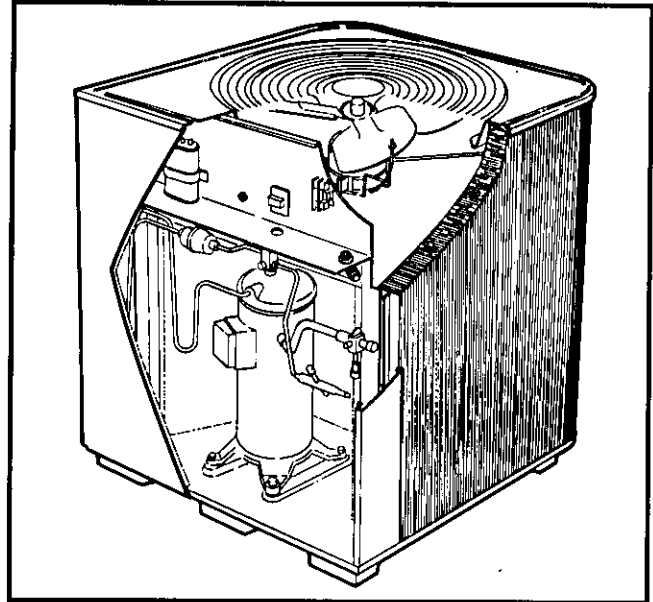


HS22 SERIES UNITS

The HS22 is a high efficiency residential split-system condensing unit which features a scroll compressor. It operates much like a standard condensing unit, but the HS22's scroll compressor is unique in the way that it compresses refrigerant. Several models are available in sizes ranging from 1-1/2 through 3-1/2 tons. The series is designed for use with an expansion valve in the indoor unit.



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

All specifications in this manual are subject to change.

SPECIFICATIONS

Model No.		HS22-211V	HS22-261V	HS22-311V	HS22-411V	HS22-461V
Outdoor Coil	Face area (sq.ft.) inside / outside	---/11.8	5.4/11.8	5.5/15.9	5.5/15.9	8.8/15.9
	Tube diameter (in.)	3/8	3/8	3/8	3/8	3/8
	No. of Rows	1.0	1.48	1.36	1.36	1.57
	Fins per inch	20	20	20	20	20
Condenser Fan	Diameter (in.)	20	20	24	24	24
	No. of Blades	4	4	3	3	3
	Motor hp	1/6	1/6	1/6	1/6	1/6
	Cfm	2600	2450	3150	3150	3100
	RPM	820	820	820	820	820
	Watts	200	210	215	210	205
Refrigerant-22 (charge furnished)		6lbs. 2oz.	6lbs. 8oz.	8lbs. 1oz.	8lbs. 1oz.	8lbs. 5oz.
Liquid line connection		3/8	3/8	3/8	3/8	3/8
Suction line connection		5/8	3/4	3/4	3/4	7/8

ELECTRICAL DATA

Model No.		HS22-211	HS22-261	HS22-311	HS22-411	HS22-461
Line voltage data - 60hz./1 phase		208/230V	208/230V	208/230V	208/230V	208/230V
Compressor	Rated load amps	9.7	11.6	13.5	18.0	20
	Power factor	.96	.96	.96	.96	.97
	Locked rotor amps	50.0	62.5	76.0	90.5	107
Condenser Fan Motor	Full load amps	1.1	1.1	1.1	1.1	1.1
	Locked rotor amps	2.0	2.0	2.0	2.0	2.0
Max fuse or c.b. size (amps)		20	25	30	40	45
*Minimum circuit ampacity		13.3	15.6	18.0	23.6	26.1

*Refer to National Electrical Code Manual to determine wire, fuse and disconnect size requirements.

NOTE - Extremes of operating range are plus 10% and minus 5% of line voltage

I-APPLICATION

All major components (indoor blower/coil) must be matched according to Lennox recommendations for the compressor to be covered under warranty. Refer to the Engineering Handbook for approved system matchups. A misapplied system will cause erratic operation and can result in early compressor failure.

II-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 2. The scrolls are located in the top of the compressor can and the motor is located just below. The oil level is immediately below the motor.

The scroll is a simple compression concept centered around the unique spiral shape of the scroll and its inherent properties. Figure 1 shows the basic scroll form. Two identical scrolls are mated together forming concentric spiral shapes (figure 3). One scroll remains stationary, while the other is allowed to "orbit" (figure 4). Note that the orbiting scroll does not rotate or turn but merely "orbits" the stationary scroll.

