LENNOX
Service Literature

UNIT INFORMATION

Corp. 1811-L3
May 15, 2018

ELS

6 - 20 TON

ELS SERIES UNITS

The ELS 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, 12.5, 15 and 20 tons (21, 26, 35, 44, 53, and 70 kW).ELS072, ELS090 and ELS120S4S models have one dual-speed scroll compressor. ELS120S4D, ELS150S4D, ELS180S4D and ELS240S4D models have two single-speed scroll compressors. ELS units match with the ELA blower-coil units. All ELS units are three phase and use HFC-410A refrigerant.

This manual covers ELS072S4S, ELS090S4S, ELS120S4S, ELS120S4D, ELS150S4D, ELS180S4D and ELS240S4D 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.

Table of Contents

⚠ WARNING

Improper installation, adjustment, alteration, service or maintenance can cause property damage, personal injury or loss of life. Installation and service must be performed by a licensed professional HVAC installer or equivalent, service agency, or the gas supplier.

⚠ IMPORTANT

The Clean Air Act of 1990 bans the intentional venting of refrigerant (CFCs, HCFCs and HFCs) as of July 1, 1992. Approved methods of recovery, recycling or reclaiming must be followed. Fines and/or incarceration may be levied for noncompliance.

⚠ WARNING

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

Replace all parts and panels before operating.

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

⚠ CAUTION

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

SPECIFICATIONS - 6 - 7.5 TON

General Data	Model No.	ELS072S4S	ELS090S4S
	Nominal Size - Tons	6	7.5
Connections (sweat)	Liquid line - in. (o.d)	(1) 3/8	(1) 5/8
	Suction line - in. (o.d)	(1) 1-1/8	(1) 1-1/8
Refrigerant (R-410A)	Factory Charge	R-410A holding charge (2 lbs. per stage)	
	[1] Field charge (25 ft. line set)	18 lbs. 0 oz.	20 lbs. 0 oz.
Compressor		(1) Two-Stage Scroll	(1) Two-Stage Scroll
Condenser Coil	Net face area - sq. ft. Outer coil	29.3	29.3
	Inner coil	14.2	28.4
	Tube diameter - in. & no. of rows	3/8 - 1.5	3/8 - 2
	Fins per inch	20	20
Condenser Fan(s)	Diameter - in. & no. of blades	(1) 24 - 3	(1) 24 - 4
	Motor hp	(1) 1/3	(1) 1/2
	Total air volume - cfm	4700	5600
	Rpm	1075	1075
	Watts	400	580

ELECTRICAL DATA

	Line voltage data - 60 hz - 3 phase	208/230V	460V	575V	208/230V	460V	575V
	[2] Maximum Overcurrent Protection (amps)	40	15	15	60	25	20
	[3] Minimum circuit ampacity	24	12	9	37	17	13
Compressor	No. of Compressors	1	1	1	1	1	1
	Rated load amps	17.6	8.5	6.3	26.9	12	9
	Locked rotor amps	136	66	55	165	94	65
Condenser Fan Motor (1 phase)	No. of motors	1	1	1	1	1	1
	Full load amps	1.7	0.8	1	3	1.5	1.2
	Locked rotor amps	4.3	2.4	1.9	6	3	2.9

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

[1] Field provided charge with 25 ft. line set. Refer to the Lennox Refrigerant Piping Manual to determine refrigerant charge required with longer length refrigerant lines.

[2] HACR type circuit breaker or fuse.

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

SPECIFICATIONS - 10 TON

General Data	Model No.	ELS120S4S	ELS120S4D
	Nominal Size - Tons	10	10
Connections (sweat)	Liquid line - in. (o.d)	(1) 5/8	(2) 3/8
	Suction line - in. (o.d)	(1) 1-1/8	(2) 1-1/8
Refrigerant (R-410A)	Factory Charge	R-410A holding charge (2 lbs. per stage)	
	[1] Field charge (25 ft. line set) Circuit 1	32 lbs. 0 oz.	12 lbs. 0 oz.
	[1] Field charge (25 ft. line set) Circuit 2	- - -	12 lbs. 0 oz.
Compressor		(1) Two-Stage Scroll	(2) Single-Stage Scroll
Condenser Coil	Net face area - sq. ft. Outer coil	29.3	29.3
	Inner coil	28.4	28.4
	Tube diameter - in. & no. of rows	3/8 - 2	3/8 - 2
	Fins per inch	20	20
Condenser Fan(s)	Diameter - in. & no. of blades	(2) 24 - 3	(2) 24 - 3
	Motor hp	(2) 1/3	(2) 1/3
	Total air volume - cfm	8300	8300
	Rpm	1075	1075
	Watts	830	830

ELECTRICAL DATA

	Line voltage data - 60 hz - 3 phase	208/230V	460V	575V	208/230V	460V	575V
	[2] Maximum Overcurrent Protection (amps)	80	30	25	40	20	15
	[3] Minimum circuit ampacity	47	21	16	30	16	13
Compressor	No. of Compressors	1	1	1	2	2	2
	Rated load amps (total)	34.6	14.8	11.1	12 (24)	6.3 (12.6)	4.9 (9.8)
	Locked rotor amps (total)	240	130	94	90 (180)	60 (120)	41 (82)
Condenser Fan Motor (1 phase)	No. of motors	2	2	2	2	2	2
	Full load amps (total)	1.7 (3.4)	0.8 (1.6)	1 (2)	1.7 (3.4)	0.8 (1.6)	1 (2)
	Locked rotor amps (total)	4.3 (8.6)	2.4 (4.8)	1.9 (3.8)	4.3 (8.6)	2.4 (4.8)	1.9 (3.8)

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

[1] Field provided charge with 25 ft. line set. Refer to the Lennox Refrigerant Piping Manual to determine refrigerant charge required with longer length refrigerant lines.

[2] HACR type circuit breaker or fuse.

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

SPECIFICATIONS - 12.5 - 20 TON

General Data			ELS150S4D	ELS180S4D	ELS240S4D
		Model No.			
		Nominal Size - Tons	**12.5**	**15**	**20**
Connections (sweat)		Liquid line - in. (o.d)	(2) 3/8	(2) 5/8	(2) 5/8
		Suction line - in. (o.d)	(2) 1-1/8	(2) 1-1/8	(2) 1-1/8
Refrigerant (R-410A)		Factory Charge	R-410A holding charge (2 lbs. per stage)		
	[1] Field charge (25 ft. line set)	Circuit 1	15 lbs. 0 oz.	24 lbs. 0 oz.	22 lbs. 4 oz.
		Circuit 2	15 lbs. 0 oz.	24 lbs. 0 oz.	23 lbs. 3 oz.
Compressor			(2) Single-Stage Scroll	(2) Single-Stage Scroll	(2) Single-Stage Scroll
Condenser Coil		Net face area - sq. ft. Outer coil	34.2	58.7	58.7
		Inner coil	33.3	57.7	57.7
		Tube diameter - in. & no. of rows	3/8 - 2	3/8 - 2	3/8 - 2
		Fins per inch	20	20	20
Condenser Fan(s)		Diameter - in. & no. of blades	(2) 24 - 4	(4) 24 - 3	(4) 24 - 3
		Motor hp	(2) 1/2	(4) 1/3	(4) 1/3
		Total air volume - cfm	10,300	16,600	16,600
		Rpm	1075	1075	1075
		Watts	1130	1660	1660

ELECTRICAL DATA

		Line voltage data - 60 hz - 3 phase	**208/230V**	**460V**	**575V**	**208/230V**	**460V**	**575V**	**208/230V**	**460V**	**575V**
		[2] Maximum Overcurrent Protection (amps)	60	25	25	80	40	30	90	50	40
		[3] Minimum circuit ampacity	50	21	20	63	31	25	70	36	30
Compressor		No. of Compressors	2	2	2	2	2	2	2	2	2
		Rated load amps (total)	19.6 (39.2)	8.2 (16.4)	6.6 (13.2)	25 (50)	12.2 (24.4)	9 (18)	28.2 (56.4)	14.7 (29.4)	11.3 (22.6)
		Locked rotor amps (total)	136 (272)	66 (132)	55 (110)	164 (328)	100 (200)	78 (156)	240 (480)	130 (260)	93.7 (187.4)
Condenser Fan Motor (1 phase)		No. of motors	2	2	2	4	4	4	4	4	4
		Full load amps (total)	3 (6)	1.5 (3)	1.2 (2.4)	1.7 (6.8)	0.8 (3.2)	1 (4)	1.7 (6.8)	0.8 (3.2)	1 (4)
		Locked rotor amps (total)	6 (12)	3 (6)	2.9 (5.8)	4.3 (17.2)	2.4 (9.6)	1.9 (7.6)	4.3 (17.2)	2.4 (9.6)	1.9 (7.6)

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

[1] Field provided charge with 25 ft. line set. Refer to the Lennox Refrigerant Piping Manual to determine refrigerant charge required with longer length refrigerant lines.

[2] HACR type circuit breaker or fuse.

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

WEIGHT DATA

Model No.	**Net**		**Shipping**	
	lbs.	**kg**	**lbs.**	**kg**
072S	318	144	338	153
090S	345	157	365	166
120S	452	205	477	216
120D	480	218	505	229
150S	535	243	560	254
180S	775	352	800	363
240S	832	377	857	389

OPTIONS / ACCESSORIES

COMBINED COIL/HAIL GUARDS

T2GARD20L-1	40	18	45	20
T2GARD20M-1	45	20	50	23
T2GARD21M-1	45	20	50	23
T2GARD20N-1-	90	41	100	45

OPTIONS / ACCESSORIES

Item		Catalog No.	ELS 072 S4S	ELS 090 S4S	ELS 120 S4S	ELS 120 S4D	ELS 150 S4D	ELS 180 S4D	ELS 240 S4D
CABINET									
Combined Coil/Hail Guards	T2GARD51L-1	**13T29**	X	X					
	T2GARD51M11	**13T30**			X	X			
	T2GARD51M21	**13T32**					X		
	T2GARD51N-1	**13T37**						X	X
Corrosion Protection		Factory	O	O	O	O	O	O	O
CONTROLS									
BACnet® Module	A0CTRL31LS1	**17A08**	X	X	X	X	X	X	X
BACnet® Sensor with Display	K0SNSR01FF1	**97W23**	X	X	X	X	X	X	X
BACnet® Sensor without Display	K0SNSR00FF1	**97W24**	X	X	X	X	X	X	X
Network Thermostat Control (NTC)	C0CTRL07AE1L	**17M10**	X	X	X	X	X	X	X
NTC Enclosure Kit (required with NTC Controller)	A0CTRL32LS1	**16H99**	X	X	X	X	X	X	X
L Connection® Building Automation System		**- - -**	X	X	X	X	X	X	X
Low Ambient Control (0ºF)	A2CWKT01LM1-	**16F18**	X	X					
	A2CWKT04M-1-	**16F26**			X				
	A2CWKT02M-1-	**16F24**				X	X		
	A2CWKT03N-1-	**16F25**						X	X
ELECTRICAL									
GFI Service Outlets	15 amp non-powered, field-wired (208/230V, 460V only) LTAGFIK10/15/15	**74M70**	X	X	X	X	X	X	X
	20 amp non-powered, field-wired (575V only) C1GFCI20FF1	**67E01**	X	X	X	X	X	X	X
INDOOR AIR QUALITY									
Sensor - Wall-mount, off-white plastic cover with LCD display	C0SNSR50AE1L	**77N39**	X	X	X	X	X	X	X
Sensor - Wall-mount, off-white plastic cover, no display	C0SNSR52AE1L	**87N53**	X	X	X	X	X	X	X
Sensor - Black plastic case with LCD display, rated for plenum mounting	C0SNSR51AE1L	**87N52**	X	X	X	X	X	X	X
Sensor - Wall-mount, black plastic case, no display, rated for plenum mounting	C0SNSR53AE1L	**87N54**	X	X	X	X	X	X	X
CO_2 Sensor Duct Mounting Kit	C0MISC19AE1-	**85L43**	X	X	X	X	X	X	X
Aspiration Box - for duct mounting non-plenum rated CO_2 sensor (77N39)	C0MISC16AE1-	**90N43**	X	X	X	X	X	X	X

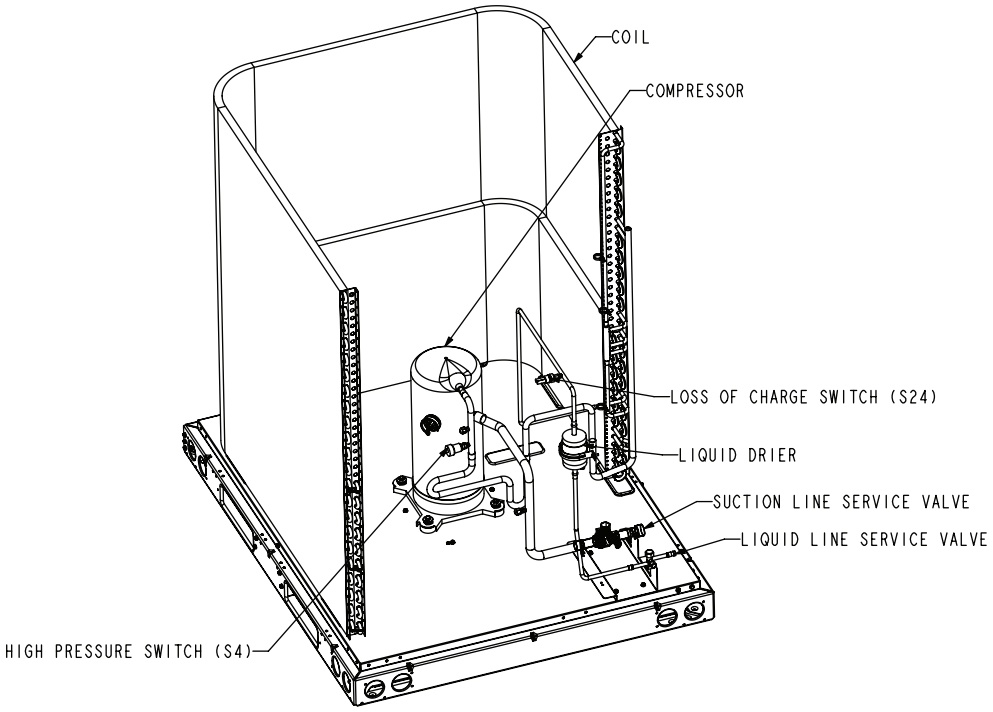
NOTE - The catalog and model numbers that appear here are for ordering field installed accessories only.

