

Residential Split Systems

ADDENDUM

Application Guidelines for Refrigerant Lines

SAFETY INFORMATION

Please read all instructions before servicing this equipment. Pay attention to all safety warnings and any other special notes highlighted in the manual. Safety markings are used frequently throughout this manual to designate a degree or level of seriousness and should not be ignored.

WARNING indicates a potentially hazardous situation that if not avoided, could result in personal injury or death.

CAUTION indicates a potentially hazardous situation that if not avoided, may result in minor or moderate injury or property damage.

WARNING:

To avoid the risk of electrical shock, personal injury, or death, disconnect all electrical power to the unit before performing any maintenance or service and follow all warning labels. The unit may have more than one electrical power supply.

- It is the responsibility of the installer to ensure that the installation is made in accordance with all applicable local and national codes.
- Be sure to read this document thoroughly and understand all procedures before attempting installation or modification of the system. Wear safety glasses, protective clothing, and work gloves. Have a fire extinguisher handy during installation and use a quenching cloth for brazing operations.
- Installed equipment must be in compliance with all national and local codes. Disconnect power to the unit before any electric service is attempted and follow all warning labels on the unit.

GENERAL INFORMATION

These guidelines apply to residential R410-A split system air conditioners and heat pumps with nominal capacities under 65,000 Btu. The installation instructions provided with the equipment specify a maximum equivalent line length of 75 feet. This guideline covers applications with equivalent line lengths up to 175 feet.

Thermal expansion valves may be used in air conditioner and heat pump systems. When properly installed, the TXV will adjust the refrigerant flow by monitoring the superheat of the system.

- If precise forming of refrigerant lines is required, a copper tubing bender is recommended. Avoid sharp bends and contact of the refrigerant lines with metal surfaces.
- Refrigerant lines should be wrapped with pressure sensitive neoprene or other suitable material where they pass against sharply edged sheet metal.
- It is good practice to add a drop of refrigerant oil on all threaded connections.

REFRIGERANT LINE CONSIDERATIONS

WARNING:

Refrigeration equipment contains liquid and gaseous refrigerant under high pressure. Installation or servicing should only be performed by trained personnel thoroughly familiar with this type of equipment.

- Always use safe and environmentally sound methods for refrigerant handling. When repairing system leakages, always utilize a nitrogen (inert) gas to protect the refrigerant system and pressure check the repair before re-charging.

WARNING:

These instructions are intended primarily to assist qualified individuals experienced in the proper installation of this appliance. Some local codes require licensed installation/service personnel for this type of equipment. Read all instructions carefully before starting the installation.

Installation, service, and repair of air conditioning units must be performed by trained service technicians only. Death, personal injury, or property damage may occur due to improper installation, system alteration, or system maintenance. It is important that qualified installers use factory approved accessories and kits when modifying any systems.

DO NOT DESTROY. PLEASE READ CAREFULLY AND KEEP IN A SAFE PLACE FOR FUTURE REFERENCE.

- Always replace the filter-dryers when performing any repair to the refrigeration system with one capable of acid removal. After completing the repairs, evacuate the system to 350-500 microns and weigh in the refrigerant to the amount specified in the Quick Reference Data sheet or the unit's rating plate.

⚠ CAUTION:

To prevent damage to the unit or internal components, it is recommended that two wrenches be used when loosening or removing lines. Do not over tighten!

- Proper sizing of the refrigerant lines is critical to maintain satisfactory performance and reliability. Many factors are involved in determining refrigerant line size include: length of horizontal run, length of vertical risers, number and placement of fittings, placement of the condensing unit to the evaporator, and total equivalent line length.

⚠ CAUTION:

To prevent damage to the TXV, brazing should be done prior to the attachment of the liquid line to the fitting assembly.

⚠ CAUTION:

It is recommended that a wet rag be wrapped around the suction line in front of the close off plate before applying heat. Failure to keep components cool during brazing may result in structural damage, premature equipment failure, or possible personal injury.

- It is recommended that all systems installed in long-line applications use only 3/8" liquid lines. Use of larger liquid lines will significantly increase the system charge and could lead to liquid refrigerant related failures of the compressor. Static head and friction losses in liquid lines must be minimized to avoid refrigerant flashing.
- The vapor line must be sized so that refrigerant velocities are high enough to return oil to the compressor. Low refrigerant velocities can result in loss of lubrication failures of the compressor.

NOTE: The ASHRAE Fundamentals recommend a refrigerant velocity under low load conditions of 500 feet per minute in horizontal runs and 1000 feet per minute in vertical risers. The approximate cooling capacity loss for various vapor line sizes and equivalent lengths are shown in Tables 1 - 4 (pages 3 - 8). Equivalent length is the total linear length of vapor line plus additional equivalent lengths for all fittings and elbows. See Table 7 (page 9) for fitting lengths.

- Use special care to isolate the refrigerant lines from the structure to prevent vibration and/or noise from being transmitted to the structure.

