Litho U S A

HP9 SERIES UNITS

I - INTRODUCTION

The HP9 was first introduced in 1977. The systems are expansion valve. All major components must be matched according to Lennox recommendations for the compressor to be covered under warranty. The Engineering Handbook lists the approved combinations.

The HP9 series units are designed for continuous low ambient operation and are not equipped with a low temperature shut-off switch like earlier HP8 models. Figure 1 shows a cutaway view of unit.

All major components must be matched according to Lennox recommendations for the compressor to be covered under warranty. A misapplied system will cause erratic operation and can result in early compressor failure. The heat pump selector in the introduction to heat pumps lists the approved match-ups.

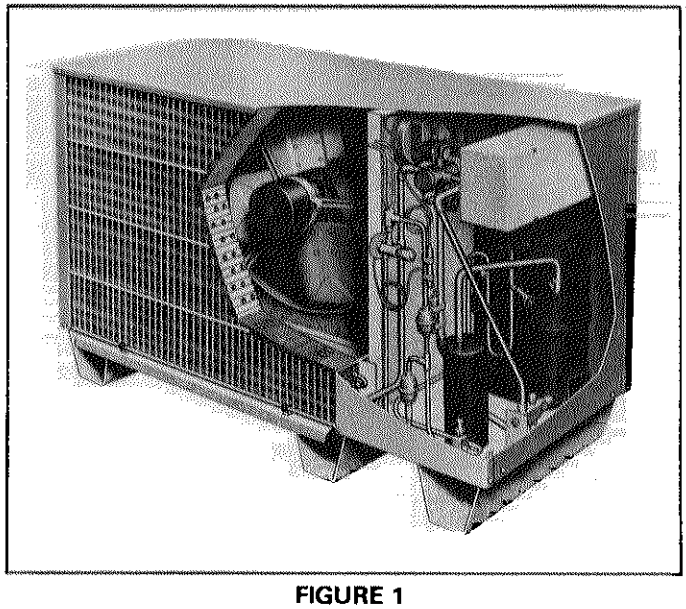


FIGURE 1

II - UNIT INFORMATION

A - Specifications

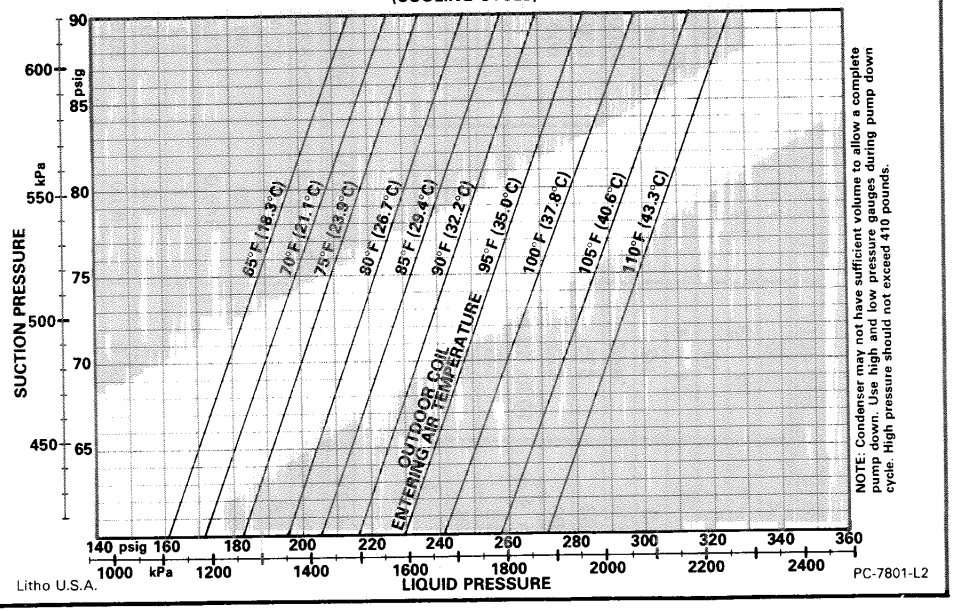
Model No.		HP9-261V	HP9-311V	HP9-411V	HP9-461V	HP9-511V	HP9-651V
Outdoor Coil	Net face area (sq. ft.)	4.06	4.06	5.64	6.30	7.92	7.92
	Tube diam. (in.) & No. of rows	1/2 — 3	1/2 — 3	1/2 — 4	1/2 — 3	1/2 — 3	1/2 — 4
	Fins per inch	13	13	10	13	10	10
Outdoor Fan	Diameter (in.) & No. of bades	20 — 4	20 — 4	22 — 4	24 — 4	26 — 4	26 — 4
	Motor hp	1/4	1/4	1/3	1/2	1/2	1/2
	Cfm (factory setting)	1950	1950	2730	3600	4830	4500
	Rpm (factory setting)	1080	1080	836	815	830	830
	Watts (factory setting)	275	275	380	525	605	600
Refrigerant-22 (charge furnished)		6 lb. 15 oz.	7 lb. 7 oz.	10 lbs. 4 oz.	10 lb. 10 oz.	13 lbs.	16 lb. 14 oz.
Liquid line connection (compression)		3/8	3/8	3/8	3/8	3/8	1/2 (sweat)
Vapor line connection (compression)		5/8	3/4	3/4	7/8	7/8	1-1/8 (sweat)
Shipping weight (lbs.) & No. of packages		255 — 1	240 — 1	390 — 1	345 — 1	440 — 1	405 — 1

B - Electrical

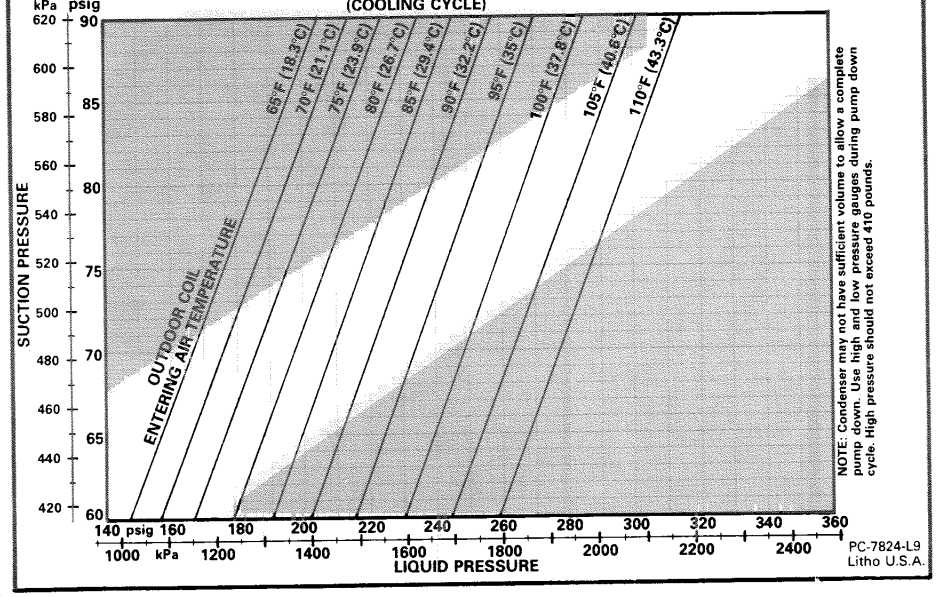
Model Number		HP9-261V	HP9-311V	HP9-411V	HP9-461V	HP9-511V	HP9-651V
Line voltage data		230v/60hz/1ph	230v/60hz/1ph	230v/60hz/1ph	230v/60hz/1ph	230v/60hz/1ph	230v/60hz/1ph
Compressor	Rated load amps	12.0	16.9	21.8	23.8	30.0	32.0
	Power factor	.92	.93	.91	.95	.89	.96
	Locked rotor amps	64.0	85.0	102.0	114.0	145.0	175.0
Outdoor Coil Fan Motor	Full load amps	1.6	1.6	3.0	2.9	3.2	3.2
	Locked rotor amps	4.1	4.1	6.6	6.1	6.6	6.9
Recommended maximum fuse size (amps)		30.0	35.0	50.0	50.0	60.0	60.0
*Minimum circuit ampacity		16.6	22.6	30.3	32.6	40.7	43.2

*Refer to National Electrical Code manual to determine wire, fuse and disconnect size requirements.
NOTE — Extremes of operating range are plus and minus 10% of line voltage.

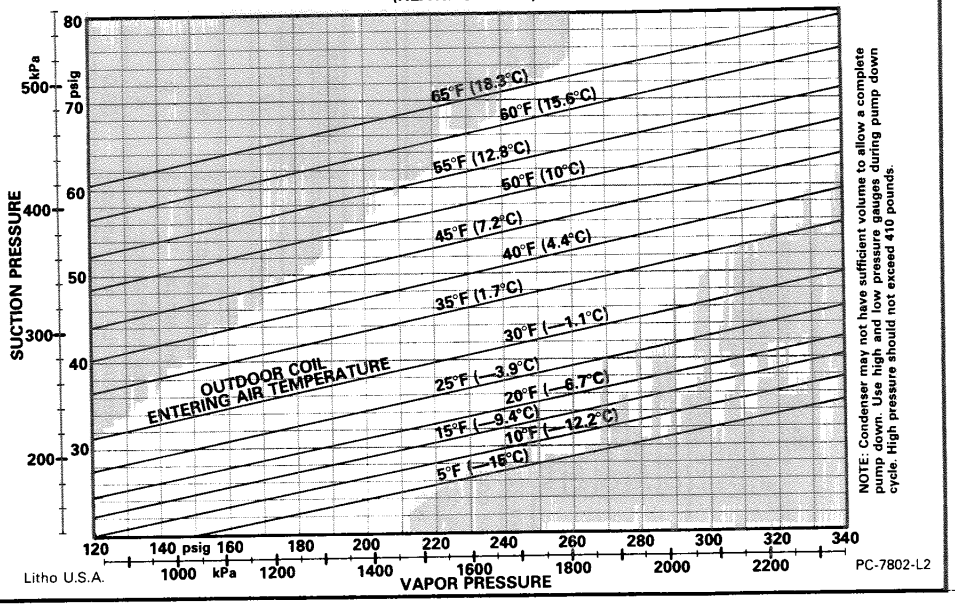
NORMAL OPERATING PRESSURE CURVE FOR HP9-261 SERIES UNITS (60 HZ) (COOLING CYCLE)



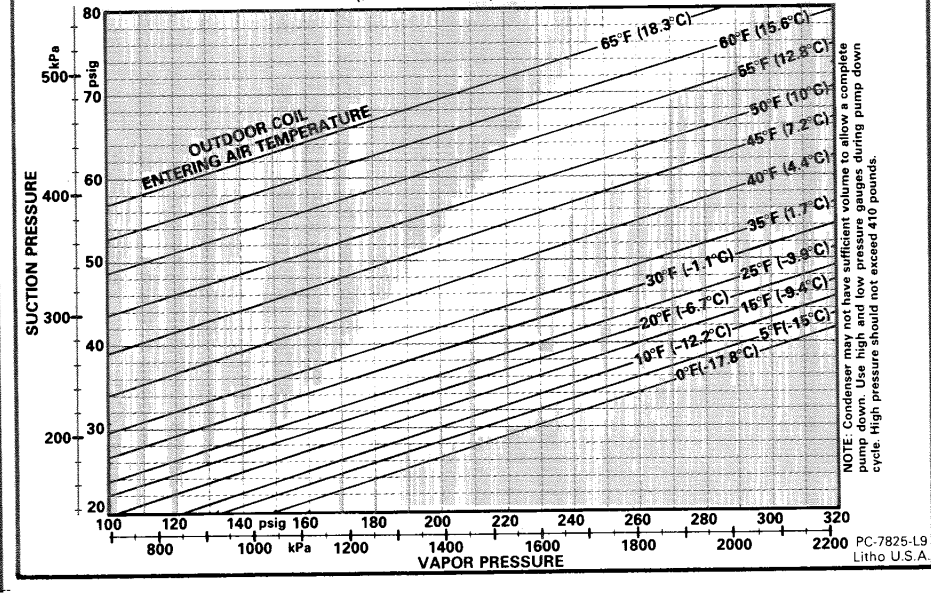
NORMAL OPERATING PRESSURE CURVE FOR HP9-210 SERIES UNITS (60 HZ) (COOLING CYCLE)

