

**installation
operation
and
service
instructions**

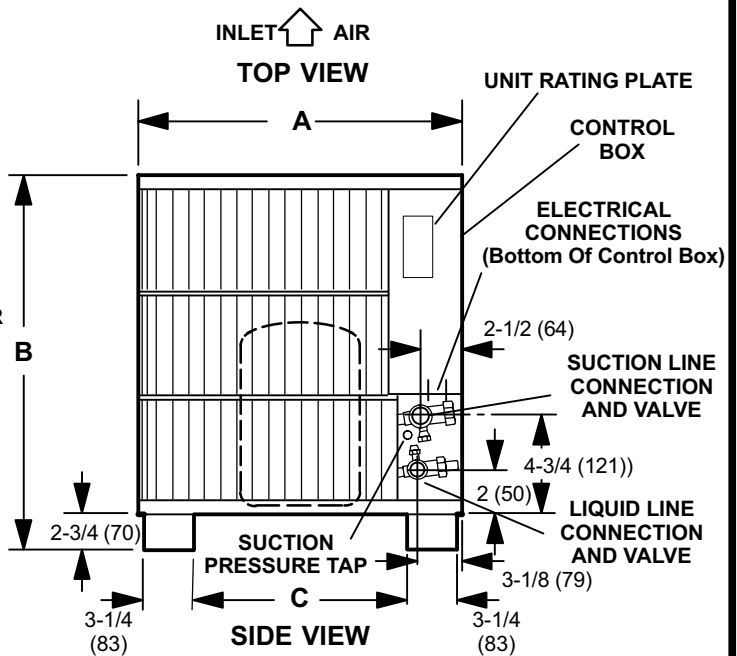
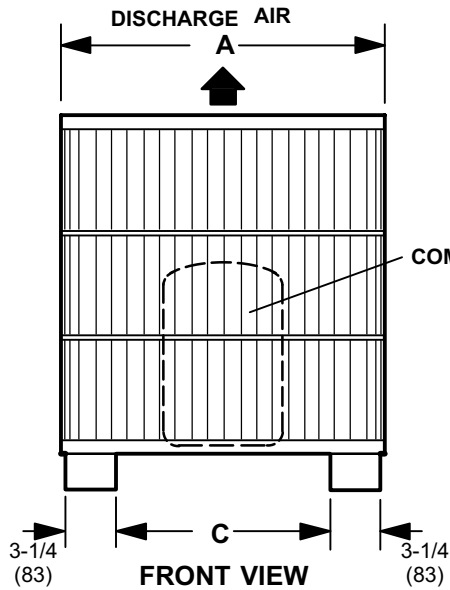
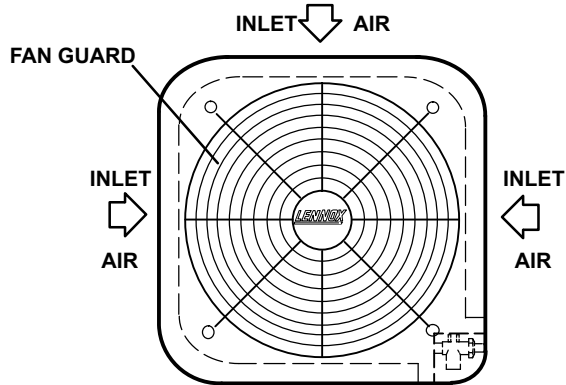
HP24 Series Units

502,801M
9/92
Supersedes 502,646M

**RETAIN THESE INSTRUCTIONS
FOR FUTURE REFERENCE**

HP24 UNIT DIMENSIONS

| UNIT | A | B | C |
|--------------|---------|---------|-----------|
| HP24-141 | 26-3/8" | 26-3/4" | 16-7/8" |
| HP24-211 | (670) | (670) | (429) |
| HP24-261 | | | |
| HP24-311 | 26-3/8" | 30-3/4" | 16-7/8" |
| HP24-411/413 | (670) | (781) | (429) |
| HP24-461/463 | | | |
| HP24-511/513 | 31-3/8" | 34-3/4" | 21-13/16" |
| HP24-651/653 | (797) | (883) | (538) |



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 _____ Outdoor Fan _____
 Maximum Fuse Size _____ Compressor _____
 Electrical Connections Tight?
 Supply Voltage (Unit Off) _____ Indoor Filter Clean? Indoor Blower RPM _____
 S.P. Drop Over Evaporator (Dry) _____
 Outdoor Coil Entering Air Temperature _____
 Liquid Pressure _____ Suction Pressure _____
 Refrigerant Charge Checked?
HEAT PUMP SECTION
 Refrigerant Lines: **THERMOSTAT**
 Leak Checked? Calibrated? Properly Set? Level?
 Service Valves Tightened? Properly Insulated?
 Outdoor Fan Checked?
 Voltage With Compressor Operating _____

I-SHIPPING AND PACKING LIST

Package 1 of 1 contains:

- 1- Assembled heat pump unit
- 1- Bag assembly

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.