RESTRICTOR SIZING

Long refrigerant line runs result in increased frictional flow losses. In order to compensate for these losses, the restrictor(s) must be re-sized per the following tables. If the total equivalent horizontal length is greater than 100 feet, the restrictor(s) bore must be increased by .001 inches over the value shown in Table 6 (page 9).

If the required restrictor size determined from Table 6 is a non-standard size, round up to the nearest standard restrictor size.

CHARGING

All split systems are factory shipped with the refrigerant charge noted on the unit nameplate. This charge is for a typical application of 15 feet of actual line length. Systems installed with more than 25 feet of refrigerant line should be charged following the charging method described in the installation instructions. No additional oil charge is required for these applications.

ADDITIONAL COMPONENTS

- For equivalent line lengths above 100 feet, a compressor crankcase heater is required.
- For applications where the outdoor unit is more than 50 feet above the indoor unit, an oil trap must be installed in the vapor line at the 50 foot elevation and every 40 feet above 50 feet.
- For applications with a vertical separation of more than 75 feet between the indoor and outdoor units, a liquid line solenoid kit must be installed within 10 feet of the outdoor unit. An anti-short cycle timer (ASCT) is recommended for all applications with vertical separation above 75 feet. Note that ASCT is standard on all heat pumps and many electronic thermostats. See Table 5 (page 9).

| NOMINAL UNIT CAPACITY | MAXIMUM LIQUID LINE DIAMETERS | EXTENDED RUN VAPOR LINE DIAMETER | PERCENT NOMINAL COOLING CAPACITY VS. EQUIVALENT LINE LENGTH | | | | | | |
|-----------------------|-------------------------------|----------------------------------|---|--------|--------|---------|---------|---------|---------|
| | | | 25 FT. | 50 FT. | 75 FT. | 100 FT. | 125 FT. | 150 FT. | 175 FT. |
| 18,000 | 1/4 | 5/8 | 100 | 100 | 100 | 100 | 99 | 99 | 99 |
| | | 3/4 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| | | 7/8 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| | | 1 1/8 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| | 5/16 | 5/8 | 100 | 100 | 99 | 99 | 99 | 98 | 98 |
| | | 3/4 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| | | 7/8 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| | | 1 1/8 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| | 3/8 | 5/8 | 100 | 99 | 99 | 99 | 99 | 98 | 98 |
| | | 3/4 | 100 | 100 | 100 | 100 | 99 | 99 | 99 |
| | | 7/8 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| | | 1 1/8 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| 24,000 | 1/4 | 5/8 | 100 | 99 | 99 | 98 | 98 | 97 | 96 |
| | | 3/4 | 100 | 100 | 100 | 100 | 99 | 99 | 99 |
| | | 7/8 | 100 | 100 | 100 | 100 | 100 | 100 | 99 |
| | | 1 1/8 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| | 5/16 | 5/8 | 100 | 99 | 99 | 98 | 98 | 97 | 97 |
| | | 3/4 | 100 | 100 | 100 | 100 | 100 | 99 | 99 |
| | | 7/8 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| | | 1 1/8 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| | 3/8 | 5/8 | 100 | 100 | 99 | 98 | 97 | 97 | 96 |
| | | 3/4 | 100 | 100 | 100 | 100 | 99 | 99 | 99 |
| | | 7/8 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| | | 1 1/8 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| 30,000 | 1/4 | 5/8 | 100 | 99 | 98 | 98 | 97 | 96 | 95 |
| | | 3/4 | 100 | 100 | 100 | 99 | 99 | 99 | 99 |
| | | 7/8 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| | | 1 1/8 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| | 5/16 | 5/8 | 100 | 99 | 98 | 97 | 96 | 96 | 95 |
| | | 3/4 | 100 | 100 | 99 | 99 | 99 | 99 | 98 |
| | | 7/8 | 100 | 100 | 100 | 100 | 100 | 99 | 99 |
| | | 1 1/8 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| | 3/8 | 5/8 | 100 | 99 | 98 | 97 | 96 | 96 | 95 |
| | | 3/4 | 100 | 100 | 99 | 99 | 99 | 98 | 98 |
| | | 7/8 | 100 | 100 | 100 | 100 | 100 | 99 | 99 |
| | | 1 1/8 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| 36,000 | 1/4 | 5/8 | 100 | 98 | 97 | 95 | 93 | 92 | 90 |
| | | 3/4 | 100 | 99 | 99 | 98 | 97 | 96 | 95 |
| | | 7/8 | 100 | 100 | 99 | 99 | 98 | 97 | 97 |
| | | 1 1/8 | 100 | 100 | 100 | 99 | 99 | 98 | 98 |
| | 5/16 | 5/8 | 99 | 98 | 97 | 96 | 95 | 93 | 92 |
| | | 3/4 | 100 | 100 | 99 | 99 | 98 | 98 | 97 |
| | | 7/8 | 100 | 100 | 100 | 100 | 99 | 99 | 99 |
| | | 1 1/8 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| | 3/8 | 5/8 | 99 | 98 | 97 | 96 | 94 | 93 | 92 |
| | | 3/4 | 100 | 100 | 99 | 99 | 98 | 98 | 97 |
| | | 7/8 | 100 | 100 | 100 | 100 | 99 | 99 | 99 |
| | | 1 1/8 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |

Cells shaded in gray are not recommended due to low vapor velocities through the compressor.

