

## HS16 SERIES CONDENSING UNITS (211, 261, 311, 410, 460, 510 & 650)

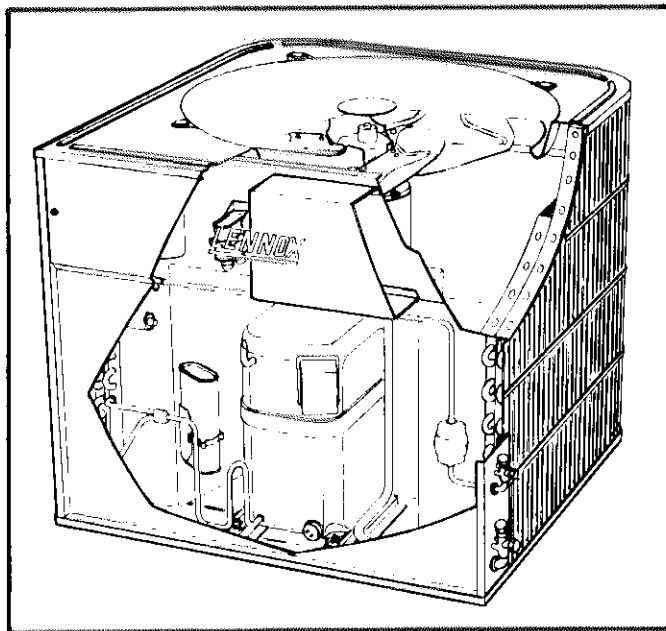
### I-INTRODUCTION

The HS16 was introduced in late 1980. It is a high efficiency unit in 7 sizes, 1-1/2 through 5 ton. The 1-1/2, 2 and 2-1/2 ton units are similar in appearance to the smaller HS9's, but do not have a compressor wrapper. The 3, 3-1/2, 4 and 5 ton units are in a new wider cabinet with compressor wrappers. Compressor wrappers are available to provide additional sound attenuation for the 1-1/2, 2 and 2-1/2 ton units in the form of a "Compressor Cover Kit LB-47552BA".

The HS16 applies to expansion valve systems only. Refer to the Engineering Handbook for expansion valve kit numbers and proper coil match-ups. The expansion valves have internal bleed ports so hard start kits are not necessarily needed.

Starting components are standard on the 3-1/2, 4 and 5 ton units. If a hard start kit is needed for the smaller units, refer to the "Cross Reference Section" of the Lennox Repair Parts for kit numbers.

A low ambient kit (LB-50352BA) allows unit operation from 35°F down to 0°F. A timed off control (Part No. LB-50603BA) is available to prevent short cycling.



### II - UNIT INFORMATION

#### A - Specifications

Model No.			HS16-211V	HS16-261V	HS16-311V	HS16-411V HS16-413V	HS16-461V HS16-463V	HS16-511V HS16-513V	HS16-651V HS16-653V
Condenser Coil	Net face area (sq. ft.)	Outer coil	11.8	11.8	11.8	15.66	15.66	15.66	18.51
		Inner coil	---	2.23	7.80	4.07	8.14	14.94	17.65
	Tube diameter (in.) & No. of rows		3/8 — 1	3/8 — 1.19	3/8 — 1.66	3/8 — 1.26	3/8 — 1.52	3/8 — 2	3/8 — 2
	Fins per inch		20	20	20	20	20	20	20
Condenser Fan	Diameter (in.) & No. of blades		20 — 4	20 — 4	20 — 4	24 — 3	24 — 3	24 — 3	24 — 4
	Motor hp		1/4	1/4	1/4	1/6	1/6	1/6	1/4
	Cfm (factory setting)		3100	3000	3000	3400	3200	2940	4300
	Rpm (factory setting)		1060	1060	1060	820	820	820	820
	Watts (factory setting)		260	270	290	215	200	205	440
**Refrigerant — 22 charge furnished			4 lbs.-8 oz.	6 lbs.-3 oz.	7 lbs.-0 oz.	6 lbs.-9 oz.	7 lbs.-0 oz.	9 lbs.-10 oz.	10 lbs.-0 oz.
Liquid line (o.d. in.) connection (compression)			3/8	3/8	3/8	3/8	3/8	3/8	3/8
Suction line (o.d. in.) connection (compression)			5/8	5/8	3/4	3/4	7/8	7/8	1-1/8 (sweat)
Shipping weight (lbs.) — 1 Package			190	198	214	250	265	275	330

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

#### B - Electrical Data

Model No.		HS16-211V	HS16-261V	HS16-311V	HS16-411V	HS16-413V
Line voltage data		208/230v 60hz/1ph	208/230v 60hz/1ph	208/230v 60hz/1ph	208/230v 60hz/1ph	208/230v 60hz/3ph
Compressor	Rated load amps	9.6	11.5	15.3	17.6	11.8
	Power factor	.98	.98	.98	.98	.88
	Locked rotor amps	48.0	54.0	69.0	87.0	70.0
Condenser Coil	Full load amps	1.3	1.3	1.3	1.0	1.0
Fan Motor	Locked rotor amps	1.4	1.4	1.4	1.2	1.2
Recommended maximum fuse size (amps)		20.0	25.0	35	40.0	25.0
*Minimum circuit ampacity		13.7	16.0	20.8	23.6	15.3

\*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.

