

Residential Piping and Long Line Guideline


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SAFETY CONSIDERATIONS

Only trained service technicians familiar with standard service instructions and training materials should attempt installation, service, and repair of these units. Improper installation, adjustment, alteration, service, maintenance, or use can cause explosion, fire, electrical shock, or other conditions which may cause death, personal injury, or property damage. Consult a qualified installer, service agency, or your distributor or branch for information or assistance. The qualified installer or agency must use factory-authorized kits or accessories when modifying this product. Refer to the individual instructions packaged with the kits or accessories when installing.

Follow all safety codes. Wear safety glasses, protective clothing, and work gloves. Use quenching cloth for brazing operations. Have fire extinguisher available. Read these instructions thoroughly and follow all warnings or cautions included in literature and attached to the unit. Consult local building codes and National Electrical Code (NEC) for special requirements.

Recognize safety information. This is the safety-alert symbol . When you see this symbol on the unit and in instructions or manuals, be alert to the potential for personal injury. Understand these signal words; DANGER, WARNING, and CAUTION. These words are used with the safety-alert symbol. DANGER identifies the most serious hazards which **will** result in severe personal injury or death. WARNING signifies hazards which **could** result in personal injury or death. CAUTION is used to identify unsafe practices which **may** result in minor personal injury or product and property damage. NOTE is used to highlight suggestions which **will** result in enhanced installation, reliability, or operation.

WARNING

ELECTRICAL SHOCK HAZARD

Failure to follow this warning could result in personal injury or death.

All equipment should be installed in accordance with accepted practices and unit Installation Instructions, and in compliance with all national and local codes. Power should be turned off when servicing or repairing electrical components. Extreme caution should be observed when troubleshooting electrical components with power on. Observe all warning notices posted on equipment and in instructions or manuals.

WARNING

EXPLOSION AND PERSONAL SAFETY HAZARD

Failure to follow this warning could result in personal injury, equipment damage or improper operation.

Refrigeration systems contain refrigerant under pressure. R-410A refrigerant systems operate at higher pressure than standard R-22 systems. Use only service equipment and components rated for R-410A refrigerant. Extreme caution should be observed when handling refrigerants. Wear safety glasses and gloves to prevent personal injury. During normal system operations, some components are hot and can cause burns. Rotating fan blades can cause personal injury. Appropriate safety considerations are posted throughout this manual where potentially dangerous techniques are addressed.

Refrigeration systems contain refrigerant under pressure. Extreme caution should be observed when handling refrigerants. Wear safety glasses and gloves to prevent personal injury. During normal system operations, some components are hot and can cause burns. Rotating fan blades can cause personal injury. Appropriate safety considerations are posted throughout this manual where potentially dangerous techniques are addressed.

DEFINITIONS

This Guideline covers **all** residential split system air conditioner and heat pump products using R-410A refrigerant **including two-stage and variable speed models.**

INTRODUCTION

An application is considered Long Line, when the refrigerant level in the system requires the use of accessories to maintain acceptable refrigerant management for systems reliability. Accessory requirements depend on the system type, and are defined in this document. Defining a system as long line depends on the liquid line diameter, indoor metering device (piston or TXV), actual length of the tubing, and vertical separation between the indoor and outdoor units.

For Air Conditioner systems, the charts below show when an application is considered Long Line:

AC with R-410A Refrigerant Long Line Description ft (m) Beyond these lengths, a TXV is required

Total Length	Outdoor Unit Above or Below Indoor Unit
TXV required beyond 50 ft. (15.2 m)	TXV required beyond 20 ft. (6.1 m)

AC with R-410A Refrigerant Long Line Description ft (m) (Beyond these lengths, long line accessories are required)

Liquid Line Size	Units On Same Level	Outdoor Below Indoor	Outdoor Above Indoor
1/4 + TXV	No accessories needed within allowed lengths	No accessories needed within allowed lengths	175 (53.3)
5/16 + TXV	120 (36.6)	50 (15.2) vertical or 120 (36.6) total	120 (36.6)
3/8 + TXV	80 (24.4)	35 (10.7) vertical or 80 (24.4) total	80 (24.4)

For Heat Pump systems, the chart below shows when an application is considered Long Line:

HP with R-410A Refrigerant Long Line Description ft (m) (Beyond these lengths, long line accessories are required)