Table 1. Single Stage Air Conditioners Capacity Losses

| NOMINAL UNIT CAPACITY | MAXIMUM LIQUID LINE DIAMETERS | EXTENDED RUN VAPOR LINE DIAMETER | PERCENT NOMINAL COOLING CAPACITY Vs. EQUIVALENT LINE LENGTH | | | | | | |
|-----------------------|-------------------------------|----------------------------------|---|--------|--------|---------|---------|---------|---------|
| | | | 25 FT. | 50 FT. | 75 FT. | 100 FT. | 125 FT. | 150 FT. | 175 FT. |
| 42,000 | 1/4 | 5/8 | 100 | 98 | 96 | 95 | 93 | 91 | 90 |
| | | 3/4 | 100 | 100 | 99 | 98 | 97 | 97 | 96 |
| | | 7/8 | 100 | 100 | 100 | 100 | 99 | 99 | 99 |
| | | 1 1/8 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| | 5/16 | 5/8 | 99 | 98 | 96 | 95 | 93 | 92 | 90 |
| | | 3/4 | 100 | 99 | 99 | 98 | 98 | 97 | 97 |
| | | 7/8 | 100 | 100 | 100 | 100 | 99 | 99 | 99 |
| | | 1 1/8 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| | 3/8 | 5/8 | 99 | 98 | 96 | 95 | 93 | 92 | 90 |
| | | 3/4 | 100 | 99 | 99 | 98 | 98 | 97 | 97 |
| | | 7/8 | 100 | 100 | 100 | 99 | 99 | 99 | 99 |
| | | 1 1/8 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| 48,000 | 1/4 | 5/8 | 100 | 98 | 95 | 93 | 91 | 88 | 86 |
| | | 3/4 | 100 | 100 | 99 | 98 | 96 | 95 | 94 |
| | | 7/8 | 100 | 100 | 100 | 99 | 98 | 97 | 96 |
| | | 1 1/8 | 100 | 100 | 100 | 100 | 99 | 99 | 98 |
| | 5/16 | 5/8 | 99 | 97 | 95 | 94 | 92 | 90 | 88 |
| | | 3/4 | 100 | 99 | 99 | 98 | 97 | 97 | 96 |
| | | 7/8 | 100 | 100 | 100 | 100 | 99 | 99 | 99 |
| | | 1 1/8 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| | 3/8 | 5/8 | 99 | 97 | 95 | 94 | 92 | 90 | 88 |
| | | 3/4 | 100 | 100 | 99 | 98 | 97 | 97 | 96 |
| | | 7/8 | 100 | 100 | 100 | 100 | 99 | 99 | 99 |
| | | 1 1/8 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| 60,000 | 1/4 | 5/8 | 98 | 95 | 92 | N/A | N/A | N/A | N/A |
| | | 3/4 | 99 | 98 | 97 | N/A | N/A | N/A | N/A |
| | | 7/8 | 100 | 100 | 99 | N/A | N/A | N/A | N/A |
| | | 1 1/8 | 100 | 100 | 100 | N/A | N/A | N/A | N/A |
| | 5/16 | 5/8 | 98 | 95 | 93 | 90 | 87 | 85 | 82 |
| | | 3/4 | 99 | 98 | 97 | 96 | 95 | 94 | 93 |
| | | 7/8 | 100 | 100 | 99 | 98 | 98 | 97 | 97 |
| | | 1 1/8 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| | 3/8 | 5/8 | 98 | 95 | 93 | 90 | 87 | 85 | 82 |
| | | 3/4 | 99 | 98 | 97 | 96 | 95 | 94 | 93 |
| | | 7/8 | 100 | 99 | 99 | 98 | 98 | 97 | 97 |
| | | 1 1/8 | 100 | 100 | 100 | 100 | 100 | 100 | 99 |

Cells shaded in gray are not recommended due to low vapor velocities through the compressor.

