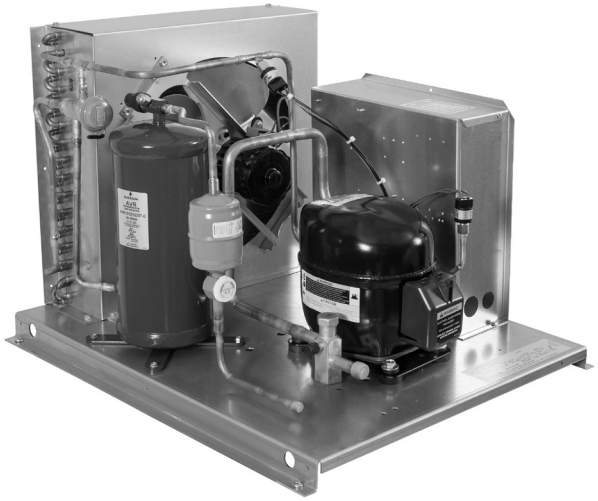
Split-Pak™ Condensing Unit and Refrigeration System Installation & Operations Manual R448A/R449A, R407 & R404A





Images are for illustration only and may not reflect your exact model.

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INTRODUCTION

This manual contains important instructions for installation, use and service. Read all of this manual carefully before installing or servicing your refrigeration equipment.

NOTICE Installation and service of the refrigeration and electrical components must be performed by a refrigeration mechanic or licensed electrician.

The portions of this manual covering refrigeration and electrical components contain technical instructions intended only for persons qualified to perform refrigeration and electrical work.

DANGER

Equipment MUST be properly grounded.

Improper or faulty hook-up of electrical components of the refrigeration units can result in severe injury or death.

All electrical wiring hook-ups must be done in accordance with all applicable local, regional or national standards.

NOTICE

Read this manual before installing your refrigeration. Keep the manual and refer to it before doing any service. Failure to do so could result in personal injury or equipment damage.

This manual cannot cover every installation, use or service situation. If you need additional information, contact us at:

Parts and Technical Service Department

800-388-5253

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WARNING LABELS AND SAFETY INSTRUCTIONS

This is the safety-alert symbol. When you see this symbol, be alert to the potential for personal injury or damage to your equipment.

Be sure you understand all safety messages and always follow recommended precautions and safe operating practices.

NOTICE TO EMPLOYERS

You must make sure that everyone who installs uses or services your refrigeration is thoroughly familiar with all safety information and procedures.

Important safety information is presented in this section and throughout the manual. The following signal words are used in the warnings and safety messages.

DANGER: Severe injury or death WILL occur if you ignore the message.

WARNING: Severe injury or death CAN occur if you ignore the message.

CAUTION: Minor injury or damage to your refrigeration can occur if you ignore the message.

NOTICE: This is important installation, operation, or service information. If you ignore the message, you may damage your refrigeration.

The warning and safety labels shown throughout this manual are placed on your refrigeration at the factory. Follow all warning label instructions. If any warning or safety labels become lost or damaged, call our parts and technical service department for replacements.



This label is located on the condensing unit.

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M-SERIES CONDENSING UNIT FEATURES

STANDARD COMPONENTS

The M-Series set of standard features (pre-wired and mounted except as noted) * include:

- Preset non-adjustable high-pressure control and preset non-adjustable low-pressure control**
- Crankcase heater
- Head pressure control (flooding valve)
- Heavy gauge, galvanized steel mechanically fastened weather hood
- Suction service valve
- Heavy-duty angle leg base
- Liquid line filter/drier
- Pre-wired electrical control panel
- Sight glass
- Liquid and suction line kit with service valve
- Timer (standard on low temp and medium temp units)
- Compressor contactor
- Defrost heater contactor (when required)
- Generously sized condenser (rated up to 120° ambient)
- Rifled tubes in condenser for greater efficiency
- Liquid line shut-off valve for easy change of filter
- PSC condenser fan motors
- Large liquid receiver (good for maximum 100 ft. line run)
- One-year limited compressor warranty
- Low Pressure Control settings: cut out at 3psig and cut in at 20psig
- High Pressure Control settings: cut out is 450 psig and cut in at 375 psig

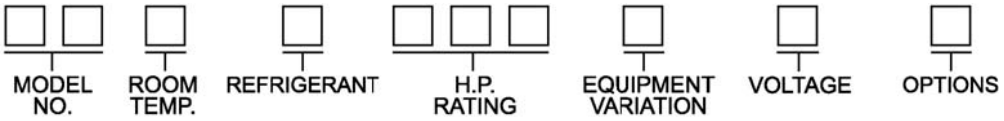
**Components may vary depending on horsepower and application. Consult our factory for verification of standard and optional components.*
***Preset high pressure control and preset low pressure control are non-adjustable in medium temp M-Series units. The low-pressure control is adjustable in low temp units.*

OPTIONALLY AVAILABLE

- Special voltages
- Insulated and heated receiver (thermostatically controlled)
- Suction accumulator
- Coated condenser coils
- Oil separator
- Phase loss/low voltage monitor
- Factory pre-assembled evaporator coil (includes factory pre-mounting of thermostatic air control and expansion valve)
- Factory pre-charged system with quick connect liquid and suction line sets up to 50 ft. (specify length when ordering)
- Adjustable low-pressure control for medium and high temp units
- Dual pressure control
- Circuit breaker
- Suction filter
- Fan cycling switch
- Pre-mounted solenoid at evaporator
- Liquid line solenoid valve (shipped loose)
- Extended four years limited compressor warranty
- LogiTemp® electronic controller system
- LogiTemp® Plus with Reverse Cycle Defrost electronic controller system

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REFRIGERATION MODEL NOMENCLATURE



MODEL NUMBER EXPLANATION

MH = Hermetic Condensing Unit
MS = Scroll Condensing Unit

ROOM TEMPERATURE EXPLANATION

L = 0° F. Thru -30° F. Room Temperature
M = 0° Thru +55° F. Room Temperature

REFRIGERANT EXPLANATION

D = R448A/R449A
V = R-407A
Z = R-404A (available where applicable codes allow)

HORSEPOWER RATING EXPLANATION

005 = ½ H.P.	017 = 1¾ H.P.	040 = 4H.P.	100 = 10 H.P.
007 = ¾ H.P.	020 = 2 H.P.	045 = 4 1/2H.P.	130 = 13 H.P.
010 = 1 H.P.	025 = 2½ H.P.	050 = 5 H.P.	150 = 15 H.P.
012 = 1 1/4 H.P.	030 = 3 H.P.	060 = 6 H.P.	
015 = 1 1/2 H.P.	035 = 3 1/2 H.P.	075 = 7 1/2 H.P.	

EQUIPMENT VARIATION EXPLANATION

A = STANDARD UNIT
H = HEATED AND INSULATED RECEIVER
E = ELECTRIC DEFROST
M = FLOATING HEAD (MC)
R= REVERSING VALVE

VOLTAGE EXPLANATION

A = 115/60/1
B = 230/60/1 or 208-230/60/1 (As Applicable)
C = 208-230/60/3
D = 460/60/1
E = 460/60/3
F = 200-220/50/3
G = 380-420/50/3
J = 380/50/1
K = 200-220/50/1 or 220/50/1

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PRE-INSTALLATION INSTRUCTIONS

I. General Information

Please read this manual prior to installing your equipment. This information is based on good refrigeration practice and should be used as a guide for installation and operation.

To complete the installation, please record the data requested on the Installation Data form on the last page of the manual and return this manual to the owner.

II. Delivery Inspection

You are responsible for filing all freight claims with the delivering truck line. Inspect all cartons and crates for damage as soon as they arrive. If damage is noted to shipping crates, cartons or if a shortage is found; note this on the bill of lading (all copies) prior to signing.

If damage is discovered when the cabinet is uncrated, immediately call the delivering truck line and follow up the call with a written report indicating concealed damage to your shipment. Ask for an immediate inspection of your concealed damage item. Crating material MUST be retained to show the inspector from the truck line.

INSTALLATION INSTRUCTIONS

I. Handling and Placement of Condensing Unit

To minimize damage to the unit housing, it is recommended that the crate not be removed until the unit is moved to its final location.

The following should be considered when placing the unit:

A. The condenser coil (air inlet) should not be located where air flow into the coil would be restricted.
   A minimum of 18" is required between the face of the coil and a wall or other vertical obstruction (may vary with different models).

B. A minimum of 6" is required on the sides to allow access to the housing clamps.

C. A minimum of 24" is required on the louvered end (air outlet) for clearance when opening housing and for ease of maintenance.

D. Do not position multiple units so that the air discharge of one is into the condenser air intake of another.

Holes are provided in the base supports for mounting bolts and for bridle lift rods.

For indoor mounting, motor rooms should be provided with fans designed to move 1000 cfm of air per ton of refrigeration.

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II. Handling and Placement of Evaporator Coil in Walk-In

To minimize damage to the evaporator coil, it is recommended that the carton (or crate) not be removed until the evaporator coil is moved close to its final location. When the container is removed from the evaporator coil, extreme care must be used when lifting and mounting to the ceiling, to prevent sheet metal damage.

