installation — operation — maintenance instructions

HS17-1853 and 2753 SERIES UNITS

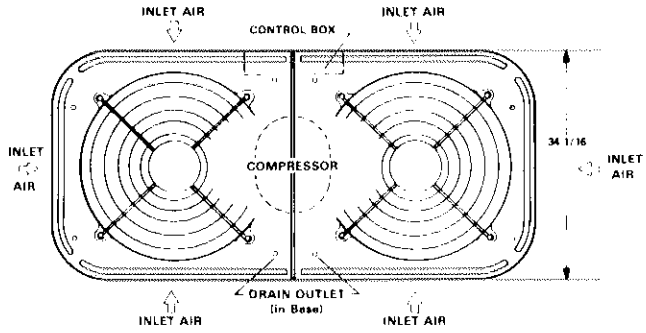
LENNOX Industries Inc.

Litho U.S.A.

501,850M
1/85

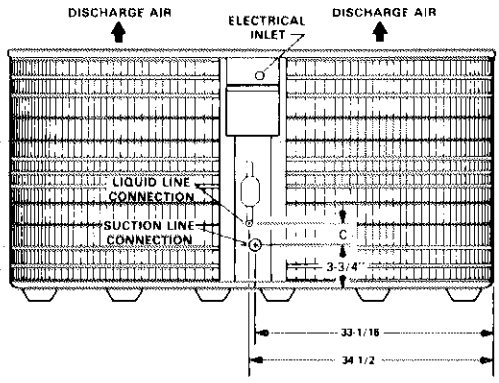
15 and 20 ton units

UNIT DIMENSIONS

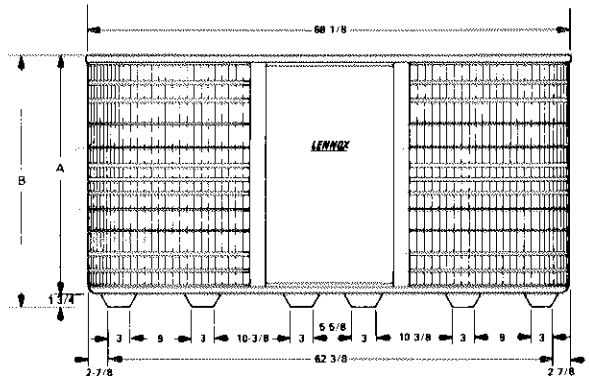


TOP VIEW

UNIT	A	B	C
HS17-1853	40	41-3/4	7
HS17-2753	44	45-3/4	6



BACK VIEW



FRONT VIEW

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 _____
Minimum Circuit Ampacity _____
Maximum Fuse Size _____
Electrical Connections Tight? ☐
Supply Voltage (Unit Off) _____

Amps:
Supply _____ Condenser Fan _____
Compressor _____
Indoor Filter Clean? ☐ Indoor Blower RPM _____
S.P. Drop Over Evaporator (Dry) _____
Condenser Entering Air Temperature _____
Liquid Pressure _____ Suction Pressure _____
Refrigerant Charge Checked? ☐

COOLING SECTION

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

THERMOSTAT

Calibrated? ☐ Properly Set? Level? ☐

INSTALLATION

PACKAGE 1 OF 1 CONTAINS:

1 - Assembled unit

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

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

APPLICATION

HS17-1853/2753 condensing units are designed for expansion valve systems only. They are not designed for RFC systems. Refer to coil selector table below for approved applications.

COIL SELECTOR		
Condensing Unit	**Lennox Evaporator Coil**	
HS17-1853V	CB3-185V	4 row & 6 row
	CB3-205V	4 row & 6 row
	CB17-185V	
HS17-2753V	CB3-205V	4 row & 6 row
	CB3-305V	4 row & 6 row
	CB17-275V	

SETTING THE UNIT

Refer to unit dimensions on page 1 for sizing mounting slab, platforms or supports.

