LENNOX® Service Literature

UNIT INFORMATION

HS29

Corp. 0104-L2
Revised 04-2003

HS29 SERIES UNITS

The HS29 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 HS29 units use single speed scroll compressors. The 15 (53kW) and 20 ton (70kW) units each have two single-speed scroll compressors. The HS29 units match with the CB17 blower-coil units. All HS29 units are three-phase.

This manual covers HS29-072, HS29-090, HS29-120, HS29-180 and HS29-240 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.

HS29-120 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.

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SPECIFICATIONS

Model No.			HS29-072-1/-2	HS29-090-2	HS29-120-2	HS29-180-2	HS29-240-2
Nominal Size - Tons (kW)			6 (21.1)	7.5 (26.4)	10 (35.2)	15 (52.8)	20 (70.3)
Liquid line (o.d.) — in. (mm) connection (sweat)			5/8 (15.9)			(2) 5/8 (15.9)	
Suction line (o.d.) — in. (mm) connection (sweat)			1-1/8 (28.6)	1-3/8 (34.9)		(2) 1-3/8 (34.9)	
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			dry air holding charge				
Shipping weight — lbs. (kg) 1 package			354 (161)	427 (193)	567 (257)	998 (453)	1189 (539)
Optional Accessories – Must Be Ordered Extra							
Hail Guards			**86K90**	**83K36**	**79K91**		
Hot Gas Bypass Kit (hot gas bypass/superheat valve)			**89K83**	**79K90**	**89K84**	not available	
Hot Gas Bypass Kit (hot gas bypass valve only)			**93K76**	**93K77**	**93K78**		

ELECTRICAL DATA

Model No.		HS29-072-1/-2			HS29-090-2			HS29-120-2			HS29-180-2			HS29-240-2		
Line voltage data - 60 hz - 3 phase		208/230v	460v	575v	208/230v	460v	575v	208/230v	460v	575v	208/230v	460v	575v	208/230v	460v	575v
Recommended maximum fuse or [1]circuit breaker size (amps)		40	20	15	60	30	25	80	40	25	100	50	35	130	60	40
†Minimum circuit ampacity		27	13	11	39	20	15	53	25	18	75	39	29	95	44	32
Compressor	No. of Compressors	1			1			1			2			2		
	Rated load amps (total)	18.6	9	7.4	28.8	14.7	10.8	37.8	17.2	12.4	28.8 (57.6)	14.7 (29.4)	10.8 (21.6)	37.8 (75.6)	17.2 (34.4)	12.4 (24.8)
	Locked rotor amps (total)	156	75	54	195	95	80	239	125	80	195 (390)	95 (190)	80 (160)	239 (478)	125 (250)	80 (160)
Condenser Coil Fan Motor (1 phase)	No. of motors	1			1			2			4			4		
	Full load amps (total)	3	1.5	1.2	3	1.5	1.2	2.4 (4.8)	1.3 (2.6)	1 (2)	2.4 (9.6)	1.3 (5.2)	1 (4)	2.4 (9.6)	1.3 (5.2)	1 (4)
	Locked rotor amps (total)	6	3	2.9	6	3	2.9	4.7 (9.4)	2.4 (4.8)	1.9 (3.8)	4.7 (18.8)	2.4 (9.6)	1.9 (7.6)	4.7 (18.8)	2.4 (9.6)	1.9 (7.6)

†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

General Data	Model No.	HS29-072-3	HS29-090-3	HS29-120-3
	Nominal Size - Tons (kW)	6 (21.1)	7.5 (26.4)	10 (35.2)
Connections (sweat)	Liquid line (o.d.) - in. (mm)	5/8 (15.9)	5/8 (15.9)	5/8 (15.9)
	Suction line (o.d.) - in. (mm)	1-1/8 (28.6)	1-3/8 (34.9)	1-3/8 (34.9)
Refrigerant		dry air holding charge		
Condenser Coil	Net face area - sq. ft. (m^2) Outer coil	12.92 (1.20)	22.50 (2.09)	29.36 (2.73) total
	Inner coil	12.59 (1.17)	21.70 (2.02)	- - -
	Tube diameter - in. (mm) & no. of rows	3/8 (9.5) - 2	3/8 (9.5) - 2	3/8 (9.5) - 2
	Fins per inch (m)	20 (787)	20 (787)	15 (630)
Condenser Fan(s)	Diameter - in. (mm) & no. of blades	(1) 24 (610) - 4	(1) 24 (610) - 4	(2) 20 (610) - 3
	Motor hp (W)	(1) 1/2 (373)	(1) 3/4 (560)	(2) 1/3 (249)
	cfm (L/s) total air volume	4500 (2125)	5150 (2430)	8200 (3870)
	Rpm	1075	1060	1100
	Watts	600	570	700 total
Shipping	lbs. (kg) 1 package	319 (145)	405 (184)	567 (257)
Optional Accessories – Must Be Ordered Extra				
Hail Guards		**29M43**	**29M44**	**79K91**
Hot Gas Bypass Kit (bypass to suction)		**28M73**	**79K90**	**89K84**
Hot Gas Bypass Kit (bypass to evaporator)		**28M72**	**93K77**	**93K78**

ELECTRICAL DATA

General Data	Model No.	HS29-072-3			HS29-090-3			HS29-120-3		
	Line voltage data - 60 hz - 3 phase	208/230v	460v	575v	208/230v	460v	575v	208/230v	460v	575v
	Recommended maximum fuse or [1] circuit breaker size (amps)	40	20	15	60	35	25	80	40	25
	†Minimum circuit ampacity	27	13	11	40	21	16	54	25	18
Compressor	No. of Compressors	1	1	1	1	1	1	1	1	1
	Rated load amps (total)	18.6	9	7.4	28.8	14.7	10.8	37.8	17.2	12.4
	Locked rotor amps (total)	156	75	54	195	95	80	239	125	80
Condenser Fan Motor (1 phase)	No. of motors	1	1	1	1	1	1	2	2	2
	Full load amps (total)	3	1.5	1.2	3.7	1.9	1.6	2.4 (4.8)	1.3 (2.6)	1 (2)
	Locked rotor amps (total)	6	3	2.9	7.3	3.7	3.4	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.

HS29-072-3 & HS29-090-3 PARTS ARRANGEMENT
(HS29-072-3 shown)