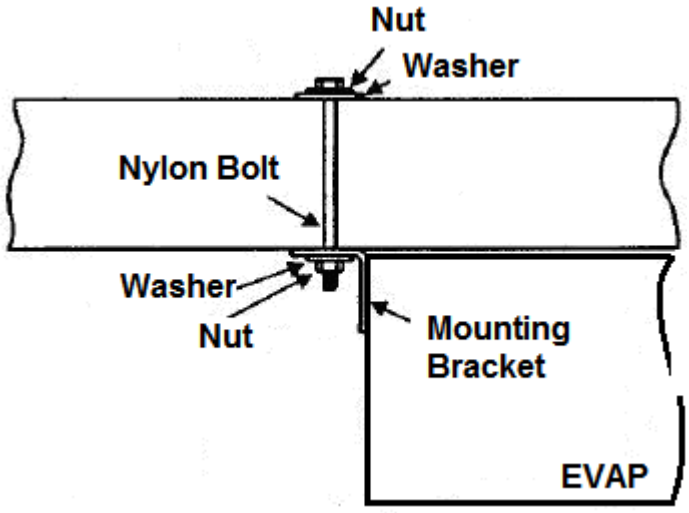
EVAPORATOR INSTALLATION INSTRUCTIONS

A. Do not install the evaporator too close to door openings to prevent icing problems.

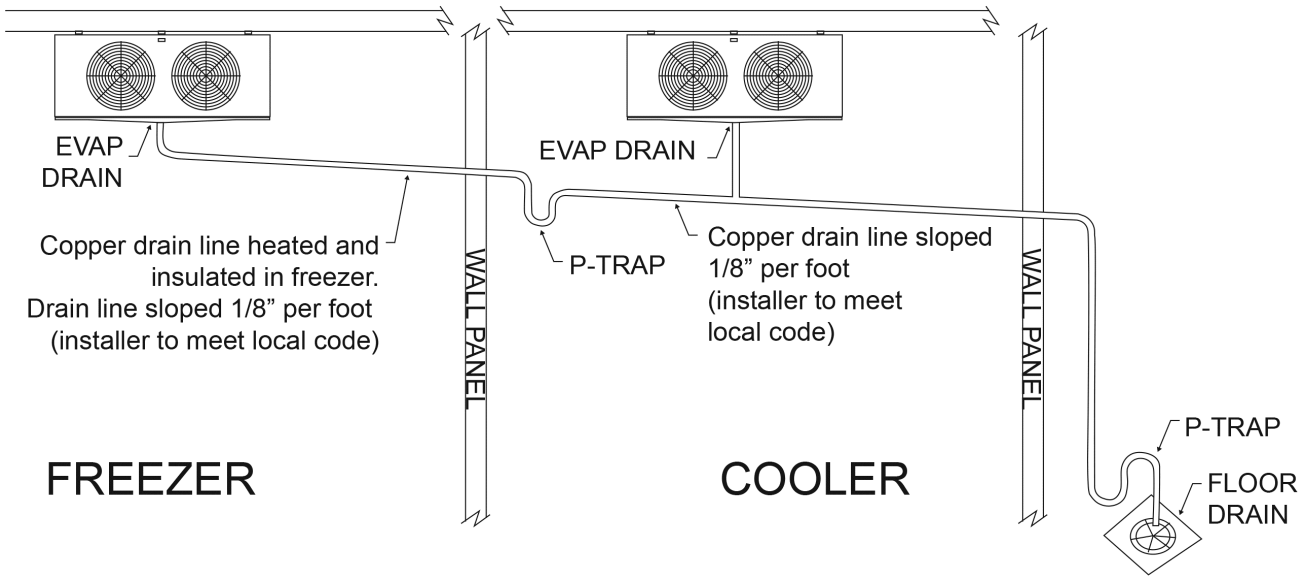
B. Minimum clearance between evaporator and the walls is equal to or greater than the coil height for proper air flow and service access.

C. Refer to the evaporator coil drawing dimension for mounting holes location.

D. Install washers and secure with nuts. Tighten until the coil is firm against the ceiling. The evaporator coil must be level.



EVAPORATOR DRAIN LINE INSTALLATION:



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III. Electrical

Electric power supply must match the condensing unit power requirements indicated on the unit data plate**.**

A WIRING DIAGRAM IS LOCATED ON THE INSIDE OF THE ELECTRICAL BOX COVER. All field wiring may enter the holes provided in left side, back and bottom of the electrical box. All field wiring should be done in a professional manner, in accordance with all governing codes. Double check all wiring connections, including factory terminals, before start-up of condensing unit.

DANGER
Installation of the refrigeration and electrical components must be performed only by a refrigeration mechanic or licensed electrician.

Improper or faulty hook-up of electrical components can result in death.

IV. Refrigerant Piping

The condensing unit must remain sealed and pressurized from the manufacturer until piping is complete and final connections are ready to be made.

Use only refrigeration grade copper tubing, (ACR), type "L", bright annealed, dehydrated, and properly sealed against contamination. Soft temper tubing may not be used for field interconnection of refrigeration components (condensing unit to evaporator assembly). Take extreme care to keep refrigeration tubing clean and dry prior to installation. Use an appropriate size tube cutter ***(DO NOT CUT TUBING WITH A SAW)***.

Note: The liquid line size is determined by conventional piping practices for air and electric defrost (use chart on pages 15-1). For reverse cycle defrost, the liquid line must be selected by choosing the liquid line **one nominal step larger than the conventional approach**.

Suction lines should slope down 1/2 inch for each 10 feet of horizontal run towards the compressor.

If any portion of the suction line rises above the exit elevation of the evaporator, P-type oil traps should be located at the base of each suction riser for proper oil return to the compressor. An additional trap is needed for every 20 feet of rise and an inverted trap should be installed on the roof

When brazing, dry nitrogen MUST be passed through the lines at low pressure to prevent scaling and oxidation inside the tubing and fittings. All flux must be removed from the joints after brazing.

MINIMIZE the amount of flux used to prevent internal contamination of the refrigeration system.

Silver brazing wire is to be utilized (high temperature alloy of 15% silver content on all copper-to-copper connections, and high temperature alloy of 45% silver content on all dissimilar metal connections).

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NOTICE

Be sure solenoid valves are open before beginning evacuation and leak check.

V. Leak Check

When all refrigeration line connections have been made, the complete system, including factory connections, should be leak checked.

Add the proper refrigerant to 60 PSIG, then boost to 175 PSIG with dry nitrogen. Leak check all joints with an electronic leak detector or a halide torch. If leaks are found, relieve the pressure, and make repairs as necessary and recheck.

VI. Evacuation, Dehydration and Start-Up

A vacuum of 500 microns or less must be pulled to properly dehydrate the system. This requires a two-stage vacuum pump with an electronic vacuum indicator.

******DO NOT USE THE SYSTEM COMPRESSOR AS A VACUUM PUMP. ******

******DO NOT OPERATE COMPRESSOR WHILE SYSTEM IS IN A VACUUM. ******

Evacuation Procedure

A. Open all condensing unit service valves and relieve system pressure. Also, open any line valves installed in the system and energize all solenoid valves to facilitate evacuation.

B. Connect the vacuum pump to the high and low sides of the system using 1/4" or larger cop per lines or 1/4" ID hoses with high vacuum designation.

C. Leaks or moisture will be indicated if the system pressure rises when the vacuum line is closed off.

D. Pull a vacuum of 1500 microns, close vacuum line and “break” vacuum to 3 PSIG, maximum, with refrigerant to be used in the system.

E. Repeat step D.

F. A final vacuum of 250 microns should be pulled before charging. When 250 microns is reached, close vacuum line and charge through high side, with proper refrigerant to the level of 2-1/2 lbs. per ton of refrigeration.

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Finish Charging Procedures

A. Preliminary

1. Be sure all service valves are “open”.

2. Loosen the compressor hold-down bolts and remove shipping clips to allow compressor to float freely on the springs.

3. Check evaporator fan motors after start-up. Medium temperature, air defrosts fans run continuously. Low temperature fans and coolers provided with electric defrost will be delayed by the fan control.

4. Start the system by “flipping on” the circuit breaker in the unit electric box.

5. Start charging per (B) or (C) on the following pages.

CAUTION: Never add liquid refrigerant to the suction side of the compressor.

6. Check operating pressures while charging and on initial pull down to prevent damage if a problem occurs. If system “floods” back to the compressor, adjust the thermostatic expansion valve as required for proper operation. There should be at least 20°F superheat entering the compressor.

7. Observe compressor amperage draw and compare to compressor nameplate to prevent damage due to high amperage. The oil sight glass should be between 1/2 and 3/4 full during normal operation.

B. Remote "M-Series" Condensing Units

1. **For models without head pressure control valve:** With the system operating, add refrigerant until the sight glass indicates a full charge, then add one pound for each 2 rated horsepower of the condensing unit when charging above +75°F. If ambient is below +75°F, add 1/2 to the above. See A.6 above.

2. **For models with head pressure control valve**: System should be pressurized with dry nitrogen to check for leaks.

   Once system is confirmed to be leak free a vacuum should be pulled to 500 microns to ensure no contaminants are in the system.

   Once the vacuum is obtained it should be broken on the “high side” of the system with the refrigerant the system is designed for and roughly 1 to 2 pounds per horsepower as a starting charge for thermostatic expansion valve (TXV or TEV) systems.

   The system can then be started. Gauges will need to be installed on the “high” and “low” side of the system.

   Continue to slowly add refrigerant to the low side of the system. Be sure the direction of the refrigerant tank is correct. The refrigerant should leave the tank as a liquid but fed slow enough that it transfers to a gas before reaching the compressor to prevent damage to the compressor.

