

4.0 INSTALLATION

4.1 Tools and Refrigerant

4.1.1 Tools Required for Installing and Servicing R-454B Models

Manifold Sets:

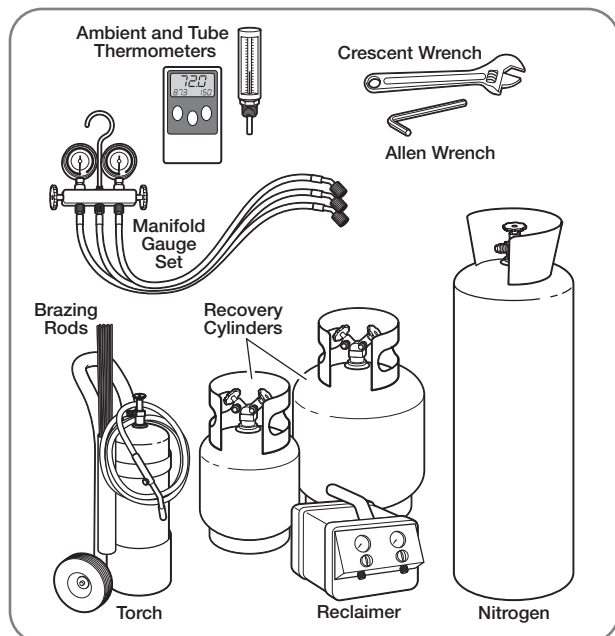
- Up to 800 PSIG High-Side
- Up to 250 PSIG Low-Side
- 550 PSIG Low-Side Retard

Manifold Hoses:

- Service Pressure Rating of 800 PSIG

Recovery Cylinders:

- 400 PSIG Pressure Rating



CAUTION: Any and all equipment must be compatible with refrigerant R-454B.

DANGER: Risk Of Fire Or Explosion. Flammable Refrigerant Used. Consult Repair Manual/Owner's Guide Before Attempting To Service This Product. All Safety Precautions Must Be Followed.

A leak detection system is installed in this unit. The unit must be powered at all times except during service.

The unit is equipped with electrically powered safety measures. To be effective, the unit must be electrically powered at all times after installation, other than when servicing.

4.1.2 Working Personnel

DANGER: Risk of Fire or Explosion. Flammable Refrigerant Used. To Be Repaired Only By Trained

Service Personnel. Do Not Puncture Refrigerant Tubing.

Every installation, maintenance, service, and repair working procedure must be conducted by qualified personnel who have been trained in operating and servicing units that employ flammable refrigerants such as R-454B.

Examples of working procedures include but are not limited to:

- Breaking into the refrigeration circuit
- Opening sealed components
- Opening ventilated enclosures

This appliance is not intended for use by persons (including children) with reduced physical, sensory, or mental capabilities, or lack of experience and knowledge, unless they have been given supervision or instruction concerning the use of the appliance by a person responsible for their safety.

Children should be supervised to ensure that they do not play with the appliance.

4.1.3 Specifications of R-454B

Application: R-454B is not a drop-in replacement for R-410A. Equipment designs must accommodate the safety group A2L of R-454B. It cannot be retrofitted into R-410A units.

Physical Properties: R-454B has an atmospheric bubble point of -59.6°F [50.9°C] and an atmospheric dew point of -58.0°F [-50.0°C]. Its bubble point saturation pressure at 77°F [25°C] is 213 psig [1469 kPa] and dew point saturation pressure at 77°F [25°C] is 205 psig [1415 kPa].

Pressure: The pressure of R-454B is similar to that of R-410A. Recovery and recycle equipment, pumps, hoses, and the like must have design pressure ratings appropriate for R-454B. Manifold sets need to range up to 800 psig [5,516 kPa] high-side and 250 psig [1,724 kPa] low-side with a 550 psig [3,792 kPa] low-side retard. Hoses need to have a service pressure rating of 800 psig [5,516 kPa]. Recovery cylinders need to have a 400 psig [2,758 kPa] service pressure rating, DOT 4BA400 or DOT BW400.

Flammability: R-454B is classified as safety group A2L, where the 2L flammability class indicates mild flammability.

R-454B and air should never be mixed in cylinders or supply lines or be allowed to accumulate in storage cylinders. Leak checking should never be done with a mixture of R-454B and air.

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4.1.4 Quick-Reference Guide for R-454B

- Ensure that service equipment is designed to operate with R-454B.
- Refrigerant R-454B operates at pressures similar to R-410A. However, it is classified in safety group A2L. Ensure that servicing equipment is compatible with R-454B.
- Refrigerant cylinders are no longer color-coded. R-454B refrigerant cylinders are light green grey in color with a red band on the shoulder or top of the cylinder to indicate flammability.
- R-454B is only compatible with POE oils.
- Vacuum pumps will not remove moisture from POE oil used in R-454B systems.
- R-454B systems are to be charged with liquid refrigerants.
- Do not install a suction line filter drier in the liquid line.
- A factory-approved biflow liquid line filter drier is shipped with every unit and must be installed in the liquid line at the time of installation. Only manufacturer-approved liquid line filter driers can be used. These filter driers are rated for a minimum working pressure of 600 PSIG. The filter drier will only have adequate moisture-holding capacity if the system is properly evacuated.
- Desiccant (drying agent) must be compatible for POE oils and R-454B refrigerant

4.1.5 Minimum Room Area

Because this unit uses refrigerant R-454B, UL requires a minimum room area for the total conditioned space (T_{Amin}) that is supplied by this equipment.

The UL Safety Standard defines an individual room area as the room area enclosed by floors, walls, partitions, and doors of the space where the unit is installed, also as the room area into which refrigerant can leak. Each room/conditioned space will need to be considered for the total area requirements.

The minimum room area of the total conditioned space for each base model is listed in **3.2 A2L Refrigerant Installation Safety Data**.

4.1.6 No Ignition Sources

When performing work that involves exposing any pipework, no person working on or near the refrigerating system may use any ignition sources that could lead to the risk of fire or explosion. All possible ignition sources, including cigarette smoking, should be kept far away from the site during installation, repair, removal, or disposal, during which refrigerant can possibly be released into the surrounding space. Before work takes place, the area around the equipment must be surveyed to ensure that there are no flammable hazards or ignition risks. Additionally, “No Smoking” signs must be displayed.

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4.2 Choosing a Location

4.2.1 Allowable Clearances

24" [61.0 cm] to side intake louvers

24" [61.0 cm] between multiple units

36" [91.4 cm] to service access panels

60" [152.4 cm] vertical for fan discharge

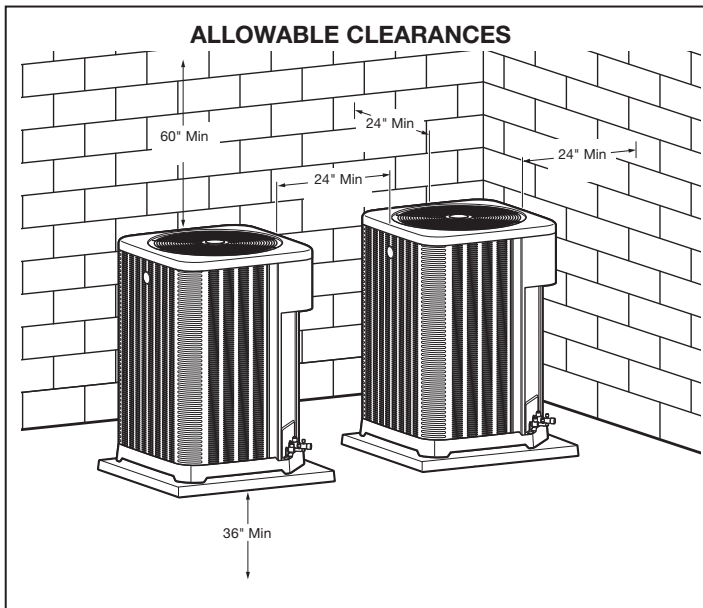
IMPORTANT: Consult local and national building codes and ordinances for special installation requirements. Following location information will provide longer life and simplified servicing of the outdoor unit.

NOTICE: These units must be installed outdoors. No ductwork can be attached, or other modifications made, to the discharge grille. Modifications will affect performance or operation.