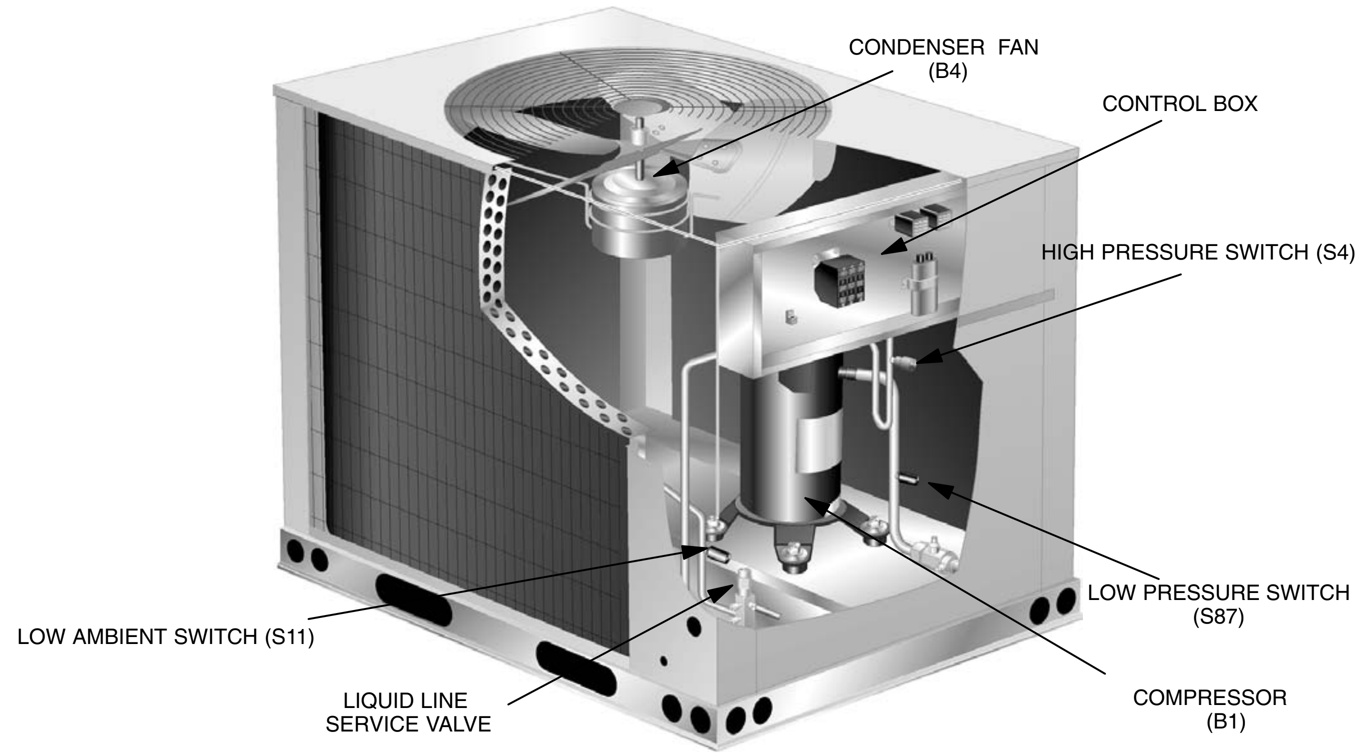


FIGURE 1

HS29-120-3 PARTS ARRANGEMENT

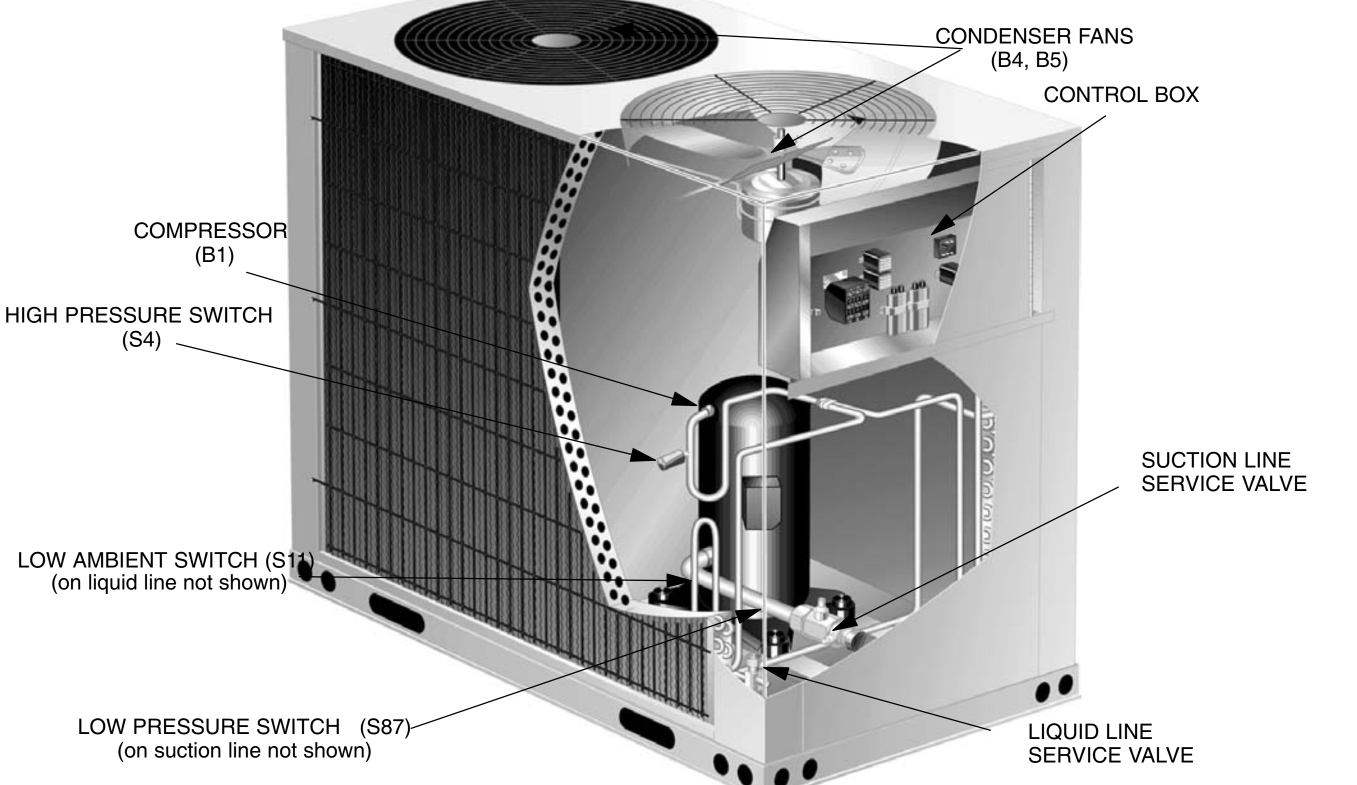


FIGURE 2

HS29-180 & HS29-240 PARTS ARRANGEMENT

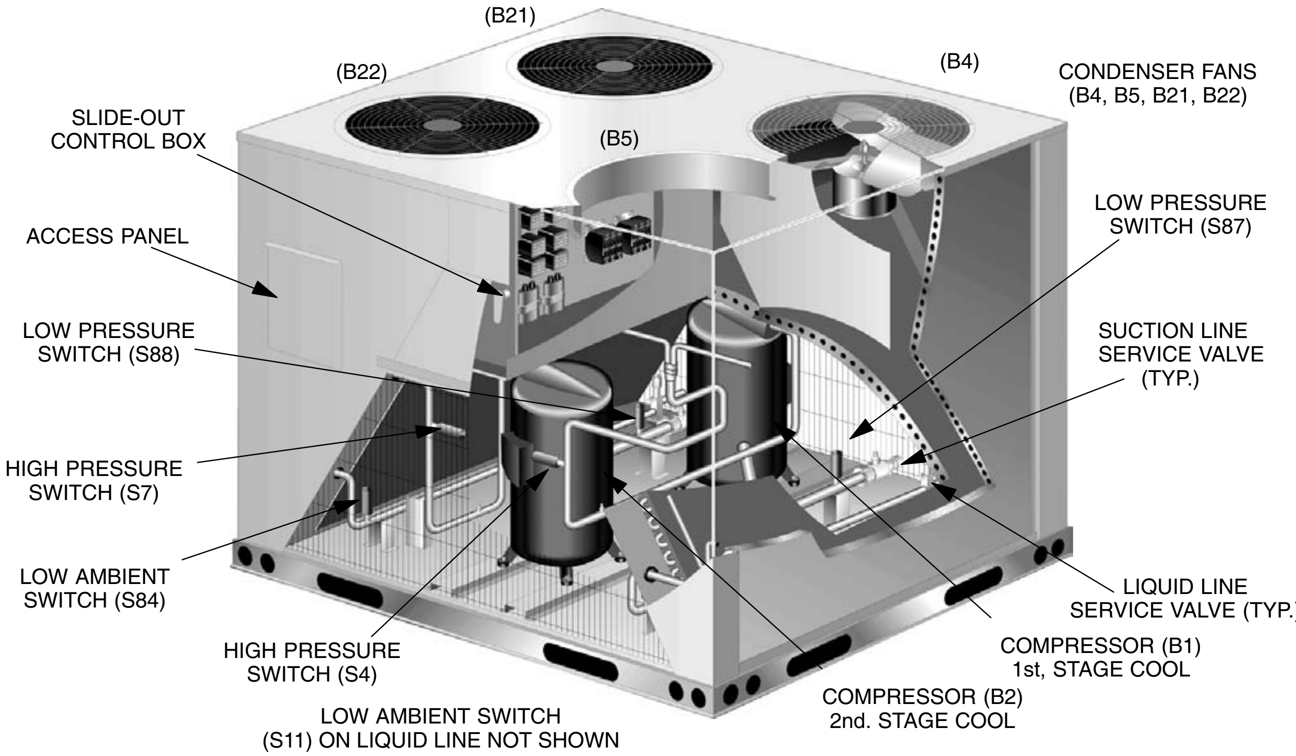


FIGURE 3

HS29-072 & HS29-090 CONTROL BOX

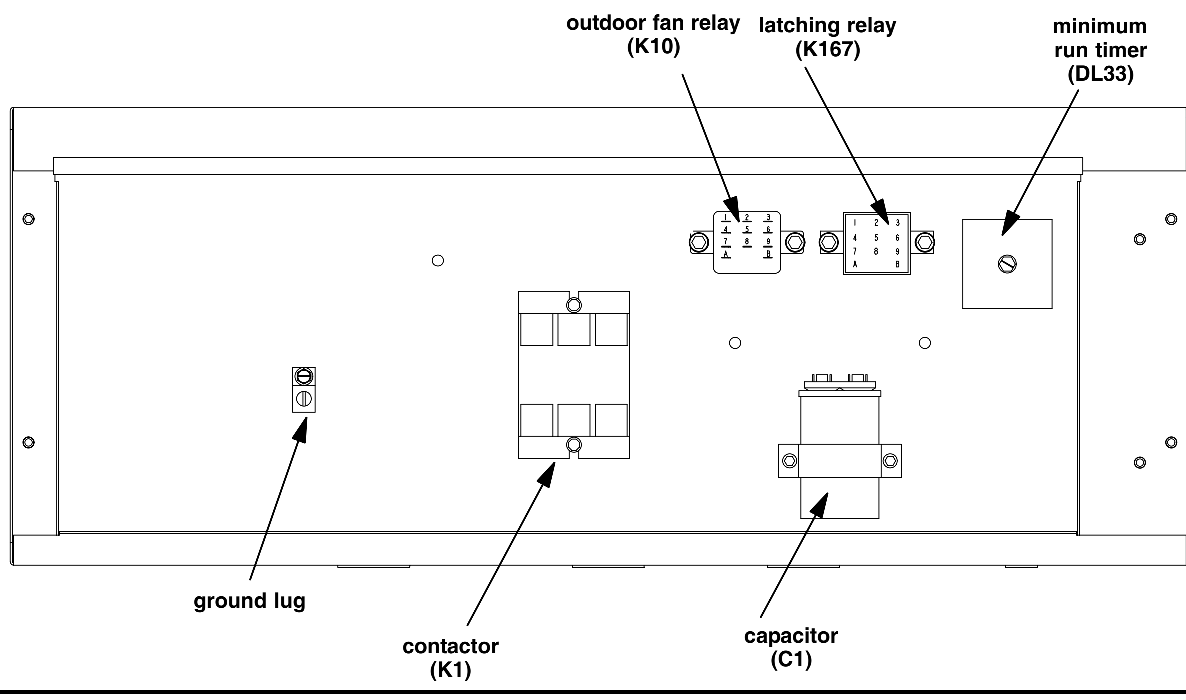


FIGURE 4

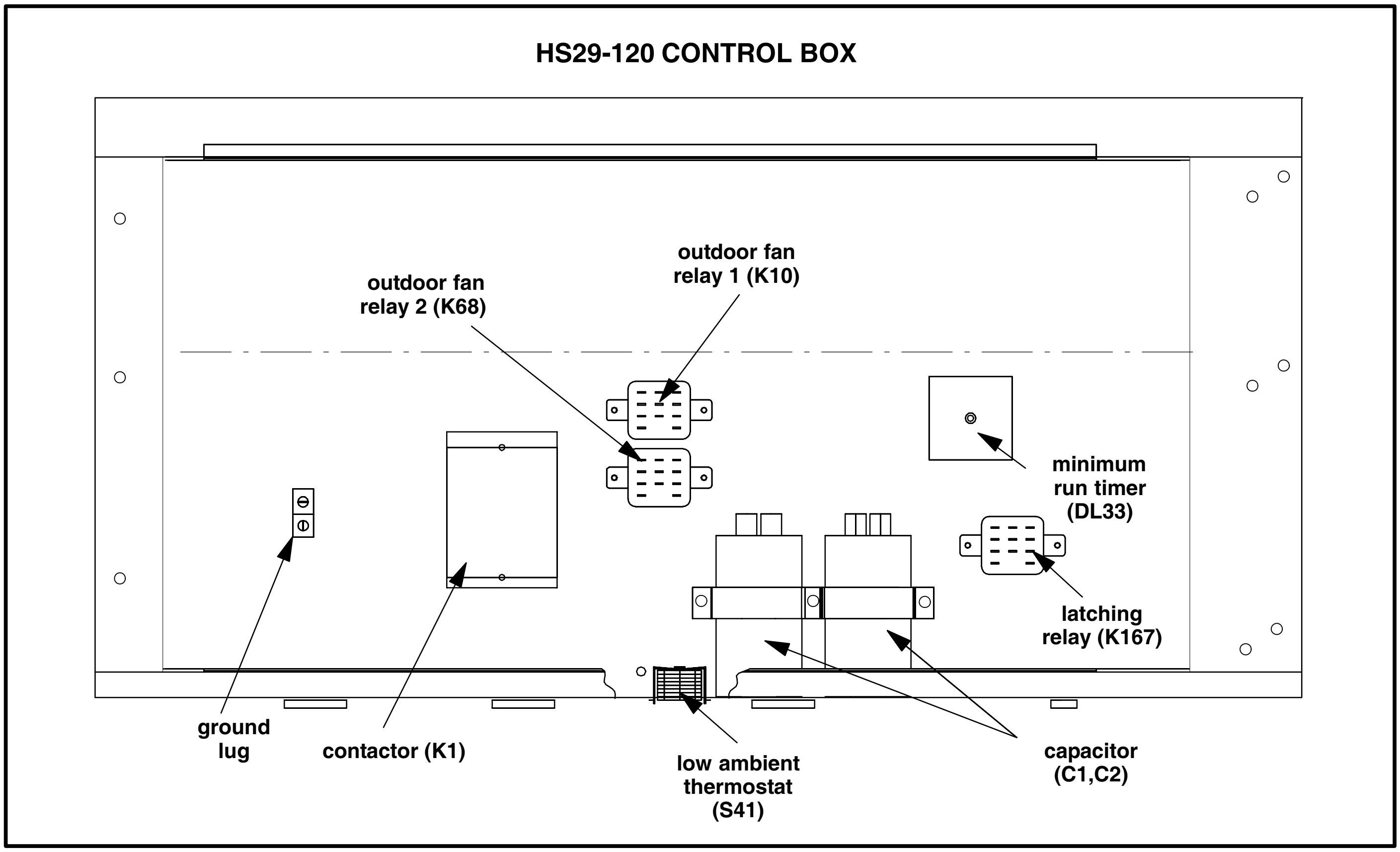


FIGURE 5

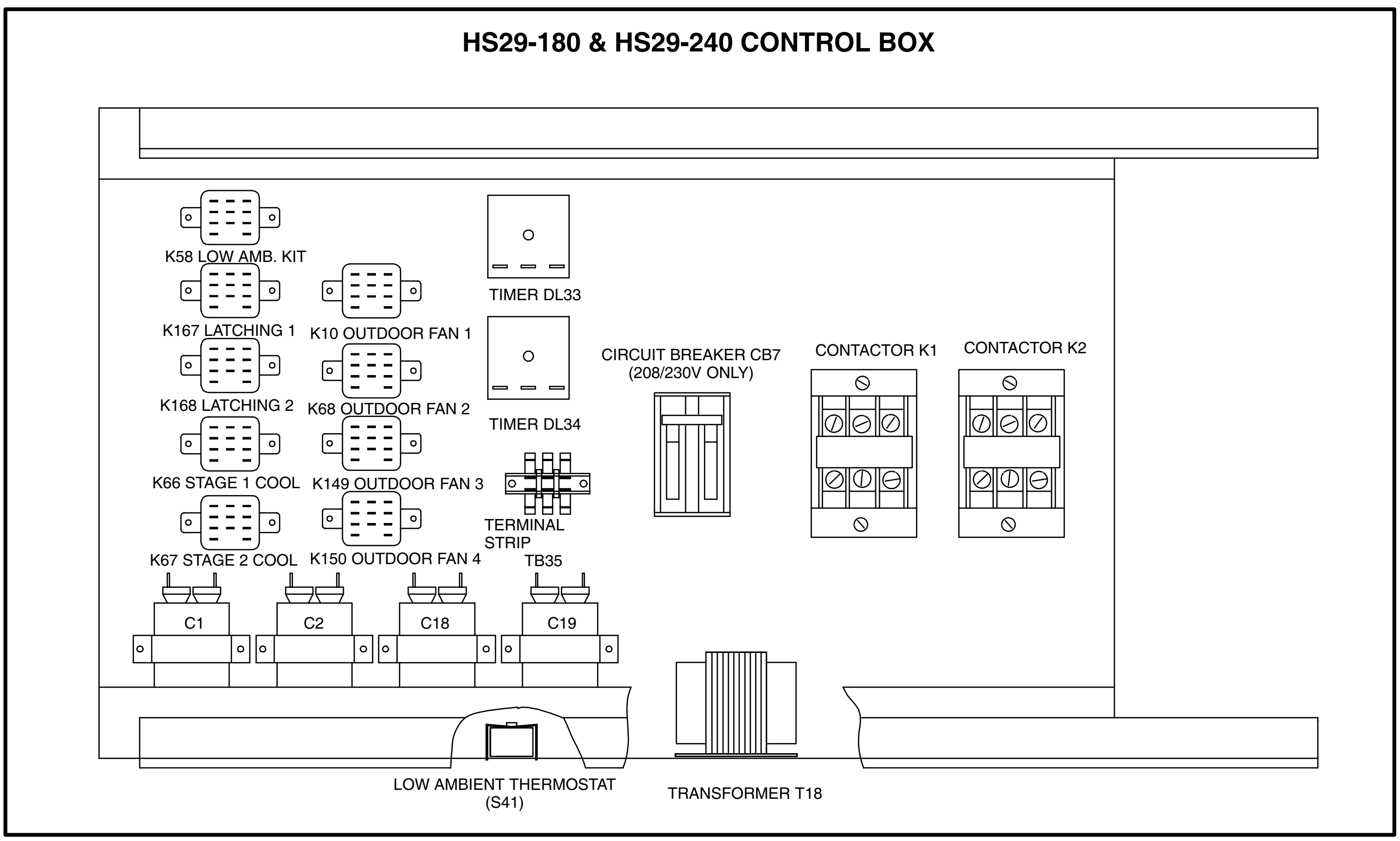


FIGURE 6

I-UNIT COMPONENTS

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.

The HS29-072/090 components are shown in figure 1. The HS29-120 components are shown in figure 2 and the HS29-180/240 components are in figure 3.

A-CONTROL BOX COMPONENTS

The HS29-072/090 control box components are shown in figure 4. The HS29-120 control box components are shown in figure 5 and the HS29-180/240 control box components are in figure 6. The control box for the HS29-072/090 and 120 units is located in a separate compartment. The HS29-180/240 has a slide-out control box.

1 - Disconnect Switch S48 (Option on HS29-1 and -2 units)

Some HS29 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 HS29-180/240 units.

2 - Transformer T18 (180, 240)

The HS29 15 and 20 ton units use a line voltage to 24VAC transformer mounted in the control box. Transformer T18 supplies power to control circuits in the HS29 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.

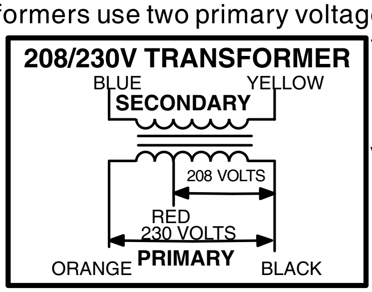


FIGURE 7

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 (180, 240)

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

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

All HS29 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.

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

All compressor contactors are three-pole double- break contactors with a 24V coil. In HS29-072/090 and the HS29-120 units, K1 energizes compressor B1. In HS29-180/240 units, K1 and K2 energize compressors B1 and B2.

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

All HS29 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.

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

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 HS29-180/240 units, K167 and K168 close energizing timers DL33 and DL34.