   The evaporator is typically designed for a 10 degree temperature differential (TD) and the condenser designed for 20 degree TD.

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This means the evaporator temp would be 10 degrees lower than the space temperature and the condenser would be 20 degrees higher than the ambient.

Example: For cooler using R404A, 35 degree space with 90 degree ambient, evaporator would need to be 25 degrees and condenser coil would need to be roughly 110. Using a Pressure/Temperature(PT) chart, the suction pressure at gauge would be 61 and the discharge pressure would be 270.

Freezer using R404A, -10 space, 90 degree ambient: -20 suction or 16 psig, 110 discharge or 270 psig

Once these pressures are obtained, the superheat at the evaporator should be confirmed to be between 8 to 10 degrees.This ensures that the full capacity of the evaporator is being used and confirms no flooding in the evaporator.

For systems that have a head pressure control, an additional 1 pound per horsepower should be added for low ambient (outside) temperature conditions.

Note that the pressures will change as space and/or ambient changes. If the temp goes up, the pressure will go up. If temp goes down, the pressure goes down.

This is assuming a correctly charged system per the above recommendations and no faulty components.

DANGER

Charging of the refrigeration system must be performed only by a certified refrigeration mechanic. Improper or faulty hook-up of refrigeration electrical components can result in injury or death.

Technical installation instructions for Pre-Charged Remote Refrigeration are given on the following pages. Installation requirements for other remote refrigeration systems may vary. If additional information is needed, your certified refrigeration mechanic or electrician can call our technical service department. Quick-Couples are pre-charged with the proper refrigerant at the factory.

C. Pre-Charged Remote Refrigeration Systems.

- Place a steel or treated-wood spreader on the top of the walk-in to distribute the load of the coil. The spreader must be at least twice the width of the coil. The coil must be mounted away the edge of the roof a distance equal to the height of the coil (See Figure #1).

- Uncrate the coil and through-bolt it to the ceiling of the walk-in with suitable fasteners.

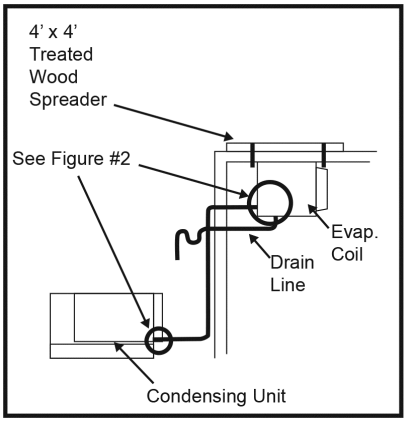


Figure #1 Quick-Couple Remote Refrigeration

- Uncrate the condensing unit and locate near coil. Be sure air movement around the unit is not restricted, so the condensing unit will have a sufficient supply of air to function properly.

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NOTE: Install evaporator coil in accordance with the manufacturer's recommendations from inside wall or obstructions to rear of evaporator.

- Drill holes through the walk-in wall large enough to pass refrigeration lines, electrical line and drain line.

- Connect liquid and suction lines to the coil and the condensing unit.

- Lubricate rubber seal in male half of coupling with refrigeration oil.

- Thread coupling halves together by hand to ensure proper mating of threads. Tighten with wrenches until coupling bodies "bottom" or a definite resistance is felt (See Figure #2.)

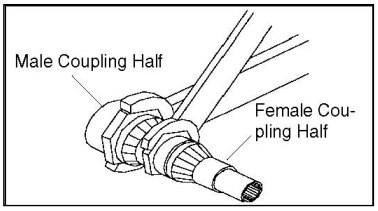


Figure #2 Quick-Couple Coupling Detail

- Using a scribe or ink pen, mark a line lengthwise from the coupling hex to the bulkhead. Then tighten an additional 1/6 to 1/4 turn. The misalignment of the mark will show the degree of tightening for future reference. This final turn is necessary to ensure that the knife edge metal seal bites into the brass seat of the coupling halves, forming a leak-proof joint.

- When routing refrigeration lines, special care should be taken not to "kink" the lines and restrict the flow of refrigerant.

NOTE: Wiring diagrams are located inside the pre-wired electrical panel on the condensing unit.

CAUTION

Be sure the electrical supply is sufficient for all electrical loads of the Quick-Couple Remote Refrigeration system.

- Connect correctly rated over current protection device in the service line to the service line J-box on the condensing unit.

- After routing condensate line from drain pan of evaporator coil, seal around all refrigeration, electrical and drain lines with silicone or butyl caulking.

- Start compressor and allow to run at least 24 hours before placing product into the walk-in.

During the testing period you should:

- Check the temperature holding range against the control setting.

- On low temperature units, check the defrost control system to see that all ice is removed from the coil during each defrosts cycle.

- Perform checks of door operation and all other component operations.

These systems are pre-charged at the factory with proper refrigerant, but should be operationally checked as per page 11, A.6 and A.7.

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VII. Final Check List for All Models

A. Check high-low pressure control settings:
   - Low Pressure Control settings: cut out at 3psig and cut in at 20psig
     High Pressure Control settings: cut out is 450 psig and cut in at 375 psig

B. Check setting of defrost timer:
   - Medium temperature 2 to 4 defrosts/24 hours, with 35 minutes fail safe.
   - Low temperature 3 to 4 defrosts/24 hours, with 44 minutes fail safe.

C. Check operating pressure:
   - Freezer (-10°F) with R448/449 refrigerant at a 90° ambient suction pressure range should be 8-10psig and the head pressure range is 260-275psig.
   - Cooler (35° F) application with R448/449 refrigerant at a 90° ambient, suction pressure range should be 44-48psig and the head pressure range would be 260-275psig.

D. Check electrical requirements of unit to power supply voltage.

E. Set temperature control for desired temperature range.

F. Check setting of thermostatic expansion valve for proper operation. Both freezer and cooler superheat range should be 8-10 degrees.

G. Check sight glass for proper refrigerant charge.

H. Check compressor oil level.

I. Check system for proper defrost settings and operation.

J. Check condensing unit for vibrating or rubbing tubing. Dampen or clamp as required.

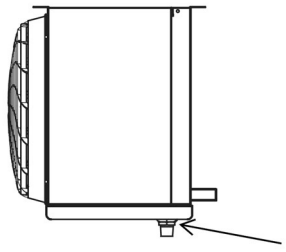
K. Open all valves completely counterclockwise.

L. Check packing nuts on all service valves.

M. Replace all service valve caps and latch unit covers.

N. If system is equipped with a fan cycle control, set it to cut out at 173 and in at 225.

O. With walk-in temperature pulled down to temperature setpoint, and, after the unit has cycled a couple of times, check around the drain pan nipple for leaks (see image below). If a leak is found, tighten drain nipple lock nut to 80 in-lb (±10%). If leak continues, slowly tighten by ¼ turn intervals until leak has stopped.



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SUCTION AND LIQUID LINE SIZES

Liquid Lines

Liquid lines should be sized for a minimum pressure drop to prevent "flashing." Flashing in the liquid lines would create additional pressure drop and poor expansion valve operation. If a system requires long liquid lines from the receiver to the evaporator or if the liquid must rise vertically upward any distance, the losses should be calculated to determine whether a heat exchanger is required. The use of a suction to liquid heat exchanger may be used to subcool the liquid to prevent flashing. This subcooling method will normally provide no more than 20°F subcooling on high pressure systems. The amount of subcooling will depend on the design and size of the heat exchanger and on the operating suction and discharge pressures. An additional benefit of using the suction to liquid type heat exchanger is that it can help raise the superheat in the suction line to prevent liquid returning to the compressor via the suction line. Generally, heat exchangers are not recommended on R-22 low temperature systems. However, they have proved necessary on short, well insulated suction line runs to provide superheat at the compressor.

Refrigerant Piping

Install all refrigerant components per applicable local and national codes and in accordance with good practice for proper system operation. The thermostatic expansion valve must be the externally equalized type. It can be mounted inside the unit end compartment. Mount expansion valve bulb on a horizontal run of suction line as close as possible to the suction header. Use the clamps provided with the valve to fasten the bulb securely so there is a tight line-to-line contact between the bulb and the suction line. Note position of bulb. Suction and hot gas connections are made on outside of unit.

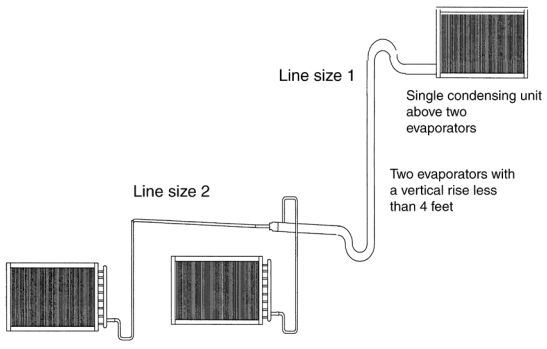
Suction lines should be sloped towards the compressor at the rate of one ½-inch per 10 feet for good oil return. Vertical risers of more than four (4) feet should be trapped at the bottom with a P-trap. If a P-trap is used, the expansion valve bulb should be installed between the unit and the trap

Unit Cooler Piping

Pipe size example:

Given: **-10°F Freezer** with one system having (2) evaporators

- One condensing unit rated at 24,000 BTUH's @ -20°F SST R404A refrigerant.
- Two evaporators each rated at 12,000 BTUH's @ 10°F TD.
- 100 feet of actual line run between condensing unit to first evaporator and 20 feet of actual line run between the first evaporator and the second evaporator (see figure below).



