

installation – operation – maintenance instructions

HS14 SERIES UNITS

LENNOX Industries Inc.

3 through 5 Ton

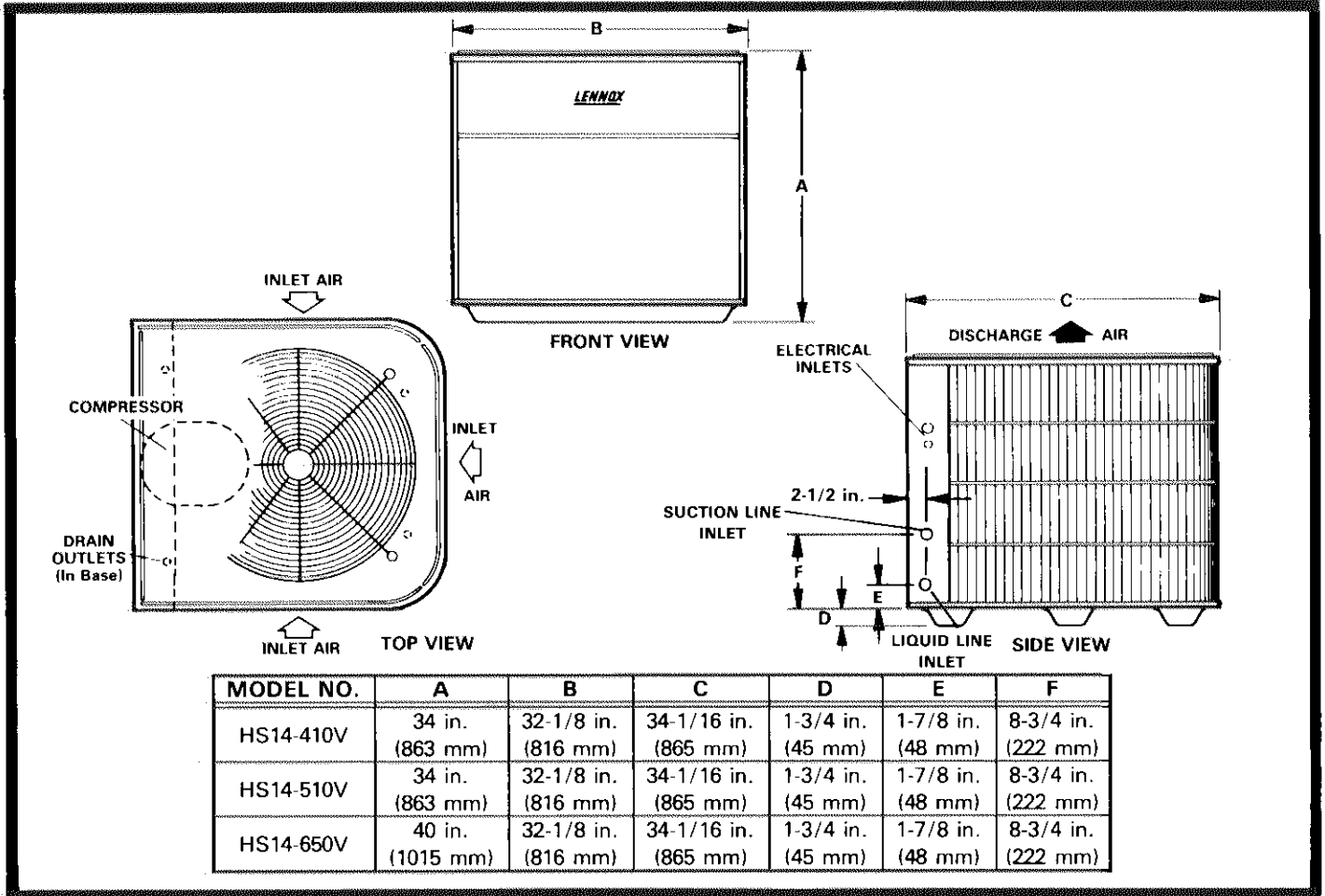
Litho U.S.A.

