

INDEX

SECTION 1. General Requirements for All Long Line Set Applications	2
SECTION 2. Outdoor Unit and Indoor Unit are at the Same Elevation	4
SECTION 3. Outdoor Unit is Above the Indoor Unit	5
SECTION 4. Outdoor Unit is Below the Indoor Unit	6
SECTION 5. Calculations - Tubing Equivalent Length, Tube Size and Refrigerant ...	7

- Only allow qualified, experienced technicians to install or service this unit.
- 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.

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 these guidelines.
- Pay special attention to all safety warnings posted on the equipment. 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 Technical Publication are intended as supplemental to existing Installation and Operation (IO) Manual practices. However, if there is a direct conflict between existing IO practices and the content of this manual, the precautions listed here take precedence.

This long line set application guideline applies to all AHRI listed R-32 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 80 feet (24.4 m) 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, (3) Outdoor unit is below the Indoor unit.

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.

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. For any residential split system installed with a long line set, 3/8" liquid line size must be used. 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 life-span.
 - a. Exceptions for air conditioning (cooling only) applications, 1/4" liquid line may be used in:
 - i. 1.5 ton applications for up to 100 equivalent feet (30.5 equivalent meters) with maximum 40' (12.2 m) vertical lift
 - ii. 2.0 ton applications for up to 75 equivalent feet (22.9 equivalent meters) with maximum 20' (6.1 m) vertical lift
 - b. Exceptions for air conditioning and heat pump applications, 5/16" liquid line may be used in:
 - i. 1.5 ton applications for up to 250 equivalent feet (76.2 equivalent meters) with maximum 60' (18.3 m) vertical lift
 - ii. 2.0 ton applications for up to 200 equivalent feet (61.0 equivalent meters) with maximum 40' (12.2 m) vertical lift
 - iii. 2.5 ton applications for up to 175 equivalent feet (53.3 equivalent meters) with maximum 30' (9.1 m) vertical lift
3. Suction lines must be insulated with 3/8" (9.5 mm) thick insulation. For line sets over 80 feet (24.4m), if the line passes through a high ambient temperature zone, 1/2" (12.7 mm) thick suction line insulation is required. Insulate any portion of the liquid line that passes through an area with temperature 10°F (5.6°C) greater than ambient temperature. Never attach a liquid line to the bare copper of the suction line.
4. A 40 watt (W) crankcase heater must be installed on any compressor (if crankcase heater is not already factory installed). All heat pumps have factory installed crankcase heaters. Refer to the air conditioning outdoor unit's specification sheet, under the Accessories tab, for SKU's with factory installed crankcase heaters.
5. Hard start assist kit is required (if hard start assist is not already factory installed). This requirement applies to all compressor types. Refer to the outdoor unit's specification sheet, under the Accessories table, for compatible hard start components.
6. Use of a non-bleed thermostatic expansion valve (TXV) is required in all long line set applications. Refer to the outdoor unit Installation Instructions for superheat requirements.
7. Fixed orifice (piston) indoor units are not approved for line lengths greater than 80ft.
8. Maximum equivalent length of line set is:
 - a. 250 feet (76.2 m) for single stage units with scroll compressors.
 - b. 150 feet (45.7 m) for single stage units with rotary compressors.
 - c. 150 feet (45.7 m) for two stage units.
9. Maximum linear length of line set is:
 - a. 200 feet (61.0 m) for single stage units with scroll compressors.
 - b. 150 feet (45.7 m) for single stage units with rotary compressors.
 - c. 150 feet (45.7 m) for two stage units.

Refer to the outdoor unit's specification sheet, under the Product Specifications table, to identify the compressor type.
10. Low voltage wiring. Verify low voltage wire gauge is adequate for the length used due to increased line set application. 18 AWG thermostat wiring is recommended to ensure sufficient voltage at the outdoor unit.
11. 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.