Table 1. Continued

| NOMINAL UNIT CAPACITY | MAXIMUM LIQUID LINE DIAMETERS | EXTENDED RUN VAPOR LINE DIAMETER | PERCENT NOMINAL COOLING CAPACITY VS. EQUIVALENT LINE LENGTH | | | | | | |
|-----------------------|-------------------------------|----------------------------------|---|--------|--------|---------|---------|---------|---------|
| | | | 25 FT. | 50 FT. | 75 FT. | 100 FT. | 125 FT. | 150 FT. | 175 FT. |
| 18,000 | 1/4 | 5/8 | 100 | 100 | 99 | 99 | 99 | 98 | 98 |
| | | 3/4 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| | | 7/8 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| | | 1 1/8 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| | 5/16 | 5/8 | 100 | 99 | 99 | 99 | 99 | 98 | 98 |
| | | 3/4 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| | | 7/8 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| | | 1 1/8 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| | 3/8 | 5/8 | 100 | 99 | 99 | 98 | 98 | 98 | 97 |
| | | 3/4 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| | | 7/8 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| | | 1 1/8 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| 24,000 | 1/4 | 5/8 | 100 | 99 | 98 | 97 | 96 | 95 | 94 |
| | | 3/4 | 100 | 100 | 99 | 99 | 98 | 98 | 97 |
| | | 7/8 | 100 | 100 | 100 | 100 | 100 | 99 | 99 |
| | | 1 1/8 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| | 5/16 | 5/8 | 100 | 99 | 98 | 97 | 96 | 95 | 95 |
| | | 3/4 | 100 | 100 | 100 | 100 | 100 | 99 | 99 |
| | | 7/8 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| | | 1 1/8 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| | 3/8 | 5/8 | 100 | 99 | 99 | 98 | 98 | 97 | 97 |
| | | 3/4 | 100 | 100 | 100 | 100 | 99 | 99 | 99 |
| | | 7/8 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| | | 1 1/8 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| 30,000 | 1/4 | 5/8 | 100 | 99 | 98 | 97 | 96 | 95 | 94 |
| | | 3/4 | 100 | 100 | 99 | 99 | 98 | 98 | 97 |
| | | 7/8 | 100 | 100 | 100 | 99 | 99 | 99 | 98 |
| | | 1 1/8 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| | 5/16 | 5/8 | 99 | 99 | 98 | 97 | 96 | 95 | 95 |
| | | 3/4 | 100 | 100 | 99 | 99 | 99 | 99 | 98 |
| | | 7/8 | 100 | 100 | 100 | 100 | 100 | 99 | 99 |
| | | 1 1/8 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| | 3/8 | 5/8 | 99 | 98 | 98 | 97 | 96 | 95 | 94 |
| | | 3/4 | 100 | 100 | 99 | 99 | 99 | 98 | 98 |
| | | 7/8 | 100 | 100 | 100 | 100 | 100 | 99 | 99 |
| | | 1 1/8 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| 36,000 | 1/4 | 5/8 | 100 | 98 | 97 | 95 | 94 | 92 | 91 |
| | | 3/4 | 100 | 100 | 99 | 98 | 98 | 97 | 96 |
| | | 7/8 | 100 | 100 | 100 | 99 | 99 | 98 | 98 |
| | | 1 1/8 | 100 | 100 | 100 | 100 | 100 | 99 | 99 |
| | 5/16 | 5/8 | 99 | 98 | 97 | 95 | 94 | 93 | 92 |
| | | 3/4 | 100 | 100 | 99 | 99 | 98 | 98 | 98 |
| | | 7/8 | 100 | 100 | 100 | 100 | 100 | 99 | 99 |
| | | 1 1/8 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| | 3/8 | 5/8 | 99 | 97 | 96 | 95 | 93 | 92 | 91 |
| | | 3/4 | 100 | 99 | 99 | 98 | 98 | 97 | 97 |
| | | 7/8 | 100 | 100 | 100 | 99 | 99 | 99 | 99 |
| | | 1 1/8 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |

Cells with gray shading are not recommended due to low vapor velocities through the compressor.

Table 2. Single Stage Heat Pumps Capacity Losses

| NOMINAL UNIT CAPACITY | MAXIMUM LIQUID LINE DIAMETERS | EXTENDED RUN VAPOR LINE DIAMETER | PERCENT NOMINAL COOLING CAPACITY Vs. EQUIVALENT LINE LENGTH | | | | | | |
|-----------------------|-------------------------------|----------------------------------|---|--------|--------|---------|---------|---------|---------|
| | | | 25 FT. | 50 FT. | 75 FT. | 100 FT. | 125 FT. | 150 FT. | 175 FT. |
| 42,000 | 1/4 | 5/8 | 99 | 97 | 95 | 94 | 92 | 90 | 88 |
| | | 3/4 | 100 | 99 | 98 | 97 | 97 | 96 | 95 |
| | | 7/8 | 100 | 100 | 99 | 99 | 98 | 98 | 97 |
| | | 1 1/8 | 100 | 100 | 100 | 99 | 99 | 99 | 98 |
| | 5/16 | 5/8 | 99 | 97 | 96 | 94 | 93 | 91 | 89 |
| | | 3/4 | 100 | 100 | 99 | 98 | 98 | 97 | 96 |
| | | 7/8 | 100 | 100 | 100 | 99 | 99 | 99 | 99 |
| | | 1 1/8 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| | 3/8 | 5/8 | 99 | 97 | 95 | 94 | 92 | 90 | 89 |
| | | 3/4 | 100 | 99 | 99 | 98 | 98 | 97 | 97 |
| | | 7/8 | 100 | 100 | 100 | 99 | 99 | 99 | 99 |
| | | 1 1/8 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| 48,000 | 1/4 | 5/8 | 100 | 98 | 96 | 94 | 92 | 90 | 87 |
| | | 3/4 | 100 | 100 | 100 | 98 | 97 | 96 | 95 |
| | | 7/8 | 100 | 100 | 100 | 99 | 99 | 98 | 97 |
| | | 1 1/8 | 100 | 100 | 100 | 100 | 100 | 100 | 99 |
| | 5/16 | 5/8 | 98 | 97 | 95 | 93 | 92 | 90 | N/A |
| | | 3/4 | 100 | 100 | 99 | 99 | 98 | 98 | 98 |
| | | 7/8 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| | | 1 1/8 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| | 3/8 | 5/8 | 98 | 96 | 94 | 92 | 90 | 88 | 86 |
| | | 3/4 | 100 | 99 | 98 | 98 | 97 | 96 | 96 |
| | | 7/8 | 100 | 100 | 100 | 99 | 99 | 99 | 99 |
| | | 1 1/8 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| 60,000 | 1/4 | 5/8 | N/A | 100 | 96 | 93 | 90 | N/A | N/A |
| | | 3/4 | N/A | 100 | 100 | 100 | 99 | N/A | N/A |
| | | 7/8 | N/A | N/A | N/A | 100 | 100 | N/A | N/A |
| | | 1 1/8 | 100 | 100 | 100 | 100 | 100 | N/A | N/A |
| | 5/16 | 5/8 | 98 | 96 | 93 | 91 | 89 | 86 | 84 |
| | | 3/4 | 100 | 100 | 100 | 99 | 99 | 98 | 98 |
| | | 7/8 | 100 | 100 | N/A | N/A | N/A | N/A | N/A |
| | | 1 1/8 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| | 3/8 | 5/8 | 97 | 94 | 91 | 88 | 85 | 83 | 80 |
| | | 3/4 | 99 | 99 | 98 | 97 | 96 | 95 | 94 |
| | | 7/8 | 100 | 100 | 100 | 99 | 99 | 99 | 99 |
| | | 1 1/8 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |

