

# LONG LINE SET APPLICATION R-410A

*This guideline is meant to provide installation instructions based on most common long line set applications. Installation variables may affect the system operation.*

*Contact Technical Services for variations or applications outside those outlined in this document.*

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### Attention Installing Personnel

As a professional installer, you have an obligation to know the product better than the customer. This includes all safety precautions and related items.

Prior to actual installation, thoroughly familiarize yourself with this Instruction Manual. Pay special attention to all safety warnings. Often during installation or repair, it is possible to place yourself in a position which is more hazardous than when the unit is in operation.

Remember, it is **your** responsibility to install the product safely and to know it well enough to be able to instruct a customer in its safe use.

Safety is a matter of common sense...a matter of thinking before acting. Most dealers have a list of specific good safety practices...follow them.

The precautions listed in this Installation Manual are intended as supplemental to existing practices. However, if there is a direct conflict between existing practices and the content of this manual, the precautions listed here take precedence.



### WARNING

ONLY PERSONNEL THAT HAVE BEEN TRAINED TO INSTALL, ADJUST, SERVICE OR REPAIR (HEREINAFTER, "SERVICE") THE EQUIPMENT SPECIFIED IN THIS MANUAL SHOULD SERVICE THE EQUIPMENT. THE MANUFACTURER WILL NOT BE RESPONSIBLE FOR ANY INJURY OR PROPERTY DAMAGE ARISING FROM IMPROPER SERVICE OR SERVICE PROCEDURES. IF YOU SERVICE THIS UNIT, YOU ASSUME RESPONSIBILITY FOR ANY INJURY OR PROPERTY DAMAGE WHICH MAY RESULT. IN ADDITION, IN JURISDICTIONS THAT REQUIRE ONE OR MORE LICENSES TO SERVICE THE EQUIPMENT SPECIFIED IN THIS MANUAL, ONLY LICENSED PERSONNEL SHOULD SERVICE THE EQUIPMENT. IMPROPER INSTALLATION, ADJUSTMENT, SERVICING OR REPAIR OF THE EQUIPMENT SPECIFIED IN THIS MANUAL, OR ATTEMPTING TO INSTALL, ADJUST, SERVICE OR REPAIR THE EQUIPMENT SPECIFIED IN THIS MANUAL WITHOUT PROPER TRAINING MAY RESULT IN PRODUCT DAMAGE, PROPERTY DAMAGE, PERSONAL INJURY OR DEATH.

### NOTES:

- Units must be installed in accordance with Regulations of the National Fire Protection Association and applicable local codes. Where local regulations are at a variance with instructions, installer should adhere to local codes.
- Before connecting tubing, read the outdoor unit installation manual. Pay particular attention to all safety precautions.

### DESCRIPTION

This long line set application guideline applies to all AHRI listed R-410A air conditioner and heat pump split system matches of nominal capacity 90,000 and 120,000 Btuh. This guideline will cover installation requirements and additional accessories needed for split system installations where the line set exceeds 80 feet in actual length. The long line sets can have three different configurations (1) Outdoor unit and Indoor unit are at the same level, (2) Outdoor unit is above the Indoor unit coil, (3) Outdoor unit is below the Indoor unit.