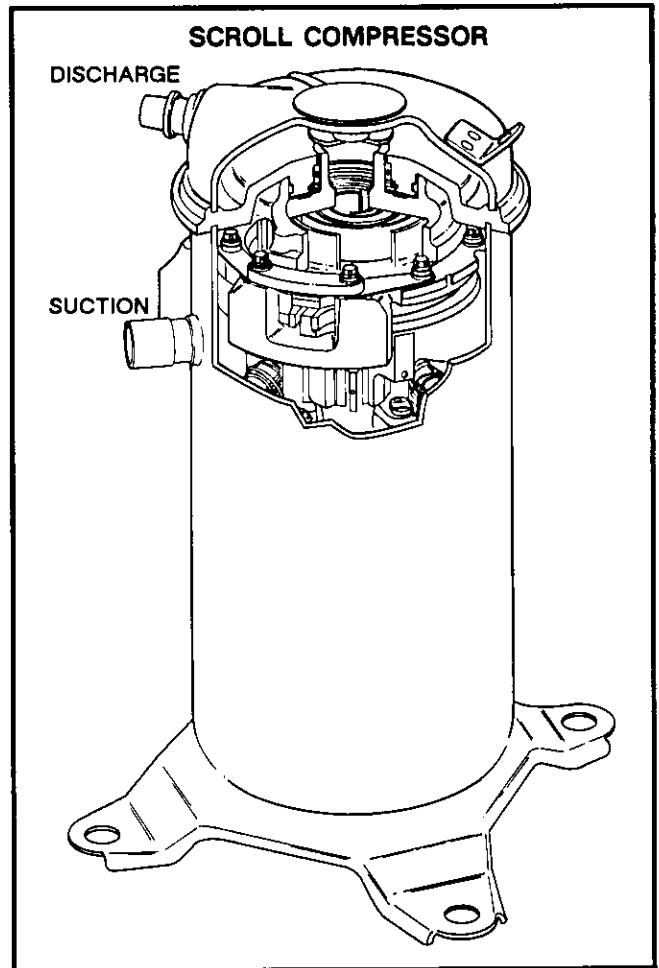


FIGURE 2

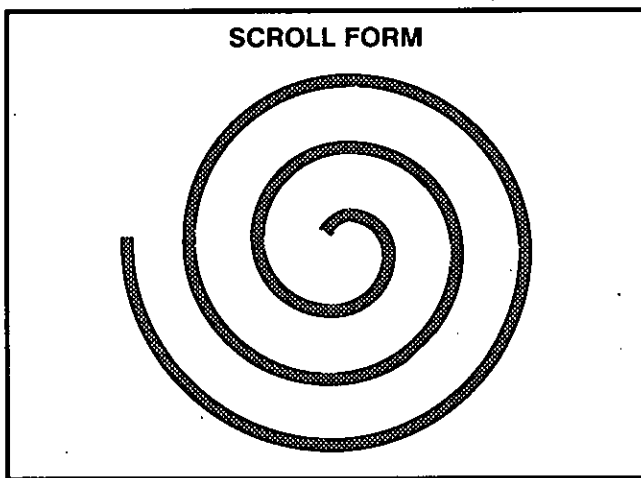


FIGURE 1

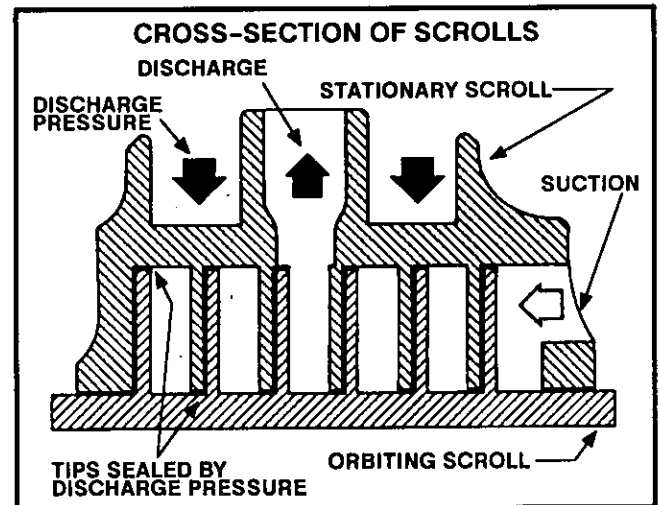


FIGURE 3

The counterclockwise orbiting scroll draws gas into the outer crescent shaped gas pocket created by the two scrolls (figure 4 - 1). The centrifugal action of the orbiting scroll seals off the flanks of the scrolls (figure 4 - 2). As the orbiting motion continues, the gas is forced toward the center of the scroll and the gas pocket becomes compressed (figure 4 - 3). When the compressed gas reaches the center, it is discharged vertically into a chamber and discharge port in the top of the compressor (figure 2). The discharge pressure forcing down on the top scroll helps seal off the upper and lower edges (tips) of the scrolls (figure 3). During a single orbit, several pockets of gas are compressed simultaneously providing smooth continuous compression.

The scroll compressor is tolerant to the effects of liquid return. If liquid enters the scrolls, the orbiting scroll is al-

lowed to separate from the stationary scroll. The liquid is worked toward the center of the scroll and is discharged. If the compressor is replaced, conventional Lennox cleanup practices must be used.

Due to its efficiency, the scroll compressor is capable of drawing a much deeper vacuum than reciprocating compressors. Deep vacuum operation can cause internal fuse arcing resulting in damaged internal parts and will result in compressor failure. Never use a scroll compressor for evacuating or "pumping-down" the system. This type of damage can be detected and will result in denial of warranty claims.