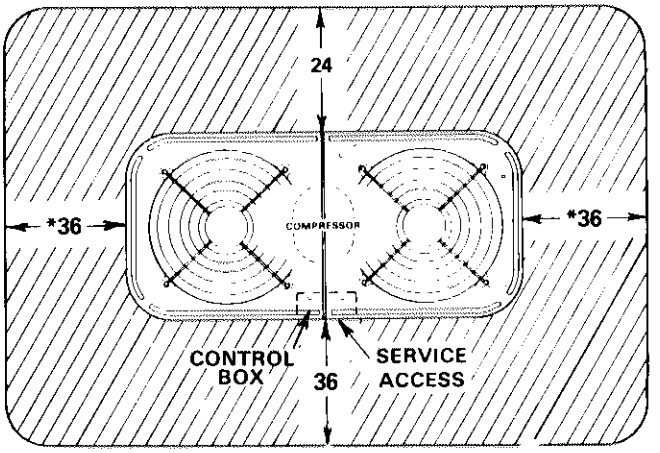
Slab Mounting

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

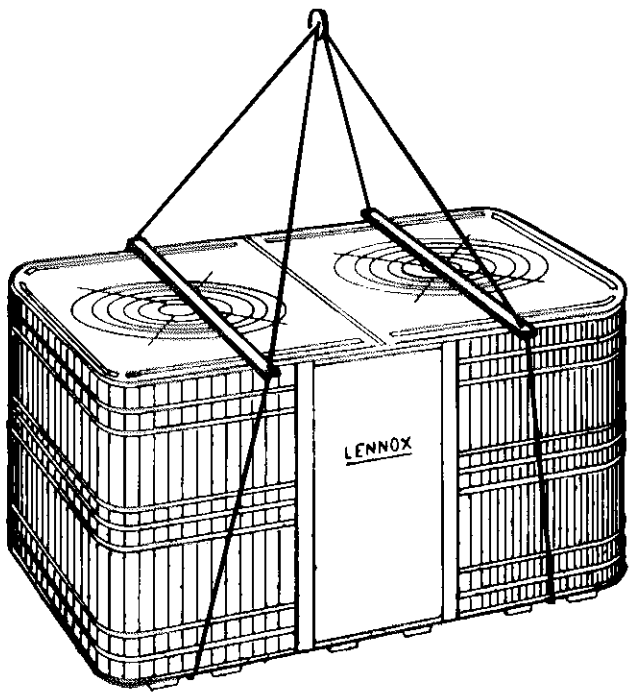
Install the unit a minimum of 4 inches (102mm) above the surface of the roof. Care must be taken to ensure that the weight of the unit is properly distributed over roof joists and rafters. Either redwood or steel supports are recommended.

INSTALLATION CLEARANCES



NOTE — 48 inch clearance required on top of unit.
***NOTE — One side may be 12" (305mm).**

RIGGING AND HOISTING HS17



UNIT	WEIGHT	
	lbs.	kg
HS17-1853	580	265
HS17-2753	720	325

LIFTING INSTRUCTIONS

1 - Run hoisting sling underneath unit as shown.
2 - Use spreader bars to avoid damaging top of unit.

ELECTRICAL

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

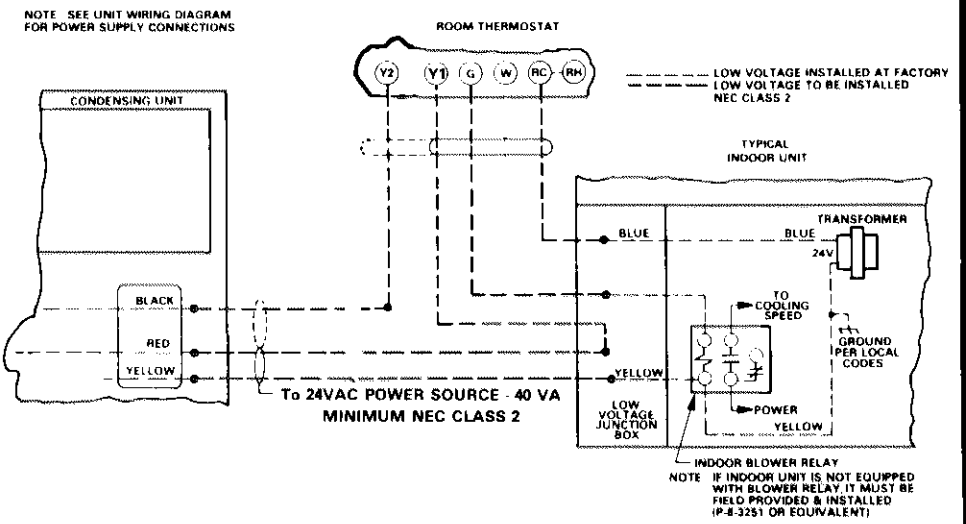
LINE VOLTAGE

To facilitate conduit, a hole is provided in make-up box. Connect conduit directly to make-up box with proper conduit fitting. *NOTE - Units are approved for use with copper conductors only.*