## SECTION 1. GENERAL REQUIREMENTS FOR ALL LONG LINE SET APPLICATIONS

1. Equivalent length must be used to determine acceptability of any long line set application. See Section 5 for equivalent length calculations.
2. **Commercial split systems long line set applications must use 5/8" liquid line.**  
Limiting the liquid line size to 5/8" is critical since an increased refrigerant charge level from having a larger liquid line could possibly shorten a compressor's life-span.
3. Most refrigerant tubing kits are supplied with 3/8" thick insulation on the suction line. For long line installations over 80 feet, if the line set passes through a high ambient temperature zone, 1/2" thick suction line insulation is required to reduce loss of capacity. The liquid line must be insulated if more than 50 feet of liquid line will pass through an area that might reach temperatures of 30°F or higher than outdoor ambient. Never attach a liquid line to any uninsulated portion of the suction line.
4. Use of a thermostatic expansion valve (TXV) is required in all long line set applications. Unit must be charged to 7 to 9 °F subcooling at the indoor unit.
5. Maximum equivalent length of line set is:
  - 250 feet for single stage units with scroll compressors.
6. Maximum linear length of line set is:
  - 200 feet for single stage units with scroll compressors.
7. **Low voltage wiring.** Verify low voltage wire gauge is adequate for the length used due to increased line set application.
8. **Vibration and Noise:** In long line applications, refrigerant tubing is highly prone to transmit noise and vibration to the adjoining structure. Use adequate vibration-isolating hardware when mounting line set to structural members. See Figures 1-1, 1-2 and 1-3 for example of proper mounting.

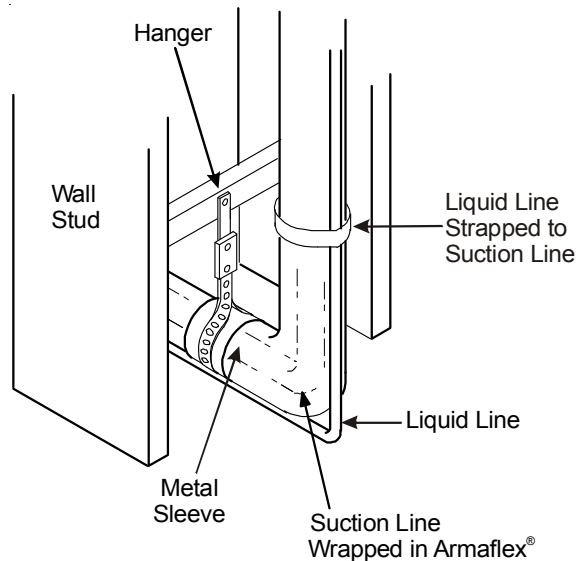


Figure 1-1.  
Installation of Refrigeration Piping From Vertical to Horizontal

**IMPORTANT** - Refrigerant lines must not touch wall.

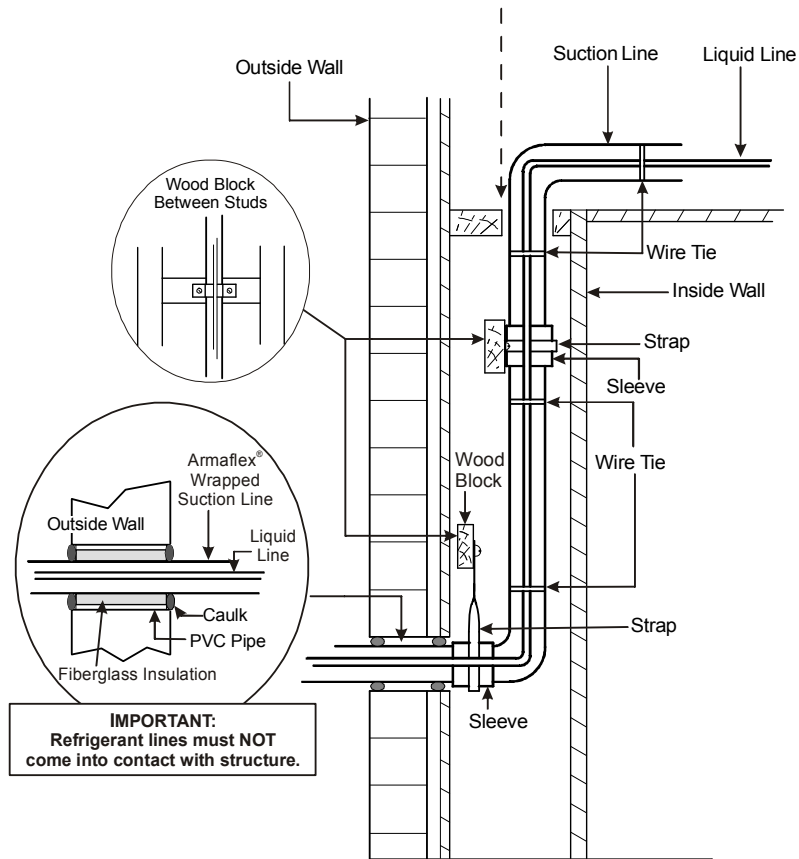


Figure 1-2. Installation of Refrigerant Piping (Vertical)