502,123M

7/87

Supersedes 502,061M

UNIT DIMENSIONS



CHECK POINTS

START-UP AND PERFORMANCE CHECK LIST

Job Name _____ Job No. _____ Date _____
 Job Location _____ City _____ State _____
 Installer _____ City _____ State _____
 Unit Model No. _____ Serial No. _____ Serviceman _____
 Nameplate Voltage _____ Amps: _____
 Minimum Circuit Ampacity _____ Supply _____ Condenser Fan _____
 Maximum Fuse Size _____ Compressor _____
 Electrical Connections Tight? Indoor Filter Clean? Indoor Blower RPM _____
 Supply Voltage (Unit Off) _____ S.P. Drop Over Evaporator (Dry) _____
 Condenser Entering Air Temperature _____

COOLING SECTION

Refrigerant Lines:
 Leak Checked? Properly Insulated?
 Service Valves Backseated?
 Condenser Fan Checked?
 Voltage With Compressor Operating _____

Discharge Pressure _____ Suction Pressure _____
 Refrigerant Charge Checked?

THERMOSTAT

Calibrated? Properly Set? Level?

INSTALLATION

SHIPPING AND PACKING LIST

Package 1 of 1 contains:

- 1 - Assembled unit

SHIPPING DAMAGE

Check unit for shipping damage. Consult last carrier immediately if any damage is found.

GENERAL

These instructions are intended as a general guide and do not supersede local codes. Authorities having jurisdiction should be consulted before installation.

APPLICATION

The condensing units are designed for expansion valve systems only. They are not designed for RFC systems. Refer to the Engineering Handbook for expansion valve kits; they must be ordered separately.

SETTING THE UNIT

Refer to unit dimensions on page 1 for sizing mounting slab, platforms, or supports. Refer to figure 1 and unit nameplate for installation clearances.

NOTE - Remove shipping skids bolted to unit before setting.

Slab Mounting

When installing a unit at grade level, install on a level slab high enough above the grade to allow adequate drainage of water. Top of the slab should be located so run-off water from higher ground will not collect around unit.

Roof Mounting

Install the unit a minimum of 4 inches (102 mm) above the surface of the roof. Care must be taken to insure that the weight of unit is properly distributed over roof joists and rafters. Either redwood or steel supports are recommended.

Compressor Shipping Clips

Certain compressor models require that they be secured during shipping with slotted clips in the mounting feet. These clips must be removed prior to starting unit.

- 1 - Loosen compressor mounting bolts, and remove slotted shipping clips.
- 2 - Retighten compressor mounting bolts.

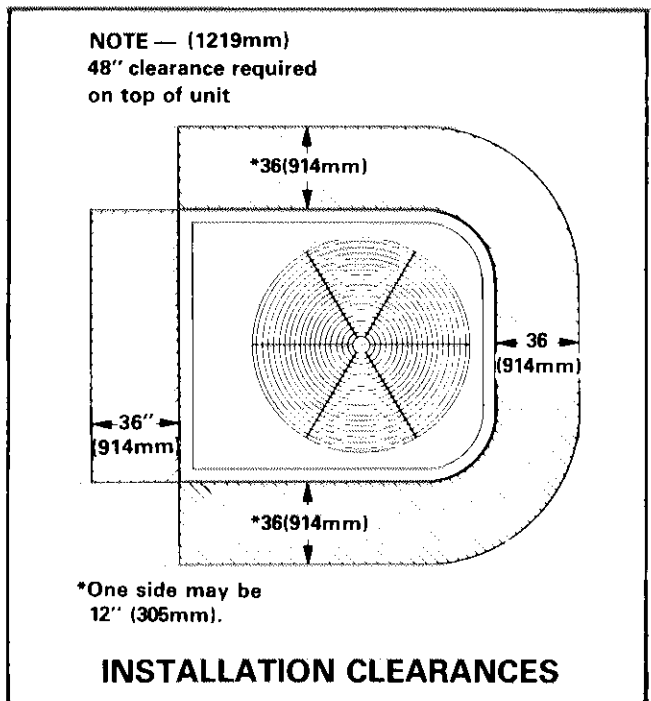


FIGURE 1

ELECTRICAL

Wiring must conform to the National Electric Code (NEC) and local codes. Refer to the furnace or blower coil instructions for additional wiring application diagrams and refer to the unit rating plate for minimum circuit ampacity and maximum fuse size.