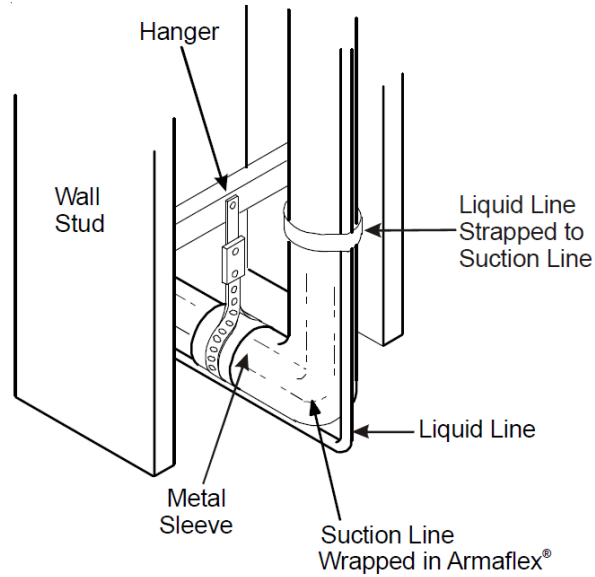


Figure 1-1

Installation of Refrigeration Piping from Vertical to Horizontal

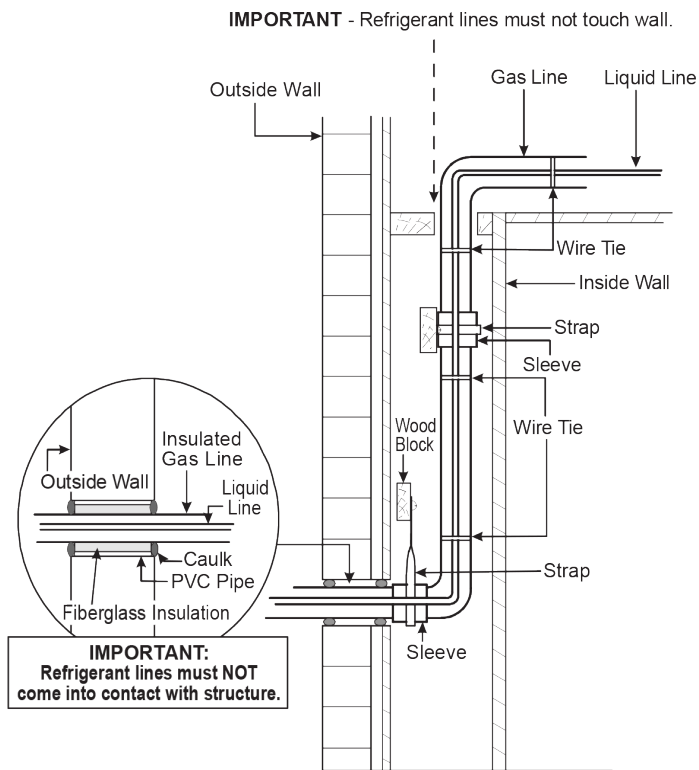


Figure 1-2 Installation of Refrigerant Piping (Vertical)