Liquid Line Size	Units On Same Level	Outdoor Below Indoor	Outdoor Above Indoor
3/8 + TXV	80 (24.4)	20 (6.1) vertical or 80 (24.4) total	80 (24.4)

NOTE: Multi-stage and variable speed products must use TXV indoor metering device

NOTE: All single stage heat pumps must use TXV indoor metering device

Long line applications are clearly defined in this Guideline, and must be treated differently from standard systems. A long line system requires special consideration for the following reasons:

- Additional refrigerant charge
- Refrigerant migration control
- Oil return concerns
- Capacity losses
- Metering device adjustments

Longer line sets require additional refrigerant charge that must be managed throughout the entire range of possible ambient conditions. Off-cycle refrigerant migration that results in excess refrigerant in the compressor at start up, or condensed liquid refrigerant in the suction line at start up must be avoided for compressor reliability. Follow all accessory requirements in this Guideline to control off-cycle refrigerant migration.

Another concern is proper line set sizing and construction to control oil return to the compressor, and minimize capacity losses. In residential applications, proper suction line sizing is critical to achieve adequate oil return, and maintain expected system performance. Oil return in heating mode is different from cooling mode thus, in some cases, heat pumps have additional line set limitations from air conditioning units. Follow all suction line sizing recommendations to ensure system performance and adequate oil return for compressor lubrication.

The third concern is refrigerant metering. Equivalent length and elevation changes affect pressure drop in refrigerant lines. These effects must be considered when sizing liquid lines and orifice-metering devices. Most current indoor products utilize a TXV for cooling mode metering, however, some fan coil models use a piston for refrigerant metering in cooling mode. Proper piston sizing is a concern where piston metering devices are used. Follow piston change recommendations in this Guideline for proper equipment operation (see Tables 7 & 10).

Testing has been done to determine limitations for the application of 1/4 and 5/16 inch liquid lines in cooling only systems. The limiting factor when sizing liquid lines is pressure drop. Equivalent length and vertical separation both contribute to the pressure drop in a liquid line. The liquid line sizing charts in this guideline specify whether the metering device is a piston or TXV.

NOTE: When an application is “Long Line”, accessory requirements differ depending on product type. Requirements are listed in the individual product-type sections.

GENERAL LIMITATIONS

Liquid Lines – AC Only

Liquid line diameters of 1/4” and 5/16” are allowed with published limitations for cooling-only system with TXV device only. Use 3/8” liquid lines for systems with piston indoor metering device. Using smaller liquid lines affects the maximum allowable equivalent length and when the application qualifies as long line. Elevation changes between the indoor and outdoor units also affect allowable equivalent lengths. (See tables 3, 5, and 8 to properly size liquid lines.)

NOTE: Using 1/4 and 5/16” liquid lines within the limits provided, result in no capacity or efficiency changes to the system.

Liquid Lines – Heat Pump

Liquid line sizing for heat pumps is currently limited to 3/8”. Installations with an alternate heat pump liquid line application must be approved. Please provide model numbers, quantities, line set length, vertical separation, and other pertinent information via an email to the technical support group.

Suction Lines

Refer to individual Specification Sheets for acceptable suction line diameters and related capacity effects.

INTERCONNECTING TUBING AND FITTING LOSSES

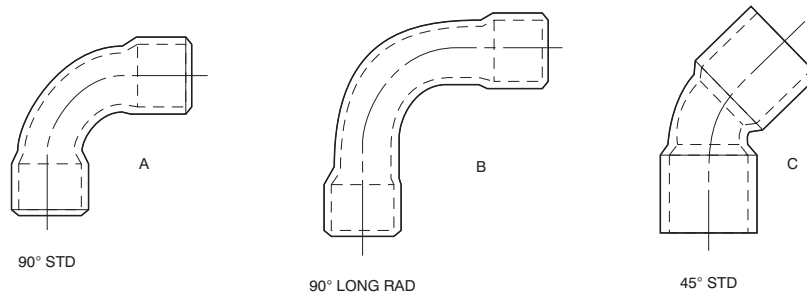
Choosing the proper tubing diameters is critical for reliable long line applications. For proper suction line sizing, see suction line sizing charts in individual unit Specification Sheets. These charts show all acceptable suction line diameters and related performance data based on total equivalent length. See Tables 3, 5, and 8 for the allowable liquid tubing diameters for both single-stage and two-stage.