## B - Electrical Data

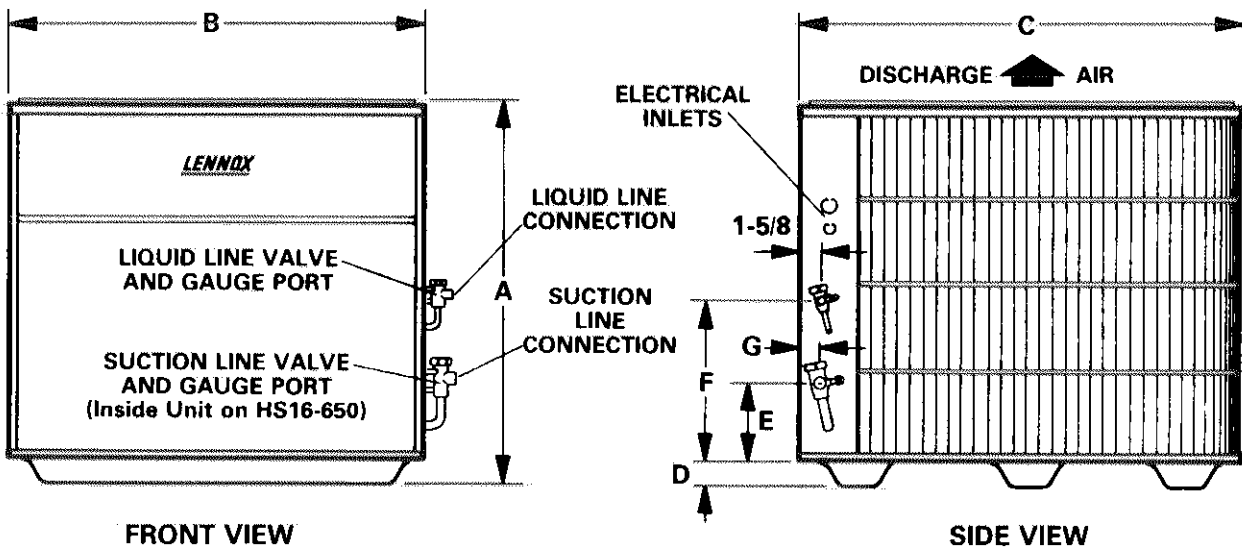
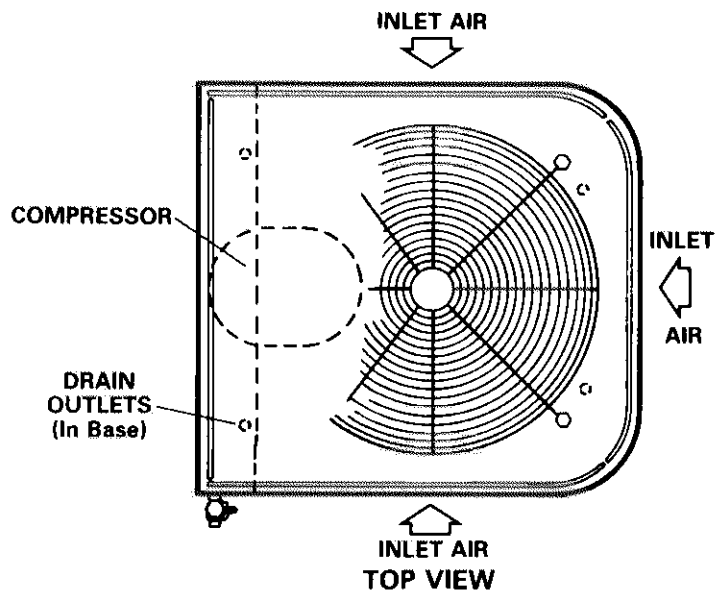
Model No.		HS16-461V	HS16-463V	HS16-511V	HS16-513V	HS16-651V	HS16-653V	
Line voltage data		208/230v	208/230v	208/230v	208/230v	208/230v	208/230v	460v
		60hz/1ph.	60hz/3ph	60hz/1ph	60hz/3ph	60hz/1ph	60hz/3ph	60hz/3ph
Compressor	Rated load amps	20.0	12.8	23.7	15.0	28.8	17.3	8.9
	Power factor	.97	.88	.98	.88	.98	.88	.88
	Locked rotor amps	110.0	78.0	114.0	84.0	139.0	104.0	52.0
Condenser Coil	Full load amps	1.0	1.0	1.0	1.0	2.2	2.2	1.1
Fan Motor	Locked rotor amps	1.2	1.2	1.2	1.2	2.2	2.2	1.1
Recommended maximum fuse size (amps)		45.0	30.0	50.0	35.0	60.0	40.0	20.0
*Minimum circuit ampacity		26.3	17.3	30.9	20.1	38.3	23.9	12.3

\*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.