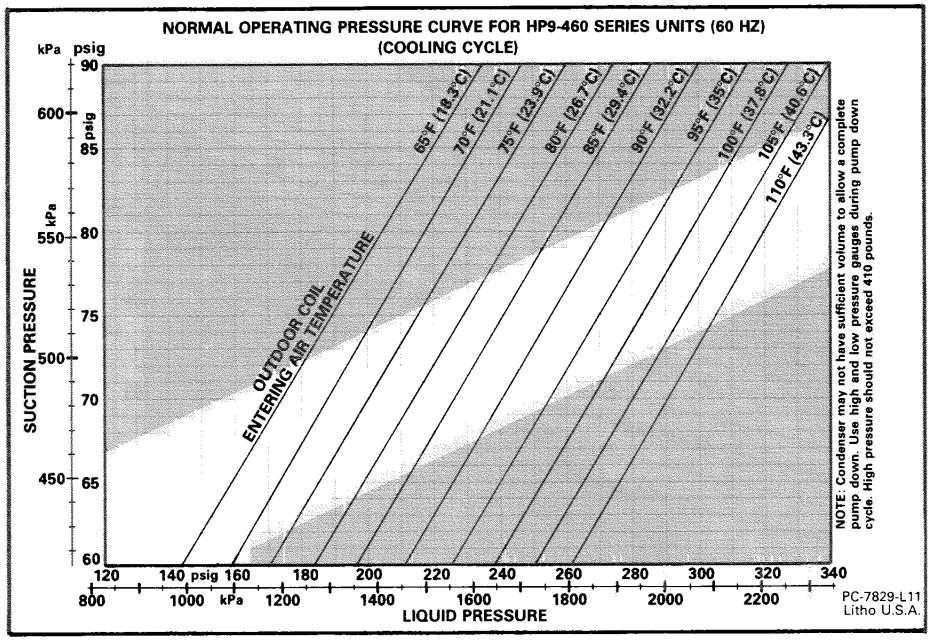


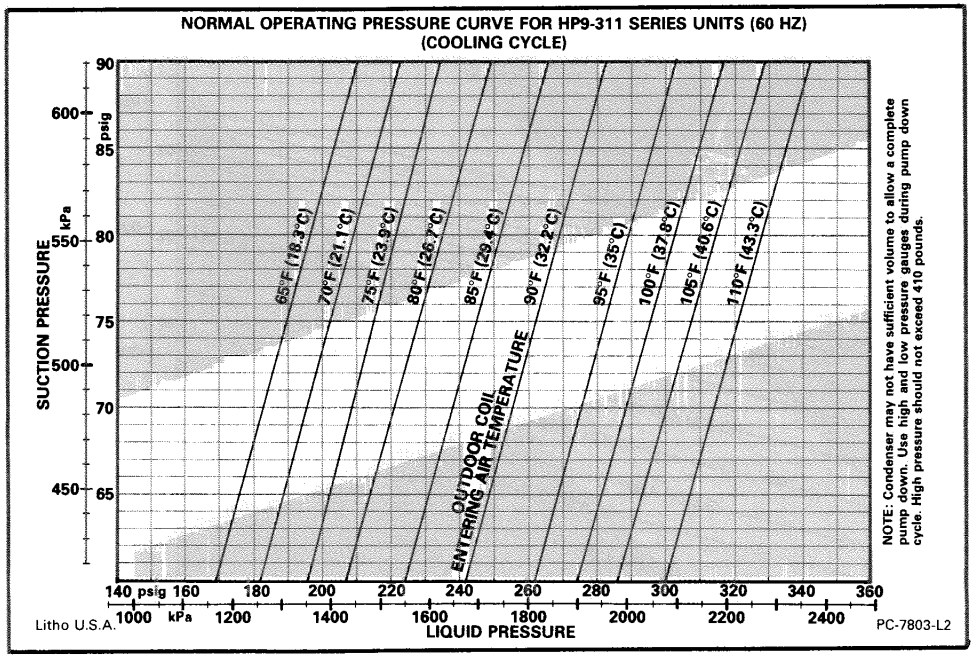
NORMAL OPERATING PRESSURE CURVE FOR HP9-261 SERIES UNITS (60 HZ) (HEATING CYCLE)

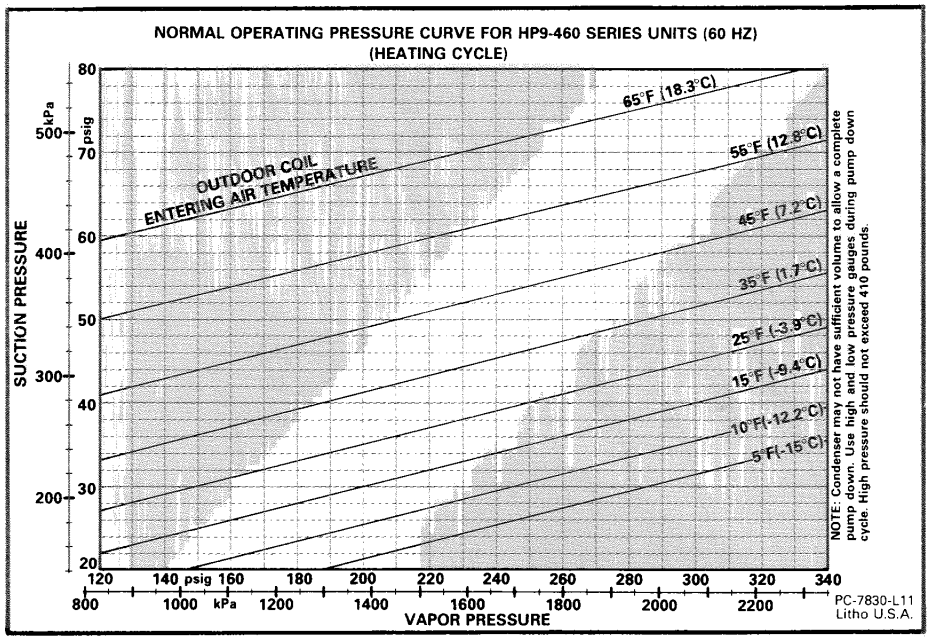


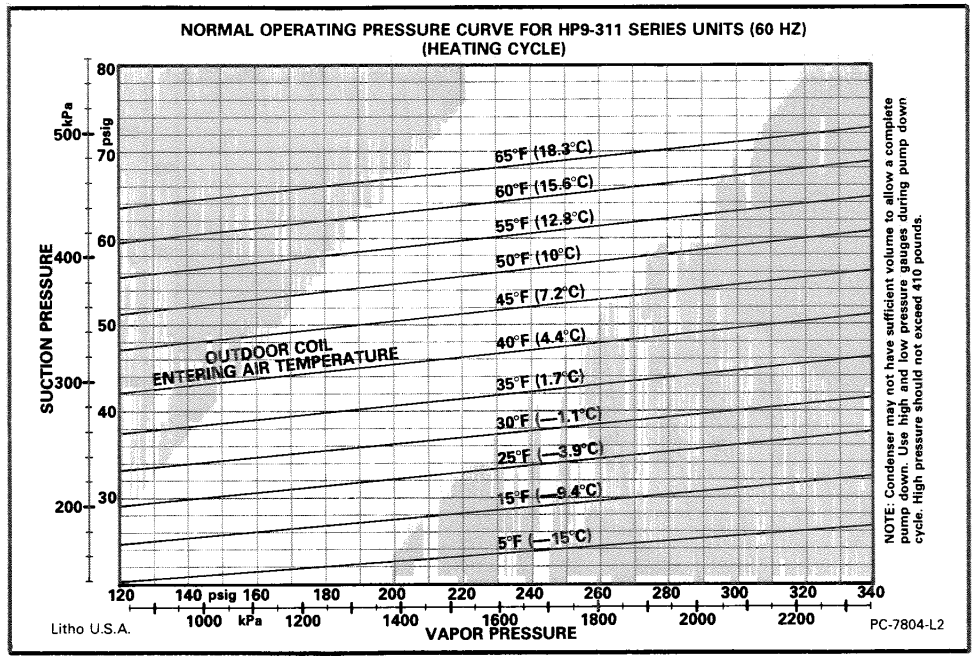
NORMAL OPERATING PRESSURE CURVE FOR HP9-210 SERIES UNITS (60 HZ) (HEATING CYCLE)

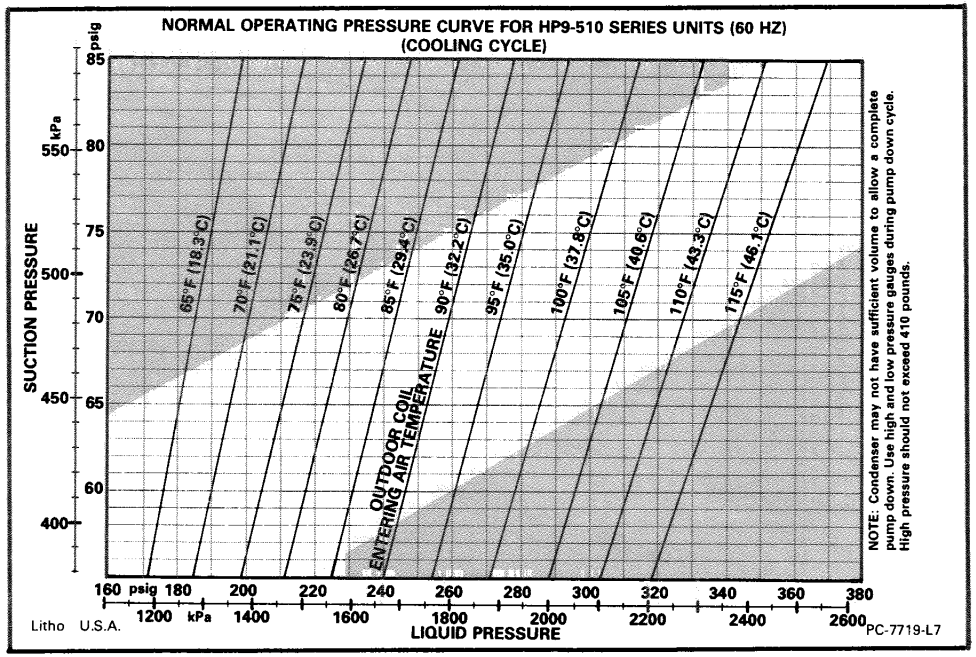


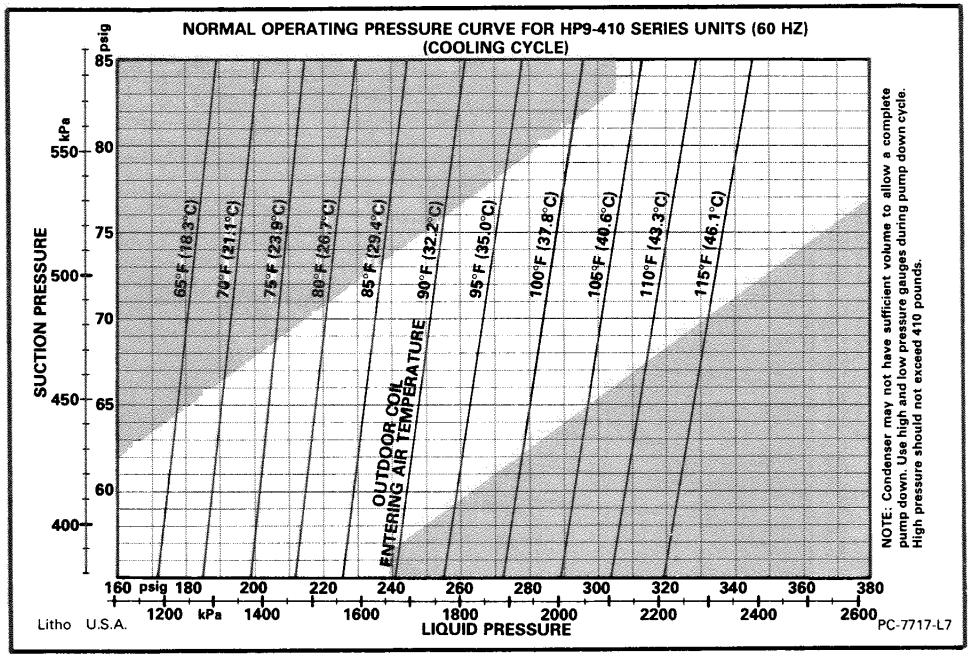

NORMAL OPERATING PRESSURE CURVE FOR HP9-460 SERIES UNITS (60 HZ)
(COOLING CYCLE)
kPa psig
SUCTION PRESSURE
LIQUID PRESSURE
OUTDOOR COIL ENTERING AIR TEMPERATURE
65°F (18.3°C)
70°F (21.1°C)
75°F (23.9°C)
80°F (26.7°C)
85°F (29.4°C)
90°F (32.2°C)
95°F (35°C)
100°F (37.8°C)
105°F (40.6°C)
110°F (43.3°C)
NOTE: Condenser may not have sufficient volume to allow a complete pump down. Use high and low pressure gauges during pump down cycle. High pressure should not exceed 410 pounds.
PC-7829-L11
Litho U.S.A.