⚠ WARNING

Product contains fiberglass wool.

Disturbing the insulation in this product during installation, maintenance, or repair will expose you to fiberglass wool. Breathing this may cause lung cancer. (Fiberglass wool is known to the State of California to cause cancer.)

Fiberglass wool may also cause respiratory, skin, and eye irritation.

To reduce exposure to this substance or for further information, consult material safety data sheets available from address shown below, or contact your supervisor.

**Lennox Industries Inc.
P.O. Box 799900
Dallas, TX 75379-9900**

II-INSTALLATION

HP24 heat pump units are approved and warranted only for installation with specially matched indoor coils, L10 line sets, and refrigerant control devices as designated by Lennox. Refer to the Lennox Engineering Handbook for approved systems.

A-Setting the Unit

Heat pump units operate under a wide range of weather conditions; therefore, several factors must be considered when positioning the outdoor unit. Unit must be positioned to give adequate clearances for sufficient air-flow and servicing. A minimum clearance of 36 in. (914 mm) between multiple units must be maintained. Refer to figure 1 for installation clearances.

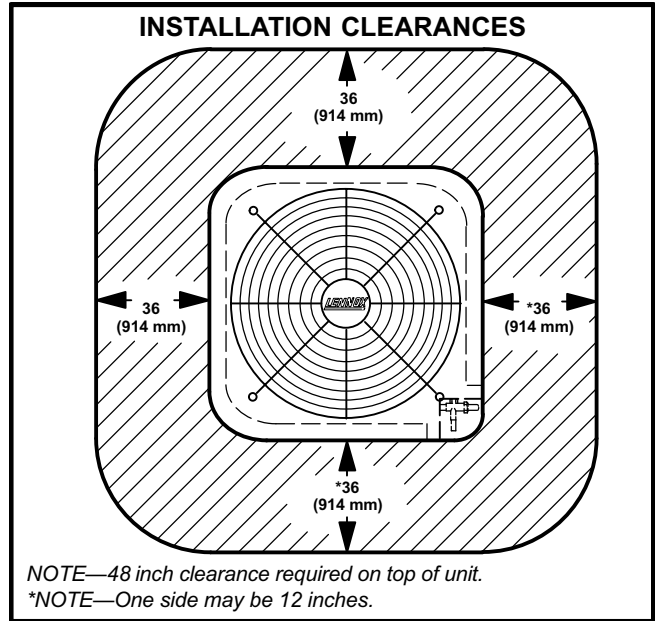


FIGURE 1

- 1- Place a sound-absorbing material, such as Iso-mode, under the unit if it will be installed in a location or position that will transmit sound or vibration to the living area or adjacent buildings.
- 2- Mount unit high enough above ground or roof to allow adequate drainage of defrost water and prevent ice build-up.
- 3- In heavy snow areas, do not locate unit where drifting will occur. The unit base should be elevated above the depth of average snows.
NOTE—Elevation of the unit may be accomplished by constructing a frame using suitable materials. If a support frame is constructed, it must not block drain holes in unit base.
- 4- When installed in areas where low ambient temperatures exist, locate unit so winter prevailing winds do not blow directly into outdoor coil.
- 5- Locate unit away from overhanging roof lines which would allow water or ice to drop on, or in front of, coil or into unit.

B-Slab Mounting-Figure 2

When installing unit at grade level, top of slab should be high enough above the grade so that water from higher ground will not collect around unit. See figure 2. Slab should have a slope tolerance away from the building of 2 degrees or 2 inches per 5 feet (51 mm per 1524 mm). This will prevent ice build-up under the unit during a de-frost cycle. Refer to roof mounting section for barrier construction if unit must face prevailing winter winds.

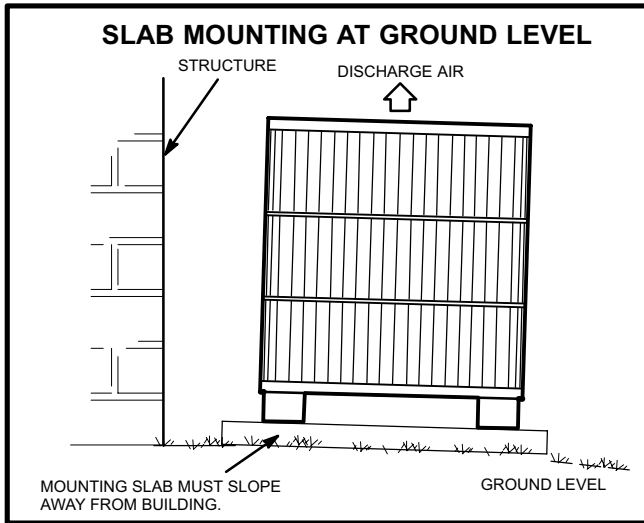


FIGURE 2

C-Roof Mounting-Figure 3

Install unit a minimum of 6 inches (152 mm) above the roof surface to avoid ice build-up around the unit. Locate the unit above a load bearing wall or area of the roof that can adequately support the unit. Consult local codes for rooftop applications.