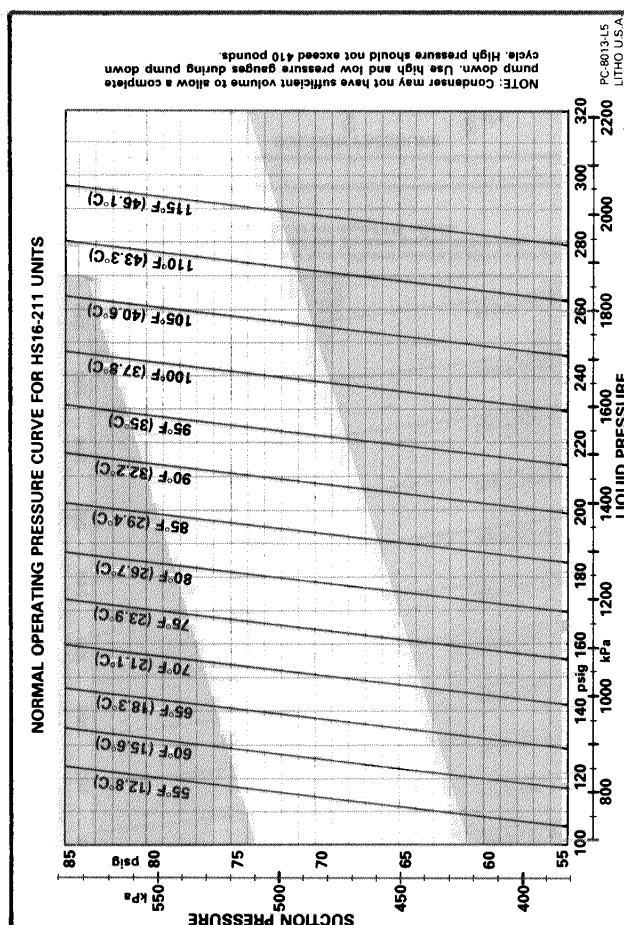
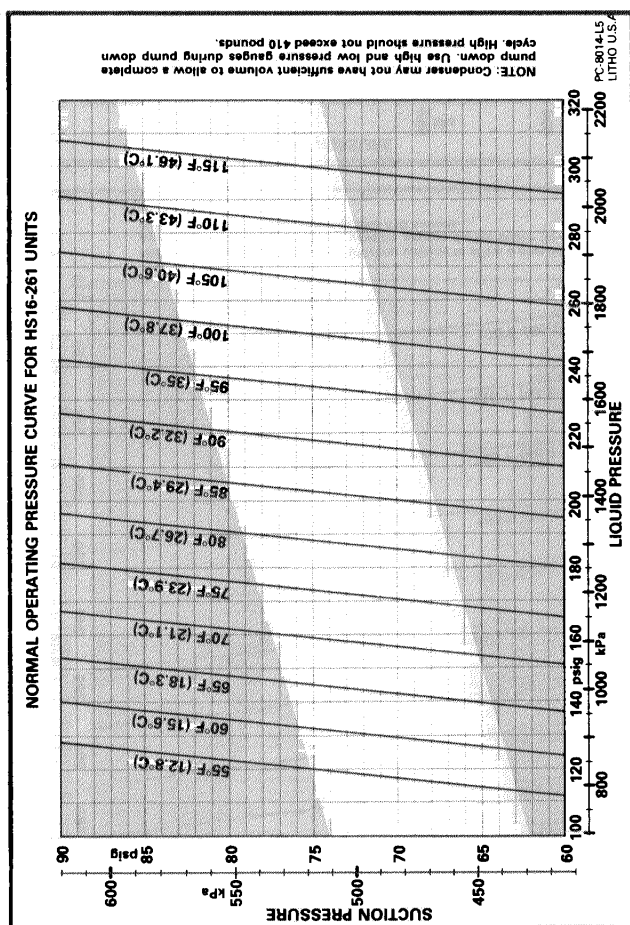
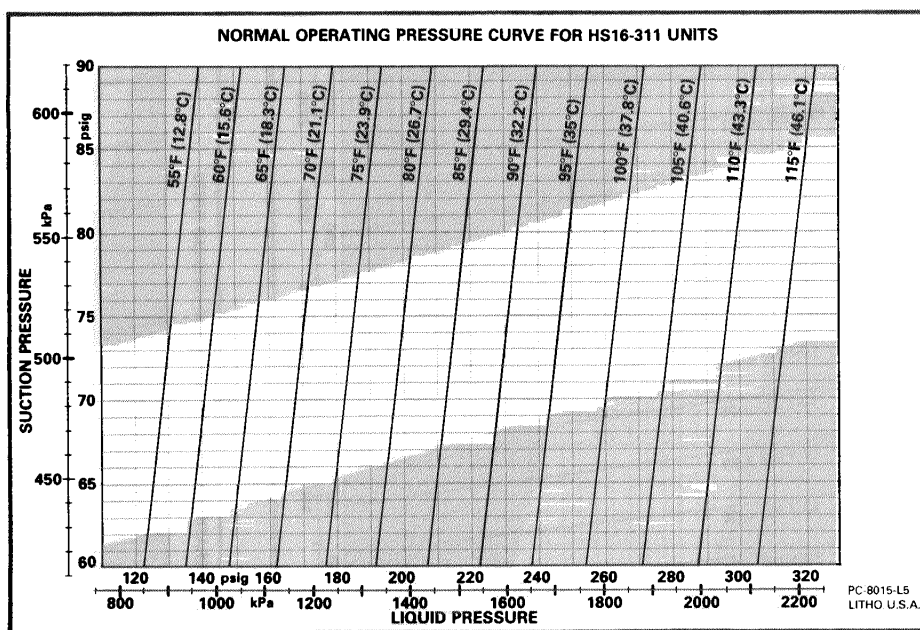
## C - Unit Dimensions