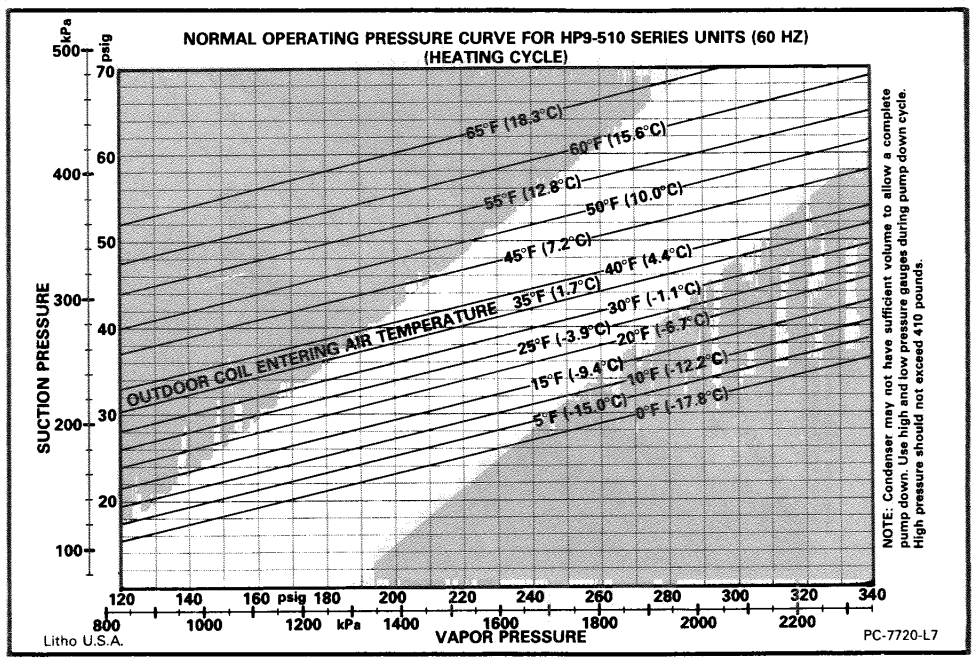

NORMAL OPERATING PRESSURE CURVE FOR HP9-311 SERIES UNITS (60 HZ)
(COOLING CYCLE)
SUCTION PRESSURE
LIQUID PRESSURE
OUTDOOR COIL ENTERING AIR TEMPERATURE
65°F (18.3°C)
70°F (21.1°C)
75°F (23.9°C)
80°F (26.7°C)
85°F (29.4°C)
90°F (32.2°C)
95°F (35°C)
100°F (37.8°C)
105°F (40.6°C)
110°F (43.3°C)
NOTE: Condenser may not have sufficient volume to allow a complete pump down. Use high and low pressure gauges during pump down cycle. High pressure should not exceed 410 pounds.
Litho U.S.A.
PC-7803-L2

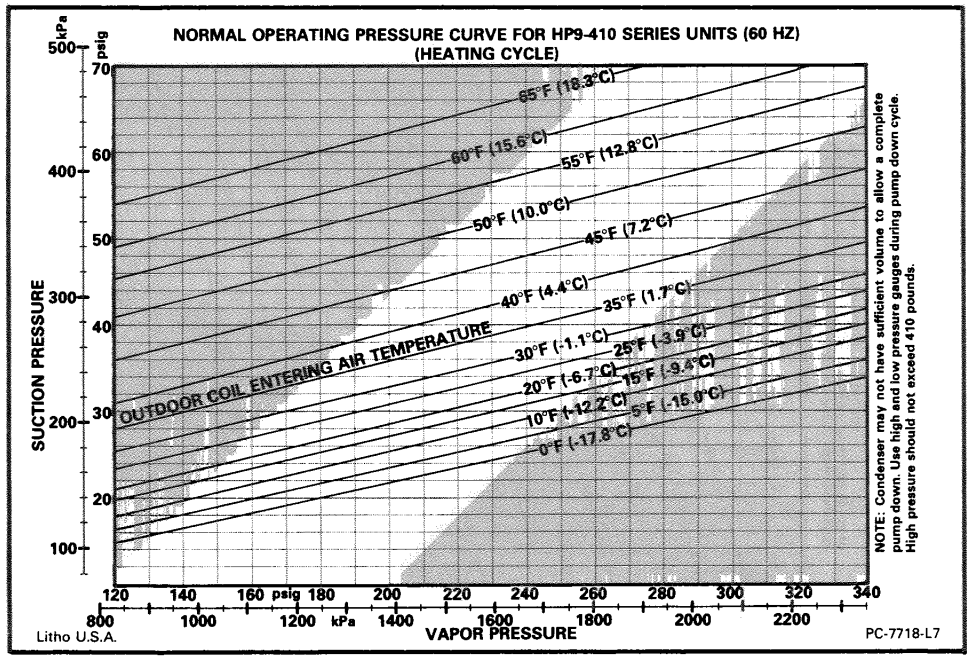

NORMAL OPERATING PRESSURE CURVE FOR HP9-460 SERIES UNITS (60 HZ)
(HEATING CYCLE)
SUCTION PRESSURE
VAPOR PRESSURE
OUTDOOR COIL ENTERING AIR TEMPERATURE
65°F (18.3°C)
55°F (12.8°C)
45°F (7.2°C)
35°F (1.7°C)
25°F (-3.9°C)
15°F (-9.4°C)
10°F(-12.2°C)
5°F(-15°C)
NOTE: Condenser may not have sufficient volume to allow a complete pump down. Use high and low pressure gauges during pump down cycle. High pressure should not exceed 410 pounds.
PC-7830-L11
Litho U.S.A.

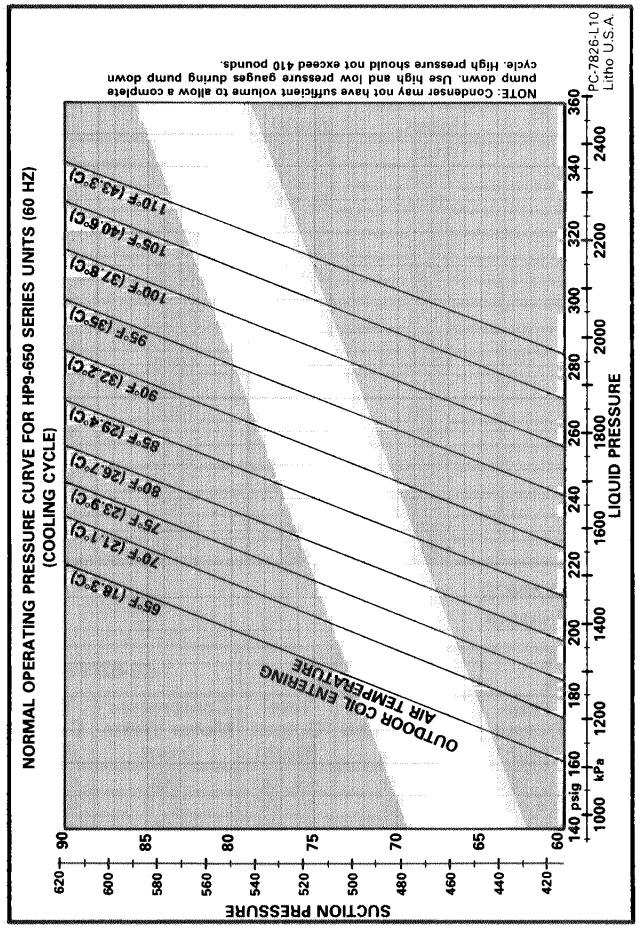

NORMAL OPERATING PRESSURE CURVE FOR HP9-311 SERIES UNITS (60 HZ)
(HEATING CYCLE)
SUCTION PRESSURE
VAPOR PRESSURE
OUTDOOR COIL ENTERING AIR TEMPERATURE
65°F (18.3°C)
60°F (15.6°C)
55°F (12.8°C)
50°F (10°C)
45°F (7.2°C)
40°F (4.4°C)
35°F (1.7°C)
30°F (—1.1°C)
25°F (—3.9°C)
15°F (—9.4°C)
5°F (—15°C)
NOTE: Condenser may not have sufficient volume to allow a complete pump down. Use high and low pressure gauges during pump down cycle. High pressure should not exceed 410 pounds.
Litho U.S.A.
PC-7804-L2

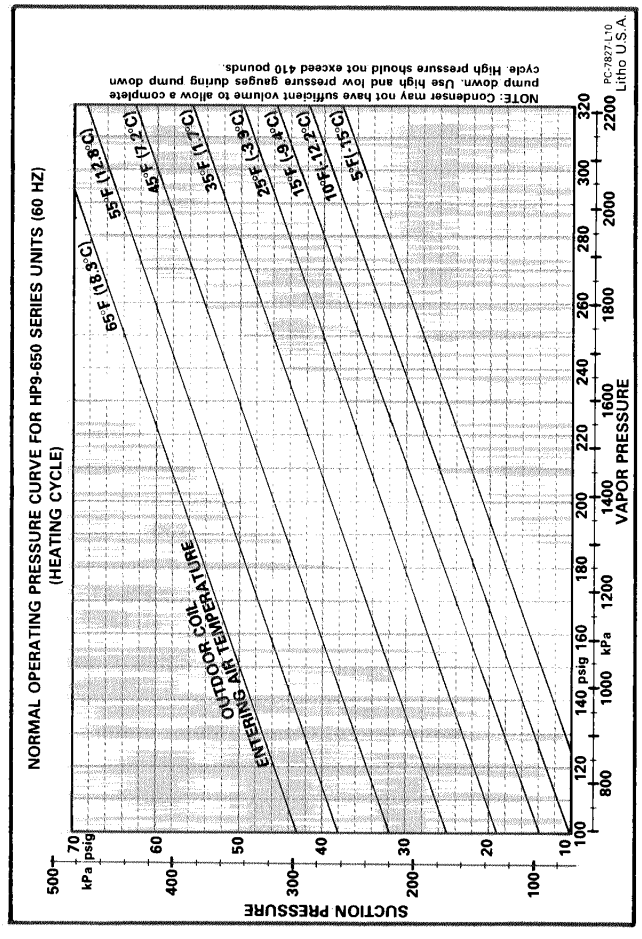

NORMAL OPERATING PRESSURE CURVE FOR HP9-510 SERIES UNITS (60 HZ)
(COOLING CYCLE)
SUCTION PRESSURE
psig
kPa
65°F (18.3°C)
70°F (21.1°C)
75°F (23.9°C)
80°F (26.7°C)
85°F (29.4°C)
90°F (32.2°C)
95°F (35.0°C)
100°F (37.8°C)
105°F (40.6°C)
110°F (43.3°C)
115°F (46.1°C)
OUTDOOR COIL ENTERING AIR TEMPERATURE
LIQUID PRESSURE
NOTE: Condenser may not have sufficient volume to allow a complete pump down. Use high and low pressure gauges during pump down cycle. High pressure should not exceed 410 pounds.
Litho U.S.A.
PC-7719-L7