O - Factory Installed with extended lead time.

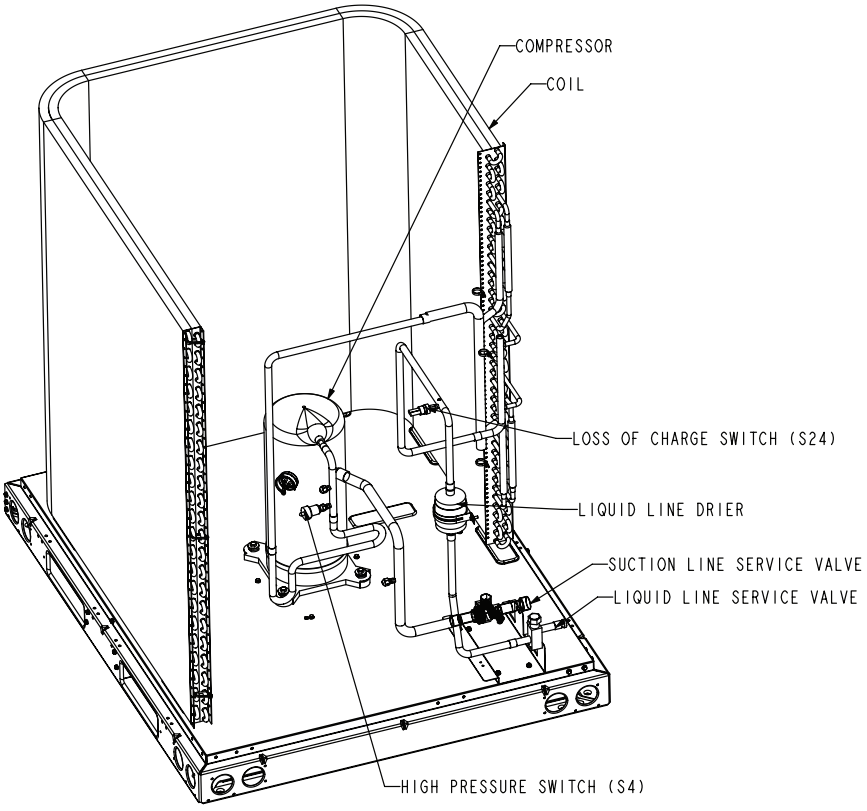
X - Field Installed

Unit Plumbing Parts Arrangement

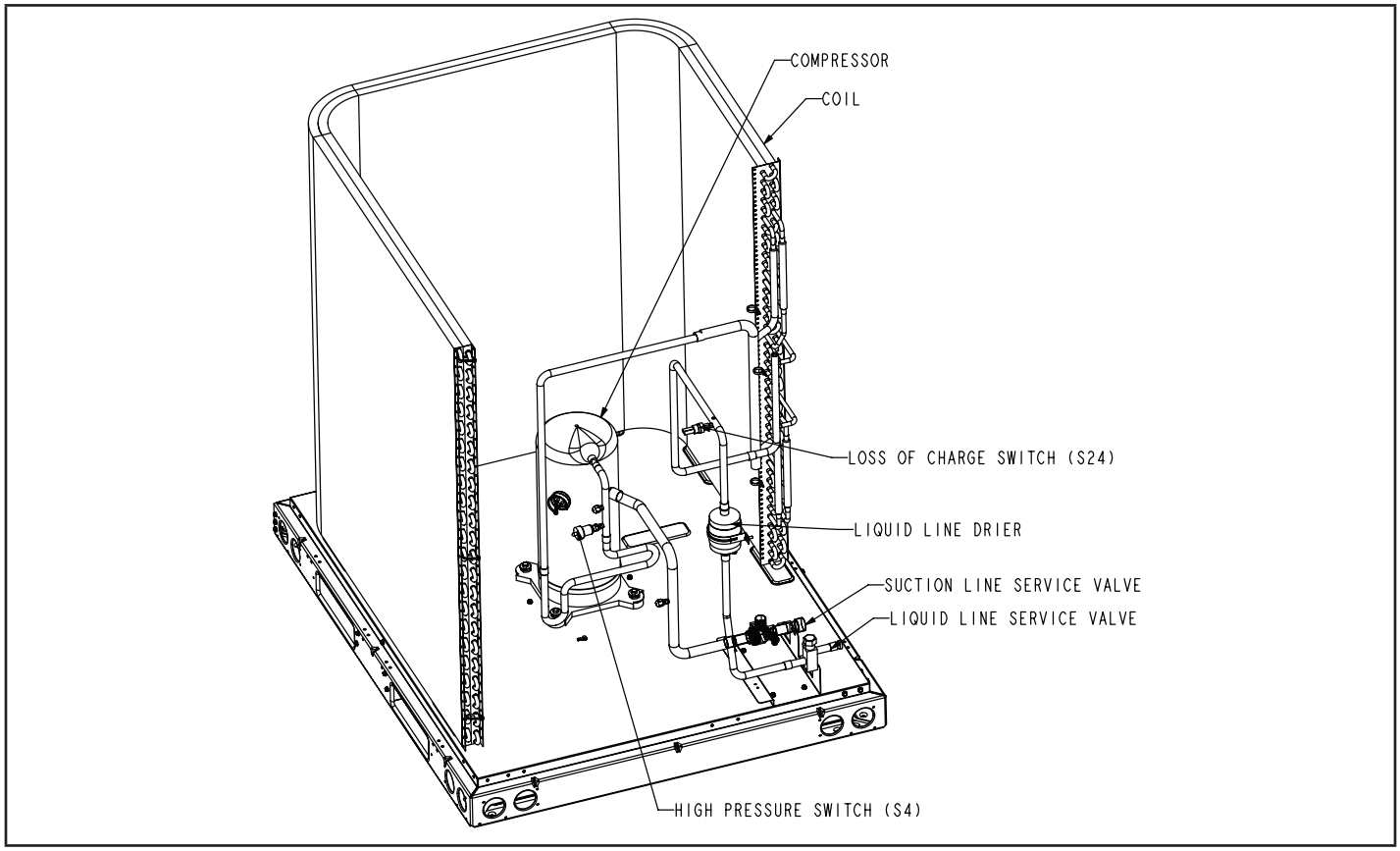
ELS072S4S



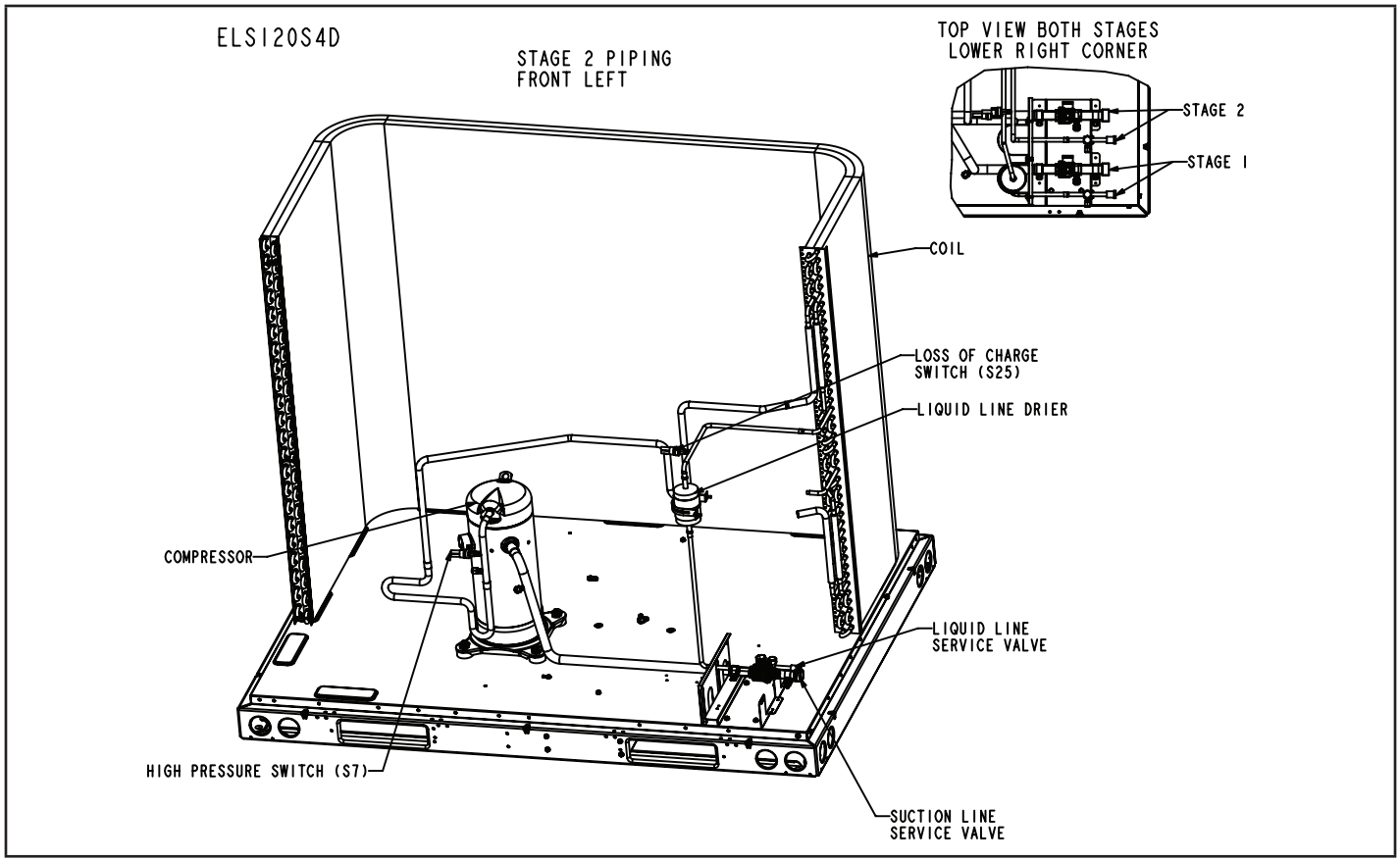
ELS090S4S



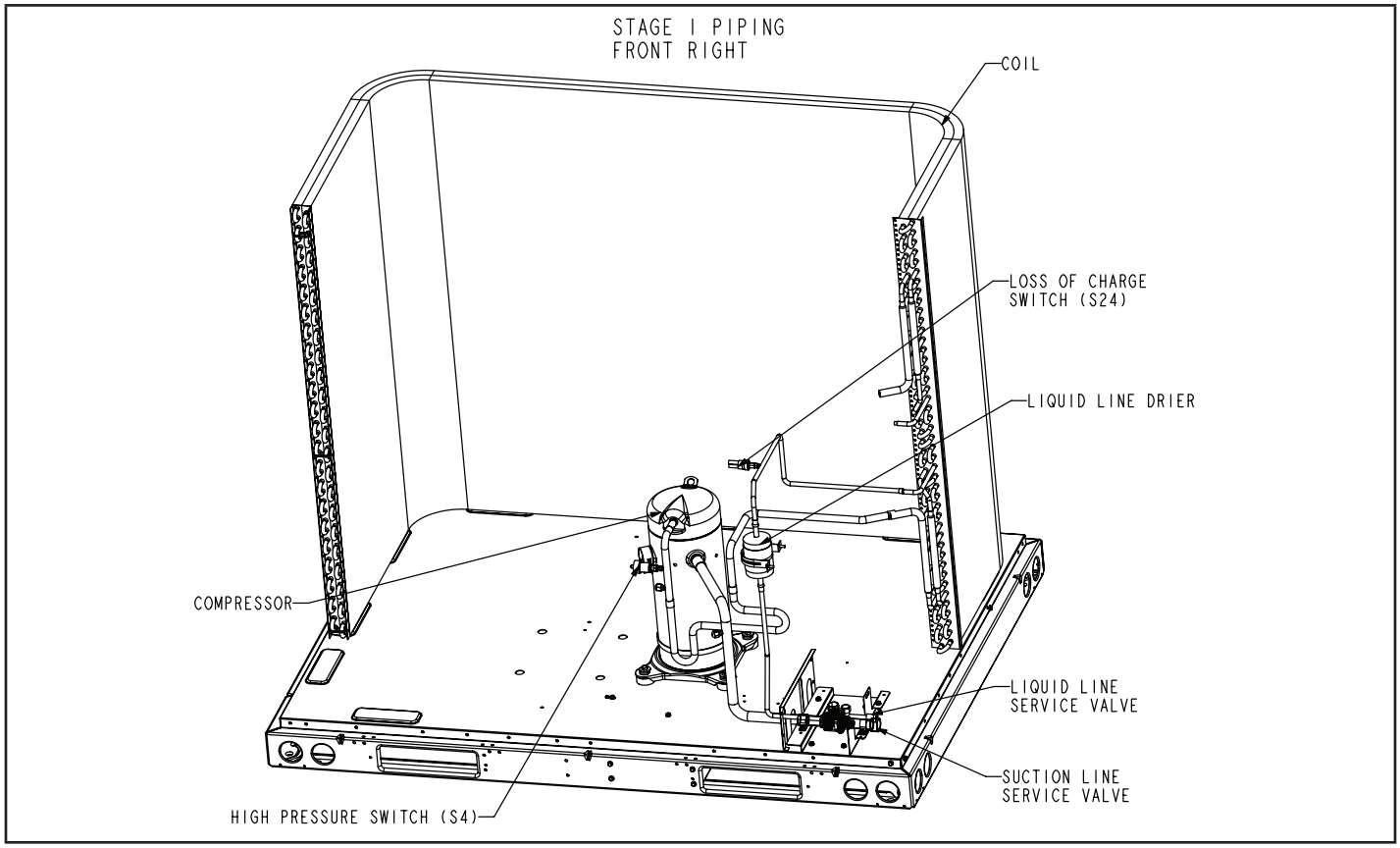
ELS120S4S



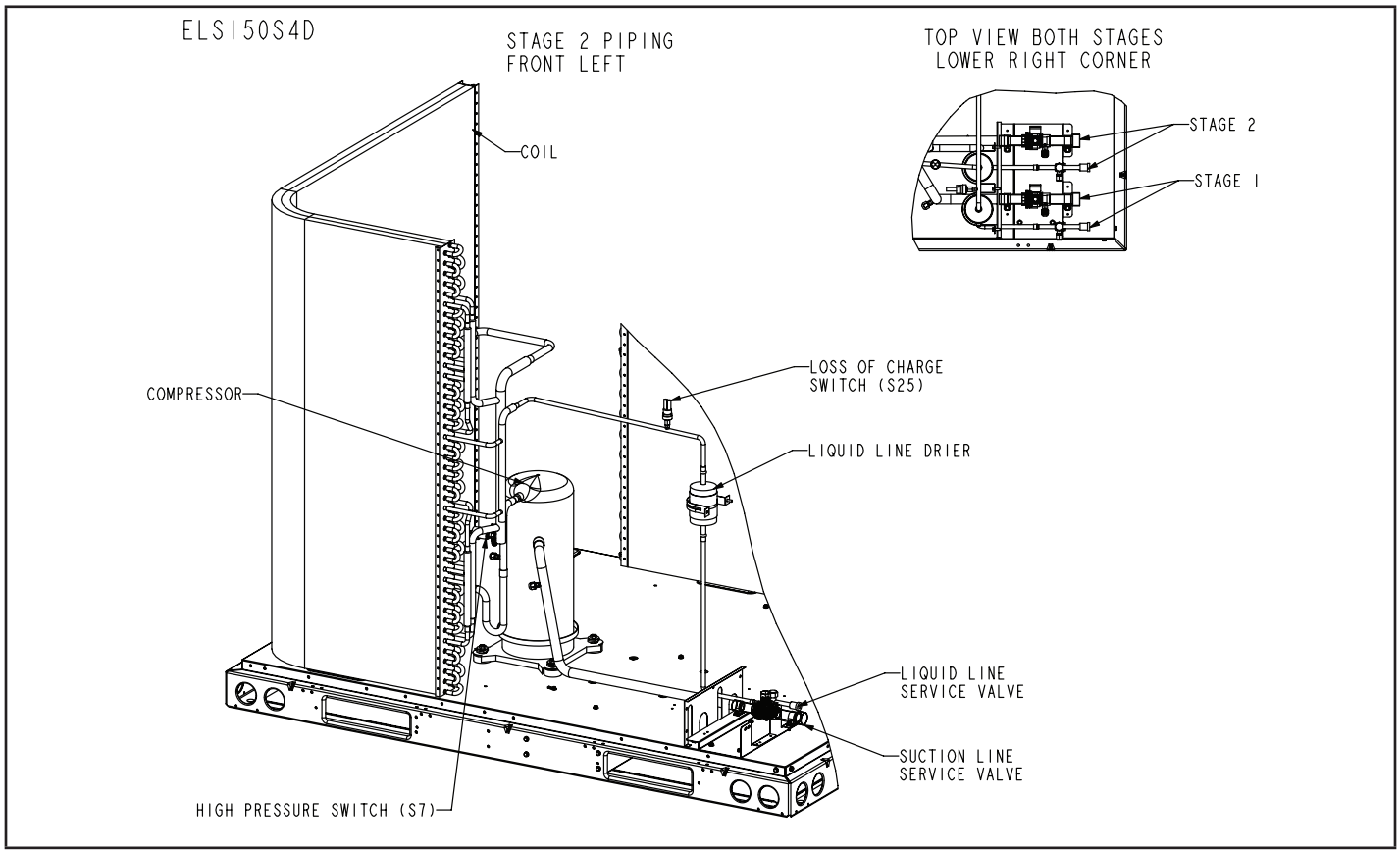
ELS120S4D – STAGE 2