4.2.2 Operational Issues Related to Unit Location

IMPORTANT: Locate the unit in a manner that will not prevent, impair, or compromise the performance of other equipment installed in proximity to the unit. Maintain all required minimum distances to gas and electric meters, dryer vents, and exhaust and inlet openings. In the absence of national codes or manufacturers' recommendations, local code recommendations and requirements will take precedence.

- Refrigerant piping and wiring should be properly sized and kept as short as possible to avoid capacity losses and increased operating costs.
- Locate the unit where water runoff will not create a problem with the equipment. Position the unit away from the drip edge of the roof whenever possible. Units are weatherized, but can be affected by the following:
- Water pouring into the unit from the junction of rooflines, without protective guttering. Large volumes of water entering the unit while in operation can impact fan blade or motor life.
- Closely follow the clearance recommendations in section 4.2.1.



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4.2.3 Corrosive Environment

The metal parts of this unit may be subject to rust or deterioration if exposed to a corrosive environment. This oxidation could shorten the equipment's useful life.

Corrosive elements include, but are not limited to, salt spray, fog or mist in seacoast areas, sulphur or chlorine from lawn watering systems, and various chemical contaminants from industries such as paper mills and petroleum refineries.

If the unit is to be installed in an area where contaminants are likely to be a problem, special attention should be given to the equipment location and exposure.

- Avoid having lawn sprinkler heads spray directly on the unit cabinet.
- In coastal areas, locate the unit on the side of the building away from the waterfront.
- Shielding provided by a fence or shrubs may give some protection, but cannot violate minimum airflow and service access clearances.

⚠ WARNING: Disconnect all power to unit before starting maintenance. Failure to do so can cause electrical shock resulting in severe personal injury or death.

Regular maintenance will reduce the buildup of contaminants and help to protect the unit's finish.

- Frequent washing of the cabinet, fan blade, and coil with fresh water will remove most of the salt or other contaminants that build up on the unit.
- Regular cleaning and waxing of the cabinet with a good automobile polish will provide some protection.
- A good liquid cleaner may be used several times a year to remove matter that will not wash off with water.

4.2.4 Customer Satisfaction Issues

- The outdoor unit should be located away from areas where noise from the unit would be considered objectionable.
- To prevent noise transmission, the mounting pad for the outdoor unit should not be connected to the structure and should be located a sufficient distance above grade to prevent ground water from entering the unit.

4.3 Mounting Unit

4.3.1 Corner Weights and Rigging

For lifting unit into place, rig it as shown in the illustration on the following page, making certain that the rigging slings are of sufficient length to maintain balance of the unit when it is being lifted. Before placing the unit on the roof, make certain that the roof structure is strong enough to support the weight of the unit. Corner weights are provided in the table below.

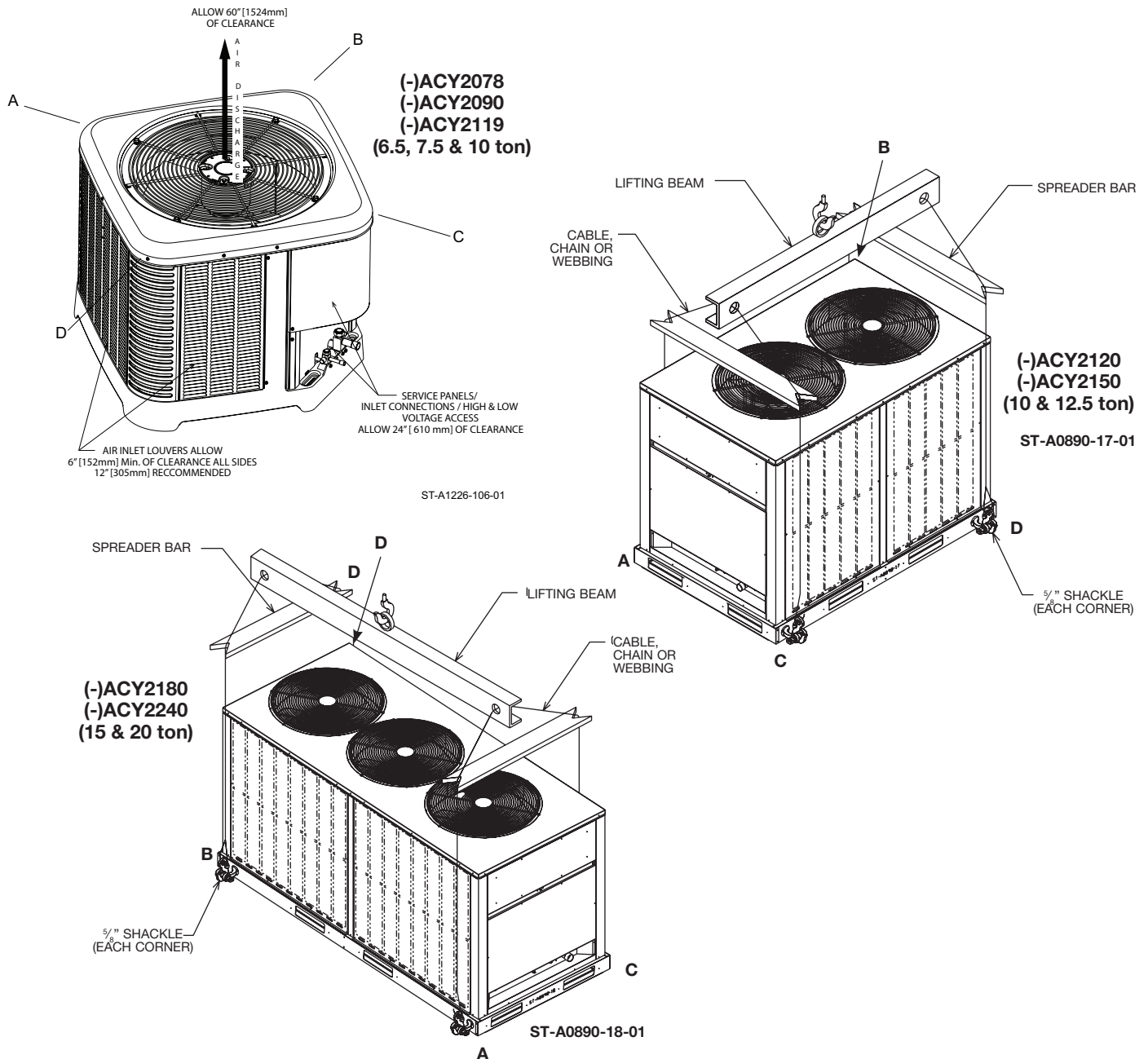
For the 6.5, 7.5, and smaller 10 ton (one fan) units, to move unit into place, secure nylon straps to the unit instead of the shackle and lifting beam method used for the two and three fan units.

CORNER WEIGHTS – POUNDS

Model	Total Weight Lbs[kg]	Corner Weights LBS[kg]			
		A	B	C	D
(-)ACY2078	383 [174]	104 [47]	82 [37]	107 [49]	89 [40]
(-)ACY2090	383 [174]	104 [47]	82 [37]	107 [49]	89 [40]
(-)ACY2119	411 [186]	112 [51]	88 [40]	115 [52]	96 [44]
(-)ACY2120	565[256]	97[44]	181[82]	215[98]	73[33]
(-)ACY2150	647[293]	189[86]	157[71]	161[73]	139[63]
(-)ACY2180	832[377]	240[109]	183[83]	167[6]	242[110]
(-)ACY2240	926[420]	308[140]	128[58]	161[73]	328[149]

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ROOFTOP INSTALLATION – RIGGING



4.3.2 High Wind and Seismic Tie-Down Methods

The manufacturer-approved/recommended method is a guide to securing equipment for wind and seismic loads. Other methods might provide the same result, but the manufacturer method is the only one endorsed by the manufacturer for securing equipment where wind or earthquake damage can occur. Additional information is available on the manufacturer's website or from the wholesale distributor.

4.3.3 Elevating Unit

WARNING: Secure an elevated unit and its elevating stand in order to prevent tipping. Failure to do so may result in severe personal injury or death.

If elevating a unit on a flat roof, use 4" x 4" [10.2 cm x 10.2 cm] or equivalent stringers positioned to distribute unit weight evenly and prevent noise and vibration.

NOTICE: Do not block drain openings on bottom of unit.

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4.4 Refrigerant Line Set Selection

4.4.1 Replacing Existing Systems

To prevent failure of a new unit, the existing line set must be correctly sized for the new unit and must be cleaned or replaced. Care must be taken so the expansion device is not plugged. For new and replacement units, a liquid line filter drier must be installed and the line set must be properly sized. Test the oil for acid. If it tests positive for acid, a suction line filter drier is mandatory.