NORMAL OPERATING PRESSURE CURVE FOR HP9-410 SERIES UNITS (60 HZ)
(COOLING CYCLE)
SUCTION PRESSURE
psig
kPa
65°F (18.3°C)
70°F (21.1°C)
75°F (23.9°C)
80°F (26.7°C)
85°F (29.4°C)
90°F (32.2°C)
95°F (35.0°C)
100°F (37.8°C)
105°F (40.6°C)
110°F (43.3°C)
115°F (46.1°C)
OUTDOOR COIL ENTERING AIR TEMPERATURE
LIQUID PRESSURE
NOTE: Condenser may not have sufficient volume to allow a complete pump down. Use high and low pressure gauges during pump down cycle. High pressure should not exceed 410 pounds.
Litho U.S.A.
PC-7717-L7

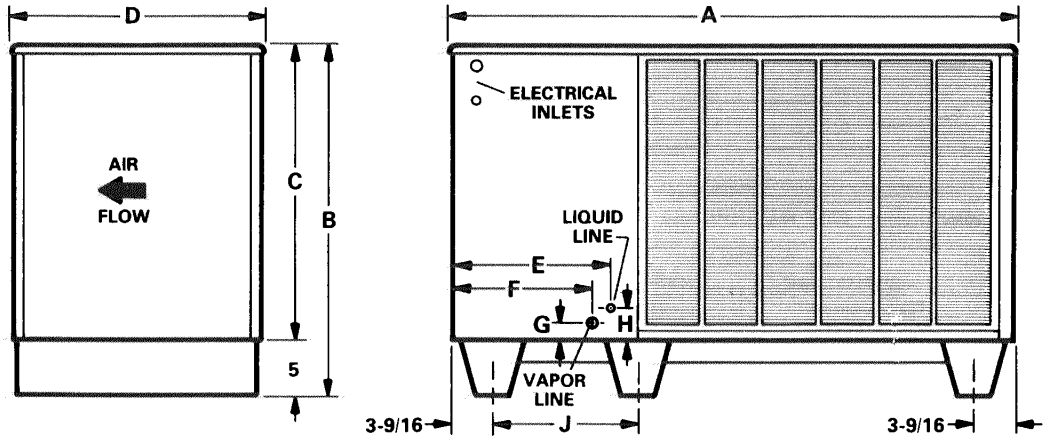

NORMAL OPERATING PRESSURE CURVE FOR HP9-510 SERIES UNITS (60 HZ)
(HEATING CYCLE)
SUCTION PRESSURE
kPa
psig
65°F (18.3°C)
60°F (15.6°C)
55°F (12.8°C)
50°F (10.0°C)
45°F (7.2°C)
40°F (4.4°C)
35°F (1.7°C)
30°F (-1.1°C)
25°F (-3.9°C)
20°F (-6.7°C)
15°F (-9.4°C)
10°F (-12.2°C)
5°F (-15.0°C)
0°F (-17.8°C)
OUTDOOR COIL ENTERING AIR TEMPERATURE
VAPOR PRESSURE
NOTE: Condenser may not have sufficient volume to allow a complete pump down. Use high and low pressure gauges during pump down cycle. High pressure should not exceed 410 pounds.
Litho U.S.A.
PC-7720-L7


NORMAL OPERATING PRESSURE CURVE FOR HP9-410 SERIES UNITS (60 HZ)
(HEATING CYCLE)
SUCTION PRESSURE
kPa
psig
65°F (18.3°C)
60°F (15.6°C)
55°F (12.8°C)
50°F (10.0°C)
45°F (7.2°C)
40°F (4.4°C)
35°F (1.7°C)
30°F (-1.1°C)
25°F (-3.9°C)
20°F (-6.7°C)
15°F (-9.4°C)
10°F (-12.2°C)
5°F (-15.0°C)
0°F (-17.8°C)
OUTDOOR COIL ENTERING AIR TEMPERATURE
VAPOR PRESSURE
NOTE: Condenser may not have sufficient volume to allow a complete pump down. Use high and low pressure gauges during pump down cycle. High pressure should not exceed 410 pounds.
Litho U.S.A.
PC-7718-L7





D - Dimensions



Model No.	A	B	C	D	E	F	G	H	J
HP9-261V	42-7/8	28	23	18-3/8	6-5/8	4-1/8	2-5/8	2	----
HP9-311V	42-7/8	28	23	18-3/8	6-5/8	4-1/8	3-1/4	2	----
HP9-411V	48-1/8	30-1/2	25-1/2	21-3/8	14-3/8	13-3/8	3	2-3/4	12-1/2
HP9-461V	53-7/8	33	28	27-1/16	17	15	1-7/8	1-3/8	15
HP9-511V, HP9-651V	59	35-1/2	30-1/2	27-1/16	17	15	2	1-3/8	15

E - Heating Performance Charts

HP9-261V HEATING PERFORMANCE
at 900 cfm Indoor Coil Air Volume

*Outdoor Temperature (Degree F)	CBP13-480FF		C12-420 & CR12-420	
	Compressor Motor Watts Input	Total Output (Btuh)	Compressor Motor Watts Input	Total Output (Btuh)
65	2730	32,200	2780	32,300
60	2540	29,900	2585	29,900
55	2345	27,900	2390	27,900
50	2180	25,700	2220	25,700
45	2040	23,500	2075	23,500
40	1900	21,200	1935	21,200
35	1790	19,600	1870	19,600
30	1705	18,300	1810	18,300
25	1635	16,500	1730	16,700
20	1555	15,000	1670	15,200
15	1500	13,600	1620	13,800
10	1430	11,900	1560	12,200
5	1375	10,500	1500	10,700
0	1310	9100	1430	9,200
-5	1250	7800	1350	7,800
-10	1195	6700	1290	6,900
-15	1130	6100	1235	6,200
-20	1060	5700	1150	5,800

HP9-311V HEATING PERFORMANCE
at 1125 cfm Indoor Coil Air Volume

*Outdoor Temperature (Degree F)	C12-420 & CR12-420		C12-525 & CR12-525	
	Compressor Motor Watts Input	Total Output (Btuh)	Compressor Motor Watts Input	Total Output (Btuh)
65	3105	38,200	3150	38,200
60	2965	35,600	3010	35,600
55	2830	33,300	2870	33,300
50	2690	30,900	2730	30,900
45	2570	28,500	2610	28,500
40	2430	26,200	2465	26,200
35	2300	23,900	2335	23,900
30	2170	22,000	2200	22,000
25	2060	20,000	2090	20,000
20	1965	18,100	1995	18,100
15	1875	16,200	1900	16,200
10	1780	14,300	1805	14,300
5	1685	12,300	1710	12,300
0	1605	11,600	1630	11,600
-5	1505	10,500	1525	10,500
-10	1415	9600	1435	9600
-15	1320	8500	1340	8500
-20	1230	7200	1250	7200

HP9-411V HEATING PERFORMANCE
at 1350 cfm Indoor Coil Air Volume

Outdoor Temperature (Degrees F)	CBP10-41		CBPH10-490/41 & CPH10-490		CP12-630 & CR12-630N		C12-630 & CR12-630		C5-620FF	
	Compressor Motor Watts Input	Total Output (Btuh)	Compressor Motor Watts Input	Total Output (Btuh)	Compressor Motor Watts Input	Total Output (Btuh)	Compressor Motor Watts Input	Total Output (Btuh)	Compressor Motor Watts Input	Total Output (Btuh)
65	3900	48,400	3955	48,400	4125	47,100	4020	49,700	3990	48,400
60	3720	45,600	3775	45,600	3935	44,400	3835	46,800	3810	45,600
55	3555	42,300	3600	42,400	3760	41,200	3665	43,400	3640	42,300
50	3410	39,500	3450	39,500	3610	38,500	3520	40,500	3490	39,500
45	3235	36,900	3280	36,900	3420	35,900	3335	37,900	3310	36,900
40	3180	34,200	3120	34,100	3365	33,300	3280	35,100	3255	34,200
35	3085	32,100	3035	31,700	3255	31,300	3180	32,900	3160	32,100
30	2935	29,400	2880	28,900	3105	28,600	3025	30,200	3005	29,400
25	2775	26,500	2725	26,000	2910	26,200	2835	27,400	2840	26,500
20	2610	23,700	2560	23,300	2735	23,400	2665	24,600	2670	23,700
15	2540	21,500	2475	21,000	2665	21,500	2595	22,300	2600	21,500
10	2375	18,600	2320	18,100	2490	18,600	2425	19,300	2430	18,600
5	2215	16,400	2165	15,900	2325	16,400	2265	17,000	2265	16,400
0	2055	13,500	2005	13,000	2150	13,500	2100	14,000	2105	13,500
-5	1940	11,300	1755	11,300	2025	11,300	1980	11,700	1985	11,300
-10	1615	9,700	1635	9,700	1690	9,700	1650	10,000	1655	9,700
-15	1435	8,300	1450	8,300	1500	8,300	1465	8,600	1470	8,300
-20	1255	6,800	1270	6,800	1310	6,800	1280	7,100	1285	6,800

HP9-461V HEATING PERFORMANCE
at 1575 cfm Indoor Coil Air Volume

Outdoor Temperature (Degress F)	C12 & CR12-630, CBPH10-645/51 & CPH10-645	
	Compressor Motor Watts Input	Total Output (Btuh)
65	4630	59,300
60	4430	55,900
55	4285	51,600
50	4080	47,300
45	3870	43,500
40	3665	40,200
35	3525	37,200
30	3390	34,600
25	3220	31,700
20	3020	29,400
15	2860	26,700
10	2670	23,400
5	2460	20,500
0	2260	17,200
-5	1960	13,400
-10	1695	10,800
-15	1595	8700
-20	1505	7000

HP9-651V HEATING PERFORMANCE
at 2250 cfm Indoor Coil Air Volume
(C12-1120 & CR12-1120)

*Outdoor Temperature (Degrees F)	Compressor Motor Watts Input	Total Output (Btuh)
65	5680	69,600
60	5530	66,900
55	5365	64,100
50	5160	61,000
45	4940	57,300
40	4690	52,600
35	4465	47,000
30	4245	43,000
25	4025	39,600
20	3825	36,400
15	3655	33,300
10	3515	30,300
5	3335	27,300
0	3165	24,600
-5	2960	21,900
-10	2770	19,400
-15	2585	17,200
-20	2415	15,100

*Outdoor temperature at 70% relative humidity.
Indoor temperature at 70°.

HP9-511V HEATING PERFORMANCE
at 1800 cfm Indoor Coil Air Volume

Outdoor Temperature (Degrees F)	CBP10-51, C12-840 & CR12-840		CBPH10-645/51 & CPH10-645		C5-805FF	
	Compressor Motor Watts Input	Total Output (Btuh)	Compressor Motor Watts Input	Total Output (Btuh)	Compressor Motor Watts Input	Total Output (Btuh)
65	5390	64,000	5390	64,000	5390	66,500
60	5165	60,300	5165	60,300	5165	62,700
55	4995	56,700	4995	56,700	4995	58,900
50	4755	53,100	4755	53,100	4755	55,200
45	4540	49,500	4540	49,500	4540	51,400
40	4300	45,800	4285	45,800	4300	47,600
35	4135	42,400	4090	42,200	4135	44,100
30	3975	39,400	3915	38,900	3975	40,900
25	3780	36,100	3680	35,100	3780	37,500
20	3545	33,500	3445	32,500	3545	34,800
15	3355	30,400	3255	29,400	3355	31,600
10	3135	26,700	3035	25,700	3135	27,700
5	2890	23,300	2790	22,300	2890	24,200
0	2655	19,600	2555	18,600	2655	20,400
-5	2300	15,300	2200	14,800	2300	15,900
-10	1990	12,300	1990	12,300	1990	12,800
-15	1875	9,200	1875	92,00	1875	9,600
-20	1770	7,200	1770	7,200	1770	7,480

F - Field Wiring

High voltage leads provided in make-up area of control box for connection to power supply. Figure 2 shows two typical low voltage hook-ups.