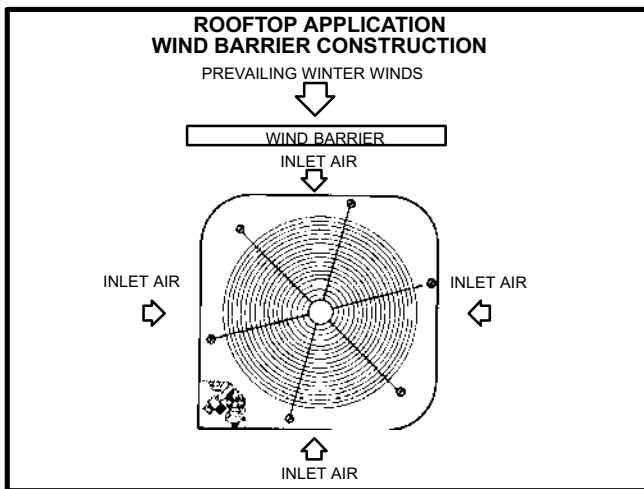


FIGURE 3

If unit coil cannot be mounted away from prevailing winter winds, a wind barrier should be constructed. Size barrier at least the same height and width as outdoor unit. Mount barrier 24 inches (610 mm) from the sides of the unit in the direction of prevailing winds.

III-ELECTRICAL CONNECTIONS

Wiring must conform with the National Electric Code (NEC) and local codes. An application diagram is included in this instruction and in indoor unit instructions.

Refer to unit rating plate, located on the control box cover, for minimum circuit ampacity and maximum fuse size.

- 1- Provide line voltage power supply to unit from a properly sized disconnect switch. Location of disconnect switch should be easily accessible and within sight of the unit.
- 2- Route power and ground wires from disconnect switch to unit. Electrical openings are provided under the control box cover. See unit dimension illustration on page 1.
- 3- Remove control box cover and connect power wiring to contactor. Connect ground wire to ground lug.
- 4- Install room thermostat (ordered separately) in the conditioned area. See figure 4 for new Lennox thermostat nomenclature versus old style nomenclature. Locate thermostat where it will not be affected by sunlight, drafts or vibration. Do not install thermostat on an outside wall. A position approximately 5 feet (1524 mm) from the floor and near the center of the conditioned area is most desirable.

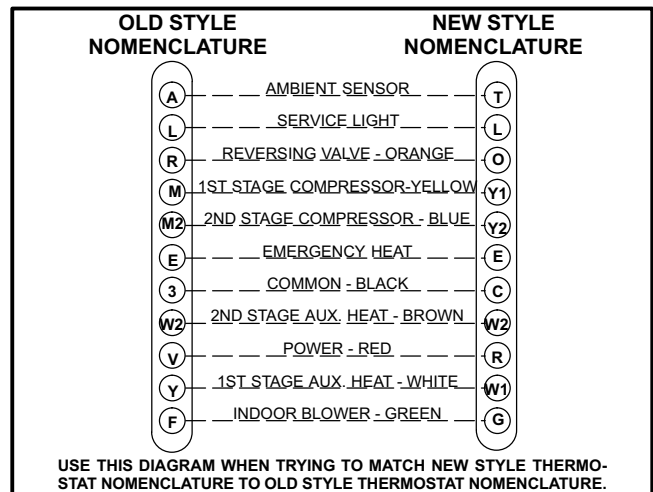


FIGURE 4

- 5- Route 24VAC control wires from the thermostat to indoor unit and from indoor unit to pigtail leads of the outdoor unit as shown in figure 5.