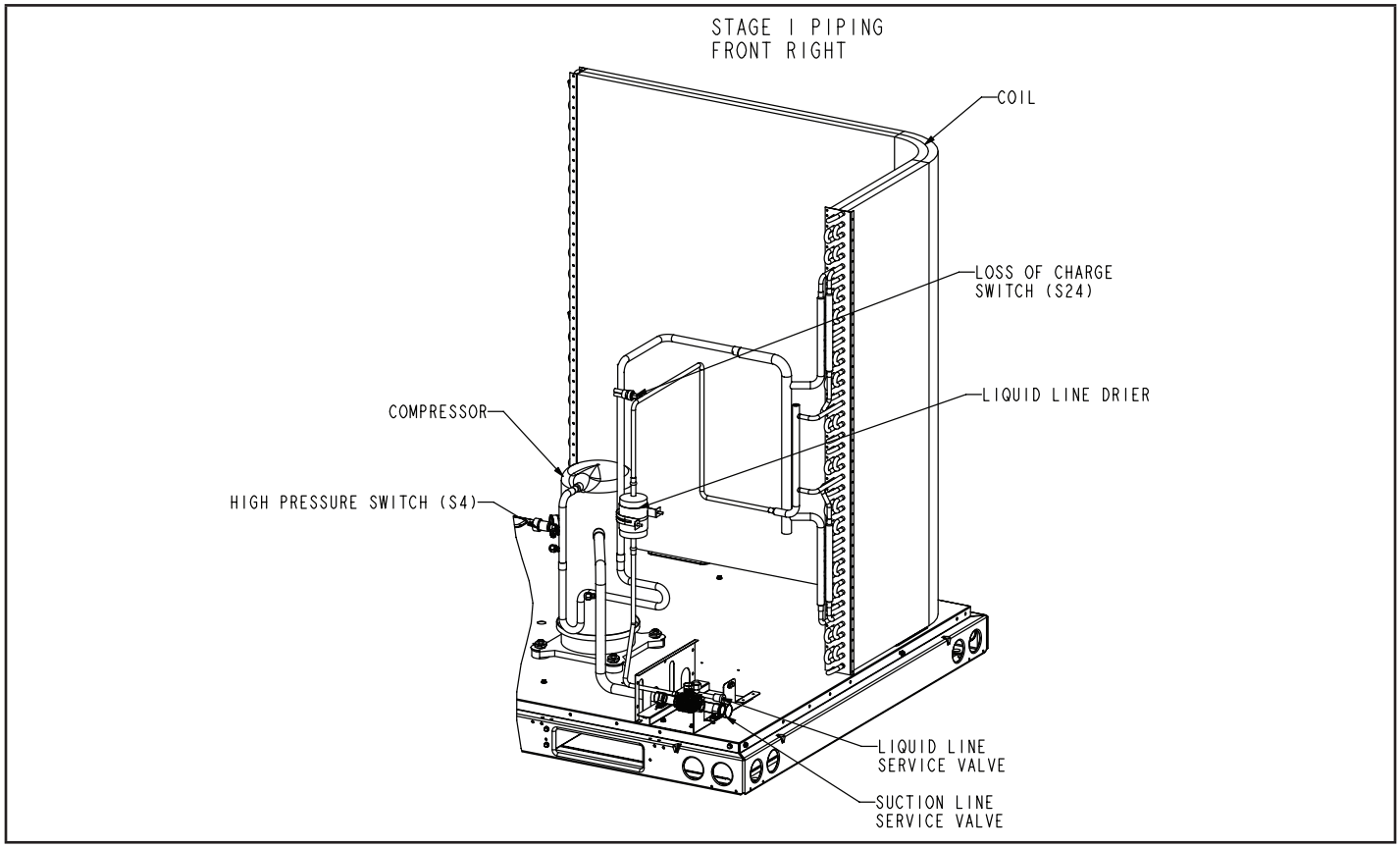
ELS120S4D – STAGE 1



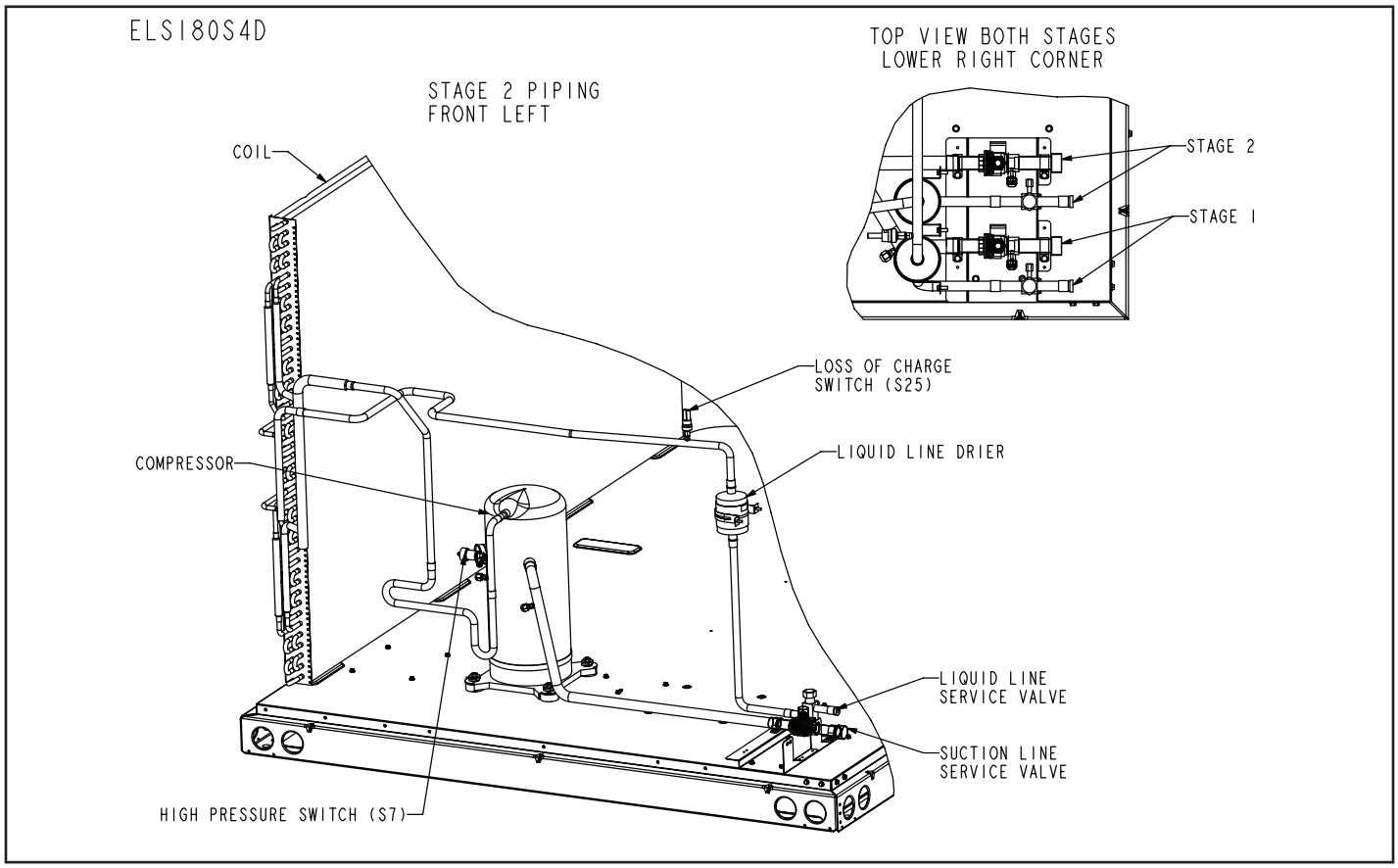
ELS150S4D – STAGE 2



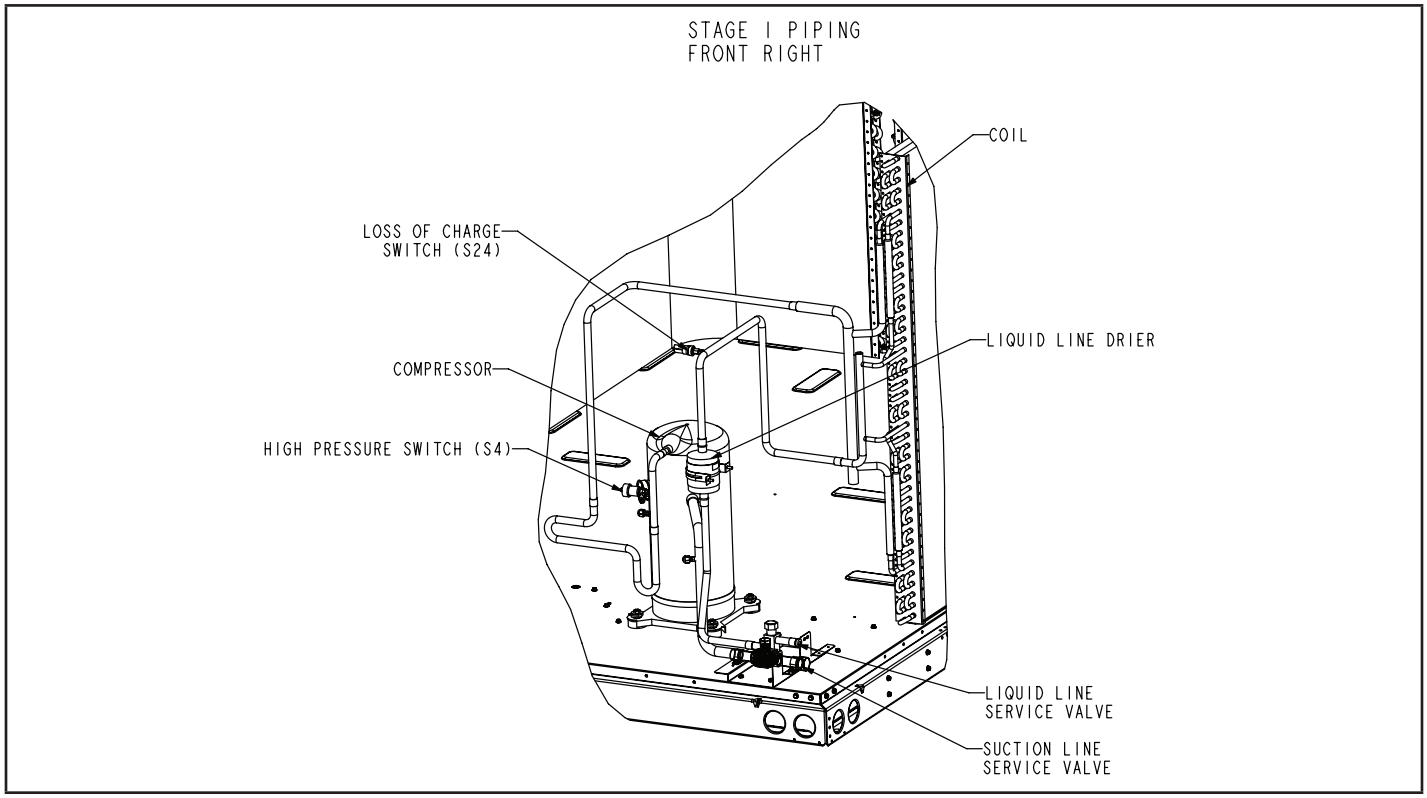
ELS150S4D – STAGE 1



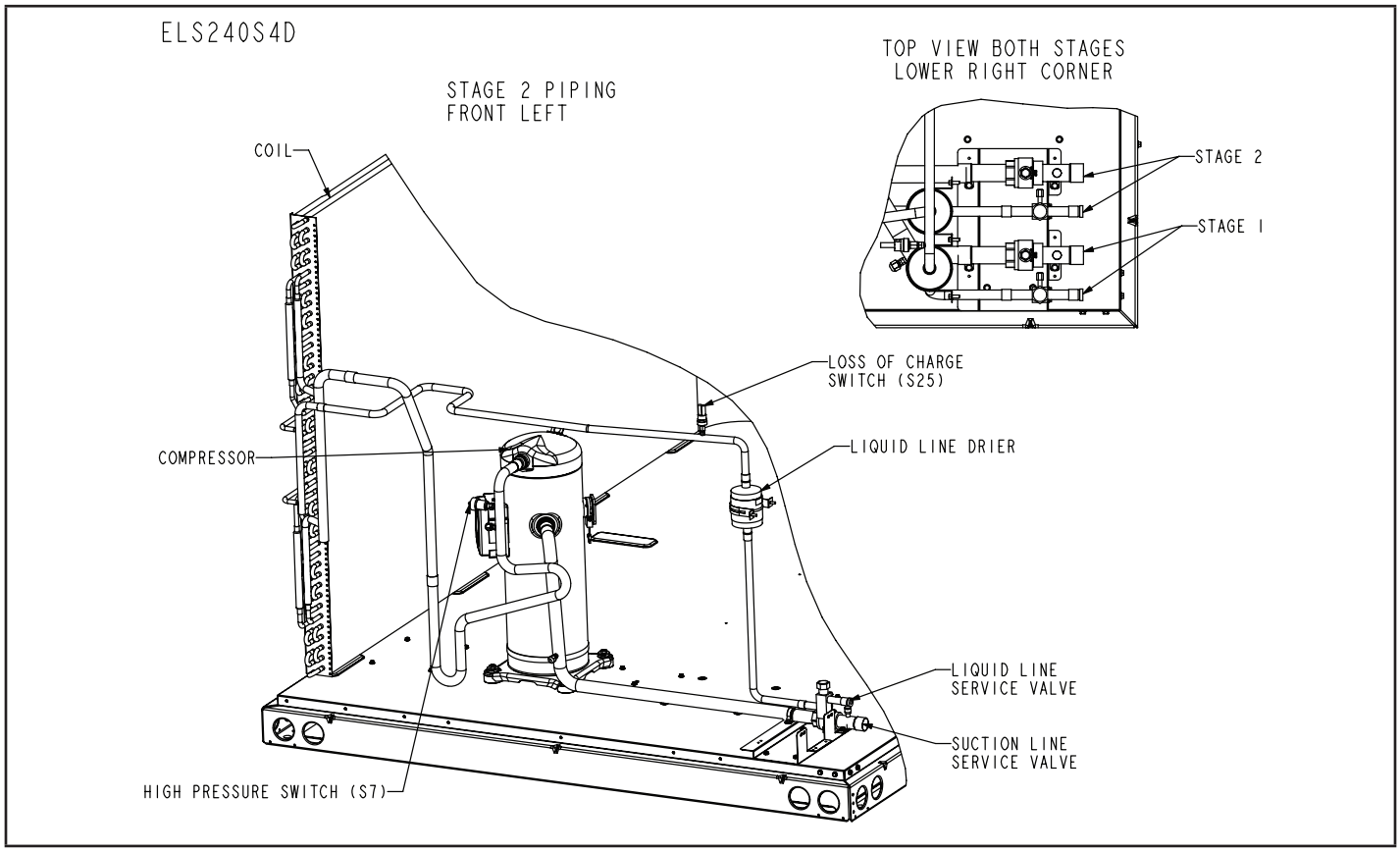
ELS180S4D – STAGE 2



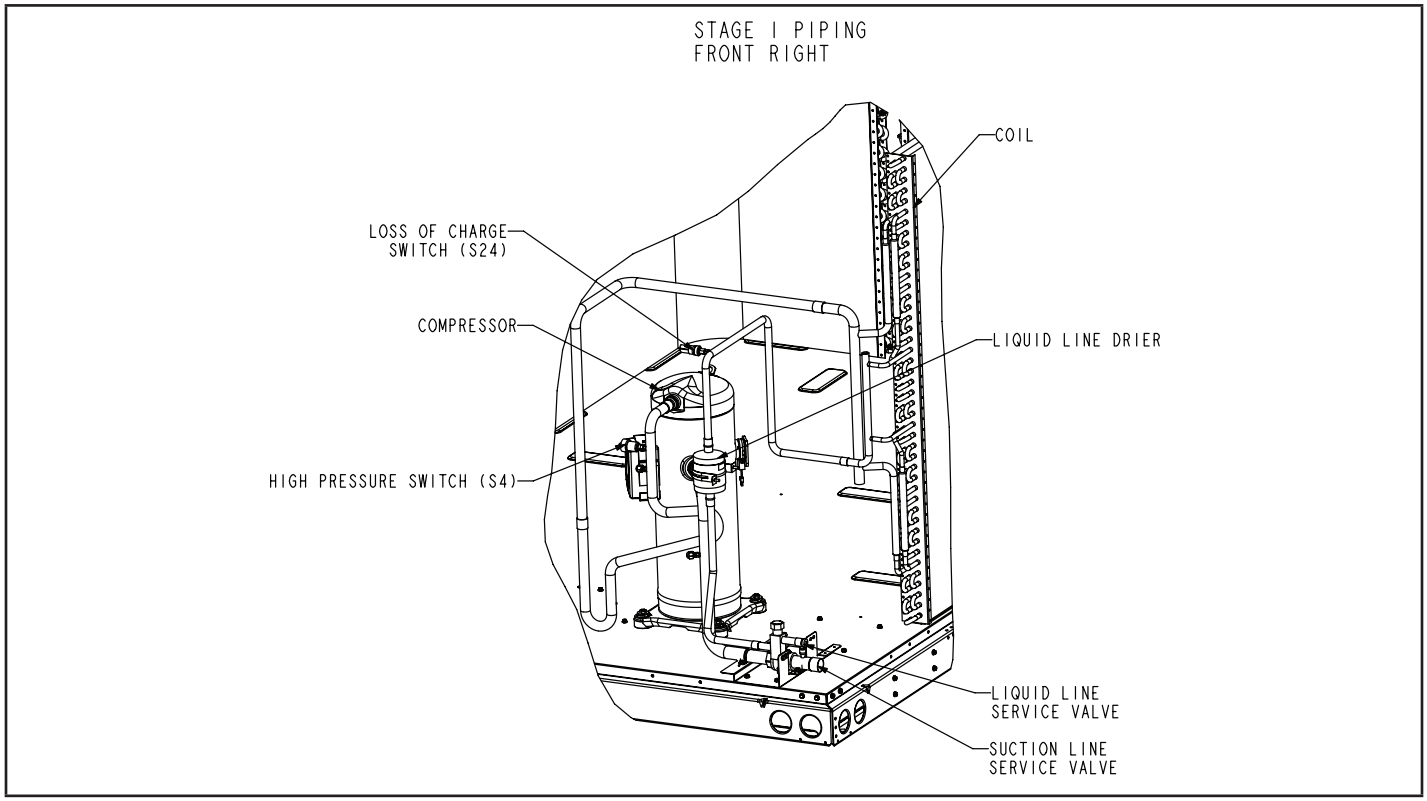
ELS180S4D – STAGE 1



ELS240S4D – STAGE 2



ELS240S4D – STAGE 1



Model Number Identification