Lines for multi-evaporator systems should be as equidistant as possible

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How to figure line sizes:

1. Determine equivalent line run = actual run + valves and fitting allowances.
2. Use Line Sizing Tables to size lines.
3. Note any special considerations.

Fittings in this system:

- 90° elbows in main line plus a 90° turn through a tee.
- additional 90° elbows to first evaporator.
- (4) additional 90° elbows to second evaporator.

Determine line size 1 (main line from condensing unit):

1. Main line from the condensing unit to be sized for the total capacity (balance) of the whole system of 24,000 BTUH's (Table 7).
2. Refer to 24,000 @100 feet at -20°F SST R404A on the chart. You will find the suction line to be 1-3/8" and 1/2" liquid line.
3. Refer to Table 5. For every 1-3/8" 90° elbow you must add 4 equivalent feet of pipe and 2.5 equivalent feet of pipe for each 1-3/8" tee.

Therefore, total equivalent line run =	
Actual line run	100 feet
+ (6) 1-3/8" elbows @ 4'	24 feet
+ (1) 1-3/8" tee @ 2.5'	2.5 feet
Total equivalent line run	**126.5 feet**

4. Refer to Table 7. For 126.5 total equivalent feet, the suction line size should be 1-3/8" and the liquid line stays at 1/2" line.

Note: The gray shaded areas on Table 7. For 24,000 BTUHs, the maximum suction riser is 1-1/8" to ensure proper oil return and pressure drop from the bottom p-trap to the top p-trap.

Determine line size 2 (evaporators):

1. Line sizing to each evaporator is based on 12,000 BTUH's and equivalent run from condensing unit. First evaporator has a 105 ft. run, and the second evaporator has a 120 ft. run.
2. Table 7 indicates 1-1/8" suction for the first evaporator and indicates 1-1/8" suction for the second evaporator.
3. Refer to Table 5. Each 1-1/8" 90° elbow adds 3 equivalent feet of pipe. Each 90° turn through a 1-1/8" tee adds 6 equivalent feet.
4.

Actual line run (evap 1)	105 feet
+ (5) 1-1/8" elbows @ 3'	15 feet
+ (1) 90° turn through tee @ 6'	6 feet
Total equivalent line run	**126 feet**
Actual line run (evap 2)	120 feet
+ (4) 1-1/8" elbows @ 3'	12 feet
Total equivalent line run	**132 feet**

5. Table 7 indicates 1-1/8" suction line and 3/8" liquid line from main line to both evaporators.

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Line Sizing

The following tables indicate liquid lines and suction lines for all condensing units for R-404A, R-507, R-407A/C/F, R-448A and R-449A.

When determining the refrigerant line length, be sure to add an allowance for fittings. See Table 5. Total equivalent length of refrigerant lines is the sum of the actual linear footage and the allowance for fittings.

Table 3. Weight of Refrigerants in Copper Lines During Operation (Pounds per 100 lineal feet of type "L" tubing)

Line Size O.D. (Inches)	Refrigerant	Liquid Line	Hot Gas Line	Suction Line at Suction Temperature				
				-40˚F	-20˚F	0˚F	+20˚F	+40˚F
3/8	R-407	3.8	0.25	0.02	0.03	0.04	0.06	0.09
	R-448A/R-449A	3.6	0.24	0.02	0.03	0.04	0.06	0.09
	R-507, R-404A	3.4	0.31	0.03	0.04	0.06	0.09	0.13
1/2	R-407	7.2	0.46	0.03	0.05	0.08	0.11	0.17
	R-448A/R-449A	6.7	0.44	0.03	0.05	0.07	0.11	0.16
	R-507, 404A	6.4	0.58	0.04	0.07	0.13	0.16	0.24
5/8	R-407	11.5	0.74	0.05	0.08	0.12	0.18	0.26
	R-448A/R-449A	10.8	0.71	0.05	0.08	0.12	0.18	0.26
	R-507, 404A	10.3	0.93	0.07	0.11	0.17	0.25	0.35
7/8	R-407	11.5	1.53	0.05	0.08	0.12	0.18	0.26
	R-448A/R-449A	22.5	1.48	0.10	0.16	0.25	0.37	0.54
	R-507, 404A	21.2	1.92	0.15	0.23	0.37	0.51	0.72
1-1/8	R-407	23.8	2.60	0.10	0.16	0.25	0.37	0.54
	R-448A/R-449A	38.4	2.53	0.17	0.27	0.42	0.63	0.92
	R-507, 404A	36.1	3.27	0.26	0.39	0.63	0.86	1.24
1-3/8	R-407	40.7	3.96	0.17	0.27	0.43	0.63	0.93
	R-448A/R-449A	58.4	3.85	0.25	0.41	0.64	0.96	1.40
	R-507, 404A	55.0	4.98	0.40	0.58	0.95	1.32	1.87
1-5/8	R-407	61.8	5.61	0.26	0.41	0.65	1.96	1.43
	R-448A/R-449A	82.7	5.45	0.36	0.58	0.90	1.36	1.98
	R-507, 404A	78.0	7.07	0.56	0.82	1.35	1.86	2.64
2-1/8	R-407	87.4	9.76	0.36	0.57	0.91	1.38	2.01
	R-448A/R-449A	143.8	9.48	0.62	1.01	1.57	2.36	3.44
	R-507, 404A	134	12.25	0.98	1.43	2.35	3.23	4.58
2-5/8	R-407	152	15.05	0.63	1.00	1.60	2.38	3.49
	R-448A/R-449A	222	14.62	0.96	1.56	2.42	3.65	5.30
	R-507, 404A	209	18.92	1.51	2.21	3.62	5.00	7.07
3-1/8	R-407	235	21.48	0.98	1.55	2.46	3.67	5.39
	R-448A/R-449A	317	20.86	1.37	2.22	3.45	5.20	7.57
	R-507, 404A	298	27.05	2.16	3.15	5.17	7.14	9.95
3-5/8	R-407	345	29.05	1.40	2.23	3.50	5.23	8.27
	R-448A/R-449A	428	28.22	1.86	3.01	4.67	7.04	10.24
	R-507, 404A	403	36.50	2.92	4.25	6.97	19.65	13.67
4-1/8	R-407	589	37.60	2.45	3.92	6.17	17.80	9.23
	R-448A/R-449A	554	36.53	2.40	3.89	6.05	9.11	13.25
	R-507, 404A	526	47.57	3.80	5.55	9.09	12.58	17.80

Table 4. Pressure Loss of Liquid Refrigerants in Liquid Line Risers (Expressed in Pressure Drop, PSIG, and Subcooling Loss, ˚F)

Refrigerant	Liquid Line Rise in Feet																	
	10'		15'		20'		25'		30'		40'		50'		75'		100'	
	PSIG	˚F	PSIG	˚F	PSIG	˚F	PSIG	˚F	PSIG	˚F	PSIG	˚F	PSIG	˚F	PSIG	˚F	PSIG	˚F
R-407	4.3	1.4	6.4	2.0	8.5	2.7	10.6	3.4	12.8	4.1	17.0	5.4	21.3	6.8	31.9	10.1	42.5	13.5
R-448A, R-449A	4.3	1.1	6.5	1.7	8.7	2.3	10.9	2.8	13.0	3.4	17.4	4.5	21.7	5.6	32.6	8.3	43.5	10.9
R-50, R-404A	4.1	1.1	6.1	1.6	8.2	2.1	10.2	2.7	12.2	3.3	16.3	4.1	20.4	5.6	30.6	8.3	40.8	11.8

Based on 110˚F liquid temperature at bottom of riser.

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Table 5. Equivalent Feet of Pipe Due to Valve and Fitting Friction

Copper Tube, O.D., Type "L"	1/2	5/8	7/8	1-1/8	1-3/8	1-5/8	2-1/8	2-5/8	3-1/8	3-5/8	4-1/8	5-1/8	6-1/8
Globe Valve (Open)	14	16	22	28	36	42	57	69	83	99	118	138	168
Angle Valve (Open)	7	9	12	15	18	21	28	34	42	49	57	70	83
90˚ Turn Through Tee	3	4	5	6	8	9	12	14	17	20	22	28	34
Tee (Straight Through) or Sweep Below	.75	1	1.5	2	2.5	3	3.5	4	5	6	7	9	11
90˚ Elbow or Reducing Tee (Straight Through)	1	2	2	3	4	4	5	7	8	10	12	14	16