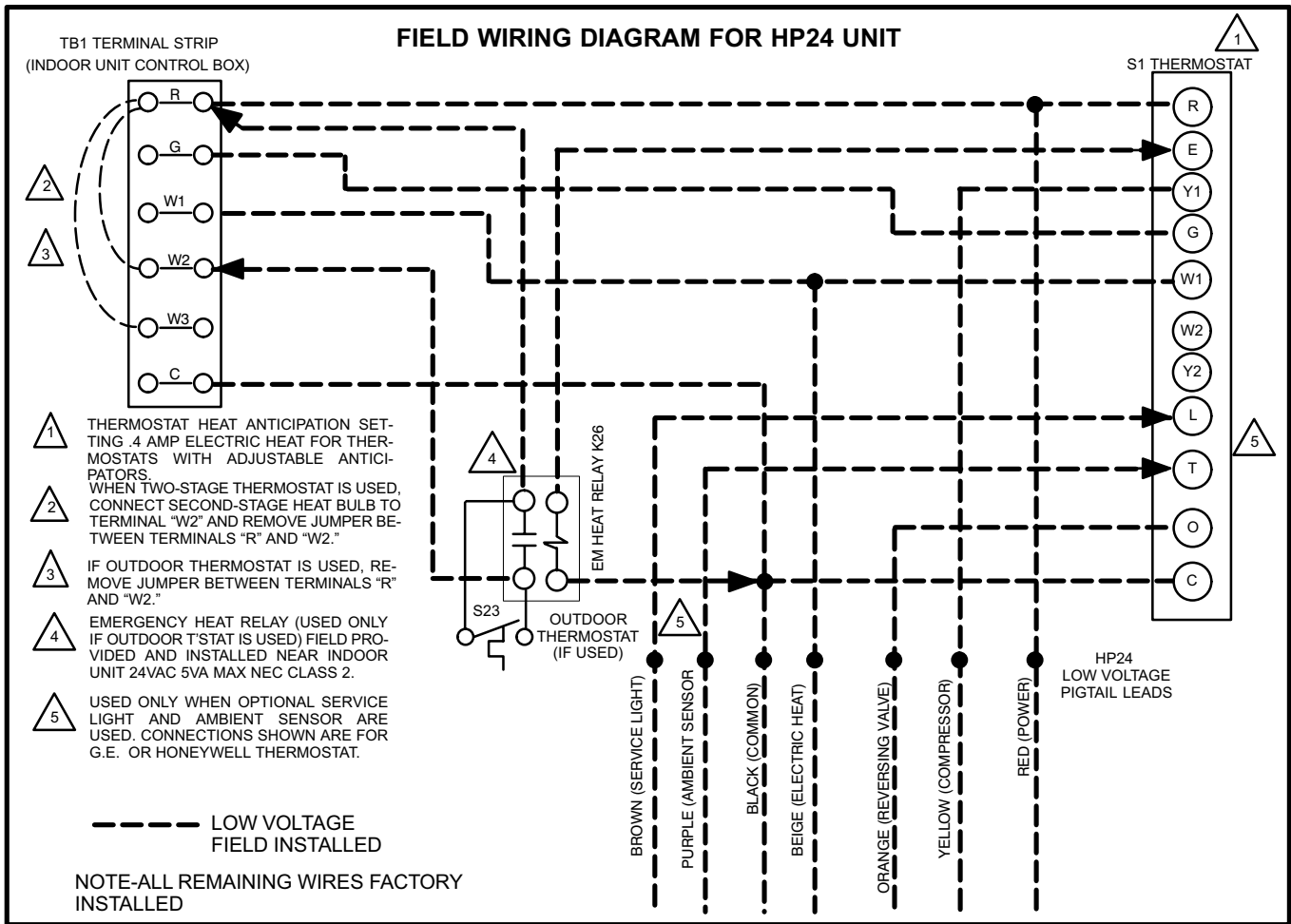


FIGURE 5

IV-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 line sets as shown in table 1 or use field-fabricated refrigerant lines. Refer to unit information manual piping section for proper size, type and application of field-fabricated lines.

If refrigerant tubes are routed through a wall, seal and isolate the opening so vibration is not transmitted to the building.

NOTE-Line length should be no greater than 50 feet (15.2 m). Select line set diameters from table 1 to ensure oil return to compressor.

TABLE 1

| UNIT | LIQUID LINE | VAPOR LINE | L10 LINE SETS |
|------------------------------|----------------|------------------|---|
| HP24-141 | 1/4 in. (6mm) | 1/2 in. (12mm) | Field Fabricated |
| HP24-211 HP24-261 | 5/16 in. (8mm) | 5/8 in. (16mm) | L10-21 20 ft. - 50 ft. (3m - 15.2m) |
| HP24-311 HP24-411/413 | 3/8 in. (10mm) | 3/4 in. (19mm) | L10-41 20 ft. - 50 ft. (6.1m - 15.2m) |
| HP24-461/463 HP24-511/513 | 3/8 in. (10mm) | 7/8 in. (22mm) | L10-65 30 ft. - 50 ft. (9.1m - 15.2m) |
| HP24-651/653 | 3/8 in. (10mm) | 1-1/8 in. (29mm) | Field Fabricated |

NOTE-To obtain maximum efficiency, remove the 3/4" reduction from the L10-65 series line sets and the flare fitting from the indoor coil. Then, make a sweat connection using a 7/8" X 1-1/8" reducer bushing.