LOW VOLTAGE

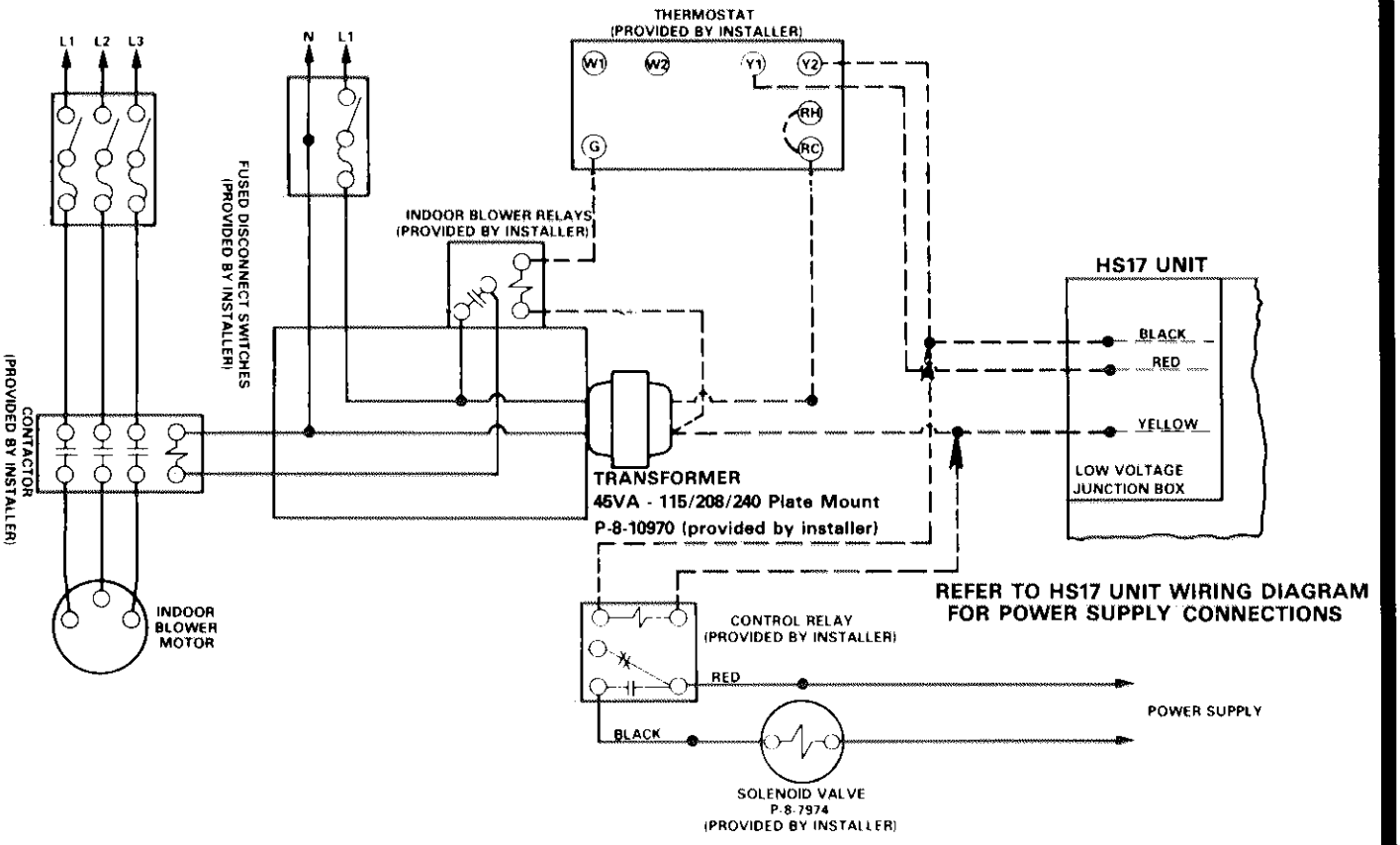
Low voltage connections are made up just below the control box.

