HS14 SERIES UNITS WITH "L7" TWO SPEED COMPRESSOR

I - INTRODUCTION

The HS14 features the Lennox "L7" two speed compressor which shifts speeds to match load requirements. At low speed it cuts energy consumption by nearly 50% over a single speed compressor. Figure 1 shows a cutaway of the unit. In addition, the HS14 can be applied to cooling loads in which the unit is wired for low speed only. The heat transfer surfaces become oversized causing increased capacity and efficiency. The following table lists the unit nominal tonnages at low and high speed.

Unit	Tonnage At Low Speed	Tonnage At High Speed
HS14-410V	2	3
HS14-510V	2-1/2	4
HS14-650V	3	5

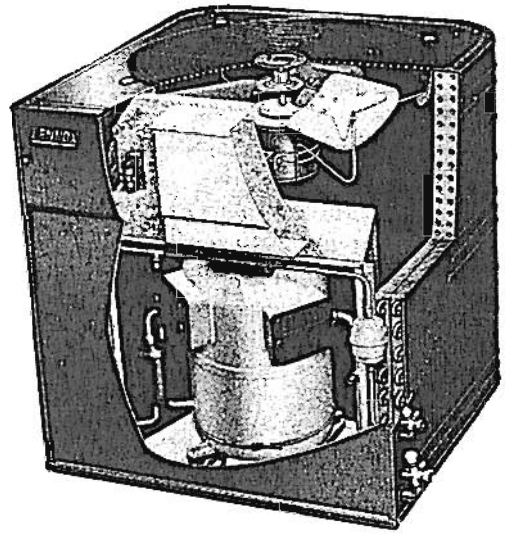


FIGURE 1

II - UNIT INFORMATION

A - Specifications

Model No.			HS14-411V-413V	HS14-511V-513V	HS14-651V-653V
Condenser Coil	Net face area (sq. ft.)	Outer coil	18.51	18.51	21.36
		Inner coil	17.65	17.65	20.36
	Tube diameter (in.) & No. of rows		3/8 — 2	3/8 — 2	3/8 — 2
	Fins per inch		20	20	20
Condenser Fan	Diameter (in.) & No. of blades		24 — 3	24 — 3	24 — 4
	Motor hp		1/10	1/6	1/4
	Cfm (factory setting)		2800	3200	4200
	Rpm (factory setting)		830	830	815
	Watts (factory setting)		150	210	310
**Refrigerant — 22 charge furnished			10 lbs. 4 oz.	10 lbs. 0 oz.	14 lbs. 0 oz.
Liquid line (o.d. in.) connection			3/8 (compression)	3/8 (compression)	3/8 (compression)
Suction line (o.d. in.) connection			7/8 (compression)	1-1/8 (sweat)	1-1/8 (sweat)
Shipping weight (lbs.)			314	322	356
Number of packages in shipment			1	1	1