LINE VOLTAGE

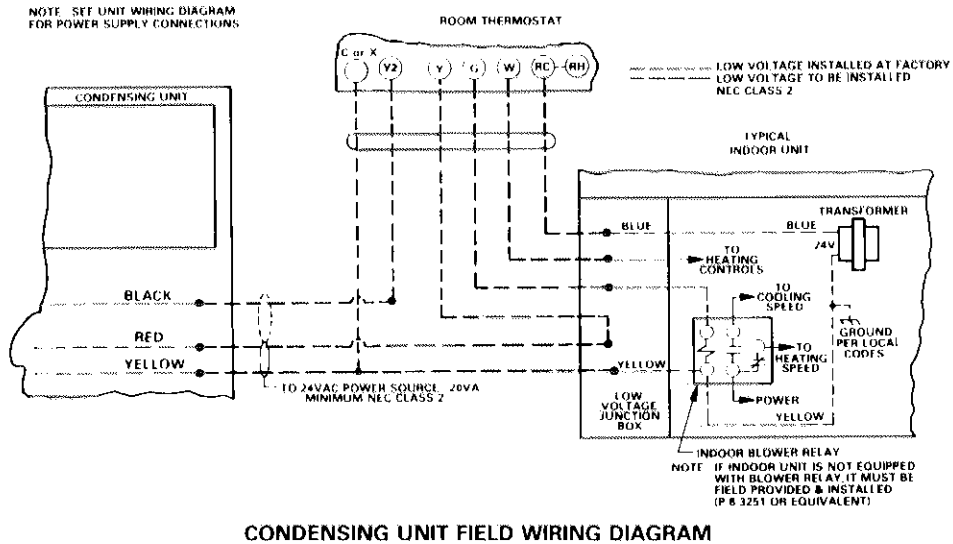
To facilitate conduit, openings are provided in cabinet panel that line up with a wiring hole in control box. Route conduit through openings in cabinet and connect to hole in control box with proper conduit fitting.

NOTE - Units are approved for use with copper conductors only.

LOW VOLTAGE

Low voltage connections are made up just below the control box.

NOTE - A complete unit wiring diagram is located on the inside of the unit control box cover.



PLUMBING

Field refrigerant piping consists of liquid and suction lines from the condensing unit (sweat connections) to the indoor evaporator coil (flare connections). Use Lennox L10 series sets as shown in table 1 or field fabricated refrigerant lines. Refer to "Piping Section" of the Lennox Service Manual for proper size, type and application of field fabricated lines.

TABLE 1

UNIT	LIQUID LINE	SUCTION LINE	L10 LINE SETS
HS14-410	3/8 in. (10 mm)	7/8 in. (22 mm)	L10-65 30 ft. — 50 ft. (9144 mm — 15240 mm)
HS14-510 HS14-650	3/8 in. (10 mm)	1-1/8 in. (29 mm)	FIELD FABRICATED

Sweat Connection Procedure

- 1 - End of refrigerant line must be cut square, round, free from nicks or dents and deburred (I.D. and O.D.).
- 2 - Wrap a wet cloth around valve body and copper tube stub; braze the line set tubing to the valve.
- 3 - Quench the joint with water or wet cloth to prevent possible heat damage to the valve core opening port.

IMPORTANT - Tube end must stay bottomed in the fitting during final assembly to ensure proper seating, sealing and rigidity.

PIPING

REFRIGERANT PIPING GUIDELINES

Special considerations must be given to refrigerant piping to ensure system efficiency and provide safe compressor operating conditions. The following piping guidelines must be followed.

Piping Objectives

All refrigerant piping systems must meet the following objectives to ensure unit efficiency to provide safe operating conditions for the compressor.

- 1 - Ensure proper liquid refrigerant feed to evaporators.
- 2 - Provide practical line size without excessive pressure drop.
- 3 - Prevent an excessive amount of lubricating oil from being trapped in any part of system.
- 4 - Minimize loss of lubricating oil from compressor by returning oil at the same rate it leaves.
- 5 - Prevent liquid refrigerant from entering compressor during operation and shutdown.

