

### HP29 HEAT PUMP SERIES

The HP29 7.5 and 10 (26.4 and 35.2 kW) ton heat pump units are designated for light commercial applications, with a remotely located blower-coil unit or a furnace with an add-on evaporator coil. HP29 model units are equipped with a scroll compressor. The HP29 heat pumps match with the CB/CBH17 blower-coil units. All HP29 units are three-phase.

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

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



HP29-090

#### **⚠ 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**

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.		HP29-090-2	HP29-120-2
Nominal Size - Tons (kW)		7.5 (26.4)	10 (35.2)
Liquid line (o.d.) — in. (mm) connection (sweat)		5/8 (15.9)	
Vapor line (o.d.) — in. (mm) connection (sweat)		1-3/8 (34.9)	
Outdoor Coil	Net face area — sq. ft. (m <sup>2</sup> )	Outer coil	(2) 29.34 (2.73)
		Inner coil	----
	Tube diameter — in. (mm) & no. of rows		3/8 (9.5) - 2
	Fins per inch (m)		20 (787)
Outdoor Coil Fan(s)	Diameter — in. (mm) & no. of blades		(1) 24 (610) - 4      (2) 24 (610) - 3
	Motor hp (W)		(1) 1/2 (373)      (2) 1/3 (249)
	Cfm (L/s) total air volume		5300 (2500)      8200 (3870)
	Rpm		1075      1100
	Motor Input - Watts		350      700
Refrigerant charge		dry air	
Shipping weight — lbs. (kg) 1 package		506 (230)	604 (284)
OPTIONAL ACCESSORIES – Must Be Ordered Extra			
Hail Guards		<b>83K37</b>	<b>79K91</b>

**SPECIFICATIONS**

General Data		Model No.	HP29- 090-3	HP29-120-3
Nominal Size - Tons (kW)			7.5 (26.4)	10 (35.2)
Connections (sweat)	Liquid line (o.d.) - in. (mm) connection		5/8 (15.9)	5/8 (15.9)
	Vapor line (o.d.) - in. (mm) connection		1-3/8 (34.9)	1-3/8 (34.9)
Refrigerant			dry air holding charge	dry air holding charge
Outdoor Coil	Net face area - sq. ft. (m <sup>2</sup> )	Outer coil	30.0 (2.79)	(2) 29.34 (2.73)
		Inner coil	28.94 (2.69)	---
	Tube diameter - in. (mm) & no. of rows		3/8 (9.5) - 2	3/8 (9.5) - 2
	Fins per inch (m)		20 (787)	20 (787)
Outdoor Coil Fan(s)	Diameter - in. (mm) & no. of blades		(1) 24 (610) - 4	(2) 24 (610) - 3
	Motor hp (W)		(1) 3/4 (560)	(2) 1/3 (249)
	cfm (L/s) total air volume		5400 (2550)	8200 (3870)
	Rpm		1075	1100
	Motor Input - Watts		600	700
Shipping		lbs. (kg) 1 package	485 (220)	604 (284)
OPTIONAL ACCESSORIES – Must Be Ordered Extra				
Hail Guards			<b>29M45</b>	<b>79K91</b>

### ELECTRICAL DATA

Model No.		HP29-090-2			HP29-120-2		
Line voltage data — 60 hz - 3 phase		208/230v	460v	575v	208/230v	460v	575v
Rec. max. fuse or □ circuit breaker size (amps)		60	30	25	80	40	25
†Minimum circuit ampacity		39	20	15	53	25	18
Compressor (1)	Rated load amps	28.8	14.7	10.8	37.8	17.2	12.4
	Locked rotor amps	195	95	80	239	125	80
Outdoor Coil Fan Motor (1 phase)	Full load amps (total)	3	1.5	1.2	2.4 (4.8)	1.3 (2.6)	1 (2)
	Locked rotor amps (total)	6	3	2.9	4.7 (9.4)	2.4 (4.8)	1.9 (3.8)

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

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

□ HACR type (under 100 amps). U.S. only.

### ELECTRICAL DATA

General Data		Model No.	HP29-090-3			HP29-120-3		
Line voltage data - 60 hz - 3 phase		208/230v	460v	575v	208/230v	460v	575v	
Rec. max. fuse or □ circuit breaker size (amps)		60	35	25	80	40	25	
†Minimum circuit ampacity		40	21	16	53	25	18	
Compressor (1)	Rated load amps	28.8	14.7	10.8	37.8	17.2	12.4	
	Locked rotor amps	195	95	80	239	125	80	
Outdoor Coil Fan Motor (1 phase)	Full load amps (total)	3.7	1.9	1.6	2.4 (4.8)	1.3 (2.6)	1 (2)	
	Locked rotor amps (total)	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.

□ HACR type (under 100 amps). U.S. only.