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

HS29-120 and HS29-180/240 units have a low ambient thermostat. S41 is a N.C. switch which opens on temperature fall at 55± 5°F. The switch resets when temperature rises to 65± 6°F. On the HS29-120, S41 opens and de-energizes K68 which de-energizes outdoor fan B5. On the HS29-180/240 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.

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

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 HS29-120,180 and 240, K68 energizes condenser fan B5 (fan 2) in response to thermostat demand. In the HS29-180/240, K149 and K150 energize condenser fans B21 (fan 3) and B22 (fan 4), in response to thermostat demand.

GFI- J11
(Option on HS29-1 and -2 units)

Some HS29 units may be equipped with a 110v ground fault interrupter (GFI) receptacle. The GFI is located on the control box panel on the HS29-072/090 and 120. The GFI is located in a separate box on the opposite side of unit form the control box on the HS29-180/240. Separate wiring must be run for the 110v receptacle.

10 - Circuit Breaker CB7 (180/240 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.

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 (180/240)

ALL HS29 -072/090, 120 and 180/240 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

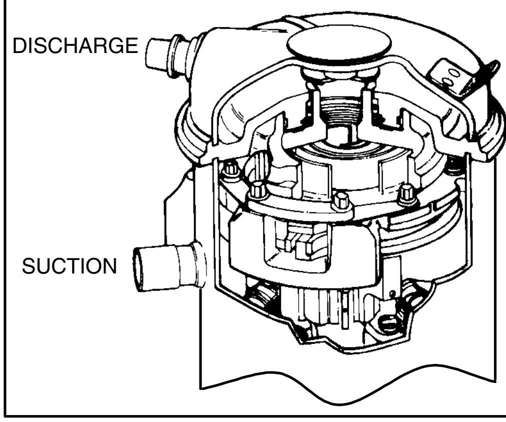


FIGURE 8

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.

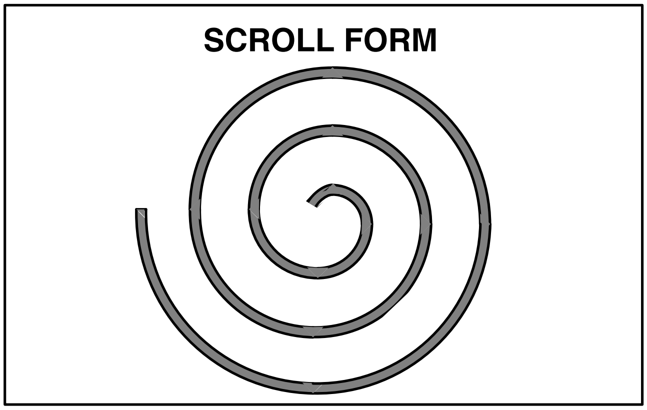


FIGURE 9

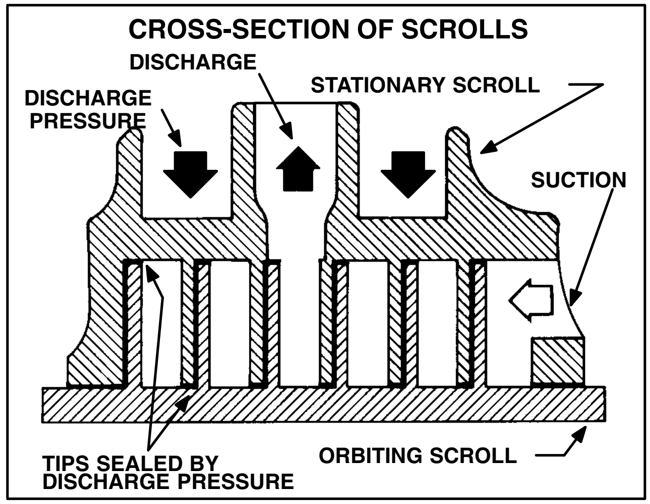


FIGURE 10

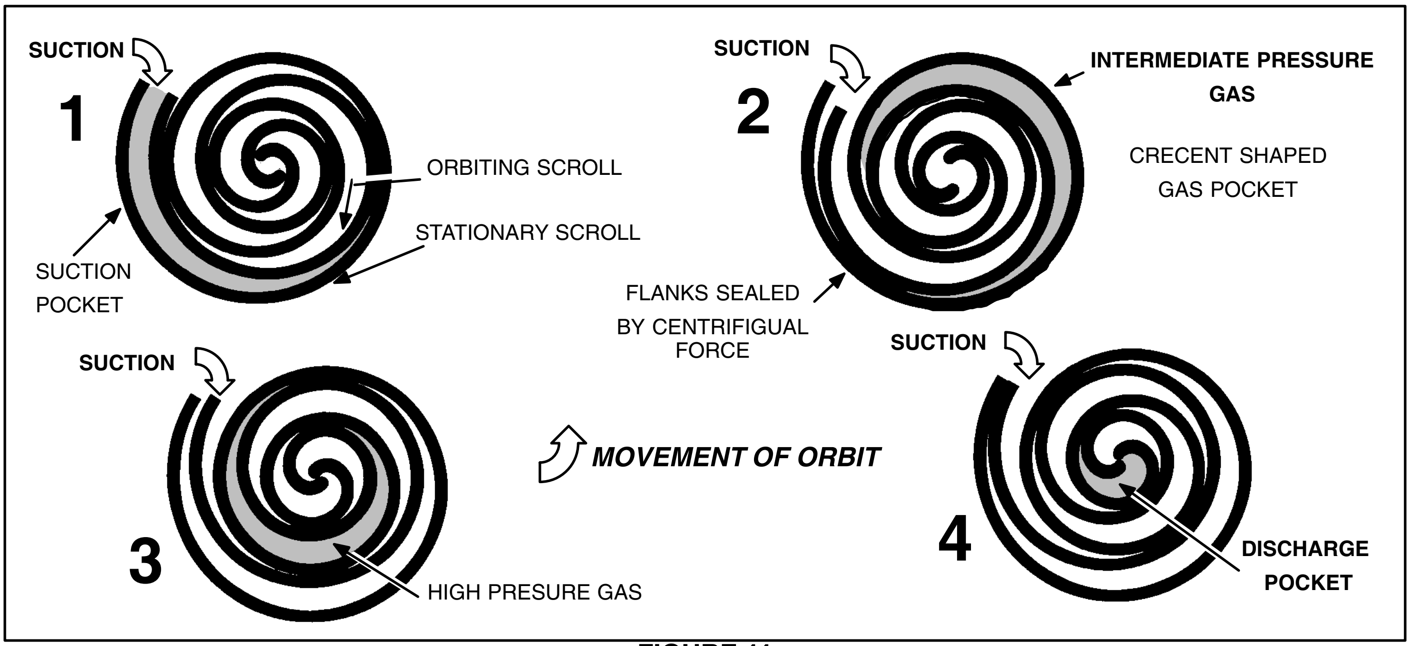


FIGURE 11

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 (180/240 only)

Cooling relays K66 and K67 are N.O. 3PDT relays used in the HS29-180/240. 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 (180/240)

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 (120, 180/240)

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 discharge line and is wired in series with the compressor contactor coil. When discharge pressure rises to 450 $\pm$ 10 psig (3101 $\pm$ 69 kP) the switch opens and the compressor is de-energized.