NOTE - During operation, the head of a scroll compressor may be hot since it is in constant contact with discharge gas.

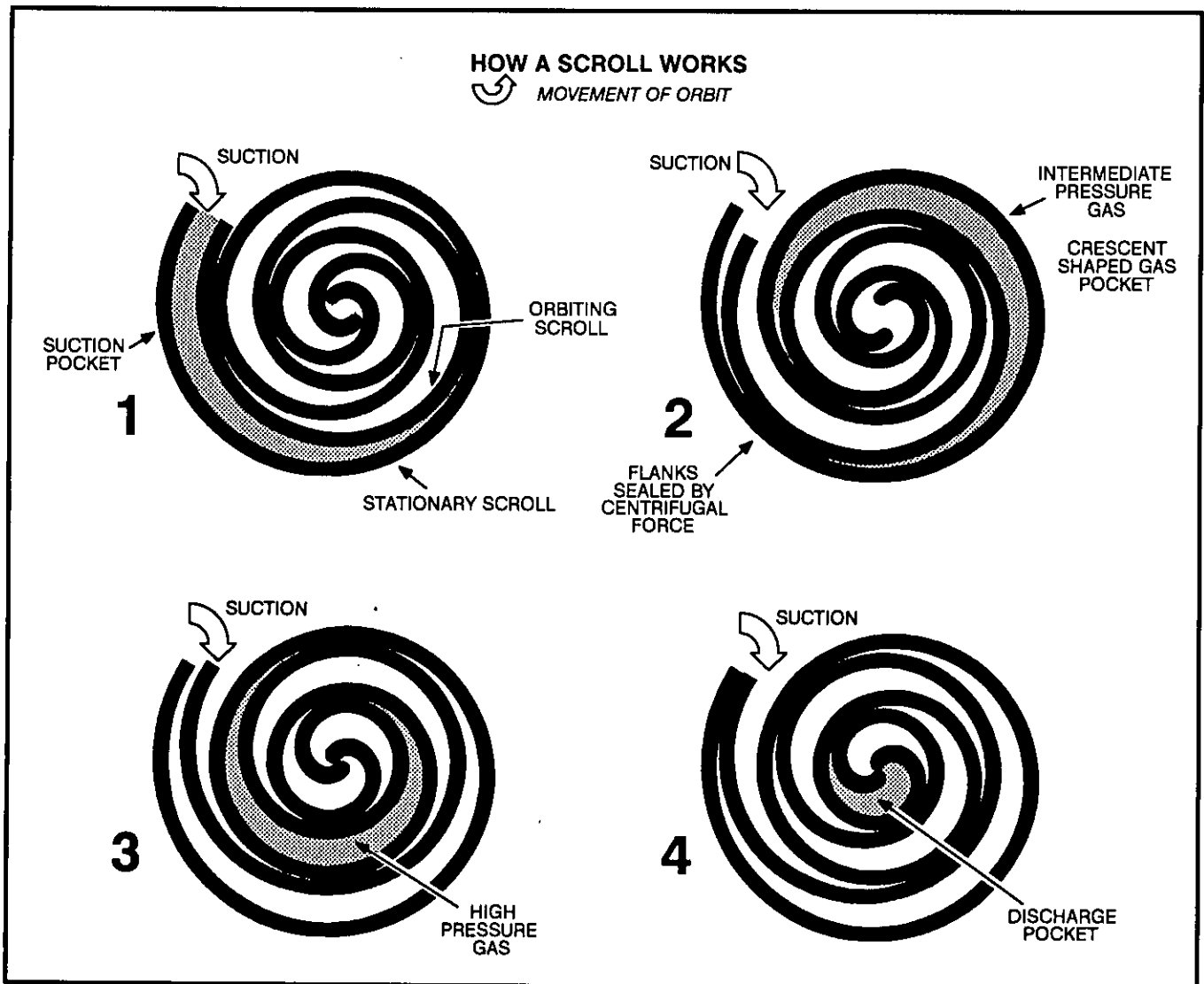


FIGURE 4

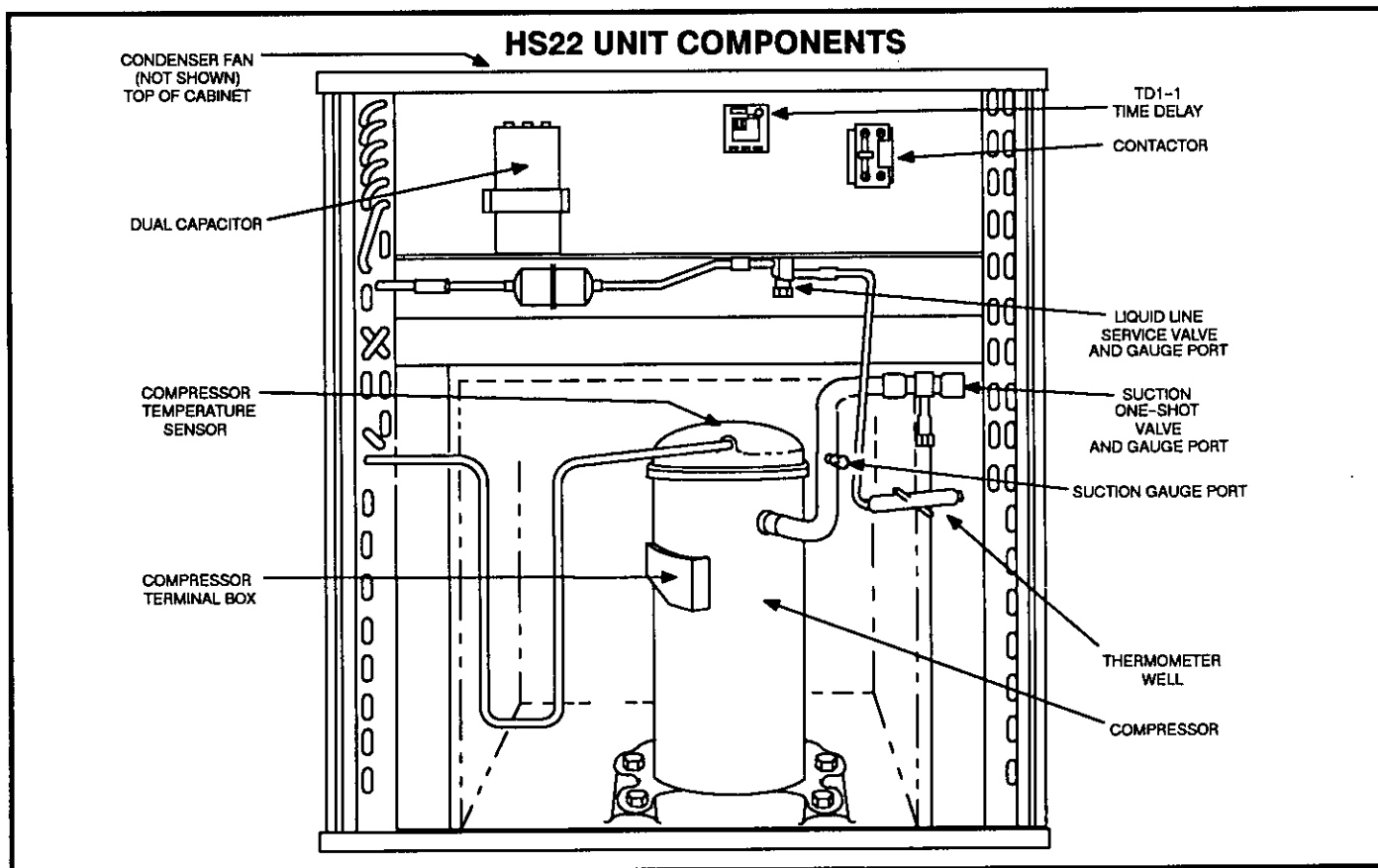


FIGURE 5

III-UNIT COMPONENTS

A-Transformer

The contactor coil, time delay and temperature sensor are all energized by 24VAC supplied by the indoor unit. All other controls in the outdoor unit are powered by line voltage. Refer to unit wiring diagram. The HS22 is not equipped with an internal line voltage to 24V transformer.

B-Contactor

The compressor is energized by a contactor located in the control box. All units use SPST contactors. The contactor is energized by indoor thermostat terminal Y when thermostat demand is present.

WARNING - ALL HS22 UNITS USE SINGLE-POLE CONTACTORS. ONE LEG OF COMPRESSOR, CAPACITOR AND CONDENSER FAN ARE CONNECTED TO LINE VOLTAGE AT ALL TIMES. POTENTIAL EXISTS FOR ELECTRICAL SHOCK RESULTING IN INJURY OR DEATH. REMOVE ALL POWER AT DISCONNECT BEFORE SERVICING.

C-TD1-1 Time Delay

Each HS22 is equipped with a Lennox built TD1-1 time delay located in the control box (figure 5). The time delay is electrically connected between thermostat terminal Y and the compressor contactor. On initial thermostat demand, the compressor contactor is delayed for 8.5 seconds. At the end of the delay, the compressor is allowed to energize. When thermostat demand is satisfied, the time delay opens the circuit to the compressor contactor coil and the compressor is de-energized.

The time delay performs no other functions. Without the delay it would be possible to short cycle the compressor. A scroll compressor, when short cycled, can run backward if head pressure is still high. It does not harm a scroll compressor to run backward, but it could cause a nuisance trip-out of safety limits (internal overload). For this reason, if a TD1-1 delay should fail, it must be replaced. Do not bypass the control.

DANGER - DO NOT ATTEMPT TO REPAIR THIS CONTROL. UNSAFE OPERATION WILL RESULT. IF THE CONTROL IS FOUND TO BE INOPERATIVE, SIMPLY REPLACE THE ENTIRE CONTROL.