## HP29-090-3 MODEL PARTS ARRANGEMENT

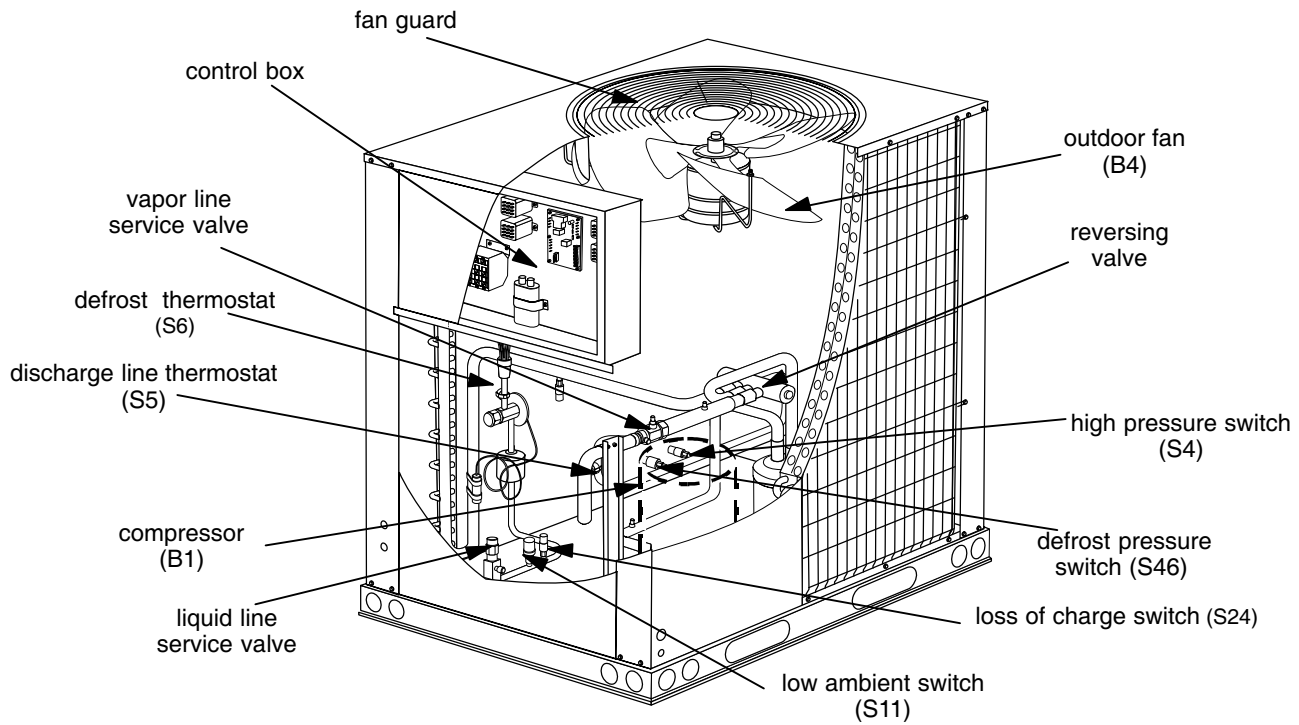


FIGURE 1

## HP29-120-3 MODEL PARTS ARRANGEMENT

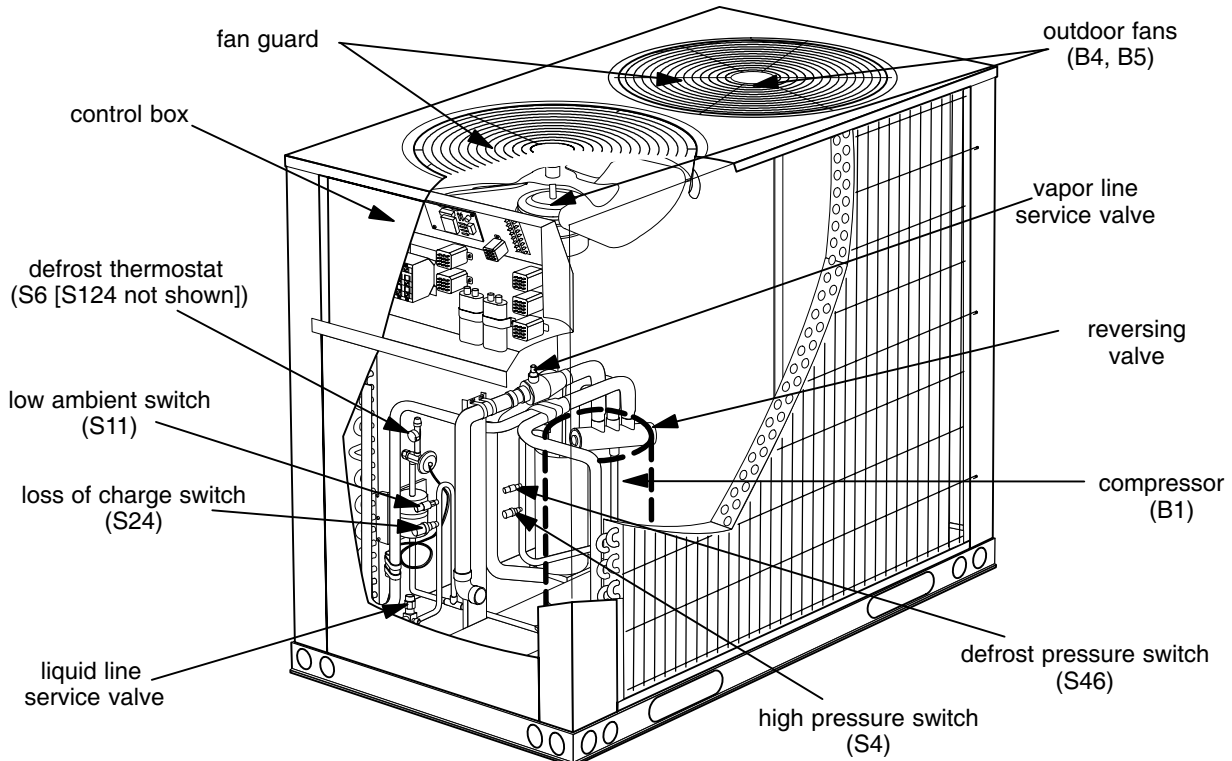


FIGURE 2

## HP29-090-3 CONTROL BOX

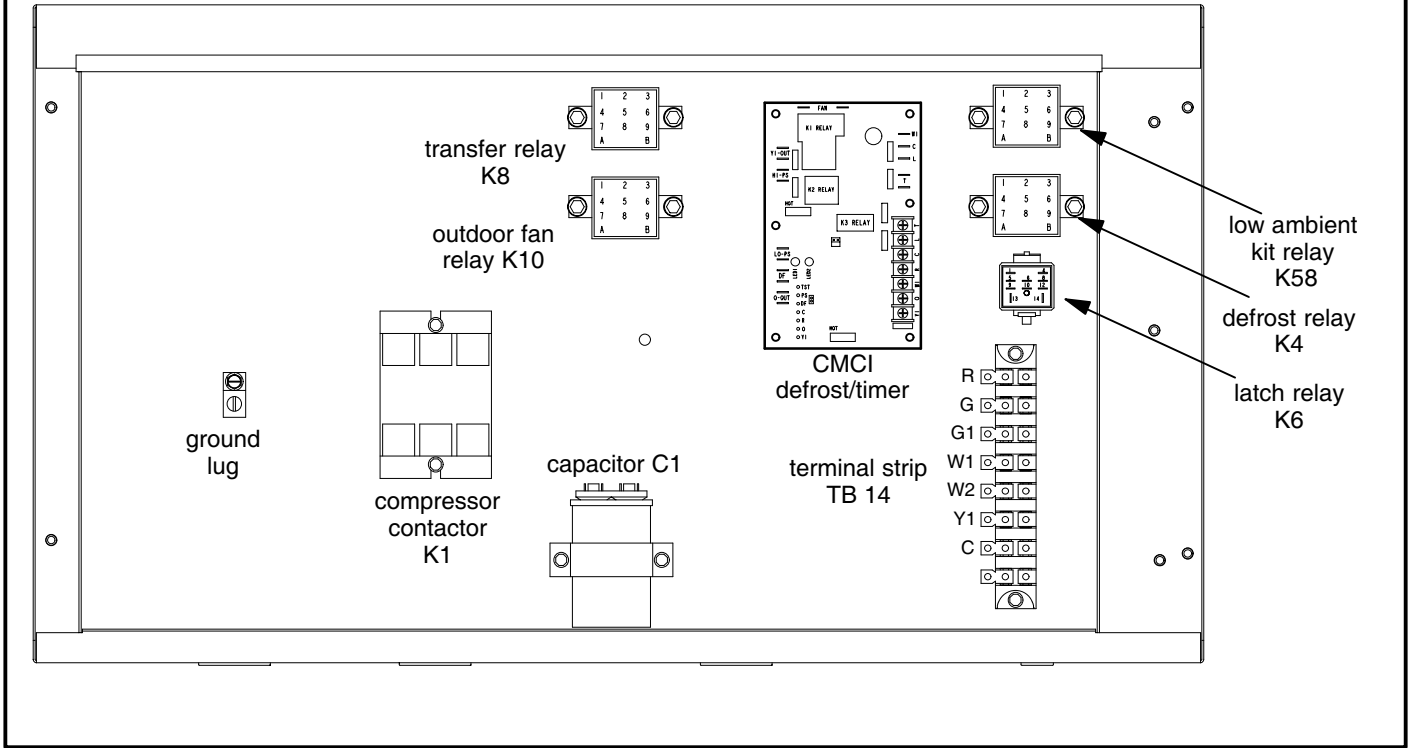


FIGURE 3

## HP29-120-3 CONTROL BOX

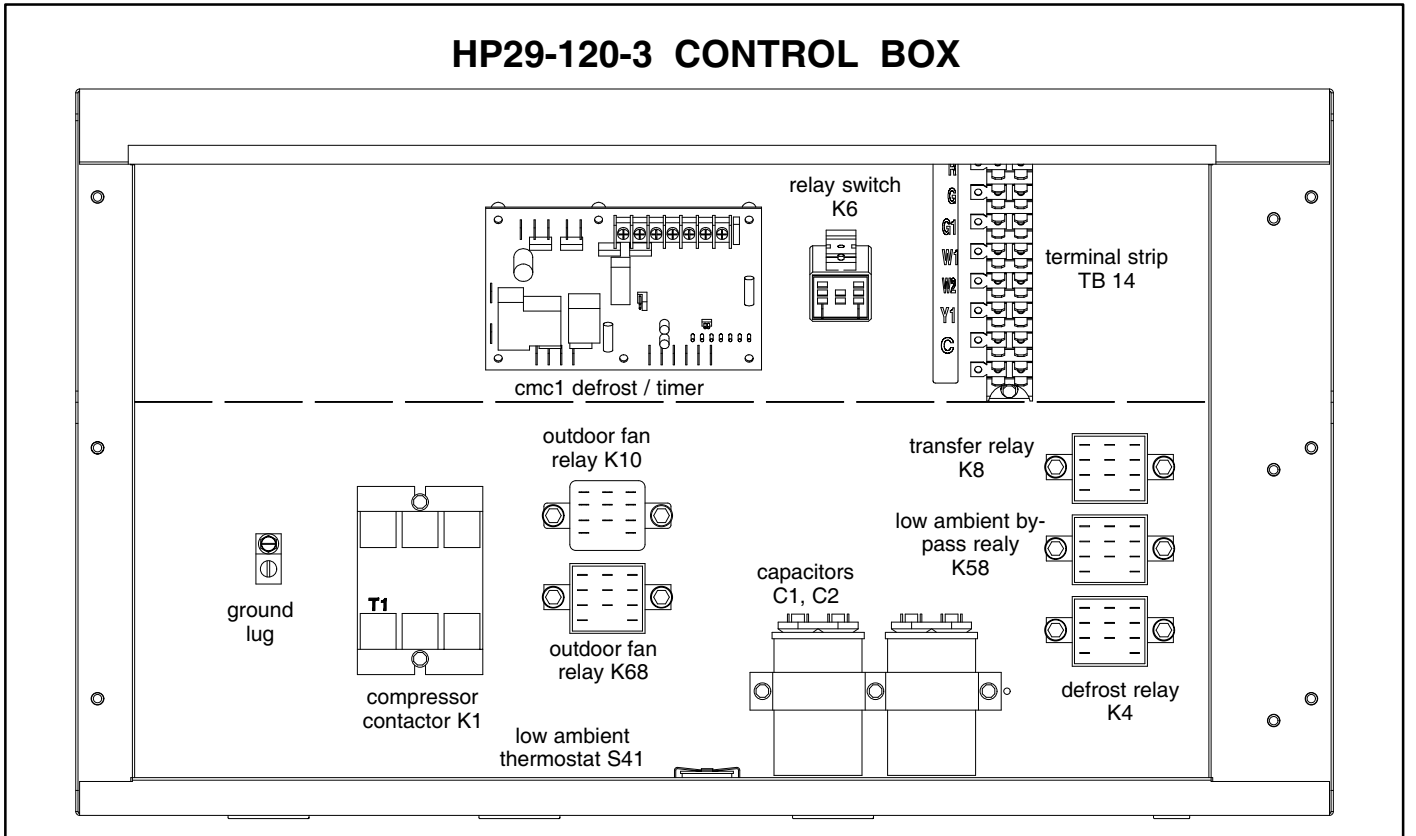


FIGURE 4

## I-UNIT COMPONENTS

The HP29-090 and HP29-120 components are shown in figures 1 and 2.

## A-CONTROL BOX COMPONENTS

The HP29-090 control box components are shown in figure 3. The HP29-120P control box components are shown in figure 4.

### 1 - Disconnect Switch S48 (Option -2 Units)

HP29 heat pumps units may be equipped with an optional disconnect switch S48. S48 is a factory-installed toggle switch used to disconnect power to the unit.

### 2 - Outdoor Fan Capacitors C1 (all units) and C2 (120P)

All HP29 units use single-phase condenser fan motors. Motors are equipped with a fan run capacitor to maximize motor efficiency. Outdoor fan capacitors C1 and C2 assist in the start up of condenser fan motors B4 and B5. Capacitor ratings are on outdoor fan motor nameplates.

### 3 - Compressor Contactor K1 (all units)

All compressor contactors are three-pole-double break contactors with a 24V coil. K1 energizes compressor B1 in both HP29-090 and HP29-120 units. The contactor is energized from indoor thermostat terminal Y when thermostat demand is present.

### 4 - Low Ambient Thermostat S41 (HP29-120 only)

S41 is a N.C. limit which opens on temperature fall at  $55 \pm 5^\circ\text{F}$ . The switch resets when temperature rises to  $65 \pm 6^\circ\text{F}$ . S41 opens and de-energizes K68 which de-energizes outdoor fan B5. When S41 closes, fans will be re-energized. This intermittent fan operation increases indoor evaporator coil temperature to prevent icing.

### 5 - Latch Relay K6 (all units)

HP29 units are plumbed so that the unit is in cooling mode when the reversing valve is energized. Latch relay K6 controls operation of the reversing valve and is controlled (indirectly) by the indoor thermostat. The combined operation of latch relay K6 and transfer relay K8 allows the **HP29 heat pumps to use a conventional heat/cool thermostat instead of a heat pump thermostat.**

A latch relay (figure 5) has two coils: a "SET" coil and a "RESET" coil. When 24VAC is applied to the "SET" coil, the normally open contacts close and the normally closed contacts open. When power is removed from the "SET" coil, nothing happens; the NO. contacts remain closed and the N.C. contacts remain open. The contacts do not return to their normal position until the "RESET" coil is energized. Once the contacts are reset, they remain in their normal position when power is removed.

HP29 units use a DPDT latch relay. Each set of normally open contacts controls a reversing valve. When the "SET" coil is energized, the normally open contacts close to energize the reversing valve (thereby placing the unit in the cooling mode). When power is removed from the "SET" coil (such as when thermostat demand is satisfied), the normally open contacts remain closed, the reversing valve remains energized and the unit remains in the cooling mode.

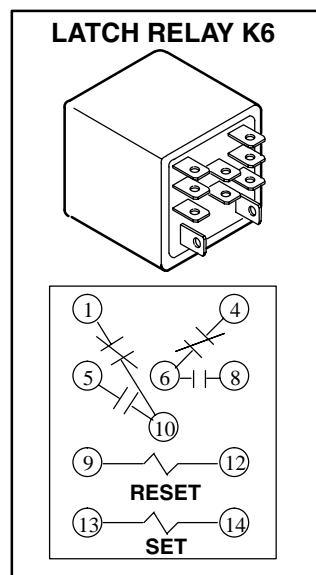


FIGURE 5

remains in the cooling mode.

When a heating demand is initiated, the "RESET" coil is energized. The normally open contacts open and the reversing valve is de-energized (thereby placing the unit in the heating mode). When heat demand is satisfied and power to the "RESET" coil is removed, the normally open contacts remain open, the normally closed contacts remain closed and the unit remains in the heating mode.

## 6 - Transfer Relay K8 (all units)

Transfer relay K8 ensures that the indoor blower will operate during all modes of operation. K8 also completes the circuit to Y1 on the defrost control board CMC1. The combined operation of latch relay K6 and transfer relay K8 allows the HP29 unit to use a conventional heat/cool thermostat instead of a heat pump thermostat. When there is a demand for cooling, K8-1 closes completing the Y1 circuit to defrost control board CMC1 terminal Y1. Normally open K6-1 closes energizing the reversing valve. K8-2 normally closed contacts ensure an unbroken circuit between indoor thermostat "G" and indoor blower contactor through terminals "G" and "G1" on terminal strip TB14. When there is a heat demand, normally closed K8-1 opens breaking the Y1 circuit to the defrost control CMC1. Power is sent to the "RESET" coil on K6. K6-1 opens de-energizing the reversing valve. K8-2 closes sending voltage from "G1" to the indoor blower control.

## 7 - Outdoor Fan Relay K10 (all units) K68 (HP29-120)

Outdoor fan relay K10 is a DPDT relay and K68 is a SPDT relay with a 24V coil. In all units K10 energizes outdoor fan B4 (fan 1) in response to thermostat demand. In the HP29-120, K68 energizes outdoor fan B5 (fan 2) in response to thermostat demand.

## 8 - Terminal Strip TB14 (all units)

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

## 9 - Low Ambient Bypass Relay K58 (all units)

K58 is a normally closed DPDT relay with a 24V coil, used in both HP29-090 and HP29-120 units. K58 is wired parallel with the reversing valve L1. When L1 is energized in the cooling cycle, K58 is also energized, opening K58-1. On the HP29-120, K58-1 and K58-2 will open. This shuts off power to the outdoor fans but does not by-pass S11 and S41, which allow fans to cycle during cooling demand. During heating demand, K58 remains closed by-passing S11 and S41 so fans can operate.

## 10 - GFI- J11 (Optional -2 units)

HP29 units may be equipped with a 110v ground fault interrupter (GFI). The GFI is located on the control box panel on the HP29. Separate wiring must be run for the 110v receptacle.

## B-COOLING COMPONENTS

### ⚠ 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 match-ups.**

## 1 - Scroll Compressor B1

All HP29 units utilize a scroll compressor. The scroll compressor design is simple, efficient and requires few moving parts. A cutaway diagram of the scroll compressor is shown in figure 6. The scrolls are located in the top of the compressor can and the motor is located in the bottom of the compressor can. The oil level is immediately below the motor and oil is pressure

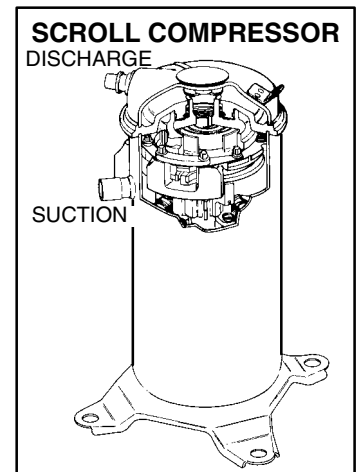


FIGURE 6

fed to the moving parts of the compressor. The lower portion of the compressor shell is exposed to low side pressure while only the very top of the shell is exposed to high side pressure.

The scroll is a simple compression concept centered around the unique spiral shape of the scroll and its inherent properties. Figure 7 shows the basic scroll form. Two identical scrolls are mated together forming concentric spiral shapes (figure 9). One scroll remains stationary, while the other is allowed to orbit (figure 8-1). Note that the orbiting scroll does not rotate or turn but merely orbits the stationary scroll.