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

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. HS29-180 and 240 units are equipped with both S11 and S84. A switch is located in each liquid line. In all HS29 units, S11 is wired in series with fan relay K10. In the HS29-180 and 240, S84 is wired in series with fan relay K149. When liquid pressure rises to 275 $\pm$ 10 psig (1896 $\pm$ 69 kPa), the switch closes and the condenser fan is energized. When the liquid pressure drops to 150 $\pm$ 10 psig (1034 $\pm$ 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 (180/240)

The low pressure switch is an auto-reset SPST N.O. switch which opens on pressure drop. All HS29 units are equipped with S87. HS29-180 and 240 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 $\pm$ 5 psig (172 $\pm$ 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 $\pm$ 5 psig (379 $\pm$ 34 kPa).

7 - Filter Drier (all units)

All HS29 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.

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

See page 2 for the specifications on the condenser fans used in the HS29 units. All condenser fans have single-phase motors. The HS29-072 and 090 units are equipped with a single condenser fan. The HS29-120 is equipped with two fans. HS29-180 and 240 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.

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

The hot gas bypass kit is used with split system units requiring capacity reduction (up to 6 tons 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 de-superheating 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 12

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 15.

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

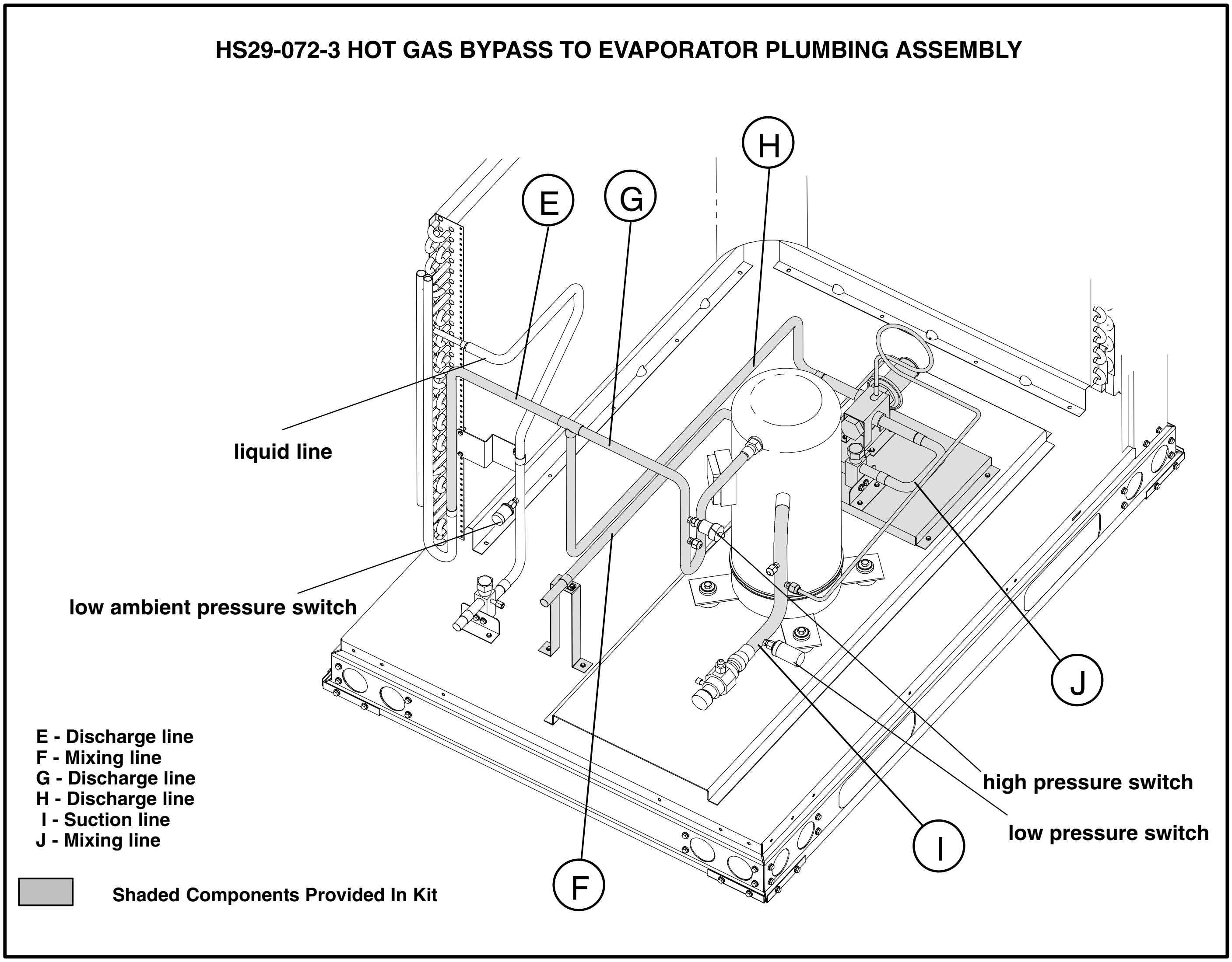


FIGURE 12

BYPASS TO SUCTION LINE 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 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 figure14.

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.