**Refrigerant charge is sufficient for 25 ft. length line set.

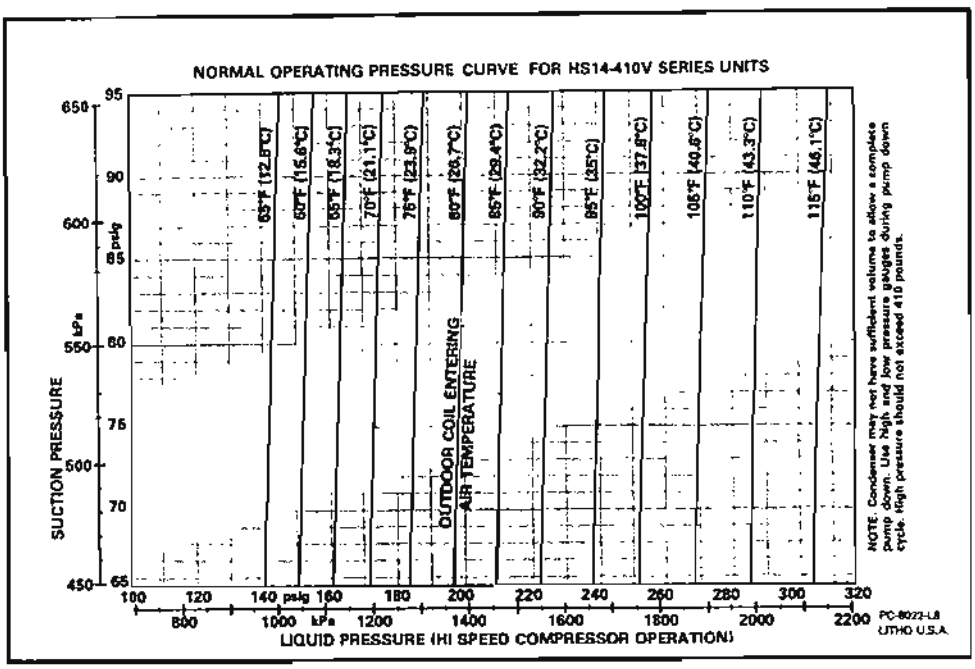
B - Electrical Data

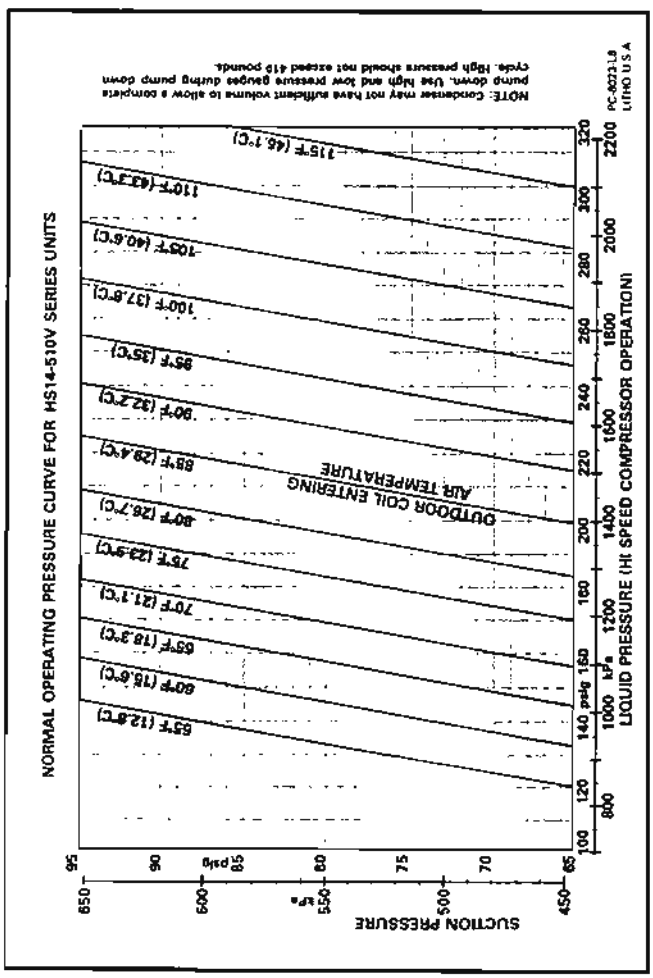
Model No.		HS14-411V	HS14-413V	HS14-511V	HS14-513V	HS14-651V	HS14-653V
Line voltage data		230v 60hz/1ph	208/230v 60hz/3ph	230v 60hz/1ph	208/230v 60hz/3ph	230v 60hz/1ph	208/230v 60hz/3ph
Compressor	Rated load amps	14.8	11.1	21.6	15.7	32.1	17.2
	Power factor	.98	.88	.97	.88	.97	.88
	Locked rotor amps	90.0	83.0	133.0	125	163.0	144
Condenser Coil Fan Motor	Full load amps	0.7	0.7	1.0	1.0	1.7	1.7
	Locked rotor amps	1.2	1.2	1.9	1.9	2.9	2.9
Recommended maximum fuse size (amps)		30	25	45	35	60	40
*Minimum circuit ampacity		19.2	14.6	28.0	20.6	41.8	23.2

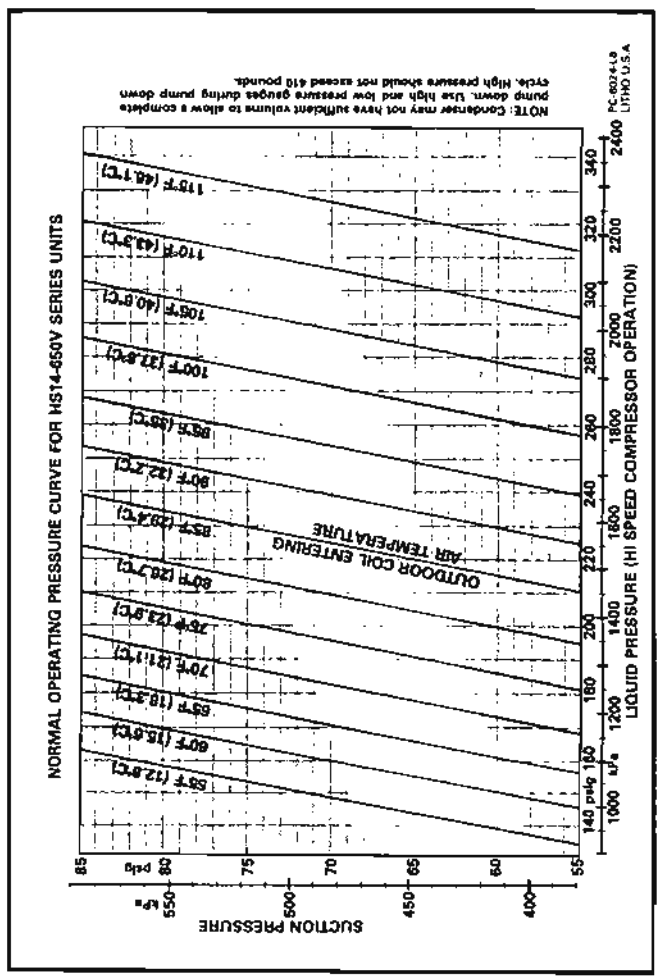
*Refer to National Electrical Code manual to determine wire, fuse and disconnect size requirements.
NOTE — Extremes of operating range are plus and minus 10% of line voltage.

C - Pressure Curves

Each unit is furnished with a normal operating pressure curve. The curve uses suction pressure, liquid pressure and outdoor temperature comparison. To use the chart, first check suction pressure, then move over to the outdoor temperature and finally down to the liquid pressure. If the liquid pressure is within five pounds of this reading, the unit is properly charged, providing the three conditions meet in the unshaded area of the chart. If they meet in the shaded area, there is something wrong with the system and further checks are needed.

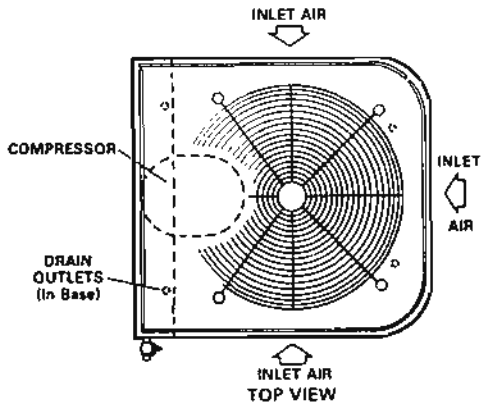


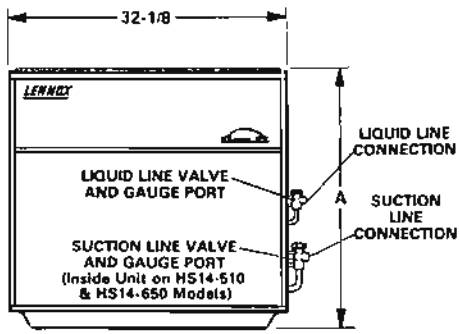


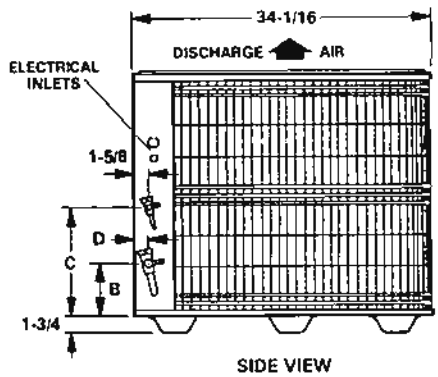


D - Dimensions

Model No.	A	B	C	D
HS14-411V HS14-413V	34-1/2	4-1/2	11-1/4	1-1/2
HS14-511V HS14-513V	34-1/2	5-7/8	12	2-1/16
HS14-651V HS14-653V	39-1/2	5-7/8	12	2-1/16