E L S 120 S 4 D S 1 Y

Brand/Family
Elite™ Product Line

S = Split System Air Conditioner

Nominal Cooling Capacity - Tons
072 = 6 Tons
090 = 7.5 Tons
120 = 10 Tons
150 = 12.5 Tons
180 = 15 Tons
240 = 20 Tons

Cooling Efficiency
S = Standard Efficiency

Refrigerant Type
4 = R-410A

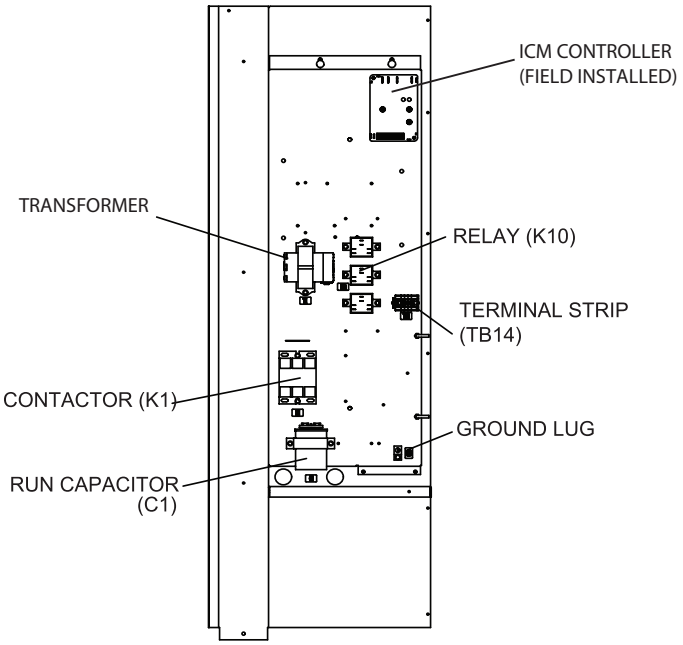
Refrigerant Circuits
S = Single Circuit
D = Dual Circuits