NOTE: Only 3/8" diameter liquid lines are allowed for variable-speed outdoor units.

Refrigerant tubing must be measured both in terms of actual length and equivalent length. Use actual length for limitations and refrigerant charge calculation. The maximum liquid line length will vary depending on diameter and elevation change between indoor and outdoor units. Equivalent length takes into account pressure losses from both tubing length and losses due to fittings and accessories, such as elbows, liquid line solenoid and filter drier. Losses from fittings are expressed in equivalent length, meaning the length of straight tubing that would have the same pressure loss as the fitting. See Table 1 for equivalent lengths of commonly used fittings and accessories; maximum equivalent length allowed is up to 250 ft (76.2 m) See Tables 3, 5, 8, 11 and 12 for maximum total equivalent length.

Calculate total equivalent length by adding linear (actual) length of the tubing required and the equivalent length of all elbows and accessories used. This data can be found in the outdoor unit Specification Sheets.

Example: A 4-ton system using 7/8 in. diameter line set has a total tubing length of 165 ft. The tubing configuration uses four standard 90° elbows and two 90° long-radius elbows. Checking Table 1, the total equivalent length is calculated as: 165 ft straight tubing + (four standard 90° elbows x 2 ft) + (two long-radius 90° elbows x 1.4 ft) = 165 ft. + 8 ft + 2.8 ft = 175.8 ft total equivalent length.



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Fig. 1 – Tube Bend Losses

Table 1 – Fitting Losses in Equivalent Feet

Tube Size O.D. (In.)	Fitting— Reference Diagram in Fig. 1		
	90° Std (A)	90° Long-Rad (B)	45° Std (C)
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		

METERING DEVICE — LONG LINE COOLING

In current equipment, most indoor units use a hard-shutoff TXV for metering in the cooling mode. This provides adequate refrigerant migration protection for all applications. For fan coils using piston (or fixed orifice) metering device, the addition of a TXV is required at 50 ft. (15.2 m) total length or when the units have a vertical separation of 20 ft (6.1 m) or more. Once a TXV is added, other accessories are required as shown.

HEAT PUMP PISTON SIZING — 1 AND 2-STAGE

A fixed orifice is used for refrigerant metering in the heating mode in 1 and 2-stage heat pumps. This fixed expansion device must be changed from the factory-supplied fixed orifice based on indoor/outdoor vertical separation and system capacity. For horizontal applications up to 200 ft (61 m) linear length and 250 ft (76 m) total equivalent length, no heating piston change is necessary.

When sizing the heating piston for installations where the outdoor unit is below the indoor unit, use Table 7. When outdoor unit is located above indoor unit, use Table 10.

Example: The factory supplied fixed orifice for a single-stage 3-ton heat pump is a number 57. A system is installed with 200 equivalent ft of line set. Approximately 60 ft (18.3 m) is horizontal and the outdoor unit is 140 ft (42.7 m) above the indoor unit. Table 10 shows the fixed orifice piston change to be +6. The new piston size is $57 + 6 = 63$. If a 63 is not produced, round up to the next larger available piston size.

On the same heat pump, if the outdoor unit was located 49 ft (14.9 m) below the indoor unit, Table 7 shows the piston change to be $57 - 2 = 55$. If a 55 piston is not produced, round up to the next available size.

HEAT PUMPS CONTAINING ELECTRONIC EXPANSION VALVE (EXV FOR HEATING MODE)

Variable-speed heat pumps contain an EXV for refrigerant metering in the heating mode, and will self-adjust for longer line sets.

LIQUID LINE SOLENOID — LONG LINE HEAT PUMP HEATING

Since fixed orifice do not provide off-cycle refrigerant migration protection in the heating mode, a liquid line solenoid is required for single-stage and two-stage heat pump long line applications. A bi-flow solenoid valves provide flow control protection only in the direction of the arrow molded into the valve. **The arrow must point toward the outdoor unit** for off-cycle refrigerant control in the heating mode. The arrow shows the direction of flow control. The solenoid should be installed within 2 ft. (609.6 mm) of the outdoor unit. See the Specification Sheets of individual equipment for part numbers.

NOTE: Equivalent length of the liquid line solenoid should be added to the total equivalent length of the tubing.

