 ± .5)
LSA072C**	16 ± 1 (8.9 ± .5)
LSA090C**	14 ± 1 (7.8 ± .5)
LSA120C***	9 ± 1 (5.0 ± .5)

Note - For best results, the same temperature probe should be used to check both outdoor ambient and liquid temperatures.
**Matched with CB30U-65 or typical 5-ton indoor evaporator coil.*
***Matched with CB17/CBH17-95V.*
****Matched with CB17/CBH17-135V.*

TABLE 9
LSAC-2 MODELS

MODEL NO.	APPROACH TEMPERATURE LIQUID TEMP. MINUS AMBIENT TEMP. °F (°C)
LSA090C**	11 ± 1 (6.0 ± .5)
LSA120C***	11 ± 1 (6.0 ± .5)

Note - For best results, the same temperature probe should be used to check both outdoor ambient and liquid temperatures.
***Matched with CB17/CBH17-95V.*
****Matched with CB17/CBH17-135V.*

D-Oil Charge

See compressor nameplate for oil charge.

IV-MAINTENANCE

⚠ CAUTION

Electrical shock hazard. Turn off power to unit before performing any maintenance, cleaning or service operation on the unit.

At the beginning of each heating or cooling season, the system should be cleaned as follows:

A-Outdoor Unit

1 - Clean and inspect condenser coil (Coil may be flushed with water hose).
2 - Visually inspect all connecting lines, joints and coils for evidence of oil leaks.
3 - Condenser fan motor is prelubricated and sealed. No further lubrication is needed.
4 - Check wiring for loose connections.
5 - Check for correct voltage at unit (unit operating).
6 - Check amp-draw of condenser fan motor (s).
Unit nameplate________Actual_____.
Unit nameplate________Actual_____.
Unit nameplate________Actual_____.
Unit nameplate________Actual_____.

⚠ IMPORTANT

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

B-Indoor Unit

1 - Clean or change filter if necessary.
2 - Clean coil if necessary.
3 - Check connecting lines and coil for leaks.
4 - Check condensate line and clean if necessary.
5 - Adjust blower speed for cooling. The pressure drop over the coil should be measured to determine the correct blower CFM. Refer to unit information service manual for pressure drop tables and procedure.
6 - On belt drive blowers, check belt for wear and proper tension. Check pulleys for wear. Anything less than a true "V" should be replaced.
7 - Check wiring for loose connections.
8 - Check for correct voltage at unit (unit operating).
9 - Check amp-draw on blower motor
Unit nameplate________Actual_____.

V-STARTUP

The following is a general procedure and does not apply to all thermostat control systems. Refer to sequence of operation in this manual for more information.

⚠ WARNING

Crankcase heaters must be energized for 24 hours before attempting to start compressors. Set thermostat so there is no compressor demand before closing disconnect switch. Attempting to start compressors during the 24-hour warm -up period could result in damage or failed compressors.

1 - Set fan switch to AUTO or ON and move the system selection switch to COOL. Adjust the thermostat to a setting far enough below room temperature to bring on compressors. Compressors will start and cycle on demand from the thermostat (allowing for unit and thermostat time delays).
2 - Each circuit is field charged with HCFC-22 refrigerant. See unit name plate for correct charge amount.
3 - Refer to Charging section for proper method of checking and charging the system.