HS29-072-3 HOT GAS BYPASS TO SUCTION LINE ASSEMBLY

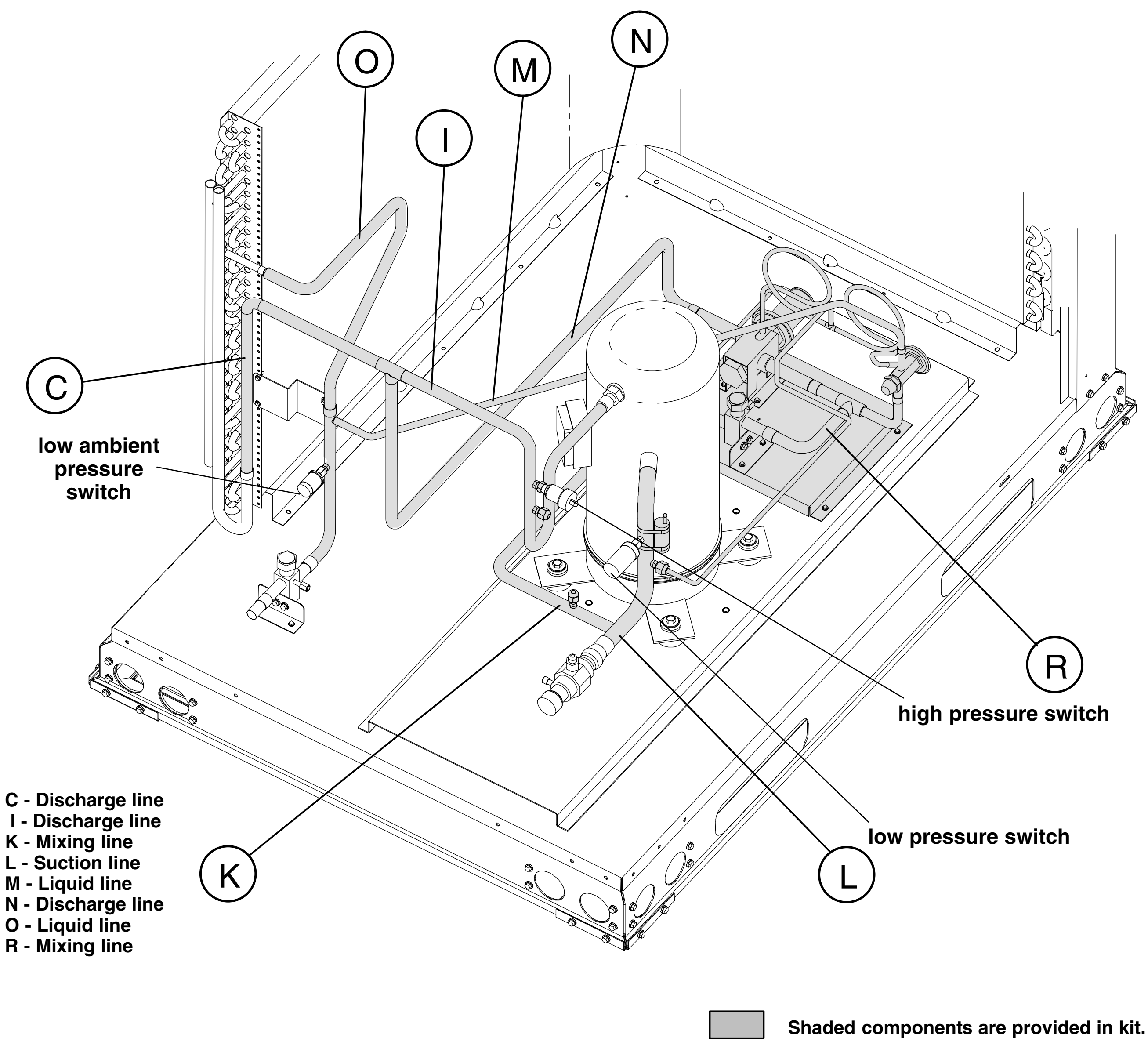


FIGURE 13

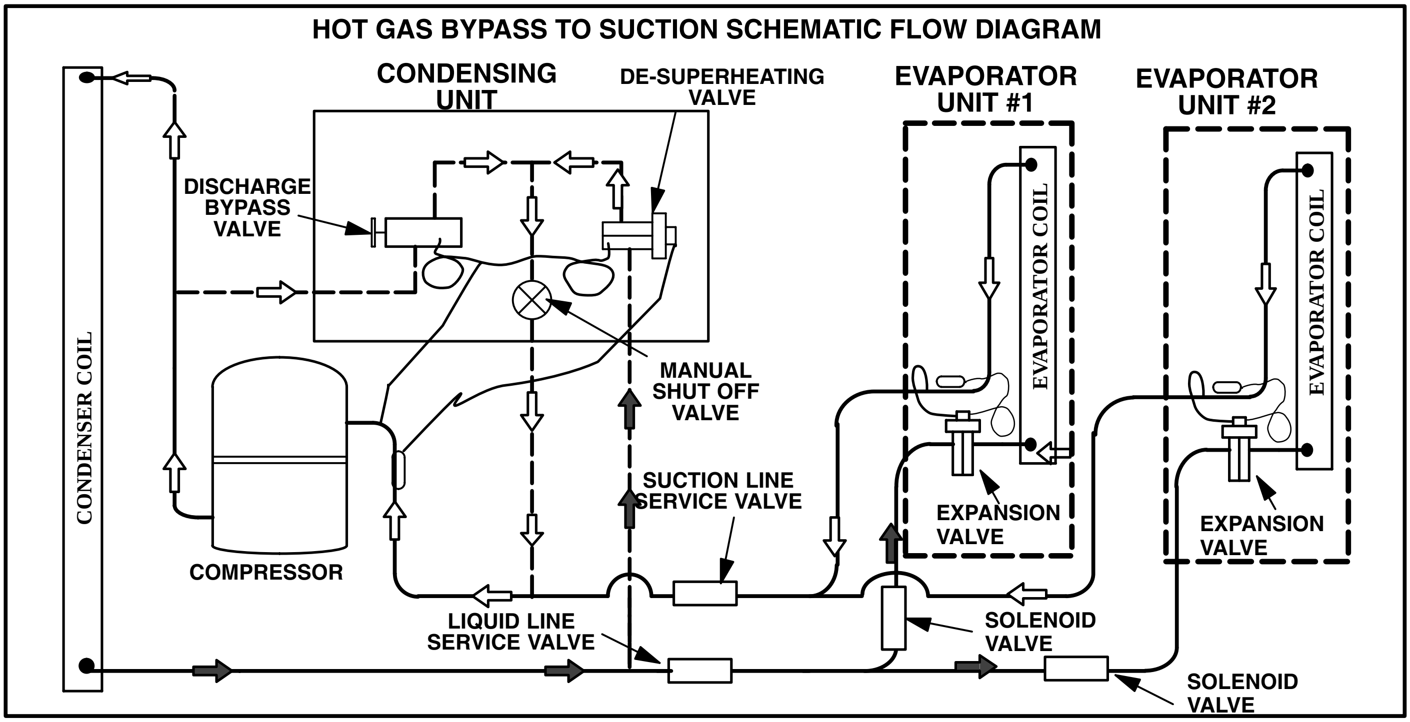


FIGURE 14

Hot Gas Bypass 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 13 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).

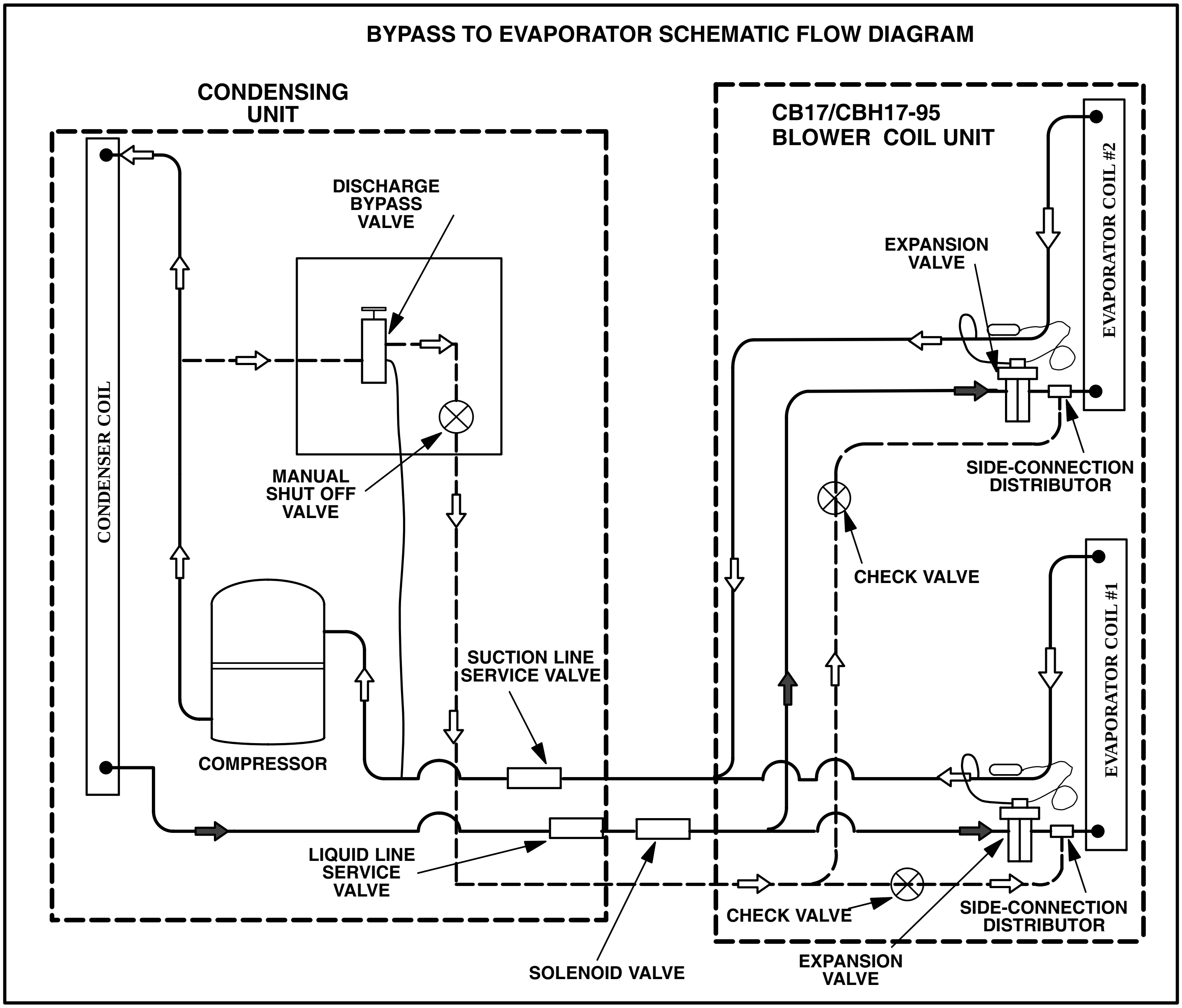


FIGURE 15

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, 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 bypass to the suction line or evaporator. If bypass 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 valve core 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 - If bypass 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

HS29 UNIT	LIQUID LINE	SUCTION LINE
-072	5/8 in (16 mm)	1-1/8 in (29 mm)
-090, -120, -180, -240	5/8 in (16 mm)	1-3/8 in (35 mm)

B-Service Valves

All HS29 units are equipped with service valves located in the suction and liquid lines. The service valves are manually operated. See figures 16, 17, 18 and 19 . The service ports are used for leak testing, evacuating, charging and checking charge.

1 - Liquid Line Service Valve

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. All HS29-072, -090 and -120 units and HS29-180/240-2 units produced after 10-01-01, use valves shown in figure 16. HS29-180/240 units produced before 10-01-01 use valves shown in figure 17. 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.

To Access Schrader Port: All HS29 UNITS

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.

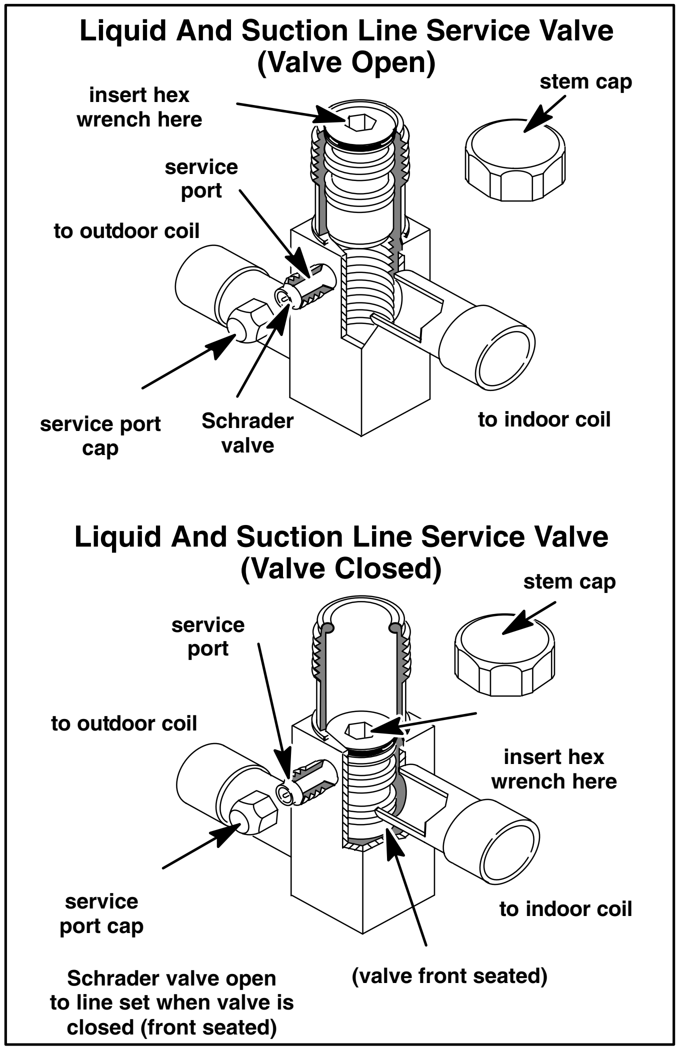


FIGURE 16
HS29-072, -090, -120

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

HS29-1 and -2 units are equipped with service valves with a retaining ring. Do not attempt to backseat these valves past the retaining ring. Attempts to backseat these valves 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.

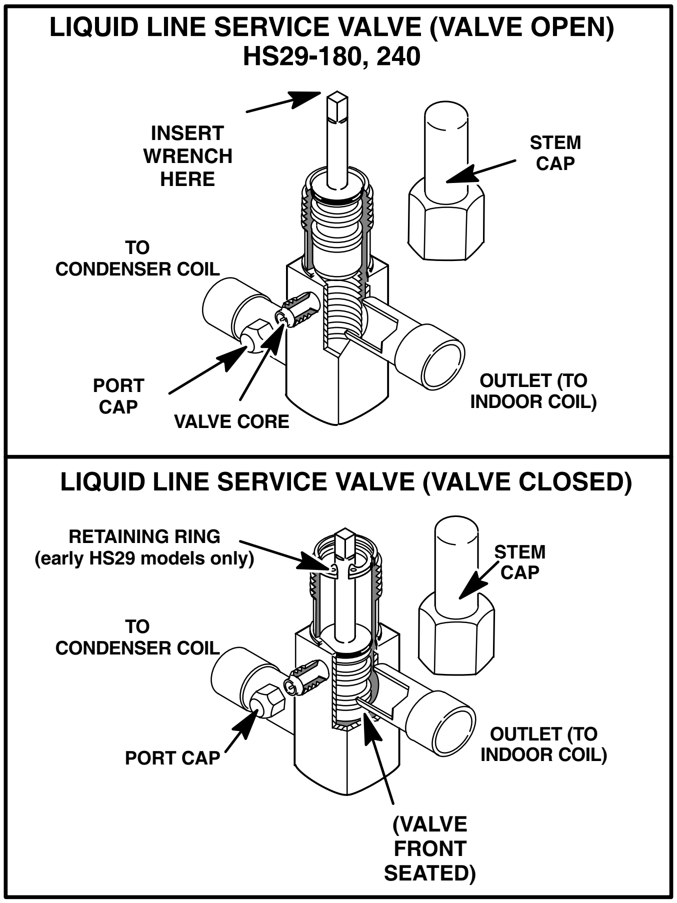


FIGURE 17

HS29-180/240

To Open Liquid 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.

2 - Suction Line Service Valve HS29-072-1

A full service front and back seating suction line service valve is used on HS29-072-1 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 18.

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 HS29-072-2/-3, HS29-090, -120, -180/240

The HS29072-2, -3 and all HS29-090 through -240 model units are equipped with a full service ball valve, as shown in figure 19. 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.