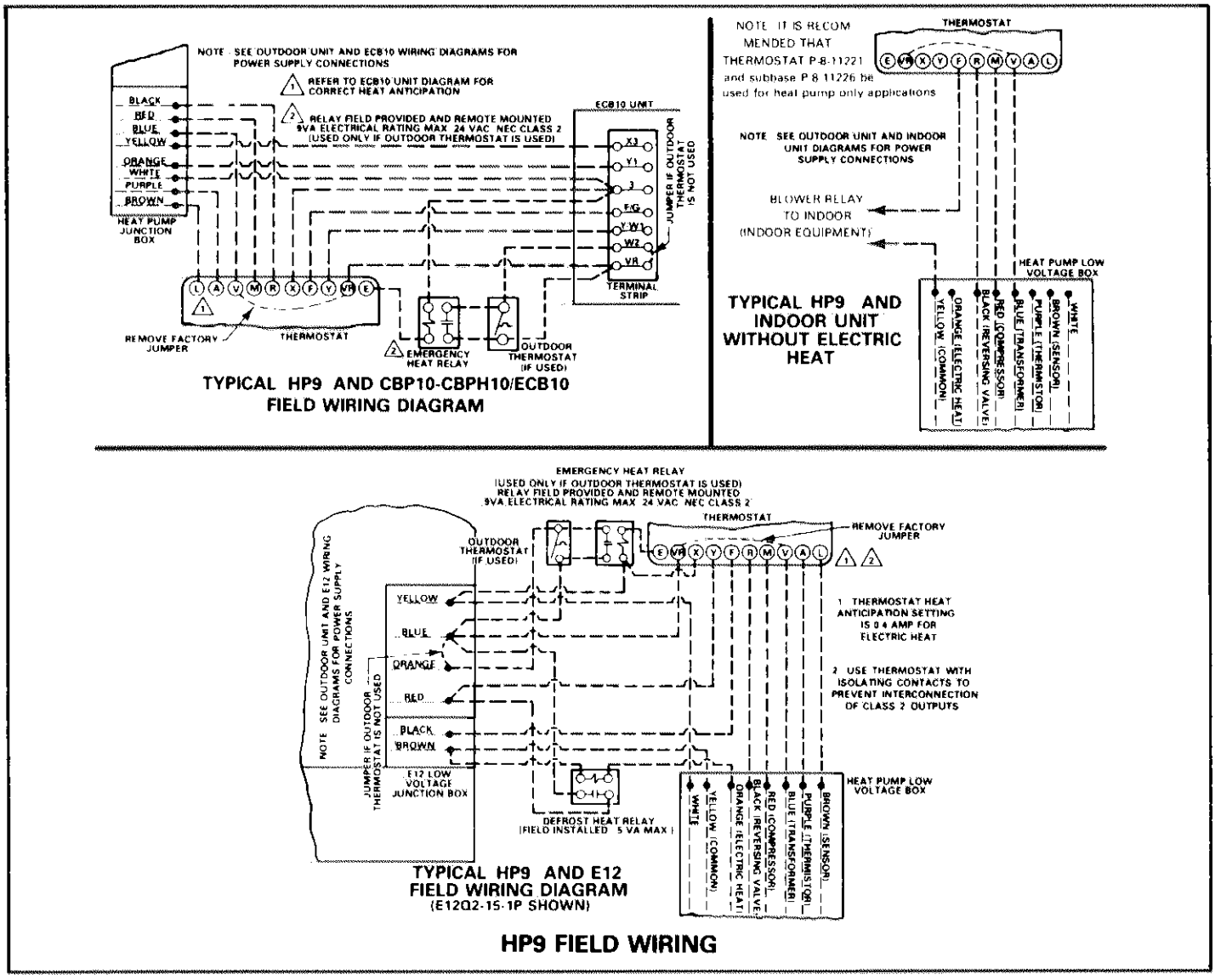
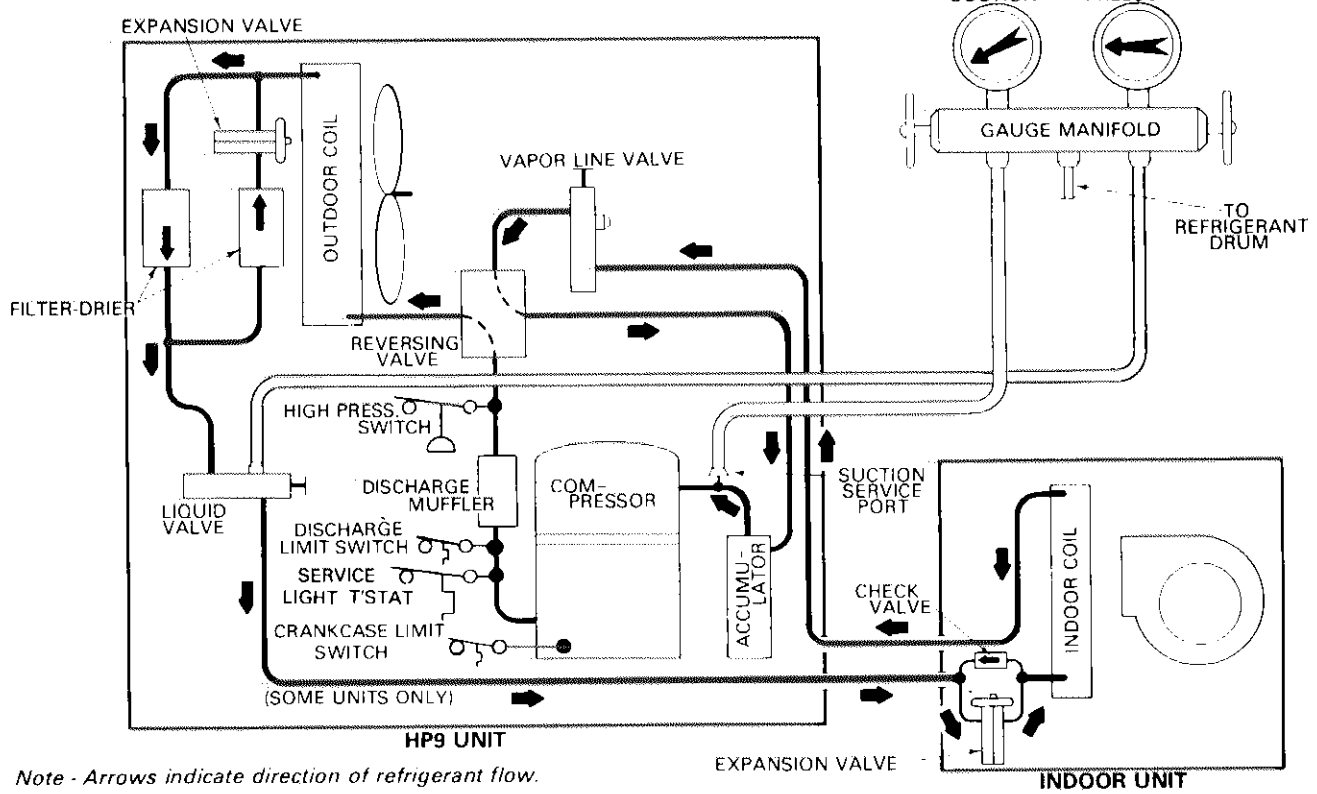


FIGURE 2

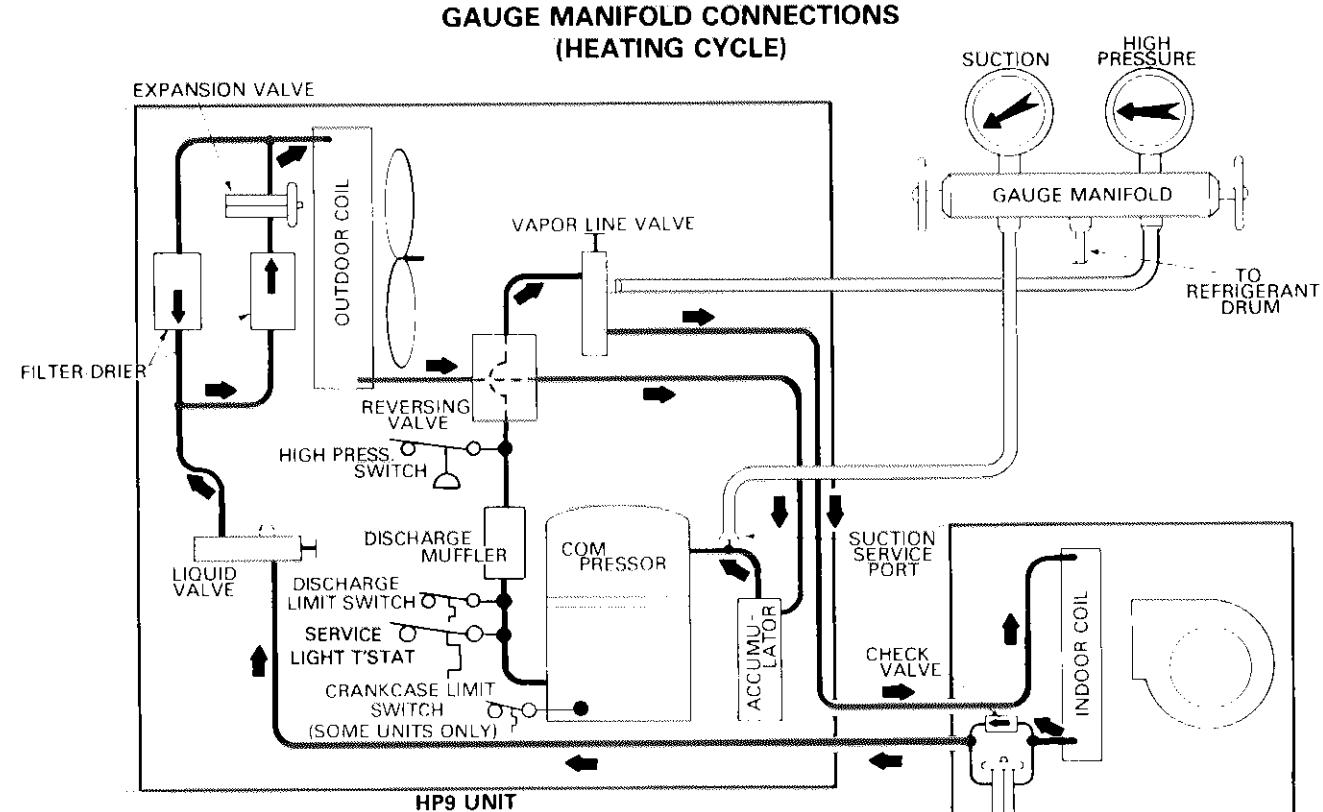
GAUGE MANIFOLD CONNECTIONS (COOLING CYCLE)



Note - Arrows indicate direction of refrigerant flow.

FIGURE 3

GAUGE MANIFOLD CONNECTIONS (HEATING CYCLE)



Note - Arrows indicate direction of refrigerant flow.

FIGURE 4

III - REFRIGERANT SYSTEM

Figures 3 and 4 show the gauge manifold for both the cooling and heating cycles. They also show the refrigerant flow. The vapor line and liquid service valves and gauge port connections are located inside cabinet as shown in Figure 5.

Two special filter-drier/check valves are used. The driers are mounted in the liquid line in a parallel flow arrangement with one drier for the cooling cycle and the other drier for the heating cycle. They are single directional flow with built-in check valves for correct refrigerant flow.

The expansion valve used changes superheat setting in response to the affects of low ambient conditions on the outdoor coil. This expansion valve allows a slight floodback to the accumulator during low ambients to maintain the refrigerant flow rate to compressor. This keeps oil and discharge temperatures within safe limits and helps prevent motor "hot spotting" from occurring. As a typical example, one might expect 15°F superheat at approximately 47°F ambient and zero superheat at 0°F.

It is very critical not to overcharge a heat pump. It is desirable to charge the system in the cooling cycle if weather conditions permit. However, if the unit must be charged in the heating cycle, the charge should be rechecked in the cooling cycle when outdoor conditions permit.