D-Compressor

Table 1 shows the specifications of compressors used in HS22 series units.

TABLE 1

Unit	Phase	LRA	RLA	Oil fl.oz.
HS22-211	1	50.0	9.7	24*
HS22-261	1	62.5	11.6	28*
HS22-311	1	76.0	13.5	28*
HS22-411	1	90.5	18.0	34*
HS22-461	1	107	20.0	38*

*Shipped with conventional white oil (Sontex 200LT). 3GS oil may be used if additional oil is required.

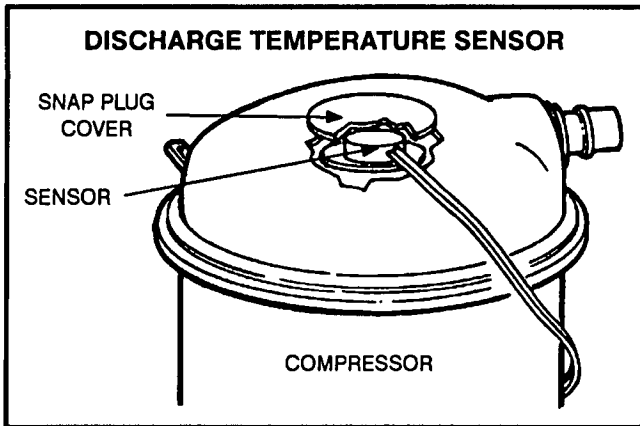


FIGURE 6

E-Temperature Sensor

Each scroll compressor is equipped with a temperature sensor located on the outside top of the compressor. The sensor is a SPST thermostat which opens when the discharge temperature exceeds $280^{\circ}\text{F} \pm 8^{\circ}\text{F}$ on a temperature rise. When the switch opens, the circuit to the compressor contactor and the time delay is de-energized and the unit shuts off. The switch automatically resets when the compressor temperature drops below $130^{\circ}\text{F} \pm 14^{\circ}\text{F}$.

The sensor can be accessed by prying off the snap plug on top of the compressor (see figure 6). Make sure to securely seal the sensor after replacement. The sensor pigtails are located inside the unit control box. Figure 7 shows the arrangement of compressor line voltage terminals and discharge sensor pigtails.

F-Condenser Fan Motor

All units use single-phase PSC fan motors which require a run capacitor. The "FAN" side of the dual capacitor is used for this purpose. The specifications table on page 1 of this manual shows the specifications of outdoor fans used in HS22s. In all units, the outdoor fan is controlled by the compressor contactor.

G-Dual Capacitor

The compressor and fan in HS22-211, 261, -311, -411 and -461 series units use permanent split capacitor motors. A single "dual" capacitor is used for both the fan motor and the compressor (see unit wiring diagram). The fan side of the capacitor and the compressor side of the capacitor have different mfd ratings. The capacitor is located inside the unit control box (see figure 5). Table 2 shows the ratings of the dual capacitor.

TABLE 2

HS22 DUAL CAPACITOR RATING			
Units	Terminal	MFD	VAC
HS22-211	FAN	5	370
	HERM	25	
HS22-261	FAN	5	
	HERM	30	
HS22-311	FAN	5	
	HERM	35	
HS22-411	FAN	5	440
	HERM	35	
HS22-461	FAN	5	
	HERM	35	

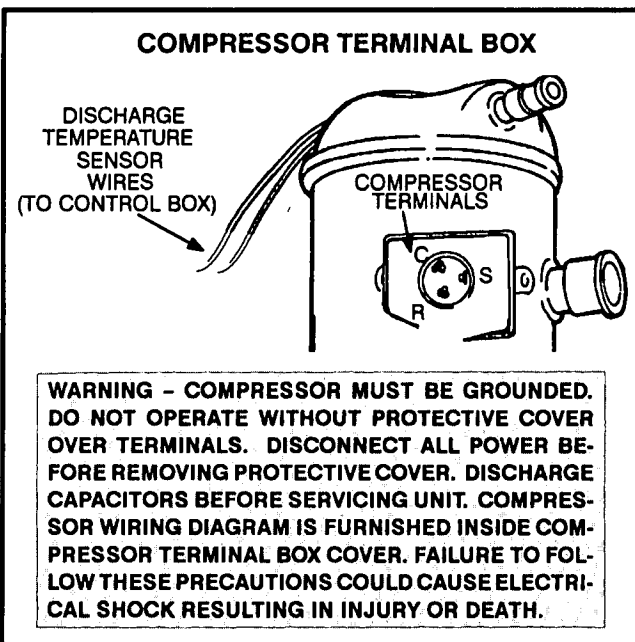


FIGURE 7

IV-REFRIGERANT SYSTEM

A-Plumbing

Field refrigerant piping consists of liquid and vapor lines from the outdoor unit (sweat connections). Use Lennox L10 series line sets as shown in table 3 or field fabricated refrigerant lines. Refer to the piping section of the Lennox Service Unit Information Manual (SUI-803-L9) for proper size, type and application of field-fabricated lines.