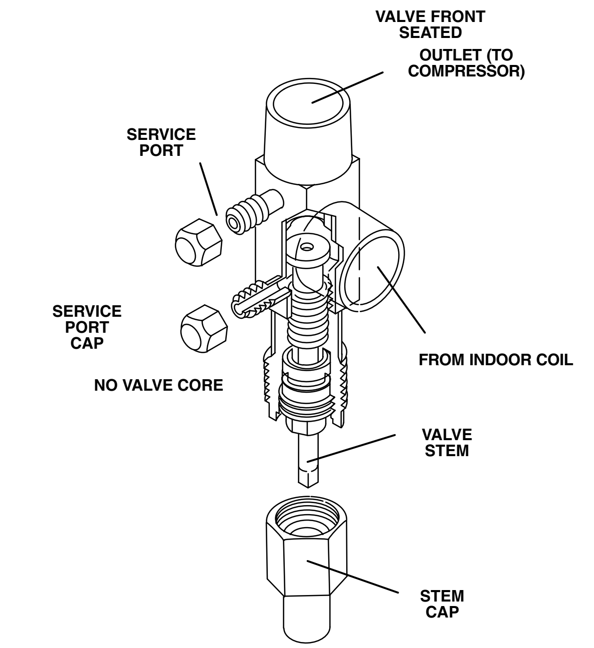
Closing the Suction Line Service Valve

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.

SUCTION LINE SERVICE VALVE (VALVE OPEN)
HS29-072-1



NOTE-When valve is front seated, service port is not isolated (blocked off) from system.

FIGURE 18

SUCTION LINE (BALL TYPE) SERVICE VALVE
HS29-072-2, -3, HS29-090, 120, 180,240
USE ADJUSTABLE WRENCH
ROTATE STEM CLOCKWISE 90° TO CLOSE
ROTATE STEM COUNTERCLOCKWISE 90° TO OPEN

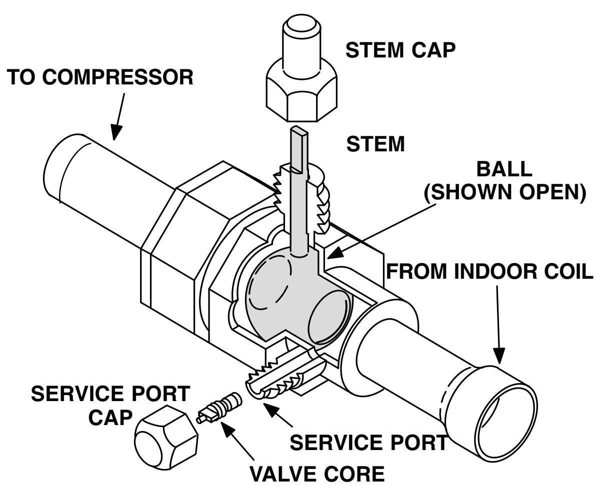


FIGURE 19

III-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.

⚠ IMPORTANT

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.

IV- CHARGING

⚠ 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.

HS29 units are to be **field charged** with the amount of HCFC-22 refrigerant indicated on the unit nameplate or unit Installation Instructions. 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 HS29-072, HS29-090 and HS29-120 series units and table 3 for HS29-180 and HS29-240 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) *
HS29-072	12 lbs. 8 ozs. (5.7kg)	1.8 ozs. (51g)
HS29-090-2 HS29-090-3	16 lbs. 0 ozs. (7.5kg) 17 lbs. 8 ozs. (7.94)	1.8 ozs. (51g)
HS29-120	23 lbs 8 ozs. (10.4kg)	1.8 ozs. (51g)

**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)
UNIT	Circiut 1	Circuit 2	Each Circuit
HS29-180	14.5 lbs. (6.6kg)	14.5 lbs. (6.6 kg)	1.8 ozs. (51 g)
HS29-240	22 lbs. (10kg)	22 lbs. (10 kg)	1.8 ozs. (51 g)

***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 HS29 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

TABLE 4

HS29-072-1, -2, -3 & HS29-090-2 & HS29-120-2 Units

Outdoor Coil Entering Air Temperature	HS29-072* Discharge ± 10 psig	HS29-072* Suction ± 5 psig	HS29-072** Discharge ± 10 psig	HS29-072** Suction ± 5 psig	HS29-090** Discharge ± 10 psig	HS29-090** Suction ± 5 psig	HS29-120*** Discharge ± 10 psig	HS29-120*** Suction ± 5 psig
65°F (18°C)	173	61	180	73	196	71	181	66
75°F (24°C)	199	63	207	75	224	72	206	68
85°F (29°C)	229	65	238	77	254	73	234	69
95°F (35°C)	261	67	271	79	288	74	265	70
105°F (40°C)	298	71	308	82	323	76	300	72
115°F (46°C)	333	72	342	83	363	77	335	73

**HS29-072 tested with CB30U-65. Pressure shown is with typical 5-ton indoor coil match-up.*
***HS29-072 and HS29-090 tested with CB17/CBH17-95V.*
****HS29-120 tested with CB17/CBH17-135V.*

TABLE 5

HS29-090-3 and HS29-120-3 Units

Outdoor Coil Entering Air Temperature	HS29-090** Discharge ± 10 psig	HS29-090** Suction ± 5 psig	HS29-120*** Discharge ± 10 psig	HS29-120*** Suction ± 5 psig
65°F (18°C)	189	72	169	63
75°F (24°C)	217	73	197	67
85°F (29°C)	245	75	226	70
95°F (35°C)	278	76	256	71
105°F (40°C)	314	77	290	73
115°F (46°C)	352	79	328	74

***HS29-072 and HS29-090 tested with CB17/CBH17-95V.*
****HS29-120 tested with CB17/CBH17-135V.*

TABLE 6

Outdoor Coil Entering Air Temperature	HS29-180* Circuit 1		HS29-180* Circuit 2		HS29-240** Circuit 1		HS29-240** 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)	174	62	173	67	190	70	193	68
75°F (24°C)	202	64	200	69	213	71	216	70
85°F (29°C)	231	65	229	70	240	73	245	71
95°F (35°C)	263	67	260	71	272	75	275	73
105°F (40°C)	298	68	294	72	305	76	309	74
115°F (46°C)	336	70	331	73	342	78	346	76

**HS29-180 tested with CB17/CBH17-185V. **HS29-240 tested with CB17/CBH17-275V.*

NOTE - System charging is not recommended below 60°F (15°C). If the temperature is below 60°F (15°C), the charge must be weighed into the system.

Units are shipped with a holding charge of dry air and helium which must be removed before the unit is evacuated and charged with refrigerant. The most accurate method of charging is to weigh the refrigerant into the unit as indicated in the following procedure.

1 - Recover the refrigerant from the unit.
2 - Conduct a leak check, then evacuate as previously outlined.
3 - Weigh in the amount of charge listed in tables 2 and 3.

If weighing facilities are not available, or if the charge needs to be checked, use the following method.

1 - Attach the gauge manifolds and operate the unit in cooling mode until the system stabilizes (approximately five minutes).
2 - Use a digital thermometer to accurately measure the outdoor ambient temperature. For HS29-180 and HS29-240 units, check each system separately with all stages operating.
3 - Apply the outdoor temperature to table 4 or 6 to determine normal operating pressures.
4 - 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.
5 - Add or remove the charge in increments and allow the system to stabilize each time you add or remove the refrigerant.

HS29-072, HS29-090, HS29-120 ONLY

Use the approach method to confirm readings.

Verifying the Charge Using Approach Method for Temperatures > 60°F only

Do not use the approach method if the system pressures do not match the pressures given in table 4. The approach method is not valid for grossly over- or undercharged systems.

⚠ 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 - Use the same digital thermometer to take the liquid line temperature and the outdoor ambient temperature. Measure the liquid line temperature at the condenser outlet. Then compare the liquid line temperature to the outdoor ambient temperature. **The approach temperature equals the liquid line temperature minus the outdoor ambient temperature.**
2 - The approach temperature should match values given in table 7. An approach temperature greater than the value shown indicates an undercharge. An approach temperature that is less than the value shown indicates an overcharge.

TABLE 7
Approach Method

MODEL NO.	LIQUID TEMP. MINUS AMBIENT TEMP. °F (°C)
HS29-072-1, -2 , -3*	12 ± 1 (6.7 ± .5)
HS29-072-1, -2, -3**	16 ± 1 (8.9 ± .5)
HS29-090-2,**	11 ± 1 (6.0 ± .5)
HS29-120-2,***	11 ± 1 (6.0 ± .5)
HS29-090-3**	12 ± 1 (6.7 ± .5)
HS29-120-3***	9 ± 1 (5.0 ± .5)

Note - For best results, use the same digital thermometer check both outdoor ambient and liquid line temperature at the exit of the condenser.
**Matched with CB30U-65 or typical 5-ton indoor evaporator coil.*
***Matched with CB17/CBH17-95V.*
****Matched with CB17/CBH17-135V.*

HS29-180, HS29-240 ONLY

Use subcooling method to confirm readings.

Charge Verification Using the Subcooling Method

1 - Use the same thermometer to take both liquid line temperature and outdoor ambient temperature.
2 - Note the liquid line pressure and convert the value to the saturated condensing temperature using a standard HCFC-22 temperature/pressure table or the conversion scale on the gauge.

TABLE 8
Subcooling Values

Outdoor Coil Entering Air Temperature	HS29-180		HS29-240	
	Circuit 1 (± 1°F)	Circuit 2 (± 1°F)	Circuit 1 (± 1°F)	Circuit 2 (± 1°F)
65°F (18°C)	9	8	12	13
75°F (24°C)	10	9	13	13
85°F (29°C)	12	13	12	14
95°F (35°C)	14	15	14	15
105°F (41°C)	17	17	15	16
115°F (46°C)	18	19	15	16

3 - Subtract the liquid line temperature from the saturated condensing temperature to calculate the subcooling value. (Saturated condensing temperature - Liquid line temperature = Subcooling value.) The subcooling value should approximate the corresponding value found in table 8.
4 - Add refrigerant to increase the subcooling value. Remove refrigerant to reduce the subcooling value. Charge adjustments should be done in increments and the system should be allowed to stabilize between adjustments.

D-Oil Charge

See compressor nameplate for oil charge.

V-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 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.