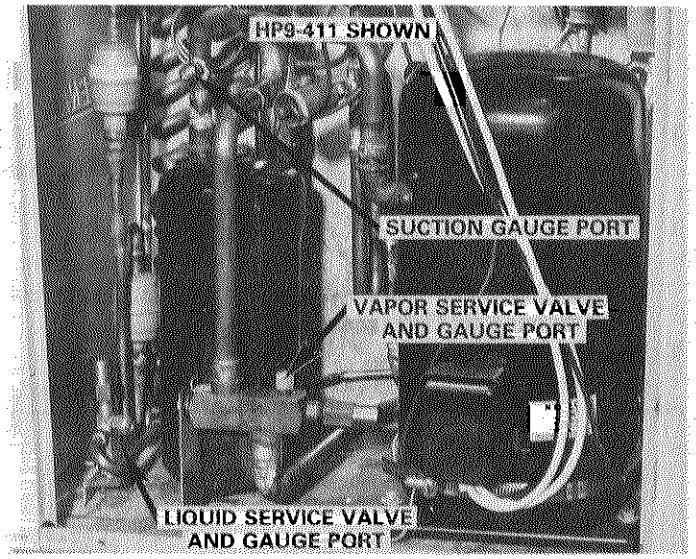
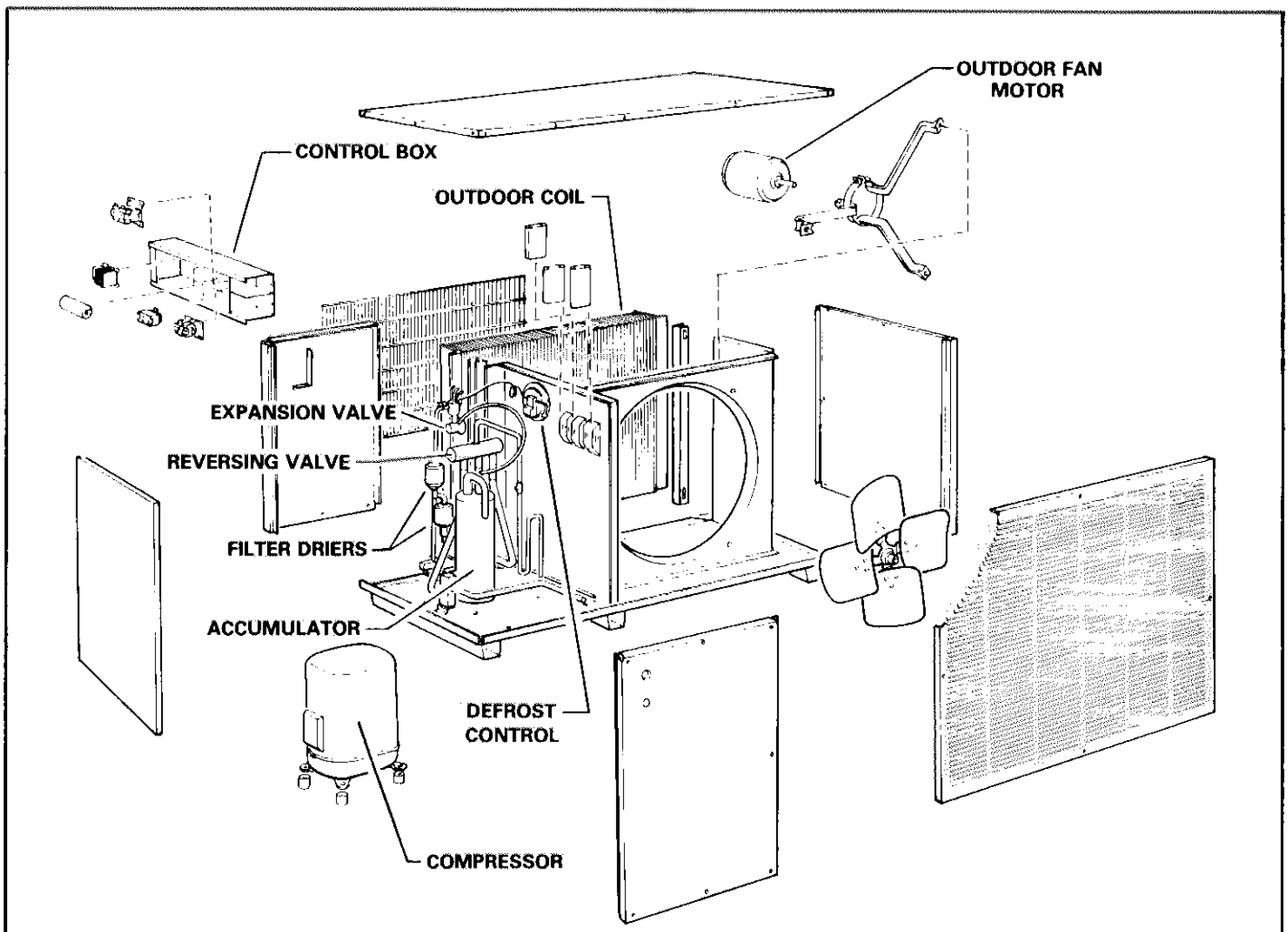


FIGURE 5

IV - HP9 COMPONENTS

Figure 6 shows an exploded view of the HP9.



HP9 EXPLODED VIEW

FIGURE 6

A - Control Box (Figure 7)

1 - Transformers

Powers the heat pump control circuits and the "V" leg of thermostat. Transformer is fused.

2 - Compressor Contactor

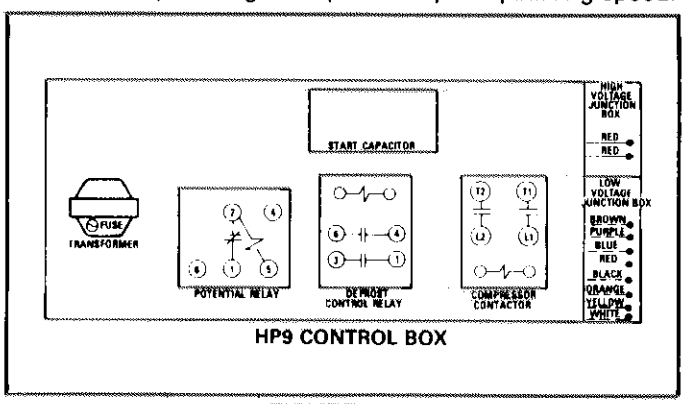
Powers the compressor and condenser fan (through the defrost control) on demand.

3 - Defrost Control Relay

Is a two-pole single-throw with normally open contacts and 208/240V coil. Switches the unit into defrost cycle upon demand by Defrost Control.

4 - Potential Relay And Start Capacitor

On start-up it brings compressor up to operating speed.



HP9 CONTROL BOX

FIGURE 7

B - Compressor Compartment (Figure 8)

1 - Compressor

Compressor uses an internal overload and a pressure relief valve. The relief valve opens at a discharge and suction differential of 450 psig ± 50.

2 - High Pressure Switch

This switch mounts in the discharge line. It cuts out at 410 psig and must be manually reset when pressure drops below 180 psig.

3 - Discharge Temperature Limit Switch or Crankcase Temperature Limit Switch

Some HP9 units are equipped with a discharge limit switch which is mounted on the compressor discharge line. It shuts off the system if discharge temperature exceeds 260°F (127°C). The limit switch must be manually reset when discharge temperature drops to 225°F (107°C) or below.

Some HP9 units are equipped with a crankcase temperature limit switch (located on outside bottom of compressor) which prevents compressor from operating at excessive oil temperatures by opening control circuit at 190°F.

4 - Service Light Thermostat

The service light thermostat is used in conjunction with the room thermostat. It monitors discharge temperature and closes on a temperature fall (110°F closes - 130°F opens). The red service light on the room thermostat is energized when thermostat closes, providing second stage bulb is made. This service light may briefly come on during a compressor start-up.

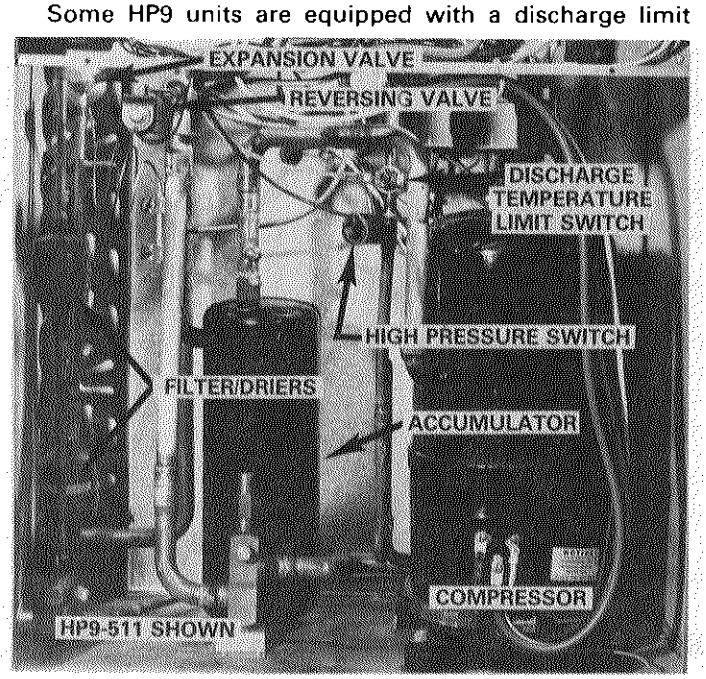


FIGURE 8

C - Outdoor Coil Compartment (Figure 9)

The high pressure monitor portion of the defrost control is located between the outdoor coil and outdoor fan. The ambient compensating thermistor is used in conjunction with the room thermostat. It varies heat anticipator resistance as the ambient temperature changes. The outdoor coil is circuited with the refrigerant flow from bottom to top during a defrost cycle. This provides more positive defrost and better condensate run-off.

The unit uses a blow-through coil with horizontal discharge. The fan motor is prelubricated for an extended period of operation. Some motors employ sealed ball bearings which need no further lubrication. Check motor for lubrication requirements. For fan service access, remove top of unit and then remove the bolts securing fan assembly. Figure 10 illustrates the condenser fan and motor assemblies.

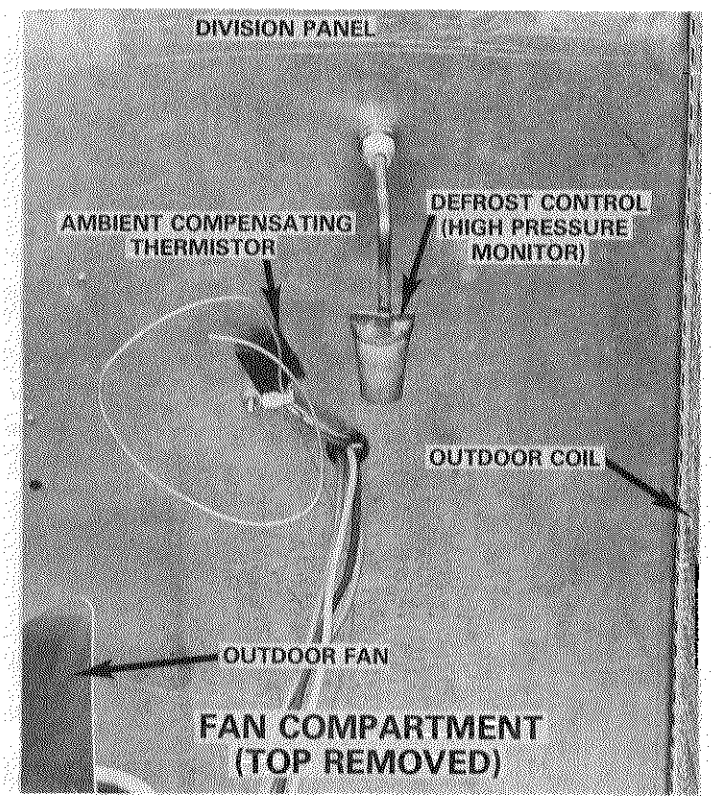
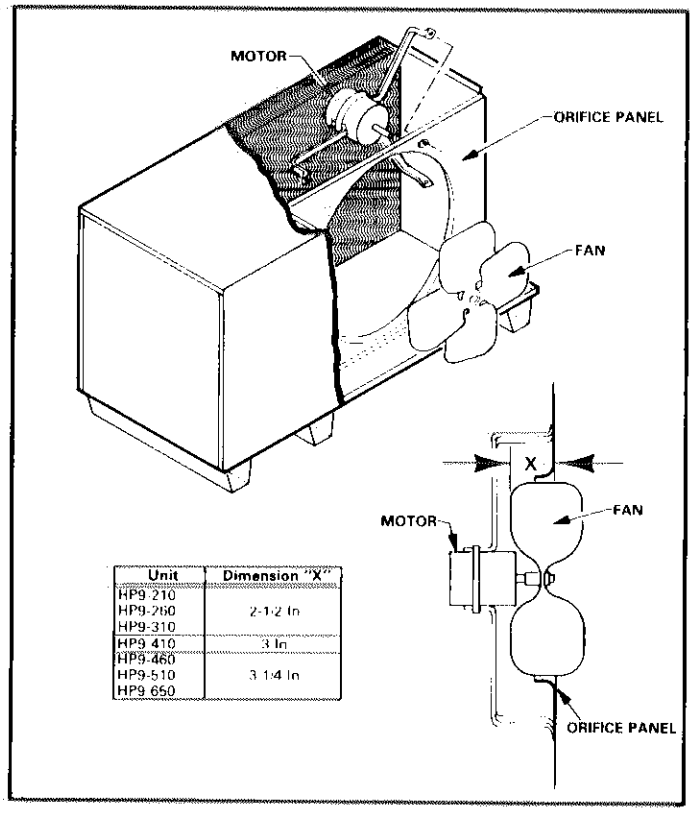