Cells with gray shading are not recommended due to low vapor velocities through the compressor.

Table 2. Continued

| NOMINAL UNIT CAPACITY | MAXIMUM LIQUID LINE DIAMETERS | EXTENDED RUN VAPOR LINE DIAMETER | PERCENT NOMINAL COOLING CAPACITY VS. EQUIVALENT LINE LENGTH | | | | | | |
|-----------------------|-------------------------------|----------------------------------|---|--------|--------|---------|---------|---------|---------|
| | | | 25 FT. | 50 FT. | 75 FT. | 100 FT. | 125 FT. | 150 FT. | 175 FT. |
| 24,000 | 1/4 | 5/8 | 100 | 99 | 99 | 98 | 98 | 97 | 96 |
| | | 3/4 | 100 | 100 | 100 | 100 | 99 | 99 | 99 |
| | | 7/8 | 100 | 100 | 100 | 100 | 100 | 100 | 99 |
| | | 1 1/8 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| | 5/16 | 5/8 | 100 | 99 | 99 | 98 | 98 | 97 | 97 |
| | | 3/4 | 100 | 100 | 100 | 100 | 100 | 99 | 99 |
| | | 7/8 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| | | 1 1/8 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| | 3/8 | 5/8 | 100 | 100 | 99 | 98 | 97 | 97 | 96 |
| | | 3/4 | 100 | 100 | 100 | 100 | 99 | 99 | 99 |
| | | 7/8 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| | | 1 1/8 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| 36,000 | 1/4 | 5/8 | 100 | 98 | 97 | 95 | 93 | 92 | 90 |
| | | 3/4 | 100 | 99 | 99 | 98 | 97 | 96 | 95 |
| | | 7/8 | 100 | 100 | 99 | 99 | 98 | 97 | 97 |
| | | 1 1/8 | 100 | 100 | 100 | 99 | 99 | 98 | 98 |
| | 5/16 | 5/8 | 99 | 98 | 97 | 96 | 95 | 93 | 92 |
| | | 3/4 | 100 | 100 | 99 | 99 | 98 | 98 | 97 |
| | | 7/8 | 100 | 100 | 100 | 100 | 99 | 99 | 99 |
| | | 1 1/8 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| | 3/8 | 5/8 | 99 | 98 | 97 | 96 | 94 | 93 | 92 |
| | | 3/4 | 100 | 100 | 99 | 99 | 98 | 98 | 97 |
| | | 7/8 | 100 | 100 | 100 | 100 | 99 | 99 | 99 |
| | | 1 1/8 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| 48,000 | 1/4 | 5/8 | 100 | 98 | 95 | 93 | 91 | 88 | 86 |
| | | 3/4 | 100 | 100 | 99 | 98 | 96 | 95 | 94 |
| | | 7/8 | 100 | 100 | 100 | 99 | 98 | 97 | 96 |
| | | 1 1/8 | 100 | 100 | 100 | 100 | 99 | 99 | 98 |
| | 5/16 | 5/8 | 99 | 97 | 95 | 94 | 92 | 90 | 88 |
| | | 3/4 | 100 | 99 | 99 | 98 | 97 | 97 | 96 |
| | | 7/8 | 100 | 100 | 100 | 100 | 99 | 99 | 99 |
| | | 1 1/8 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| | 3/8 | 5/8 | 99 | 97 | 95 | 94 | 92 | 90 | 88 |
| | | 3/4 | 100 | 100 | 99 | 98 | 97 | 97 | 96 |
| | | 7/8 | 100 | 100 | 100 | 100 | 99 | 99 | 99 |
| | | 1 1/8 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| 60,000 | 1/4 | 5/8 | 98 | 95 | 92 | N/A | N/A | N/A | N/A |
| | | 3/4 | 99 | 98 | 97 | N/A | N/A | N/A | N/A |
| | | 7/8 | 100 | 100 | 99 | N/A | N/A | N/A | N/A |
| | | 1 1/8 | 100 | 100 | 100 | N/A | N/A | N/A | N/A |
| | 5/16 | 5/8 | 98 | 95 | 93 | 90 | 87 | 85 | 82 |
| | | 3/4 | 99 | 98 | 97 | 96 | 95 | 94 | 93 |
| | | 7/8 | 100 | 100 | 99 | 98 | 98 | 97 | 97 |
| | | 1 1/8 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| | 3/8 | 5/8 | 98 | 95 | 93 | 90 | 87 | 85 | 82 |
| | | 3/4 | 99 | 98 | 97 | 96 | 95 | 94 | 93 |
| | | 7/8 | 100 | 99 | 99 | 98 | 98 | 97 | 97 |
| | | 1 1/8 | 100 | 100 | 100 | 100 | 100 | 100 | 99 |