IMPORTANT: When replacing a unit, the indoor and outdoor units must match in refrigerant type. Mismatching is not acceptable, meaning both units need to be replaced if refrigerant type is changing.

4.4.2 Line Set Length and Fitting Losses

Refrigerant tubing is measured in terms of actual length and equivalent length. Actual length is used for refrigerant charge applications. Equivalent length takes into account pressure losses from tubing length, fittings, vertical separation, accessories, and filter driers. The table below references commonly used equivalent lengths.

4.4.3 Liquid Line Selection

The purpose of the liquid line is to transport warm sub-cooled liquid refrigerant between the outdoor unit to the indoor unit. It is important not to allow the refrigerant to flash into superheated vapor prior to the expansion device of the indoor coil. The flashing of refrigerant can occur for the following reasons:

- Low refrigerant charge
- Improperly selected liquid line size

- Absorption of heat prior to expansion device
- Excessive vertical separation between the outdoor unit and indoor coil
- Restricted liquid line or filter drier
- Kinked liquid line

Table 2 lists the equivalent length per 25' of liquid line at various diameters up to 250' [76 m]. The total pressure drop allowed for the liquid line is 50 PSI [345 kPa]. The procedure for selecting the proper liquid line is as follows:

- Measure the total amount of vertical separation between the outdoor unit and indoor coil.
- Measure the linear length of liquid line needed.
- Add all of the equivalent lengths associated with any fittings or accessories using Table 1 above.
- Add the linear length to the total fitting equivalent length. This will equal your total equivalent line length.
- Reference Table 2 to verify the calculated equivalent length is acceptable with the required vertical separation and diameter of liquid line.

Notes:

1. The minimum velocity line (1500 FPM) [7.5 m/s] is recommended.
2. With the outdoor unit located below the indoor air handler, all vertical vapor lines must not exceed 1 1/8" [28.58 mm] O.D.
3. For suction pressure drop (PSIG) [6.9 kPa], multiply percent (%) loss by 1.18.
4. Size vapor lines for no more than a 5 PSIG [34.5 kPa] pressure drop (2.54% capacity loss) which corresponds to approximately 2°F [-16.7°C] loss.
5. All vertical vapor lines, 3 ft [.91 m] or more in length, must have a short radius oil trap at the bottom of the riser.
6. All vertical vapor lines, 30 ft [9.14 m] or more in length, must have short radius oil traps every 15 to 20 feet [4.57 to 6.10 m] of run.

Table 1

Equivalent Length for Fittings (ft)				
Line Size (in)	90° Short Radius Elbow	90° Long Radius Elbow	45° Elbow	Filter Drier
1/2 [12.71]	1.4 [0.43]	0.9 [0.27]	0.4 [0.12]	6 [1.83]
5/8 [15.88]	1.5 [0.46]	1 [0.30]	0.5 [0.15]	6 [1.83]
3/4 [19.01]	1.9 [0.58]	1.3 [0.40]	0.6 [0.18]	6 [1.83]
7/8 [22.23]	2.3 [0.70]	1.5 [0.46]	0.7 [0.21]	6 [1.83]
1-1/8 [28.58]	2.7 [0.82]	1.8 [0.55]	0.9 [0.27]	N/A
1-3/8 [34.89]	3.6 [1.10]	2.4 [0.73]	1.2 [0.37]	N/A
1-5/8 [44.28]	4.2 [1.28]	2.8 [0.85]	1.4 [0.43]	N/A
2-1/8 [53.98]	5.9 [1.80]	3.9 [1.19]	1.8 [0.55]	N/A

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TABLE 2

10 - 20 Ton Air-Conditioners (English Units)										
Unit Size	Allowable Liquid Line Size	Allowable Suction Line Size	Equivalent Length (Feet)							
			< 25	26-50	51-75	76-100	101-125	126-150	151-175	176-200
			Maximum Vertical Rise (Outdoor Unit Below Indoor Unit) * / Capacity Multiplier							
7.5 Ton	1/2"	1-1/8"	25 / 1.00	50 / 0.99	75 / 0.98	90 / 0.98	84 / 0.97	77 / 0.96	70 / 0.95	63 / 0.94
	5/8"	1-1/8"	25 / 1.00	50 / 0.99	75 / 0.98	100 / 0.98	100 / 0.97	100 / 0.96	100 / 0.95	100 / 0.94
	1/2"	1-3/8"	25 / 1.00	50 / 1.00	75 / 1.00	90 / 1.00	84 / 0.99	77 / 0.99	70 / 0.99	63 / 0.99
	5/8"	1-3/8"	25 / 1.00	50 / 1.00	75 / 1.00	100 / 1.00	100 / 0.99	100 / 0.99	100 / 0.99	100 / 0.99
10 Ton	5/8"	1-3/8"	25 / 1.00	50 / 1.00	75 / 0.99	100 / 0.99	102 / 0.99	99 / 0.99	96 / 0.98	93 / 0.98
	5/8"	1-5/8"	25 / 1.00	50 / 1.00	75 / 1.00	100 / 1.00	102 / 1.00	99 / 1.00	96 / 0.99	93 / 0.99
12.5 Ton	5/8"	1-3/8"	25 / 1.00	50 / 1.00	75 / 0.99	99 / 0.99	94 / 0.98	89 / 0.98	84 / 0.97	78 / 0.97
	5/8"	1-5/8"	25 / 1.00	50 / 1.00	75 / 1.00	99 / 1.00	94 / 0.99	89 / 0.99	84 / 0.99	78 / 0.99
15 Ton	5/8"	1-5/8"	25 / 1.00	50 / 1.00	75 / 0.99	89 / 0.99	82 / 0.99	74 / 0.99	66 / 0.98	59 / 0.98
	3/4"	1-5/8"	25 / 1.00	50 / 1.00	75 / 0.99	100 / 0.99	105 / 0.99	102 / 0.99	99 / 0.98	96 / 0.98
	5/8"	2-1/8"	25 / 1.00	50 / 1.00	75 / 1.00	89 / 1.00	82 / 1.00	74 / 1.00	66 / 1.00	59 / 1.00
	3/4"	2-1/8"	25 / 1.00	50 / 1.00	75 / 1.00	100 / 1.00	105 / 1.00	102 / 1.00	99 / 1.00	96 / 1.00
20 Ton	7/8"	1-5/8"	25 / 1.00	50 / 1.00	75 / 0.99	100 / 0.99	110 / 0.98	108 / 0.98	106 / 0.97	103 / 0.97
	7/8"	2-1/8"	25 / 1.00	50 / 1.00	75 / 1.00	100 / 1.00	110 / 1.00	108 / 1.00	106 / 1.00	103 / 1.00

Notes:

1) Do not exceed 200ft linear line length.

2) Always use the smallest liquid line allowable to minimize refrigerant charge.

3) Applications shaded in light gray indicate capacity multipliers between 0.90 and 0.96 which are not recommended, but are allowed.