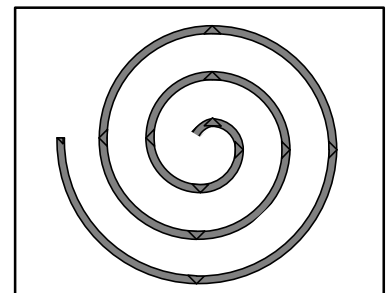
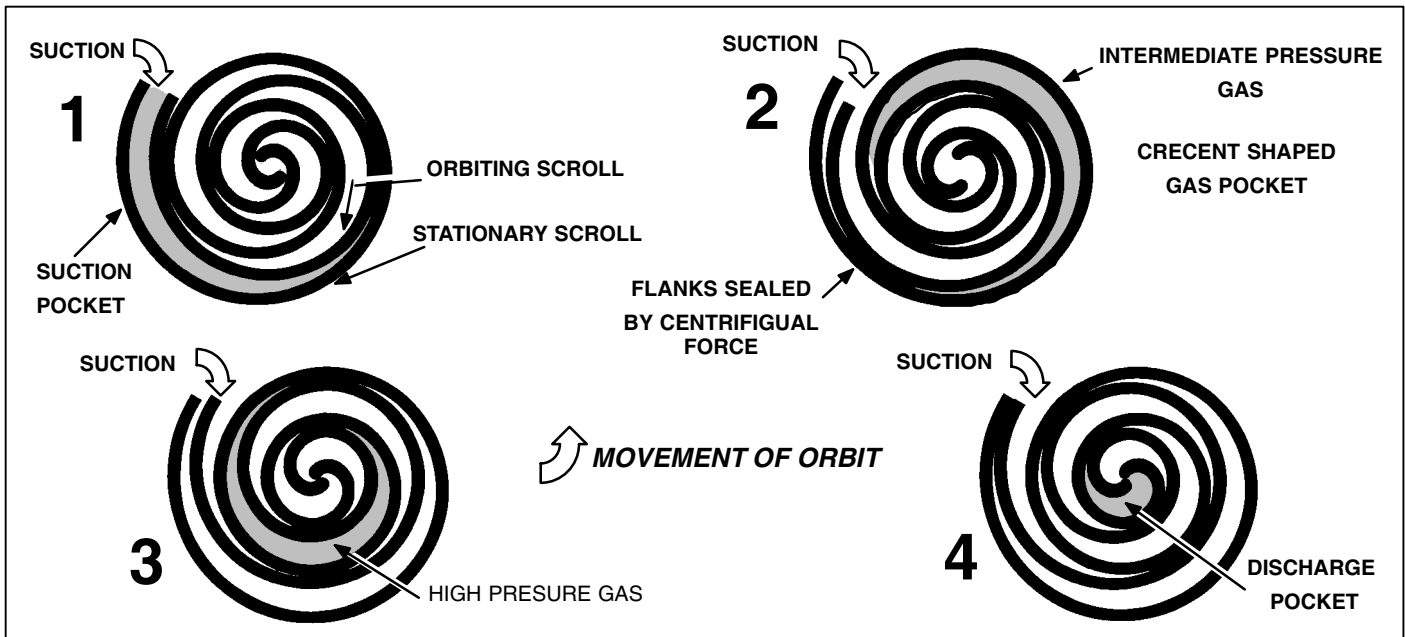


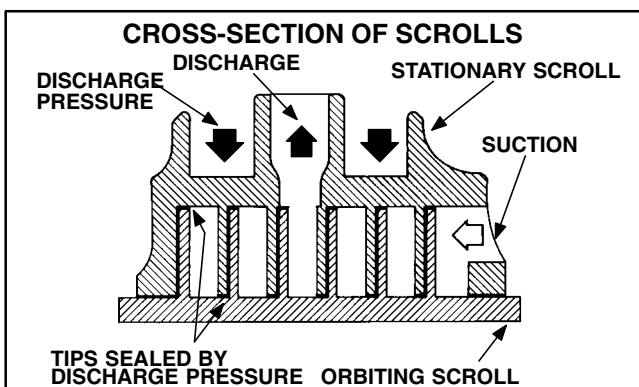
FIGURE 7



**FIGURE 8**

The counterclockwise orbiting scroll draws gas into the outer crescent shaped gas pocket created by the two scrolls (figure 8-2). The centrifugal action of the orbiting scroll seals off the flanks of the scrolls (figure 8-3). As the orbiting motion continues, the gas is forced toward the center of the scroll and the gas pocket becomes compressed (figure 8-4).

When compressed gas reaches the center, it is discharged vertically into a chamber and discharge port in the top of the compressor (figure 6). The discharge pressure forcing down on the top scroll helps seal the upper and lower edges (tips) of the scrolls (figure 9). During a single orbit, several pockets of gas are compressed simultaneously providing smooth continuous compression.



**FIGURE 9**

**2 - Crankcase Heaters HR1 (all units)**

All HP29 units use a belly-band crankcase heater. Heater HR1 is wrapped around compressor B1. HR1 assures proper compressor lubrication at all times.

**3 - High Pressure Switch S4 (all units)**

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

**4 - Low Ambient Switch S11 (all units)**

The low ambient switch is an auto-reset SPST N.O. pressure switch, which allows for mechanical cooling operation at low outdoor temperatures. All HP29 units are equipped with S11. The switch is located in the liquid line. In all HP29 units, S11 is wired in series with fan relay K10. When liquid pressure rises to  $275 \pm 10$  psig ( $1896 \pm 69$  kPa), the switch closes and the condenser fan is energized. When the discharge pressure drops to  $150 \pm 10$  psig ( $1034 \pm 69$  kPa), the switch opens and the condenser fan 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.



## 5 - Discharge Line Thermostat S5

S5 is an automatic reset SPST N.C. switch which opens on a temperature rise. The switch is located on the discharge line and wired in series with the CMCI board and S4 pressure switch. When discharge line temperature rises to  $275^{\circ} \pm 5^{\circ}\text{F}$  the switch opens and the compressor is de-energized through the CMCI. The switch automatically resets when discharge temperature drops to  $225^{\circ} \pm 5^{\circ}\text{F}$ .

## 6 - Loss of Charge Switch S24

The loss of charge switch is an auto-reset SPST N.O. switch, which opens on pressure drop. The switch is located on the liquid line and is wired to the defrost control board CMC1. When liquid pressure drops to  $25 \pm 5$  psig ( $172 \pm 34$  kPa), the switch opens and the compressor is de-energized. The switch automatically resets when pressure in the liquid line rises to  $55 \pm 5$  psig ( $379 \pm 34$  kPa).

## 7 - Reversing Valve L1 (all units)

A reversing valve with an electromechanical solenoid is used to reverse refrigerant flow during unit operation. L1 is energized during cooling demand and defrost. See figures 12 and 13.

## 8 - Expansion Valves

The HP29-120-2 uses two expansion valves in the liquid line adjacent to the left and right refrigerant coil. The HP29-090-2 units have one expansion valve. A liquid line filter/drier and check valve are connected in parallel with each expansion valve. The check valve allows for reverse refrigerant flow. The HP29-120-3 uses two internally checked expansion valves and the HP29-090-3 uses one internally checked expansion valve. The valves are located in the liquid line adjacent to the left and right refrigerant coil. In all units expansion valve control is provided by a superheat sensing bulb which is connected by a capillary tube to the expansion valve. The sensing bulb is strapped to the vapor line where it exits the coil. If the bulb senses low superheat, the expansion valve throttles down and restricts refrigerant flow through the coil. When excessive superheat is sensed, the valve opens to allow more refrigerant flow through the coil. See figures 12 and 13.

## 9 - Condenser Fan B4 (both units) B5 (HP29-120)

See page 2 for the specifications on the condenser fans used in the HP29 units. All condenser fans have single-phase motors. The HP29-090 units are equipped with a single condenser fan. The HP29-120 is equipped with two fans. The fan assembly may be removed for servicing by removing the motor mounts nuts.

## C-Defrost System

### 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 defrost system includes four components: a defrost thermostat, defrost pressure switch, defrost relay and defrost control.

#### Defrost Thermostat Switch S6, S124

Defrost thermostat switches S6 (refrigeration circuit one) and S124 (refrigeration circuit two) are S.P.S.T. N.O. contacts which close on temperature fall (initiating defrost after minimum run time of 30, 60, or 90 minutes). The switches are located on each of the expansion valve distributor assemblies. The switches monitor the outdoor coil saturation temperature to determine when defrost is needed. When the outdoor coil temperature falls to  $35^{\circ}\text{F} \pm 4^{\circ}\text{F}$  ( $1.7^{\circ}\text{C} \pm 2.2^{\circ}\text{C}$ ), the switch closes (initiating defrost after minimum run time of 30, 60, or 90 minutes). When the temperature rises to  $60^{\circ}\text{F} \pm 5^{\circ}\text{F}$  ( $15.6^{\circ}\text{C} \pm 2.8^{\circ}\text{C}$ ), the switch opens.

#### Defrost Pressure Switch S46

Defrost switch S46 is an auto-reset SPST N.C. pressure switch which opens on pressure rise of  $275 \pm 10$  psi ( $1896 \pm 69$  kPa). When S46 opens, defrost operation ends. The switch will reset when the unit receives a heat call and pressure falls to  $195 \pm 10$  psi ( $1344 \pm 69$  kPa). All HP29 units are equipped with this switch located on the discharge line. See figures 1 and 2. S46 is wired through the K8 transfer relay to the defrost board CMC1.

#### Defrost Relay K4

Defrost relay K4 controls defrost in the HP29 units. K4 is controlled by defrost board CMC1 and defrost pressure switch S46. When K4 is energized, contacts close and defrost is initiated.

## Defrost Control CMC1

The defrost control board combines functions of a time / temperature initiated and time / pressure terminated defrost control, defrost relay, time delay, diagnostic LEDs and field connection terminal strip. See figure 10.

The control provides automatic switching from normal heating operation to defrost mode and back. During compressor cycle (call for defrost), the control accumulates compressor run times at 30, 60 or 90 minute field adjustable intervals. If the defrost thermostat remains closed when the accumulated compressor run time ends, the defrost relay is energized and defrost begins. The defrost cycle is terminated by the defrost pressure switch or in 14 minutes whichever occurs first.

### Defrost Control Components

#### 1- Defrost Control Timing Pins

Each timing pin selection provides a different accumulated compressor run period during one thermostat run cycle. This time period must occur before a defrost cycle is initiated. The defrost interval can be adjusted to 30, 60 or 90 minutes. See figure 10. If no timing is selected, the control defaults to the factory setting 90 minutes. The defrost period is a maximum of 14 minutes and cannot be adjusted.

A TEST option is provided for troubleshooting. When the jumper is placed across the TEST pins, the timing of all functions is reduced by a factor of 128. For example, a 90 minute interval during TEST is 42 seconds and the 14-minute defrost is reduced to 6.5 seconds.

The TEST mode may be started at anytime. If the jumper is in the TEST position at power-up or for longer than five minutes, the control will ignore the TEST selection and will default to a 90 minute interval. **In order to test defrost cycle, defrost thermostat must be closed or jumpered.** Once defrost is initiated, remove jumper immediately. Failure to remove jumper will reduce defrost time to seconds.

#### 2- Time Delay

The timed-off delay is five minutes long. The delay feature is provided to help protect the compressor in case of interruption in power to the unit before thermostat demand is satisfied, or when a pressure switch resets. If thermostat demand is satisfied and the off cycle is greater than 5 minutes, the compressor will energize immediately on next heating or cooling demand.

#### 3- Pressure Switch Safety Circuits

The defrost control incorporates a pressure switch safety circuit that allows the application of an additional pressure switch; high pressure switch (S4) is factory-wired to this circuit. See figure 10. PS1 and PS2 terminals are internally connected in series with a jumper internal to the control board.

During one demand cycle, the defrost control will lock out the unit on the third instance that the unit goes off on any auto-reset pressure switch wired to this circuit. The diagnostic LEDs will display a pattern for a locked out pressure switch on the third open pressure switch occurrence. See table 1. The unit will remain locked out until power is broken then remade to the control.

The PS2 safety circuit terminals are connected to the compressor thermostat.

#### 4- Diagnostic LEDs

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

TABLE 1

DEFROST CONTROL BOARD DIAGNOSTIC LED		
MODE	LED 1	LED 2
Normal Operation/ Power to board	Flash together with LED 2	Flash together with LED 1
Time Delay To Protect Compressor	Alternating Flashes with LED 2	Alternating Flashes with LED 1
Pressure Switch Open	Off	On
Pressure Switch Lockout	On	Off
Board Malfunction	On	On

#### 5-Anti-Short Cycle

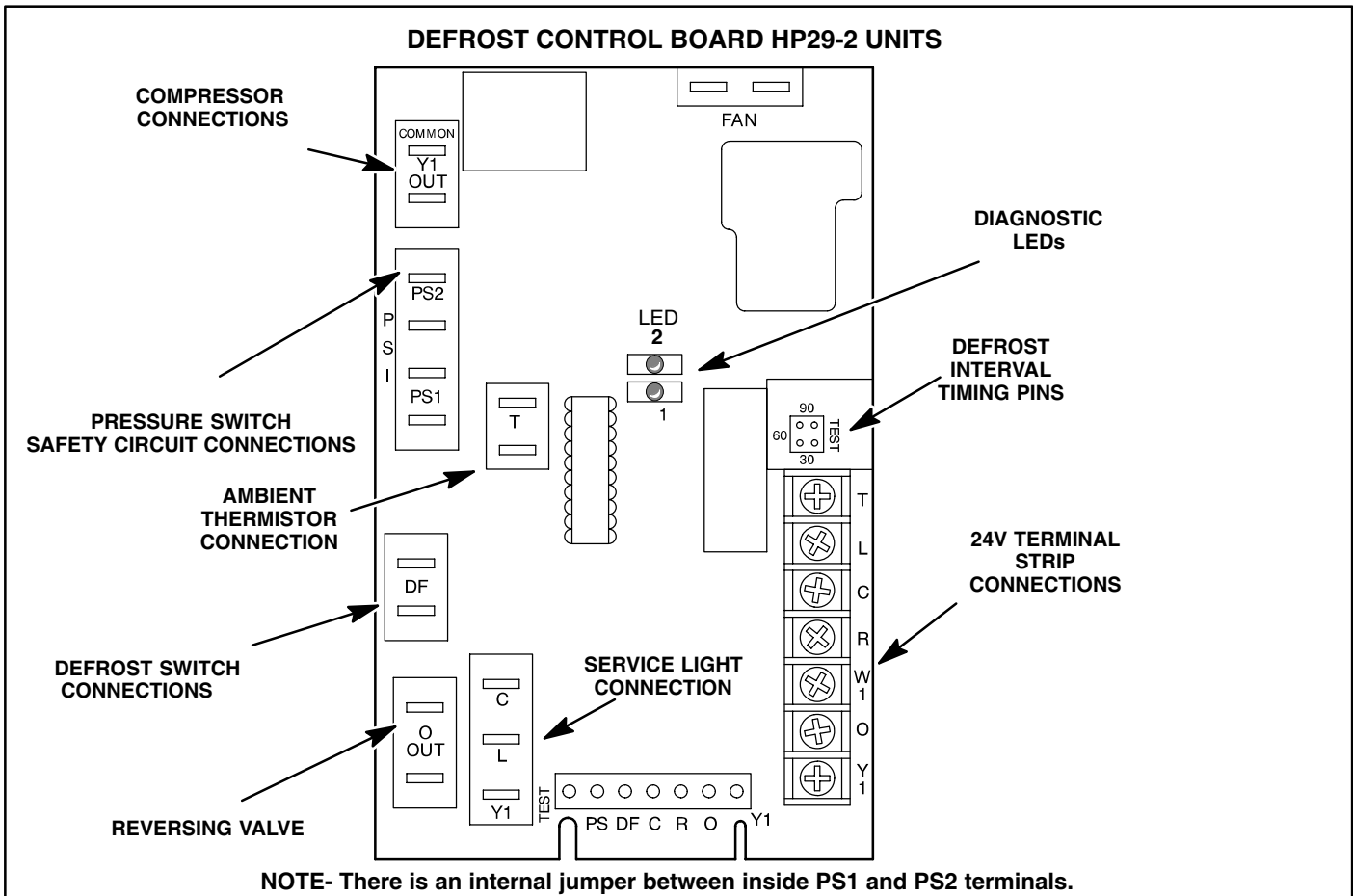
This feature of the board prevents the compressor from being short-cycled which could result in damage. An internal board timer prevents the compressor from being energized for approximately 5 minutes, after thermostat demand is met. During this time off, the system refrigerant pressure is able to equalize (between low and high sides) which eases compressor start up.