Cells with gray shading are not recommended due to low vapor velocities through the compressor.

Table 3. Two - Stage Air Conditioner Capacity Losses

| NOMINAL UNIT CAPACITY | MAXIMUM LIQUID LINE DIAMETERS | EXTENDED RUN VAPOR LINE DIAMETER | PERCENT NOMINAL COOLING CAPACITY Vs. EQUIVALENT LINE LENGTH | | | | | | |
|-----------------------|-------------------------------|----------------------------------|---|--------|--------|---------|---------|---------|---------|
| | | | 25 FT. | 50 FT. | 75 FT. | 100 FT. | 125 FT. | 150 FT. | 175 FT. |
| 24,000 | 1/4 | 5/8 | 100 | 99 | 98 | 97 | 96 | 95 | 94 |
| | | 3/4 | 100 | 100 | 99 | 99 | 98 | 98 | 97 |
| | | 7/8 | 100 | 100 | 100 | 100 | 100 | 99 | 99 |
| | | 1 1/8 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| | 5/16 | 5/8 | 100 | 99 | 98 | 97 | 96 | 95 | 95 |
| | | 3/4 | 100 | 100 | 100 | 100 | 100 | 99 | 99 |
| | | 7/8 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| | | 1 1/8 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| | 3/8 | 5/8 | 100 | 99 | 99 | 98 | 98 | 97 | 97 |
| | | 3/4 | 100 | 100 | 100 | 100 | 99 | 99 | 99 |
| | | 7/8 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| | | 1 1/8 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| 36,000 | 1/4 | 5/8 | 100 | 98 | 97 | 95 | 94 | 92 | 91 |
| | | 3/4 | 100 | 100 | 99 | 98 | 98 | 97 | 96 |
| | | 7/8 | 100 | 100 | 100 | 99 | 99 | 98 | 98 |
| | | 1 1/8 | 100 | 100 | 100 | 100 | 100 | 99 | 99 |
| | 5/16 | 5/8 | 99 | 98 | 97 | 95 | 94 | 93 | 92 |
| | | 3/4 | 100 | 100 | 99 | 99 | 98 | 98 | 98 |
| | | 7/8 | 100 | 100 | 100 | 100 | 100 | 99 | 99 |
| | | 1 1/8 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| | 3/8 | 5/8 | 99 | 97 | 96 | 95 | 93 | 92 | 91 |
| | | 3/4 | 100 | 99 | 99 | 98 | 98 | 97 | 97 |
| | | 7/8 | 100 | 100 | 100 | 99 | 99 | 99 | 99 |
| | | 1 1/8 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| 48,000 | 1/4 | 5/8 | 100 | 98 | 96 | 94 | 92 | 90 | 87 |
| | | 3/4 | 100 | 100 | 100 | 98 | 97 | 96 | 95 |
| | | 7/8 | 100 | 100 | 100 | 99 | 99 | 98 | 97 |
| | | 1 1/8 | 100 | 100 | 100 | 100 | 100 | 100 | 99 |
| | 5/16 | 5/8 | 98 | 97 | 95 | 93 | 92 | 90 | N/A |
| | | 3/4 | 100 | 100 | 99 | 99 | 98 | 98 | 98 |
| | | 7/8 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| | | 1 1/8 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| | 3/8 | 5/8 | 98 | 96 | 94 | 92 | 90 | 88 | 86 |
| | | 3/4 | 100 | 99 | 98 | 98 | 97 | 96 | 96 |
| | | 7/8 | 100 | 100 | 100 | 99 | 99 | 99 | 99 |
| | | 1 1/8 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| 60,000 | 1/4 | 5/8 | N/A | 100 | 96 | 93 | 90 | N/A | N/A |
| | | 3/4 | N/A | 100 | 100 | 100 | 99 | N/A | N/A |
| | | 7/8 | N/A | N/A | N/A | 100 | 100 | N/A | N/A |
| | | 1 1/8 | 100 | 100 | 100 | 100 | 100 | N/A | N/A |
| | 5/16 | 5/8 | 98 | 96 | 93 | 91 | 89 | 86 | 84 |
| | | 3/4 | 100 | 100 | 100 | 99 | 99 | 98 | 98 |
| | | 7/8 | 100 | 100 | N/A | N/A | N/A | N/A | N/A |
| | | 1 1/8 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| | 3/8 | 5/8 | 97 | 94 | 91 | 88 | 85 | 83 | 80 |
| | | 3/4 | 99 | 99 | 98 | 97 | 96 | 95 | 94 |
| | | 7/8 | 100 | 100 | 100 | 99 | 99 | 99 | 99 |
| | | 1 1/8 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |