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



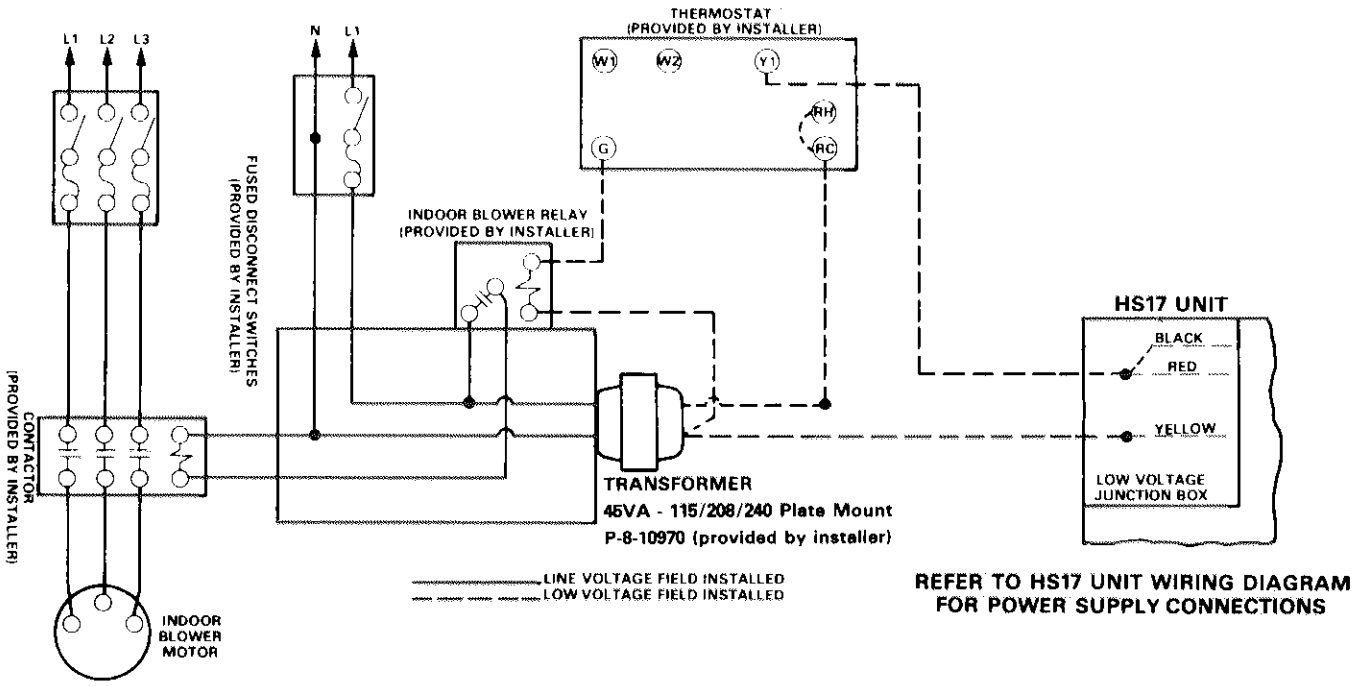
APPLICATION WIRING FOR HS17 AND TYPICAL INDOOR COIL/BLOWER UNIT

APPLICATION WIRING FOR HS17 AND COIL/BLOWER WITH TWO STAGE COOLING OPERATION



ELECTRICAL

APPLICATION WIRING FOR HS17 AND COIL/BLOWER WITH SINGLE STAGE COOLING OPERATION (BOTH COMPRESSOR MOTORS RUNNING)



REFRIGERATION

REFRIGERANT PIPING GUIDELINES

Special considerations must be given to refrigerant piping due to the capacity reduction capability of the HS17 with two-stage twinned compressor and the dual circuit CB17 or blower coil unit. To ensure system efficiency and provide safe compressor operating conditions, the following piping guidelines must be followed:

I - PIPING OBJECTIVES

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

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

II - FIELD PIPING

Field piping consists of single liquid and suction lines between the HS17 and CB17 blower coil unit (Refer to illustrations). The CB17 has two liquid connections and two suction connections for the dual circuit coil. A field provided solenoid is required in the top (second stage) liquid line to shut off the circuit during first stage compressor operation. The exception is when humidity control is not a factor, then the solenoid is not used and the full evaporator is used with both first and second stage compressor operation.

NOTE - Heat shield which surrounds suction line connection should be removed after field piping hookups have been made. Loosen two screws at bottom of shield and remove.

III - UNIT CAPACITY AND PIPE SIZING TABLES

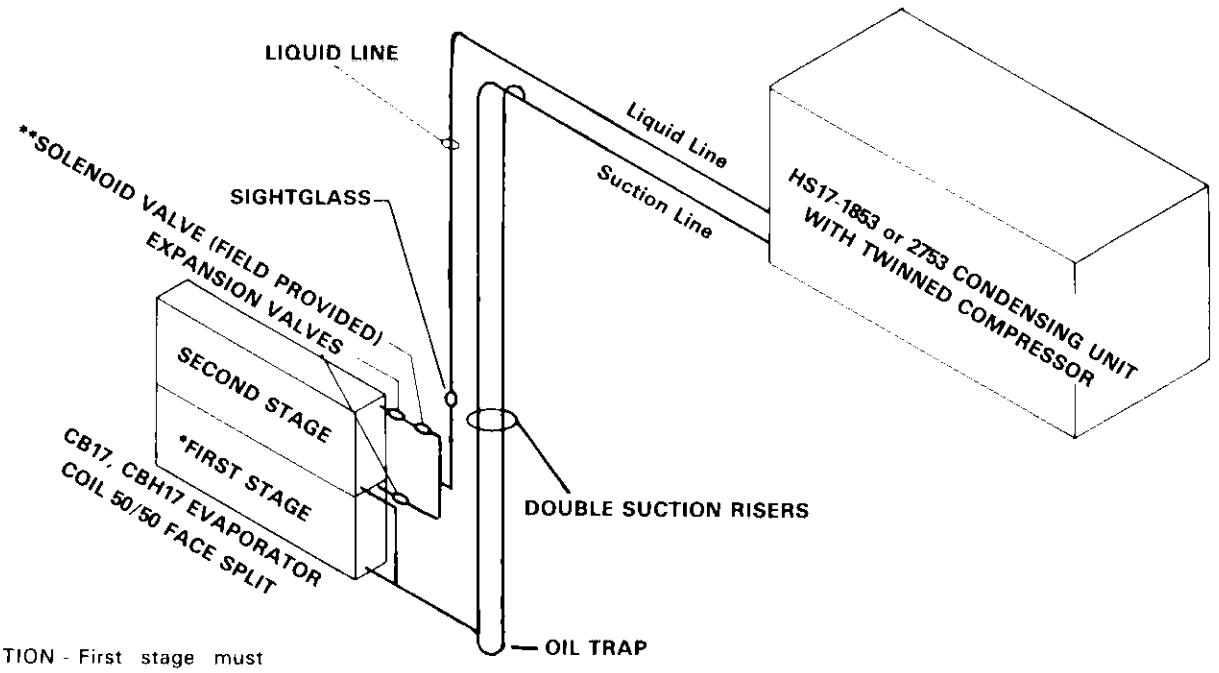
TABLE 1 UNIT CAPACITY

UNIT	COMPRESSOR	NOMINAL TONS	
		STAGE 1	STAGE 2
HS17-1853	2 Stage	7-1/2	7-1/2
HS17-2753	2 Stage	10	10

NOTE - A 1-5/8—2-1/8 coupling is provided with the HS17-2753 for use on the suction line connection.

REFRIGERATION CONT.