Liquid Lines

Liquid lines offer only two points that must be kept in mind to prevent serious capacity loss in system. First, the high pressure drops (due to either friction or to head loss in the high riser) should be avoided. Second, all Lennox condensing units are rated 10° F, or more, subcooling. Any reduction in this degree of subcooling will reduce the capacity of the system.

Suction Lines

Suction lines must be designed to return oil from the evaporator to the compressor under minimum load conditions. See figure 2. Oil which leaves the compressor and continues through the evaporator separates from the refrigerant gas. A distillation process occurs within the evaporator. This separated oil can only be returned to the compressor by entrainment with the returning gas.

Oil entrainment is dependent upon proper velocity, which in turn is dependent upon correct suction line design and size. Horizontal suction lines require a minimum of 600 fpm velocity for oil entrainment while risers require approximately 1,000 fpm or greater velocity. Velocity must be below 3,000 fpm for satisfactory noise levels.

When indoor unit is below compressor, suction line must be trapped at the bottom of each vertical riser. Refer to Double Suction Line Riser section which follows.

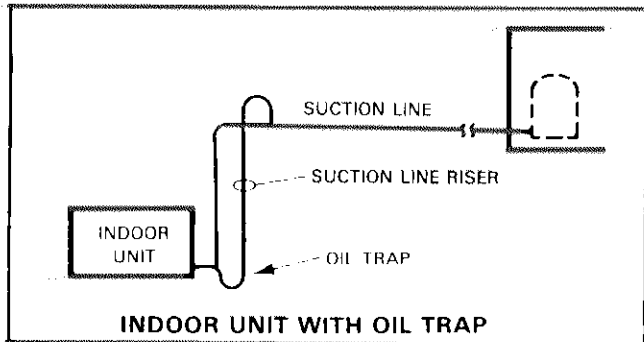


FIGURE 2

Double Suction Risers

During partial load operation when gas velocity is not sufficient to return oil through both risers, the trap gradually fills with oil until the second riser is sealed off. When this occurs, the

refrigerant gas travels up the first riser only and there is enough velocity to carry the oil. This trap must be close-coupled to limit the oil holding capacity to a minimum. Otherwise, the trap could accumulate enough oil on a partial load to seriously lower the compressor crankcase oil level.

SIZING

NOTE - It is not recommended to install refrigerant line sets over 60 ft. (18 m). Refrigerant line losses deduct from the net capacity of the complete system. Additional refrigerant charge required may also upset the refrigerant and oil ratio.

Table 2 can be used to size the liquid lines of any system unless the liquid line has more than eight elbows, is unusually long, or rises over 30 ft. (9144 mm). Special applications should be referred to your Lennox division service department. For better performance, line lengths should be kept to a minimum.

TABLE 2

FIELD-INSTALLED PIPE SIZING
AIR CONDITIONING SYSTEMS (Refrigerant 22)

Nominal Tons	LENGTH OF RUN IN FEET			
	Up to 30 Feet		30-60 Feet	
	Liquid	Suction	Liquid	Suction
1-1/2	3/8	3/4	3/8	3/4
2	3/8	3/4	3/8	7/8
2-1/2	3/8	7/8	1/2	7/8
3	3/8	7/8	1/2	1-1/8
4	1/2	1 1/8	1/2	1-1/8
5	1/2	1-1/8	1/2	1-1/8

Table is based on pressure drop of eight elbows in addition to the length of the line.

Size double suction line riser from table 3 and figure 3.

IMPORTANT - Due to the capacity reduction capability of the two-speed compressor, double suction line risers must be used on all suction lines to assure proper oil return to the compressor.

TABLE 3

SIZING FOR DOUBLE SUCTION LINE RISERS
(REQUIRED FOR HS14 SERIES UNITS)

Relationship of Load		Total Tons in Risers									
Smallest Load	Balance of Load	1-1/2		2		2-1/2		3		4 & 5	
A*	B*	A*	B*	A*	B*	A*	B*	A*	B*	A*	B*
50%	50%	1/2	1/2	1/2	1/2	5/8	5/8	5/8	5/8	3/4	3/4

HS14-SERIES has 50% reduction.