Part Load Capability
S = Single Stage Compressor
T = Two Stage Compressor

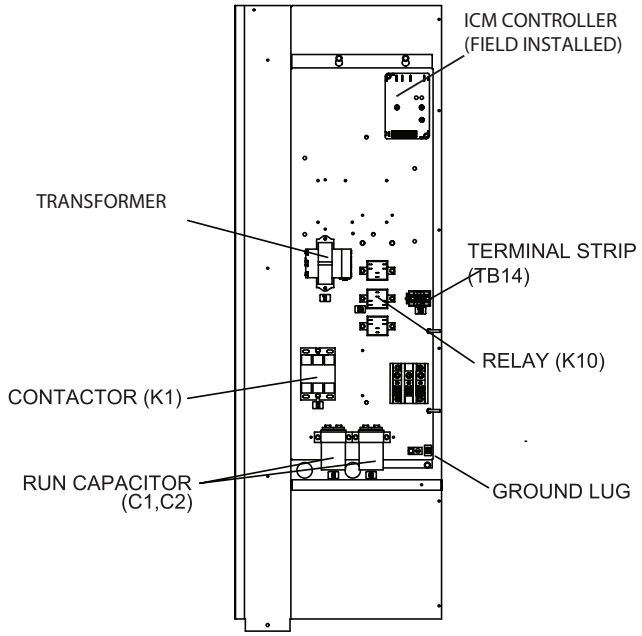
Minor Design Sequence
1 = 1st Revision
2 = 2nd Revision
3 = 3rd Revision

Voltage
Y = 208/230V-3 phase-60hz
G = 460V-3 phase-60hz
J = 575V-3 phase-60hz
M = 380/420V-3 phase-50hz

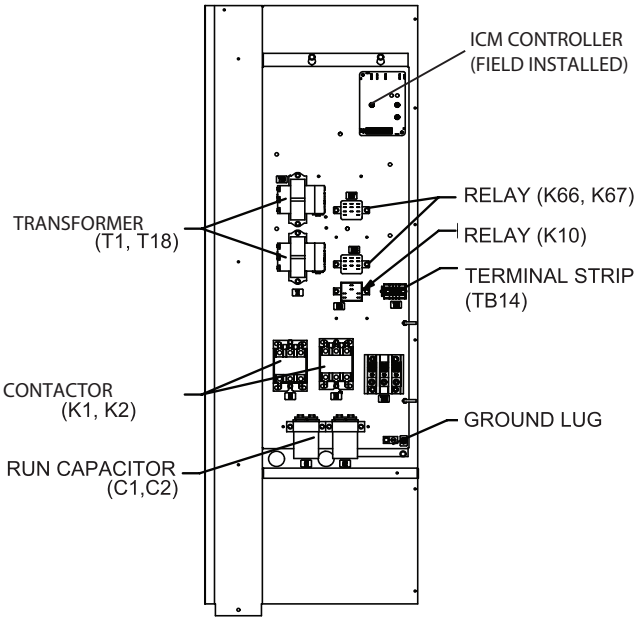
Unit Control Box Components Arrangement



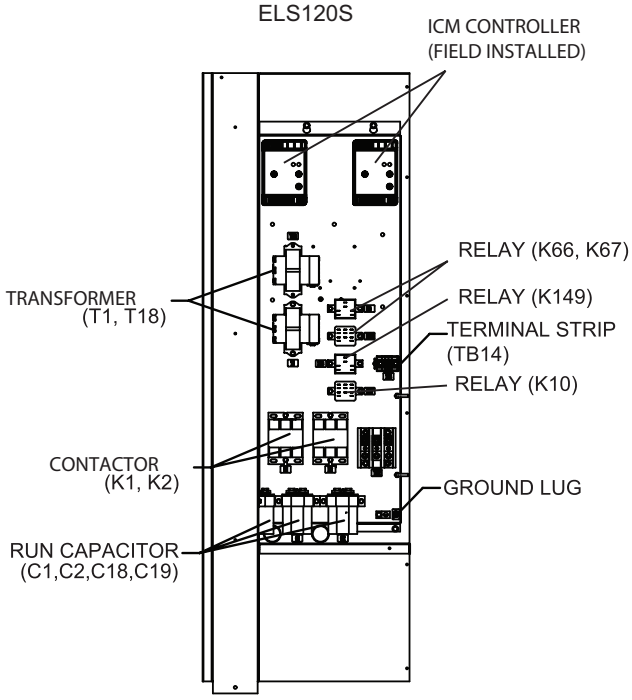
ELS072/090S



ELS120S



ELS120D/ELS150D



ELS180D / ELS240D

I-UNIT COMPONENTS

The ELS parts arrangements are shown on pages 5 - 10 and control boxes on page 11.

⚠ WARNING	
ELECTROSTATIC DISCHARGE (ESD) Precautions and Procedures	Electrostatic discharge can affect electronic components. Take care 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. Touch hand and all tools on an unpainted unit surface before performing any service procedure to neutralize electrostatic charge.

A-CONTROL BOX COMPONENTS

1 - Transformer T1 & T18

All ELS models use a single line voltage to 24VAC transformer mounted in the control box. Transformer T1 supplies power to control circuits in the ELS unit. The transformer is rated at 70VA and is protected by a 3.5 amp circuit breaker (CB8). CB8 is internal to the transformer. The 208/230 (Y) voltage transformers use two primary voltage taps as shown in figure 1, while 460 (G) and 575 (J) voltage transformers use a single primary voltage tap. T18 is identical to T1 used in ELS120, 150, 180 and 240 and is protected by internal circuit breaker CB18.

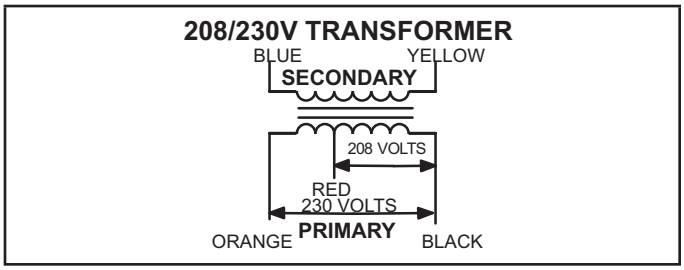


FIGURE 1

***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.*

2 - Terminal Strip TB14 & TB2

Terminal strip TB14 used in all units distributes 24V power and common from the transformer T18 to the control box components. Terminal block TB2 used in the 120, 150, 180 and 240 units, distributes line voltage to line voltage components.

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

All ELS 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.

4 - Compressor Contactor K1 (all units) K2 (120S4D, 150, 180, 240)

All compressor contactors are three-pole double-break contactors with auxiliary switch with a 24V coil. In ELS072, 090 and 120S4S, K1 energizes compressor B1. In ELS120S4D, 150, 180 and 240 units, K1 and K2 energize compressors B1 and B2.

5 - Condenser Fan Relay K10 (all units) K149 (180, 240)

Condenser fan relays K10 and K149 are DPDT with a 24V coil. In all units K10 energizes condenser fan B4 (fan 1) in response to thermostat demand. In the ELS120S4D, 150, 180 and 240, K10 also energizes condenser fan B5 (fan 2) In the ELS180 and 240 K149 energizes condenser fans B21 (fan 3) and B22 (fan 4) in response to thermostat demand.

6 - Cooling Relays K66 (120S4D, 150, 180, 240) & K67 (all units)

Cooling relays K66 and K67 are N.O. DPDT relays. K66 is energized from "Y1" (1st stage cool), which in turn energizes contactor K2. K67 is energized by "Y2" (2nd stage cool), which in turn energizes contactor K1. This sequence is the start up of compressors B1 and B2.

B-COOLING COMPONENTS

⚠ WARNING

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

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

1 - Compressor

ALL ELS model units use scroll compressors. ELS072, ELS090 and ELS120S4S models have one two-stage scroll compressor. ELS120S4D, ELS150S4D, ELS180S4D and ELS240S4D models have two single-stage scroll compressors.

Compressor consists of two involute spiral scrolls matched together to generate a series of crescent shaped gas pockets between them.

During compression, one scroll remains stationary while the other scroll orbits around it.

Gas is drawn into the outer pocket, the pocket is sealed as the scroll rotates.

As the spiral movement continues, gas pockets are pushed to the center of the scrolls. Volume between the pockets is simultaneously reduced.

When pocket reaches the center, gas is now high pressure and is forced out of a port located in the center of the fixed scrolls.

During compression, several pockets are compressed simultaneously resulting in a smooth continuous compression cycle.

Continuous flank contact, maintained by centrifugal force, minimizes gas leakage and maximizes efficiency.

Scroll compressor is tolerant to the effects of slugging and contaminants. If this occurs, scrolls separate, allowing liquid or contaminants to be worked toward the center and discharged.

Low gas pulses during compression reduces operational sound levels.

Compressor motor is internally protected from excessive current and temperature.

Compressor is installed in the unit on resilient rubber mounts for vibration free operation.

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.

ELS072, ELS090 and ELS120S4S Two Stage Models

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

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

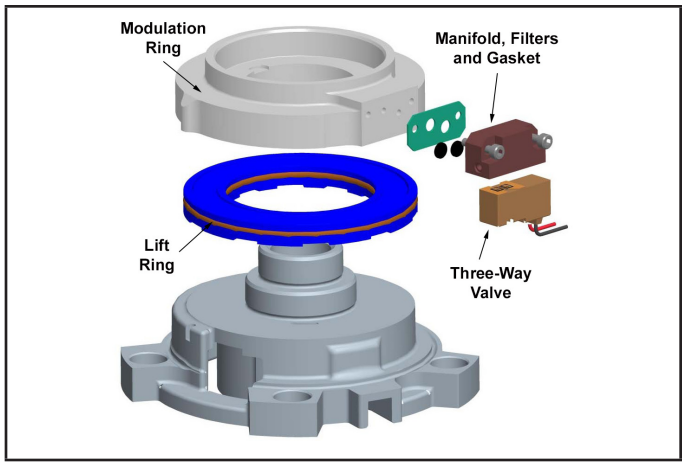


FIGURE 2. Two-Stage Scroll Compressor

2 - Crankcase Heaters HR1 (all units) and HR2 (120S4D, 150, 180, 240)

All ELS 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.

3 - High Pressure Switch S4 (all units) & S7 (120S4D, 150, 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 640 + 10 psig (4413 + 69 kP) the switch opens and the compressor is de-energized.

4 - Filter Drier (all units)

All ELS 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.

5 - Condenser Fan B4 (all units) B5 (120S4S,120S4D, 150, 180, 240) B21 & B22 (180, 240)

See pages 2 and 3 for the specifications on the condenser fans used in the ELS units. All condenser fans have single- phase motors. The ELS072 and 090 units are equipped with a single condenser fan. The ELS120 and 150 are equipped with two fans and the 180 and 240 have four fans. The fan assembly may be removed for servicing by removing the fan grill, unplugging the motor then loosening the motor bracket. The assembly will lift out.

6 - Loss of Charge Switch S24 & S25

The loss of charge switch is an auto-reset SPST N.C. switch which opens on a pressure drop (almost a complete loss of charge). All ELS units have S24 and the 120S4D through 240 have S25. The switch is located in the liquid line and wired in series with compressor contactor and high pressure switch. S24 is wired in series with first stage cool and S25 is wired in series with second stage cool. When pressure drops below 40+ 5 psig (indicating loss of charge in the system) the switch opens and compressor is de-energized. The switch automatically resets when refrigerant is added and pressure in the discharge line rises above 90+ 5 psig.

7 - Head Pressure Control A190 & A191 and Pressure Transducer A188 & A189

The low ambient kit is designed to maintain the head pressure across the liquid line by varying the condenser speed fan.

Head pressure Control A190 (all units) and A191 (ELS180, 240) is used to set the desired liquid line pressure (315 psig in ELS units). The pressure transducer A190 (All units) A191 (120S4D through 240) measures the liquid line pressure sending an analog signal to the head pressure controller. If pressure falls below set point, the head pressure controller reduces the fan speed to increase the liquid line pressure to the set point.

II- REFRIGERANT SYSTEM

A-Plumbing

Field refrigerant piping consists of liquid and suction lines connecting the condensing unit and the indoor unit. Liquid and suction service valves are located in a compartment at the corner of the unit below the control box. Piping can be routed directly from the service valves or field supplied elbows can be added to divert the piping as required Refer to table 1 for field-fabricated refrigerant line sizes for runs up to 50 linear feet (15 m).

TABLE 1

ELS Unit	Liquid Line	Suction Line
072	3/8" (10mm)	1-1/8" (29mm)
090	5/8" (16mm)	1-1/8" (29mm)
120S4S	5/8" (16mm)	1-1/8" (29mm)
120S4D	3/8" (10mm)	1-1/8" (29mm)
150	3/8" (10mm)	1-1/8" (29mm)
180	5/8" (16mm)	1-1/8" (29mm)
240	5/8" (16mm)	1-1/8" (29mm)

Refrigerant Line Limitations

You may install the unit in applications that have line set lengths of up to 50 linear feet (15 m) with refrigerant line sizes as outlined in table 1 (excluding equivalent length of fittings). Size refrigerant lines greater than 50 linear feet (15m or greater) according to the Lennox Refrigerant Piping Design and Fabrication Guidelines (Corp. 9351-L9) or latest version.

B-Service Valves

OPERATING SERVICE VALVES

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

⚠ IMPORTANT

Only use Allen wrenches of sufficient hardness (50Rc - Rockwell Harness Scale minimum). Fully insert the wrench into the valve stem recess.