#### 6-Ambient (outdoor air) Thermistor

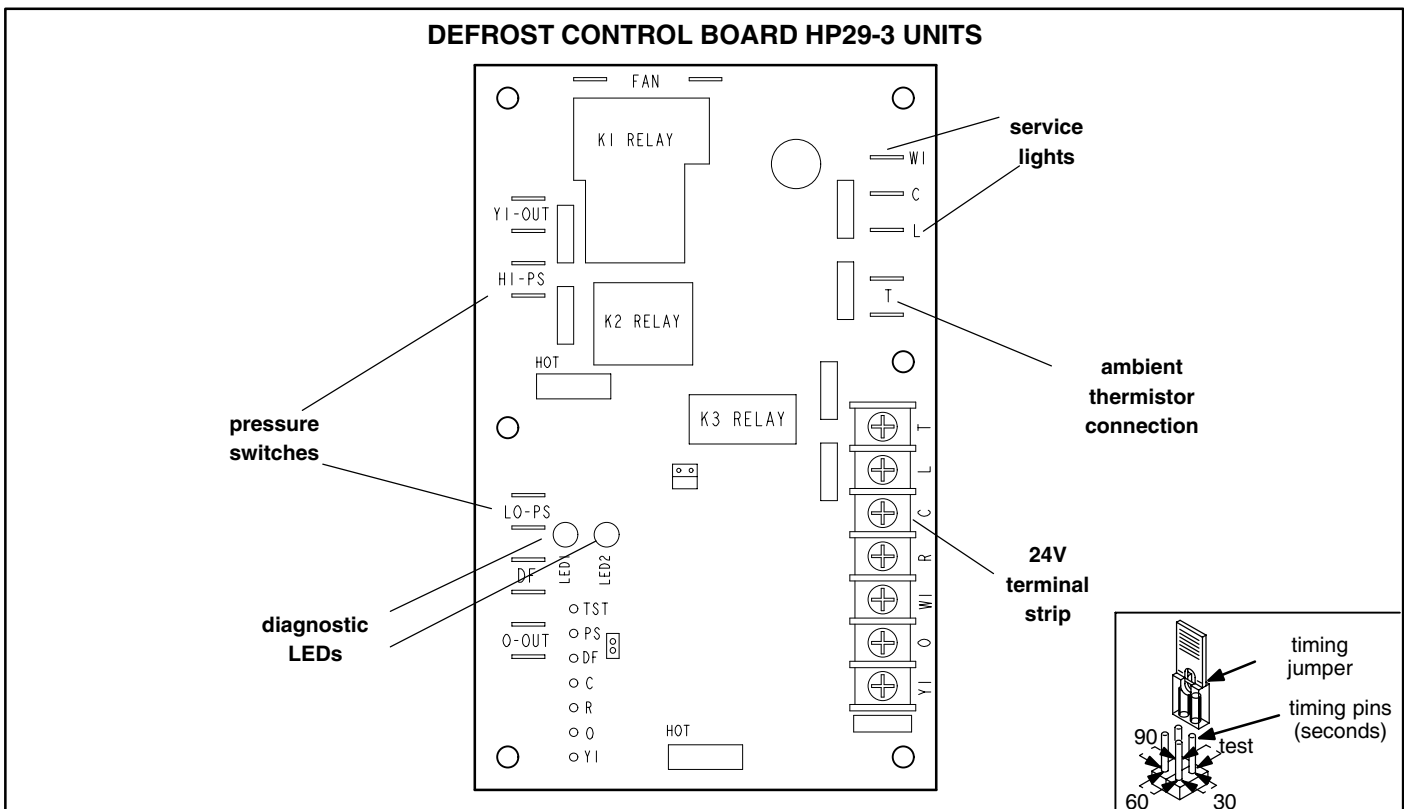
The defrost control board has two terminal connections for an ambient thermistor. The thermistor compensates for changes in the outdoor air temperature. This change in temperature can cause thermostat droop. Droop may be defined as the difference between the room thermostat set-point and the lowest temperature of the indoor air once the indoor blower is energized. Cool air (relative to thermostat set-point or desired room air temperature) will enter the home when the indoor blower is energized. The thermistor raises the thermostat set-point by a fractional amount (1 or 2° F) to keep the indoor air temperature near the thermostat set-point.

#### 7-Service Light Connection

Terminal connections W1, L and C are for the addition of a thermostat service light. This light can be used with any thermostat. It is powered from the W1 (second stage heat) terminal of the indoor thermostat and is controlled by a discharge line thermostat (S54). The discharge line thermostat will close and activate the service light when discharge line temperature drops below 110°F ± 5° during compressor operation. The light informs the home owner of a problem with the system (specifically the compressor). When the light is on, second stage heating may be initiated. The normally closed thermostat will open when discharge line reaches 130°F ± 5° which requires 30 to 40 seconds of compressor operation, at which time the service light is de-energized.



**FIGURE 10**



**FIGURE 11**

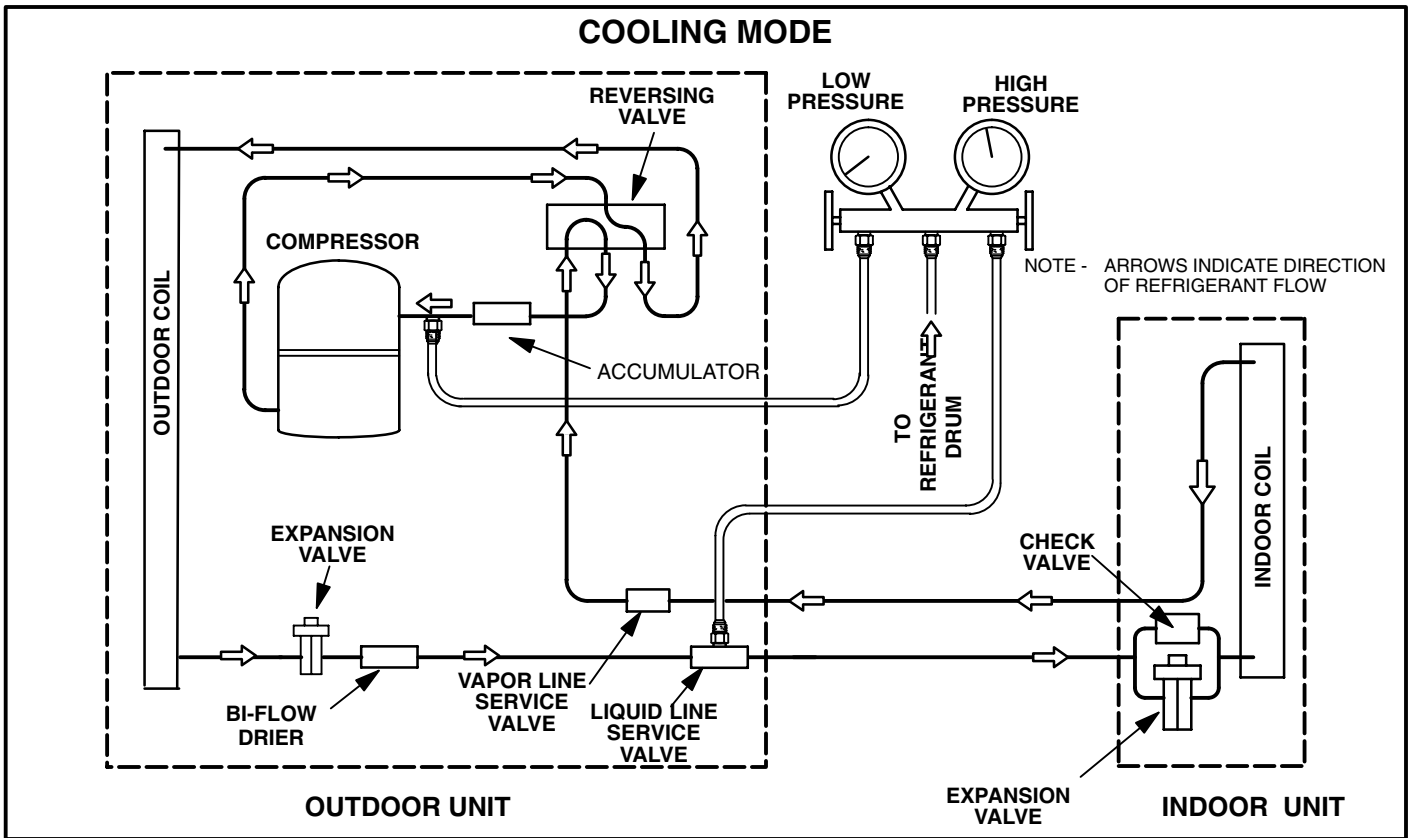


FIGURE 12

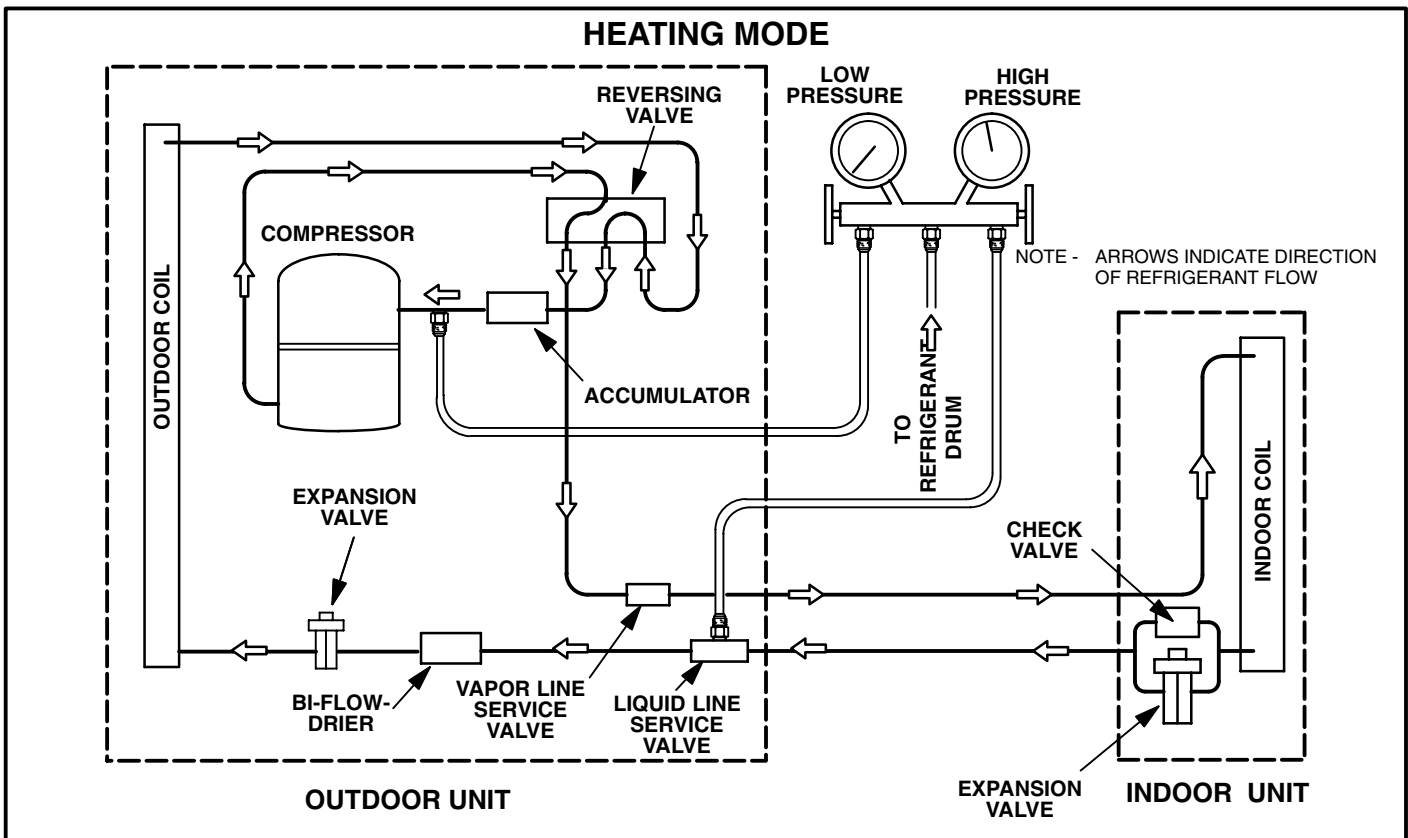


FIGURE 13

## II- REFRIGERANT SYSTEM

### A-Plumbing

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

### B-Accumulator

All HP29-2 units are equipped with an accumulator. The accumulator prevents compressor slugging by holding excess refrigerant and then slowly metering it back into the system.