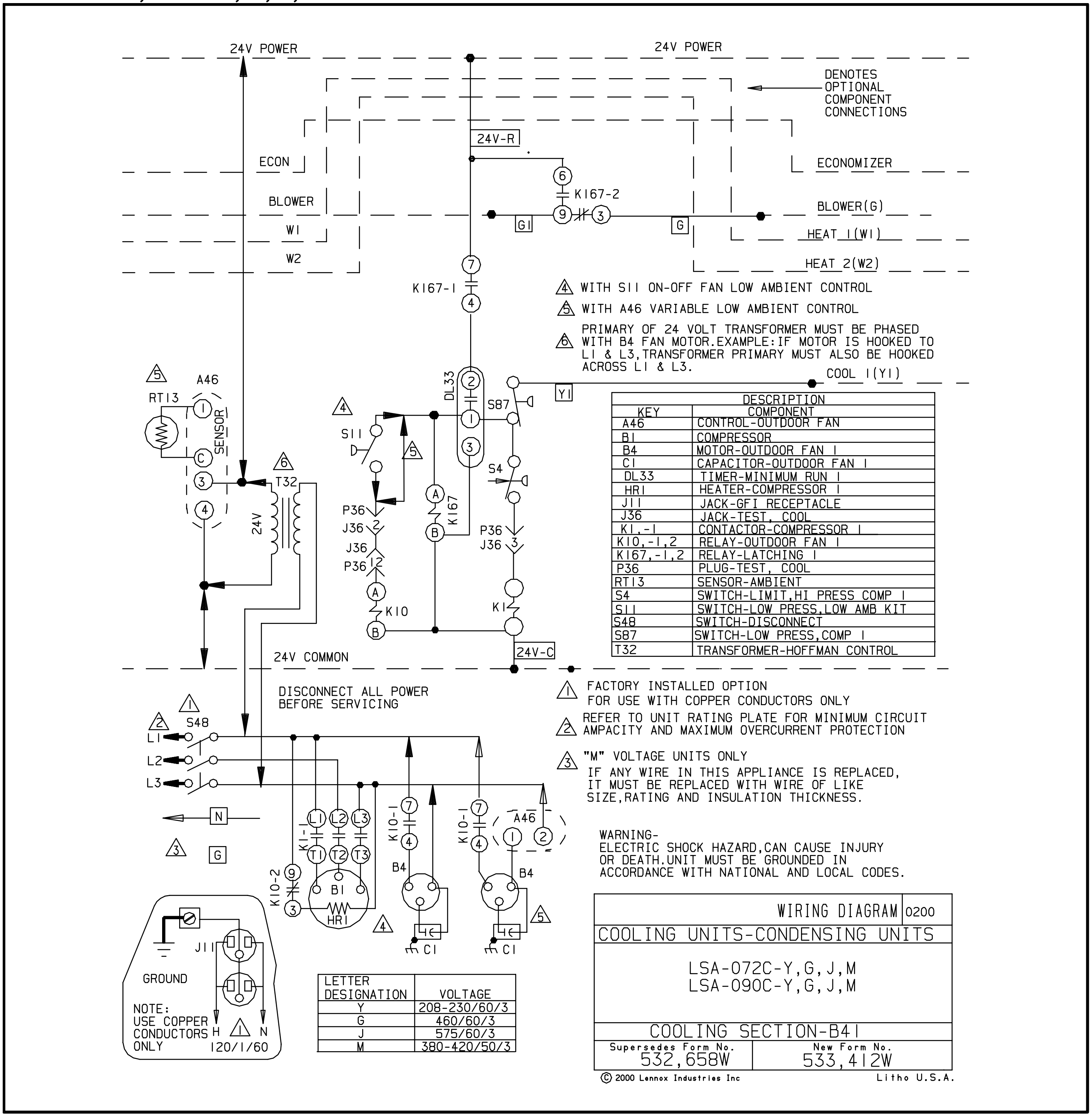
Three-phase scroll compressors must be phased sequentially to ensure correct compressor rotation and operation. At compressor start-up, a rise in discharge and drop in suction pressures indicate proper compressor phasing and operation. If discharge and suctions pressures do not perform normally, follow the steps below to correctly phase in the unit.

1 - Disconnect power to the unit.
2 - Reverse any two field power leads (L1 and L3 preferred) to the unit.
3 - Reapply power to the unit.

Discharge and suction pressures should operate at their normal start-up ranges.

NOTE - Compressor noise level will be significantly higher when phasing is incorrect and the unit will not provide cooling when compressor is operating backwards. Continued backward operation will cause the compressor to cycle on internal protector.