Service valve stems are factory-torqued (from 9 ft-lbs for small valves, to 25 ft-lbs for large valves) to prevent refrigerant loss during shipping and handling. Using an Allen wrench rated at less than 50Rc risks rounding or breaking off the wrench, or stripping the valve stem recess.

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

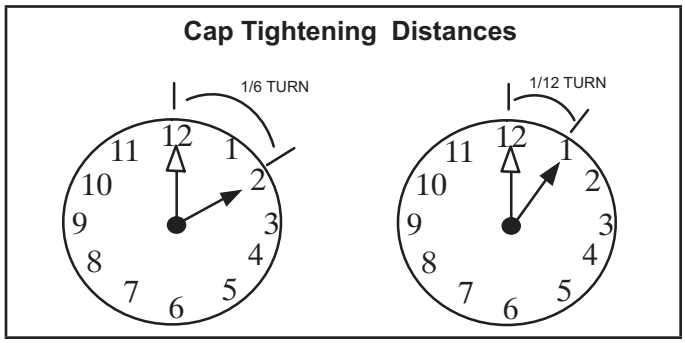


FIGURE 3

⚠ IMPORTANT

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

TABLE 2

Torque Requirements

Part	Recommended Torque	
Service valve cap	8 ft.-lb.	11 NM
Sheet metal screws	16 in.-lb.	2 NM
Machine screws #10	28 in.-lb.	3 NM
Compressor bolts	90 in.-lb.	10 NM
Gauge port seal cap	8 ft.-lb.	11 NM

To Access Angle-Type Service Port:

A service port cap protects the service port core from contamination and serves as the primary leak seal.

1 - Remove service port cap with an appropriately sized wrench.

2 - Connect gauge to the service port.

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

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

To Open Liquid Line Service Valve:

1 - Remove stem cap with an adjustable wrench.

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

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

To Close Liquid Line Service Valve:

1 - Remove stem cap with an adjustable wrench.

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

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

Service (Ball) Valve

Some ELS units are equipped with a full service ball valve, as shown in figure 4. One service port that contains a valve core is present in this valve. A cap is also provided to seal off the service port. The valve is not rebuildable so it must always be replaced if failure has occurred.

Opening the Suction Line Service Valve

1 - Remove the stem cap with an adjustable wrench.

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

3 - Replace the stem cap and tighten it firmly.

Closing the Suction Line Service Valve

1 - Remove the stem cap with an adjustable wrench.

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

3 - Replace the stem cap and tighten firmly.

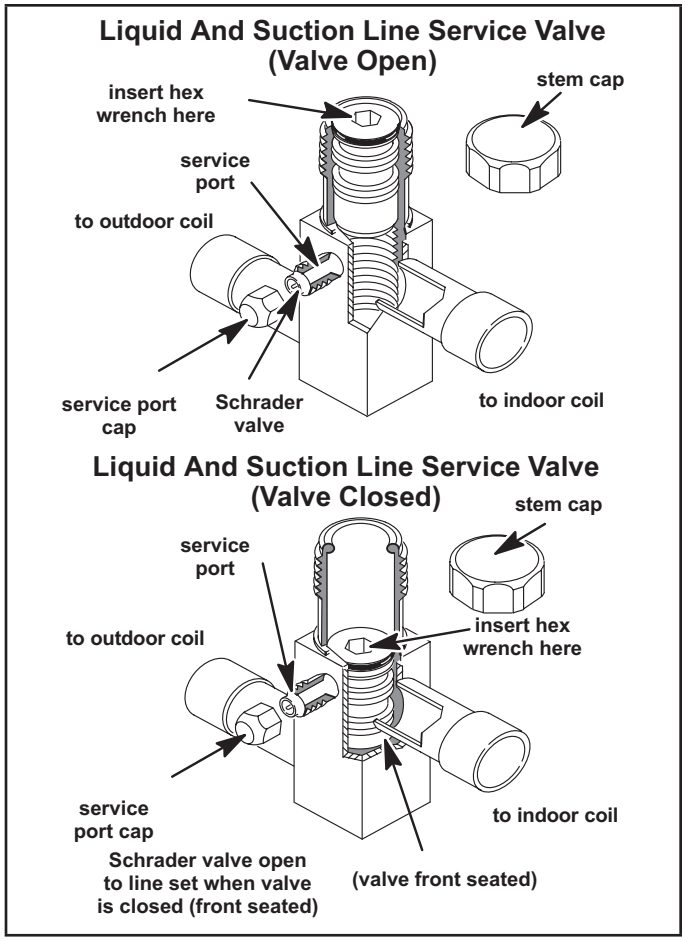


FIGURE 4

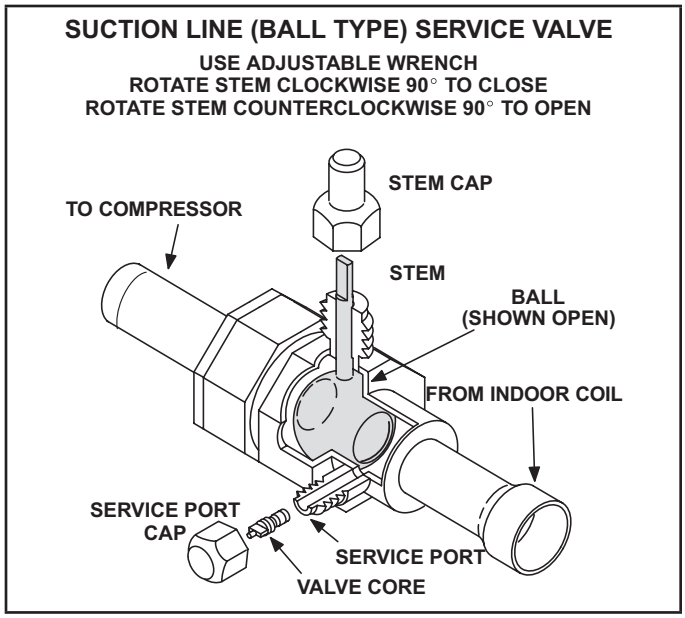


FIGURE 5

III-START-UP

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.

⚠ IMPORTANT

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-410A refrigerant.

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

A-Leak Testing

⚠ WARNING

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

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

⚠ WARNING

Fire, Explosion and Personal Safety hazard. Failure to follow this warning could result in damage, personal injury or death.

Never use oxygen to pressurize or purge refrigeration lines. Oxygen, when exposed to a spark or open flame, can cause fire and/or an explosion, that could result in property damage, personal injury or death.

1 - Connect an HFC-410A manifold gauge set as illustrated in figure 6.

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

3 - Open the high pressure side of the manifold to allow HFC-410A into the line set and indoor unit. Weigh in a trace amount of HFC-410A. [A trace amount is a maximum of two ounces (57 g) refrigerant or three pounds (31 kPa) pressure].

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

5 - Disconnect the HFC-410A cylinder.

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

7 - Adjust dry nitrogen pressure to 150 psig (1034 kPa). Open the valve on the high side of the manifold gauge set in order to pressurize the line set and the indoor unit.

8 - After a few minutes, open one of the service valve ports and verify that the refrigerant added to the system earlier is measurable with a leak detector.

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

9 - Check all joints for leaks.

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

11 - Correct any leaks and recheck.

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

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

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

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

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

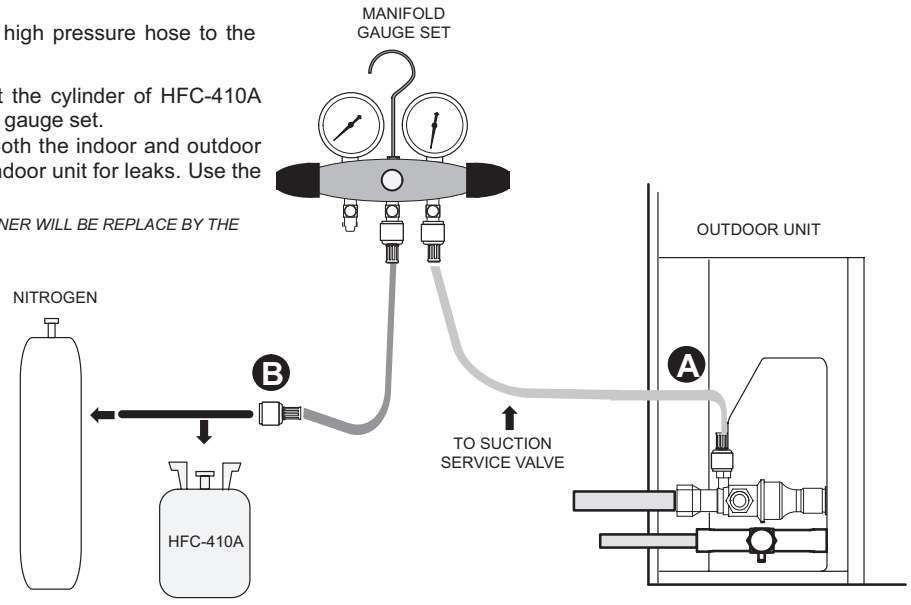
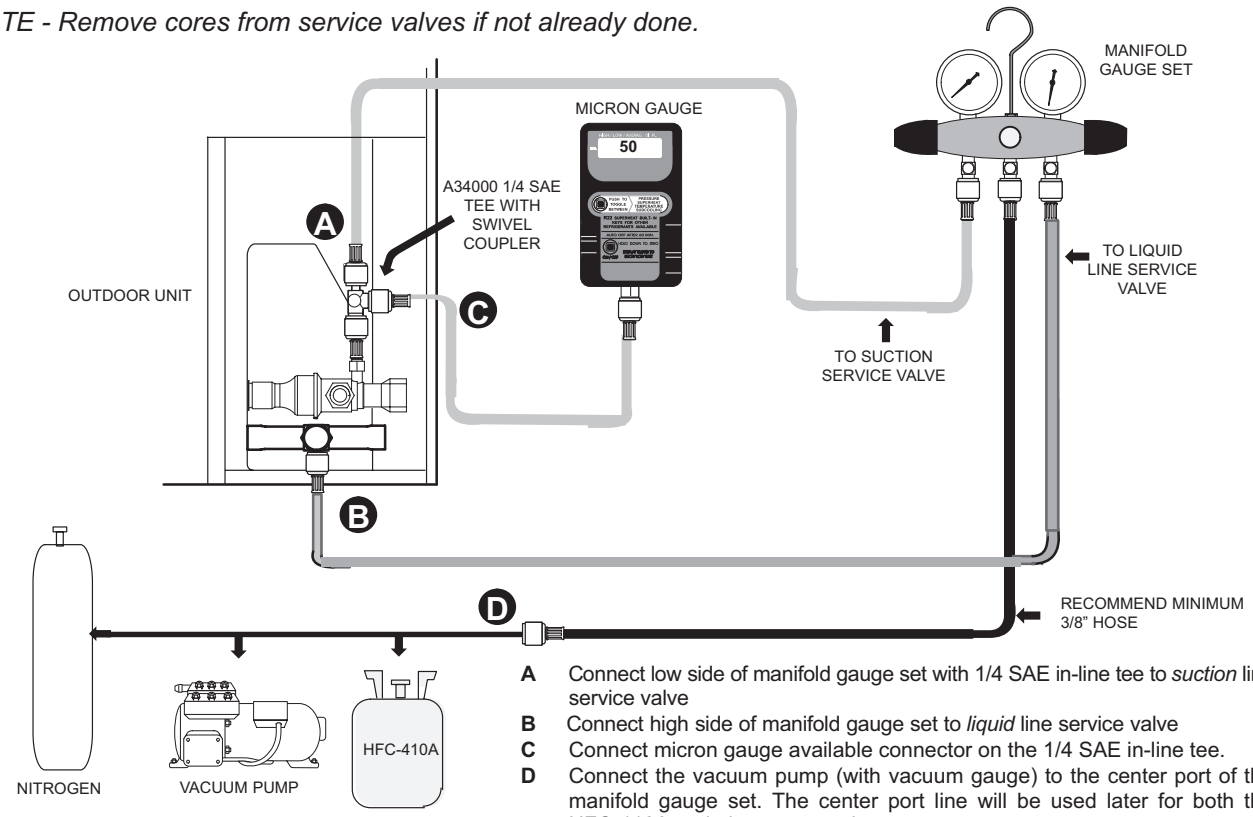


FIGURE 6

B-Evacuating the System

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



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

B Connect high side of manifold gauge set to *liquid* line service valve

C Connect micron gauge available connector on the 1/4 SAE in-line tee.

D Connect the vacuum pump (with vacuum gauge) to the center port of the manifold gauge set. The center port line will be used later for both the HFC-410A and nitrogen containers.

FIGURE 7

⚠ WARNING

Possible equipment damage.

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

⚠ IMPORTANT

Use a thermocouple or thermistor electronic vacuum gauge that is calibrated in microns. Use an instrument capable of accurately measuring down to 50 microns.

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

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

1 - Connect an HFC-410A manifold gauge set as illustrated in figure 5.