A-Sweat Connection Procedure

- 1- End of refrigerant line must be cut square, free from nicks or dents, deburred. Pipe must remain round, do not pinch end of line. (I.D. and O.D.)
- 2- The thermometer well (packaged separately and attached to the liquid line) should be installed in the liquid line close to the HP24 unit as shown in figure 5. Connect thermometer well male end to female end of liquid valve. Take care to install thermometer well so that the thermometer can be inserted and read easily. Wrap a wet cloth around the liquid line valve body and copper tube stub to protect from heat damage during brazing. Wrap another wet cloth underneath the liquid valve to protect the base paint.

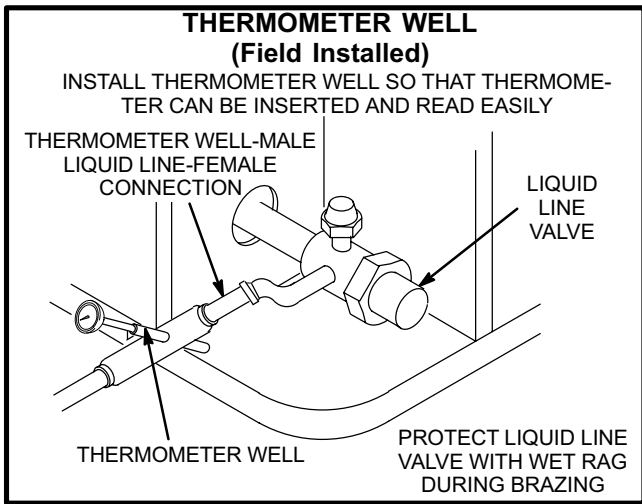


FIGURE 6

- 3- Quench the joint with water or a wet cloth to prevent possible heat damage to valve core and opening port.

B-Indoor Coil Connections

Piping consists of flare connections to the indoor coil. Refer to installation instructions packaged with the indoor coil and the expansion valve kit for proper installation of the expansion valve.

V-REFRIGERATION

Processing Procedure

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 20 foot (6096 mm) line set. For varying lengths of line set, refer to table 2 for refrigerant charge adjustment.

TABLE 2

| Liquid Line Set Diameter | Ozs. per 5 ft. (ml per mm) adjust from 20 ft. (7620 mm) line set* |
|--------------------------|---|
| 1/4 in. (6mm) | 1 ounce per 5 ft. (30ml per 1524 mm) |
| 5/16 in. (8mm) | 2 ounce per 5 ft. (60ml per 1524 mm) |
| 3/8 in. (10mm) | 3 ounce per 5 ft. (90ml per 1524 mm) |

*If line length is greater than 20 feet (6096 mm), add this amount. If line length is less than 20 feet (6096 mm), subtract this amount.

A-Service Valves and Gauge Manifold Attachment

The liquid line and vapor line service valves and gauge ports are accessible from outside the unit. These valves can be closed once they have been opened. The liquid line service valve is a back-seating valve. The gauge port is closed when the valve is fully back-seated. The gauge port does not contain a valve core. The valve must be turned one-half turn clockwise from the full back-seated position to take pressure measurement. The gauge ports are used for leak testing, evacuating, charging and checking operating pressures. A separate gauge port is provided for checking the suction pressure when the unit is in the heating cycle.

! IMPORTANT

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

B-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 collector is used, add a trace of refrigerant to the nitrogen for leak detection.
- 4- Release nitrogen pressure from the system. Correct any leaks and recheck.

C-System Evacuation

- 1- Attach gauge manifold as shown in figure 7. 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.
- 2- Evacuate the system to 29 inches (737 mm) 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 leak testing procedures would be necessary.

- 3- After the system has been evacuated to 29 inches (737 mm), 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- Reconnect vacuum pump to gauge manifold center port. Evacuate system through manifold service valves until vacuum in system does not rise above 29.7 inches (754 mm) mercury (5 mm absolute pressure) with a 20-minute period after stopping vacuum pump.
- 6- After evacuation is completed, close manifold service valves, disconnect vacuum pump from gauge manifold center port, and connect refrigerant drum. Pressurize system slightly with refrigerant to break vacuum.