CHARGING INFORMATION

Use subcooling as the primary method for charging longline applications. Outdoor units are pre-charged for 15 ft (4.6 m) of 3/8 liquid line. When using different length diameter liquid lines, charge adjustments are required. See Table 2 for charge adjustments required. The charge adjustment will depend on the liquid line diameter used. See unit installation instructions for proper charging procedure.

For all long line applications, pressure drop and subcooling loss become a concern. In these applications, a **minimum of 10°F (5.6°C) of subcooling** is required for all liquid line diameters to ensure no refrigerant flashing occurs before the TXV metering device. Systems should be charged to 10° subcooling or the rating plate subcooling, whichever is greater.. Ensure the indoor and outdoor conditions are within allowable limits to charge by subcooling – indoor between 70°F and 80°F (21.1°C and 26.7°C), outdoor between 65°F and 100°F (18.3°C and 37.8°C). If outside these limits, weight in charge. The amount of factory-charge can be found on the unit rating plate or in the Specification Sheets literature.

Table 2 – Refrigerant Charge Adjustments

Liquid Line Size	R-410A Charge (oz/ft)
3/8	0.60 (Factory charge for lineset = 9 oz)
5/16	0.40
1/4	0.27

Units are factory-charged for 15 ft (4.6 m) of 3/8" lineset. Factory charge for 3/8 lineset is 9 oz. When using other length or diameter liquid lines, charge adjustments are required per chart above.

Charging Formula:

$[(\text{Lineset oz/ft} \times \text{total length}) - (\text{factory charge for lineset})] = \text{charge adjustment}$

Example 1: System has 15 ft of line set using existing 1/4" liquid line. What charge adjustment is required?

Formula: $(.27 \text{ oz/ft} \times 15\text{ft}) - (9 \text{ oz}) = (-4.95) \text{ oz.}$

Net result is to remove 4.95 oz of refrigerant from the system

Example 2: System has 45 ft of existing 5/16" liquid line. What is the charge adjustment?

Formula: $(.40 \text{ oz/ft.} \times 45\text{ft}) - (9 \text{ oz.}) = 9 \text{ oz.}$

Net result is to add 9 oz of refrigerant to the system

NOTE: Conditions must be favorable for charging by subcooling method. Indoor temperature must be 70°F to 80°F (21.1°C to 26.7°C), and outdoor temperature must be 70°F to 100°F (21.1°C to 37.8°C). If outside these conditions, adjust charge for long line sets by weigh-in method.

VAPOR LINE SIZING AND COOLING CAPACITY LOSS

Acceptable vapor line diameters provide adequate oil return to the compressor while avoiding excessive capacity loss. Charts with acceptable suction line diameters and capacity losses are shown in the Specification Sheets for each individual model number. Please refer to the Specification Sheets sheets for this information

APPLICATIONS

1 and 2-stage Long Line Applications and Accessory Usage – Units on Equal Level

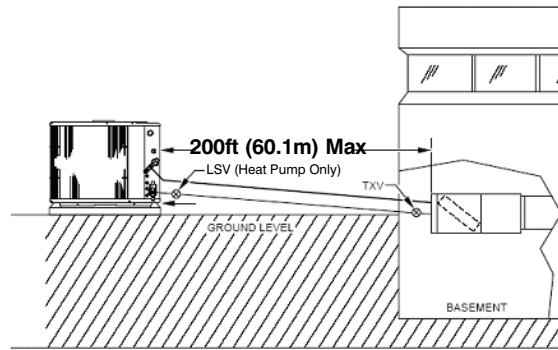


Fig. 2 – Equal-Level Outdoor/Indoor Unit

- Maximum actual length is 200 ft (60.1 m)
- Maximum equivalent length is 250 ft (76.2 m)
- A hard shut-off TXV is required on the indoor unit beyond 50 ft (15.2 m), other accessories per lengths and heights in Table 4 below.
- A hard start kit (capacitor and relay) is required on 1-stage units
- A crankcase heater must be installed on compressor if not factory-supplied
- Vapor line should slope toward indoor unit
- Heat pump only – Bi-flow liquid line solenoid must be installed within 2 ft (0.61 m) of outdoor unit with arrow pointing towards outdoor unit.
- Heat Pump Only – no heating piston adjustment required.
- See Specification Sheets for specific unit for accessory part numbers.