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

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

***NOTE** - During the early stages of evacuation, it is desirable to close the manifold gauge valve at least once to determine if there is a rapid rise in pressure this indicates a relatively large leak. If this occurs, repeat the leak testing procedure.*

***NOTE** - The term absolute pressure means the total actual pressure within a given volume or system, above the absolute zero of pressure. Absolute pressure in a vacuum is equal to atmospheric pressure minus vacuum pressure.*

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

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

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

7 - When the absolute pressure requirement above has been met, disconnect the manifold hose from the vacuum pump and connect it to an upright cylinder of HFC-410A refrigerant. Open the manifold gauge valve pressure line set to break vacuum with 2 to 5 psi.

8 - Perform the following:

A - Close manifold gauge valves

B - Shut off HFC-410A cylinder

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

D - Replace the stem caps and secure finger tight, then tighten an additional one-sixth (1/6) of a turn as illustrated in figure 2.

C-Charging

ELS units have a factory holding charge of 2 pounds of HFC-410A in each circuit. Additional refrigerant will need to be added during installation (table 3).

TABLE 3
Adding Refrigerant

Models	Stage 1 lbs for 25ft line set	Stage 2 lbs for 25ft line set	Liq. Line Dia.	Suction Line Dia.	Ounces Adjustment per foot of line set[1]
ELS072S4S	18.5	N/A	3/8	1-1/8	0.7
ELS090S4S	21.75	N/A	5/8	1-1/8	1.7
ELS120S4S	23	N/A	5/8	1-1/8	1.7
ELS120S4D	12	12	3/8	1-1/8	0.7
ELS150S4D	15	15.5	3/8	1-1/8	0.7
ELS180S4D	23.75	23.5	5/8	1-1/8	1.7
ELS240S4D	22.5	23.5	5/8	1-1/8	1.7

[1] If line set length is greater than 25 feet, add this amount to each circuit. If line set is less than 25 feet, subtract this amount from each circuit. Refer to Lennox Refrigerant Piping Design and Fabrication Guidelines for more information.

***NOTE** - Refrigerant line sets longer than 200 feet (60 meters) are not recommended. For assistance contact Lennox Application Department*.

To check the charge, use the following procedure:

1 - Attach gauge manifolds and operate unit in cooling mode until system stabilizes (approximately five minutes). Make sure outdoor air dampers are closed.

2 - Use a thermometer to accurately measure the outdoor ambient temperature.

3 - Apply the outdoor temperature to tables 5 and 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 - 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.

CHARGE VERIFICATION - APPROACH METHOD

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

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

Approach Temperature = Liquid temperature minus ambient temperature

2 - Approach temperature should as indicated in table 4 for each stage. An approach temperature greater than this value indicates an undercharge. An approach temperature less than this value indicates an overcharge.

3 - Do not use the approach method if system pressures do not match pressures in table 5 except when the outdoor ambient temperature is below 65ºF (18ºC). The approach method is not valid for grossly over- or undercharged systems.

TABLE 4

HFC-410A Approach Temperatures

Models	Stage	Approach Temperature (ºF)	Approach Temperature (ºC)
ELS072S4S	1	4.0	2.2
ELS090S4S	1	7.0	3.9
ELS120S4S	1	4.0	2.2
ELS120S4D	1	5.0	2.8
	2	5.0	2.8
ELS150S4D	1	7.0	3.9
	2	5.0	2.8
ELS180S4D	1	4.0	2.2
	2	4.0	2.2
ELS240S4D	1	7.0	3.9
	2	8.0	4.4

TABLE 5

HFC-410A Normal Operating Pressures (Liquid ±10 and Suction ±5 psig) (Single-Stage Units)**

Temp*	-072S4S		-090S4S		-120S4S	
	Liquid	Suction	Liquid	Suction	Liquid	Suction
65° F (18° C)	245	137	240	128	243	135
75° F (24° C)	283	141	294	130	285	136
85° F (29° C)	327	143	338	131	332	138
95° F (35° C)	377	145	385	133	378	139
105° F (41° C)	426	148	435	135	434	141
115° F (46° C)	484	150	489	136	491	142
125° F (52° C)	540	155	545	140	548	146
STD. CFM	2600		2725		3850	

**Temperature of air entering outdoor coil.*

***With indoor conditions at 80ºF dry bulb and 67ºF wet bulb temperatures.*

TABLE 6
HFC-410A Normal Operating Pressures (Liquid ±10 and Suction ±5 psig) (Dual-Stage Units)**

Temp*	-120S4D STAGE 1		-120S4D STAGE 2		-150S4D STAGE 1		-150S4D STAGE 2	
	Liquid	Suction	Liquid	Suction	Liquid	Suction	Liquid	Suction
65° F (18° C)	244	133	240	133	254	132	254	130
75° F (24° C)	282	136	278	135	291	135	289	133
85° F (29° C)	326	139	322	137	337	138	336	134
95° F (35° C)	373	141	372	138	381	140	382	136
105° F (41° C)	423	142	420	141	432	142	433	139
115° F (46° C)	477	144	476	143	487	144	489	141
125° F (52° C)	534	147	539	145	543	147	550	145
STD. CFM	4000				4400			

Temp*	-180S4D STAGE 1		-180S4D STAGE 2		-240S4D STAGE 1		-240S4D STAGE 2	
°F (°C)*	Liquid	Suction	Liquid	Suction	Liquid	Suction	Liquid	Suction
65° F (18° C)	233	110	236	110	236	129	236	128
75° F (24° C)	274	120	276	119	275	132	275	129
85° F (29° C)	317	128	319	125	321	134	322	131
95° F (35° C)	364	134	366	131	370	137	368	133
105° F (41° C)	418	138	416	132	420	139	425	136
115° F (46° C)	475	141	468	134	477	142	478	139
125° F (52° C)	536	143	529	136	539	146	534	144
STD. CFM	5150				6975			

**Temperature of air entering outdoor coil.*

***With indoor conditions at 80ºF dry bulb and 67ºF wet bulb temperatures.*

TABLE 7. Approach Temperatures – Residential Matchups

Models		Approach Temperature		
Outdoor	Indoor	Stage	(ºF) (+/- 1)	(ºC) (+/- 0.5)
ELS120S4D	(2) CBA27UHE-060 or (2) CBA38MV-060	1	4	2.2
		2	4	2.2
ELS120S4D	(2) CH33-62D	1	4	2.2
		2	4	2.2
ELS120S4D	(2) CH23-068	1	4	2.2
		2	4	2.2
ELS120S4D	(2) CX35-60C	1	4	2.2
		2	4	2.2
ELS120S4D	(2) CX35-60D	1	4	2.2
		2	4	2.2

TABLE 8. Normal Operating Temperatures – Residential Matchups

ELS120S4D + (2) CBA27UHE-060 or (2) CBA38MV-060				ELS120S4D + (2) CH33-62D				ELS120S4D + (2) CH23-068			
Normal Operating Pressures				Normal Operating Pressures				Normal Operating Pressures			
	(ºF)	Liquid at ODSV	Suction		(ºF)	Liquid at ODSV	Suction		(ºF)	Liquid at ODSV	Suction
STAGE 1	**65**	251	133	STAGE 1	**65**	240	125	STAGE 1	**65**	241	128
	75	292	135		**75**	280	129		**75**	281	131
	85	340	137		**85**	324	132		**85**	325	134
	95	391	140		**95**	372	135		**95**	373	137
	105	446	143		**105**	425	139		**105**	427	141
	115	505	145		**115**	483	143		**115**	484	144
	125	569	148		**125**	545	146		**125**	547	147
STAGE 2	**65**	250	131	STAGE 2	**65**	241	125	STAGE 2	**65**	242	128
	75	287	134		**75**	282	128		**75**	283	131
	85	333	136		**85**	326	131		**85**	326	133
	95	384	139		**95**	374	134		**95**	375	136
	105	441	142		**105**	427	137		**105**	428	139
	115	501	144		**115**	484	141		**115**	486	142
	125	566	147		**125**	548	145		**125**	550	146

Normal Operating Temperatures – Residential Matchups

ELS120S4D + (2) CX35-60C				ELS120S4D + (2) CX35-60D			
Normal Operating Pressures				Normal Operating Pressures			
	(ºF)	Liquid at ODSV	Suction		(ºF)	Liquid at ODSV	Suction
STAGE 1	**65**	241	130	STAGE 1	**65**	240	127
	75	282	133		**75**	281	130
	85	326	136		**85**	325	134
	95	374	139		**95**	373	137
	105	427	142		**105**	427	141
	115	485	145		**115**	484	145
	125	548	148		**125**	548	148
STAGE 2	**65**	243	129	STAGE 2	**65**	241	127
	75	282	132		**75**	282	130
	85	327	135		**85**	327	133
	95	375	138		**95**	374	136
	105	428	141		**105**	428	139
	115	486	144		**115**	486	143
	125	550	147		**125**	550	146

V-MAINTENANCE

Installation and service must be performed by a licensed professional installer (or equivalent) or a service agency. At the beginning of each cooling season, the system should be checked as follows:

⚠ WARNING

Electric Shock Hazard. Can cause injury or death. Unit must be properly grounded in accordance with national and local codes.

Line voltage is present at all components when unit is not in operation on units with single-pole contactors. Disconnect all remote electric power supplies before opening access panel. Unit may have multiple power supplies.

OUTDOOR UNIT

1 - Clean and inspect outdoor coil (may be flushed with a water hose). Ensure power is off before cleaning.

2 - Outdoor unit fan motor is pre-lubricated and sealed. No further lubrication is needed.

3 - Visually inspect all connecting lines, joints and coils for evidence of oil leaks.

4 - Check all wiring for loose connections.

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

6 - Check amp draw on outdoor fan motor.

UNIT NAMEPLATE: _____ ACTUAL: _____

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

INDOOR COIL

1 - Clean coil if necessary.

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

3 - Check condensate line and clean if necessary.

INDOOR UNIT

1 - Clean or change filters.

2 - Blower motors are prelubricated and permanently sealed. No more lubrication is needed.

3 - Adjust blower speed for cooling. Measure the pressure drop over the coil to determine the correct blower CFM. Refer to the unit information service manual for pressure drop tables and procedure.

4 - Belt Drive Blowers - Check belt for wear and proper tension.

5 - Check all wiring for loose connections.

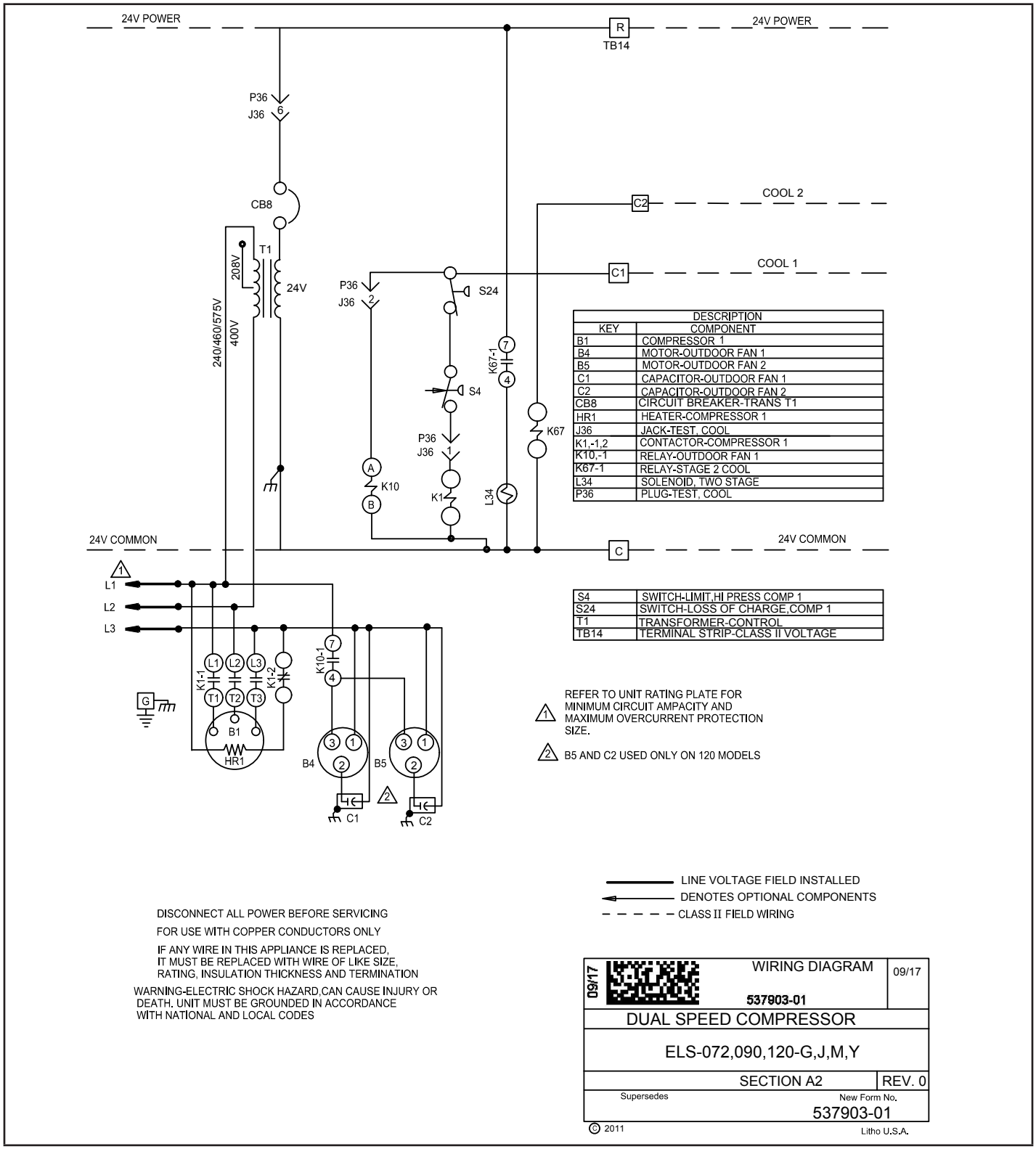
6 - Check for correct voltage at unit. (blower operating)

7 - Check amp draw on blower motor.