VI-Wiring Diagram and Sequence of Operation
A-LSA072C, 090C-Y, G, J, M



KEY	DESCRIPTION COMPONENT
A46	CONTROL-OUTDOOR FAN
B1	COMPRESSOR
B4	MOTOR-OUTDOOR FAN 1
C1	CAPACITOR-OUTDOOR FAN 1
DL33	TIMER-MINIMUM RUN 1
HR1	HEATER-COMPRESSOR 1
J11	JACK-GFI RECEPTACLE
J36	JACK-TEST, COOL
K1,-1	CONTACTOR-COMPRESSOR 1
K10,-1,2	RELAY-OUTDOOR FAN 1
K167,-1,2	RELAY-LATCHING 1
P36	PLUG-TEST, COOL
RT13	SENSOR-AMBIENT
S4	SWITCH-LIMIT,HI PRESS COMP 1
S11	SWITCH-LOW PRESS,LOW AMB KIT
S48	SWITCH-DISCONNECT
S87	SWITCH-LOW PRESS,COMP 1
T32	TRANSFORMER-HOFFMAN CONTROL

LETTER DESIGNATION	VOLTAGE
Y	208-230/60/3
G	460/60/3
J	575/60/3
M	380-420/50/3

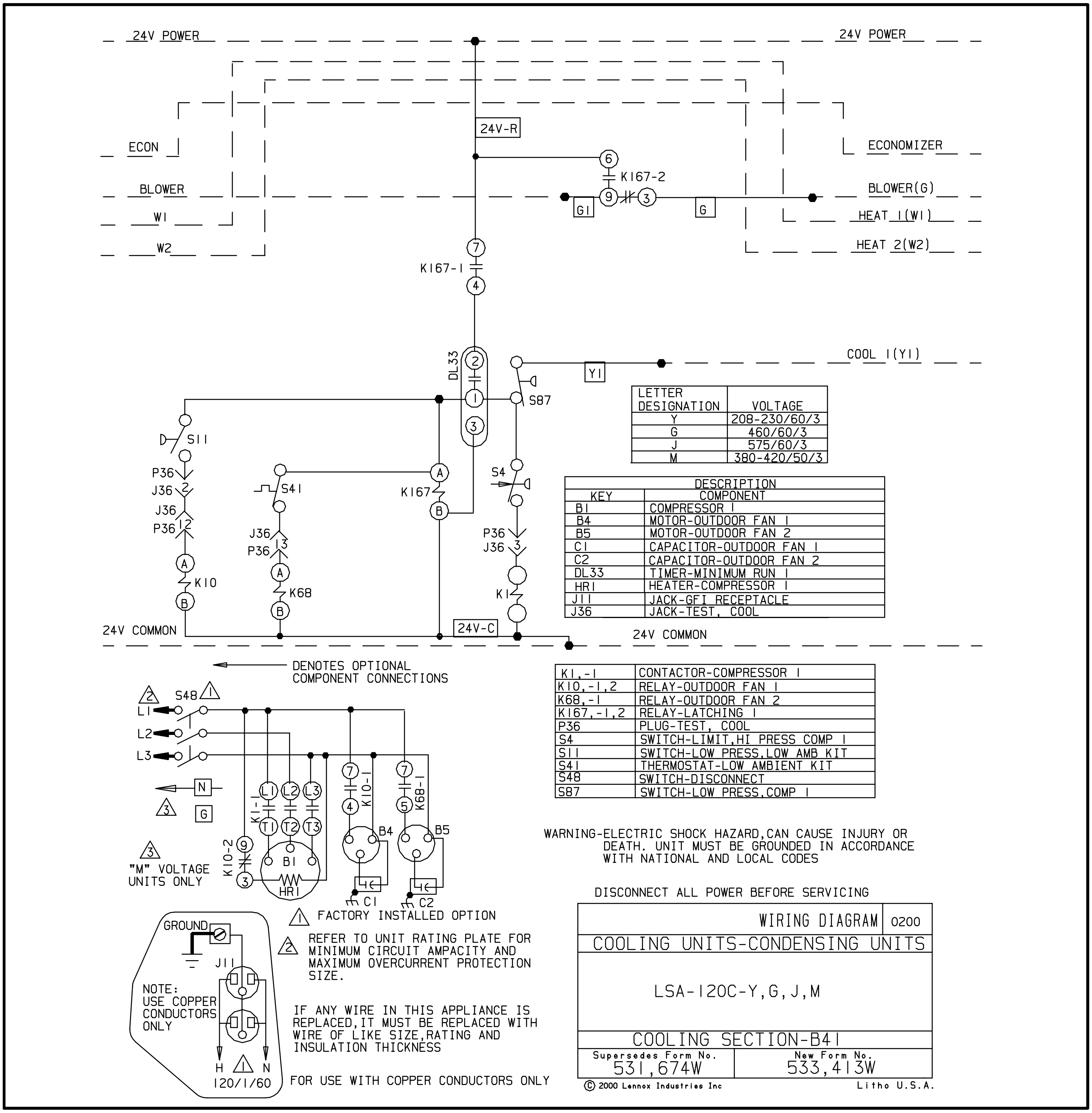
1 - Cooling demand energizes at thermostat terminal Y1. Voltage passes through N.C. low pressure switch S87 to terminal 1 on timer DL33, and K167 latching relay coil, and to S11 low ambient low pressure switch.