Table 3 – Maximum Total Equivalent Length Units on Equal Level

Size	System Type	Liquid Line Diameter w/ TXV	Maximum Total Equivalent Length†: Equal Level
			0–5 ft (0–1.5 m)
18000	AC Only	1/4	150
	AC Only	5/16	250*
	AC/HP	3/8	250*
24000	AC Only	1/4	75
	AC Only	5/16	250*
	AC/HP	3/8	250*
30000	AC Only	1/4	30
	AC Only	5/16	175
	AC/HP	3/8	250*
36000	AC Only	5/16	175
	AC/HP	3/8	250*
	AC Only	5/16	125
42000	AC/HP	3/8	250*
	AC/HP	3/8	250*
60000	AC/HP	3/8	250*

* Maximum actual length not to exceed 200 ft (61 m)

† Total equivalent length accounts for losses due to elbows or fitting.

**Table 4 – AC / HP with R-410A Refrigerant Long Line Description ft (m)
Beyond these lengths, long line accessories are required**

AC 1 & 2–Stg	AC Liquid Line Size	Units On Same Level
	1/4 + TXV	No accessories needed within allowed lengths
	5/16 + TXV	120 (36.6)
	3/8 + TXV	80 (24.4)
HP 1 & 2–Stg	HP Liquid Line Size	Units On Same Level
	3/8 + TXV	80 (24.4)

1 and 2-stage Long Line Applications and Accessory Usage – Outdoor Unit Below Indoor Unit

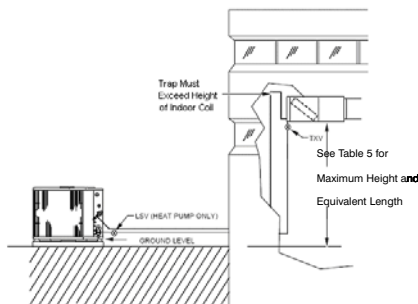


Fig. 3 – Outdoor Unit Below Indoor Unit

- Maximum actual length and lift per Table 5 below
- A hard shut-off TXV is required beyond 50ft (15.2 m) total length or 20ft (6.1m) vertical separation, other accessories per lengths and heights in Table 6 below.
- A hard start kit (capacitor and relay) is required on 1-stage units
- A crankcase heater must be installed on compressor if not factory-supplied
- Heat pump only – Bi-flow liquid line solenoid must be installed within 2 ft (0.61 m) of outdoor unit with arrow pointing towards outdoor unit.
- Heat Pump Only – outdoor piston adjustment required per Table 7 below
- An inverted vapor-line trap must be installed at indoor unit. The top peak of trap must be greater than height of indoor coil.
- Unit must be charged to 10 deg subcooling or nameplate subcooling, whichever is greater..
- See Specification Sheets for specific unit for accessory part numbers.

**Table 5 – Maximum Total Equivalent Length†
Outdoor Unit Below Indoor Unit**

Size	System Type	Liquid Line Diameter w/ TXV	Maximum Total Equivalent Length†: Outdoor unit BELOW Indoor Vertical Separation ft (m)								
			0–5 (0–1.5)	6–10 (1.8–3.0)	11–20 (3.4–6.1)	21–30 (6.4–9.1)	31–40 (9.4–12.2)	41–50 (12.5–15.2)	51–60 (15.5–18.3)	61–70 (18.6–21.3)	71–80 (21.6–24.4)
18000	AC Only	1/4	150	150	125	100	100	75	---	---	---
	AC Only	5/16	250*	250*	250*	250*	250*	250*	250*	225*	150
	AC/HP	3/8	250*	250*	250*	250*	250*	250*	250*	250*	250*
24000	AC Only	1/4	75	75	75	50	50	---	---	---	---
	AC Only	5/16	250*	250*	250*	250*	250*	225*	175	125	100
	AC/HP	3/8	250*	250*	250*	250*	250*	250*	250*	250*	250*
30000	AC Only	1/4	30	---	---	---	---	---	---	---	---
	AC Only	5/16	175	225*	200	175	125	100	75	---	---
	AC/HP	3/8	250*	250*	250*	250*	250*	250*	250*	250*	250*
36000	AC Only	5/16	175	150	150	100	100	100	75	---	---
	AC/HP	3/8	250*	250*	250*	250*	250*	250*	250*	250*	250*
42000	AC Only	5/16	125	100	100	75	75	50	---	---	---
	AC/HP	3/8	250*	250*	250*	250*	250*	250*	250*	250*	150
48000	AC/HP	3/8	250*	250*	250*	250*	250*	250*	230	160	---
60000	AC/HP	3/8	250*	250*	250*	225*	190	150	110	---	---

* Maximum actual length not to exceed 200 ft (61 m)

† Total equivalent length accounts for losses due to elbows or fitting. See the Table 1 for details.