Cells with gray shading are not recommended due to low vapor velocities through the compressor.

Table 4. Two - Stage Heat Pump Capacity Losses

| Component | Outdoor Units Above | | Outdoor Units Below | | No Elevation Change | |
|---------------------------------------|---------------------|-------------------|---------------------|-------------------|---------------------|-----------|
| | Air Conditioner | Heat Pump | Air Conditioner | Heat Pump | Air Conditioner | Heat Pump |
| Liquid line solenoid (LLS) at outdoor | NO | YES | NO | YES | NO | NO |
| TXV on indoor | YES | YES | YES | YES | YES | YES |
| Crankcase Heater | YES | YES | YES | YES | YES | YES |
| Start Capacitor & relay | YES | YES | YES | YES | YES | YES |
| Heating Piston Change | N/A | YES - SEE TABLE 9 | N/A | YES - SEE TABLE 8 | N/A | NO |
| Inverted Trap | N/A | N/A | YES - SEE TABLE 6 | YES - SEE TABLE 6 | N/A | N/A |

Table 5. Additional Component Requirements

| Indoor Restrictor Bore Size Reduction (Air Conditioner and Heat pump) | |
|--|------------------------|
| Vertical Separation (Feet) | Restrictor Size Change |
| 75 - 100 | -0.007 |
| 101 - 125 | -0.009 |
| 126 - 150 | -0.01 |
| 151 - 175 | -0.011 |

NOTE: If unit is equipped with a TXV, no change is required

Table 6. Restrictor Sizing

| Tube O.D. (in) | Fitting Type | | |
|----------------------|--------------|---------------|---------|
| | 90° Std | 90° Long Rad. | 45° Std |
| 1/2 | 1.2 | 0.8 | 0.6 |
| 5/8 | 1.6 | 1.0 | 0.8 |
| 3/4 | 1.8 | 1.2 | 0.9 |
| 7/8 | 2.0 | 1.4 | 1.0 |
| 1 1/8 | 2.6 | 1.7 | 1.3 |
| Liquid Line Solenoid | 12 | | |
| Filter Drier | 6 | | |

Table 7. Fitting Lengths

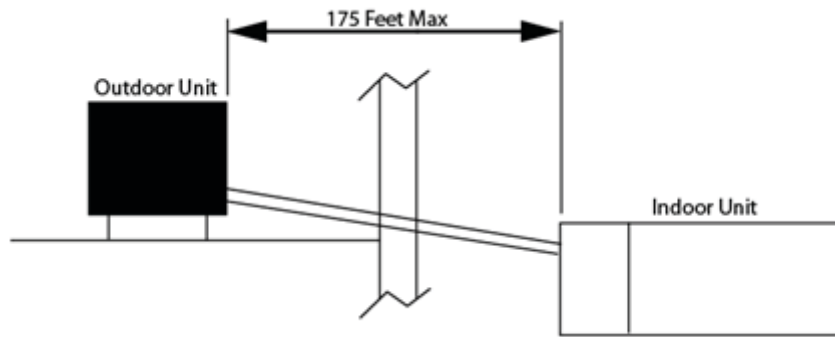


Figure 1. Air Conditioner or Heat Pump – Horizontal Run

- Increase restrictor bore 0.001 inches if total equivalent horizontal length is more than 100 feet.
- Crankcase heater required if total equivalent length is more than 100 feet.
- Vapor line should be sloped towards indoor unit.
- 175 feet maximum equivalent line length. See Figure 1.