E - Approved Match-Ups

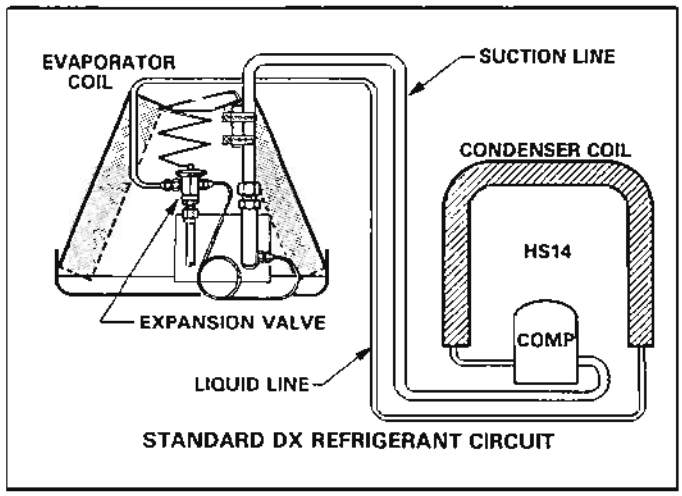
The HS14 is for use with single circuit coils and expansion valve systems only. The 3, 4 & 5 ton expansion valves use equalizer lines.

Refer to the Lennox Engineering Handbook for approved system match-ups and the correct expansion valve kit. The following table lists the line sets for the HS14.

Condensing Unit Model No.	Line Set Model No.	Length Suc. & Liq. Lines (ft.)	Liquid Line (o.d. in.)	Suction Line (o.d. in.)
HS14-410V	L10-65-30	30	3/8	7/8
	L10-65-40	40		
	L10-65-50	50		
HS14-510V HS14-650V	field fabricate	---	3/8	1-1/8

The 410 units use compression connections at the unit. The 510 and 650 units use a compression connection for the liquid line and a sweat connection for the suction line.

The HS14 is applicable to the ZoneMaster system. This is a direct expansion valve refrigerant system using multiple evaporators. The HS14 unit and RTM1-65 Tank Module are used to couple the system together. Refer to the ZoneMaster literature for further details.

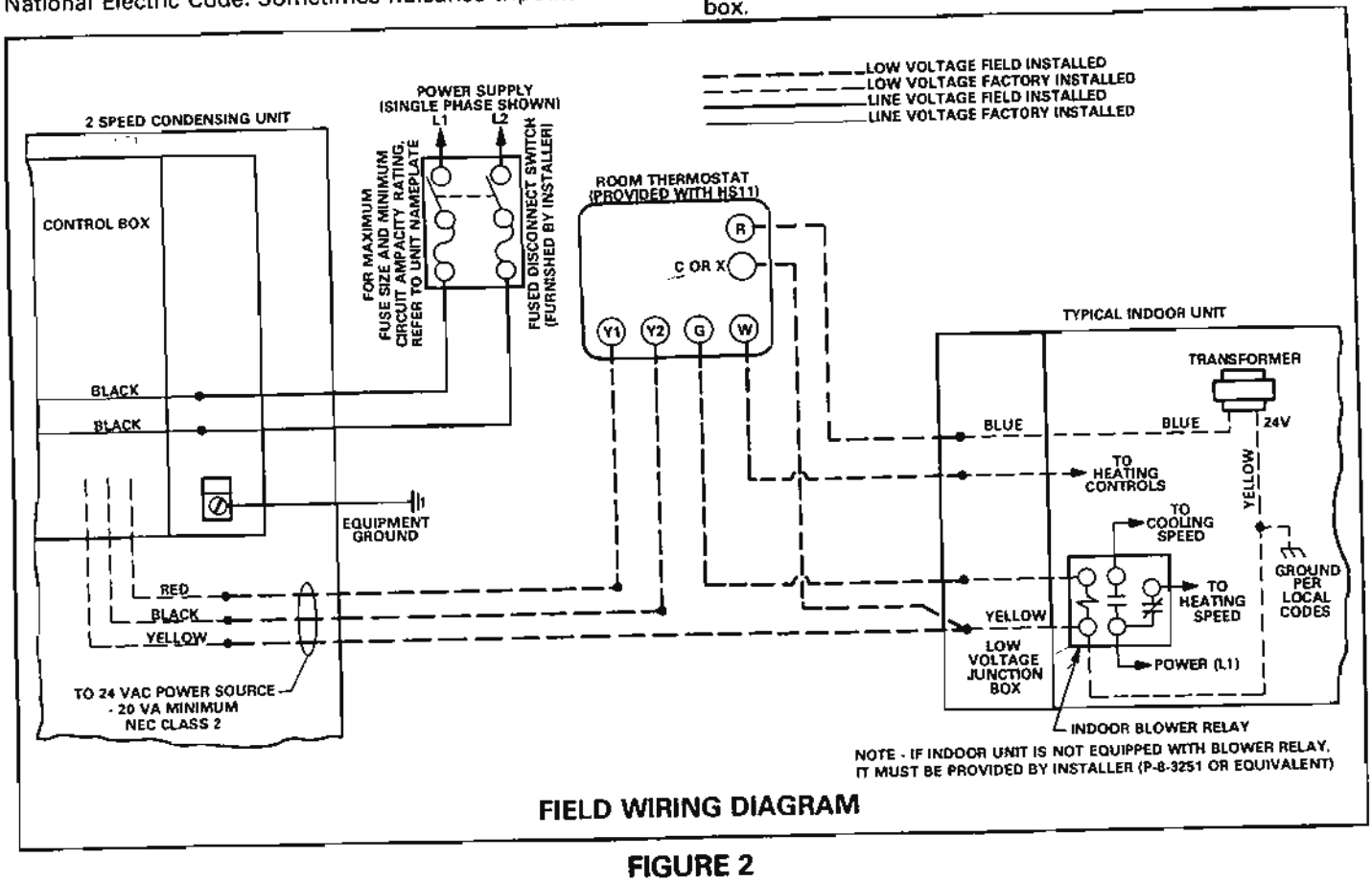


F - Typical Field Wiring Diagram (Figure 2)

High voltage pigtail leads are provided in the make-up area of control box for connection to power supply. A ground lug is also provided.