**New construction shown**

**NOTE:** If line set is installed on the exterior of an outside wall, similar installation practices are to be used.

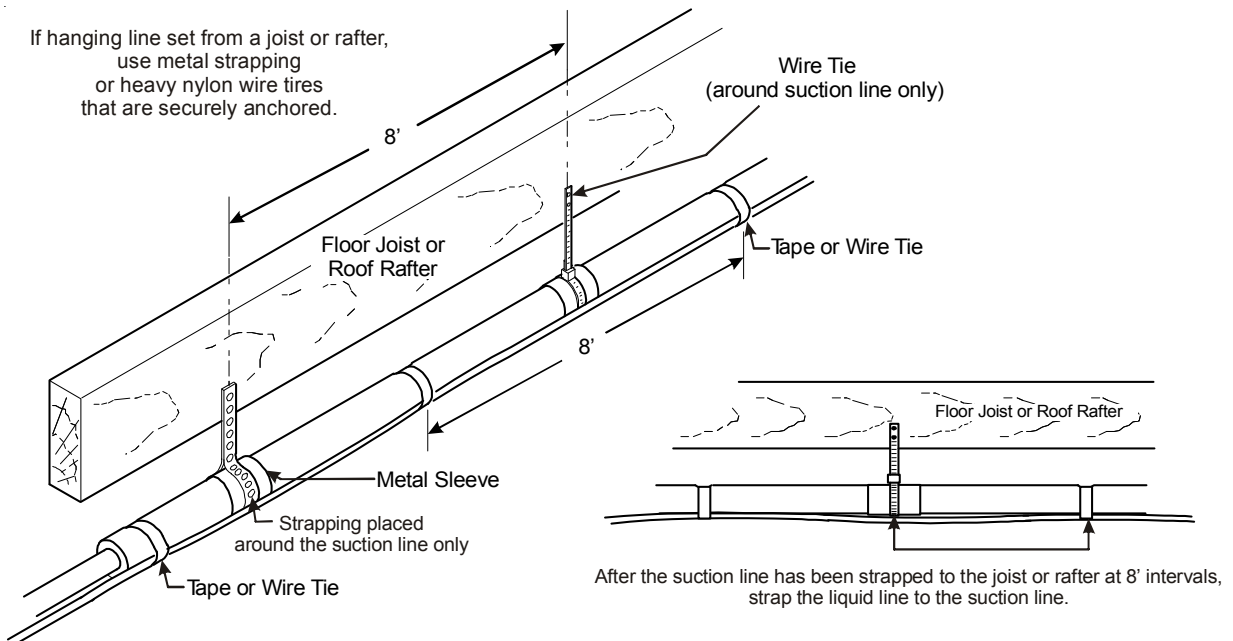


Figure 1-3. Installation of Refrigerant Piping (Horizontal)

9. **Final Charge Adjustment.** All units must have refrigerant charge verified by proper adjustment of subcooling at the indoor unit after initial charge adjustment per Section 5. Proper adjustment means pressure and temperature of the liquid line at the indoor unit must be measured to calculate subcooling at the indoor unit. If subcooling at the indoor unit is less than 5°F, then additional refrigerant must be added until this subcooling level is achieved. If subcooling at the indoor unit is more than 7°F, then refrigerant must be removed until this subcooling level is achieved.