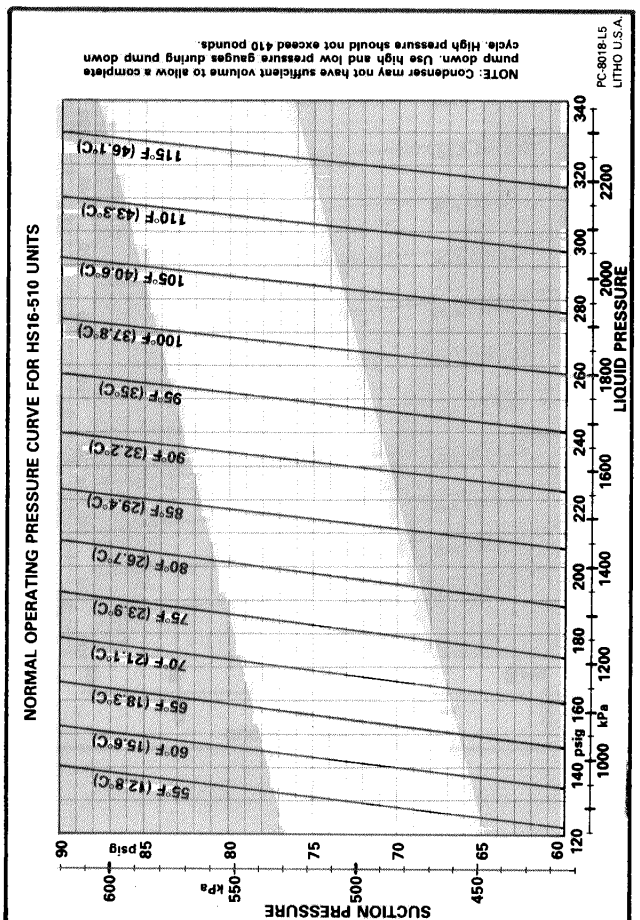
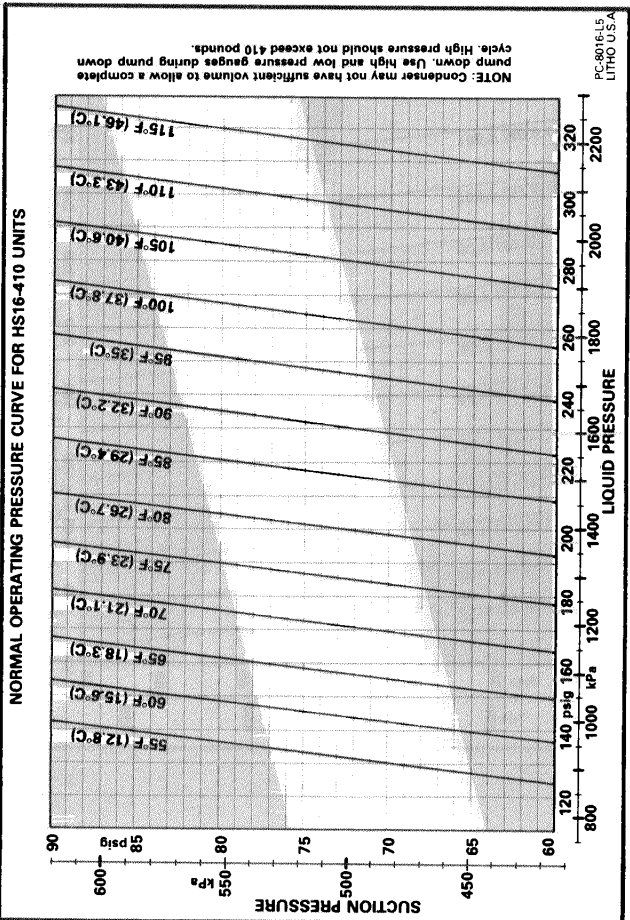
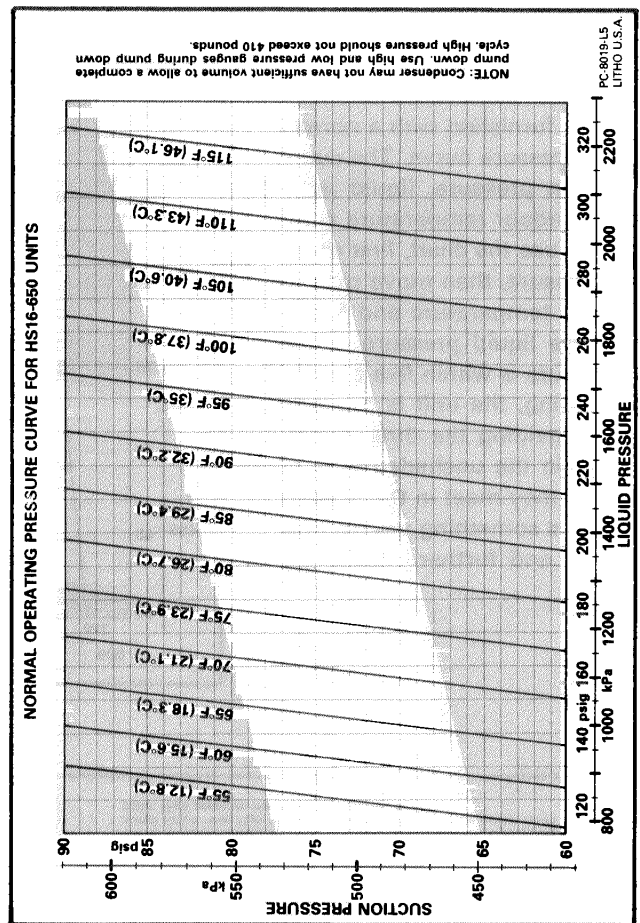
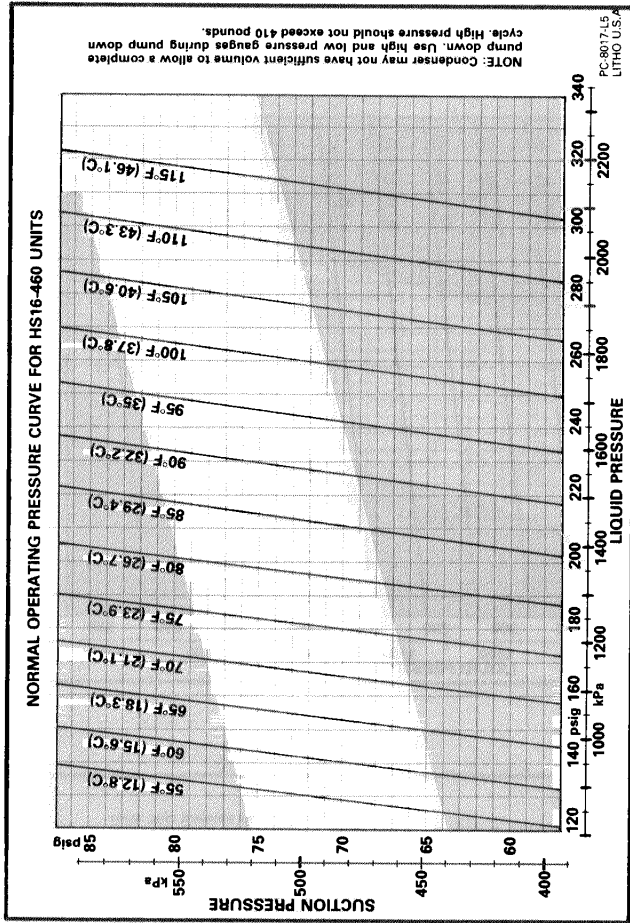
Model No.	A	B	C	D	E	F	G
HS16-211V							
HS16-261V	26 1/2	25-7/8	29-7/8	3/4	4-1/4	11 1/4	1-7/16
HS16-311V							
HS16-410V							
HS16-460V	29-1/2	32-1/8	34-1/16	1-3/4	4-1/2	11 1/4	1 1/2
HS16-510V							
HS16-650V	34-1/2	32-1/8	34-1/16	1-3/4	5-7/8	12	2-1/16