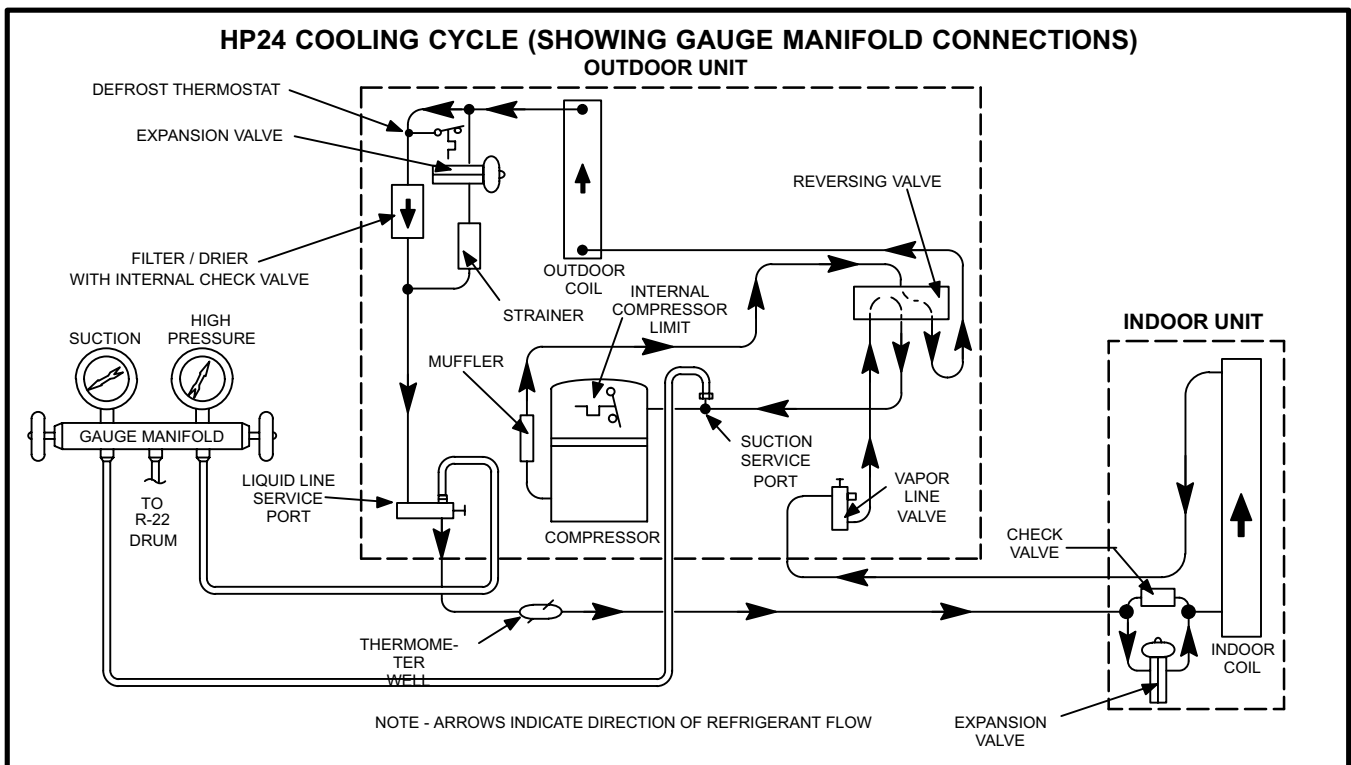


FIGURE 7

VI-UNIT START-UP AND ADJUSTMENTS

A-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 vapor line service valves (counterclockwise) to release refrigerant charge (contained in heat pump unit) into the system.
- 4- Replace stem caps and secure finger tight, then tighten an additional (1/6) one-sixth of a turn.
- 5- Check voltage supply at the disconnect switch. The voltage must be within the range listed on the unit nameplate. If not, do not start the equipment until the power company has been consulted and the voltage condition has been corrected.
- 6- Set the thermostat for a cooling demand, turn on power to indoor blower coil and close heat pump unit disconnect to start unit.
- 7- Recheck unit 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.

B-Charging

Charging the unit should be done in the cooling mode. If the system is void of refrigerant weigh in the factory charge as specified on unit rating plate. See dimension drawing on page 1 for unit nameplate location. The HP24 unit may be used with either expansion valve systems or RFCIII systems. Charging procedures for each are described in the following section and on the charging sticker located on the inside of the control box. The model number "410" refers to both 411 (single-phase) and 413 (three-phase) units. The same applies for 460 (461/463), 510 (511/513) and 650 (651/653) units.

1-Expansion Valve Systems

Those systems using expansion valves may charge to two different methods: Approach or Subcooling. See table 3 for applicable check and expansion valve kits.