2 - K167-1 closes energizing timer DL33. Timer begins. (After 5 minutes DL33 is de-energized). K167-2 contacts close opening contacts 9 and 3. Indoor blower is energized.

3 - Voltage passes through high pressure switch S4, energizing compressor contactor coil K1. K1-1 closes energizing compressor B1.

4 - Voltage passes through low ambient low pressure switch S11. (Switch will close provided liquid line pressure is high enough). Outdoor fan coil K10 is energized. K10-1 closes energizing outdoor fan B4. K10-2 opens de-energizing HR1 crankcase heater.

B-LSA120C-Y, G, J, M



1 - Cooling demand energizes through thermostat terminal Y1. Voltage passes through N.C. low pressure switch S87, to terminal 1 on N.O. timer DL33, to K167 latching relay coil and to S11 and S41.

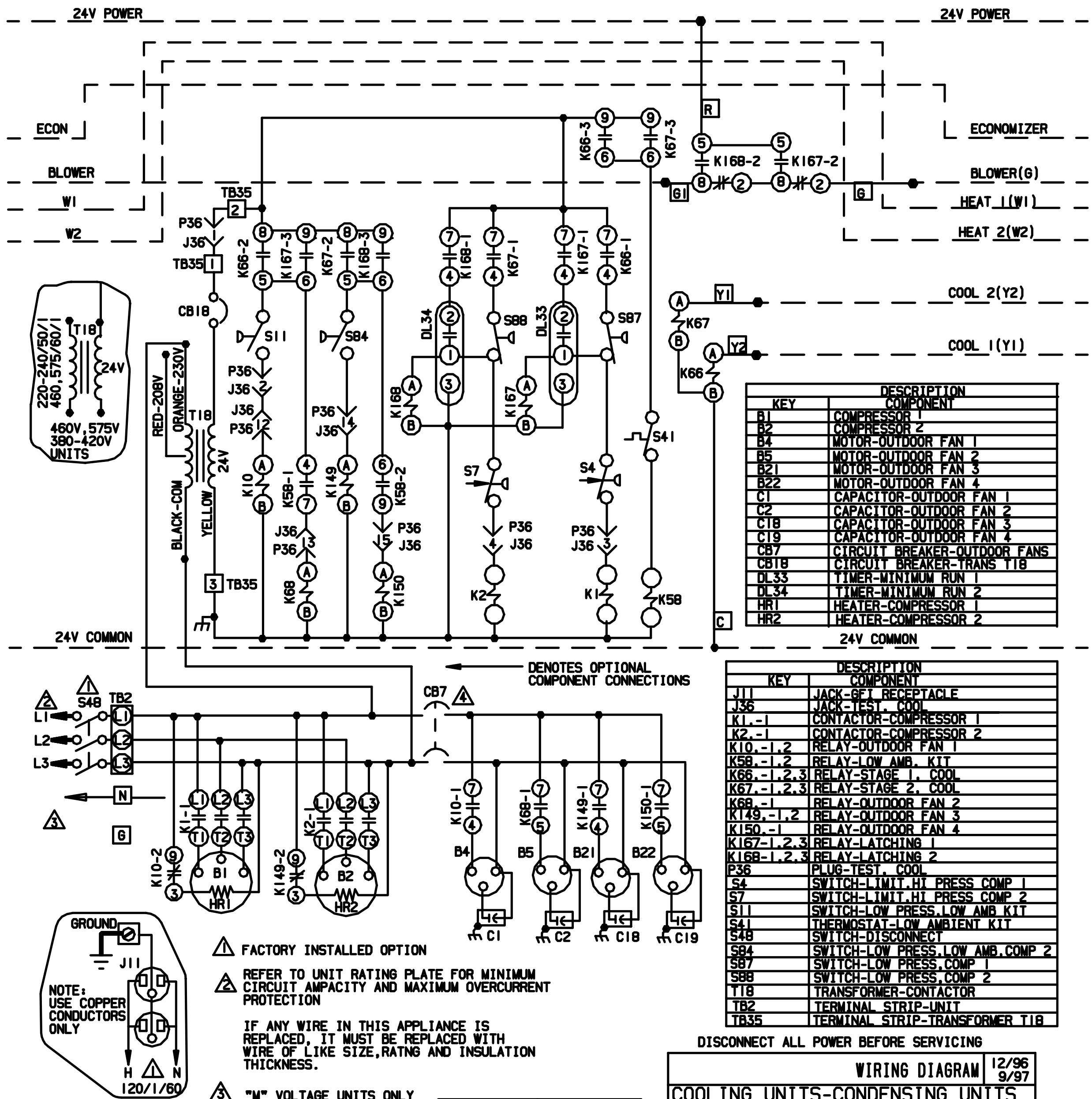
2 - K167-1 contacts close energizing DL33. Timer begins. (After 5 minutes DL33 is de-energized.) K167-2 contacts close opening contacts 9 and 3. Indoor blower is energized.