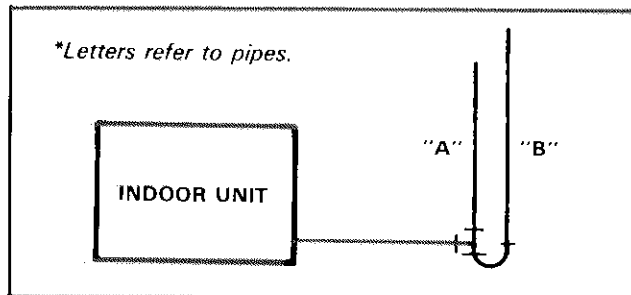


FIGURE 3

REFRIGERATION

Service Valve and Gauge Manifold Attachment

The liquid line and suction line service valves and gauge ports are located inside the cabinet.

These gauge ports are used for leak testing, evacuating, charging and checking charge. A separate gauge port for system pumpdown is provided in the liquid line between the condenser coil and filter-drier if future service pumpdown is required to make repairs on low side.

IMPORTANT - Service valves are closed to condensing unit and open to line set connections. Do not open until refrigerant lines and indoor coil have been leak tested and evacuated. All precautions should be exercised in keeping the system free from dirt, moisture and air.

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).

- 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.

Evacuating and Dehydrating System

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

NOTE - A temperature vacuum gauge, mercury vacuum "U" tube, or thermocouple gauge should be used. The usual Bourdon tube gauges are inaccurate in the vacuum range.

- 2 - Evacuate the system to 29 inches (737 mm) vacuum. During the initial stages of evacuation, stop the pump at least once to determine if there is a loss of vacuum. A rapid loss of vacuum indicates a leak in the system.
- 3 - After system has been evacuated to 29 inches (737 mm) close manifold valve to center port. Stop the vacuum pump and disconnect from gauge manifold. Attach a drum of dry nitrogen to center port of gauge manifold, open drum valve slightly to purge line, then break vacuum in system to 3 psig (20.7 kPa) pressure by opening manifold high pressure valve to center port.
- 4 - Close nitrogen drum valve, disconnect drum from manifold center port, and release nitrogen pressure from system.
- 5 - Reconnect vacuum pump to manifold center port hose. Evacuate system through manifold service valves until vacuum in system does not rise above 29.7 inches (754 mm) mercury (5 mm absolute pressure) within a 20 minute period after stopping vacuum pump.

- 6 - After evacuation is complete, close gauge manifold service valves. Disconnect vacuum pump from manifold center port and connect refrigerant drum. Pressurize system slightly with refrigerant to break vacuum.

Start-Up

- 1 - Rotate fan to check for frozen bearings or binding.
- 2 - Inspect all factory and field installed wiring for loose connections.
- 3 - Open liquid line and suction line service valves (back seat) to release refrigerant charge (contained in condensing unit) into the system. Replace and tighten stem caps.
- 4 - To open suction valve, tighten the opening cap (longest) until a bottoming is felt (nut will be within 1/8" or less of the body). Tighten an additional 1/6 turn to make metal to metal seal.

NOTE - When tightening, the torque will increase, then drop off as the frangible plug shears.