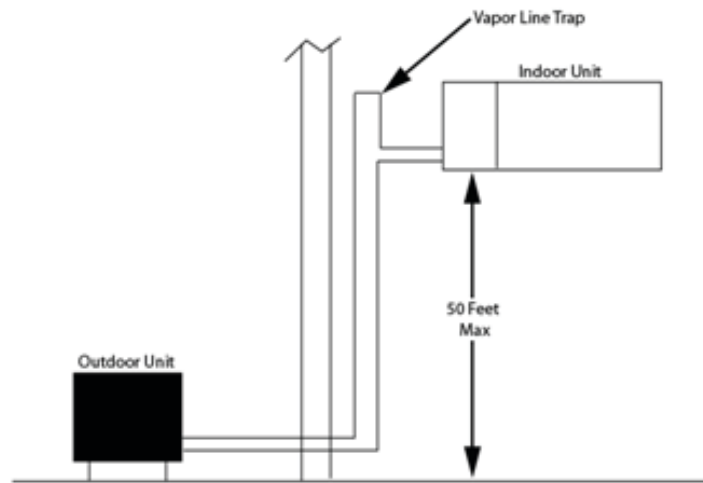


Figure 2. Air Conditioner or Heat Pump – Indoor Unit above Outdoor Unit

- Increase Restrictor bore 0.001 inches if total equivalent horizontal length is more than 100 feet.
- Crankcase heater required if total equivalent length is more than 100 feet.
- An inverted vapor line trap must be installed with the top of the trap above the unit. See Figure 2.
- 175 feet maximum equivalent line length.
- 50 feet maximum vertical separation.
- Change outdoor piston. See Table 8.

| Btuh | Vertical Separation (ft) | | | |
|--------|--------------------------|-------|-------|-------|
| | 0-20 | 21-30 | 31-40 | 41-50 |
| 18,000 | 0 | -1 | -1 | -2 |
| 24,000 | 0 | -1 | -1 | -2 |
| 30,000 | 0 | -1 | -1 | -2 |
| 36,000 | 0 | -1 | -2 | -2 |
| 42,000 | 0 | -1 | -2 | -2 |
| 48,000 | 0 | -1 | -2 | -2 |
| 60,000 | 0 | -1 | -2 | -3 |

**Table 8. Heat Pump Outdoor Piston Change
Outdoor Unit Below Indoor Unit**

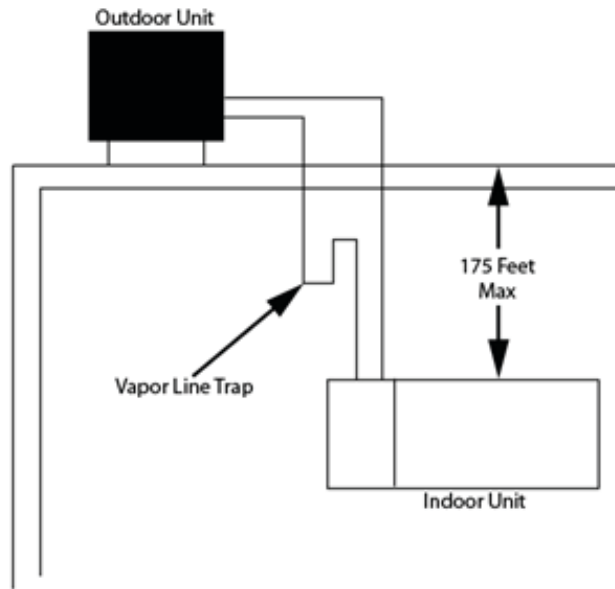


Figure 3. Air Conditioner Or Heat Pump – Outdoor Unit Above Indoor Unit

- Adjust restrictor size(s). See Table 6 (page 4).
- Increase restrictor bore 0.001 inches if total horizontal equivalent length is more than 100 feet.
- Crankcase heater required if total equivalent length is more than 100 feet.
- If vertical separation is greater than 50 feet, install a vapor line oil trap 50 feet above indoor unit and every 40 feet up to outdoor unit elevation. See Figure 3.
- 175 feet maximum equivalent line length.
- If vertical separation is greater than 75 feet, install a liquid line solenoid valve within 10 feet of outdoor unit. A hard start kit is also required for single phase reciprocating compressor applications. An ASCT is recommended for air conditioners.
- Change the outdoor piston. See Table 9.

| Btuh | Vertical Separation (ft) | | | | | | |
|--------|--------------------------|-------|-------|--------|---------|---------|---------|
| | 20-25 | 26-50 | 51-75 | 76-100 | 101-125 | 126-150 | 151-175 |
| 18,000 | +1 | +1 | +2 | +3 | +3 | +4 | +5 |
| 24,000 | +1 | +1 | +2 | +3 | +4 | +5 | +6 |
| 30,000 | +1 | +2 | +2 | +4 | +5 | +6 | +8 |
| 36,000 | +1 | +2 | +2 | +4 | +5 | +6 | +8 |
| 42,000 | +1 | +2 | +3 | +4 | +5 | +7 | +8 |
| 48,000 | +1 | +2 | +3 | +4 | +5 | +7 | +9 |
| 60,000 | +1 | +2 | +3 | +5 | +6 | +8 | +10 |

NOTE: If unit is equipped with a TXV, no change is required

Table 9. Heat Pump Outdoor Piston Change – Outdoor Unit Above Indoor Unit

**INSTALLER: PLEASE LEAVE THESE
INSTRUCTIONS WITH THE OWNER.**