Table 6. Recommended Remote Condenser Line Sizes

Net Evaporator Capacity	Total Equiv. Length	R-407A/C/F, R-448A & R-449A		R-507 & R-404A	
		Discharge Line (O.D.)	Liquid Line Cond. to Receiver (O.D.)	Discharge Line (O.D.)	Liquid Line Cond. to Receiver (O.D.)
3,000	50	3/8	3/8	3/8	3/8
	100	3/8	3/8	3/8	3/8
6,000	50	3/8	3/8	1/2	3/8
	100	1/2	3/8	1/2	3/8
9,000	50	1/2	3/8	1/2	3/8
	100	1/2	3/8	1/2	3/8
12,000	50	1/2	3/8	1/2	3/8
	100	5/8	3/8	5/8	1/2
18,000	50	5/8	3/8	5/8	1/2
	100	5/8	3/8	7/8	1/2
24,000	50	5/8	3/8	5/8	1/2
	100	7/8	1/2	7/8	5/8
36,000	50	7/8	1/2	7/8	5/8
	100	7/8	5/8	7/8	7/8
48,000	50	7/8	5/8	7/8	5/8
	100	7/8	7/8	1-1/8	7/8
60,000	50	7/8	5/8	7/8	7/8
	100	1-1/8	7/8	1-1/8	7/8
72,000	50	7/8	7/8	1-1/8	7/8
	100	1-1/8	7/8	1-1/8	1-1/8
90,000	50	1-1/8	7/8	1-1/8	7/8
	100	1-1/8	7/8	1-1/8	1-1/8
120,000	50	1-1/8	7/8	1-1/8	1-1/8
	100	1-3/8	1-1/8	1-3/8	1-3/8
180,000	50	1-3/8	1-1/8	1-3/8	1-3/8
	100	1-5/8	1-3/8	1-5/8	1-5/8
240,000	50	1-3/8	1-3/8	1-5/8	1-3/8
	100	1-5/8	1-3/8	2-1/8	1-5/8
300,000	50	1-5/8	1-3/8	1-5/8	1-5/8
	100	2-1/8	1-5/8	2-1/8	2-1/8
360,000	50	1-5/8	1-5/8	2-1/8	1-5/8
	100	2-1/8	2-1/8	2-1/8	2-1/8
480,000	50	2-1/8	1-5/8	2-1/8	2-1/8
	100	2-1/8	2-1/8	2-1/8	2-5/8
600,000	50	2-1/8	2-1/8	2-1/8	2-1/8
	100	2-5/8	2-5/8	2-5/8	2-5/8
720,000	50	2-1/8	2-1/8	2-1/8	2-5/8
	100	2-5/8	2-5/8	2-5/8	3-1/8
840,000	50	2-1/8	2-1/8	2-5/8	2-5/8
	100	2-5/8	2-5/8	2-5/8	3-1/8
960,000	50	2-5/8	2-5/8	2-5/8	2-5/8
	100	2-5/8	3-1/8	3-1/8	3-5/8
1,080,000	50	2-5/8	2-5/8	2-5/8	3-1/8
	100	3-1/8	3-1/8	3-1/8	3-5/8
1,200,000	50	2-5/8	2-5/8	2-5/8	3-1/8
	100	3-1/8	3-1/8	3-5/8	4-1/8
1,440,000	50	2-5/8	3-1/8	3-1/8	3-5/8
	100	3-1/8	3-5/8	3-5/8	4-1/8
1,680,000	50	3-1/8	3-1/8	3-1/8	3-5/8
	100	3-5/8	3-5/8	3-5/8	4-1/8

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Table 7. Recommended Line Sizes for R-404A and R507*

Capacity BTUH	Suction Line Size																								Liquid Line Size			
	Suction Temperature																								Receiver to Expansion Valve Equivalent Lengths			
	+20˚F Equivalent Lengths				+10˚F Equivalent Lengths				-10˚F Equivalent Lengths				-20˚F Equivalent Lengths				-30˚F Equivalent Lengths				-40˚F Equivalent Lengths							
	25'	50'	100'	150'	25'	50'	100'	150'	25'	50'	100'	150'	25'	50'	100'	150'	25'	50'	100'	150'	25'	50'	100'	150'	25'	50'	100'	150'
1,000	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	1/2	1/2	3/8	3/8	1/2	1/2	3/8	3/8	1/2	1/2	3/8	1/2	1/2	5/8	3/8	3/8	3/8	3/8
3,000	3/8	3/8	1/2	1/2	3/8	1/2	1/2	5/8	1/2	1/2	5/8	5/8	1/2	1/2	5/8	7/8	1/2	1/2	5/8	7/8	1/2	1/2	5/8	7/8	3/8	3/8	3/8	3/8
4,000	3/8	1/2	1/2	5/8	1/2	1/2	5/8	5/8	1/2	5/8	5/8	7/8	1/2	5/8	7/8	7/8	5/8	5/8	7/8	7/8	1/2	5/8	7/8	7/8	3/8	3/8	3/8	3/8
6,000	1/2	1/2	5/8	7/8	1/2	1/2	5/8	7/8	1/2	5/8	7/8	7/8	5/8	5/8	7/8	7/8	5/8	5/8	7/8	7/8	5/8	5/8	7/8	7/8	3/8	3/8	3/8	3/8
9,000	5/8	5/8	7/8	7/8	5/8	5/8	7/8	7/8	5/8	7/8	7/8	7/8	5/8	7/8	7/8	1-1/8	5/8	7/8	7/8	1-1/8	5/8	7/8	7/8	1-1/8	3/8	3/8	3/8	3/8
12,000	5/8	7/8	7/8	7/8	5/8	7/8	7/8	7/8	7/8	7/8	7/8	1-1/8	7/8	7/8	1-1/8	1-1/8	7/8	7/8	1-1/8	1-1/8	7/8	7/8	1-1/8	1-1/8	3/8	3/8	3/8	3/8
15,000	5/8	7/8	7/8	7/8	7/8	7/8	7/8	1-1/8	7/8	7/8	1-1/8	1-1/8	7/8	7/8	1-1/8	1-1/8	7/8	7/8	1-1/8	1-1/8	7/8	7/8	1-1/8	1-1/8	3/8	3/8	3/8	1/2
18,000	7/8	7/8	7/8	1-1/8	7/8	7/8	1-1/8	1-1/8	7/8	7/8	1-1/8	1-1/8	7/8	1-1/8	1-1/8	1-3/8	7/8	1-1/8	1-1/8	1-3/8	7/8	1-1/8	1-1/8	1-3/8	3/8	3/8	1/2	1/2
24,000	7/8	7/8	1-1/8	1-1/8	7/8	1-1/8	1-1/8	1-1/8	7/8	1-1/8	1-1/8	1-3/8	1-1/8	1-1/8	1-3/8	1-3/8	1-1/8	1-1/8	1-3/8	1-3/8	1-1/8	1-1/8	1-3/8	1-3/8	3/8	3/8	1/2	1/2