3 - Voltage passes through S4 high pressure switch, energizing K1 compressor contactor coil. K1-1 contacts close energizing compressor B1.

4 - Voltage passes through low ambient low pressure switch S11 (switch will close provided liquid line pressure is high enough) energizing K10 outdoor fan coil. K10-1 closes energizing outdoor fan B4. K10-2 contacts open, de-energizing HR1 crankcase heater.

5 - Voltage passes through N.C. low ambient thermostat S41 (switch will be closed provided ambient is warm enough). K68 outdoor fan coil is energized. K68-1 close energizing outdoor fan B5.

C-LSA180C, 240C-Y, G, J, M



KEY	DESCRIPTION COMPONENT
B1	COMPRESSOR 1
B2	COMPRESSOR 2
B4	MOTOR-OUTDOOR FAN 1
B5	MOTOR-OUTDOOR FAN 2
B21	MOTOR-OUTDOOR FAN 3
B22	MOTOR-OUTDOOR FAN 4
C1	CAPACITOR-OUTDOOR FAN 1
C2	CAPACITOR-OUTDOOR FAN 2
C18	CAPACITOR-OUTDOOR FAN 3
C19	CAPACITOR-OUTDOOR FAN 4
CB7	CIRCUIT BREAKER-OUTDOOR FANS
CB18	CIRCUIT BREAKER-TRANS T18
DL33	TIMER-MINIMUM RUN 1
DL34	TIMER-MINIMUM RUN 2
HR1	HEATER-COMPRESSOR 1
HR2	HEATER-COMPRESSOR 2