Note on unit wire sizing & fuse selection - Minimum circuit ampacity and maximum fuse size are listed on the unit nameplate (also on pg. 1 under 'Electrical Data' of this manual and in the Engineering Handbook). The unit supply wire size must be obtained from the appropriate Table 310 of the National Electric Code. Sometimes nuisance tripouts occur due to circuit breakers that may be in the branch circuit. This condition is usually encountered when the circuit breaker is sized to the equipment's minimum circuit ampacity (MCA) instead of the maximum fuse size. Lennox recommends using the maximum fuse size listed on the unit nameplate to assure maximum current-carrying capacity. A circuit breaker size from MCA is normally one or two sizes smaller than the maximum fuse size and is often marginal in carrying the normal starting current.

Low voltage connections are made just below the control box.



FIELD WIRING DIAGRAM

FIGURE 2

G - Optional Latent Load Discriminator (LB-34857BA)

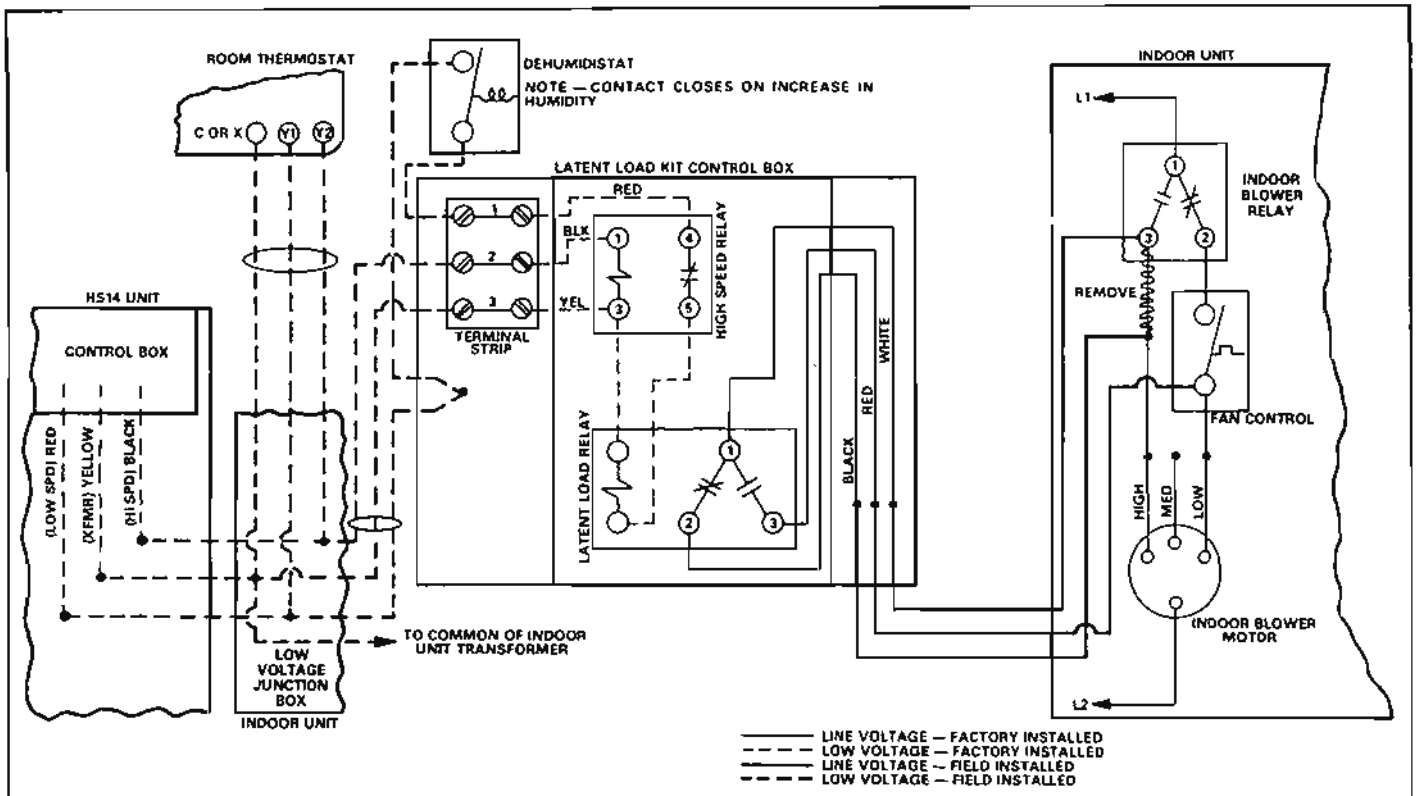
The optional Latent Load Discriminator Kit controls the speed of the indoor blower motor to obtain maximum dehumidification during low speed compressor operation. The kit has a dehumidistat which switches blower to low speed at high humidity conditions for latent cooling. During low humidity conditions, blower operates at high speed for maximum sensible cooling. The indoor blower motor automatically runs at high speed whenever compressor operates at high speed. Figure 3 shows the field wiring for the Latent Load Discriminator.

The dehumidistat mounts in the conditioned space. It is adjustable. The recommended setting is 50%.

With dehumidistat contacts closed (high humidity), the Latent Load Relay is energized through the N.C. contacts of the High Speed Relay. The blower motor runs at low speed.

With dehumidistat contacts open (low humidity), the Latent Load Relay is de-energized and the blower motor runs at high speed.

A high speed demand will energize the High Speed Relay to consequently de-energize the Latent Load Relay and run the blower motor at high speed.