30,000	7/8	7/8	1-1/8	1-1/8	7/8	1-1/8	1-1/8	1-3/8	1-1/8	1-1/8	1-3/8	1-3/8	1-1/8	1-1/8	1-3/8	1-3/8	1-1/8	1-1/8	1-3/8	1-3/8	1-1/8	1-1/8	1-3/8	1-3/8	3/8	1/2	1/2	1/2
36,000	7/8	1-1/8	1-1/8	1-3/8	1-1/8	1-1/8	1-3/8	1-3/8	1-1/8	1-1/8	1-3/8	1-3/8	1-1/8	1-1/8	1-3/8	1-3/8	1-1/8	1-3/8	1-3/8	1-3/8	1-1/8	1-3/8	1-3/8	1-5/8	1/2	1/2	1/2	1/2
42,000	1-1/8	1-1/8	1-3/8	1-3/8	1-1/8	1-1/8	1-3/8	1-3/8	1-1/8	1-3/8	1-3/8	1-5/8	1-1/8	1-3/8	1-5/8	1-5/8	1-1/8	1-3/8	1-3/8	1-5/8	1-1/8	1-3/8	1-3/8	1-5/8	1/2	1/2	1/2	5/8
48,000	1-1/8	1-1/8	1-3/8	1-3/8	1-1/8	1-1/8	1-3/8	1-5/8	1-1/8	1-3/8	1-3/8	1-5/8	1-1/8	1-3/8	1-5/8	1-5/8	1-1/8	1-3/8	1-3/8	1-5/8	1-1/8	1-3/8	1-3/8	1-5/8	1/2	1/2	5/8	5/8
54,000	1-1/8	1-1/8	1-3/8	1-3/8	1-1/8	1-3/8	1-3/8	1-5/8	1-3/8	1-3/8	1-5/8	1-5/8	1-3/8	1-3/8	1-5/8	1-5/8	1-3/8	1-3/8	1-5/8	1-5/8	1-3/8	1-3/8	1-5/8	1-5/8	1/2	1/2	5/8	5/8
60,000	1-1/8	1-1/8	1-3/8	1-5/8	1-1/8	1-3/8	1-5/8	1-5/8	1-3/8	1-3/8	1-5/8	1-5/8	1-3/8	1-3/8	1-5/8	1-5/8	1-3/8	1-3/8	1-5/8	1-5/8	1-3/8	1-3/8	1-5/8	1-5/8	1/2	1/2	5/8	5/8
66,000	1-1/8	1-3/8	1-3/8	1-5/8	1-1/8	1-3/8	1-5/8	1-5/8	1-3/8	1-5/8	1-5/8	1-5/8	1-3/8	1-5/8	1-5/8	1-5/8	1-3/8	1-5/8	1-5/8	1-5/8	1-3/8	1-5/8	1-5/8	1-5/8	1/2	1/2	5/8	5/8
72,000	1-1/8	1-3/8	1-5/8	1-5/8	1-1/8	1-3/8	1-5/8	1-5/8	1-3/8	1-5/8	1-5/8	1-5/8	1-3/8	1-5/8	1-5/8	1-5/8	1-3/8	1-5/8	1-5/8	1-5/8	1-3/8	1-5/8	1-5/8	1-5/8	1/2	5/8	5/8	5/8
78,000	1-1/8	1-3/8	1-5/8	1-5/8	1-3/8	1-3/8	1-5/8	1-5/8	1-3/8	1-5/8	1-5/8	1-5/8	1-5/8	1-5/8	1-5/8	2-1/8	1-5/8	1-5/8	1-5/8	2-1/8	1-5/8	1-5/8	1-5/8	2-1/8	5/8	5/8	5/8	5/8
84,000	1-1/8	1-3/8	1-5/8	1-5/8	1-3/8	1-3/8	1-5/8	2-1/8	1-3/8	1-5/8	1-5/8	2-1/8	1-5/8	1-5/8	2-1/8	2-1/8	1-5/8	1-5/8	2-1/8	2-1/8	1-5/8	1-5/8	2-1/8	2-1/8	5/8	5/8	5/8	7/8
90,000	1-3/8	1-3/8	1-5/8	2-1/8	1-3/8	1-5/8	1-5/8	2-1/8	1-5/8	1-5/8	2-1/8	2-1/8	1-5/8	1-5/8	2-1/8	2-1/8	1-5/8	2-1/8	2-1/8	2-1/8	1-5/8	1-5/8	2-1/8	2-1/8	5/8	5/8	7/8	7/8
120,000	1-3/8	1-5/8	2-1/8	2-1/8	1-3/8	1-5/8	2-1/8	2-1/8	1-5/8	2-1/8	2-1/8	2-5/8	1-5/8	2-1/8	2-1/8	2-5/8	1-5/8	2-1/8	2-1/8	2-5/8	1-5/8	2-1/8	2-1/8	2-5/8	5/8	5/8	7/8	7/8
150,000	1-5/8	1-5/8	2-1/8	2-1/8	1-5/8	2-1/8	2-1/8	2-1/8	2-1/8	2-1/8	2-5/8	2-5/8	2-1/8	2-1/8	2-5/8	2-5/8	2-1/8	2-1/8	2-5/8	2-5/8	2-1/8	2-1/8	2-5/8	2-5/8	5/8	7/8	7/8	7/8
180,000	1-5/8	2-1/8	2-1/8	2-1/8	1-5/8	2-1/8	2-1/8	2-5/8	2-1/8	2-1/8	2-5/8	2-5/8	2-1/8	2-1/8	2-5/8	2-5/8	2-1/8	2-1/8	2-5/8	2-5/8	2-1/8	2-1/8	2-5/8	2-5/8	7/8	7/8	7/8	1-1/8
210,000	1-5/8	2-1/8	2-1/8	2-5/8	2-1/8	2-1/8	2-5/8	2-5/8	2-1/8	2-1/8	2-5/8	3-1/8	2-1/8	2-5/8	2-5/8	3-1/8	2-1/8	2-5/8	2-5/8	3-1/8	2-1/8	2-5/8	2-5/8	3-1/8	7/8	7/8	1-1/8	1-1/8
240,000	1-5/8	2-1/8	2-1/8	2-5/8	2-1/8	2-1/8	2-5/8	2-5/8	2-1/8	2-5/8	2-5/8	3-1/8	2-1/8	2-5/8	2-5/8	3-1/8	2-5/8	2-5/8	3-1/8	3-1/8	2-5/8	2-5/8	3-1/8	3-1/8	7/8	7/8	1-1/8	1-1/8
300,000	2-1/8	2-1/8	2-5/8	2-5/8	2-1/8	2-5/8	2-5/8	3-1/8	2-5/8	2-5/8	3-1/8	3-1/8	2-5/8	2-5/8	3-1/8	3-5/8	2-5/8	2-5/8	3-1/8	3-5/8	2-5/8	2-5/8	3-5/8	3-5/8	7/8	1-1/8	1-1/8	1-3/8
360,000	2-1/8	2-1/8	2-5/8	3-1/8	2-1/8	2-5/8	2-5/8	3-1/8	2-5/8	2-5/8	3-1/8	3-5/8	2-5/8	2-5/8	3-5/8	3-5/8	2-5/8	3-1/8	3-5/8	3-5/8	2-5/8	3-1/8	3-5/8	4-1/8	1-1/8	1-1/8	1-3/8	1-3/8
480,000	2-1/8	2-5/8	3-1/8	3-1/8	2-5/8	2-5/8	2-5/8	3-5/8	2-5/8	3-1/8	3-5/8	3-5/8	2-5/8	3-1/8	3-5/8	3-5/8	3-1/8	3-5/8	4-1/8	4-1/8	3-1/8	3-5/8	4-1/8	4-1/8	1-1/8	1-1/8	1-3/8	1-5/8
600,000	2-5/8	2-5/8	3-1/8	3-5/8	2-5/8	2-5/8	3-1/8	3-5/8	3-1/8	3-1/8	3-5/8	4-1/8	3-1/8	3-1/8	3-5/8	3-5/8	3-1/8	3-5/8	4-1/8	4-1/8	3-1/8	3-5/8	4-1/8	4-1/8	1-1/8	1-3/8	1-5/8	1-5/8