10 - 20 Ton Air-Conditioners (Metric Units)										
Unit Size	Allowable Liquid Line Size	Allowable Suction Line Size	Equivalent Length (Meters)							
			< 8	8-15	16-23	24-30	31-38	39-46	47-53	54-61
			Maximum Vertical Rise (Outdoor Unit Below Indoor Unit) * / Capacity Multiplier							
7.5 Ton	1/2"	1-1/8"	8 / 1.00	15 / 0.99	23 / 0.98	27 / 0.98	26 / 0.97	23 / 0.96	21 / 0.95	19 / 0.94
	5/8"	1-1/8"	8 / 1.00	15 / 0.99	23 / 0.98	30 / 0.98	30 / 0.97	30 / 0.96	30 / 0.95	30 / 0.94
	1/2"	1-3/8"	8 / 1.00	15 / 1.00	23 / 1.00	27 / 1.00	26 / 0.99	23 / 0.99	21 / 0.99	19 / 0.99
	5/8"	1-3/8"	8 / 1.00	5 / 1.00	23 / 1.00	30 / 1.00	30 / 0.99	30 / 0.99	30 / 0.99	30 / 0.99
10 Ton	5/8"	1-3/8"	8 / 1.00	15 / 1.00	23 / 0.99	30 / 0.99	31 / 0.99	30 / 0.99	29 / 0.98	28 / 0.98
	5/8"	1-5/8"	8 / 1.00	15 / 1.00	23 / 1.00	30 / 1.00	31 / 1.00	30 / 1.00	29 / 0.99	28 / 0.99
12.5 Ton	5/8"	1-3/8"	8 / 1.00	15 / 1.00	23 / 0.99	30 / 0.99	29 / 0.98	27 / 0.98	26 / 0.97	24 / 0.97
	5/8"	1-5/8"	8 / 1.00	15 / 1.00	23 / 1.00	30 / 1.00	29 / 0.99	27 / 0.99	26 / 0.99	24 / 0.99
15 Ton	5/8"	1-5/8"	8 / 1.00	15 / 1.00	23 / 0.99	27 / 0.99	25 / 0.99	23 / 0.99	20 / 0.98	18 / 0.98
	3/4"	1-5/8"	8 / 1.00	15 / 1.00	23 / 0.99	30 / 0.99	32 / 0.99	31 / 0.99	30 / 0.98	29 / 0.98
	5/8"	2-1/8"	8 / 1.00	15 / 1.00	23 / 1.00	27 / 1.00	25 / 1.00	23 / 1.00	20 / 1.00	18 / 1.00
	3/4"	2-1/8"	8 / 1.00	15 / 1.00	23 / 1.00	30 / 1.00	32 / 1.00	31 / 1.00	30 / 1.00	29 / 1.00
20 Ton	7/8"	1-5/8"	8 / 1.00	15 / 1.00	23 / 0.99	30 / 0.99	34 / 0.98	33 / 0.98	32 / 0.97	31 / 0.97
	7/8"	2-1/8"	8 / 1.00	15 / 1.00	23 / 1.00	30 / 1.00	34 / 1.00	33 / 1.00	32 / 1.00	31 / 1.00

Example: A 10 ton condensing unit is installed 50' below the indoor unit, requires 75' of 5/8" diameter liquid line, 1-3/8" diameter suction line, and 4 90° LR elbows, and a filter drier.

- Filter Drier Equivalent Length (ft.) = 6'
- Fitting Equivalent Length (ft.) = 4 × 1' = 3.6'
- Total Equivalent Length (ft.) = 75' + 6' + 4' = 85'

This application is acceptable because the 50' vertical rise is less than the maximum rise of 100' for this application.

Unit Size	Allowable Liquid Line Size	Allowable Suction Line Size	Equivalent Length (Feet)							
			< 25	26-50	51-75	76-100	101-125	126-150	151-175	176-200
			Maximum Vertical Rise (Outdoor Unit Below Indoor Unit) * / Capacity Multiplier							
10 Ton	5/8"	1-3/8"	25 / 1.00	50 / 1.00	75 / 0.99	100 / 0.99	102 / 0.99	99 / 0.99	96 / 0.98	93 / 0.98
	5/8"	1-5/8"	25 / 1.00	50 / 1.00	75 / 1.00	100 / 1.00	102 / 1.00	99 / 1.00	96 / 0.99	93 / 0.99

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4.4.4 Suction Line Selection

Purpose of the vapor line is to return superheated vapor to the condensing unit from the evaporator. Proper suction line sizing is important because it plays an important role in returning oil to the compressor to prevent potential damage to the bearings, valves, and scroll sets. Also, an undersized suction line can dramatically reduce capacity and performance of the system. The procedure for selecting the proper suction line is as follows:

- Determine the total linear length of suction line required.
- Add all of the equivalent lengths associated with any fittings or accessories using the table on previous page.
- Add the linear length and total fitting equivalent length. This will equal your total equivalent length.
- Reference Table 2 to verify that the calculated equivalent length falls within the acceptable region of the chart.
- Verify the capacity difference is compatible with the application using the multiplier in Table 2.
- Use only suction line sizes listed in Table 2.

4.4.5 Long Line Set Considerations

Generally, installations with actual (linear) line set lengths over 80 ft. [24 m] or vertical separation between the outdoor and indoor units exceed 20 ft. [6 m] are considered long line length applications and require special considerations to maintain good performance and compressor reliability. The following things should be considered when installing a system with a long line set length.

- Additional refrigerant charge
- Fitting losses and maximum equivalent length considerations
- Refrigerant migration during the off cycle
- Oil return to the compressor
- Capacity losses
- Additional oil

4.4.5.1 Oil Return to Compressor

Small amounts of compressor crankcase oil is picked up and carried out of the compressor by the moving refrigerant and is circulated through the system along with the refrigerant before it returns to the compressor crankcase. It is critical to the life of the compressor for the oil to be able to return to the compressor to maintain an adequate level of oil in the compressor crankcase. Oversized vapor lines result in inadequate refrigerant velocities

to carry the oil along with the refrigerant and will cause the oil to accumulate in the low spots in the vapor line instead of being returned to the compressor crankcase. This is especially true for long line lengths. Only use the vapor line sizes listed in Table 2 to assure proper oil return. Do not oversize the vapor line.

4.4.5.2 Refrigerant Migration During Off Cycle

Long line set applications can require a considerable amount of additional refrigerant. This additional refrigerant must be managed throughout the entire outdoor ambient operating range that the system will experience throughout its life cycle. Off-cycle refrigerant migration is where refrigerant condenses and migrates to the coldest and/or lowest part of the system. Excessive build-up of refrigerant near or inside the compressor can result in poor reliability and noisy operation during start-up. Long line set applications require a non-bleed TXV on the indoor coil and a crankcase heater. All models related to this manual have a crankcase heater from the factory and all AHRI matched indoor units have a non-bleed TXV. If only the condensing unit is being replaced, it is important to confirm that the indoor coil has a non-bleed TXV. If it doesn't, a liquid line solenoid valve must be installed near the indoor coil with the flow arrow pointing toward the indoor coil.

4.4.5.3 Maximum Liquid Pressure Drop

The total liquid line pressure drop must not exceed 50 psig [345 kPa] to assure a solid column of liquid at the metering device and stable control of superheat. Be sure to account for vertical separation, elbows, filter driers, solenoid valves, sight glasses, and check valves when calculating liquid line pressure drop.

4.4.5.4 Liquid Line Refrigerant Flashing

Excessive pressure drop and heat gain in long liquid lines can result in the refrigerant flashing into a vapor before it reaches the metering device which will dramatically reduce the capacity and efficiency of the system. For this reason, the liquid line must be sized properly using Table 2 and must be insulated in unconditioned spaces.

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4.4.5.5 Compressor Oil Level Adjustment

Additional oil will need to be added for long line set applications. Below is the equation for the oil level adjustment. The compressor name plate oil charge for the different outdoor units is shown in the table below.

4.4.5.6 Capacity Losses

Long line lengths can result in a reduction in capacity due to suction line pressure drop and heat gain. Refer to Table 2 for capacity loss multipliers for various vapor line diameters and lengths. Only use vapor lines listed in Table 2 to assure proper oil return. This table does not account for any capacity loss due to heat gain from the environment. It is extremely important not to oversize the suction line to minimize capacity loss at the expense of proper oil return. The full length of the suction line must be insulated to minimize heat gain.

TABLE 3

MODEL	Compressor Nameplate Oil Charge	Oil Type
(-)ACY2078	58 fl. oz. [1715 ml]	3MAF POE
(-)ACY2090	58 fl. oz. [1715 ml]	3MAF POE
(-)ACY2119	85 fl. oz. [2514 ml]	3MAF POE
(-)ACY2120	85 fl. oz. [2514 ml]	3MAF POE
(-)ACY2150	116 fl. oz. [3431 ml]	3MAF POE
(-)ACY2180	116 fl. oz. [3431 ml]	3MAF POE
(-)ACY2240	170 fl. oz. [5028 ml]	3MAF POE

Oil to be Added = [(Refrigerant Charge Adjustment (oz.) + OD Unit Refrigerant Name Plate Charge (oz.)) × (0.022)] – [(0.10) × (Compressor Name Plate Oil Charge (oz.))]

Example:

An application for an (-)ACY2120 requires 125 ft. of line set with a liquid line diameter of 5/8" and a suction line diameter of 1-3/8", Charge Adjustment = 125 ft. × (1.65 oz./ft + 0.34 oz./ft) = 248.75 oz. See **Section 5.2** for more information.

