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LONG LINE SET APPLICATION R-22

This long line set application guideline applies to all ARI listed Goodman air conditioner and heat pump split system matches of nominal capacity 18,000 to 60,000 Btuh. This guideline will cover installation requirements and additional accessories needed for split system installations where the line set exceeds 50 ft in actual length.

This guideline does not apply to any system match for which the outdoor unit has a 2-speed compressor.

Additional Accessories:

1. **Crankcase heater**- a long line set application can critically increase the charge level needed for a system. As a result, the system is very prone to refrigerant migration during its off-cycle and a crankcase heater will help minimize this risk. A crankcase heater is recommended for any long line application (50 watt minimum).
2. **Hard start assist**- increased charge level in long line applications can require extra work from the compressor at start-up. A hard start assist device may be required to overcome this.
3. **Accumulator**- (Amana Product Only) - for any Amana heat pump not equipped with an accumulator, refer to that model's service manual regarding installation of an accumulator.

Tubing sizing:

1. In long line applications, the "equivalent line length" is the sum of the straight length portions of the suction line plus losses (in equivalent length) from 45 and 90 degree bends. **Select the proper suction tube size based on equivalent length of the suction line (see Tables 1 & 2 below) and recalculated system capacity.**

Equivalent length = Length_{horizontal} + Length_{vertical} + Losses from bends (see Table 2)

2. **For any residential split system installed with a long line set, the liquid line size must never exceed 3/8".** Limiting the liquid line size to 3/8" is critical since an increased refrigerant charge level from having a larger liquid line could possibly shorten a compressor's lifespan.
 - **50 feet** is the maximum recommended vertical difference between the condenser and evaporator when the evaporator is above the condenser. Equivalent length is not to exceed 150 feet.

- The vertical difference between the condenser and evaporator when the evaporator is below the condenser can approach 150 feet, as long as the equivalent length does not exceed 150 feet.
- The distance between the condenser and evaporator in a completely horizontal installation in which the indoor and outdoor unit do not differ more than 10 ft in vertical distance from each other can approach 150 feet, as long as the equivalent length does not exceed 150 feet.

Most refrigerant tubing kits are supplied with 3/8"-thick insulation on the vapor line. For long line installations over 50 ft, especially if the line set passes through a high ambient temperature, 1/2"-thick suction line insulation is recommended to reduce loss of capacity. The liquid line should be insulated if passing through an area of 120°F or greater. Do not attach the liquid line to any non-insulated portion of the suction line.

3. **Vibration and noise:** In long line applications, refrigerant tubing is highly prone to transmit noise and vibration to the structure it is fastened to. Use adequate vibration-isolating hardware when mounting line set to adjacent structure.

Table 1 below lists multiplier values to recalculate system-cooling capacity as a function of a system's equivalent line length (as calculated from the suction line) and the selected suction tube size. Table 2 lists the equivalent length gained from adding bends to the suction line. **Properly size the suction line to minimize capacity loss.**

TABLE 1. CAPACITY MULTIPLIERS AS A FUNCTION OF SUCTION LINE SIZE & EQUIVALENT LENGTH

Nominal capacity Btuh	Vapor line diameter (in.)	EQUIVALENT LINE LENGTH (FT)				
		50	75	100	125	150
18,000	3/4	.99	.97	.96	.95	.95
24,000	3/4	1	.99	.99	.98	.97
30,000	3/4	.98	.97	.96	.95	.94
36,000	3/4	.93	.90	.86	.83	.79
	7/8	.98	.96	.94	.92	.90
42,000	3/4	.93	.90	.87	.83	.80
	7/8	.97	.96	.94	.93	.92
	1-1/8	1	1	.99	.99	.98
48,000	3/4	.90	.86	.82	.78	N/R
	7/8	.96	.94	.93	.91	.89
	1-1/8	1	1	.99	.99	.98
60,000	7/8	.93	.91	.89	.86	.84
	1-1/8	.99	.98	.98	.97	.97

NOTE: For a condenser with a liquid valve tube connection less than 3/8" diameter, use 3/8" liquid line tubing for a line set greater than 25 ft.

TABLE 2. LOSSES FROM SUCTION LINE ELBOWS (EQUIVALENT LENGTH, FEET)

Type of elbow fitting	I.D. (in.)		
	3/4	7/8	1-1/8
90° short radius	1.7	2	2.3
90° long radius	1.5	1.7	1.6
45°	0.7	0.8	1

Installation Requirements

1. In a completely horizontal installation with a long line set where the evaporator is at the same altitude as (or slightly below) the condenser, the line set should be sloped towards the evaporator. This helps reduce refrigerant migration to the condenser during a system's off-cycle.
2. For a system installation where the evaporator is above the condenser, an inverted vapor line trap should be installed on the suction line just before the inlet to the evaporator (see Fig 1). The top of the inverted loop must be slightly above the top of the evaporator coil and can be created simply by brazing two 90° long radius elbows together, if a bending tool is unavailable. Properly support and secure the inverted loop to the nearest point on the indoor unit or adjacent structure.