NOTES:

1. Sizes that are highlighted indicate maximum suction line sizes that should be used for risers. Riser size should not exceed horizontal size. Properly placed suction traps must also be used for adequate oil return.
2. All sizes shown are for O.D. Type L copper tubing.
3. Suction line sizes selected at pressure drop equivalent to 2˚F. Reduce estimate of system capacity accordingly.
4. Recommended liquid line size may increase with reverse cycle hot gas systems.
5. If system load drops below 40% of design, consideration to installing double suction risers should be made.

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Table 8. Recommended Line Sizes for R-407*

Capacity BTUH	Suction Line Size																		Liquid Line Size					
	Suction Temperature																		Receiver to Expansion Valve Equivalent Lengths					
	+40˚F Equivalent Lengths						+20˚F Equivalent Lengths						+10˚F Equivalent Lengths											
	25'	50'	75'	100'	150'	200'	25'	50'	75'	100'	150'	200'	25'	50'	75'	100'	150'	200'	25'	50'	75'	100'	150'	200'
1,000	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8
3,000	3/8	3/8	3/8	3/8	1/2	1/2	3/8	3/8	3/8	1/2	1/2	1/2	3/8	3/8	1/2	1/2	1/2	1/2	3/8	3/8	3/8	3/8	3/8	3/8
4,000	3/8	3/8	1/2	1/2	1/2	1/2	3/8	1/2	1/2	1/2	5/8	5/8	3/8	1/2	1/2	5/8	5/8	5/8	3/8	3/8	3/8	3/8	3/8	3/8
6,000	3/8	1/2	1/2	1/2	5/8	5/8	1/2	1/2	1/2	5/8	5/8	5/8	1/2	1/2	5/8	5/8	5/8	5/8	3/8	3/8	3/8	3/8	3/8	3/8
9,000	1/2	1/2	5/8	5/8	5/8	5/8	1/2	5/8	5/8	7/8	7/8	7/8	1/2	5/8	5/8	7/8	7/8	7/8	3/8	3/8	3/8	3/8	3/8	3/8
12,000	1/2	5/8	5/8	7/8	7/8	7/8	5/8	5/8	7/8	7/8	7/8	7/8	5/8	7/8	7/8	7/8	7/8	7/8	3/8	3/8	3/8	3/8	3/8	3/8
15,000	5/8	5/8	7/8	7/8	7/8	7/8	5/8	7/8	7/8	7/8	7/8	7/8	5/8	7/8	7/8	7/8	7/8	7/8	3/8	3/8	3/8	3/8	3/8	3/8
18,000	5/8	7/8	7/8	7/8	7/8	7/8	5/8	7/8	7/8	7/8	7/8	7/8	7/8	7/8	7/8	7/8	1 1/8	1 1/8	3/8	3/8	3/8	3/8	1/2	1/2
24,000	5/8	7/8	7/8	7/8	7/8	7/8	7/8	7/8	7/8	7/8	1 1/8	1 1/8	7/8	7/8	7/8	1 1/8	1 1/8	1 1/8	3/8	3/8	3/8	1/2	1/2	1/2
30,000	7/8	7/8	7/8	7/8	1 1/8	1 1/8	7/8	7/8	7/8	1 1/8	1 1/8	1 1/8	7/8	7/8	1 1/8	1 1/8	1 1/8	1 1/8	3/8	1/2	1/2	1/2	1/2	5/8
36,000	7/8	7/8	7/8	1 1/8	1 1/8	1 1/8	7/8	7/8	1 1/8	1 1/8	1 1/8	1 1/8	7/8	1 1/8	1 1/8	1 1/8	1 1/8	1 3/8	3/8	1/2	1/2	1/2	5/8	5/8
42,000	7/8	7/8	1 1/8	1 1/8	1 1/8	1 1/8	7/8	7/8	1 1/8	1 1/8	1 1/8	1 1/8	7/8	1 1/8	1 1/8	1 1/8	1 3/8	1 3/8	3/8	1/2	1/2	1/2	5/8	5/8
48,000	7/8	7/8	1 1/8	1 1/8	1 1/8	1 1/8	7/8	1 1/8	1 1/8	1 1/8	1 3/8	1 3/8	7/8	1 1/8	1 1/8	1 1/8	1 3/8	1 3/8	1/2	1/2	1/2	5/8	5/8	5/8
54,000	7/8	1 1/8	1 1/8	1 1/8	1 1/8	1 3/8	7/8	1 1/8	1 1/8	1 1/8	1 3/8	1 3/8	1 1/8	1 1/8	1 1/8	1 3/8	1 3/8	1 3/8	1/2	1/2	1/2	5/8	5/8	5/8
60,000	7/8	1 1/8	1 1/8	1 1/8	1 3/8	1 3/8	1 1/8	1 1/8	1 1/8	1 3/8	1 3/8	1 3/8	1 1/8	1 1/8	1 1/8	1 3/8	1 3/8	1 3/8	1/2	1/2	5/8	5/8	5/8	5/8
66,000	7/8	1 1/8	1 1/8	1 1/8	1 3/8	1 3/8	1 1/8	1 1/8	1 1/8	1 3/8	1 3/8	1 3/8	1 1/8	1 1/8	1 3/8	1 3/8	1 3/8	1 5/8	1/2	1/2	5/8	5/8	5/8	7/8
72,000	7/8	1 1/8	1 1/8	1 1/8	1 3/8	1 3/8	1 1/8	1 1/8	1 1/8	1 3/8	1 3/8	1 3/8	1 1/8	1 1/8	1 3/8	1 3/8	1 3/8	1 5/8	1/2	5/8	5/8	5/8	5/8	7/8
78,000	7/8	1 1/8	1 1/8	1 3/8	1 3/8	1 3/8	1 1/8	1 1/8	1 1/8	1 3/8	1 3/8	1 5/8	1 1/8	1 1/8	1 3/8	1 3/8	1 5/8	1 5/8	1/2	5/8	5/8	5/8	7/8	7/8
84,000	1 1/8	1 1/8	1 1/8	1 3/8	1 3/8	1 3/8	1 1/8	1 1/8	1 3/8	1 3/8	1 5/8	1 5/8	1 1/8	1 3/8	1 3/8	1 3/8	1 5/8	1 5/8	1/2	5/8	5/8	5/8	7/8	7/8
90,000	1 1/8	1 1/8	1 3/8	1 3/8	1 3/8	1 5/8	1 1/8	1 3/8	1 3/8	1 5/8	1 5/8	1 5/8	1 1/8	1 3/8	1 3/8	1 5/8	1 5/8	1 5/8	1/2	5/8	5/8	7/8	7/8	7/8
120,000	1 1/8	1 3/8	1 3/8	1 5/8	1 5/8	1 5/8	1 3/8	1 3/8	1 5/8	1 5/8	1 5/8	2 1/8	1 3/8	1 5/8	1 5/8	1 5/8	2 1/8	2 1/8	5/8	5/8	7/8	7/8	7/8	7/8
150,000	1 3/8	1 3/8	1 5/8	1 5/8	1 5/8	2 1/8	1 3/8	1 5/8	1 5/8	1 5/8	2 1/8	2 1/8	1 3/8	1 5/8	1 5/8	2 1/8	2 1/8	2 1/8	5/8	7/8	7/8	7/8	7/8	7/8
180,000	1 3/8	1 3/8	1 5/8	1 5/8	2 1/8	2 1/8	1 3/8	1 5/8	1 5/8	2 1/8	2 1/8	2 1/8	1 5/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	7/8	7/8	7/8	7/8	1 1/8	1 1/8
210,000	1 3/8	1 5/8	1 5/8	2 1/8	2 1/8	2 1/8	1 5/8	1 5/8	2 1/8	2 1/8	2 1/8	2 1/8	1 5/8	2 1/8	2 1/8	2 1/8	2 1/8	2 5/8	7/8	7/8	7/8	7/8	1 1/8	1 1/8
240,000	1 5/8	1 5/8	2 1/8	2 1/8	2 1/8	2 1/8	1 5/8	2 1/8	2 1/8	2 1/8	2 1/8	2 5/8	1 5/8	2 1/8	2 1/8	2 1/8	2 5/8	2 5/8	7/8	7/8	7/8	1 1/8	1 1/8	1 1/8
300,000	1 5/8	2 1/8	2 1/8	2 1/8	2 1/8	2 5/8	1 5/8	2 1/8	2 1/8	2 1/8	2 5/8	2 5/8	2 1/8	2 1/8	2 1/8	2 5/8	2 5/8	2 5/8	7/8	7/8	7/8	1 1/8	1 1/8	1 1/8
360,000	1 5/8	2 1/8	2 1/8	2 1/8	2 5/8	2 5/8	2 1/8	2 1/8	2 1/8	2 5/8	2 5/8	2 5/8	2 1/8	2 1/8	2 5/8	2 5/8	2 5/8	2 5/8	7/8	1 1/8	1 1/8	1 1/8	1 1/8	1 3/8
480,000	2 1/8	2 1/8	2 1/8	2 5/8	2 5/8	2 5/8	2 1/8	2 5/8	2 5/8	2 5/8	3 1/8	3 1/8	2 1/8	2 5/8	2 5/8	3 1/8	3 1/8	3 1/8	7/8	1 1/8	1 1/8	1 3/8	1 3/8	1 3/8
600,000	2 1/8	2 5/8	2 5/8	2 5/8	3 1/8	3 1/8	2 5/8	2 5/8	2 5/8	3 1/8	3 1/8	3 1/8	2 1/8	2 5/8	3 1/8	3 1/8	3 1/8	3 5/8	1 1/8	1 1/8	1 3/8	1 3/8	1 3/8	1 3/8

*** NOTES:**

1. Sizes that are highlighted indicate maximum suction line sizes that should be used for risers. Riser size should not exceed horizontal size. Properly placed suction traps must also be used for adequate oil return.
2. All sizes shown are for O.D. Type L copper tubing.
3. Suction line sizes selected at pressure drop equivalent to 2˚F. Reduce estimate of system capacity accordingly.
4. Recommended liquid line size may increase with reverse cycle hot gas systems.
5. If system load drops below 40% of design, consideration to installing double suction risers should be made.

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Table 9. Recommended Line Sizes for R-448A/R-449A*