LATENT LOAD DISCRIMINATOR KIT FIELD WIRING DIAGRAM

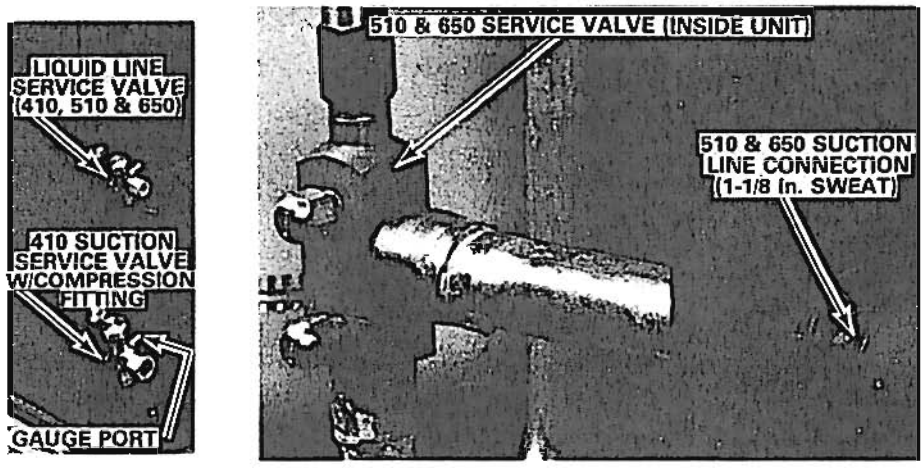
FIGURE 3

III - REFRIGERANT SYSTEM

The 410, 510 & 650 liquid line service valves and the 410 suction line valve are located outside the unit cabinet. They have side gauge ports. The liquid line valves require a 3/16 in. allen wrench and the suction line valves require a 5/16 in. allen wrench. The side gauge port is not shut off when the valve is backseated.

The suction line service valve on the 510 & 650 units is located inside the unit cabinet. A 3/16 in. hex socket wrench is required for the valve. This valve closes gauge port when backseated.

A port for the addition of a pressure switch is provided in the liquid line between the condenser coil and filter drier for a low ambient kit if needed. This port may also be used to monitor high pressure during a system pumpdown for repairs on low side. The high pressure during pumpdown must not exceed 410 psig.



SERVICE VALVES, GAUGE PORTS & LINE CONNECTIONS

IV - COMPONENTS

A - Control Box (Figure 4)

1 - Protection Module

The module connects to sensors within the compressor motor windings through S1 and S2. The module is supplied with 24 VAC at terminals P1 & P2. The compressor control circuit is connected to K1 & K2. If the sensors detect excessive winding temperatures, the module breaks power to the compressor control circuit.

2 - Current Limiting Device - RT (Single phase units only)

The current limiting device (RT) is a NTC thermistor (negative temperature coefficient - increase in temperature equals decrease in resistance). Resistance at 77°F = 5 ohms ± 10%.

When the compressor is shut off the potential relay drops out immediately. RT absorbs the current surge created when the potential relay contacts close and discharge the run capacitor(s). This prevents the relay contacts from welding.

3 - Transformer

208/230V primary/24V secondary - 70VA
3.2 Amp (type C) fuse on secondary

4 - Compressor Interlock

Prevents compressor fast cycling. The interlock provides a nominal 71 second time delay between cycles. Delay time may range from 60 to 96 seconds. The voltage input is 20 VAC min. to 30 VAC max. Reset time is 0.016 second max.

5 - Control Relays (K1 & K2)

Used in 24 volt control circuit for low and high speed compressor operation.

6 - Fan Relay (K3)

Used to control fan motor and crankcase heater. The relay energizes the heater when the unit is not operating.

7 - Compressor Contactor - Combination K4 (Low Speed) & K5 (High Speed)

The HS14 uses a special combination contactor with two coils: K5 with 5 poles and K4 with 3 poles. Two normally closed (N.C.) auxillary switches are integral to the contactor, one on the K4 side & one on the K5 side. The K4 & K5 sections are mounted on a common base plate and mechanically interlocked to prevent simultaneous operation.

The auxillary switches are used to electrically interlock the contactor coils also preventing simultaneous operation.

The electrical and mechanical interlocks protect against any condition that could attempt to energize both K4 & K5 together. This condition would result in a direct short across the line causing definite contactor and fuse or circuit breaker damage. In addition, power surges could be created possibly damaging the compressor motor windings.

8 - Time Delay (K7)

Provides time delay between compressor speeds to allow compressor to completely stop. The on time is 20 to 40 seconds and the off time is 30 to 50 seconds.