**TABLE 2  
REFRIGERANT LINE SIZES**

HP29 UNIT	LIQUID LINE	VAPOR LINE
090	5/8 in (16 mm)	1-3/8 in (35mm)
120	5/8 in (16 mm)	1-3/8 in (35mm)

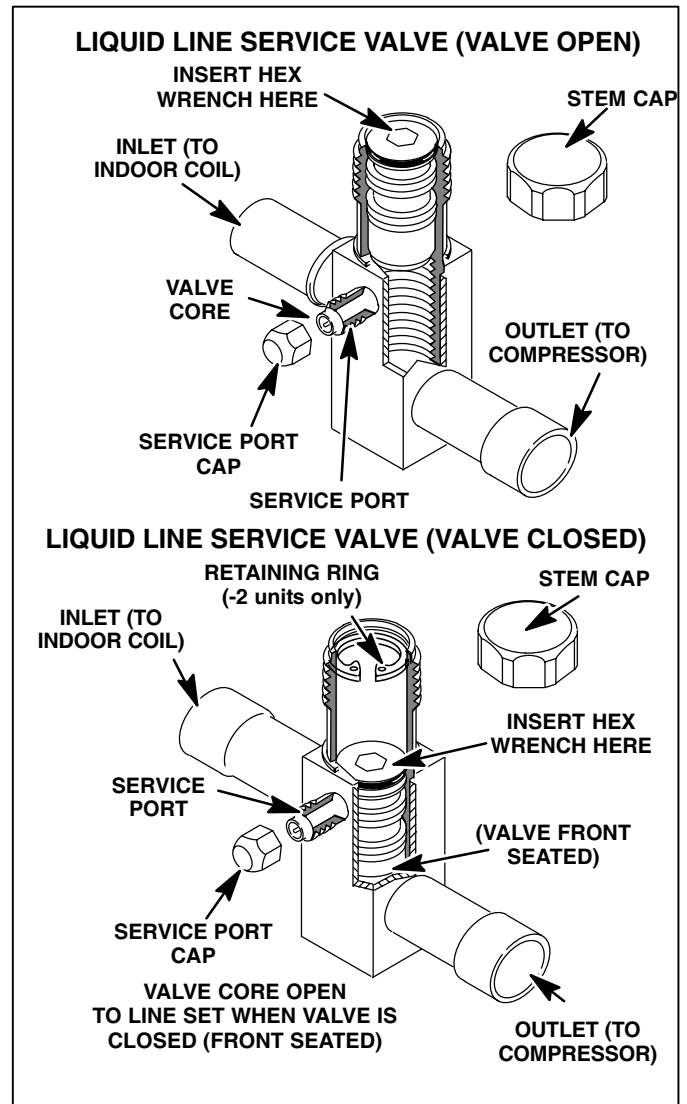
### C-Service Valves

All HP29 units are equipped with service valves located in the liquid and vapor lines. The service valves are manually operated. See figures 14 and 15. The service ports are used for leak testing, evacuating, charging and checking charge.

#### 1 - Liquid Line Service Valve

A full-service 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. The liquid line service valve is illustrated in figure 14.

A schrader valve is factory installed. A service port cap is supplied to protect the schrader valve from contamination and to serve as primary leak seal.



**FIGURE 14**

#### To Access Service Port:

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

#### Open Liquid Line Service Valve:

- 1 - Remove stem cap with an adjustable wrench.
- 2 - Using service wrench and 5/16" hex head extension (part #49A71) back the stem out counterclockwise until the valve stem just touches the retaining ring. Make sure wrench fits properly to avoid stripping stem.
- 3 - Replace stem cap. Tighten finger tight, then tighten an additional 1/6 turn.

## **⚠ DANGER**

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

### **To Close Liquid Line Service Valve:**

- 1 - Remove stem cap with an adjustable wrench.
- 2 - Using service wrench and 5/16" hex head extension (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.

### **2 - Vapor Line Service Valve**

HP29 units are equipped with a full service ball valve shown in figure 15. The valve has one service port that contains a valve core. A cap is provided to seal off the port and prevent contamination.

Different manufacturers of valves may be used. All vapor line service valves function the same way; differences are in construction. If a valve fails it must be replaced.

#### **To Access Service Port:**

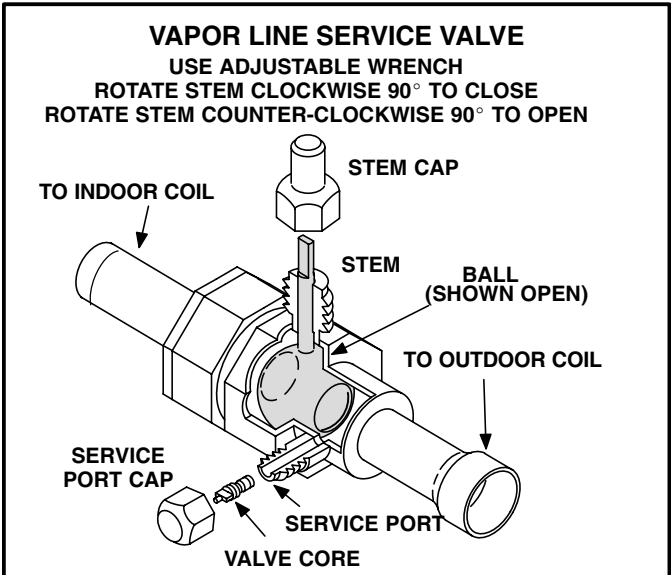
- 1 - Remove service port cap with an adjustable wrench.
- 2 - Connect gauge to the service port.
- 3 - When testing is completed, replace service port cap. Tighten finger tight, then tighten an additional 1/6 turn.

#### **To Open Vapor Line Service Valve:**

- 1 - Remove stem cap with an adjustable wrench.
- 2 - Back the stem out counterclockwise for a 1/4 turn.
- 3 - Replace stem cap and finger tighten, then tighten an additional 1/6 turn.

#### **To Close Vapor Line Service Valve:**

- 1 - Remove stem cap with an adjustable wrench.
- 2 - Turn stem in clockwise for 1/4 turn.
- 3 - Replace stem cap. Tighten finger tight, then tighten an additional 1/6 turn.



**FIGURE 15**

### **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 - Rotate the fan to check for frozen bearings or binding.
- 2 - Inspect all factory and field-installed wiring for loose connections.
- 3 - Refer to section IV- to accurately charge and check the charge on this unit.
- 4 - Check voltage supply at the disconnect switch. The voltage must be within range listed on unit nameplate. If not, do not start equipment until the power company has been consulted and the voltage condition corrected.
- 5 - Set thermostat for a cooling demand, turn on power to blower and close heat pump unit disconnect switch to start.
- 6 - Recheck unit voltage with unit running. Power must be within range shown on unit nameplate. Check amperage draw of unit. Refer to unit nameplate for correct running amps.

### Three-Phase Compressor Rotation

Three-phase scroll compressors must be phased sequentially to ensure that the compressor rotates and operates correctly. When the compressor starts, a rise in discharge and drop in suction pressures indicate proper compressor phasing and operation. If discharge and suction pressures do not perform normally, follow the steps below to correctly phase in the unit.

- 1 - Disconnect the power to the unit.
- 2 - Reverse any two field power leads to the unit.
- 3 - Reconnect the power to the unit.

The discharge and suction pressures should operate within their normal start-up ranges.

*NOTE - The compressor's noise level will be significantly higher when the phasing is incorrect. The compressor will not provide cooling when the unit is not correctly phased. Continued backward operation of the compressor due to incorrect phasing will cause the compressor to cycle on internal protector.*

### IV- CHARGING

HP29 units are **field charged** with the amount of HCFC-22 refrigerant indicated in the charging procedure. 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, refer to table 3 for refrigerant charge adjustment for HP29 series units. Units are designed for line sets up to 50 ft. (15.24 m). Consult Lennox Refrigerant Piping Manual for line sets over 50 ft. (15.24 m).

### WARNING

**Never use oxygen to pressurize refrigeration or air conditioning system. Oxygen will explode on contact with oil and could cause personal injury. Use nitrogen only for this purpose and be sure to use a regulator that can control the pressure down to 1 or 2 psig (6.9 to 13.8 kPa).**

### CAUTION

**Any nitrogen cylinder connected to system must have a 150 psig maximum setting regulator. Never introduce pressures greater than 150 psig to any refrigerant system.**

### A-Leak Testing

#### Using an Electronic Leak Detector or Halide

- 1 - Connect a cylinder of nitrogen 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 refrigerant 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 - Adjust nitrogen pressure to 300 psig (2068 kPa). Open the valve on the high side of the manifold gauge set which will pressurize the system.
- 6 - 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.
- 7 - 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.

TABLE 3

UNIT MODEL NUMBER	MATCHED INDOOR UNIT	HCFC-22 FOR 25 FEET (7.6 m) OF LINE	LIQUID LINE DIAMETER	ADJUSTMENT PER FOOT (.3 m) OF LINE*
HP29-090-2 HP29-090-3	CB17/CBH17-95	23 lbs. (10.4 kg) 21.5 lbs. (9.8 kg)	5/8 in. (16 mm)	1.8 oz.. (51g)
			3/4 in. (19 mm)	2.6 oz.. (74g)
HP29-120-2 HP29-120-3	CB17/CBH17-135	31 lbs. (14.1 kg) 30 lbs. (13.6 kg)	5/8 in. (16 mm)	1.8 oz.. (51g)
			3/4 in. (19 mm)	2.6 oz.. (74g)

\* If line length is greater than 25 feet (7.62 m), add this amount. If line length is less than 25 feet (7.62 m), subtract this amount.  
 NOTE - Refrigerant line sets should not be longer than 100 feet (30.5 m). Refrigerant line losses deduct from the net capacity of the system. Additional refrigerant required for such systems may also upset the refrigerant-to-oil ratio.

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

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

### 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.

### IMPORTANT

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.

- 2 - Connect the vacuum pump (with vacuum gauge) to the center port of the manifold gauge set.
- 3 - Open both manifold valves and start vacuum pump.
- 4 - Evacuate the line set, indoor unit and outdoor unit to an **absolute pressure** of 23mm 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.

- 5 - 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 and indoor unit. Close the manifold gauge valves.
- 6 - Shut off the nitrogen cylinder and remove the manifold gauge hose from the cylinder. Open the manifold gauge valves to release the nitrogen from the line set and indoor unit.
- 7 - Reconnect the manifold gauge to the vacuum pump, turn the pump on and continue to evacuate the line set, indoor unit and outdoor 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.
- 8 - Depending on the equipment used to determine the vacuum level, absolute pressure of .5mm of mercury is equal to 500 microns.
- 9- When the absolute pressure requirement above has been met, disconnect the manifold hose from the vacuum pump and connect it to an upright bottle of HCFC-22 refrigerant. Open the manifold gauge valves to break the vacuum in the line set and indoor unit. Close manifold gauge valves and shut off HCFC-22 bottle and remove manifold gauge set.



## C-Charging

If the system is completely void of refrigerant, the recommended and most accurate method of charging is to weigh the refrigerant into the unit according to table 3.

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

The following procedures are intended as a general guide for use with **expansion valve systems only**. For best results, indoor temperature should be between 70 °F(21°C) and 80 °F (26.6 C°). **Outdoor temperature should be 60 °F (15.5 C°) or above**. Slight variations in charging temperature and pressure should be expected. Large variations may indicate a need for further servicing.

### IMPORTANT

Use tables 5 and 6 as a general guide for performing maintenance checks. Tables 5 and 6 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, table 5 could serve as a useful service guides.

### IMPORTANT

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

- 1 - Attach gauge manifolds and operate unit in cooling mode until system stabilizes (approximately 5 minutes).
- 2 - Check each circuit separately with all stages operating.
- 3 - Use a thermometer to accurately measure the outdoor ambient temperature.
- 4 - Apply the outdoor temperature to table 5 or 6 to determine normal operating pressures.

- 5 - Compare the normal operating pressures to the pressures obtained from the gauges. Minor variations in these pressures may be expected due to differences in installations. Significant differences could mean that the system is not properly charged or that a problem exists with some component in the system. Correct any system problems before proceeding.
- 6 - If liquid pressure is high, remove refrigerant from the system. If discharge pressure is low, add refrigerant to the system.
  - Add or remove charge in increments.
  - Allow the system to stabilize each time refrigerant is added or removed.
- 7 - Use the following approach method along with the normal operating pressures to confirm readings.