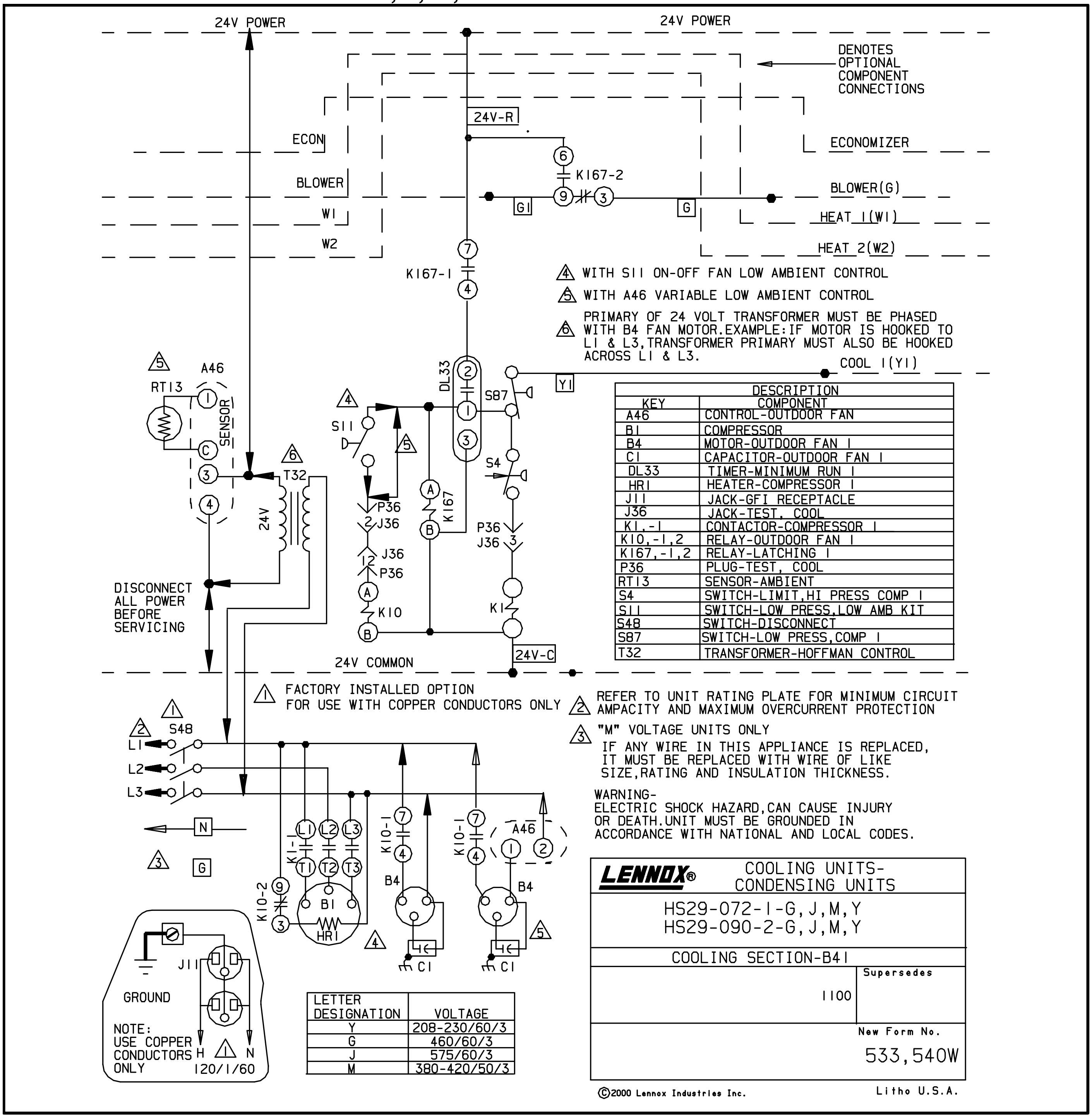
7 - Check wiring for loose connections.

8 - Check for correct voltage at unit (unit operating).

9 - Check amp-draw on blower motor
Unit nameplate________Actual_____.

VI-Wiring Diagram and Sequence of Operation

A-HS29-072-1/-2 & HS29-090-2 -G, J, M, Y



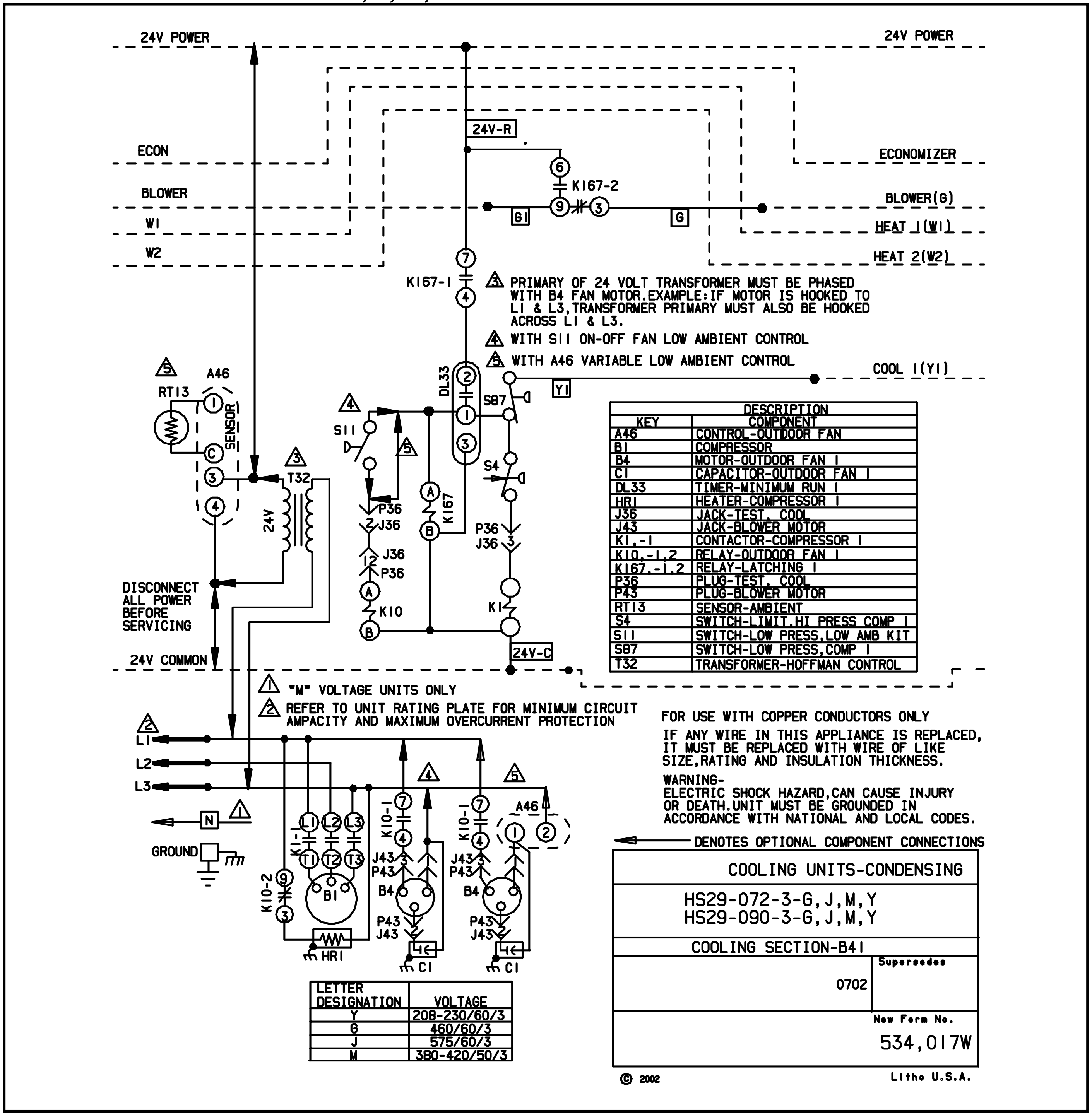
1 - Cooling demand energizes at thermostat terminal Y1. Voltage passes through N.C. low pressure switch S87 to terminal 1 on timer DL33, and K167 latching relay coil, and to S11 low ambient low pressure switch.

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-HS29-072-3 & HS29-090-3 -G, J, M, Y

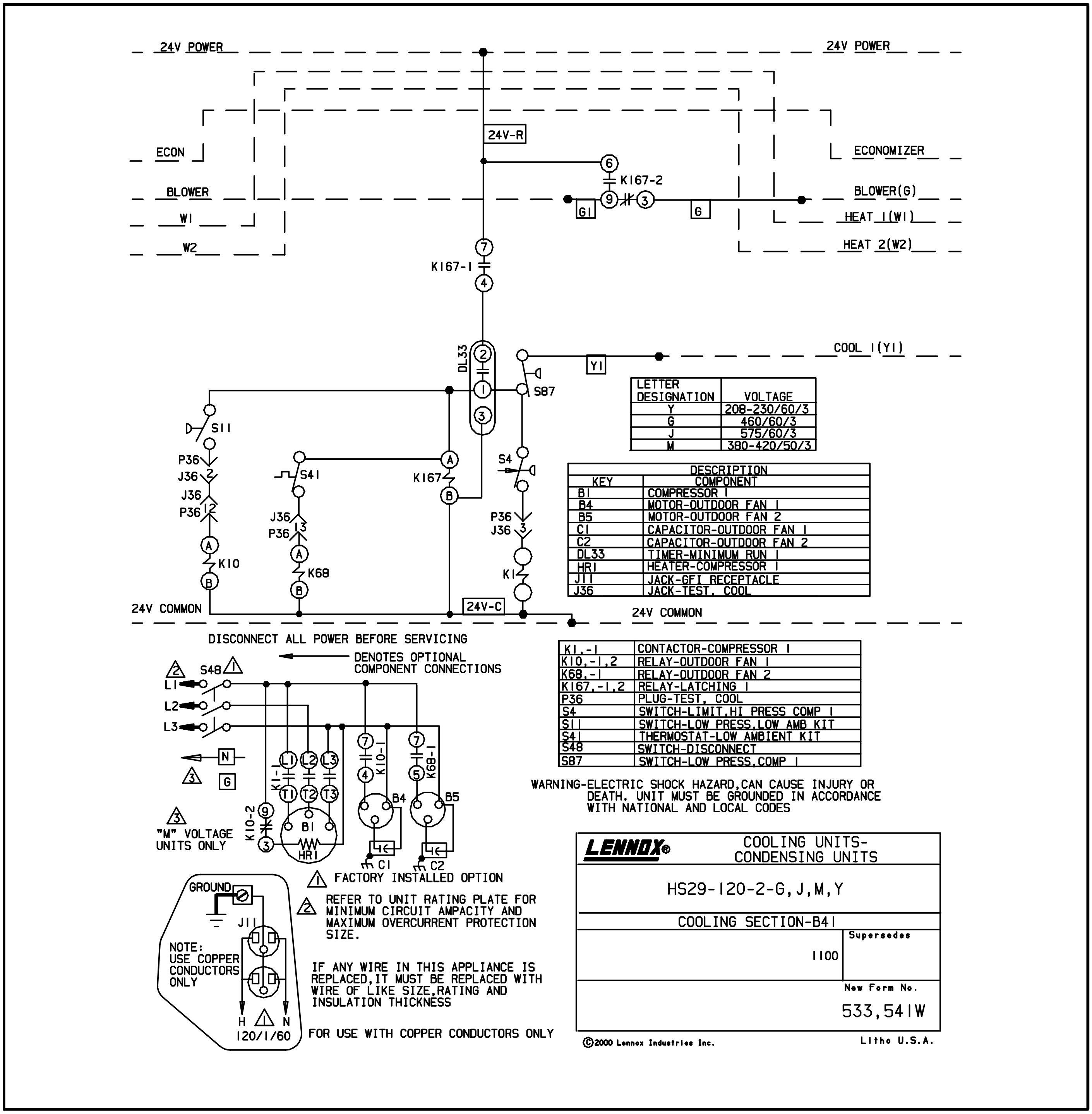


KEY	DESCRIPTION COMPONENT
A46	CONTROL-OUTDOOR FAN
B1	COMPRESSOR
B4	MOTOR-OUTDOOR FAN 1
C1	CAPACITOR-OUTDOOR FAN 1
DL33	TIMER-MINIMUM RUN 1
HR1	HEATER-COMPRESSOR 1
J36	JACK-TEST, COOL
J43	JACK-BLOWER MOTOR
K1,-1	CONTACTOR-COMPRESSOR 1
K10,-1,2	RELAY-OUTDOOR FAN 1
K167,-1,2	RELAY-LATCHING 1
P36	PLUG-TEST, COOL
P43	PLUG-BLOWER MOTOR
RT13	SENSOR-AMBIENT
S4	SWITCH-LIMIT,HI PRESS COMP 1
S11	SWITCH-LOW PRESS,LOW AMB KIT
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