**SECTION 2. OUTDOOR UNIT AND INDOOR UNIT ARE AT THE SAME ELEVATION**

Accessory	Air Conditioner (AC)	Heat Pump (HP)
Crankcase Heater (40 watts minimum)	Yes	Yes
TXV (Indoor)	Yes	Yes
Liquid Line Solenoid at Outdoor (Kit # LSK03*)	No	No
Inverted Refrigerant Trap at Indoor	No	No
Oil Trap at Indoor	No	No

1. In a completely horizontal installation with a long line set where the indoor unit is at the same altitude as (or slightly below) the outdoor unit, the line set should be sloped continuously towards the indoor unit. This helps reduce refrigerant migration to the outdoor unit during a system's off-cycle.
2. The maximum elevation (vertical) difference for this section to be applicable is 10 feet separation between outdoor unit and indoor unit. If outdoor unit is more than 10 feet above indoor unit use Section 3. If outdoor unit is more than 10 feet below indoor unit use Section 4.
3. Inverted suction loop is not required at either unit.
4. An accumulator is not required for air conditioners (accumulators are factory installed on heat pumps).
5. An oil trap at the indoor unit is not required.

### SECTION 3. OUTDOOR UNIT IS ABOVE THE INDOOR UNIT

Accessory	Air Conditioner (AC)	Heat Pump (HP)
Crankcase Heater (40 watts minimum)	Yes	Yes
TXV (Indoor)	Yes	Yes
Liquid Line Solenoid at Outdoor (Kit # LSK03*)	No	No
Inverted Refrigerant Trap at Indoor	No	No
Oil Trap at Indoor	Yes**	Yes**

\*\*An oil trap at the indoor unit is required if the elevation difference exceeds 80'. The trap can be constructed of standard refrigerant fitting (See Figure 3-1.)

1. Suction line must be sloped continuously towards the indoor unit.
2. The maximum elevation (vertical) difference between the outdoor unit and indoor unit is:
  - a. not restricted in this configuration for single stage air conditioning units (must adhere to maximum equivalent length).
  - b. 80 feet for single stage heat pump units.
  - c. 25 feet for two stage units.
3. Inverted suction loop is not required at either unit.
4. An accumulator is not required for air conditioners (accumulators are factory installed on heat pumps).

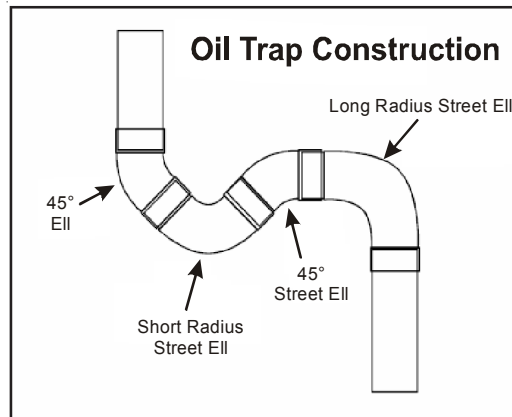


Figure 3-1. Oil Trap

**SECTION 4. OUTDOOR UNIT IS BELOW THE INDOOR UNIT**

Accessory	Air Conditioner (AC)	Heat Pump (HP)
Crankcase Heater (40 watts minimum)	Yes	Yes
TXV (Indoor)	Yes	Yes
Liquid Line Solenoid at Outdoor (Kit # LSK03*)	Yes	No
Inverted Refrigerant Trap at Indoor	Yes	Yes
Oil Trap at Indoor	No	No

1. The maximum elevation (vertical) difference between the outdoor unit and the indoor unit is 80 feet.
2. Suction line must be installed in a manner to prevent liquid migration to the outdoor unit from the indoor unit (see following note 3).
3. An inverted suction line trap must be installed on the suction line just before the inlet to the indoor unit (see Figure 4-1). The top of the inverted loop must be slightly above the top of the indoor unit 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.
4. An accumulator is required to be added (external to the outdoor unit, within 2 linear feet of the outdoor unit) for air conditioning installations. Use Goodman part number B1226212. Adapter fittings at the accumulator connection may be required. Do NOT install an accumulator in the suction line set in heat pump applications.