Name Plate Refrigerant Charge = 422 oz.,

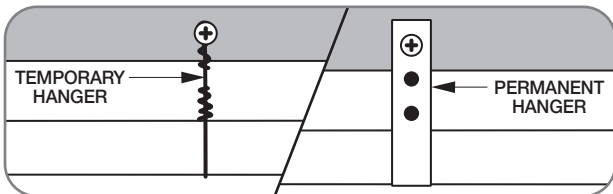
Compressor Name Plate Oil Charge = 85 oz.,

Oil to be Added = ((248.75 oz. + 422 oz.) × .022) – (.10 × 85 oz.) = 6.3 oz.

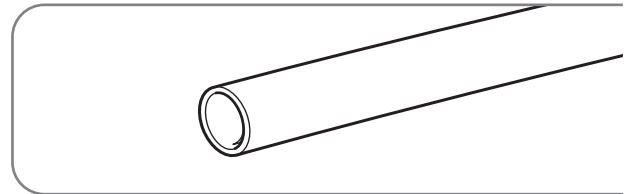
4.0 INSTALLATION

4.5 Line Set Installation

- If tubing is to be run underground, it must be run in a sealed watertight chase.
- Use care in routing tubing and do not kink or twist. Use a good quality tubing bender on the vapor line to prevent kinking.



- Locations where the tubing will be exposed to mechanical damage should be avoided. If it is necessary to use such locations, the copper tubing should be protected by a housing to prevent damage.



- Route the tubing using temporary hangers; then straighten the tubing and install permanent hangers. The tubing must be adequately supported.
- Isolate the vapor line from the building structure. If the vapor line comes in contact with inside walls, ceiling, or flooring, the vibration of the vapor line in the heating mode will result in noise inside the structure.
- Blow out the liquid and vapor lines with dry nitrogen before connecting to the outdoor unit and indoor coil to remove debris that can plug the expansion device.

4.5.1 Important Tubing Installation Practices

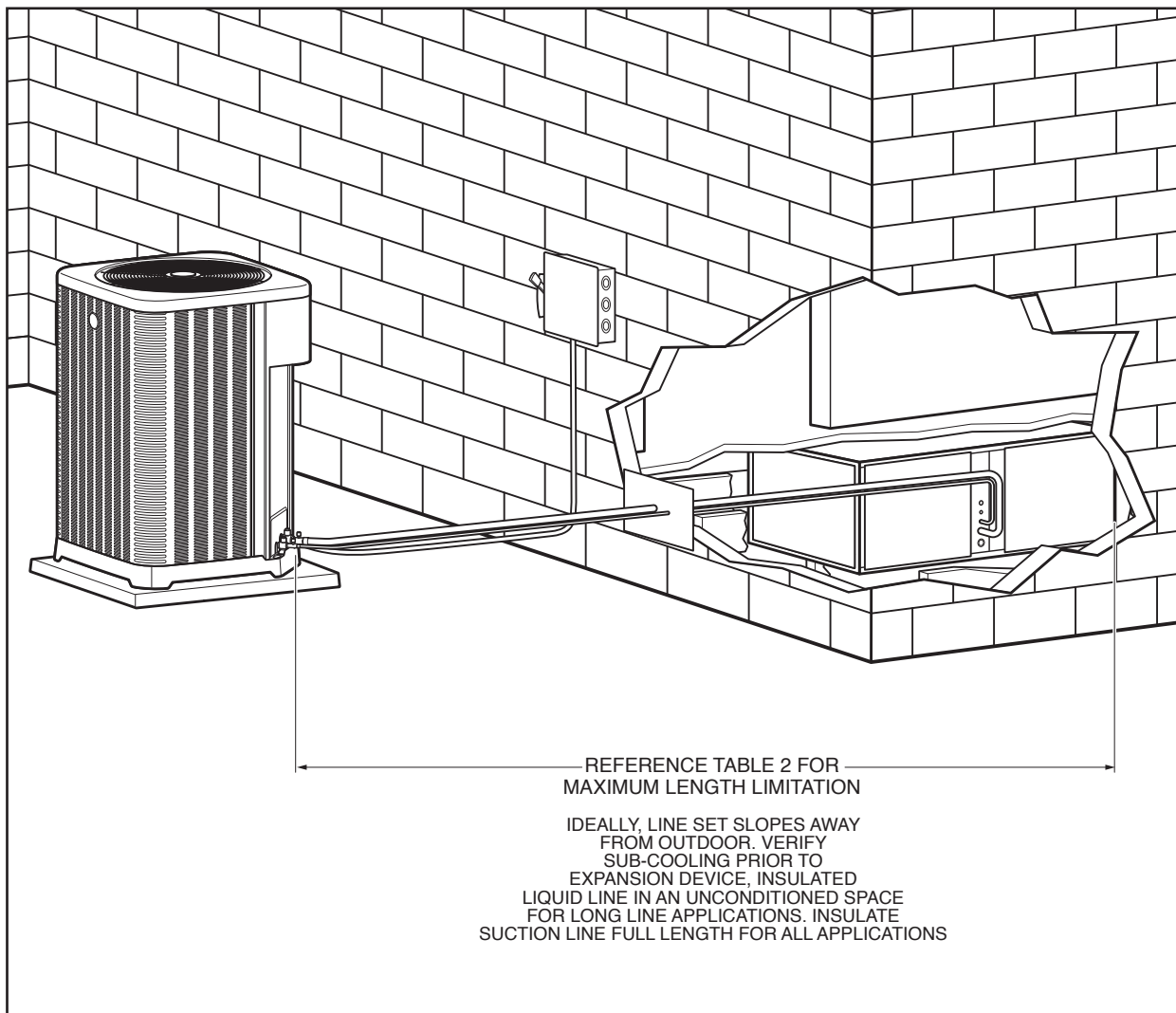
Observe the following when installing correctly sized type “L” refrigerant tubing between the outdoor unit and indoor coil:

- Check Table 2 for the correct suction line size and liquid line size.
- **If a portion of the liquid line passes through a very hot area where liquid refrigerant can be heated to form vapor, insulating the liquid line is required.**
- Use clean, dehydrated, sealed refrigeration-grade tubing.
- Always keep tubing sealed until tubing is in place and connections are to be made.
- A high-quality filter drier is included with all units and must be installed in the liquid line upon unit installation.
- If tubing has been cut, deburr the ends while holding the tubing in a position to prevent chips from falling into tubing. Burrs such as those caused by tubing cutters can affect performance dramatically, particularly on small diameter liquid lines.
- For best operation, keep tubing run as short as possible with a minimum number of elbows or bends.