#### APPROACH METHOD (TXV SYSTEMS)

(Ambient Temperature of 60°F [16°C] or above)

- 1 - Use the same thermometer to take both the liquid line temperature and the outdoor ambient temperature. Compare liquid line temperature to the outdoor ambient temperature. Approach temperature equals the liquid line temperature minus the outdoor ambient temperature.
- 2 - The approach temperature should match values given in table 4. An approach temperature greater than the value shown indicates an undercharge. An approach temperature less than the value shown indicates an overcharge.
- 3 - **Do not use the approach method if system pressures do not match the pressures given in table 5. The approach method is not valid for grossly over- or undercharged systems.**

TABLE 4

MODEL NO.	LIQUID TEMP. MINUS AMBIENT TEMP. °F (°C)
HP29-090-2	9.2°F $\pm 1$ (5.0°C $\pm 0.5$ )
HP29-090-3	14.5°F $\pm 1$ (8.0°C $\pm 0.5$ )
HP29-120-2	11.3°F $\pm 1$ (6.0°C $\pm 0.5$ )
HP29-120-3	10.0°F $\pm 1$ (5.6°C $\pm 0.5$ )

*Note- For best results, the same thermometer should be used to check both outdoor ambient and liquid temperatures.*

## D-Oil Charge

Refer to compressor nameplate.

**TABLE 5**  
**Normal Operating Pressures**

Outdoor Coil Entering Air Temperature	HP29-090-2* Discharge ± 10 psig	HP29-090-2* Vapor ± 5 psig	HP29-120-2** Discharge ± 10 psig	HP29-120-2** Vapor ± 5 psig
65°F (18°C)	188	69	180	64
75°F (24°C)	216	71	206	66
85°F (29°C)	248	72	236	67
95°F (35°C)	283	74	269	69
105°F (41°C)	319	76	304	70
115°F (46°C)	360	78	345	72

\* HP29-090 tested with CB17/CBH17-95V. \*\*HP29-120 tested with CB17/CBH17-135V.


**TABLE 6**  
**NORMAL OPERATING PRESSURES**

Outdoor Coil Entering Air Temperature	HP29-090-3* Discharge ± 10 psig	HP29-090-3* Vapor ± 5 psig	HP29-120-3** Discharge ± 10 psig	HP29-120-3** Vapor ± 5 psig
65°F (18°C)	175	66	180	64
75°F (24°C)	202	69	206	66
85°F (29°C)	232	71	236	67
95°F (35°C)	263	72	269	69
105°F (41°C)	298	74	304	70
115°F (46°C)	336	76	345	72

\* HP29-090 tested with CB17/CBH17-95V. \*\*HP29-120 tested with CB17/CBH17-135V.

## V-MAINTENANCE

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

<b>⚠ WARNING</b>	
	<b>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.</b>

### Outdoor Unit

- 1 - Clean and inspect the condenser coil. You can flush the coil with a water hose.
- 2 - The outdoor fan motor is prelubricated and sealed. No further lubrication is necessary.
- 3 - Visually inspect connecting lines and coils for evidence of oil leaks.
- 4 - Check wiring for loose connections.
- 5 - Check for correct voltage at the unit while the unit is operating and while it is off.
- 6 - Check amp-draw of the outdoor fan motor.  
Unit nameplate \_\_\_\_\_ Actual \_\_\_\_\_ .

Check amp-draw of the compressor.

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

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

### Indoor Coil

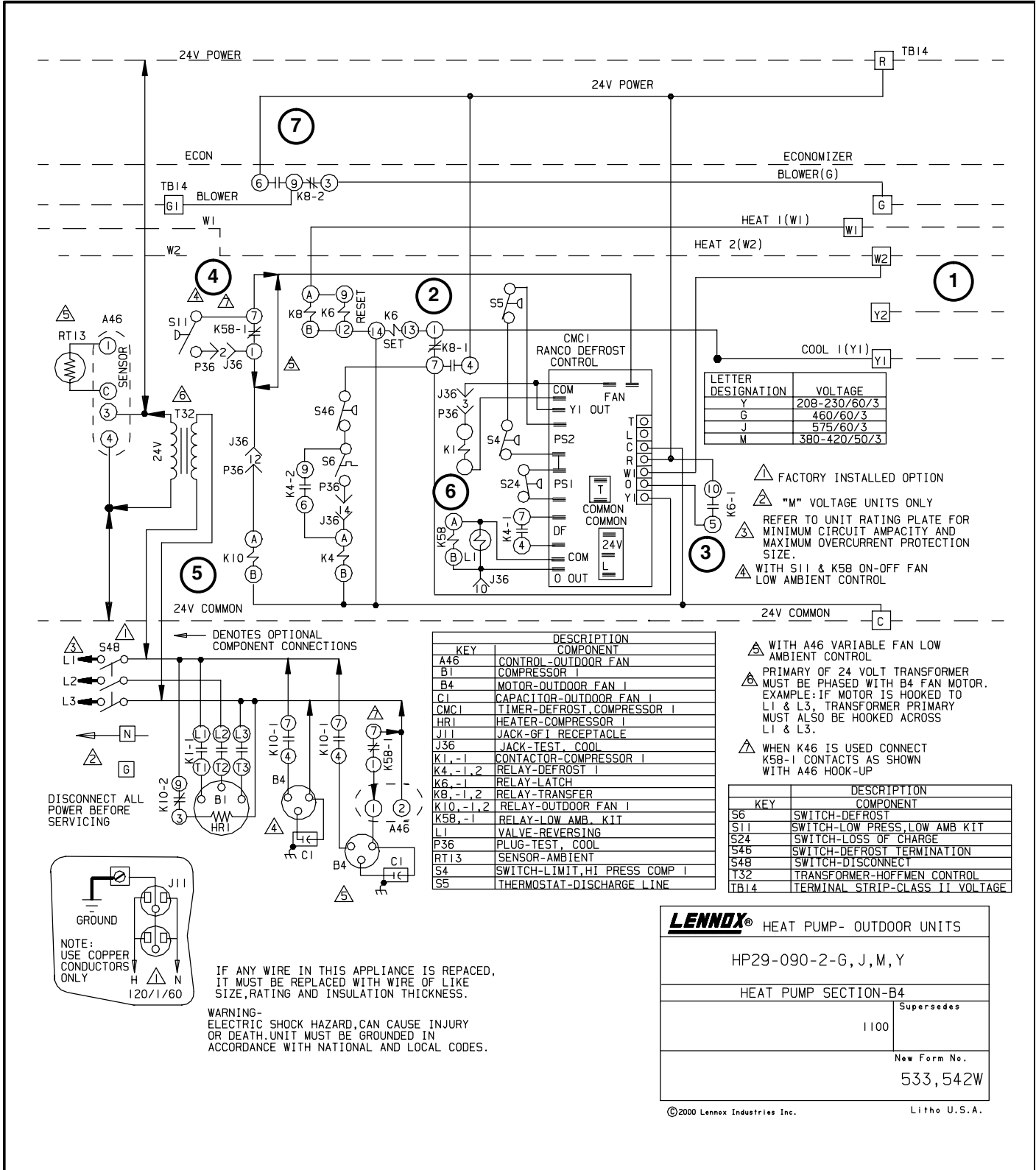
- 1 - If necessary, clean the coil.
- 2 - Check connecting lines and coils for evidence of oil leaks.
- 3 - If necessary, check the condensate line and clean it.

### Indoor Unit

- 1 - Clean or change filters.
- 2 - Adjust the blower speed for cooling. Measure the pressure drop over the coil to determine the correct blower CFM. Refer to the unit information service manual for pressure drop tables and procedure.
- 3 - On belt drive blowers, check the belt for wear and proper tension.
- 4 - Check all wiring for loose connections.
- 5 - Check for correct voltage at the unit (blower operating).
- 6 - Check amp-draw on blower motor.  
Unit nameplate \_\_\_\_\_ Actual \_\_\_\_\_ .

# VI-Wiring Diagram and Sequence of Operation

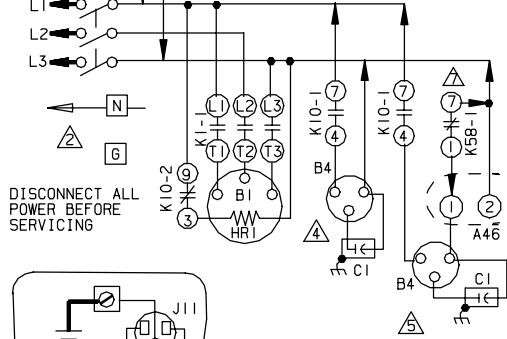
## A-HP29-090-2 Y, G, J, M



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

- ⚠️ FACTORY INSTALLED OPTION
- ⚠️ "M" VOLTAGE UNITS ONLY
- ⚠️ REFER TO UNIT RATING PLATE FOR MINIMUM CIRCUIT AMPACITY AND MAXIMUM OVERCURRENT PROTECTION SIZE.
- ⚠️ WITH S11 & K58 ON-OFF FAN LOW AMBIENT CONTROL

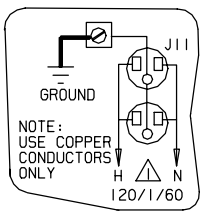
← DENOTES OPTIONAL COMPONENT CONNECTIONS



KEY	DESCRIPTION COMPONENT
A46	CONTROL-OUTDOOR FAN
B1	COMPRESSOR I
B4	MOTOR-OUTDOOR FAN I
C1	CAPACITOR-OUTDOOR FAN I
CMC1	TIMER-DEFROST, COMPRESSOR I
HR1	HEATER-COMPRESSOR I
J11	JACK-GFI RECEPTACLE
J36	JACK-TEST, COOL
K1,-1	CONTACTOR-COMPRESSOR I
K4,-1,2	RELAY-DEFROST I
K6,-1	RELAY-LATCH
K8,-1,2	RELAY-TRANSFER
K10,-1,2	RELAY-OUTDOOR FAN I
K58,-1	RELAY-LOW AMB. KIT
L1	VALVE-REVERSING
P36	PLUG-TEST, COOL
RT13	SENSOR-AMBIENT
S4	SWITCH-LIMIT, HI PRESS COMP I
S5	THERMOSTAT-DISCHARGE LINE

- ⚠️ WITH A46 VARIABLE FAN LOW AMBIENT CONTROL
- ⚠️ PRIMARY OF 24 VOLT TRANSFORMER MUST BE PHASED WITH B4 FAN MOTOR. EXAMPLE: IF MOTOR IS HOOKED TO L1 & L3, TRANSFORMER PRIMARY MUST ALSO BE HOOKED ACROSS L1 & L3.
- ⚠️ WHEN K46 IS USED CONNECT K58-1 CONTACTS AS SHOWN WITH A46 HOOK-UP

KEY	DESCRIPTION COMPONENT
S6	SWITCH-DEFROST
S11	SWITCH-LOW PRESS, LOW AMB KIT
S24	SWITCH-LOSS OF CHARGE
S46	SWITCH-DEFROST TERMINATION
S48	SWITCH-DISCONNECT
T32	TRANSFORMER-HOFFMEN CONTROL
TB14	TERMINAL STRIP-CLASS II VOLTAGE