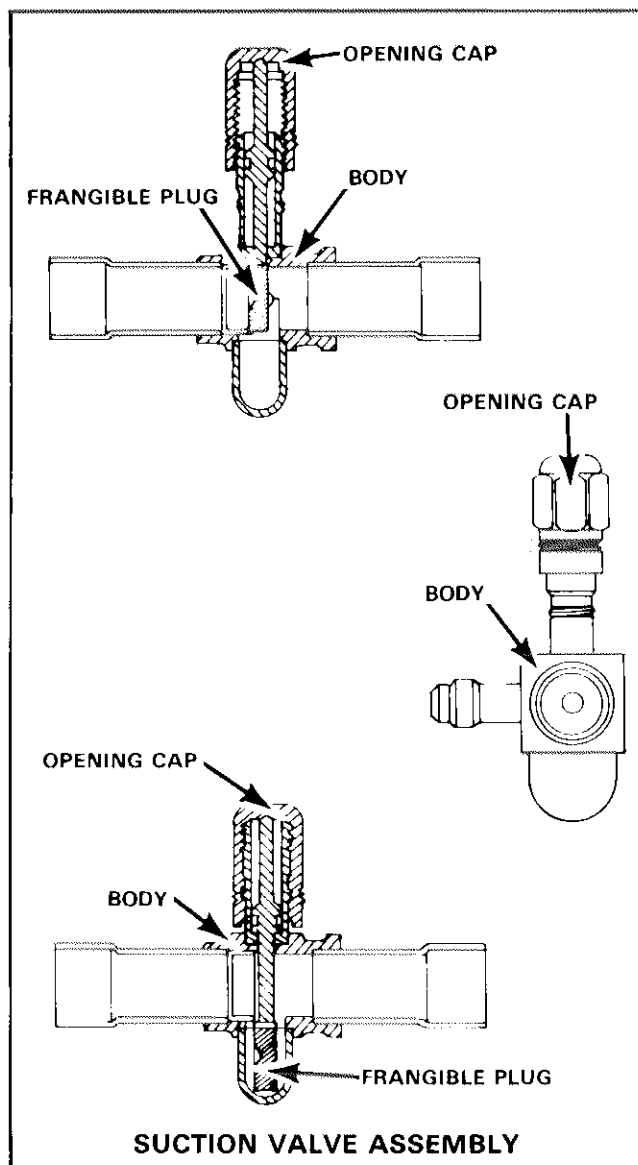


FIGURE 4

REFRIGERATION CONT.

- 5 - Check voltage supply at unit disconnect switch. The voltage must be within the range listed on unit nameplate. If not, do not start the equipment until the power company has been consulted and the voltage condition corrected.
- 6 - Set the thermostat for a cooling demand, turn on power to evaporator blower and close condensing unit disconnect switch to start unit. Wait at least 10 seconds for the two speed controller to power up. Push the override button on the two speed controller to bypass the five minute timed-off delay.
- 7 - Recheck 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.

Charging

HS14 units are factory charged with the amount of R-22 refrigerant indicated on the unit rating plate. The factory charge is based on matched condensing unit and indoor coil with a 25 ft. (7.62 M) line set. A blank space is provided to list the actual field charge on the rating plate.

Follow instructions given on unit access panel to determine if system is properly charged. Make adjustments to system charge as required. After charging, remove gauge manifold and replace service caps.

NOTE - For systems void of refrigerant, the recommended and most accurate method of charging is to weigh the refrigerant into unit according to the amount shown on the unit nameplate. Refer to the Unit Information and Service Manual for correct procedure. If weighing facilities are not available or if unit is just low on charge, use the procedure as given above.

System Pumpdown

HS14 units may be pumped down in order to make repairs on low side of system without losing complete refrigerant charge.

WARNING - Condenser coil may not have sufficient volume to allow a complete pumpdown. Always connect a high pressure gauge to the liquid line gauge port during system pumpdown. High pressure must not exceed 410 psig (2827 kPa).

OPERATION

SYSTEM OPERATION

Condensing unit and indoor blower cycle on demand from room thermostat. When blower switch on thermostat is switched to "ON" position, indoor blower operates continuously.

Lennox Two Speed Controller

The controller performs compressor speed changes on demand from the indoor thermostat. It also provides the following functions to protect unit:

- 1 - The controller provides a one minute delay between speed changes. This delay cannot be bypassed.
- 2 - The controller prevents compressor short cycling with a five minute timed-off delay.
- 3 - The controller stops compressor operation when motor winding overheats. Motor operation is blocked for a minimum of five minutes or until the winding cools within a specified temperature range.
- 4 - The controller locks out motor operation for five minutes when a safety device (e.g. high pressure switch) terminates motor operation. Motor operation is prohibited for five minutes even if the safety device is reset within that five minutes.
- 5 - The controller locks out motor operation if overheating or compressor safety devices interrupt compressor operation 3 times during one thermostat demand period. Motor operation is locked out until thermostat demand is removed or power supply to controller is terminated.

- 6 - The controller has a manual override button that bypasses the five minute timed-off delay for servicing unit. This override button does not bypass the one minute delay between speed changes.

Refer to Maintenance section for Lennox two speed controller check-out procedure.

High Pressure Switch

The high pressure switch located in the compressor compartment shuts off unit operation at 410 psig (2827 kPa) and must be manually reset.