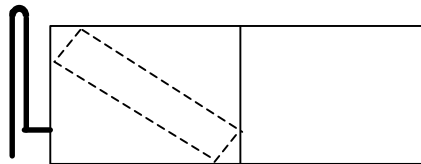
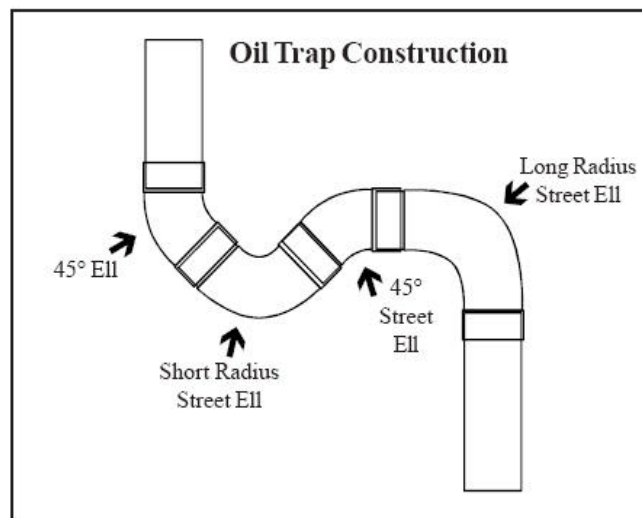


Fig 1. Evaporator unit with inverted vapor loop

3. **Oil traps (required only if the condenser is above the evaporator):** Depending on the vertical rise of the line set, oil traps are required in the suction line. Oil traps should be installed at equal intervals along the suction line. Install **1 oil trap for a height difference of 15–25 feet** between indoor and outdoor units. Install **2 oil traps for a difference of 26-50 ft, 3 for 51-100 ft, and 4 for 101-150 ft.** Preformed oil traps are available at most HVAC supply houses, or oil traps may be created by brazing tubing elbows together (see diagram below). Remember to add the equivalent length from oil traps to the equivalent length calculation of the suction line. For example, if you construct an oil trap using two 45° elbows, one short and one long 90° elbow in a 3/4" diameter suction line, the additional equivalent length would be $0.7+0.7+1.7+1.5$, which equals 4.6 feet (refer to table 2).



4. **Piston size adjustment:** Refer to the chart below to adjust the piston size for the indoor and outdoor units, based on the height difference between the two. Take the original piston size installed in the indoor and outdoor unit and add or subtract using the information from Chart 3 to determine the new piston size.

Indoor Piston Size Change		Outdoor Piston Size Change	
Outdoor unit above Indoor		Outdoor unit above Indoor	
Height difference (feet)	Piston size change	Height difference (feet)	Piston size change
26-50	-3	0-50	0
51-75	-5	51-75	+4
76-100	-7	76-100	+6
101-125	-9	101-125	+8
126-150	-10	126-150	+10
Outdoor unit below Indoor		No outdoor piston change required, if outdoor unit is below indoor (0-50 ft).	
0-25	0		
26-50	+4		

5. **Low voltage wiring:** Verify low voltage wiring size is adequate for the length used since it will be increased in a long line application.

System charging

Goodman/Amana condensers are factory charged for 15 ft of line set. To calculate the amount of extra refrigerant (in ounces) needed for a line set over 15 feet, multiply the additional length of line set by 0.6 ounces. Note for the formula below, the linear feet of line set is the actual length of liquid line (or suction line, since both should be equal) used, not the equivalent length calculated for the suction line.

Extra refrigerant needed = (Linear feet of line set – 15 ft) x **X** oz/ft.
 Where **X** = **0.6** for 3/8" liquid tubing, **0.4** for 5/16", or **0.2** for 1/4"

Remember, for condensers with a liquid valve connection less than 3/8" diameter, 3/8" liquid tubing is required for a line set longer than 25 feet.

Follow the charging procedures in the outdoor unit I/O manual to ensure proper superheat and sub-cooling levels, especially on a system with a TXV installed in the indoor unit. Heat pumps should be checked in both heating and cooling mode for proper charge level. This guideline is meant to provide installation instructions based on most common long line set applications. It may be necessary to readjust piston sizes after initial system operation if proper superheat and sub-cooling levels are not achieved (low or no superheat will cause early compressor failure). Keep in mind that installation variables may affect system operation.

NO ADDITIONAL COMPRESSOR OIL IS NEEDED FOR LONG LINE APPLICATIONS ON RESIDENTIAL SPLIT SYSTEMS