TABLE 3

Model No.	LIQUID LINE	VAPOR LINE	L10 LINE SETS
HS22-211	3/8 in.	5/8 in.	L10-26 20 ft. - 50 ft.
HS22-261 HS22-311 HS22-411	3/8 in.	3/4 in.	L10-41 20 ft. - 50 ft.
HS22-461	3/8 in.	7/8 in.	L10-65 30 ft. - 50 ft.

Separate discharge and suction service ports are provided at the compressor for connection of gauge manifold during charging procedure.

B-Service Valves

The liquid line and suction line service valves and gauge ports are accessible on the inside of the unit. The "one shot" suction line service valve (figure 8) cannot be closed once it has been opened. These gauge ports are used for leak testing, evacuating, charging and checking charge.

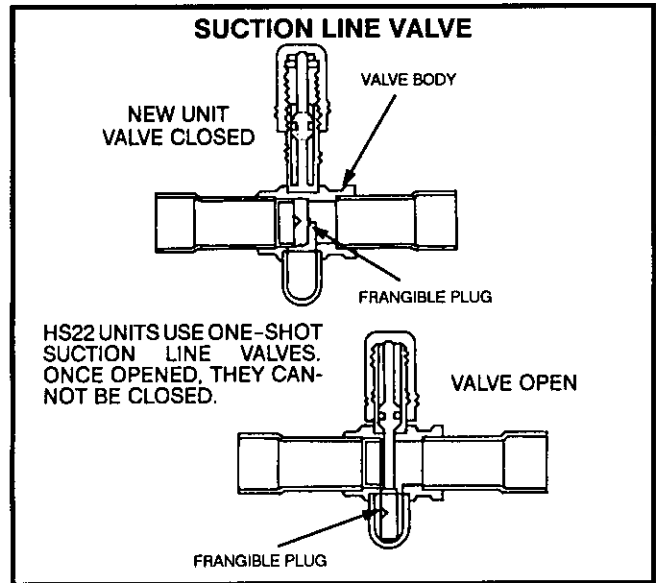


FIGURE 8

V-CHARGING

The unit is factory-charged with the amount of R-22 refrigerant indicated on the unit rating plate. This charge is based on a matching indoor coil and outdoor coil with a 25 foot (7620mm) line set. For varying lengths of line set, refer to table 4 for refrigerant charge adjustment. A blank space is provided on the unit rating plate to list actual field charge.

TABLE 4

LINE SET DIAMETER		Ozs per ft. (ml per mm) adjust from 25 ft. (7620mm) line set*
Suction	Liquid	
5/8 in. (16mm)	3/8 in. (10mm)	1 ounce (30ml)
3/4 in. (19mm)	3/8 in. (10mm)	1 ounce (30ml)
7/8 in. (22mm)	3/8 in. (10mm)	1 ounce (30ml)

* If line length is greater than 25 feet (7620 mm), add this amount. If line length is less than 25 feet (7620 mm), subtract this amount.

A-Leak Testing

- 1- Attach gauge manifold and connect a drum of dry nitrogen to center port of gauge manifold.

CAUTION-WHEN USING DRY NITROGEN, A PRESSURE REDUCING REGULATOR MUST BE USED TO PREVENT EXCESSIVE PRESSURE IN GAUGE MANIFOLD, CONNECTING HOSES, AND WITHIN THE SYSTEM. REGULATOR SETTING MUST NOT EXCEED 150 PSIG (1034 KPA). FAILURE TO USE A REGULATOR CAN CAUSE EQUIPMENT FAILURE RESULTING IN INJURY.

- 2- Open high pressure valve on gauge manifold and pressurize line set and indoor coil to 150 psig (1034 kPa).
- 3- Check lines and connections for leaks.

NOTE-If electronic leak detector is used, add a trace of refrigerant to the nitrogen for detection by the leak detector.

- 4- Release nitrogen pressure from the system, correct any leaks and recheck.

B-Evacuating the System

- 1- Attach gauge manifold. Connect vacuum pump (with vacuum gauge) to center port of gauge manifold. With both manifold service valves open, start pump and evacuate indoor coil and refrigerant lines.

NOTE-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.

IMPORTANT-Compliant scroll compressors (as with any refrigerant compressor) should never be used to evacuate a refrigeration or air conditioning system.

- 2- Evacuate the system to 29 inches (737mm) vacuum. During the early stages of evacuation, it is desirable to stop the vacuum pump at least once to determine if there is a rapid loss of vacuum. A rapid loss of vacuum would indicate a leak in the system and a repeat of the leak testing section would be necessary.
- 3- After system has been evacuated to 29 inches (737mm), close gauge manifold valves to center port, stop vacuum pump and disconnect from gauge manifold. Attach an upright nitrogen drum to center port of gauge manifold and open drum valve slightly to purge line at manifold. Break vacuum in system with nitrogen pressure by opening manifold high pressure valve. Close manifold high pressure valve to center port.
- 4- Close nitrogen drum valve and disconnect from gauge manifold center port. Release nitrogen pressure from system.
- 5- Connect vacuum pump to gauge manifold center port. Evacuate system through manifold service valves until vacuum in system does not rise above 29.7 inches (754mm) mercury (5mm absolute pressure) within a 20-minute period after stopping vacuum pump.
- 6- After evacuation is complete, close manifold center port, and connect refrigerant drum. Pressurize system slightly with refrigerant to break vacuum.