Low Pressure Switch

This switch shuts off unit operation at 25 psig (172 kPa) and cuts in at 55 psig (379 kPa).

Crankcase Heater

Units are equipped with a crankcase heater. This heater is internal to the compressor and is self-regulating.

Compressor Start Kit

Two speed, single phase compressor units have integral starting components. No field additions are necessary.

MAINTENANCE

MAINTENANCE

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

Condensing Unit

- 1 - Clean and inspect condenser coil. Coil may be flushed with a water hose.
- 2 - Condenser fan motor is prelubricated and sealed. Always relubricate motor according to the instructions on the motor manufacturer's nameplate.
- 3 - Visually inspect connecting lines and coils for evidence of oil leaks.
- 4 - Check all wiring factory and field for loose connections.
- 5 - Check for correct voltage at unit (unit operating).
- 6 - Check amp-draw on condenser fan motor.

Unit Nameplate _____ Actual _____

NOTE - If owner complains of insufficient cooling, the unit should be gauged and refrigerant charge checked. Refer to Charging section in this instruction.

Evaporator Coil

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

Indoor Unit

- 1 - Clean or change filters.
- 2 - Lubricate blower motor and blower bearings according to instructions on indoor unit.
- 3 - Adjust blower speed for cooling. The pressure drop over the coil should be measured to determine the correct blower CFM. Refer to the Cooling Service handbook for pressure drop tables and procedure.
- 4 - Belt Drive Blowers — Check belt for wear and proper tension.
- 5 - Check all wiring for loose connections.
- 6 - Check for correct voltage at unit (blower operating).
- 7 - Check amp-draw on blower motor.

Unit Nameplate _____ Actual _____

Lennox Two Speed Controller (TSC-1) Checkout Procedure

The two speed controller performs speed changes on demand from room thermostat. Use the following procedure when checking the controller:

- 1 - Manually reset high pressure switch "S1" in the outdoor unit.
- 2 - Turn thermostat to "OFF" position.
- 3 - Set thermostat to lowest temperature setting. Turn indoor thermostat to "ON" position.
- 4 - Wait at least 10 seconds for controller to power up. Push the override button on the controller to bypass the five minute timed-off delay.
- 5 - Allow one minute for unit to start.
- 6 - If unit does not start, check voltage across wires "Y1" and "C" and "Y2" and "C" of the outdoor unit. Voltage should be 24 VAC \pm 6. If voltage is not 24 VAC \pm 6, check indoor thermostat for malfunctions.
- 7 - Check contactors in the outdoor unit. "K1" and "K2" should be energized for single phase units. Only "K2" should be energized for three phase units.
- 8 - Low Speed Check-Out — Turn indoor thermostat OFF. Disconnect thermostat wire from "Y2" of the outdoor unit. Set thermostat to lowest temperature setting. Turn indoor thermostat to "ON" position.
- 9 - Wait at least 10 seconds to allow controller to power up. Push the override button to bypass the five minute timed-off delay.
- 10 - Allow one minute for unit to start.
- 11 - If unit does not start, check voltage across wires "Y1" and "C" of the outdoor unit. Voltage should be 24 VAC \pm 6. If voltage is not 24 VAC \pm 6, check indoor thermostat for malfunctions.
- 12 - Check contactors in outdoor unit, "K2" should be energized for single phase units. "K1" should be energized for three phase units.
- 13 - Check the secondary output voltage of the transformer in the outdoor unit. Voltage should be 24 VAC \pm 6. If voltage is not 24 VAC \pm 6, check the transformer.
- 14 - Turn OFF power to indoor and outdoor units. Disconnect jack plug from the TSC-1 controller.
- 15 - Turn ON power to unit. Check voltage across terminals "2" and "7" of the jack plug. Voltage should be 24 VAC \pm 6. If voltage is not 24 VAC \pm 6, check pressure switches "S1" and "S2" for malfunctions.
- 16 - Turn OFF power to unit. Disconnect the two red wires from the two speed controller. Check the resistance of the internal sensor. If resistance is within the reset range specified on the compressor nameplate, replace the TSC-1 controller. If resistance is in the range of high limit trip, allow compressor time to cool down to reset range. Reconnect red wires and jack plug. Repeat checkout procedure beginning with step 2.