UNIT NAMEPLATE: _____ ACTUAL: _____

VI-Wiring Diagram and Sequence of Operation

A-ELS072-120S



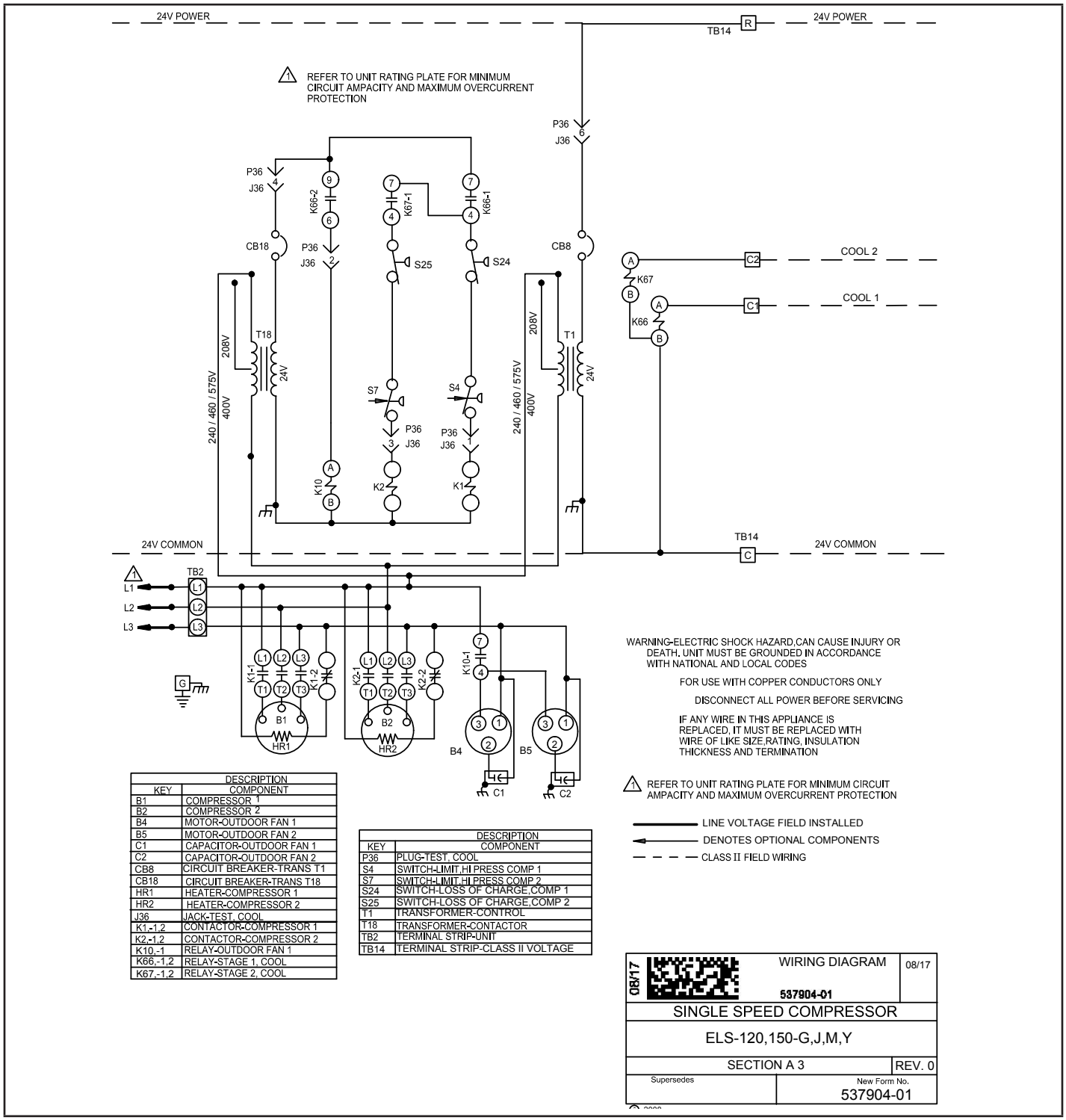
1 - Cooling demand energizes at thermostat terminal Y1. Voltage passes through N.C. loss of charge switch S24 and N.C. high pressure switch S4.

2 - Compressor contactor K1 and outdoor fan relay K10 are energized.

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

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

B-ELS120S4D, 150



KEY	DESCRIPTION COMPONENT
B1	COMPRESSOR 1
B2	COMPRESSOR 2
B4	MOTOR-OUTDOOR FAN 1
B5	MOTOR-OUTDOOR FAN 2
C1	CAPACITOR-OUTDOOR FAN 1
C2	CAPACITOR-OUTDOOR FAN 2
CB8	CIRCUIT BREAKER-TRANS T1
CB18	CIRCUIT BREAKER-TRANS T18
HR1	HEATER-COMPRESSOR 1
HR2	HEATER-COMPRESSOR 2
J36	JACK-TEST, COOL
K1-1,2	CONTACTOR-COMPRESSOR 1
K2-1,2	CONTACTOR-COMPRESSOR 2
K10,-1	RELAY-OUTDOOR FAN 1
K66,-1,2	RELAY-STAGE 1, COOL
K67,-1,2	RELAY-STAGE 2, COOL

KEY	DESCRIPTION COMPONENT
P36	PLUG-TEST, COOL
S4	SWITCH-LIMIT,HI PRESS COMP 1
S7	SWITCH-LIMIT,HI PRESS COMP 2
S24	SWITCH-LOSS OF CHARGE,COMP 1
S25	SWITCH-LOSS OF CHARGE,COMP 2
T1	TRANSFORMER-CONTROL
T18	TRANSFORMER-CONTACTOR
TB2	TERMINAL STRIP-UNIT
TB14	TERMINAL STRIP-CLASS II VOLTAGE

08/17	WIRING DIAGRAM 537904-01	08/17
SINGLE SPEED COMPRESSOR		
ELS-120,150-G,J,M,Y		
SECTION A 3		REV. 0
Supersedes	New Form No. 537904-01	

First Stage Cool

1 - Cooling demand energizes K66 relay coil at thermostat terminal Y1.

2 - K66-1 contacts close, voltage passes through S24 loss of charge switch and high pressure switch S4, energizing compressor contactor K1.

3 - At the same time, K66-2 contacts close, energizing outdoor fan relay K10.

4 - K1-1 closes, energizing compressor B1. K10-1 closes energizing outdoor fans B4 and B5. K1-2 opens to de-energize crankcase heater HR1.

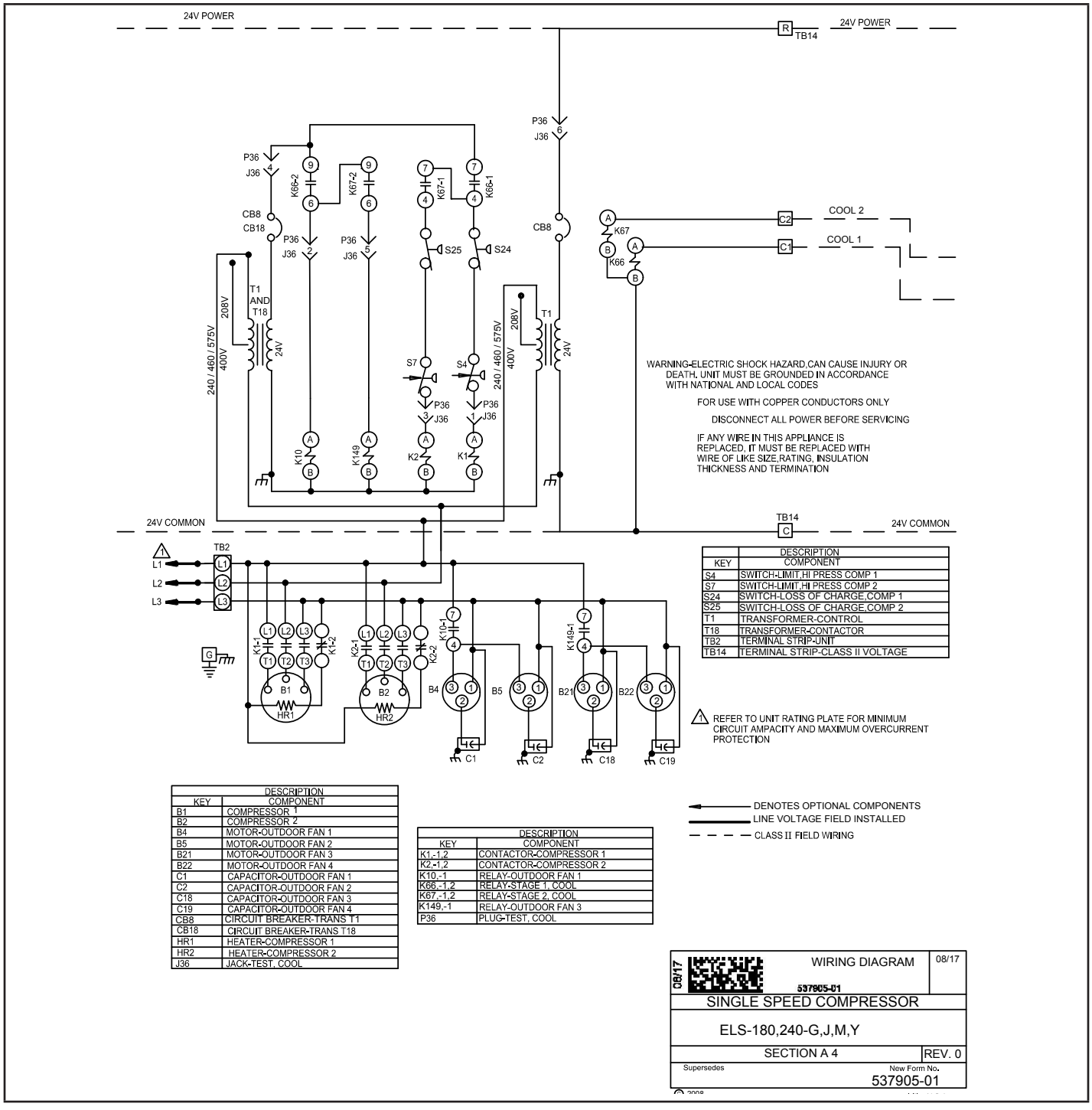
Second Stage Cool

5 - Cooling demand energizes K67 relay coil at thermostat terminal Y2.

6 - K67-1 contacts close, voltage passes through S25 loss of charge switch and S7 high pressure switch energizing compressor contactor K2.

7 - K2-1 closes energizing compressor B2. K2-2 opens to de-energize crankcase heater HR2.

C-ELS180, 240



KEY	DESCRIPTION COMPONENT
S4	SWITCH-LIMIT,HI PRESS COMP 1
S7	SWITCH-LIMIT,HI PRESS COMP 2
S24	SWITCH-LOSS OF CHARGE,COMP 1
S25	SWITCH-LOSS OF CHARGE,COMP 2
T1	TRANSFORMER-CONTROL
T18	TRANSFORMER-CONTACTOR
TB2	TERMINAL STRIP-UNIT
TB14	TERMINAL STRIP-CLASS II VOLTAGE

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
CB8	CIRCUIT BREAKER-TRANS T1
CB18	CIRCUIT BREAKER-TRANS T18
HR1	HEATER-COMPRESSOR 1
HR2	HEATER-COMPRESSOR 2
J36	JACK-TEST, COOL

KEY	DESCRIPTION COMPONENT
K1,-1,2	CONTACTOR-COMPRESSOR 1
K2,-1,2	CONTACTOR-COMPRESSOR 2
K10,-1	RELAY-OUTDOOR FAN 1
K66,-1,2	RELAY-STAGE 1, COOL
K67,-1,2	RELAY-STAGE 2, COOL
K149,-1	RELAY-OUTDOOR FAN 3
P36	PLUG-TEST, COOL

First Stage Cool

1 - Cooling demand energizes K66 relay coil at thermostat terminal Y1.

2 - K66-1 contacts close, voltage passes through S24 loss of charge switch and high pressure switch S4 energizing contactor K1.

3 - At the same time, K66-2 closes energizing relay K10.

4 - K1-1 contacts close, energizing compressor B1. K10-1 contacts close energizing outdoor fans B4 and B5. K1-2 opens to de-energize crankcase heater HR1.

Second Stage Cool

5 - Cooling demand energizes K67 relay coil at thermostat terminal Y2.

6 - K67-1 contacts close, voltage passes through S25 loss of charge switch and S7 high pressure switch energizing K2.

7 - At the same time, K67-2 closes, energizing relay K149.

8 - K2-1 contacts close energizing compressor B2 and K149-1 contacts close, energizing outdoor fans B21 and B22. K2-2 opens to de-energize crankcase heater HR2.