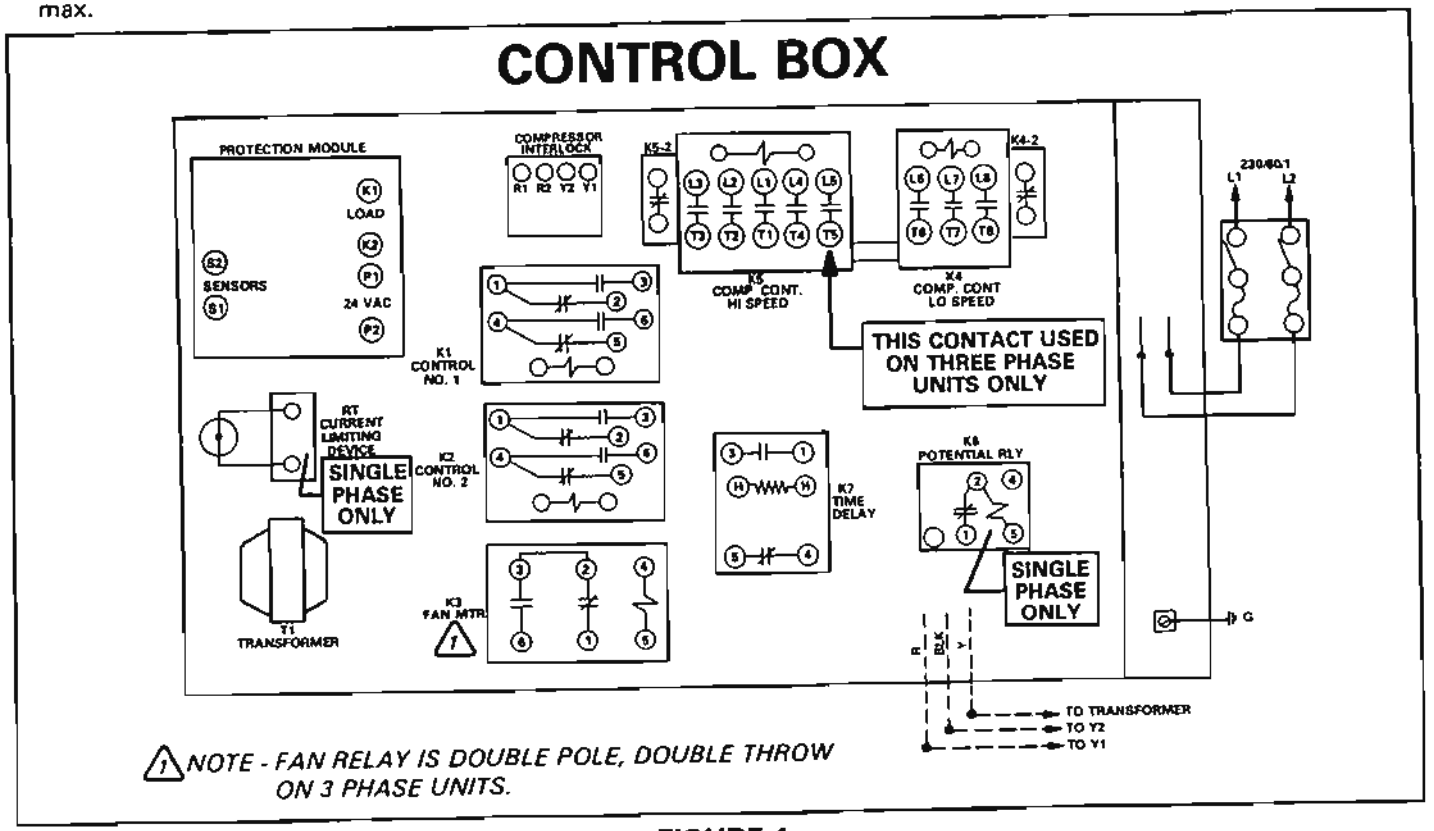


FIGURE 4

9 - Potential Relay (K3) (Single phase units only)
Used to disconnect the start capacitor from the circuit when the compressor reaches operating speed. The potential relays are matched specifically to each compressor size. See table for operating voltage.

HS14 Unit	Cold Coil Operating Voltages (VAC) Min. Pickup	Max. Pickup	Min. Dropout	Max. Dropout
411V	260	290	60	121
511V	239	268	80	130
651V	258	287	60	135

B - Compressor Compartment (Figure 5)

1 - High Pressure Switch (S1)
Switch is mounted in discharge line. This switch has a cutout pressure of 410 psig; reset 180 psig - Manual Reset.

2 - Low Pressure Switch (S2)
Switch is mounted in suction line. It has a cutout pressure of 25 psi ± 5 and an automatic cut in pressure of 55 psi ± 5.

3 - Crankcase Heater Thermostat (S6)
Thermostat opens at 101°F and closes at 81°F. De-energizes crankcase heater at temperatures above set-point.

4 - Fan Motor Capacitor (C1)
Condenser fan motor capacitors:
410 series - 3.75 mfd, 370 VAC
510 series - 5.0 mfd, 370 VAC
650 series - 10.0 mfd, 370 VAC

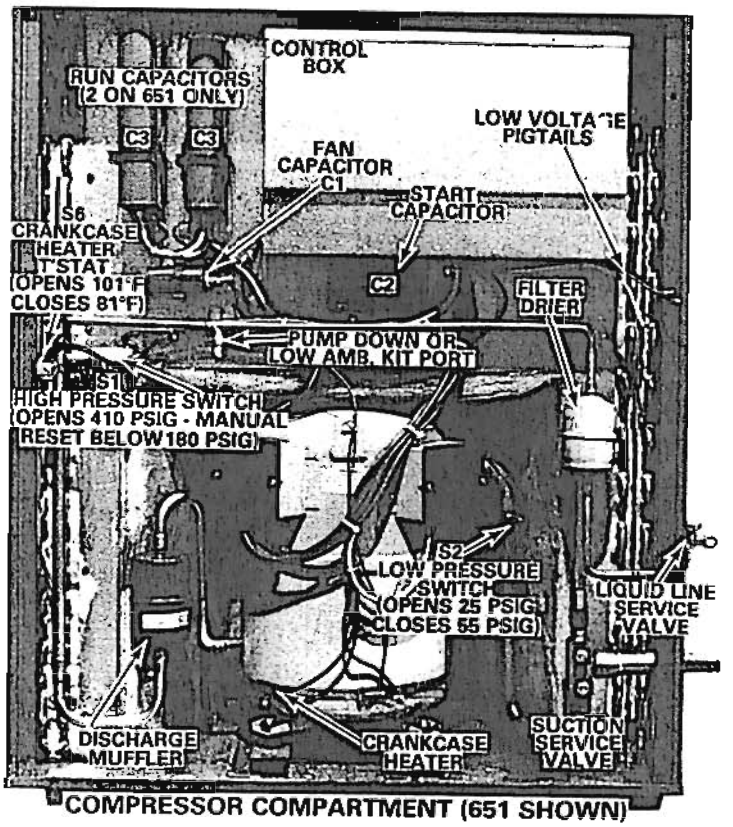
5 - Compressor Start Capacitor (C2) & Run Capacitor(s) (C3)
The start and run capacitors are matched specifically for each L7 single phase compressor motor. During starting the start and run capacitors are in parallel for increased capacity. Values are as follows:

411 Series:
Start - 145 - 175 mfd (330 VAC)
Run - 35 mfd (440 VAC)
Parallel Capacity - 180 - 210 mfd (330 VAC)

511 Series:
Start - 145 - 175 mfd (330 VAC)
Run - 45 mfd (440 VAC)
Parallel Capacity - 190 - 220 mfd (330 VAC)

651 Series:
Start - 176 - 216 mfd (320 VAC)
Run - 30 mfd (440 VAC)
Run - 25 mfd (440 VAC)
Parallel Capacity - 231 - 271 mfd (320 VAC)

Note - The 651 uses 2 run capacitors in parallel totaling 55 mfd.