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

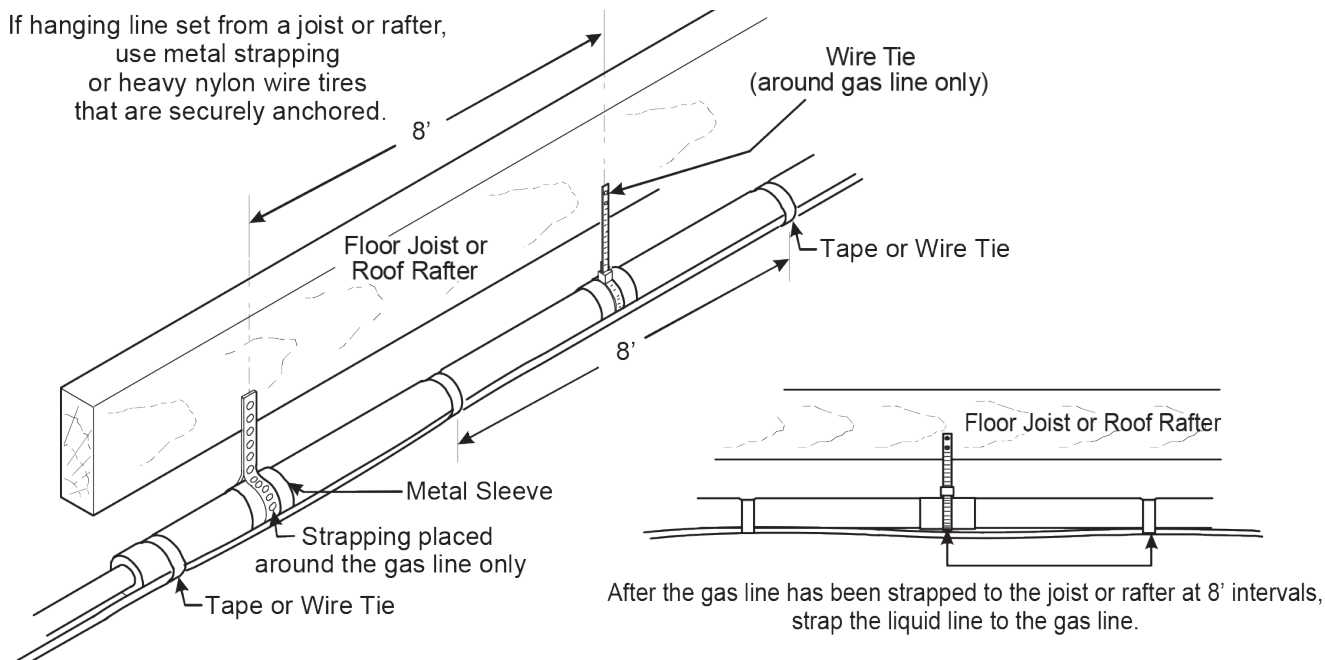


Figure 1-3. Installation of Refrigerant Piping (Horizontal)

12. **Final Charge Adjustment (Cooling Mode):** All systems must have the refrigerant charge and TXV adjustment verified by ensuring that superheat and subcool are within their specified ranges.
 - a.) System must be charged to 7-9°F subcooling at the indoor unit
 - b.) TXV must be adjusted to achieve the superheat value that is specified in the outdoor unit's Installation Instructions. For heat pumps, superheat must be measured at true compressor suction (pressure at the access port and temperature at 4-6" from the compressor's suction port).
13. **Final Charge Adjustment (Heating Mode):** If a system must be charged in heating mode, the proper method is by weight with the additional charge adjustments for line size, line length, and other system components. The outdoor TXV should be adjusted to achieve the superheat value specified in the outdoor unit's Installation Instructions (typically 7-9°F).

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
Hard Start Assist	Yes (See manual for each product)	Yes (See manual for each product)
TXV (Indoor)	Yes	Yes
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 elevation 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 (3.0 m) separation between outdoor unit and indoor unit. If outdoor unit is more than 10 feet (3.0 m) above indoor unit use Section 3. If outdoor unit is more than 10 feet (3.0 m) 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
Hard Start Assist	Yes (See manual for each product)	Yes (See manual for each product)
TXV (Indoor)	Yes	Yes
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' (24.4 m). 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 units (must adhere to maximum equivalent length).
 - b. 25 feet (7.6 m) 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).

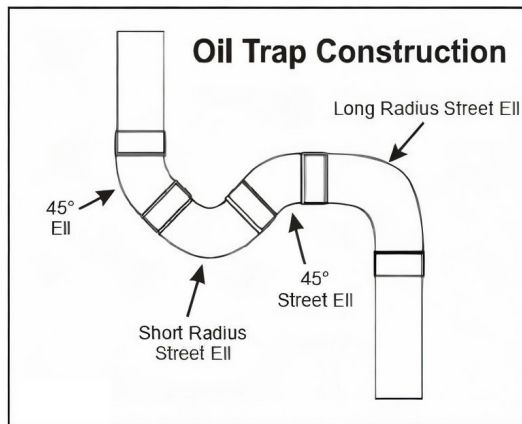


Figure 3-1 Indoor Oil Trap Construction

SECTION 4. OUTDOOR UNIT IS BELOW THE INDOOR UNIT

Accessory	Air Conditioner (AC)	Heat Pump (HP)
Crankcase Heater (40 watts minimum)	Yes	Yes
Hard Start Assist	Yes (See manual for each product)	Yes (See manual for each product)
TXV (Indoor)	Yes	Yes
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 (24.4 m).
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. Air conditioner systems with line sets over 79 feet require an accumulator to be added external to the outdoor unit. The accumulator should be chosen based on Table 4-1 to ensure proper oil return. Accumulators must be installed in the proper direction - pay careful attention to the word "IN" embossed into the top of the accumulator and ensure the flow of refrigerant enters the pipe marked "IN". Adapter fittings at the accumulator connection may be required. Do not install an external accumulator for heat pump systems.

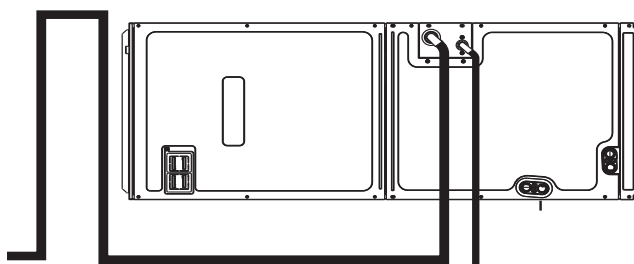


Figure 4-1 Indoor Unit with Inverted Suction

System Nominal Capacity (Btu/h)	Accumulator	
	Daikin Part Number	Connection
18,000	0151R00004P	3/4"
24,000	0151R00004P	3/4"
30,000	B1226207	7/8"
36,000	B1226207	7/8"
42,000	B1226207	7/8"
48,000	0151L00009	7/8"
60,000	0151L00009	7/8"