REFRIGERANT PIPING DIAGRAM

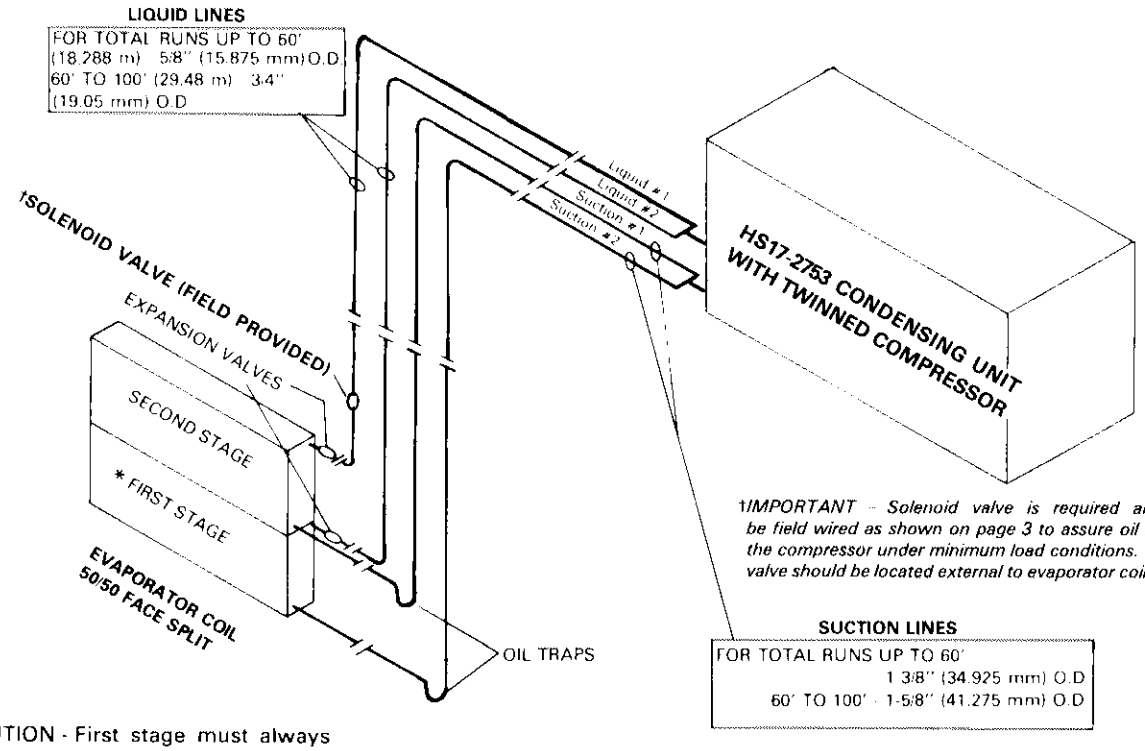


*CAUTION - First stage must always be on bottom to prevent re-evaporation over the dry part of the coil when on first stage operation.

**Solenoid valves should be located external to evaporator coil cabinet.

FIGURE 1

REFRIGERANT PIPING DIAGRAM
HS17-2753 REPLACING HS7-2753 UNIT
MATCHED WITH C3 EVAPORATOR COIL



*CAUTION - First stage must always be on bottom to prevent re-evaporation over the dry part of the coil when on first stage operation.

†*IMPORTANT - Solenoid valve is required and must be field wired as shown on page 3 to assure oil return to the compressor under minimum load conditions. Solenoid valve should be located external to evaporator coil cabinet.*

FIGURE 2

TABLE 2
FIELD INSTALLED PIPE SIZE
AIR CONDITIONING SYSTEMS WITH R-22

Nominal Tons	LENGTH OF RUN IN FEET					
	Up to 30 Feet		30-60 Feet		60-100 Feet	
	Liquid	Suction	Liquid	Suction	Liquid	Suction
1-1/2	3/8	3/4	3/8	3/4	3/8	3/4
2	3/8	3/4	3/8	7/8	3/8	7/8
2-1/2	3/8	7/8	1/2	7/8	1/2	1-1/8
3	3/8	7/8	1/2	1-1/8	1/2	1-1/8
4	1/2	1-1/8	1/2	1-1/8	1/2	1-1/8
5	1/2	1-1/8	1/2	1-1/8	5/8	1-1/8
7-1/2	5/8	1-1/8	5/8	1-3/8	5/8	1-3/8
10	5/8	1-3/8	5/8	1-3/8	3/4	1-5/8
15	3/4	1-3/8	3/4	1-5/8	7/8	2-1/8
17	3/4	1-5/8	7/8	1-5/8	7/8	2-1/8
20	7/8	1-5/8	7/8	2-1/8	1-1/8	2-1/8
25	7/8	2-1/8	1-1/8	2-1/8	1-1/8	2-1/8
30	1-1/8	2-1/8	1-1/8	2-1/8	1-1/8	2-5/8

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

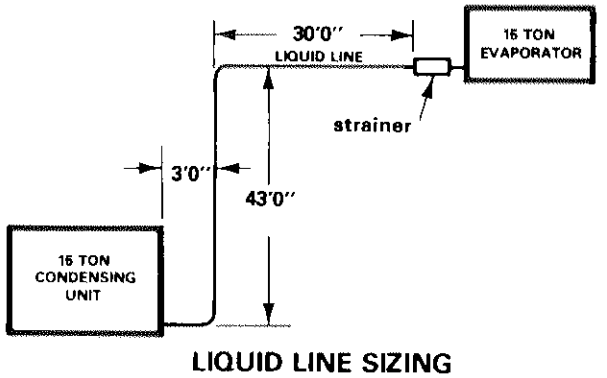
NOTE - It is not recommended to install refrigerant line sets over 100 feet. Refrigerant line losses deduct from the net capacity of the complete system. The additional refrigerant charge required may also upset the refrigerant and oil ratio.