FIGURE 9



Unit	Dimension "X"
HP9-210	2-1/2 In
HP9-260	
HP9-310	
HP9-410	3 In
HP9-460	
HP9-510	3-1/4 In
HP9-650	

FIGURE 10

D - Room Thermostat

HP9 uses a single stage cool — two stage heat thermostat with ambient compensating thermistor and emergency heat subbase. The ambient compensating thermistor cuts down thermostat droop to improve the operating characteristics. Thermostat is equipped with two indicator lights. The red service light warns the homeowner that the compressor is not operating properly and the heat pump is in need of service. As the unit is cycled "on" by a heating demand, this light may come on briefly until the compressor reaches its normal operating conditions. The homeowner should be made aware that this short intermittent lighting is normal. The amber light comes on whenever the thermostat is placed

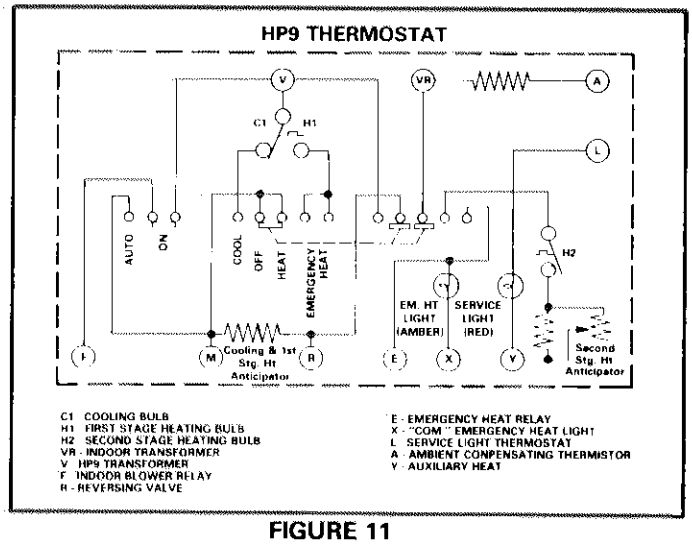


FIGURE 11

into emergency heat. It reminds the homeowner that he is not getting the benefit of his heat pump and that he is using expensive electric heat. Figure 11 illustrates thermostat. that the compressor is locked out.

See Figure 11.

E - Defrost Control (Figure 12)

Robertshaw defrost control is pressure initiated and temperature terminated. The high pressure monitor portion of the defrost control is located in the outdoor fan section between the coil and fan. Low pressure is monitored from the compressor compartment. The sensing bulb is clamped to the liquid line.

The control will initiate the defrost cycle at a pressure difference across the outdoor coil at approximately 0.5" WC. The defrost cycle will terminate when the temperature sensor clamped to the liquid line on the outdoor coil reaches 65°F.

V - SCHEMATIC WIRING DIAGRAM OPERATING SEQUENCE

The following illustrations explain the operating sequence for a typical HP9-411, CBP10-41 and ECB10-41-631 combination.

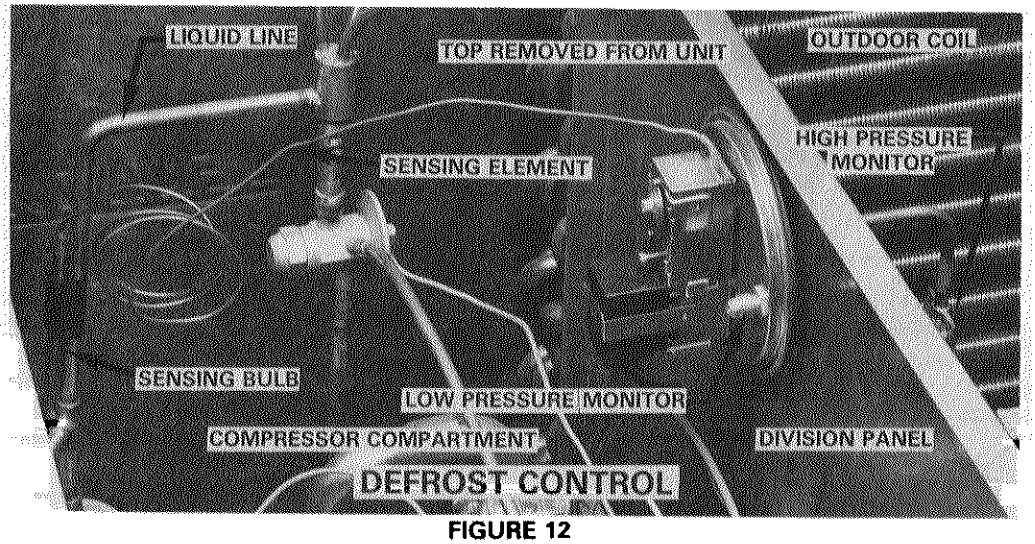
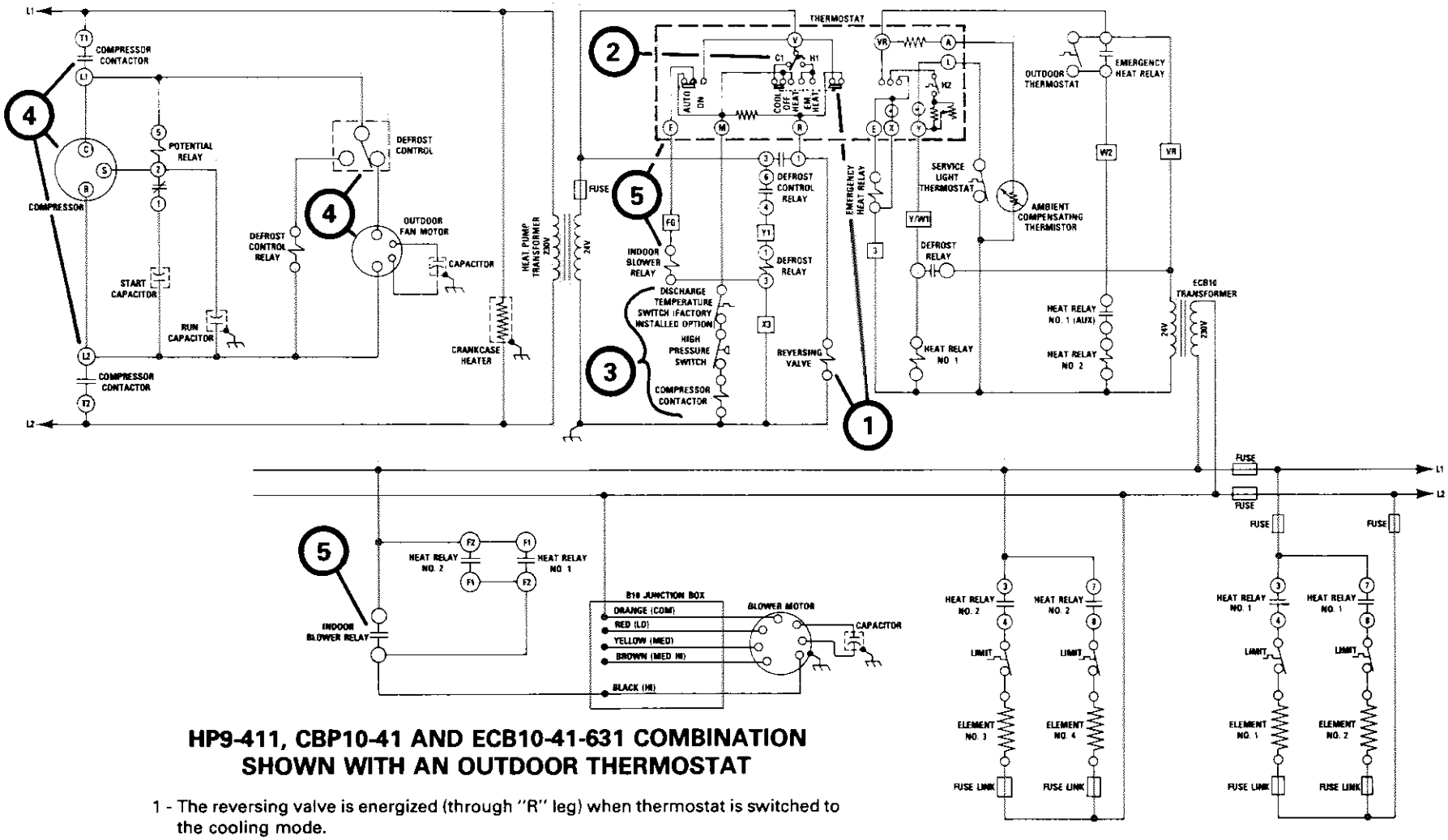


FIGURE 12

TYPICAL HP9 COOLING CYCLE SEQUENCE OF OPERATION



HP9-411, CBP10-41 AND ECB10-41-631 COMBINATION SHOWN WITH AN OUTDOOR THERMOSTAT

1 - The reversing valve is energized (through "R" leg) when thermostat is switched to the cooling mode.

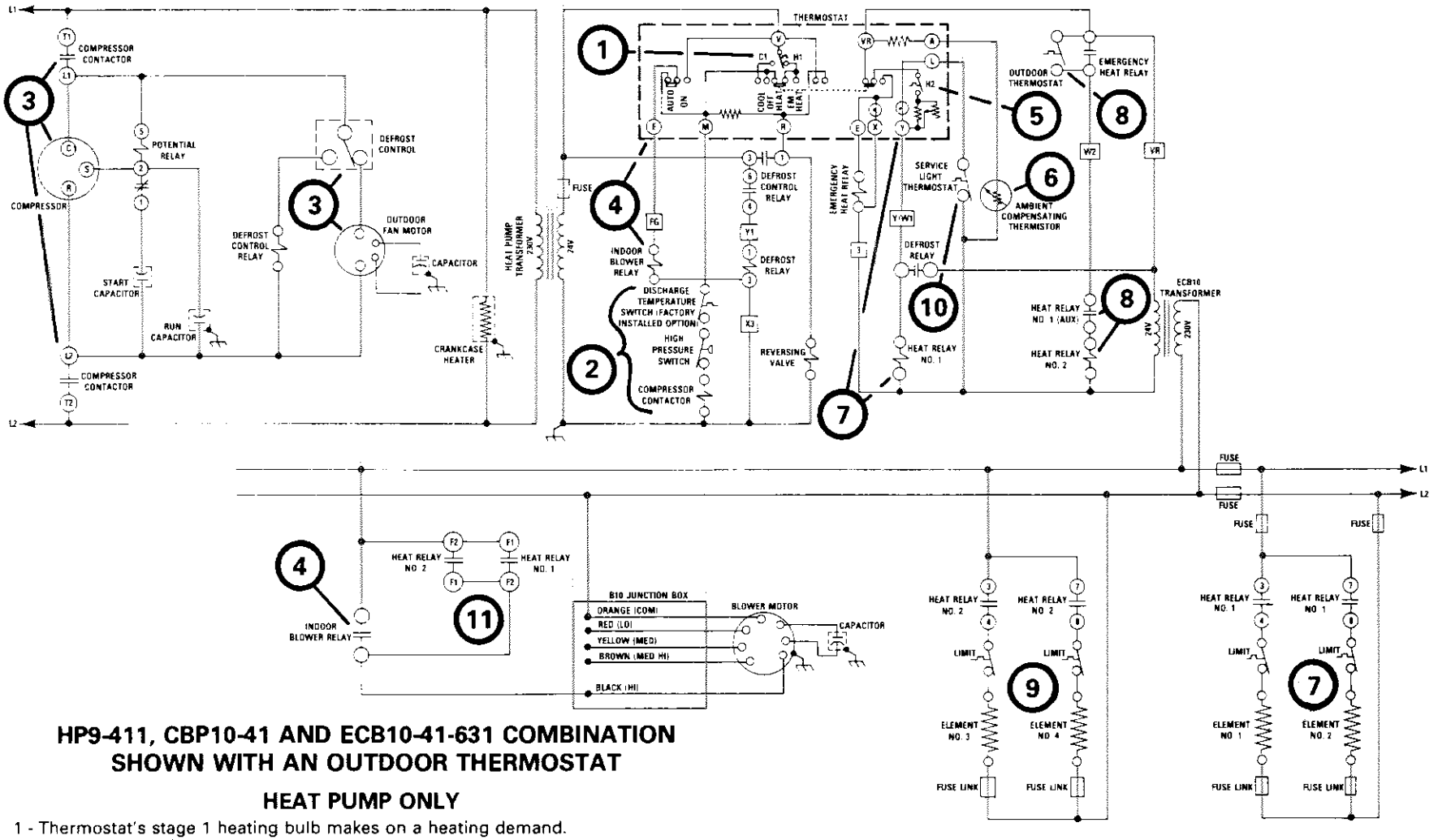
2 - Thermostat cooling bulb makes on a cooling demand.