--- = outside acceptable range

**Table 6 – AC / HP with R-410A Refrigerant Long Line Description ft (m)
Beyond these lengths, long line accessories are required**

AC 1 & 2-Stage	AC Liquid Line Size	Outdoor Below Indoor
	1/4 + TXV	No accessories needed within allowed lengths
5/16 + TXV	50 (15.2) vertical or 120 (36.6) total	
3/8 + TXV	35 (10.7) vertical or 80 (24.4) total	
HP 1 & 2-Stage	HP Liquid Line Size	Outdoor Below Indoor
	3/8 + TXV	20 (6.1) vertical or 80 (24.4) total

Table 7 – Refrigerant Heat Pump Outdoor Piston Change – Outdoor Unit BELOW Indoor Unit

Btuh	Vertical Separation ft (m) – Outdoor BELOW Indoor Unit)						
	0–19 (0–5.8)	20–29 (6.1–8.8)	30–39 (9.1–11.9)	40–49 (12.2–14.9)	50–59 (15.2–18.0)	60–69 (18.3–21.0)	70–80 (21.3–24.4)
18,000	0	-1	-1	-2	-2	-2	-2
24,000	0	-1	-1	-2	-2	-3	-3
30,000	0	-1	-1	-2	-2	-3	-3
36,000	0	-1	-2	-2	-2	-3	-3
42,000	0	-1	-2	-2	-3	-3	-4
48,000	0	-1	-2	-2	-3	-3	---
60,000	0	-1	-2	-3	-3	---	---

NOTE: (---) Indicates vertical separation exceeds allowable limits.

Example 1: On a 4 ton system the outdoor unit is 60 ft (18.3 m) below the indoor unit. This is acceptable only if the total equivalent length is 230 ft (70.1 m) or less. The heating piston must be re-sized -3.

Example 2: On a 3-ton system the outdoor unit is 80 ft (24.4 m) below the indoor unit. This is acceptable up to 250 ft (76.2 m) total equivalent length. The heating piston must be re-sized -3.

1 and 2-stage Long Line Applications and Accessory Usage – Outdoor Unit Above Indoor Unit

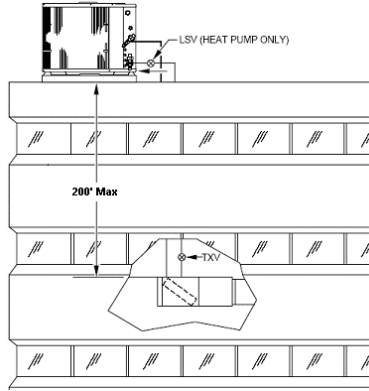


Fig. 4 – Outdoor Unit Above Indoor Unit

- Maximum lengths and separation per Table 8 below
- A hard shut-off TXV is required beyond 50ft (15.2 m) total length or 20ft (6.1m) vertical separation, other accessories per lengths and heights in Table 9 below.
- A crankcase heater must be installed on compressor if not factory-supplied.
- Hard Start Kit (start capacitor and relay) required for 1-stage units.
- Heat pump only – Heating piston must be changed as shown in Table 10.
- Heat pump only – Bi-flow liquid line solenoid must be installed within 2 ft (0.61 m) of outdoor unit with arrow pointing towards outdoor unit.
- Vapor line traps are not required.
- See Specification Sheets for specific unit for accessory part numbers.