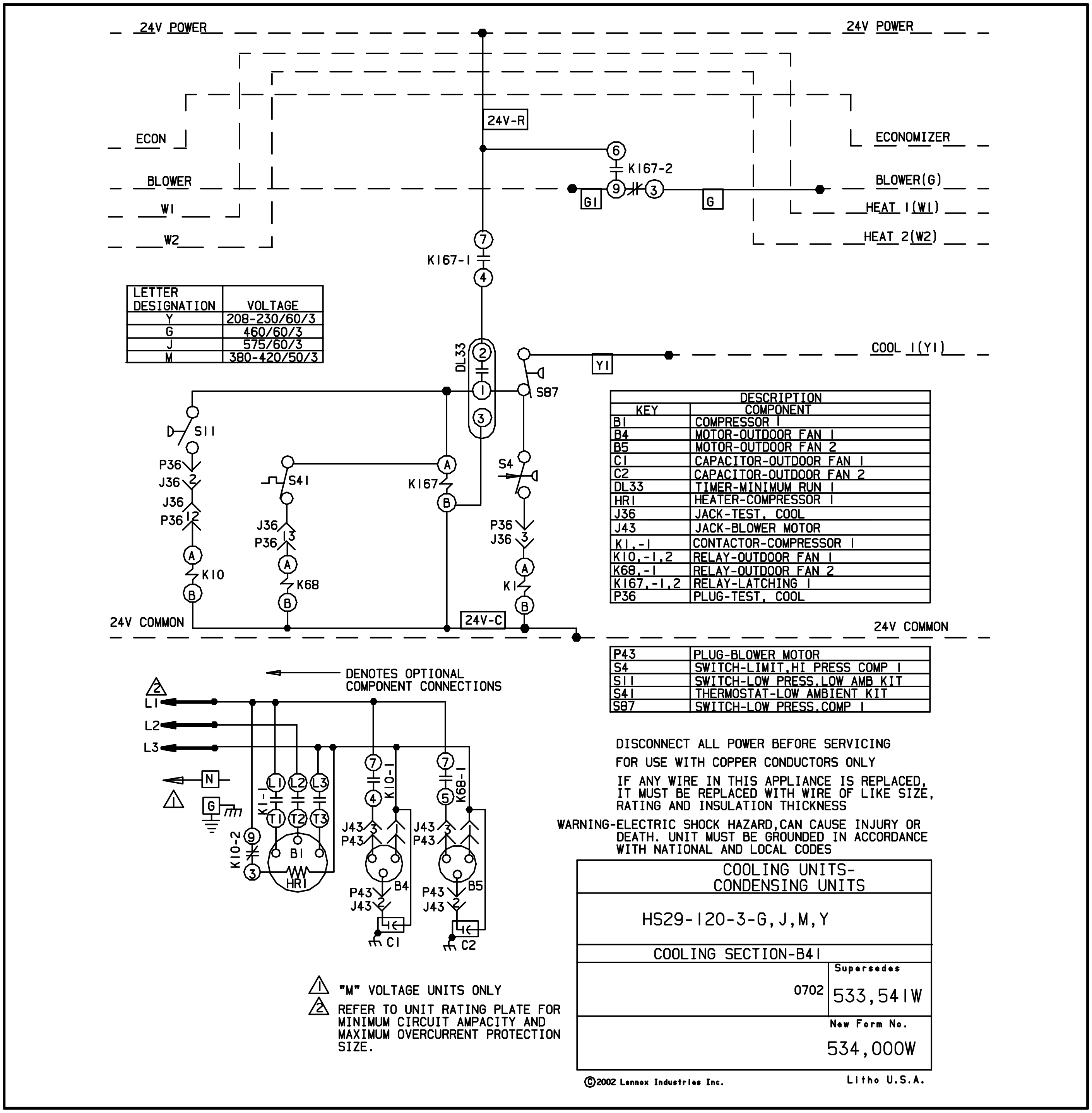
1 - Cooling demand energizes at thermostat terminal Y1. Voltage passes through N.C. low pressure switch S87 to terminal 1 on timer DL33, and K167 latching relay coil, and to S11 low ambient low pressure switch.
2 - K167-1 closes energizing timer DL33. Timer begins. (After 5 minutes DL33 is de-energized). 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.

C-HS29-120-2 -G, J, M, Y



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.

D-HS29-120-3 -G, J, M, Y



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.

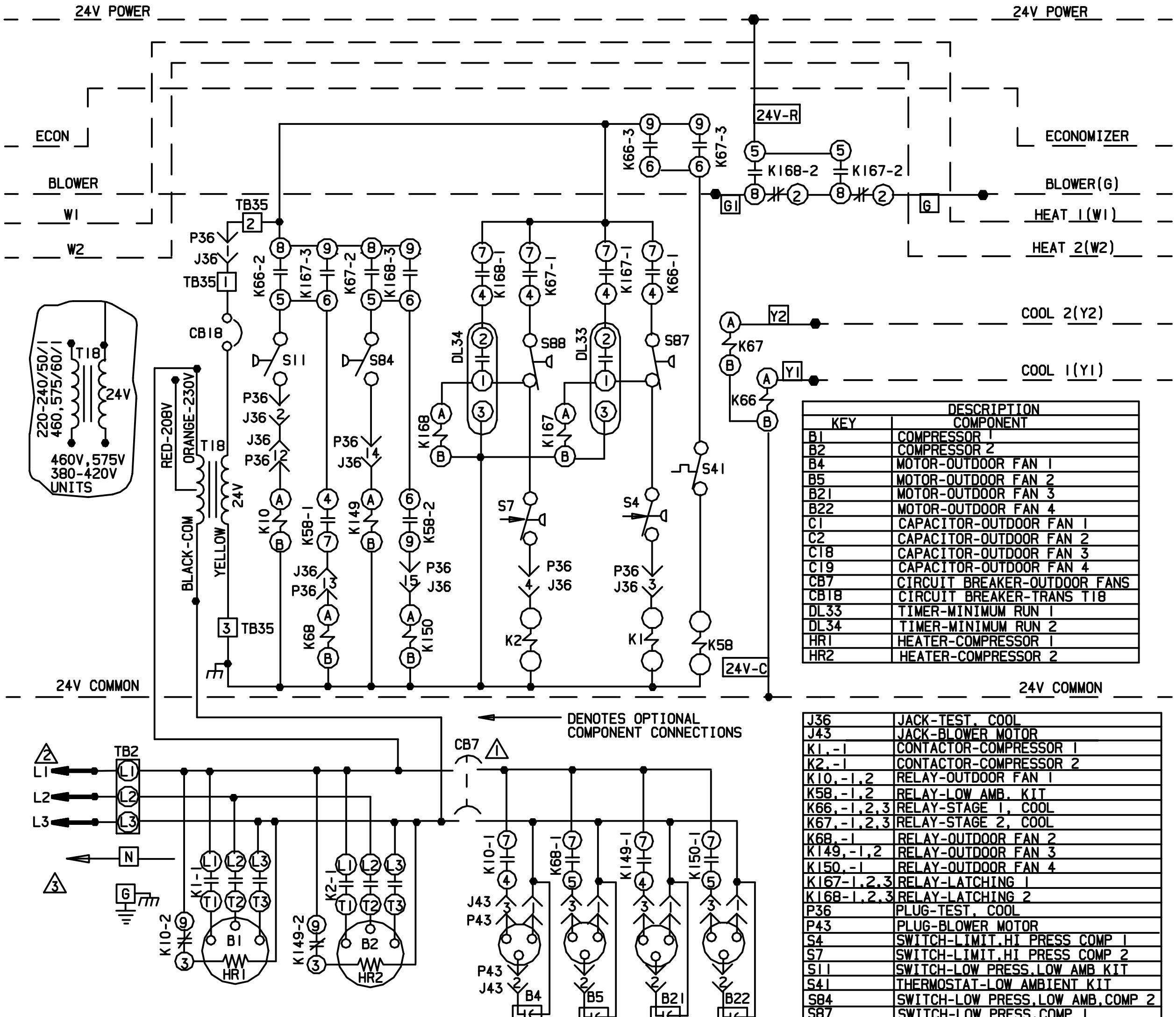
2 - K167-1 contacts close energizing DL33. Timer begins. (After 5 minutes DL33 is de-energized.) K167-2 contacts close opening contacts 9 and 3. Indoor blower is energized.

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.

E-HS29-180/240 -G, J, M, Y



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

J36	JACK-TEST, COOL
J43	JACK-BLOWER MOTOR
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
P43	PLUG-BLOWER MOTOR
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
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. CB7 USED ON "Y" VOLTAGE UNITS ONLY
2. REFER TO UNIT RATING PLATE FOR MINIMUM CIRCUIT AMPACITY AND MAXIMUM OVERCURRENT PROTECTION
3. "M" VOLTAGE UNITS ONLY

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

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

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

COOLING UNITS-CONDENSING

HS29-180-2-G,J,M,Y
HS29-240-2-G,J,M,Y

COOLING SECTION-B41

0702 Supersedes 533,512W

New Form No. 534,190W

HS29-180/240

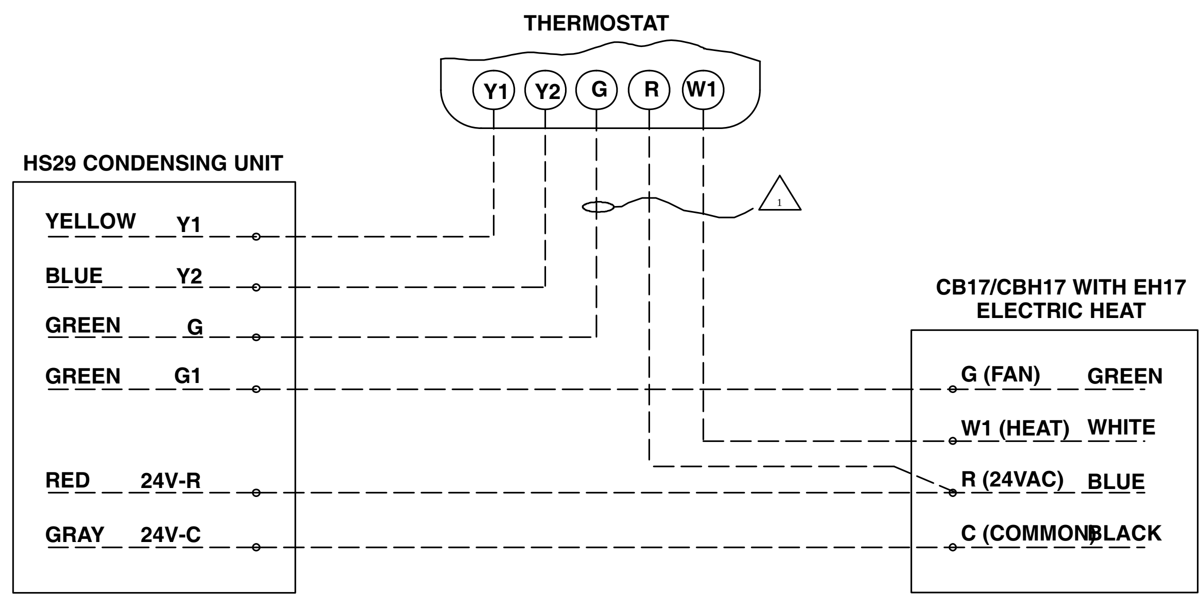
First stage cool

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.

HS29 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.