## D - 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.





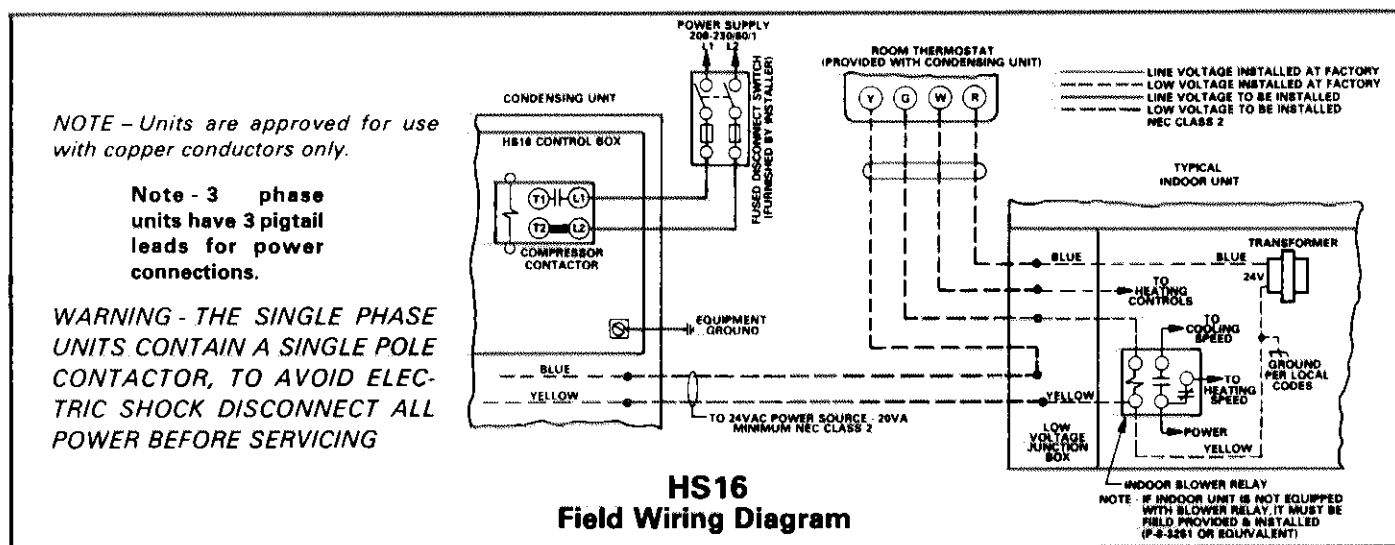
## E - Typical Field Wiring

**High voltage** field wiring connects directly to the compressor contactor terminals L1 & L2 on the single phase units. The three phase units have 3 black pigtail leads for wire nut connections to the power source.

**Note on unit wire size & 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

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** field wiring connects to the pigtail leads just below the control box.



## III - REFRIGERANT SYSTEM

### A - Service Valves

The liquid and suction line service valves are accessible from outside the unit cabinet, except for the 650 suction line valve.

All of the external service valves 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, but it does contain a valve core.

The suction line valve on the 650 units (inside cabinet) requires a 3/16 in. hex socket wrench. This valve closes gauge

port when backseated. Ports contain valve cores.

Refer to 'SPECIFICATIONS' on Page 1 for liquid and suction line sizes.

### B - Liquid Line Port

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.*

## IV - COMPONENTS

### A - Control Box (Figure 1)

#### 1 - Compressor Contactor

The 3 phase units use a 3 pole N.O. contactor with a 24 volt coil to operate compressor and condenser fan.

The single phase units use a 1 pole N.O. contactor with a 24 volt coil to operate compressor and condenser fan.

**CAUTION:** The single pole contactor on 208-230V single phase units, although not new to the industry, is new to Lennox condensing units. With the disconnect closed, the L2 line side is 'hot' throughout the unit. **TO AVOID ELECTRIC SHOCK, DISCONNECT ALL POWER TO UNIT BEFORE SERVICING.**