KEY	DESCRIPTION COMPONENT
J11	JACK-GFI RECEPTACLE
J36	JACK-TEST, COOL
K1,-1	CONTACTOR-COMPRESSOR 1
K2,-1	CONTACTOR-COMPRESSOR 2
K10,-1,2	RELAY-OUTDOOR FAN 1
K58,-1,2	RELAY-LOW AMB. KIT
K66,-1,2,3	RELAY-STAGE 1, COOL
K67,-1,2,3	RELAY-STAGE 2, COOL
K68,-1	RELAY-OUTDOOR FAN 2
K149,-1,2	RELAY-OUTDOOR FAN 3
K150,-1	RELAY-OUTDOOR FAN 4
K167-1,2,3	RELAY-LATCHING 1
K168-1,2,3	RELAY-LATCHING 2
P36	PLUG-TEST, COOL
S4	SWITCH-LIMIT,HI PRESS COMP 1
S7	SWITCH-LIMIT,HI PRESS COMP 2
S11	SWITCH-LOW PRESS,LOW AMB KIT
S41	THERMOSTAT-LOW AMBIENT KIT
S48	SWITCH-DISCONNECT
S84	SWITCH-LOW PRESS,LOW AMB,COMP 2
S87	SWITCH-LOW PRESS,COMP 1
S88	SWITCH-LOW PRESS,COMP 2
T18	TRANSFORMER-CONTACTOR
TB2	TERMINAL STRIP-UNIT
TB35	TERMINAL STRIP-TRANSFORMER T18

⚠1 FACTORY INSTALLED OPTION

⚠2 REFER TO UNIT RATING PLATE FOR MINIMUM CIRCUIT AMPACITY AND MAXIMUM OVERCURRENT PROTECTION

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

⚠3 "M" VOLTAGE UNITS ONLY

⚠4 CB7 USED ON "Y" VOLTAGE UNITS ONLY

LETTER DESIGNATION	VOLTAGE
Y	208-230/60/3
G	460/60/3
J	575/60/3
M	380-420/50/3

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

FOR USE WITH COPPER CONDUCTORS ONLY

DISCONNECT ALL POWER BEFORE SERVICING

WIRING DIAGRAM 12/96 9/97

COOLING UNITS-CONDENSING UNITS

LSA-180C-Y,G,J,M
LSA-240C-Y,G,J,M

COOLING SECTION-B41

Supersedes Form No. | New Form No. 531,646W

 Litho U.S.A.