Table 4-1 Accumulator Size

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

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

Equivalent length = LengthHorizontal + LengthVertical + Losses from bends (see Table 5-1)

2. 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	Tube Diameter (in)		
	3/4	7/8	1 1/8
90° short radius	1.7 (0.5)	2.0 (0.6)	2.3 (0.7)
90° long radius	1.5 (0.5)	1.7 (0.5)	1.6 (0.5)
45°	0.7 (0.2)	0.8 (0.2)	1.0 (0.3)

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

EXAMPLE: 3/4” suction line using 3/4” elbows

$$150 \text{ feet of straight tubing} + (\text{two short radius elbows} \times 1.7) + (\text{2 long radius elbows} \times 1.5) = 150 + 3.4 + 3 = 156.4 \text{ equivalent feet}$$

3. 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 and recalculated system capacity.

Unit (Btu/h)	Suction Dia. (in)	Capacity Multiplier for Given Equivalent Line Length (ft) ¹									
		25	50	75	100	125	150	175	200	225	250
18000	5/8	1.00	0.99	0.99	0.99	0.98	0.98	0.98	0.98	0.97	0.97
	3/4	1.00	1.00	1.00	1.00	0.99	0.99	0.99	0.99	0.99	0.99
24000	5/8	0.99	0.99	0.98	0.98	0.97	0.97	0.97	0.96	0.95	0.95
	3/4	1.00	1.00	0.99	0.99	0.99	0.99	0.99	0.99	0.97	0.97
30000	5/8	0.99	0.99	0.98	0.97	0.96	0.96	0.96	0.94	0.93	0.92
	3/4	1.00	1.00	0.99	0.99	0.99	0.98	0.98	0.98	0.98	0.97
	7/8	1.00	1.00	1.00	1.00	1.00	0.99	0.99	0.99	0.99	0.99
36000	3/4	1.00	1.00	0.99	0.99	0.98	0.98	0.97	0.97	0.96	0.96
	7/8	1.00	1.00	1.00	1.00	0.99	0.99	0.99	0.99	0.98	0.98
42000	3/4	1.00	0.99	0.99	0.98	0.97	0.97	0.96	0.96	0.95	0.94
	7/8	1.00	1.00	0.99	0.99	0.99	0.99	0.98	0.98	0.98	0.97
	1-1/8 ²	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
48000	3/4	0.99	0.99	0.98	0.97	0.96	0.96	0.95	0.95	0.94	0.93
	7/8	1.00	0.99	0.99	0.99	0.98	0.98	0.98	0.98	0.97	0.97
	1-1/8 ^{2,3}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	0.99
60000	3/4	0.99	0.98	0.97	0.96	0.94	0.93	0.93	0.91	0.90	0.89
	7/8	1.00	0.99	0.98	0.98	0.97	0.97	0.96	0.96	0.95	0.95
	1-1/8	1.00	1.00	1.00	0.99	0.99	0.99	0.99	0.99	0.99	0.99

Table 5-2 Capacity Multipliers (feet)

¹ Equivalent Length is to be used for selecting the capacity reduction multiplier

² 1-1/8" suction line is not approved for 3.5 and 4 ton heat pumps with outdoor unit below indoor unit.

³ 1-1/8" suction line is not approved for 4 ton two stage air conditioner or two-stage heat pump applications.