**TABLE 3
INDOOR CHECK AND EXPANSION VALVE KITS**

| MODEL | KIT NUMBER |
|------------------|------------|
| HP24-141 | LB-34792BJ |
| HP24-211/261 | LB-34792BE |
| HP24-311/410/460 | LB-34792BG |
| HP24-510 | LB-34792BF |
| HP24-650 | LB-34792BH |

APPROACH METHOD

(Ambient Temperature of 60°F [16°C] or Above)

- 4- If outdoor temperature is 60°F (16°C) or above, the approach method of checking charge is used. The approach temperature is equal to the liquid line temperature minus the ambient temperature. Place the thermometer in the thermometer well and read the liquid line temperature. The difference between the ambient temperature should match the value given in table 4.

**TABLE 4
APPROACH METHOD**

| MODEL | LIQUID TEMP MINUS AMBIENT TEMP. (°F) |
|--------------|--------------------------------------|
| HP24-141 | 6 |
| HP24-211 | 5 |
| HP24-261 | 7 |
| HP24-311/410 | 14 |
| HP24-410CDN | 12 |
| HP24-460 | 11 |
| HP24-510 | 11 |
| HP24-650 | 7 |

NOTE-For best results, use same thermometer to measure both ambient and liquid line temperatures.

An approach temperature greater than the value given in table 4 indicates an undercharge. Add refrigerant slowly and continue to watch liquid line temperature until approach temperature approximates the value given in table 4.

An approach temperature less than the value shown in table 4 indicates an overcharge. Use an approved refrigerant reclaiming method to remove refrigerant from the system.

SUBCOOLING METHOD

(Ambient Temperatures Below 60°F [16°C])

- 5- If outdoor temperature is less than 60°F (16°C), the subcooling method of charging is used. The subcooling temperature is equal to the condensing temperature minus the liquid line temperature.

It may be necessary to restrict air flow in order to reach liquid pressures in the 200-250 psig range which are required for checking charge. Block equal sections of air intake panels as shown in figure 8, moving obstructions sideways until liquid pressures in the 200-250 psig range are reached.

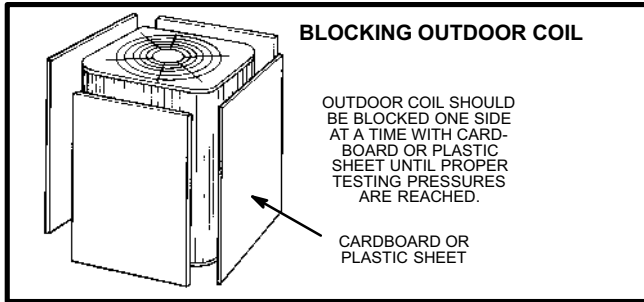


FIGURE 8

Insert thermometer in well and check liquid line temperature. Read liquid line pressure from gauge and convert to condensing temperature using standard R-22 temperature/pressure conversion chart. The subcooling temperature should approximate the value given in table 5.

**TABLE 5
SUBCOOLING METHOD**

| MODEL | SUBCOOLING TEMP. (°F) |
|-------------|-----------------------|
| HP24-141 | 4 ± 2 |
| HP24-211 | 9 ± 2 |
| HP24-261 | 13 ± 2 |
| HP24-311 | 9 ± 2 |
| HP24-410 | 9 ± 2 |
| HP24-410CDN | 13 ± 2 |
| HP24-460 | 8 ± 2 |
| HP24-510 | 6 ± 2 |
| HP24-650 | 7 ± 2 |

A subcooling temperature less than the value given in table 5 indicates an undercharge. Add refrigerant slowly and continue to watch liquid line temperature until subcooling temperature approximates the value given in table 5.

A subcooling temperature greater than the value given in table 5 indicates an overcharge. Use an approved refrigerant reclaiming method to remove refrigerant from system.

- 6- When unit is properly charged, whether by the approach or subcooling method, liquid and suction line pressures should be measured at the service valves. In heating mode, the suction pressure should be measured at the suction pressure tap as shown in the unit illustration on page 1.

2-RFCIII Systems

It is not recommended that the system be charged at ambients below 60 °F (15°C). If charging below 60 °F (15°C) is required, weigh in the amount of charge listed on the unit rating plate. See unit dimension drawing on page 1 for unit rating plate location. If line set is longer or shorter than 25 feet, add or remove refrigerant as outlined in table 2.

If ambient temperature is above 60 °F (15°C), place thermometer in well and read liquid line temperature. Read liquid line pressure and convert to condensing temperature using standard R-22 temperature/pressure conversion chart (or conversion scale on gauge). The difference between the liquid line temperature and the conversion temperature is subcooling. The subcooling temperature should approximate the value given in Table 6. Add refrigerant to increase subcooling and remove refrigerant to reduce subcooling.