IV - LIQUID LINES

Liquid lines offer only two points that must be kept in mind to prevent serious capacity loss in the system. The first is that the high pressure drops — either due to friction or to the head loss in high risers — should be avoided. The second is that all Lennox condensing units are rated 10°F or more subcooling.

EXAMPLE 1 — Liquid Line Sizing

Given: 15 ton evaporator
15 ton condensing unit
Find: Liquid line size
Length of line in feet — 76'
Size of pipe from Table 2 — 7/8"
Answer: 7/8" o.d. copper tubing



LIQUID LINE SIZING

FIGURE 3

Any reduction in this degree of subcooling will reduce the capacity of the system. Liquid lines should always be well insulated when run through areas in which they can encounter high ambient conditions.

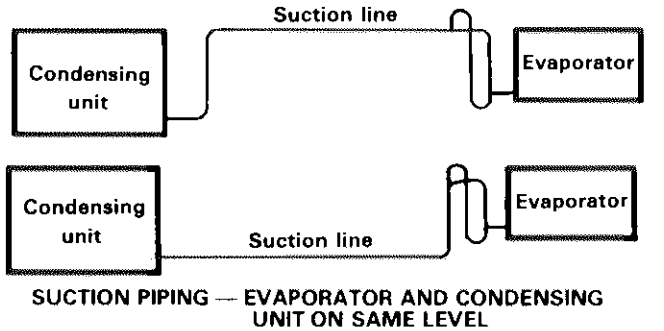
NOTE - A strainer or strainer-drier should always be installed in the liquid line of any welded system to protect the expansion valve and compressor. The proper place to install this strainer is in the liquid line as near the expansion valve as possible.

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 60 feet. Special applications should be referred to your Lennox division service department.

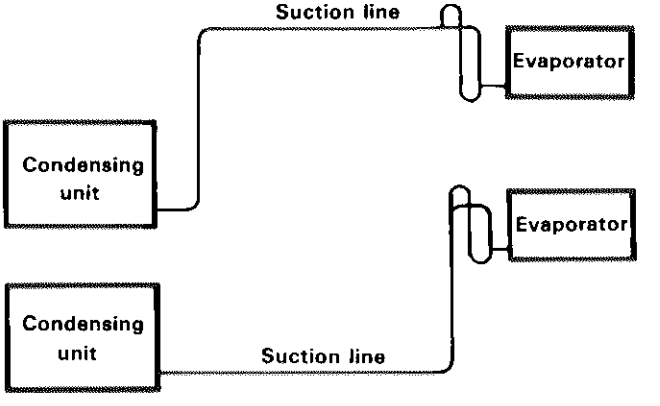
V - SUCTION LINES

Suction lines must be designed to return oil from the evaporator to the compressor under minimum load conditions. Oil which leaves the compressor and continues through the evaporator separates from the refrigerant vapor. 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 depends on proper velocity, which in turn depends on correct suction line design and size. Horizontal suction lines require a minimum of 600 fpm velocity for oil entrainment while suction risers require approximately 1000 fpm or greater velocity. Velocity must be kept below 3000 fpm for satisfactory noise levels.



SUCTION PIPING — EVAPORATOR AND CONDENSING UNIT ON SAME LEVEL



SUCTION PIPING — EVAPORATOR ABOVE CONDENSING UNIT

FIGURE 4

IMPORTANT - Due to the capacity reduction capability of the Lennox two stage compressor, double suction risers must be used in all suction riser lines to assure proper oil return to the compressor. Refer to section VI for sizing.

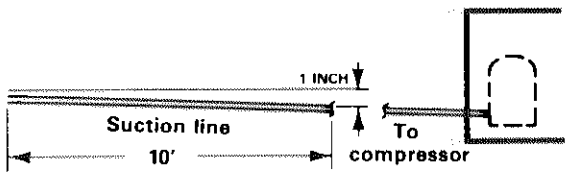
A - Piping for Compressor Protection

To prevent liquid from migrating to the compressor during an off cycle when the evaporator is located above or on the same level as the condensing unit, it is necessary to pipe the unit as shown in figure 4 with the suction line rising to approximately the height of the evaporator.

B - Designing the Suction Line for Proper Oil Return

To ensure proper oil return to the compressor, there are four elements of suction line design which must be carefully followed:

1 - All horizontal suction lines or mains must be pitched toward the compressor 1 inch for every 10 feet of run.