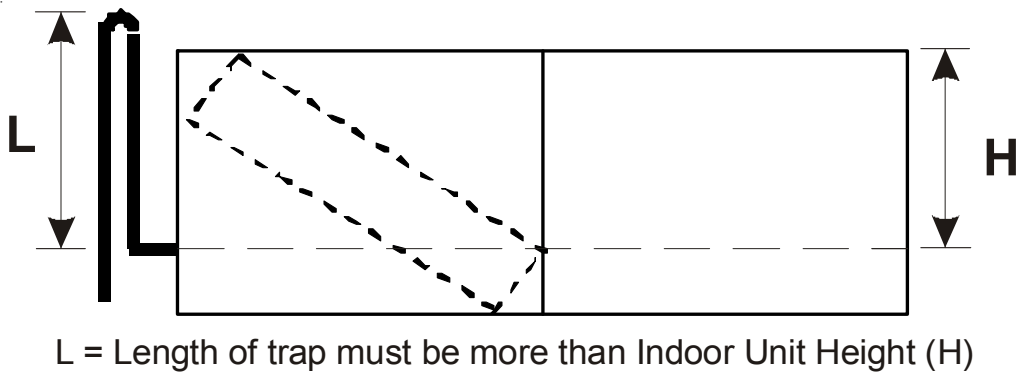


Figure 4-1. Indoor Unit with Inverted Suction

## SECTION 5. CALCULATIONS - TUBING EQUIVALENT LENGTH, TUBE SIZE AND REFRIGERANT

- 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. Add the total straight (lineal) length of tubing to the equivalent length of elbows and bends to get total equivalent length.

$$\text{Equivalent length} = \text{Length}_{\text{Horizontal}} + \text{Length}_{\text{Vertical}} + \text{Losses from bends (see Table 5-1)}$$

- Table 5-1 lists the equivalent length gained from adding bends to the suction line. Properly size the suction line to minimize capacity loss.

Type of Elbow Fitting	Inside Diameter (inches)		
	1 1/8	1 3/8	1 5/8
90° short radius	2.6	3.3	4.0
90° long radius	1.7	2.3	2.6
45°	1.3	1.7	2.1

Table 5-1. Losses from suction line elbows (equivalent length, ft.)

EXAMPLE: 1-1/8” suction line using 1-1/8” elbows

$$150 \text{ feet of straight tubing} + (\text{four short radius elbows} \times 2.6) + (\text{2 long radius elbows} \times 2.3) = 150 + 10.4 + 4.6 = 165 \text{ equivalent feet}$$

- Table 5-2 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.

NOTE: Select the proper suction tube size based on equivalent length of the suction line (see Tables 5-1 and 5-2) and recalculated system capacity.

		Capacity Multiplier for Equivalent Length (ft)									
Unit (Nom. BTU/hr)	Suction Dia (in)	25	50	75	100	125	150	175	200	225	250
90000	7/8	0.98	0.96	0.94	0.91	0.90	0.88	0.86	0.84	0.82	0.81
	1-1/8	1.00	0.99	0.98	0.97	0.96	0.95	0.94	0.93	0.92	0.91
	1-3/8	1.00	0.99	0.99	0.98	0.98	0.97	0.97	0.96	0.95	0.95
120000	1-1/8	0.99	0.97	0.94	0.92	0.91	0.89	0.87	0.85	0.84	0.82
	1-3/8	1.00	0.98	0.97	0.96	0.94	0.93	0.92	0.90	0.89	0.88
	1-5/8	1.00	0.99	0.98	0.97	0.96	0.95	0.94	0.93	0.92	0.91

Table 5-2. Capacity Multipliers

<sup>1</sup> Equivalent length is to be used for capacity multiplier reduction.

- Refrigerant Quantity Adjustment.** Commercial units are shipped with a holding charge of 35 oz. of R410A from the factory. Charge the unit per the installation instructions.

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