Unit (btu/h)	Suction Dia. (in)	Capacity Multiplier for Given Equivalent Line Length (m) ¹									
		7.6	15.2	22.9	30.5	38.1	45.7	53.3	61.0	68.6	76.2
18000	5/8	1.00	0.99	0.99	0.99	0.98	0.98	0.98	0.98	0.97	0.97
	3/4	1.00	1.00	1.00	1.00	0.99	0.99	0.99	0.99	0.99	0.99
24000	5/8	0.99	0.99	0.98	0.98	0.97	0.97	0.97	0.96	0.95	0.95
	3/4	1.00	1.00	0.99	0.99	0.99	0.99	0.99	0.99	0.97	0.97
30000	5/8	0.99	0.99	0.98	0.97	0.96	0.96	0.96	0.94	0.93	0.92
	3/4	1.00	1.00	0.99	0.99	0.99	0.98	0.98	0.98	0.98	0.97
	7/8	1.00	1.00	1.00	1.00	1.00	0.99	0.99	0.99	0.99	0.99
36000	3/4	1.00	1.00	0.99	0.99	0.98	0.98	0.97	0.97	0.96	0.96
	7/8	1.00	1.00	1.00	1.00	0.99	0.99	0.99	0.99	0.98	0.98
42000	3/4	1.00	0.99	0.99	0.98	0.97	0.97	0.96	0.96	0.95	0.94
	7/8	1.00	1.00	0.99	0.99	0.99	0.99	0.98	0.98	0.98	0.97
	1-1/8 ²	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
48000	3/4	0.99	0.99	0.98	0.97	0.96	0.96	0.95	0.95	0.94	0.93
	7/8	1.00	0.99	0.99	0.99	0.98	0.98	0.98	0.98	0.97	0.97
	1-1/8 ^{2,3}	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	0.99
60000	3/4	0.99	0.98	0.97	0.96	0.94	0.93	0.93	0.91	0.90	0.89
	7/8	1.00	0.99	0.98	0.98	0.97	0.97	0.96	0.96	0.95	0.95
	1-1/8	1.00	1.00	1.00	0.99	0.99	0.99	0.99	0.99	0.99	0.99

Table 5-3 Capacity Multipliers (meters)

4. Refrigerant Quantity Adjustment. All residential R-32 outdoor units are factory charged for 15 feet (4.6 m) of 3/8" liquid lineset, the recommended suction line per Table 5-2, and the AHRI designated tested combination. If the line set diameter, line set length, or indoor unit of your particular installation differ, then charge must be adjusted in the field during installation.

To calculate the initial amount of extra refrigerant (in ounces):

- Subtract 15 feet (4.6 m) from the total linear (not equivalent) length of actual line set
- Multiply that value by the multiplier in Table 5-4
- This will be the initial amount of R-32 refrigerant that must be added prior to final charge adjustment.
- All Systems must have final charge adjustment performed as required in Section 1

Line set diameters	Additional Refrigerant (oz. per linear foot)	Additional Refrigerant (g per linear meter)
3/8" liquid, 5/8" suction	0.53	49
3/8" liquid, 3/4" suction	0.55	51
3/8" liquid, 7/8" suction	0.58	54
3/8" liquid, 1-1/8" suction	0.64	60

Table 5-4 Additional Refrigerant Per Unit Length.

Line set sizes	Additional linear line length over 15 feet						
	25	50	75	100	125	150	175
	Initial refrigerant addition (oz)						
3/8" liquid and 5/8" suction	13	26	40	53	66	79	92
3/8" liquid and 3/4" suction	14	28	41	55	69	83	96
3/8" liquid and 7/8" suction	14	29	43	58	72	86	101
3/8" liquid nad 1-1/8" suction	16	32	48	64	81	97	113

Table 5-5 Initial Refrigerant for Given Line Length (feet)

Line set sizes	Additional linear line length over 15 feet						
	7.6	15.2	22.9	30.5	38.1	45.7	53.3
	Initial refrigerant addition (kg)						
3/8" liquid and 5/8" suction	0.37	0.75	1.12	1.49	1.87	2.24	2.61
3/8" liquid and 3/4" suction	0.39	0.78	1.17	1.56	1.95	2.34	2.73
3/8" liquid and 7/8" suction	0.41	0.82	1.22	1.63	2.04	2.45	2.85
3/8" liquid nad 1-1/8" suction	0.46	0.91	1.37	1.83	2.28	2.74	3.20

Table 5-6 Initial Refrigerant for Given Line Length (meters)

THIS PAGE LEFT INTENTIONALLY BLANK

THIS PAGE LEFT INTENTIONALLY BLANK

NOTE: SPECIFICATIONS AND PERFORMANCE DATA LISTED HEREIN ARE SUBJECT TO CHANGE WITHOUT NOTICE

Quality Makes the Difference!

All of our systems are designed and manufactured with the same high quality standards regardless of size or efficiency. We have designed these units to significantly reduce the most frequent causes of product failure. They are simple to service and forgiving to operate. We use quality materials and components. Finally, every unit is run tested before it leaves the factory. That's why we know...There's No Better Quality.

Daikin Comfort Technologies Manufacturing, L.P.
19001 Kermier Rd. Waller, TX 77484

www.daikincomfort.com • www.goodmanmfg.com • www.amana-hac.com

© 2015-2017, 2020, 2022, 2024 **DAIKIN COMFORT TECHNOLOGIES MANUFACTURING, L.P.**

Amana is a registered trademark of Maytag Corporation or its related companies and is used under license. All rights reserved.