4.0 INSTALLATION

4.5.2 Relative Location of Indoor and Outdoor Units

4.5.2.1 Indoor and Outdoor Unit Near Same Level

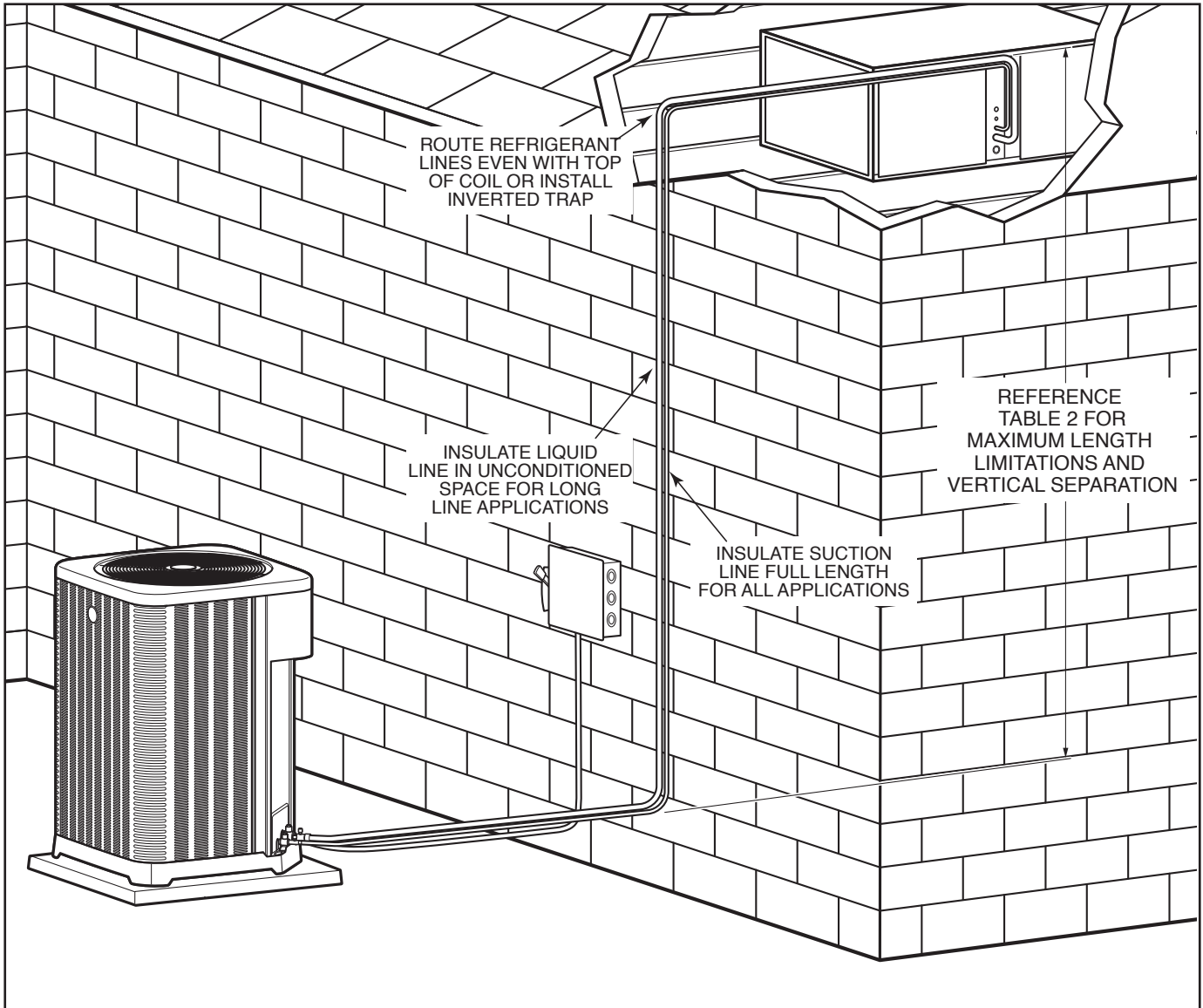


For applications that are considered to have a long line set with the outdoor unit and indoor unit near the same level the following is required:

- Insulated liquid line in unconditioned space only. Insulated suction line full length.
- Suction line should slope toward the indoor unit
- Follow the proper line sizing, maximum linear and equivalent lengths, charging requirements, and oil level adjustments spelled out in this manual.
- Verify at least 5°F [2.8°C] liquid sub-cooling at the indoor unit prior to expansion device.

4.0 INSTALLATION

4.5.2.2 Outdoor Unit Below Indoor Unit

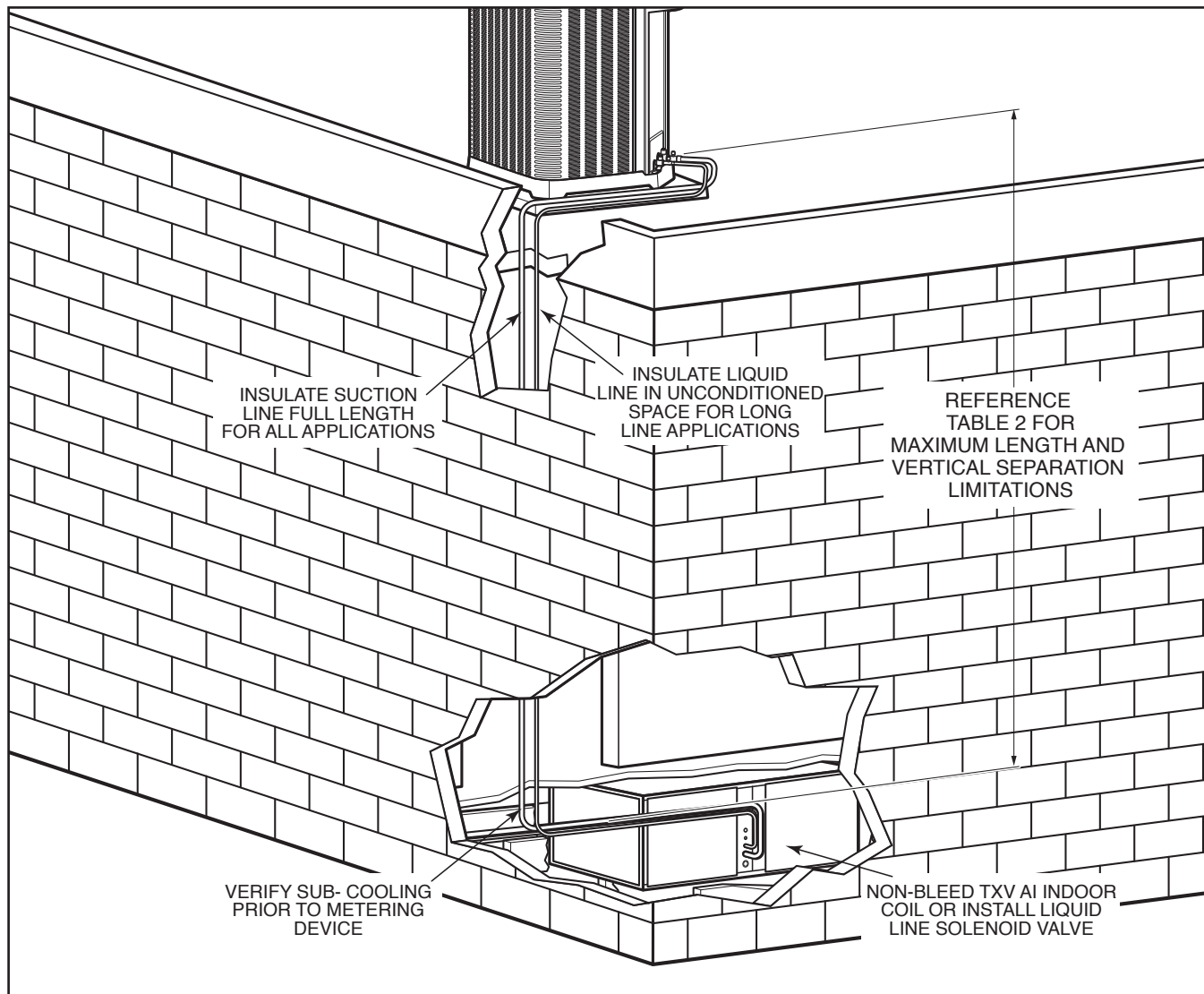


For applications that are considered to have a long line set with the outdoor unit below the indoor unit the following is required:

- Refrigerant lines should be routed even with the top of the indoor coil or an inverted trap is to be applied (refer to above illustration).
- Insulated liquid line in unconditioned space only. Insulated suction line full length.
- Follow the proper line sizing, maximum linear and equivalent lengths, charging requirements, and oil level adjustments spelled out in this manual.
- Verify at least 5°F [2.8°C] liquid sub-cooling at the indoor unit prior to expansion device.
- Vertical separations greater than 25' [7.62 m] can expect a lower sub-cooling level.

4.0 INSTALLATION

4.5.2.3 Outdoor Unit Above Indoor Unit



For applications that are considered to have a long line set with the outdoor unit above the indoor unit the following is required:

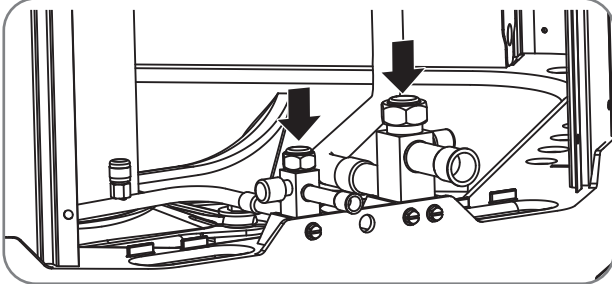
- Non-bleed TXV on the indoor coil or install liquid line solenoid valve near indoor unit with flow arrow pointing toward indoor unit.
- Insulated liquid line in unconditioned space only. Insulated suction line full length.
- Follow the proper line sizing, maximum linear and equivalent lengths, charging requirements, and oil level adjustments spelled out in this manual.