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

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

**LENNOX**® HEAT PUMP- OUTDOOR UNITS

HP29-090-2-G, J, M, Y

HEAT PUMP SECTION-B4

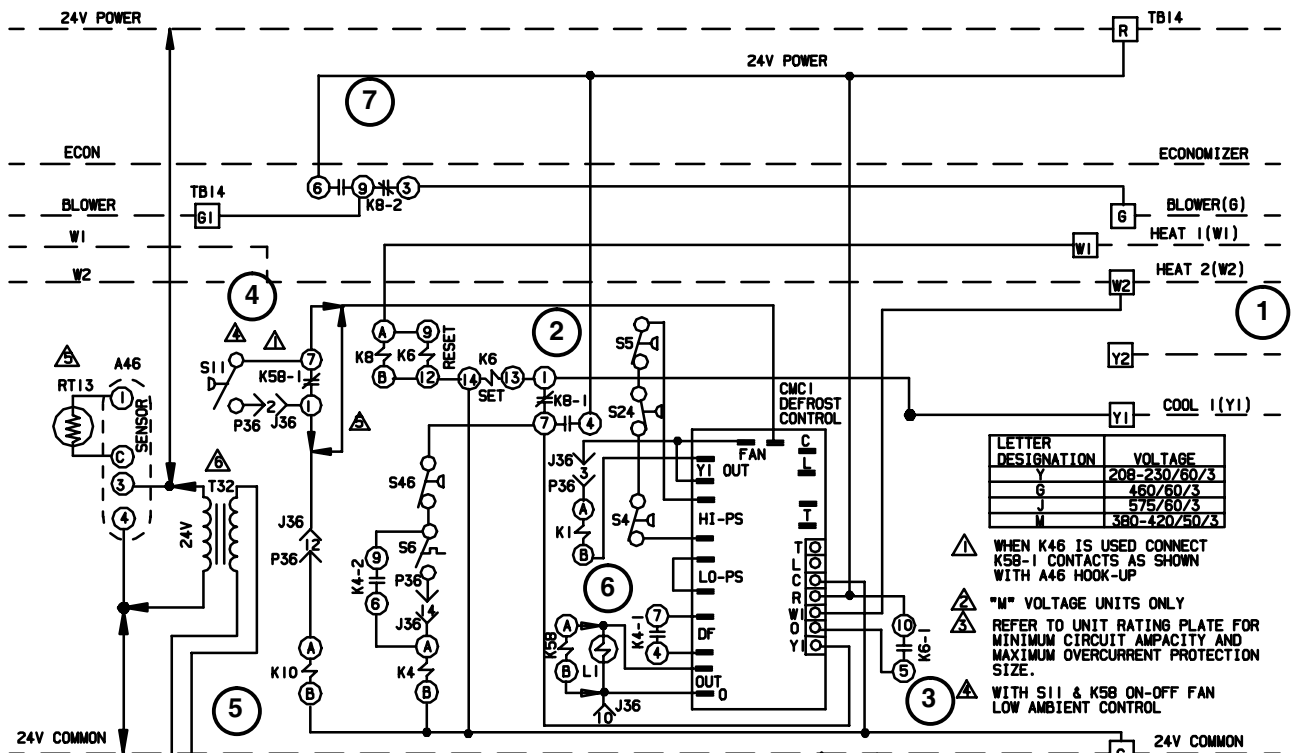
1100 Supersedes

New Form No.  
533, 542W

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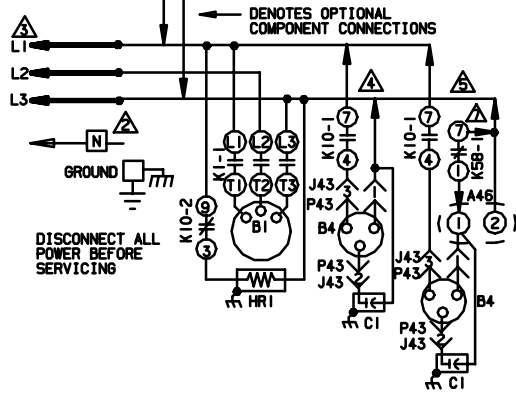
Litho U.S.A.

# B-HP29-090-3 Y, G, J, M



LETTER DESIGNATION	VOLTAGE
Y	208-230/60/3
G	460/60/3
J	575/60/3
M	360-420/50/3

- ⚠ WHEN K46 IS USED CONNECT K58-1 CONTACTS AS SHOWN WITH A46 HOOK-UP
- ⚠ "M" VOLTAGE UNITS ONLY REFER TO UNIT RATING PLATE FOR MINIMUM CIRCUIT AMPACITY AND MAXIMUM OVERCURRENT PROTECTION SIZE.
- ⚠ WITH S11 & K58 ON-OFF FAN LOW AMBIENT CONTROL



KEY	DESCRIPTION COMPONENT
A46	CONTROL-OUTDOOR FAN
B1	COMPRESSOR I
B4	MOTOR-OUTDOOR FAN I
C1	CAPACITOR-OUTDOOR FAN I
CMC1	TIMER-DEFROST COMPRESSOR I
HRI	HEATER-COMPRESSOR I
J36	JACK-TEST, COOL
J43	JACK-BLOWER MOTOR
K1	CONTACTOR-COMPRESSOR I
K4-1,2	RELAY-DEFROST I
K6-1	RELAY-LATCH
K8-1,2	RELAY-TRANSFER
K10-1,2	RELAY-OUTDOOR FAN I
K58-1	RELAY-LOW AMB. KIT
L1	VALVE-REVERSING
P36	PLUG-TEST, COOL
P43	PLUG-BLOWER MOTOR
RT13	SENSOR-AMBIENT

- ⚠ WITH A46 VARIABLE FAN LOW AMBIENT CONTROL
- ⚠ PRIMARY OF 24 VOLT TRANSFORMER MUST BE PHASED WITH B4 FAN MOTOR. EXAMPLE: IF MOTOR IS HOOKED TO L1 & L3, TRANSFORMER PRIMARY MUST ALSO BE HOOKED ACROSS L1 & L3.

KEY	DESCRIPTION COMPONENT
S4	SWITCH-LIMIT HI PRESS COMP I
S5	THERMOSTAT-DISCHARGE LINE
S6	SWITCH-DEFROST
S11	SWITCH-LOW PRESS LOW AMB KIT
S24	SWITCH-LOSS OF CHARGE
S46	SWITCH-DEFROST TERMINATION
T32	TRANSFORMER-HOFFMEN CONTROL
TB14	TERMINAL STRIP-CLASS II VOLTAGE

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

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

HEAT PUMP- OUTDOOR UNITS	
HP29-090-3-G, J, M, Y	
HEAT PUMP SECTION-B4	
0702	Supersedes
New Form No.	
534, 018W	

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## SEQUENCE OF OPERATION HP29-090

**After each thermostat demand, time delay locks out the circuit to compressor contactor coil and defrost control for  $5 \pm 2$  minutes. At the end of the time period, the time delay allows the compressor contactor and defrost control to be energized upon demand.**

### COOLING

- 1 - Cooling demand energizes through terminal Y1 at the indoor thermostat provided 5-minute time delay is satisfied.
- 2 - Voltage passes through N.C. K8-1 to CMCI defrost control. K6 set coil is energized.
- 3 - N.O. K6-1 latching relay contacts close, energizing L1 reversing valve.
- 4 - K58 low ambient relay is energized. N.C. K58-1 contacts open eliminating S11 by-pass.
- 5 - Voltage passes through S11 low pressure switch (switch will close provided liquid line pressure rises to  $275 \pm 10$  psig.), energizing outdoor fan relay K10. N.O. K10-1 contacts close, energizing outdoor fan B4. N.C. K10-2 contacts open, de-energizing HR1 crankcase heater.
- 6 - Compressor contactor K1 is energized. N.O. K1-1 contacts close, energizing compressor B1.
- 7 - "G" from indoor thermostat sends 24V through K8-2 N.C. contacts to "G1" energizing indoor blower.

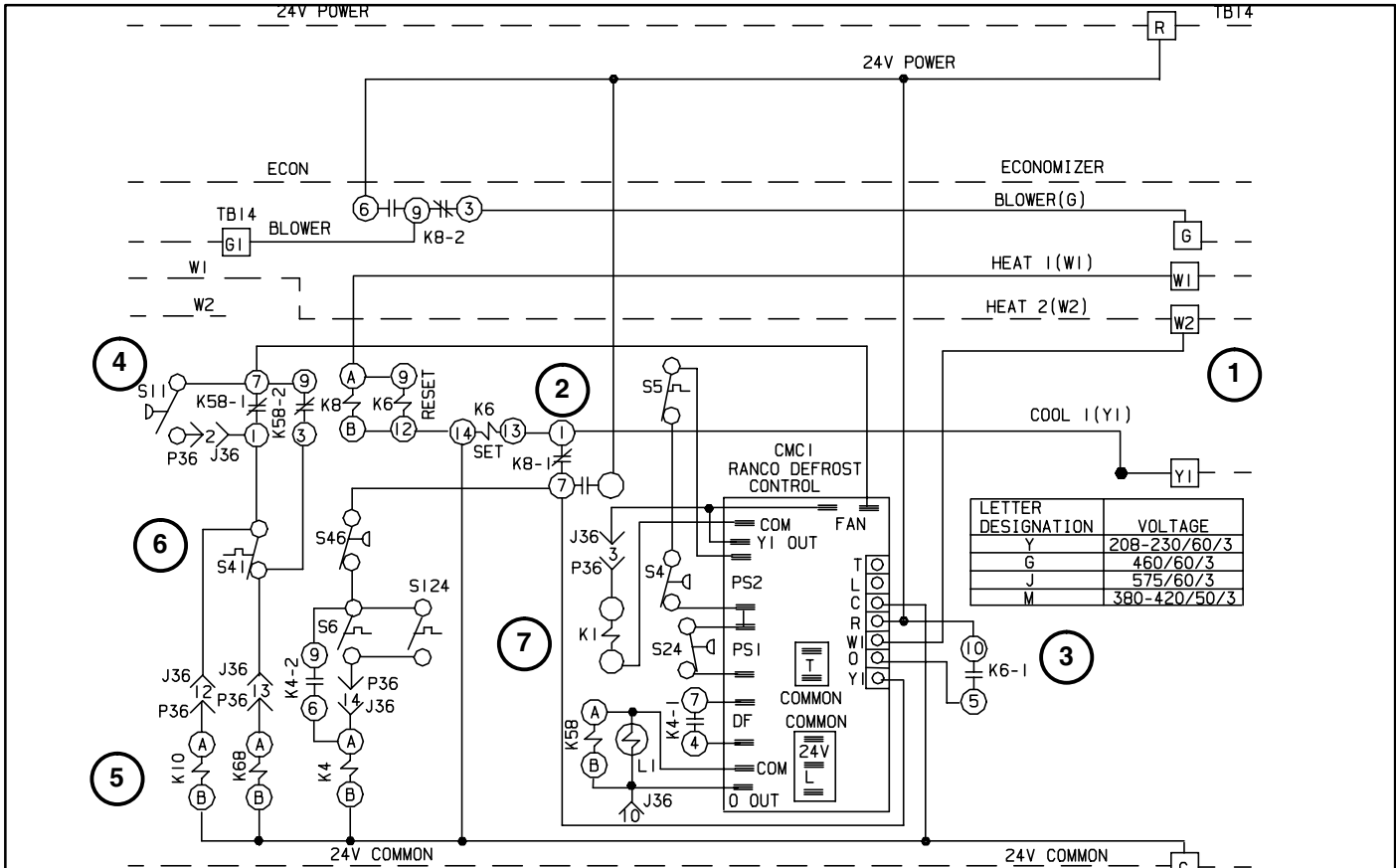
### HEATING

- 1 - Heating demand energizes through terminal W1 at the indoor thermostat provided 5-minute time delay is satisfied.
- 2 - K8 transfer relay is energized. N.C. K8-1 contacts open and N.O. contacts close, sending voltage to CMCI defrost control. K6 re-set coil is energized.
- 3 - N.O. K6-1 latching relay contacts open, de-energizing L1 reversing valve.
- 4 - K58 low ambient relay is de-energized. N.C. K58-1 contacts close, by-passing S11 low ambient switch.
- 5 - K10 outdoor fan relay is energized. N.O. K10-1 contacts close, energizing outdoor fan B4. N.C. K10-2 contacts open, de-energizing HR1 crankcase heater.
- 6 - Compressor contactor K1 is energized. N.O. K1-1 contacts close, energizing compressor B1.
- 7 - K8-2 N.O. contacts close sending 24V from "G1" energizing indoor blower.

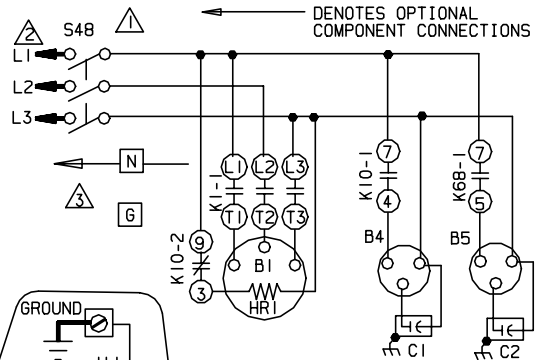
### DEFROST MODE

- 7 - During heating operation, when outdoor coil drops below  $35 \pm 4^\circ$  F, the defrost thermostat S6 closes. When S6 closes, K4 defrost relay is energized. If defrost thermostat remains closed at the end of 30, 60, or 90 minutes, defrost control energizes and defrost begins.
- 8 - When defrost control energizes, reversing valve L1 and indoor heat relay are energized. Outdoor fan is de-energized.
- 9 - Defrost continues until  $14 \pm 1$  minutes have elapsed or until S46 defrost pressure switch opens. When defrost pressure switch opens to terminate defrost, the defrost timer loses power and resets. Defrost timing is stopped until the next call for defrost (when defrost thermostat closes).