**TABLE 6
SUBCOOLING METHOD--RFCIII Systems**

| Outdoor Unit | Indoor Unit | Subcooling at Various Ambient Temperatures °F | | | | | |
|--------------|-------------|---|----|----|----|-----|-----|
| | | 65 | 75 | 85 | 95 | 105 | 115 |
| HP24-141 | CB/CBH19-21 | 5 | 5 | 4 | 1 | 0 | 0 |
| HP24-211 | CB/CBH19-21 | 13 | 13 | 13 | 12 | 6 | 4 |
| HP24-261 | CB/CBH19-26 | 12 | 12 | 11 | 9 | 7 | 5 |
| HP24-311 | CB/CBH19-31 | 12 | 12 | 10 | 8 | 6 | 4 |
| HP24-410CDN | CB/CBH19-41 | 13 | 12 | 10 | 8 | 6 | 3 |
| HP24-410 | CB/CBH19-41 | 17 | 15 | 14 | 11 | 8 | 5 |
| HP24-460 | CB/CBH19-41 | 11 | 10 | 7 | 6 | 4 | 2 |
| HP24-510 | CB19-51 | 11 | 10 | 8 | 7 | 5 | 2 |

C-Compressor Oil Charge

Refer to Lennox Cooling Service Handbook for correct procedure to check and add compressor oil. Heat pump grade mineral oil (brand and viscosity unspecified) should be used.

**TABLE 7
COMPRESSOR OIL CHARGE**

| UNIT MODEL NO. | COMPRESSOR OIL CHARGE (Fluid Ozs.) |
|----------------|------------------------------------|
| HP24-141 | 14 |
| HP24-211 | 32 |
| HP24-261 | 32 |
| HP24-311 | 32 |
| HP24-410 | 54 |
| HP24-410CDN | 40 |
| HP24-460 | 45 |
| HP24-510 | 65 |
| HP24-650 | 65 |

VII-OPERATION

A-Filter Drier

The filter drier is equipped with an internal check valve for correct refrigerant flow. See figure 7. If replacement is necessary, order another of like design and capacity. A strainer in the liquid line gives additional protection.

B-Crankcase Heater

⚠ IMPORTANT

Crankcase heater (when provided) should be energized before start-up to prevent compressor damage as a result of slugging.

C-Thermostat Operation

Some heat pump thermostats incorporate isolating contacts and an emergency heat function (which includes an amber indicating light). The thermostat is not included with the unit and must be purchased separately.

D-Emergency Heat Function

An emergency heat function is designed into some thermostats. This feature is applicable when isolation of outdoor unit is required or when auxiliary electric heat is staged by outdoor thermostats. When the room thermostat is placed in the emergency heat position, the outdoor unit control circuit is isolated from power and field-provided relays bypass the outdoor thermostats. An amber indicating light simultaneously comes on to remind the homeowner that he is operating in the emergency heat mode.

Emergency heat is usually used during a heat pump shutdown, but it should also be used following a power outage if power has been off for over an hour and the outdoor temperature is below 50°F (10°C). System should be left in the emergency heat mode at least six hours to allow the crankcase heater sufficient time to prevent compressor slugging.

E-Defrost System

The HP24 defrost system includes two components: a defrost thermostat, and a defrost timer.

Defrost Thermostat

The defrost thermostat is mounted on the liquid line between the check valve/drier and the distributor. When defrost thermostat senses 35°F (2°C) or cooler, its contacts close and send a signal to the defrost timer for it to start the timing. It also terminates defrost when the liquid line warms up to 70°F (21°C).

Defrost Timer

This control asks for a defrost every 60 minutes after the

defrost thermostat closes. The timer will not allow a defrost to last for more than 14 minutes. The defrost timer can be field adjusted from a 60-minute to a 30- or 90-minute defrost interval if warranted by climatic conditions.

VIII-MAINTENANCE

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

A-Heat Pump Unit

- 1- Clean and inspect outdoor coil (may be flushed with a water hose).
- 2- Outdoor unit fan motor is prelubricated and sealed. Always relubricate motor according to the instructions on the motor manufacturer's nameplate.
- 3- Visually inspect all connecting lines, joints 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 heat pump fan motor.
Unit nameplate _____ Actual _____.
- 7- Inspect drain holes in coil compartment base and clean if necessary.

NOTE-If insufficient heating or cooling occurs, the unit should be gauged and refrigerant charge should be 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- Lennox blower motors are prelubricated and permanently sealed. No further lubrication is necessary.
- 3- Adjust blower speed for cooling. The pressure drop over the coil should be checked to determine the correct blower CFM. Refer to the Lennox Cooling Service Handbook for pressure drop tables and procedures.
- 4- Check all wiring for loose connections.
- 5- Check for correct voltage at unit.
- 6- Check amp draw on blower motor.
Motor nameplate _____ Actual _____.