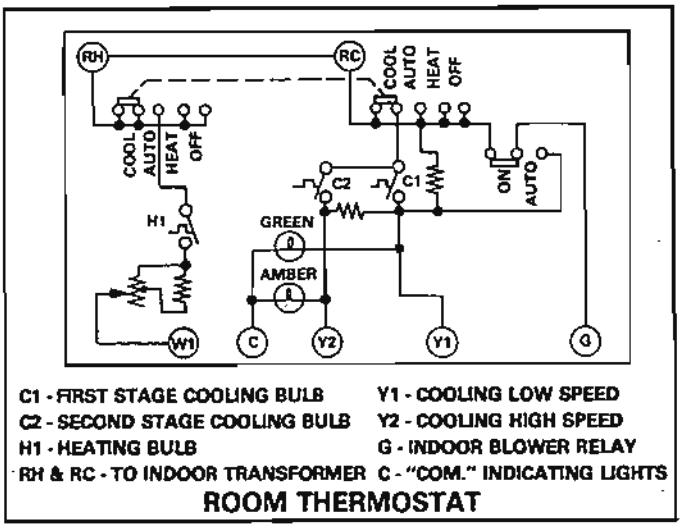


COMPRESSOR COMPARTMENT (651 SHOWN)

FIGURE 5

C - Room Thermostat (Figure 6)

HS14 units use a two stage cooling - single stage heating thermostat. Mode of operation indicator lights give visual readout of "Low" and "High" speed compressor operation. The green light comes on during low speed and the amber light comes on during high speed. Thermostat is equipped with a temperature setting dial, system selector switch (Off - Heat - Auto - Cool) and fan control switch (Auto - On). One additional wire is required for common side of indoor unit transformer to terminal C on thermostat for operation of the indicator lights.



C1 - FIRST STAGE COOLING BULB
C2 - SECOND STAGE COOLING BULB
H1 - HEATING BULB
RH & RC - TO INDOOR TRANSFORMER
Y1 - COOLING LOW SPEED
Y2 - COOLING HIGH SPEED
G - INDOOR BLOWER RELAY
C - "COM." INDICATING LIGHTS

ROOM THERMOSTAT

FIGURE 6

D - "L7" Compressor (Figure 7)

The "L7" has two electrical makeup boxes for connection to the motor winding terminals. One makeup box also contains the two terminals S1 & S2 for connection of the internal winding sensors to the protection module.

Each compressor has an external crankcase heater. The heater output is 50 watts at 240V with a resistance of 1150 ohms ± 10%.

Compressor Oil - Oils for use in the L7 compressors:

Texaco # WF68

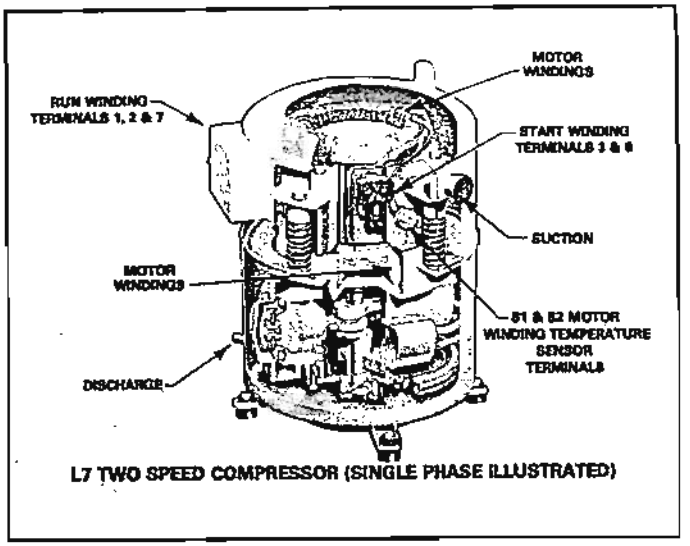
Suniso #4-GSD (Sun Oil Co.)

Amount: 3, 4 & 5 ton - 75 ounces.

1 - Single Phase "L7" Compressor (Figure 8)

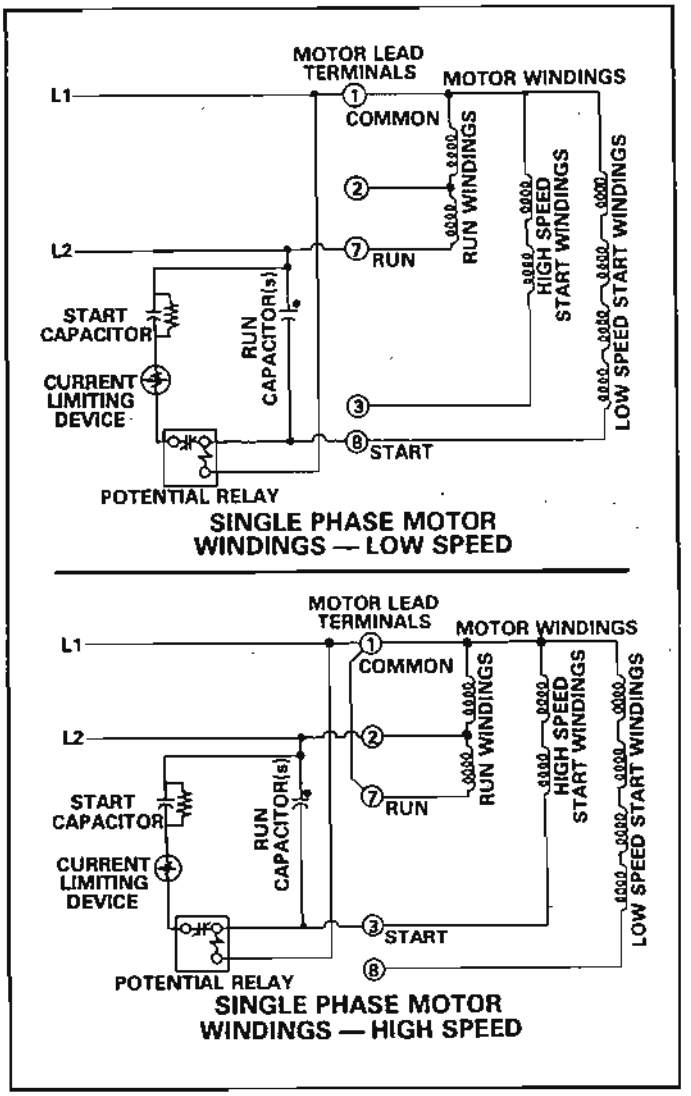
The single phase compressor has a two speed, capacitor start-capacitor run motor. For starting, the start and run capacitors are in parallel to provide the proper starting torque. The start capacitor is disconnected by the potential relay when the motor comes up to speed. The run capacitor remains connected to the start winding and the motor runs as a 2 phase induction motor with improved power factor and torque characteristics.