# C-HP29-120-2 Y, G, J, M



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



KEY	DESCRIPTION COMPONENT
B1	COMPRESSOR
B4	MOTOR-OUTDOOR FAN 1
B5	MOTOR-OUTDOOR FAN 2
C1	CAPACITOR-OUTDOOR FAN 1
C2	CAPACITOR-OUTDOOR FAN 2
CMC1	TIMER-DEFROST, COMPRESSOR 1
HRI	HEATER-COMPRESSOR 1
J11	JACK-GFI RECEPTACLE
J36	JACK-TEST, COOL
K1,-1	CONTACTOR-COMPRESSOR 1
K4,-1,2	RELAY-DEFROST 1
K6,-1	RELAY-LATCH
K8,-1,2	RELAY-TRANSFER
K10,-1,2	RELAY-OUTDOOR FAN 1
K58,-1,2	RELAY-LOW AMB. KIT
K68,-1	RELAY-OUTDOOR FAN 2
L1	VALVE-REVERSING
P36	PLUG-TEST, COOL
S4	SWITCH-LIMIT, HI PRESS COMP 1
S5	THERMOSTAT-DISCHARGE LINE
S6	SWITCH-DEFROST
S11	SWITCH-LOW PRESS, LOW AMB KIT
S24	SWITCH-LOSS OF CHARGE
S41	THERMOSTAT-LOW AMBIENT KIT
S46	SWITCH-DEFROST TERMINATION
S48	SWITCH-DISCONNECT
S124	SWITCH-DEFROST, AUX.
TB14	TERMINAL STRIP-CLASS II VOLTAGE

NOTE:  
USE COPPER CONDUCTORS ONLY

GROUND

H N 120/1/60

▲ DENOTES OPTIONAL COMPONENT CONNECTIONS

▲ FACTORY INSTALLED OPTION

▲ REFER TO UNIT RATING PLATE FOR MINIMUM CIRCUIT AMPACITY AND MAXIMUM OVERCURRENT PROTECTION SIZE

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

▲ "M" VOLTAGE UNITS ONLY

DISCONNECT ALL POWER BEFORE SERVICING

FOR USE WITH COPPER CONDUCTORS ONLY

**LENNOX®** HEAT PUMP-OUTDOOR UNITS

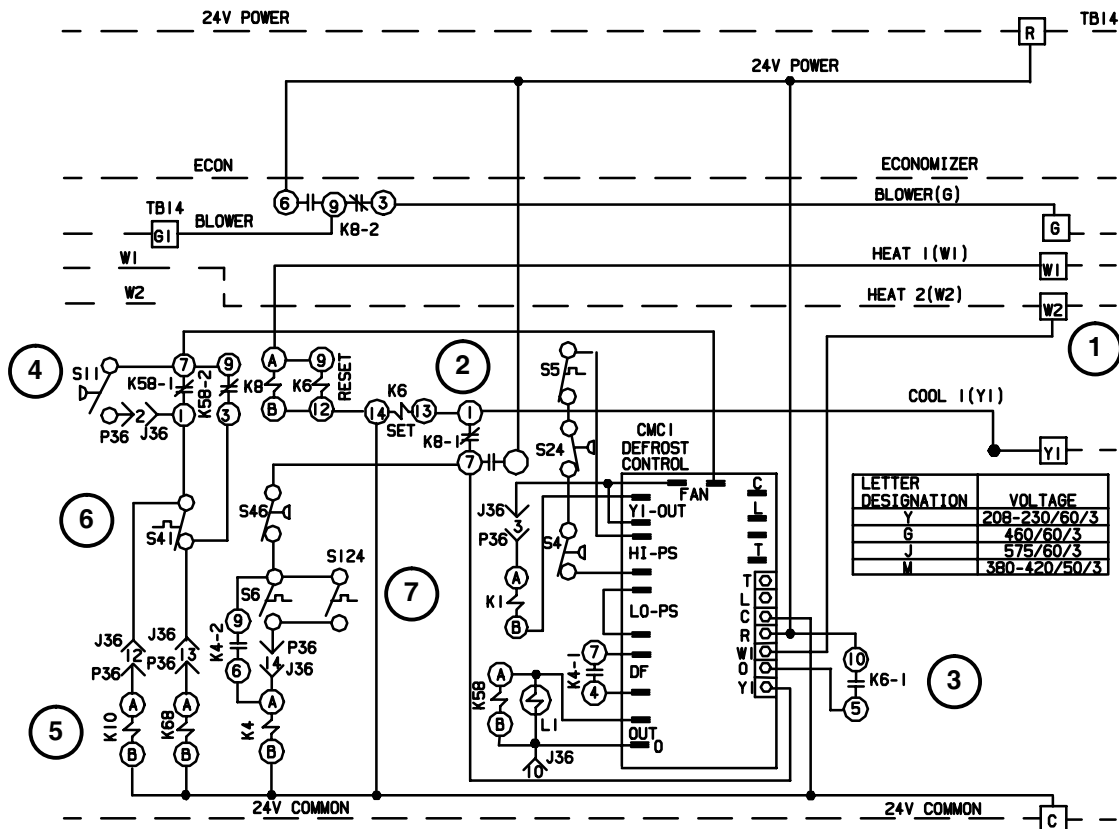
HP29-120-2-G, J, M, Y

HEAT PUMP SECTION-B4

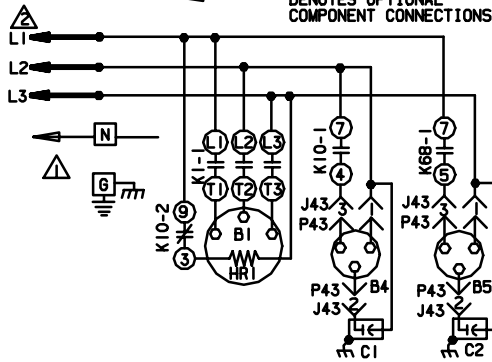
1100 Supersedes

New Form No.  
533,543W

D-HP29-120-3 Y, G, J, M



← DENOTES OPTIONAL COMPONENT CONNECTIONS



KEY	DESCRIPTION COMPONENT
B1	COMPRESSOR 1
B4	MOTOR-OUTDOOR FAN 1
B5	MOTOR-OUTDOOR FAN 2
C1	CAPACITOR-OUTDOOR FAN 1
C2	CAPACITOR-OUTDOOR FAN 2
CMC1	TIMER-DEFROST COMPRESSOR 1
HR1	HEATER-COMPRESSOR 1
J36	JACK-TEST, COOL
J43	JACK-BLOWER MOTOR
K1-	CONTACTOR-COMPRESSOR 1
K4,-1,2	RELAY-DEFROST 1
K6,-1	RELAY-LATCH
K8,-1,2	RELAY-TRANSFER
K10,-1,2	RELAY-OUTDOOR FAN 1
K5B,-1,2	RELAY-LOW AMB. KIT
K6B,-1	RELAY-OUTDOOR FAN 2
L1	VALVE-REVERSING
P36	PLUG-TEST, COOL
P43	PLUG-BLOWER MOTOR
S4	SWITCH-LIMIT HI PRESS COMP 1
S5	THERMOSTAT-DISCHARGE LINE
S6	SWITCH-DEFROST
S11	SWITCH-LOW PRESS LOW AMB KIT
S24	SWITCH-LOSS OF CHARGE
S41	THERMOSTAT-LOW AMBIENT KIT
S46	SWITCH-DEFROST TERMINATION
S124	SWITCH-DEFROST, AUX.
TB14	TERMINAL STRIP-CLASS 11 VOLTAGE

⚠ "M" VOLTAGE UNITS ONLY

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

DISCONNECT ALL POWER BEFORE SERVICING FOR USE WITH COPPER CONDUCTORS ONLY

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

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

HEAT PUMP-OUTDOOR UNITS	
HP29-120-3-G, J, M, Y	
HEAT PUMP SECTION-B4	
	Supersedes
0702	533, 543W
	New Form No.
	534, 001W

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Litro U.S.A.



## SEQUENCE OF OPERATION HP29-120

**After each thermostat demand, time delay locks out the circuit to compressor contactor coil and defrost control for  $5 \pm 2$  minutes. At the end of the time period, the time delay allows the compressor contactor and defrost control to be energized upon demand.**

### COOLING

- 1 - Cooling demand energizes through terminal Y1 at the indoor thermostat.
- 2 - Voltage passes through N.C. K8-1 to CMCI defrost control. K6 set coil is energized.
- 3 - N.O. K6-1 latching relay contacts close, energizing L1 reversing valve.
- 4 - K58 low ambient relay is energized. N.C. K58-1 contacts open, eliminating the S11 and S41 by-pass.
- 5 - Voltage passes through S11 low pressure switch, (switch will close provided liquid line pressure rises to  $275 \pm 10$  psig.), energizing K10 outdoor fan relay 1. N.O. K10-1 contacts close, energizing outdoor fan B4. N.C. K10-2 contacts open de-energizing HR1 crankcase heater.
- 6 - Voltage passes through S41 low ambient switch energizing K68 outdoor fan relay 2. N.O. K68-1 contacts close, energizing outdoor fan B5.
- 7 - Compressor contactor K1 is energized. N.O. K1-1 contacts close, energizing compressor B1.
- 8 - "G" from indoor thermostat sends 24V through K8-2 N.C. contacts to "G1" energizing indoor blower.

### HEATING

- 1 - Heating demand energizes through terminal W1 at the indoor thermostat.
- 2 - K8 transfer relay is energized. N.C. K8-1 contacts open and N.O. contacts close, sending voltage to CMCI defrost control. K6 set-coil is energized.

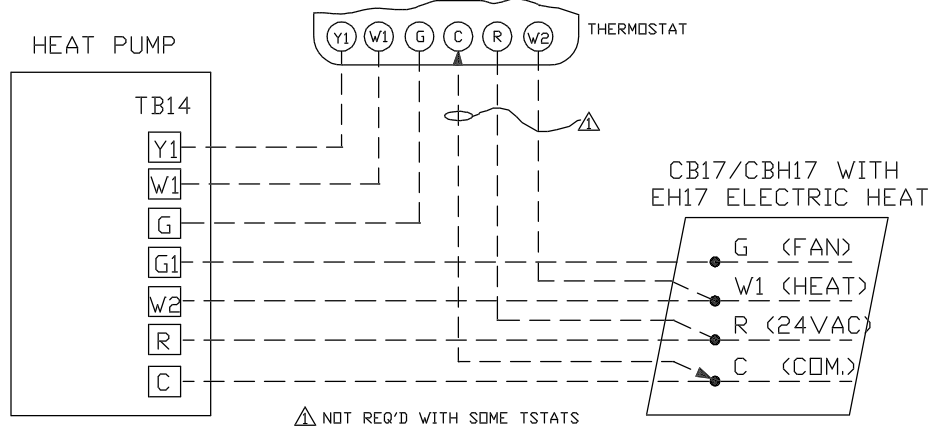
- 3 - N.O. K6-1 latching relay contacts open, de-energizing L1 reversing valve.
- 4 - K58 low ambient relay is de-energized. N.C. K58-1 contacts close by passing S11 low ambient switch and S41 low ambient thermostat.
- 5 - K10 outdoor fan relay is energized. N.O. K10-1 contacts close, energizing outdoor fan B4. N.C. K10-2 contacts open, de-energizing HR1 crankcase heater.
- 6 - Voltage passes through S41 low ambient switch (switch will close provided ambient is high enough), energizing K68 outdoor fan relay 2. N.O. K68-1 contacts close energizing outdoor fan B5.
- 7 - Compressor contactor K1 is energized. N.O. K1-1 contacts close energizing compressor B1.
- 8 - K8-2 N.O. contacts close sending 24V from "G1" energizing indoor blower.

### DEFROST MODE

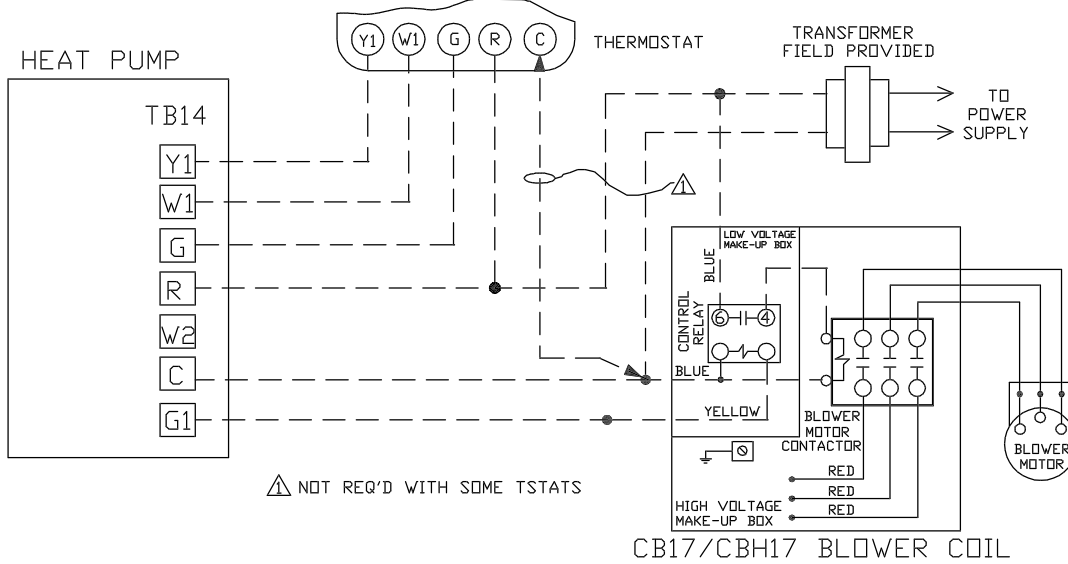
- 8 - During heating operation, when outdoor coil drops below  $35 \pm 4^\circ$  F, defrost thermostats S6 (circuit 1) and S124 (circuit 2) close. When S6 or S124 close, K4 defrost relay is energized. If defrost thermostat remains closed at the end of 30, 60, or 90 minutes, defrost control energizes and defrost begins.
- 9 - When defrost control energizes, reversing valve L1 and indoor heat relay are energized. Outdoor fan is de-energized.
- 10- Defrost continues until  $14 \pm 1$  minutes have elapsed, or until S46 defrost pressure switch opens. When defrost pressure switch opens to terminate defrost, the defrost timer loses power and resets. Defrost timing is stopped until the next call for defrost (when defrost thermostat closes).

# E- THERMOSTAT CONNECTIONS

HEAT PUMP UNIT FIELD WIRING DIAGRAM WITH AUXILIARY ELECTRIC HEAT.



HEAT PUMP UNIT FIELD WIRING DIAGRAM WITHOUT AUXILIARY HEAT.



## SERVICE NOTES