WARNING - DEEP VACUUM OPERATION CAN CAUSE INTERNAL FUSITE ARCING RESULTING IN A DAMAGED OR FAILED COMPRESSOR. THIS TYPE OF DAMAGE WILL RESULT IN DENIAL OF WARRANTY CLAIMS.

C-Charging

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 and 80°F. Outdoor temperature should be 60°F or above. Slight variations in charging temperature and pressure should be expected. Large variations may indicate a need for further servicing.

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 the total amount shown on the unit nameplate and in table 5.

TABLE 5

Model	Refrigerant Charge R-22
HS22-211	6 lbs. 2 oz.
HS22-261	6 lbs. 8 oz.
HS22-311	8 lbs. 1 oz.
HS22-411	8 lbs. 1 oz.
HS22-461	8 lbs. 5 oz.

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

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

- 1- Connect gauge manifold. Connect an upright R-22 drum to center port of gauge manifold.
- 2- Record outdoor ambient temperature.
- 3- Operate indoor and outdoor units. Allow outdoor unit to run until system pressures stabilize.

TABLE 7

OUTDOOR COIL ENTERING AIR TEMPERATURE	NORMAL OPERATING PRESSURES									
	HS22-211		HS22-261		HS22-311		HS22-411		HS22-461	
	LIQ. ± 10 PSIG	SUC. ± 10 PSIG	LIQ. ± 10 PSIG	SUC. ± 10 PSIG	LIQ. ± 10 PSIG	SUC. ± 10 PSIG	LIQ. ± 10 PSIG	SUC. ± 10 PSIG	LIQ. ± 10 PSIG	SUC. ± 10 PSIG
65 °F	138	78	143	73	140	69	136	74	149	69
75 °F	162	79	167	77	160	74	160	76	176	72
85 °F	189	80	195	80	186	78	191	78	209	74
95 °F	222	82	229	82	216	80	225	79	244	76
105 °F	255	84	263	84	254	81	260	80	275	78

- 4- Make sure that thermometer well is filled with mineral oil before checking liquid line temperature.
- 5- Place thermometer in well and read liquid line temperature. Difference between ambient and liquid line temperatures should match values given in table 6 (approach temperature = liquid line temperature minus ambient temperature). Refrigerant must be added to lower approach temperature. Remove refrigerant from system to increase approach temperature.

TABLE 6

APPROACH METHOD - EXPANSION VALVE SYSTEMS	
Model	Liquid Temp Minus Ambient Temp. (°F)
HS22-211	7 \pm 1
HS22-261	7 \pm 1
HS22-311	3 \pm 1
HS22-411	4 \pm 1
HS22-461	5 \pm 1

- 6- When unit is properly charged liquid line pressures should approximate those given in table 7 - Normal Operating Pressures.

NOTE - Use table 7 as a general guide for performing maintenance checks. Table 7 is 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 7 could serve as a useful service guide.

D-Oil Charge

Table 1 on page 5 shows the factory oil charge in HS22 units.

VI-Maintenance

At the beginning of each heating or cooling season, the system should be cleaned as follows:

A-Outdoor Unit

- 1- Clean and inspect condenser coil. (Coil may be flushed with a water hose).
- 2- Condenser fan motor is prelubricated and ports are sealed with plugs. No further lubrication is required. Oiling ports can be accessed for lubrication after extended operation by removing plugs. Be sure to securely seal after servicing.
- 3- Visually inspect all connecting lines, joints and coils for evidence of oil leaks.
- 4- Check for correct voltage at unit (unit operating).
- 5- Check all wiring for loose connections.
- 6- Check amp-draw on heat pump fan motor.
Unit nameplate _____ Actual _____.