LSA180C, 240C

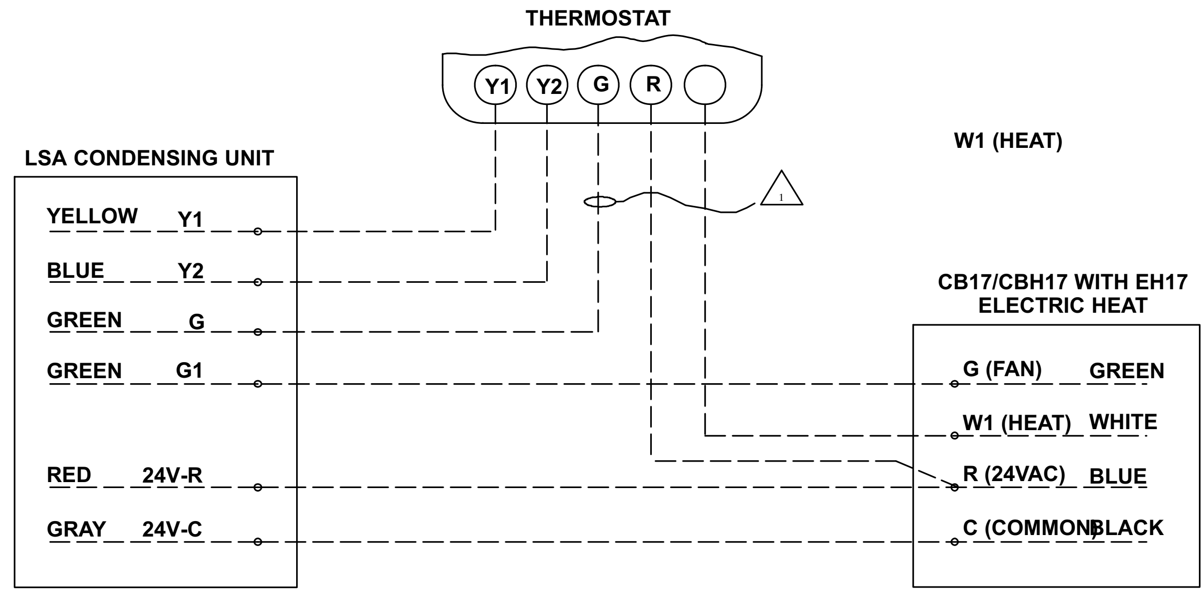
First stage cool

1 - Cooling demand energizes K66 relay coil at thermostat terminal Y1.
2 - K66-1 contacts close, voltage passes through S87 low pressure switch to terminal 1 on DL33 timer to K167 latching relay coil.
3 - K167-1 contacts close energizing DL33. Timer begins. (After 5 minutes DL33 is de-energized)
4 - Voltage passes through S4 high pressure limit energizing K1 compressor contactor. K1-1 contacts close energizing compressor B1.
5 - K167-2 contacts close. Contacts 8 and 2 open energizing indoor blower.
6 - K167-3 contacts close sending voltage to K58 low ambient contact terminal 4.
7 - K66-2 contacts close. Voltage passes through S11 low ambient pressure switch (switch will be closed provided liquid line pressure is high enough) to K10 outdoor fan relay coil.
8 - K10-1 contacts close energizing outdoor fan B4. K10-2 contacts open de-energizing HR1crankcase heater.
9 - K66-3 contacts close sending voltage through low ambient limit switch S41 (switch will close provided ambient is warm enough) to K58 low ambient coil. K58-1 closes energizing K68 outdoor fan coil. K68-1 contacts close energizing outdoor fan B5.

Second stage cool

10- Cooling demand energizes K67 relay coil at thermostat terminal Y2.
11- K67-1 contacts close, voltage passes through S88 low pressure switch to terminal 1 on DL34 timer to K168 latching relay coil.
12- K168-1 contacts close energizing DL34. Timer begins. (After 5 minutes DL34 is de-energized)
13- Voltage passes through S7 high pressure switch energizing K2 compressor contactor coil. K2-1 contacts close energizing compressor B2.
14- K168-2 contacts close. Contacts 8 and 2 open energizing indoor blower.
15- K168-3 contacts close sending voltage to K58 low ambient contact terminal 6.
16- K67-2 contacts close. Voltage passes through S84 low ambient pressure switch (switch will close provided liquid line pressure is warm enough) to outdoor fan relay coil K149.
17- K149-1 contacts close energizing outdoor fan B21. K149-2 contacts close de-energizing HR2 crankcase heater.
18- K67-3 contacts close sending voltage through S41 low ambient limit (switch will closed provided ambient is high enough) to low ambient relay coil K58. K58-2 contacts close energizing K150 outdoor fan relay coil. K150-1 contacts close energizing B22 outdoor fan.

LSA FIELD WIRING WITH BLOWER COIL UNIT AND AUXILIARY ELECTRIC HEAT



1 "G" WIRE MUST BE ROUTED FROM THERMOSTAT TO CONDENSING UNIT AS SHOWN, TO PROVIDE BLOWER INTERLOCK WITH THE COMPRESSOR.