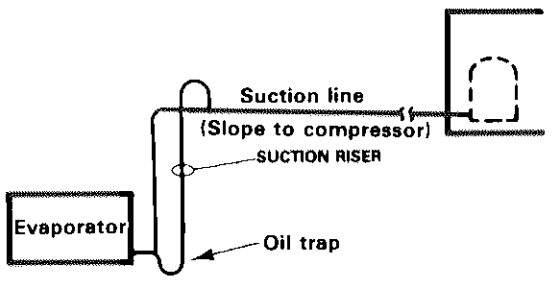
SLOPE HORIZONTAL LINES TOWARD COMPRESSOR

FIGURE 5

2 - Refrigerant velocities in all horizontal suction lines and in all suction drops must be above a minimum of 600 fpm for the refrigerant vapor to properly sweep the oil toward the compressor.

3 - The suction line from each evaporator must have an oil trap in it before rising into an overhead main or looping above the evaporator to guard against the gravity draining of liquid refrigerant to the compressor. When enough oil collects to seal the trap, a hydraulic head will be developed which will help force the oil up the riser.

4 - Refrigerant velocities in suction risers must be a minimum of 1000 fpm to ensure oil return. When evaporator is below compressor, suction line must be trapped at the bottom of each vertical riser.



EVAPORATOR WITH OIL TRAP

FIGURE 6

C - Sizing Horizontal and Down-Flow Suction Lines

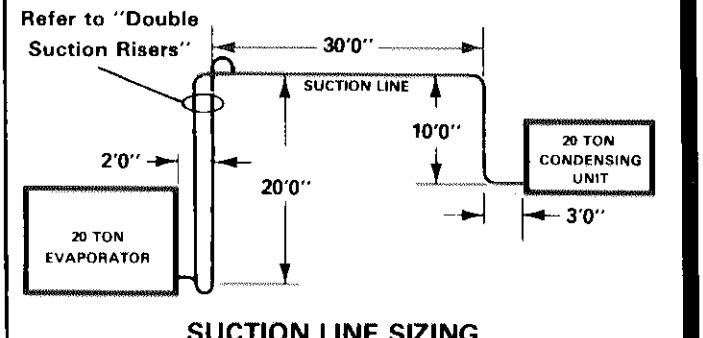
All horizontal and down-flow suction lines can be sized from Table 2. Refer to following example:

EXAMPLE 2 — Suction Line Sizing

Given : 20 ton condensing unit
20 ton evaporator

Find : Suction line size
Length of horizontal and down-flow suction line in feet = 45'
Pipe size from Table 2 = 2-1/8" o.d.

Answer : 2-1/8" o.d. copper



SUCTION LINE SIZING

FIGURE 7

VI - 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 vapor 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.

A - Sizing

HS17-1853 and -2753 series units require 1-3/8 in pipe for double suction risers.

B - Construction

Install a trap between the two risers as shown in figure 8. The trap must be close coupled. A suction line "P" trap is recommended. Part No. 10G3401 (1-3/8") is available from Lennox. The second riser must enter the main suction line from the top to avoid oil draining down the second riser during partial load operation.

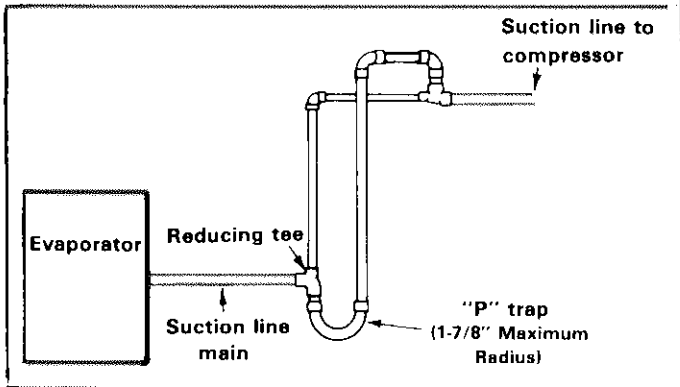


FIGURE 8

REFRIGERATION CONT.

VII - BRAZING REFRIGERANT LINES

Proper brazing techniques must be used for field fabricated refrigerant piping to prevent compressor failure, plugged expansion valves, etc. Piping must be kept clean and free of copper shavings, flux and oxidation scale. Keep the following items in mind:

1 - When cutting and deburring piping, remove all filing and shavings.

2 - Do not allow flux inside piping (start connection, apply flux, then push connection together).

3 - Flood system with nitrogen to prevent oxidation while brazing. Copper has a very high affinity for oxygen and will oxidize very rapidly when heated. This oxidation takes the form of scale which forms inside the piping during the brazing process.

CAUTION - When using dry nitrogen, a pressure-reducing regulator must be used to prevent excessive pressure.

4 - A strainer or strainer-drier should always be installed in the liquid line to each evaporator ahead of the liquid line solenoid valve and expansion valve.

VIII - REFRIGERANT LINE INSULATION AND HANGERS

1 - Always insulate all suction lines with an approved refrigeration insulation, such as Armaflex. Refer to manufacturer's recommendation for thickness.

2 - To prevent any abnormal loss in subcooling, liquid lines should always be insulated when run in areas exposed to high ambient conditions, such as rooftops or attics.

3 - All suction, liquid or hot gas refrigerant lines located underground must be properly insulated and completely waterproofed. Failure to do so can result in erratic operation and compressor damage.