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

B-Indoor Coil

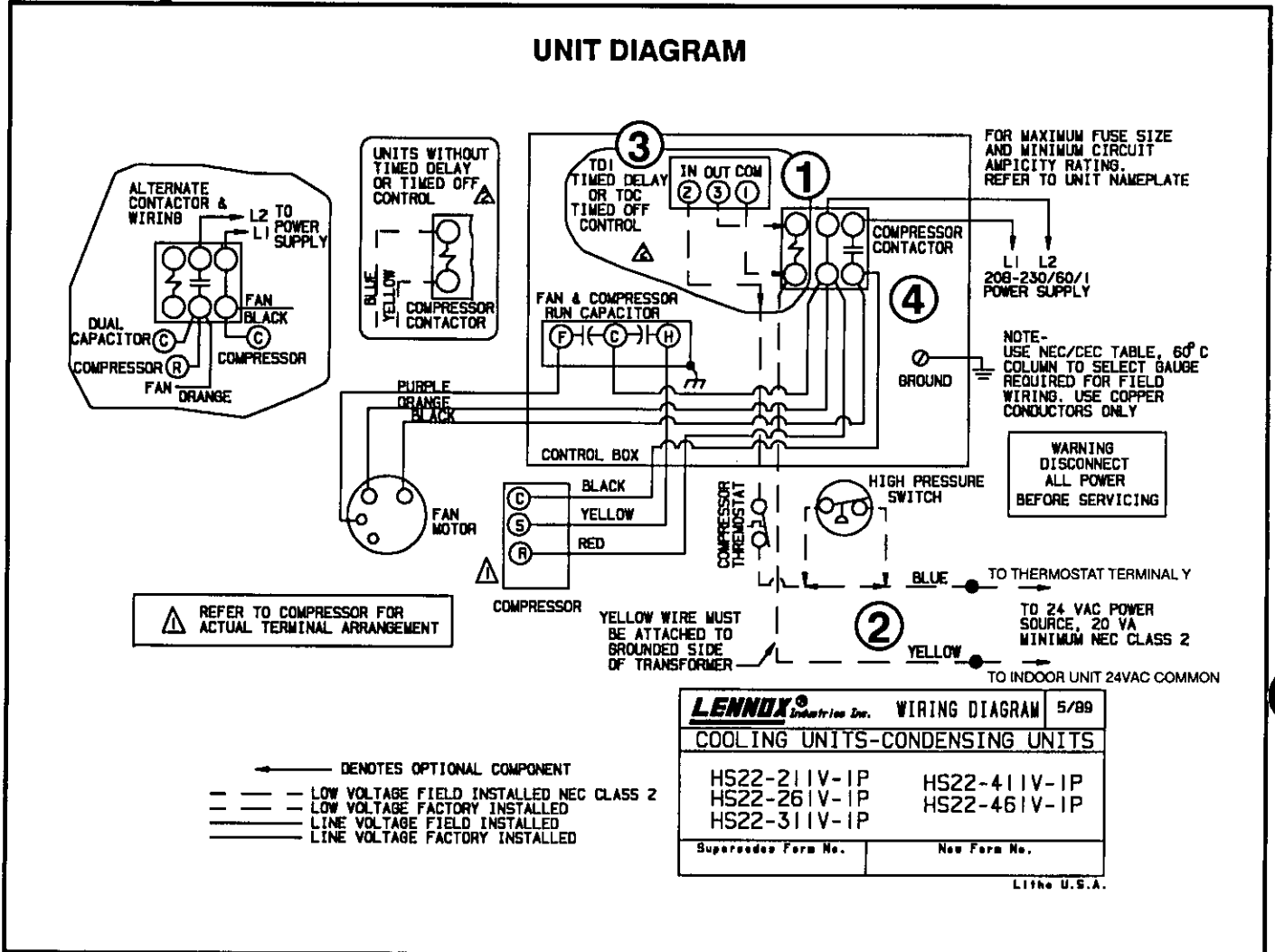
- 1- Clean coil if necessary.
- 2- Check connecting lines, joints and coil for evidence of oil leaks.
- 3- Check condensate line and clean if necessary.

C-Indoor Unit

- 1- Clean or change filters.
- 2- Lubrication of blower motor: Use the following as a guide:
 - a- *Motors without Oiling Ports* -- Prelubricated and sealed. No further lubrication required.
 - b- *Direct Drive Motors with Oiling Ports* -- Prelubricated for an extended period of operation. For extended bearing life, relubricate with a few drops of SAE 10 non-detergent oil once every two years. It may be necessary to remove blower assembly for access to oiling ports.
- 3- Adjust blower speed for cooling. The static pressure drop over the coil should be checked to determine the correct blower CFM. Refer to Lennox Engineering Handbook for Static Pressure and CFM tables.
- 4- Check all wiring for loose connections.
- 5- Check for correct voltage at unit.
- 6- Check amp-draw on blower motor.
Unit nameplate _____ Actual _____.

VII-WIRING DIAGRAMS AND OPERATION SEQUENCE

A-Unit Diagram



B-Operation Sequence

- 1- **WARNING**-All HS22 units use single-pole contactors. Capacitor terminal "COM," orange condenser fan wire and red "R" compressor wire are all connected to L2 at all times. Remove all power at disconnect before servicing.
- 2- Cooling demand energizes thermostat terminal Y. Voltage from terminal Y passes through discharge temperature sensor (compressor thermostat) to energize time delay terminal 2.
- 3- Time delay action is at the beginning of a thermostat demand. When energized, time delay TD1-1 delays 8.5 seconds before energizing TD1-1 terminal 3. When TD1-1 terminal 3 is energized, the contactor coil is energized.
- 4- When compressor contactor is energized, N.O. contactor contacts close to energize compressor terminal "C" (black wire) and black condenser fan motor wire. Condenser fan and compressor immediately begin operating.