Table 8 – Maximum Total Equivalent Length Outdoor Unit ABOVE Indoor Unit

Size	System Type	Liquid Line w/TXV Diameter	Vertical Separation ft (m) Outdoor unit ABOVE indoor unit								
			25 (7.6)	26–50 (7.9–15.2)	51–75 (15.5–22.9)	76–100 (23.2–30.5)	101–125 (30.8–38.1)	126–150 (38.4–45.7)	151–175 (46.0–53.3)	176–200 (53.6–61.0)	
18000	AC Only	1/4	175	250*	250*	250*	250*	250*	250*	250*	250*
	AC Only	5/16	250*	250*	250*	250*	250*	250*	250*	250*	250*
	AC/HP	3/8	250*	250*	250*	250*	250*	250*	250*	250*	250*
24000	AC Only	1/4	100	125	175	200	225*	250*	250*	250*	250*
	AC Only	5/16	250*	250*	250*	250*	250*	250*	250*	250*	250*
	AC/HP	3/8	250*	250*	250*	250*	250*	250*	250*	250*	250*
30000	AC Only	1/4	30	--	--	--	--	--	--	--	--
	AC Only	5/16	250*	250*	250*	250*	250*	250*	250*	250*	250*
	AC/HP	3/8	250*	250*	250*	250*	250*	250*	250*	250*	250*
36000	AC Only	5/16	225*	250*	250*	250*	250*	250*	250*	250*	250*
	AC/HP	3/8	250*	250*	250*	250*	250*	250*	250*	250*	250*
	AC Only	5/16	175	200	250*	250*	250*	250*	250*	250*	250*
42000	AC/HP	3/8	250*	250*	250*	250*	250*	250*	250*	250*	250*
	AC/HP	3/8	250*	250*	250*	250*	250*	250*	250*	250*	250*
48000	AC/HP	3/8	250*	250*	250*	250*	250*	250*	250*	250*	
60000	AC/HP	3/8	250*	250*	250*	250*	250*	250*	250*	250*	

*Maximum Actual Length Not to Exceed 200ft (61 m)

**Table 9 – 1 and 2-Stage AC/HP with R-410A Refrigerant Long Line Description ft (m)
Beyond these lengths, long line accessories are required**

AC 1 & 2-Stage	AC Liquid Line Size		Outdoor Above Indoor	
	1/4 + TXV		175 (53.3)	
	5/16 + TXV		120 (36.6)	
	3/8 + TXV		80 (24.4)	
HP 1 & 2-Stage	AC Liquid Line Size		Outdoor Above Indoor	
	3/8 + TXV		80 (24.4)	

Table 10 – Heat Pump Outdoor Piston Change – Outdoor Unit ABOVE Indoor Unit

Btuh	Vertical Separation ft (m) – Outdoor Above Indoor Unit							
	20–25 (6.1–7.6)	26–50 (7.9–15.2)	51–75 (15.5–22.9)	76–100 (23.2–30.5)	101–125 (30.8–38.1)	126–150 (38.4–45.7)	151–175 (46.0–53.3)	176–200 (53.6–61.0)
18,000	+1	+1	+2	+3	+3	+4	+5	+6
24,000	+1	+1	+2	+3	+4	+5	+6	+7
30,000	+1	+2	+2	+4	+5	+6	+8	+9
36,000	+1	+2	+2	+4	+5	+6	+8	+9
42,000	+1	+2	+3	+4	+5	+7	+8	+10
48,000	+1	+2	+3	+4	+5	+7	+9	+10
60,000	+1	+2	+3	+5	+6	+8	+10	+12

Variable Speed Long Line Applications and Accessories Required

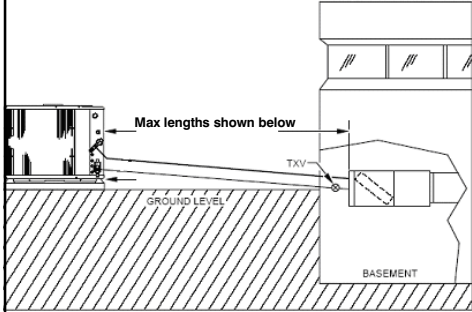
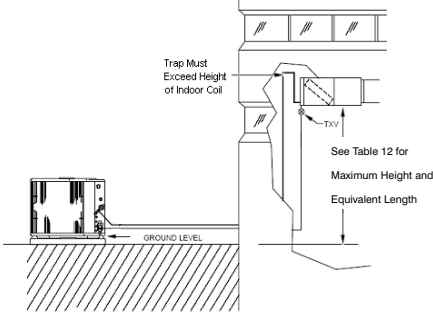
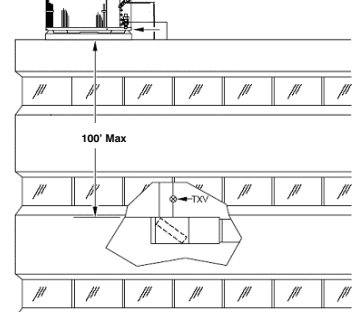
 <ul style="list-style-type: none"> Vapor line should slope toward indoor unit for all variable speed applications. Max lengths depend on unit type. See tables below. A hard shutoff TXV is required on the indoor unit for all variable-speed applications No other accessories required 	 <ul style="list-style-type: none"> An inverted vapor-line trap must be installed at indoor unit. The top peak of trap must be greater than height of indoor coil. A hard shutoff TXV is required on the indoor unit for all variable-speed applications Max lengths depend on unit type. See tables below. No other accessories required 	 <ul style="list-style-type: none"> A hard shutoff TXV is required on the indoor unit for all variable-speed applications Max lengths depend on unit type. See tables below. No other accessories are required
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Table 11 – Maximum Tubing Lengths