3 - 24V control circuit through "M" leg of thermostat, normally closed discharge temperature switch and high pressure switch. This energizes the compressor contactor.

4 - The contactor closes its N.O. contacts to power compressor and outdoor fan motor (through defrost control).

5 - As the compressor circuit is energized, the indoor blower relay is energized through "F" leg of thermostat. The indoor blower relay closes its N.O. contacts to start the indoor blower motor.

TYPICAL HP9 HEATING CYCLE SEQUENCE OF OPERATION



HP9-411, CBP10-41 AND ECB10-41-631 COMBINATION SHOWN WITH AN OUTDOOR THERMOSTAT

HEAT PUMP ONLY

1 - Thermostat's stage 1 heating bulb makes on a heating demand.

2 - 24V control circuit through "M" leg of thermostat, normally closed discharge temperature switch and high pressure switch. This energizes the compressor contactor.

3 - The contactor closes its N.O. contacts to power the compressor and the outdoor fan motor (through the defrost control).

4 - As the compressor circuit is energized, the indoor blower relay is energized through "F" leg of thermostat. The indoor blower relay closes its N.O. contacts to start the indoor blower motor.

SUPPLEMENT HEAT

5 - If additional heat is needed, the second stage heating bulb makes at thermostat.

6 - The ambient compensating thermister circuit cuts down thermostat droop.

7 - Heat relay no. 1 is energized through the "Y" leg of thermostat. The relay closes its N.O. contacts in sequence to power elements 1 and 2.

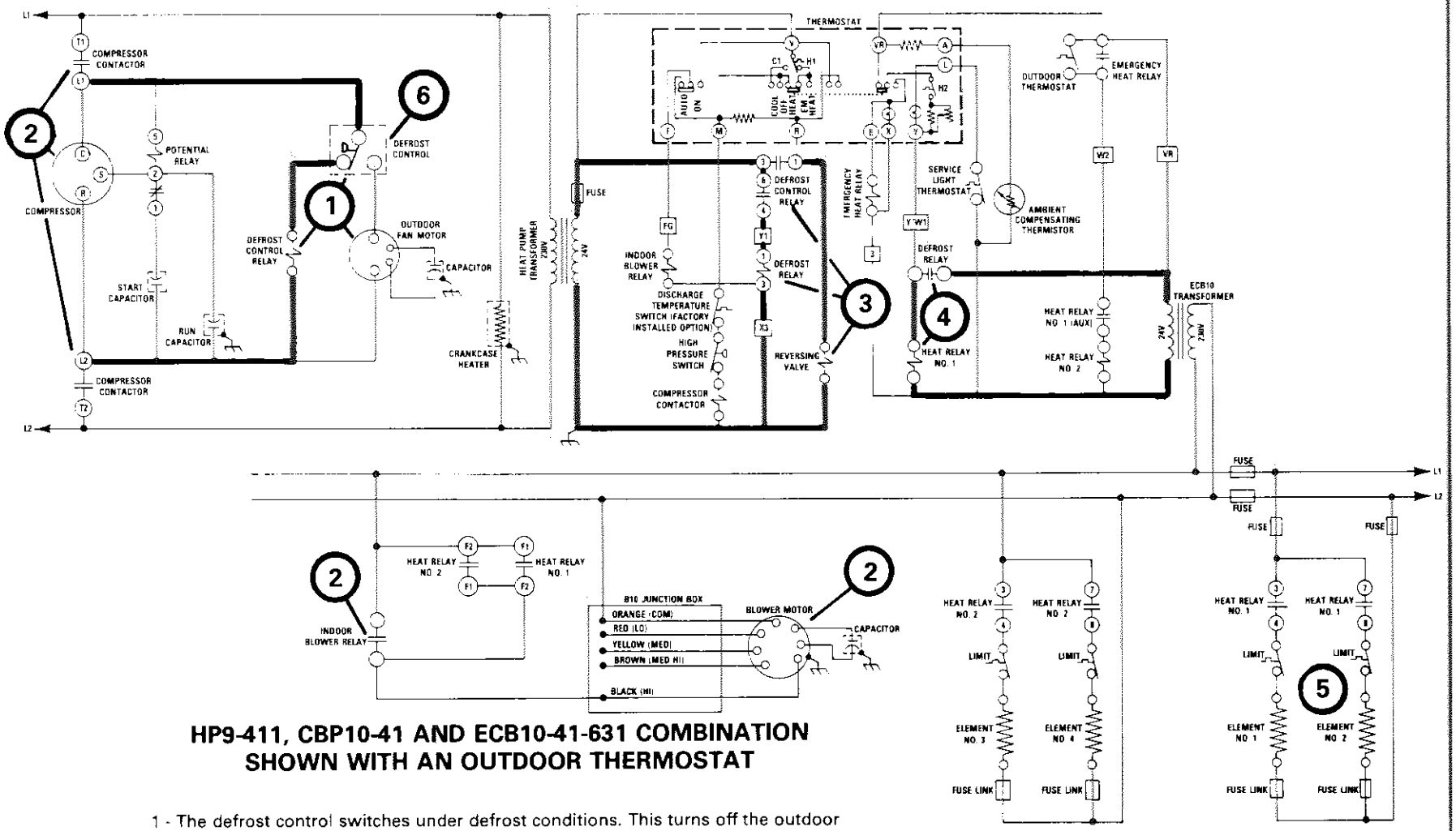
8 - Heat relay no. 1's auxiliary contacts also close to energize heat relay no. 2, providing the outdoor thermostat is closed.

9 - Heat relay no. 2 closes its N.O. contacts in sequence to power elements 3 and 4.

10 - If the heat pump fails to operate properly, the service light thermostat closes to light red bulb at thermostat.

11 - If the heat pump transformer is de-energized, the heat relay fan contacts maintain blower operation.

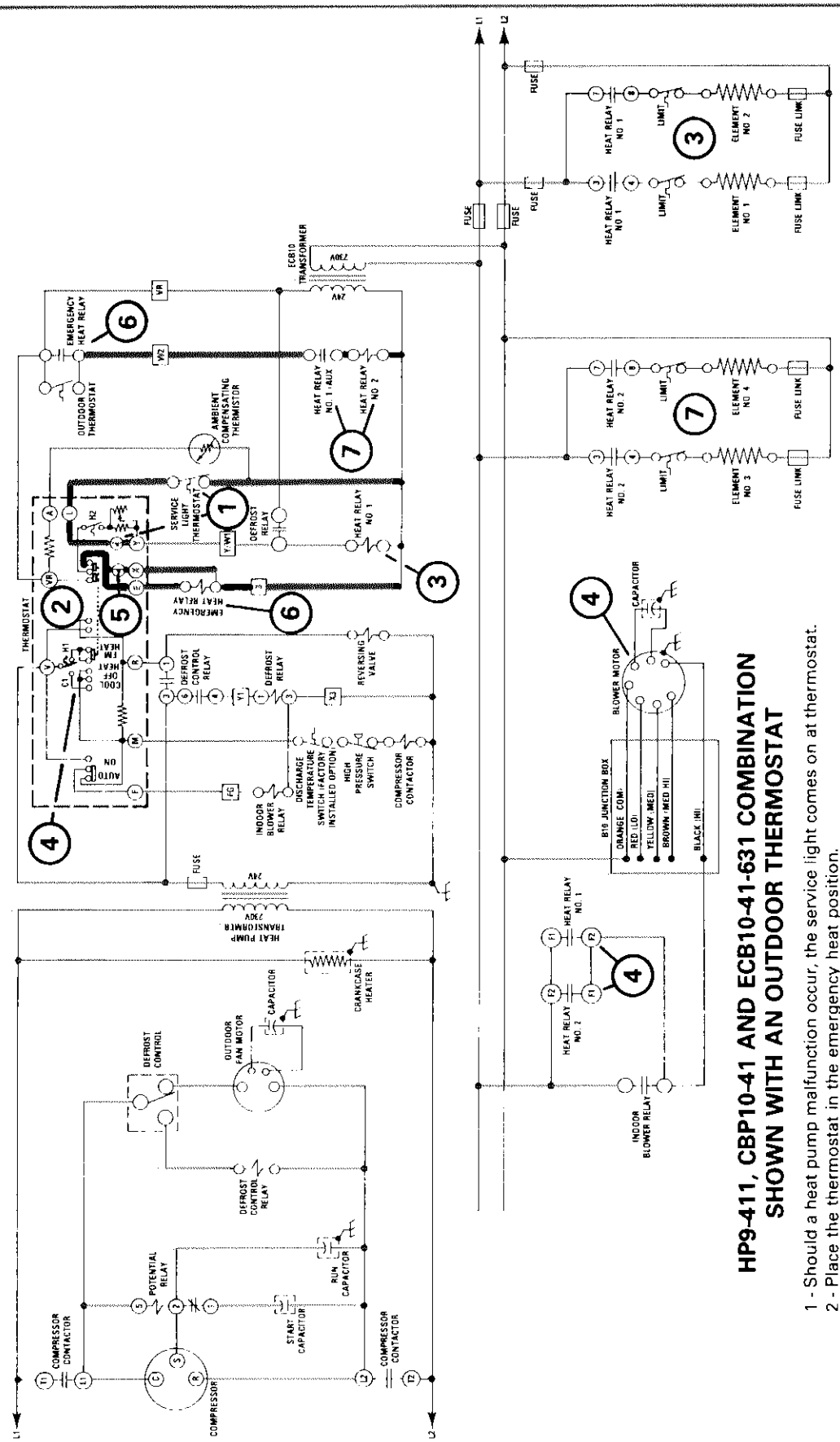
TYPICAL HP9 DEFROST CYCLE SEQUENCE OF OPERATION



HP9-411, CBP10-41 AND ECB10-41-631 COMBINATION SHOWN WITH AN OUTDOOR THERMOSTAT

1 - The defrost control switches under defrost conditions. This turns off the outdoor fan and energizes the defrost control relay.
2 - The compressor and indoor blower motor continue to operate.
3 - The defrost control relay closes its N.O. contacts to energize the reversing valve and the defrost relay.
4 - The defrost relay closes its N.O. contacts to energize heat relay no. 1.
5 - Heat relay no. 1 closes its contacts to power elements 1 & 2.
6 - The defrost control will return to its normal position after the defrost cycle is complete.

TYPICAL HP9 EMERGENCY HEAT SEQUENCE OF OPERATION



HP9-411, CBP10-41 AND ECB10-41-631 COMBINATION SHOWN WITH AN OUTDOOR THERMOSTAT

1 - Should a heat pump malfunction occur, the service light comes on at thermostat.
2 - Place the thermostat in the emergency heat position.
3 - Heat relay no. 1 remains energized as before and elements no. 1 and no. 2 are energized.
4 - Switching the thermostat de-energizes the HP9 control circuit. Blower motor operation is now through heat relay fan contacts.
5 - Switching the thermostat also brings on another service light to remind homeowner that system is on emergency heat.
6 - The emergency heat relay is energized through "E" terminal. The relay closes its contacts to by-pass outdoor thermostat.
7 - This energizes heat relay 2 to bring on elements 3 and 4.