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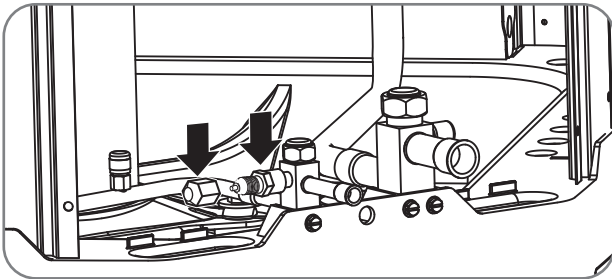
4.5.3 Tubing Connections

Indoor coils have only a holding charge of dry nitrogen. Keep all tube ends sealed until connections are to be made.

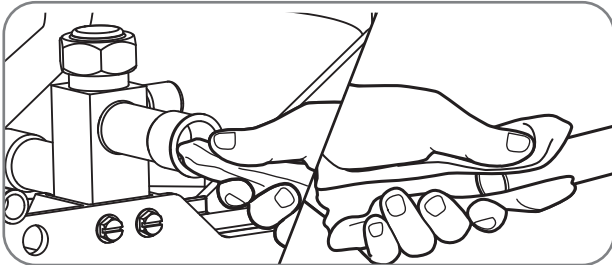
- Use type “L” copper refrigeration tubing. Braze the connections with the following alloys:
 - Copper to copper, 5% silver minimum
 - Copper to steel or brass, 15% silver minimum



- Be certain both refrigerant shutoff valves at the outdoor unit are closed.

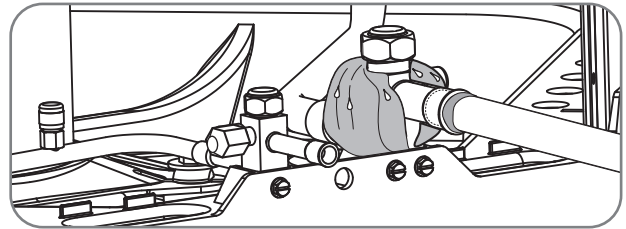


- Remove the caps and Schrader cores from the pressure ports to protect seals from heat damage. Both the Schrader valves and the service valves have seals that may be damaged by excessive heat.

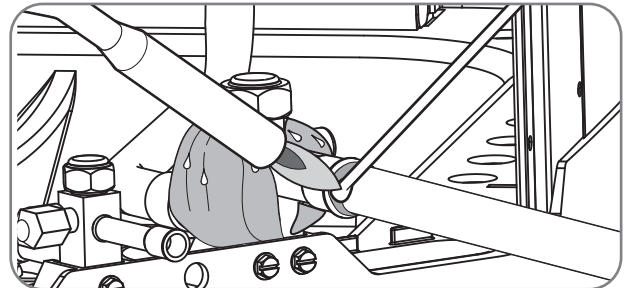


- Clean the inside of the fittings and outside of the tubing with a clean, dry cloth before soldering. Clean out debris, chips, dirt, etc., that enters tubing or service valve connections.

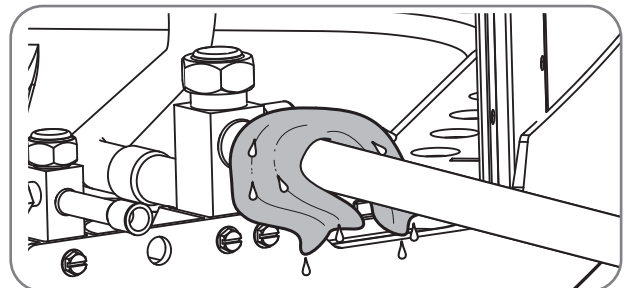
NOTE: Service valves and pressure port locations may be slightly different than shown in illustrations.



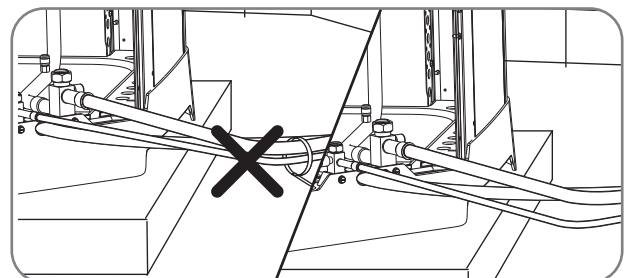
- Wrap valves with a wet rag or thermal barrier compound before applying heat.



- Braze the tubing between the outdoor unit and indoor coil. Flow dry nitrogen into a pressure port and through the tubing while brazing, but do not allow pressure inside tubing which can result in leaks. Once the system is full of nitrogen, the nitrogen regulator should be turned off to avoid pressuring the system.



- After brazing, use an appropriate heatsink material to cool the joint.
- Reinstall the Schrader cores into both pressure ports.



- Do not allow the bare suction line and liquid line to be in contact with each other. This causes an undesirable heat transfer resulting in capacity loss and increased power consumption.

4.0 INSTALLATION

4.6 Leak Testing

Before beginning any work on the system or conducting any hot work, ensure that the area is in the open or that it is adequately ventilated. Ventilation must continue while the unit is being worked on. Ventilation is required to safely disperse any released refrigerant into the atmosphere.

Inspect the unit for any damage to the coils and tubing that could cause a leak.

Under no circumstances shall potential sources of ignition be used to search for or detect refrigerant leaks. A halide torch or any other detector using a naked flame must not be used.

Electronic leak detectors may be used to detect refrigerant leaks, but the sensitivity may not be accurate and may need recalibration to accurately detect R-454B.

Before use, ensure that the detector is not a potential ignition source and is suitable for R-454B.

Leak detection equipment shall be set at a percentage of the LFL of the refrigerant and must be calibrated to R-454B.

Leak detection fluids are also suitable but do not use detergents containing chlorine. Examples of leak detection fluids are the bubble method and fluorescent method agents.

If a leak is suspected, all naked flames must be extinguished.

If a refrigerant leak is found that requires brazing, all of the refrigerants must be removed from the system.

4.6.1 Refrigerant Leak Detection System

The refrigerant leak detection system will continuously monitor the air for a refrigerant leak. If the leak detection system detects a leak, the system will begin mitigation procedures: the blower will turn on and the compressors will shut down. Note: Gas or electric heat functions may continue during mitigation.

At the end of 15 years or if the refrigerant leak detection system becomes inoperable, the leak detection system must be replaced with components specified by the unit's manufacturer. Refer to the manufacturer's website for replacement components. Refer to the alarm code diagnostics section for refrigerant leak detection system error codes.

4.6.2 Operation When a Leak is Detected

When the unit receives a signal from the A2L sensor, circulation airflow is activated, and the compressors will be shut off. The following mitigation actions will also be activated:

1. Energize the fan(s) of the appliance to deliver indoor airflow at or above the minimum airflow. See **3.2 A2L Refrigerant Installation Safety Data**.

- a. The fans shall be energized following the input signal to turn on the fan(s).

2. The system de-energizes compressor operation.

3. Activate additional mechanical ventilation, if applicable.

The above-mentioned actions shall continue for at least 5 minutes after the leak detection system begins mitigation. If the leak is no longer detected, the leak detection system will reset.

If the leak is still present, mitigation actions will continue for another 5 minutes. This cycle will repeat until no leak is detected.

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4.7 Removal and Evacuation

The minimum test pressure for the low side of the system shall be the low side design pressure and the minimum test pressure for the high side of the system shall be the high side design pressure, unless the high side of the system cannot be isolated from the low side. In which case, the entire system shall be pressure tested to the low side design pressure.

The evacuation of any system is essential before charging. Never attempt to operate a system while it is under a vacuum.

The refrigerant charge shall be recovered into R-454B recovery cylinders. The unit system must be purged with oxygen-free nitrogen to render the appliance safe for flammable refrigerants, such as R-454B, again. DO NOT USE compressed air or oxygen for purging R-454B refrigerant systems.

Refrigerant purging shall be achieved by breaking the vacuum in the system with oxygen-free nitrogen and continuing to fill until the working pressure is achieved, then venting to the atmosphere, and finally pulling down to a vacuum. This process shall be repeated until no refrigerant is within the system. When the final oxygen-free nitrogen charge is used, the system shall be vented down to the atmospheric pressure to enable work to take place.

The outlet for the vacuum pump must not be close to any potential ignition sources.

Ventilation is required during removal and evacuation.

NOTE: the condensing unit is shipped with a holding charge of dry nitrogen which must be purged from the unit before evacuation.