Models	Max Total / Equivalent Length ft. (m)	Maximum Vertical Separation ft. (m)	
		Outdoor Above	Outdoor Below
(C,H,T)VH8 / (C,H,T)VA9	100 / 100 (30.5 / 30.5)	100 (30.5)	See Table
(C,H,T)VH8 / (C,H,T)VA9	100 / 100 (30.5 / 30.5)	100 (30.5)	See Table

**Table 12 – Rotary Compressor Models
Maximum Total Equivalent Length† – Outdoor Unit BELOW Indoor Unit**

Size	Liquid Line Diameter w/ TXV	HP with R-410A Refrigerant – Maximum Total Equivalent Length† Vertical Separation ft (m) Outdoor unit BELOW indoor unit;						
		0–20 (0 – 6.1)	21–30 (6.4 – 9.1)	31–40 (9.4 – 12.2)	41–50 (12.5 – 15.2)	51–60 (15.5 – 18.3)	61–70 (18.6 – 21.3)	71–80 (21.6 – 24.4)
2–Ton	3/8	100*	100*	100*	100*	100*	100*	100*
3–Ton	3/8	100*	100*	100*	100*	100*	100*	100*
4–Ton	3/8	100*	100*	100*	100*	100	100	--
5–Ton	3/8	100*	100*	100*	100*	100	100	--

* Maximum actual length not to exceed 100 ft (30.5 m) equivalent length.

† Total equivalent length accounts for losses due to elbows or fitting.

-- = outside acceptable range

Table 13 – Common Piston Sizes Available through FAST

032	067
035	070
037	073
038	076
040	078
042	080
043	082
046	084
049	086
052	088
055	090
057	098
059	101
061	104
063	
065	

Air Conditioner and Heat Pump with R-410A Refrigerant — Quick Reference Guide

- R-410A refrigerant operates at 50–70 percent higher pressures than R-22. Be sure that servicing equipment and replacement components are designed to operate with R-410A refrigerant
- R-410A refrigerant cylinders are rose colored.
- Recovery cylinder service pressure rating must be 400 psig, DOT 4BA400 or DOT BW400.
- R-410A refrigerant systems should be charged with liquid refrigerant. Use a commercial type metering device in the manifold hose when charging into suction line with compressor operating
- Manifold sets should be 700 psig high side and 180 psig low side with 550 psig low-side retard.
- Use hoses with 700 psig service pressure rating.
- Leak detectors should be designed to detect HFC refrigerant.
- R-410A refrigerant, as with other HFCs, is only compatible with POE oils.
- Vacuum pumps will not remove moisture from oil.
- Do not use liquid-line filter driers with rated working pressures less than 600 psig.
- Do not leave R-410A suction line filter driers in line longer than 72 hours.
- Do not install a suction-line filter drier in liquid line.
- POE oils absorb moisture rapidly. Do not expose oil to atmosphere.
- POE oils may cause damage to certain plastics and roofing materials.
- Wrap all filter driers and service valves with wet cloth when brazing.
- A factory approved liquid-line filter drier is required on every unit.
- Do NOT use an R-22 TXV.
- If indoor unit is equipped with an R-22 TXV or piston metering device, it must be changed to a hard shutoff R-410A TXV.
- Never open system to atmosphere while it is under a vacuum.
- When system must be opened for service, recover refrigerant, evacuate then break vacuum with dry nitrogen and replace filter driers. Evacuate to 500 microns prior to recharging.
- Do not vent R-410A refrigerant into the atmosphere.
- Do not use capillary tube coils.
- Observe all **warnings, cautions, and bold** text.
- All indoor coils must be installed with a hard shutoff R-410A TXV metering device in long line applications.