Low speed compressor motor operation is provided by powering the run windings (internally connected in **series**) from terminals 1 (common) & 7. The windings form a four pole motor operating at 1800 RPM. The four



L7 TWO SPEED COMPRESSOR (SINGLE PHASE ILLUSTRATED)

FIGURE 7



SINGLE PHASE MOTOR WINDINGS — LOW SPEED

SINGLE PHASE MOTOR WINDINGS — HIGH SPEED

FIGURE 8

1-888-4 Lennox

low speed start windings are in series and connected to terminals 1 (common) & 8. They are used with the start & run capacitors and potential relay to start and bring the motor up to speed.

High speed compressor motor operation is provided when the run windings are connected in **parallel**; terminals 1 (common) & 7 to L1 and terminal 2 to L2. The windings form a 2 pole motor operating at 3600 RPM. The two high speed start windings are in series and connected to terminals 1 (common) & 3.

2 - Three Phase "L7" Compressor (Figure 9)

This compressor has a two speed, 3 phase induction motor.

Low speed operation is provided when the motor windings are connected in a **series "Y"** circuit. This forms a four pole motor operating at 1800 RPM.

High speed operation is provided when the motor windings are connected in a **parallel "Y"** circuit. This forms a two pole motor operating at 3600 RPM.

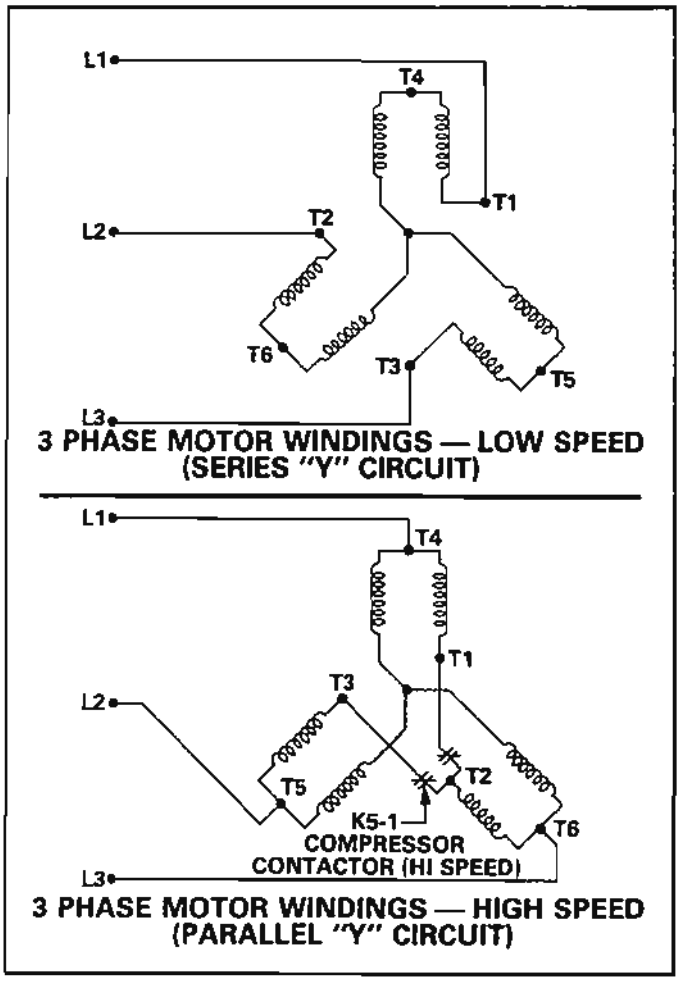
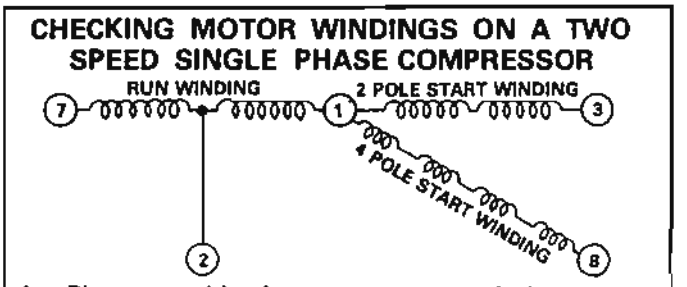


FIGURE 9

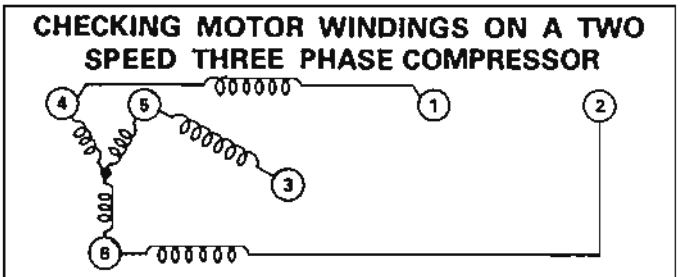
V - CHECKING L7 COMPRESSOR WINDINGS

Turn off power to unit and remove all wiring from compressor terminals. Using an ohm meter set on scale R x 10K, check windings for grounds and open circuits. Refer to Figures 10 and 11.



1 — Disconnect wiring from compressor terminals.
2 — Check for continuity from each terminal to ground. Continuity indicates a shorted winding and a defective compressor.
3 — Check for continuity from 7 to 3, 7 to 8 and 7 to 2. No continuity indicates an open winding and a defective compressor.

FIGURE 10



1 — Disconnect wiring from compressor terminals.
2 — Check for continuity from each terminal to ground. Continuity indictes a shorted winding and a defective compressor.
3 — Check for continuity from 1 to 3 and 1 to 2. No continuity indicates an open winding and a defective compressor.

FIGURE 11