## HS16

**NOTE - TIMED OFF CONTROL LOCATED IN CONTROL BOX, WHEN USED.**

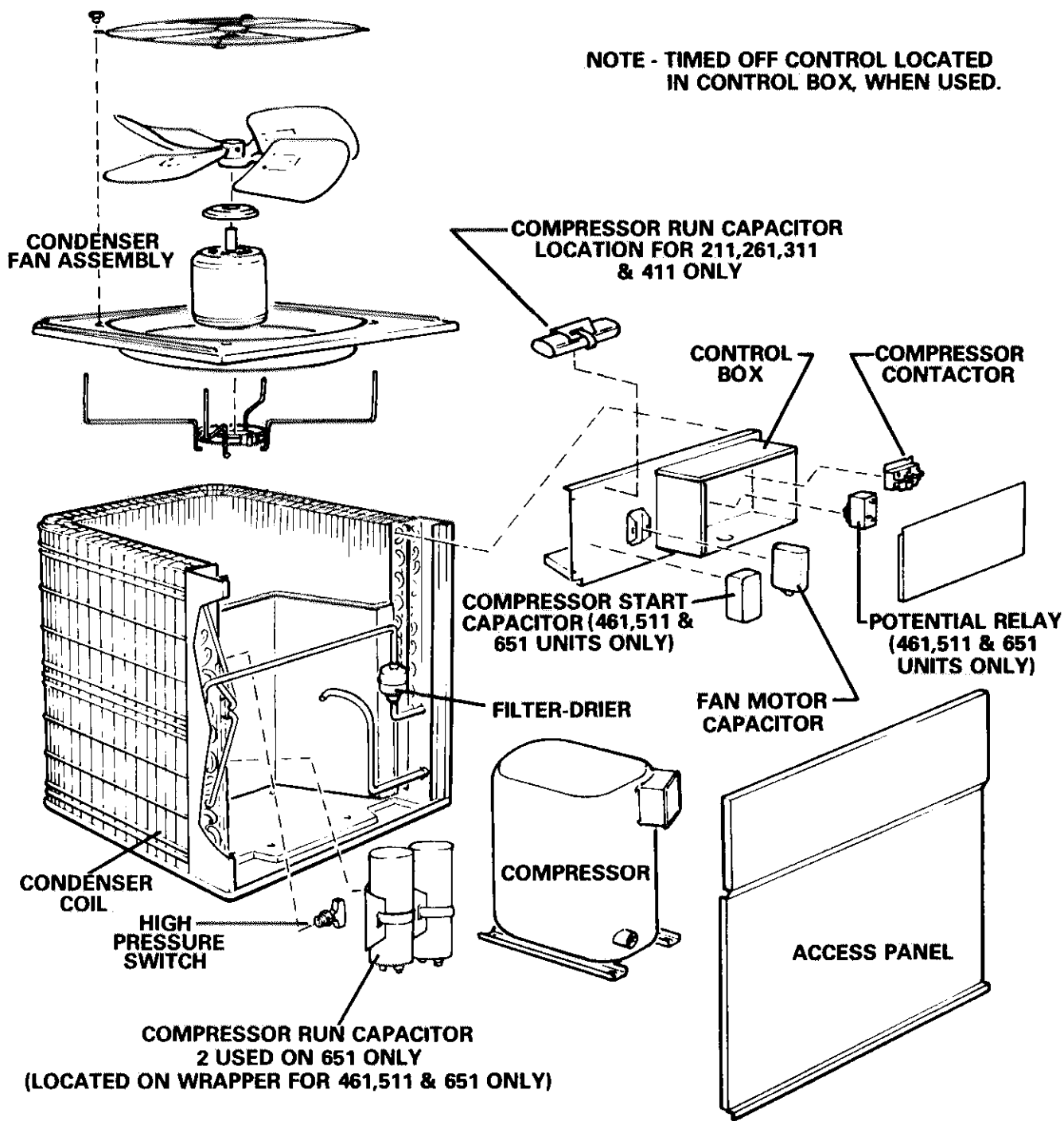


FIGURE 1

## 2 - Timed Off Control (Optional)

Prevents compressor fast cycling. The control provides a nominal 5 minutes time delay between cycles. Delay time may range from 4.25 to 6.75 minutes. The voltage input is 20 VAC min. to 30 VAC max. Reset time is 0.016 second max.

## 3 - Potential Relay (461,511 & 651 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.

## B - Compressor Compartment (Figure 3)

### 1 - High Pressure Switch

Switch is located on a condenser coil return bend and cuts out at 410 psig. Must be manually reset below 180 psig.

### 2 - Fan Motor Capacitor

Condenser fan motor capacitors: (located next to control box)

**211,261,311 & 650 Series** - 7 mfd, 370 VAC

**410,460 & 510 Series** - 5 mfd, 370 VAC

### 3 - Compressor Run Capacitor - 211,261,311 & 411

The compressor run capacitor on these units is located above the fan motor capacitor. Values are as follows:

**211 Units** - 25 mfd, 370 VAC

**261 Units** - 30 mfd, 370 VAC

**311 Units** - 35 mfd, 370 VAC

**411 Units** - 40 mfd, 370 VAC

### 4 - Compressor Start & Run Capacitor(s) - 461, 511 & 651

The start capacitor is located next to the fan motor capacitor. Run capacitors are located on the compressor wrapper.