4 - Insulate expansion valves and external fittings at the evaporators to prevent sweating.

5 - Support refrigerant lines with an approved type of hangers to prevent line vibration from being transferred to the structure. Isolate lines where they pass through roofs, walls and floors or where they come into contact with ductwoork (see figure 9). Table 3 lists the recommended hanger spacing.

TABLE 3

Recommended Hanger Spacing For Copper Tubing	
O.D. Pipe Size	Center to Center
5/8	6'
7/8" - 1-1/8"	8'
1-3/8" - 2-1/8"	10'

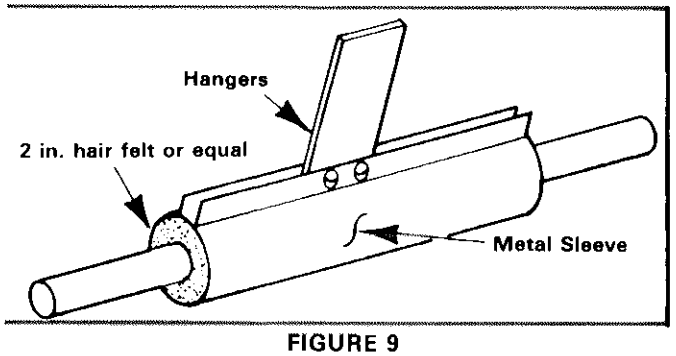


FIGURE 9

REFRIGERANT PIPING

Service Valves and Gauge Manifold Connections

The liquid line and suction line service valves and gauge ports are located on the inside of the cabinet. These gauge ports are used for leak testing, evacuating, charging and checking charge.

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

4 - Release nitrogen pressure from 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 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 vacuum 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 valves 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 completed, close gauge manifold service valves. Disconnect vacuum pump from manifold center port and connect refrigerant drum. Pressurize system slightly with refrigerant to break vacuum.

REFRIGERATION CONT.

Start-Up

1 - Inspect all fan bearings and motor bearings and lubricate if necessary.
2 - Inspect fan pulleys for proper alignment, set screws for tightness and belts for proper tension.
3 - Inspect fans or blowers for proper rotation.
4 - Inspect all wiring (both factory and field installed) for loose connections and tighten if necessary.
5 - Inspect compressor mountings and remove any shipping blocks.
6 - Check voltage supply at the disconnect switch. It must be within the range shown on the unit nameplate. If not, consult the power company and have the voltage condition corrected before continuing with the installation.

Charging

Unit is shipped with a holding charge in compressor.

1 - Back seat (open) suction and liquid line valves to pressurize system.
2 - Connect an R-22 drum to gauge port of the liquid line valve. Purge connecting line with refrigerant. Place drum upside down to charge system with liquid refrigerant.
3 - Adjust liquid line service valve slightly off back seat to record pressure at manifold discharge gauge during charging.
4 - Set cooling adjustment of room thermostat below room temperature and close disconnect switch to start unit. Adjust liquid valve to allow refrigerant to flow into system. As the head pressure increases, it will be necessary to partially close liquid line valve to maintain a flow of refrigerant from the drum into the system.

NOTE - If the unit shuts off during this procedure, open disconnect switch and jumper low pressure control. Close disconnect switch and continue charging operation.

5 - Charge a quantity of refrigerant into system, then close refrigerant drum valve and open liquid line valve. Allow unit to run for a few minutes to stabilize.
6 - Using a thermometer, record condenser entering air temperature and record the suction and liquid operating pressures.
7 - From the pressure curve on the unit, find the suction pressure and follow across the curve to the correct entering air temperature. From this point, read down to the liquid pressure. If the liquid pressure is within 3 psig (20.7 kPa) of the reading on manifold high pressure gauge, the unit is properly charged.
8 - After charging has been completed, back seat liquid line valve, disconnect charging line and replace gauge port cap. Back seat suction line service valve, disconnect gauge manifold and replace gauge port cap. Remove jumper from low pressure switch if used.

System Pump-Down

This unit 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 pump down. Always connect a high pressure gauge to the liquid line gauge port during system pump down. High pressure must not exceed 410 psig (2827 kPa).*

OPERATION — MAINTENANCE

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.

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.

Compressor Timed-Off Control

A compressor timed-off control is used for prevention of compressor fast cycling. At the end of a cooling cycle, the control de-energizes the compressor for a minimum off cycle of 5 minutes.

Low Pressure Switch

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

Crankcase Heater

Compressor is equipped with an internal self-regulating crankcase heater.

MAINTENANCE

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

Condensing Unit

1 - Clean and inspect condenser coil (May be flushed with a water hose).
2 - Condenser fan motor is prelubricated and sealed. Always relubricate motor according to instructions on the motor manufacturer's nameplate.
3 - Visually inspect connecting lines and coils for evidence of oil leaks.
4 - Check all wiring 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 section on refrigerant charging in this instruction.

Evaporator Coil

1 - Clean coil, if necessary
2 - Check 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 blower unit.
3 - Adjust blower speed for cooling. The pressure drop over the coil should be measured to determine the correct blower CFM. Refer to Unit Information Service Manual 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.
Motor nameplate _____ Actual _____