1. When breaking into the refrigeration circuit for any reason, this procedure must be followed:
2. Open the suction, discharge, and liquid shut-off valves
3. Use a refrigeration vacuum pump capable of evacuation in the 500 micron range
4. Connect the vacuum pump to the service manifold assembly with a pressure gauge that will read 30 inches vacuum.
5. Connect the service manifold to the suction line Schrader valve port.
6. Ensure there is no power to the unit.
7. With an accurate scale, ½ oz., set the refrigerant recovery cylinder in the upright position.
8. Connect the recovery cylinder to the unit using the service valves located on the outdoor unit.
9. Connect the cylinder to the liquid shut-off valve.
10. Evacuate refrigerant from the unit until the vacuum pump reads a minimum of 500 microns.
11. Purge the refrigeration circuit with inert gas until there is no refrigerant within the system.
12. Field-made refrigerant joints indoors must be tightness tested under a pressure of at least .25 times the max allowable pressure according to the unit's nameplate. Using the inert gas in the system, pressurize the unit accordingly and check the refrigerant joints for leaks.
 - If leaks are detected, make adjustments to the joints and check for leaks again.
 - If no leaks are detected, continue to the next step.
13. Evacuate the circuit again.
14. Once all inert gas is removed, pull a vacuum on the unit to check for any leaks in the system.
15. If leaks are present, spray a soapy substance over the refrigeration circuit. Bubbles will help locate the leak.
16. Patch the leak and pull a vacuum again.
17. If leaks are still detected, repeat steps eleven through sixteen..
18. If no leaks are present, charge the system as directed in the next section.
19. Remove the vacuum pump from suction, discharge, and liquid shut-off.

4.0 INSTALLATION

4.8 Charging Procedure

Prior to recharging the system, complete a leak check and purge the system with inert gas as detailed in Removal and Evacuation of Refrigerant. The charging procedure steps are as follows:

1. Ensure that the unit is properly grounded before beginning charging.
2. Install the R-454B refrigerant cylinder to the unit service valve.
3. Before tightening, purge the cylinder and service valve hose to ensure that the contamination of different refrigerants does not occur when using the charging equipment.
 - a. Hoses or lines shall be as short as possible to minimize the amount of refrigerant contained in them.
4. Position the refrigerant cylinder in the upright position. The cylinder must remain in the upright position for the entire charging procedure.
5. Use the charging charts located in this manual to properly charge the unit.
 - a. **TAKE EXTREME CARE NOT TO OVERCHARGE THE UNIT.**
 - b. Connect pressure gauges to suction and liquid ports on the condenser.
 - c. Measure the air temperature (Dry Bulb °F) entering the outdoor coil.
 - d. Place an "X" on the intersection of the suction and liquid pressures on the chart.
 - e. If "X" is below the outdoor ambient line, ADD charge and repeat step D.
 - f. If "X" is above the outdoor ambient line, RECOVER excess charge and repeat step D.
 - g. If the condenser fans are not running, the head pressure control may require jumping.
 - h. Conditions required at indoor and outdoor unit 80/67 (Indoor DB/WB °F) and 95 (Outdoor DB °F)
 - i. Connect pressure gauges to the liquid port on the condenser and install a thermocouple within 6" of the liquid port.
 - j. Calculate your subcooling by taking the pressure reading at the liquid port and the temperature value at the liquid port.
 - k. **TARGET SUBCOOLING = Refer to the Charge Chart**
 - l. Note: SUBCOOLING Tolerance = +/- 1.0 °F
 - m. If subcooling is below target, ADD charge and repeat step J.
 - n. If subcooling is above target, RECOVER excess charge and repeat step J.
6. Close the service ports on the suctions and liquid valves. Then, remove service gauges.
7. Replace service port caps and valve stem caps. These caps must be replaced to prevent leaks.
8. Label the system with the total refrigerant charge when charging is complete. This label is located on the exterior of the outdoor unit next to the rating plate.

After charging is complete, a leak test must be done. Before leaving the site, an additional leak test must also be done at the end of installation.

4.0 INSTALLATION

4.10 Control Wiring

⚠WARNING: Turn off electric power at the fuse box or service panel before making any electrical connections. Also, the ground connection must be completed before making line voltage connections. Failure to do so can result in electrical shock, severe personal injury, or death.

Running low-voltage wires in conduit with line voltage power wires is not recommended. Low-voltage wiring is to be connected to the pigtails hanging down from the bottom of the control box.

A thermostat and a 24-volt, 75 VA (6.5-15 ton) or 100 VA (20 ton) minimum transformer are required for the control circuit of the system. The appropriately sized transformer is supplied in the outdoor unit from the factory. See the wiring diagram for reference. Use “Wire Size” guide below to size the 24-volt control wiring.

Do not use phone cord to connect indoor and outdoor units and thermostat. This could damage the controls and may not be adequately sized for the control’s electrical load.

FIELD WIRE SIZE FOR 24-VOLT THERMOSTAT CIRCUITS:

Runs up to 100 ft. [30.5 m]: 18 AWG

Runs over 100 ft. [30.5 m]: 16 AWG

NOTICE: Do not use control wiring smaller than No. 18 AWG between thermostat and outdoor unit

After completing refrigerant removal, evacuation, and charging, check that the internal and field wiring will not be subject to wear, corrosion, excessive pressure, vibration, sharp edges, or any other adverse environmental effects, taking into account the effects of aging or continual vibration from sources such as compressors or fans.

4.11 Typical Field Wiring Connections.

The following diagram shows the typical wiring connections for a two-stage condensing unit and an air-handler with electric heat.

4.0 INSTALLATION

4.12 Configuring Control Transformer for 208V Applications

The control transformer supplied with 208/230V models is factory wired for 230V applications and must be reconfigured for 208V applications upon installation by disconnecting the Orange transformer primary lead from the compressor contactor L1 terminal and connecting the Red transformer primary lead to the compressor L1 terminal. The Orange and Red transformer primary lead terminals are insulated to prevent the disconnected lead from shorting to ground, but the terminal on the disconnected Orange transformer lead should still be secured with a wire tie so it is isolated from ground as to assure it cannot come in contact with a grounded surface and short the transformer out.

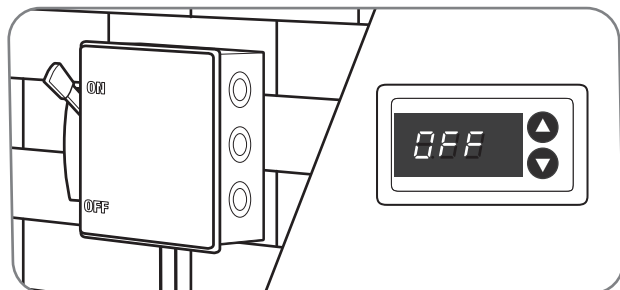
4.13 Power Wiring

It is important that proper electrical power from a commercial utility is available at the outdoor unit contactor. Voltage ranges for operation are shown below.

VOLTAGE RANGES (60 HZ)

Nameplate Voltage	Operating Voltage Range at Maximum Load Design Conditions for Compressors
208/230	187-253
460	414-506
575	517-633

Install a branch circuit disconnect within sight of the unit and of adequate size to handle the minimum circuit capacity. Refer to **Section 3.2**.



Power wiring must be run in a rain-tight conduit. Conduit must be run through the connector panel below the access cover (see illustrations in **Sections 3.2 and 3.3**) and attached to the bottom of the

control box.

Connect power wiring to line-voltage lugs located in the unit electrical box. (See illustrations in **Section 7.9** of this manual. The lugs will be on the compressor contactor for the 6.5-10 Ton model and on a terminal block for the 12.5 -20 Ton models.)

Check all electrical connections, including factory wiring within the unit and make sure all connections are tight.

DO NOT connect aluminum field wire to the contactor terminals.

4.14 Grounding

⚠WARNING: The unit must be permanently grounded. Failure to do so can cause electrical shock resulting in severe personal injury or death.

A grounding lug is provided for a ground wire inside the control box on the left side.

4.15 Potential Ignition Sources

The UL safety standard defines potential ignition sources as hot surfaces, flames, and current carrying devices which can be the source of arcing or sparking.

In case any internal electrical components need to be replaced, those replacement parts must be ordered from the unit manufacturer's website to ensure that the internal electrical components are not potential ignition sources.

Examples of internal electrical components include contactors, relays, and control boards. This is not an exhaustive list. For the safety of customers and technicians, refer to the unit manufacturer's website for proper unit component replacement.