The start and run capacitors are matched specifically for each compressor. During starting the start and run capacitors are in parallel for increased capacitance. Values are as follows:

#### 461 Units:

Start - 135 - 155 mfd (320 VAC)

Run - 40 mfd (440 VAC)

Parallel Capacitance - 175 - 190 mfd (320 VAC)

#### 511 Units:

Start - 176 - 216 mfd (320 VAC)

Run - 40 mfd (440 VAC)

Parallel Capacitance - 216 - 256 mfd (320 VAC)

#### 651 Units:

Start - 135 - 155 mfd (320 VAC)

Run - 40 mfd (440 VAC)

Run - 25 mfd (370 VAC)

Parallel Capacitance - 200 - 220 mfd (320 VAC)

Note - The 651 uses 2 run capacitors in parallel totaling 65 mfd.

## 5 - Compressor

The compressors in the HS16 series all incorporate internal line break overloads and internal pressure relief valve. The relief valve for the 211,261,311,510 & 650 unit compressors opens at a discharge and suction differential of 450 psig  $\pm$  50. The relief valve for the 410 & 460 compressors opens at a differential of 500 psig  $\pm$  50.

The 211,261,311 & 510 series units use Copeland compressors and the 410,460 & 650 series units use Bristol compressors.

Compressor oil requirements:

**211,261 & 311** - 55 ounces mineral oil, viscosity 190-210

**410 & 460** - 50 ounces Suniso 3GS

**511** - 60 ounces - mineral oil, viscosity 190-210

**513** - 60 ounces - heat pump grade mineral oil, viscosity 190-210

**650** - 55 ounces - Suniso 3GS

All of the Copeland & Bristol compressors in the HS16 series have internal self regulating crankcase heaters.

Crankcase Heater Ratings:

**211,261,311,510** - 40 watts - 230/265 VAC

**410 & 460** - 30 watts - 230 VAC

**(208/230V) 650** - 40 watts - 230/265 VAC

**(460V) 653** - 40 watts - 460 VAC

## C - Condenser Coil Compartment

The unit utilizes a draw through coil with vertical discharge. Fan motor is prelubricated for an extended period of operation. Some units employ ball bearing motors which need no further lubrication. Check motor for the particular lubrication requirements. For fan service access, remove the fan guard. The motor has a rain shield for protection from moisture. Figure 2 illustrates the condenser fan and motor assembly.

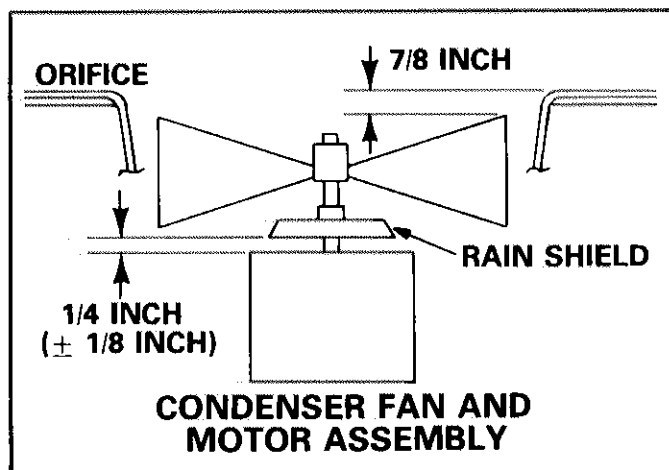


FIGURE 2



## V - SEQUENCE OF OPERATION

Each of the steps within this section are labeled in the diagram.

- 1 - Thermostat closes on a temperature rise to initiate a cooling demand through R1-Y1.
- 2 - Through thermostat switch (set to 'cool') and fan switch (set to 'auto') the blower relay is energized.
- 3 - The blower relay N.O. contacts close to energize the blower motor through the cooling speed tap.
- 4 - When the thermostat closes it also completes a circuit through the high pressure switch & timed off control R1-Y1 (if used) to energize the compressor contactor coil.
- 5 - The compressor contactor contacts close to energize the compressor motor. On 461, 511 & 651 single phase units,

the start capacitor is connected in parallel with the run capacitor(s) through the potential relay N.C. contacts. When the compressor comes up to speed the potential relay coil is energized opening its' N.C. contacts to disconnect the start capacitor from the circuit.

- 6 - The compressor contactor also powers the condenser fan motor.
- 7 - When the demand is satisfied the thermostat contacts R1-Y1 open dropping out the compressor contactor. Note - If a timed-off control is used the compressor contactor is locked out for 5 minutes after the off cycle.
- 8 - The crankcase heater is self-regulating, in response to temperature, and is energized anytime the external disconnect is in the 'ON' position.