Capacity BTUH	Suction Line Size																							
	Suction Temperature																							
	+20˚F Equivalent Lengths						+10˚F Equivalent Lengths						-10˚F Equivalent Lengths						-20˚F Equivalent Lengths					
	25'	50'	75'	100'	150'	200'	25'	50'	75'	100'	150'	200'	25'	50'	75'	100'	150'	200'	25'	50'	75'	100'	150'	200'
1,000	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	1/2	3/8	3/8	3/8	1/2	1/2	1/2	3/8	3/8	1/2	1/2	1/2	1/2
3,000	3/8	3/8	1/2	1/2	1/2	5/8	3/8	1/2	1/2	1/2	5/8	5/8	1/2	1/2	5/8	5/8	5/8	7/8	1/2	1/2	5/8	5/8	7/8	7/8
4,000	3/8	1/2	1/2	1/2	5/8	5/8	1/2	1/2	1/2	5/8	5/8	7/8	1/2	5/8	5/8	5/8	7/8	7/8	1/2	5/8	5/8	7/8	7/8	7/8
6,000	1/2	1/2	5/8	5/8	7/8	7/8	1/2	1/2	5/8	5/8	7/8	7/8	1/2	5/8	5/8	7/8	7/8	7/8	5/8	5/8	7/8	7/8	7/8	7/8
9,000	5/8	5/8	7/8	7/8	7/8	7/8	5/8	5/8	7/8	7/8	7/8	7/8	5/8	7/8	7/8	7/8	7/8	1 1/8	5/8	7/8	7/8	7/8	1 1/8	1 1/8
12,000	5/8	7/8	7/8	7/8	7/8	7/8	5/8	7/8	7/8	7/8	7/8	1 1/8	7/8	7/8	7/8	7/8	1 1/8	1 1/8	7/8	7/8	7/8	1 1/8	1 1/8	1 1/8
15,000	5/8	7/8	7/8	7/8	7/8	1 1/8	7/8	7/8	7/8	7/8	1 1/8	1 1/8	7/8	7/8	7/8	1 1/8	1 1/8	1 1/8	7/8	7/8	1 1/8	1 1/8	1 1/8	1 3/8
18,000	7/8	7/8	7/8	7/8	1 1/8	1 1/8	7/8	7/8	7/8	1 1/8	1 1/8	1 1/8	7/8	7/8	1 1/8	1 1/8	1 1/8	1 3/8	7/8	1 1/8	1 1/8	1 1/8	1 3/8	1 3/8
24,000	7/8	7/8	7/8	1 1/8	1 1/8	1 1/8	7/8	1 1/8	1 1/8	1 1/8	1 1/8	1 3/8	7/8	1 1/8	1 1/8	1 1/8	1 3/8	1 3/8	1 1/8	1 1/8	1 1/8	1 3/8	1 3/8	1 3/8
30,000	7/8	7/8	1 1/8	1 1/8	1 1/8	1 3/8	7/8	1 1/8	1 1/8	1 1/8	1 3/8	1 3/8	1 1/8	1 1/8	1 1/8	1 3/8	1 3/8	1 3/8	1 1/8	1 1/8	1 1/8	1 3/8	1 3/8	1 5/8
36,000	7/8	1 1/8	1 1/8	1 1/8	1 3/8	1 3/8	1 1/8	1 1/8	1 1/8	1 3/8	1 3/8	1 3/8	1 1/8	1 1/8	1 3/8	1 3/8	1 3/8	1 5/8	1 1/8	1 1/8	1 3/8	1 3/8	1 3/8	1 5/8
42,000	1 1/8	1 1/8	1 1/8	1 3/8	1 3/8	1 3/8	1 1/8	1 1/8	1 3/8	1 3/8	1 3/8	1 5/8	1 1/8	1 3/8	1 3/8	1 3/8	1 5/8	1 5/8	1 1/8	1 3/8	1 3/8	1 5/8	1 5/8	1 5/8
48,000	1 1/8	1 1/8	1 3/8	1 3/8	1 3/8	1 3/8	1 1/8	1 1/8	1 3/8	1 3/8	1 5/8	1 5/8	1 1/8	1 3/8	1 3/8	1 3/8	1 5/8	1 5/8	1 1/8	1 3/8	1 3/8	1 5/8	1 5/8	1 5/8
54,000	1 1/8	1 1/8	1 3/8	1 3/8	1 3/8	1 5/8	1 1/8	1 3/8	1 3/8	1 3/8	1 5/8	1 5/8	1 3/8	1 3/8	1 3/8	1 5/8	1 5/8	1 5/8	1 3/8	1 3/8	1 5/8	1 5/8	1 5/8	1 5/8
60,000	1 1/8	1 1/8	1 3/8	1 3/8	1 5/8	1 5/8	1 1/8	1 3/8	1 3/8	1 5/8	1 5/8	1 5/8	1 3/8	1 3/8	1 5/8	1 5/8	1 5/8	2 1/8	1 3/8	1 3/8	1 5/8	1 5/8	1 5/8	2 1/8
66,000	1 1/8	1 3/8	1 3/8	1 3/8	1 5/8	1 5/8	1 1/8	1 3/8	1 3/8	1 5/8	1 5/8	1 5/8	1 3/8	1 5/8	1 5/8	1 5/8	1 5/8	1 5/8	1 3/8	1 5/8	1 5/8	1 5/8	1 5/8	2 1/8
72,000	1 1/8	1 3/8	1 3/8	1 5/8	1 5/8	1 5/8	1 1/8	1 3/8	1 5/8	1 5/8	1 5/8	1 5/8	1 3/8	1 5/8	1 5/8	1 5/8	1 5/8	1 5/8	1 3/8	1 5/8	1 5/8	1 5/8	1 5/8	2 1/8
78,000	1 1/8	1 3/8	1 3/8	1 5/8	1 5/8	2 1/8	1 3/8	1 3/8	1 5/8	1 5/8	1 5/8	2 1/8	1 3/8	1 5/8	1 5/8	1 5/8	1 5/8	2 1/8	1 5/8	1 5/8	1 5/8	1 5/8	2 1/8	2 1/8
84,000	1 1/8	1 3/8	1 5/8	1 5/8	1 5/8	2 1/8	1 3/8	1 3/8	1 5/8	1 5/8	2 1/8	2 1/8	1 3/8	1 5/8	1 5/8	1 5/8	2 1/8	2 1/8	1 5/8	1 5/8	1 5/8	2 1/8	2 1/8	2 1/8
90,000	1 3/8	1 3/8	1 5/8	1 5/8	2 1/8	2 1/8	1 3/8	1 5/8	1 5/8	1 5/8	2 1/8	2 1/8	1 5/8	1 5/8	1 5/8	2 1/8	2 1/8	2 5/8	1 5/8	1 5/8	2 1/8	2 1/8	2 1/8	2 5/8
120,000	1 3/8	1 5/8	1 5/8	2 1/8	2 1/8	2 1/8	1 3/8	1 5/8	2 1/8	2 1/8	2 1/8	2 1/8	1 5/8	2 1/8	2 1/8	2 1/8	2 5/8	2 5/8	1 5/8	2 1/8	2 1/8	2 1/8	2 5/8	2 5/8
150,000	1 5/8	1 5/8	2 1/8	2 1/8	2 1/8	2 1/8	1 5/8	2 1/8	2 1/8	2 1/8	2 1/8	2 5/8	2 1/8	2 1/8	2 1/8	2 5/8	2 5/8	2 5/8	2 1/8	2 1/8	2 1/8	2 5/8	2 5/8	2 5/8
180,000	1 5/8	2 1/8	2 1/8	2 1/8	2 1/8	2 5/8	1 5/8	2 1/8	2 1/8	2 1/8	2 5/8	2 5/8	2 1/8	2 1/8	2 5/8	2 5/8	2 5/8	3 1/8	2 1/8	2 1/8	2 5/8	2 5/8	2 5/8	3 1/8
210,000	1 5/8	2 1/8	2 1/8	2 1/8	2 5/8	2 5/8	2 1/8	2 1/8	2 1/8	2 5/8	2 5/8	2 5/8	2 1/8	2 1/8	2 5/8	2 5/8	3 1/8	3 1/8	2 1/8	2 5/8	2 5/8	2 5/8	3 1/8	3 1/8
240,000	1 5/8	2 1/8	2 1/8	2 1/8	2 5/8	2 5/8	2 1/8	2 1/8	2 5/8	2 5/8	2 5/8	2 5/8	2 1/8	2 5/8	2 5/8	2 5/8	3 1/8	3 1/8	2 1/8	2 5/8	2 5/8	2 5/8	3 1/8	3 1/8
300,000	2 1/8	2 1/8	2 5/8	2 5/8	2 5/8	3 1/8	2 1/8	2 5/8	2 5/8	2 5/8	3 1/8	3 1/8	2 5/8	2 5/8	2 5/8	3 1/8	3 1/8	3 5/8	2 5/8	2 5/8	2 5/8	3 1/8	3 5/8	3 5/8
360,000	2 1/8	2 1/8	2 5/8	2 5/8	3 1/8	3 1/8	2 1/8	2 5/8	2 5/8	2 5/8	3 1/8	3 1/8	2 5/8	2 5/8	3 1/8	3 1/8	3 5/8	3 5/8	2 5/8	2 5/8	3 1/8	3 5/8	3 5/8	4 1/8
480,000	2 1/8	2 5/8	2 5/8	3 1/8	3 1/8	3 5/8	2 5/8	2 5/8	2 5/8	2 5/8	3 5/8	3 5/8	2 5/8	3 1/8	3 1/8	3 5/8	3 5/8	4 1/8	2 5/8	3 1/8	3 1/8	3 5/8	3 5/8	4 1/8
600,000	2 5/8	2 5/8	3 1/8	3 1/8	3 5/8	3 5/8	2 5/8	2 5/8	3 1/8	3 1/8	3 5/8	3 5/8	3 1/8	3 1/8	3 1/8	3 5/8	4 1/8	4 1/8	3 1/8	3 1/8	3 1/8	3 5/8	3 5/8	4 1/8

*** NOTES:**

1. Sizes that are highlighted indicate maximum suction line sizes that should be used for risers. Riser size should not exceed horizontal size. Properly placed suction traps must also be used for adequate oil return.

All sizes shown are for O.D. Type L copper tubing.

2. Suction line sizes selected at pressure drop equivalent to 2˚F. Reduce estimate of system capacity accordingly.
3. Recommended liquid line size may increase with reverse cycle hot gas systems.
4. If system load drops below 40% of design, consideration to installing double suction risers should be made.

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Table 9a. Recommended Line Sizes for R-448A/R-449A*

Capacity BTUH	Suction Line Size												Liquid Line Size					
	Suction Temperature												Receiver to Expansion Valve Equivalent Lengths					
	-30˚F Equivalent Lengths						-40˚F Equivalent Lengths											
	25'	50'	75'	100'	150'	200'	25'	50'	75'	100'	150'	200'	25'	50'	75'	100'	150'	200'
1,000	3/8	3/8	1/2	1/2	1/2	5/8	3/8	1/2	1/2	1/2	5/8	5/8	3/8	3/8	3/8	3/8	3/8	3/8
3,000	1/2	1/2	5/8	5/8	7/8	7/8	1/2	1/2	5/8	5/8	7/8	7/8	3/8	3/8	3/8	3/8	3/8	3/8
4,000	5/8	5/8	5/8	7/8	7/8	7/8	1/2	5/8	5/8	7/8	7/8	7/8	3/8	3/8	3/8	3/8	3/8	3/8
6,000	5/8	5/8	7/8	7/8	7/8	7/8	5/8	5/8	7/8	7/8	7/8	1 1/8	3/8	3/8	3/8	3/8	3/8	3/8
9,000	5/8	7/8	7/8	7/8	1 1/8	1 1/8	5/8	7/8	7/8	7/8	1 1/8	1 1/8	3/8	3/8	3/8	3/8	3/8	3/8
12,000	7/8	7/8	7/8	1 1/8	1 1/8	1 1/8	7/8	7/8	7/8	1 1/8	1 1/8	1 1/8	3/8	3/8	3/8	3/8	3/8	3/8
15,000	7/8	7/8	1 1/8	1 1/8	1 1/8	1 3/8	7/8	7/8	1 1/8	1 1/8	1 1/8	1 3/8	3/8	3/8	3/8	3/8	3/8	1/2
18,000	7/8	1 1/8	1 1/8	1 1/8	1 3/8	1 3/8	7/8	1 1/8	1 1/8	1 1/8	1 3/8	1 3/8	3/8	3/8	3/8	3/8	1/2	1/2
24,000	1 1/8	1 1/8	1 1/8	1 3/8	1 3/8	1 3/8	1 1/8	1 1/8	1 1/8	1 3/8	1 3/8	1 3/8	3/8	3/8	1/2	1/2	1/2	1/2
30,000	1 1/8	1 1/8	1 3/8	1 3/8	1 3/8	1 5/8	1 1/8	1 1/8	1 3/8	1 3/8	1 3/8	1 5/8	3/8	3/8	1/2	1/2	1/2	1/2
36,000	1 1/8	1 3/8	1 3/8	1 3/8	1 3/8	1 5/8	1 1/8	1 3/8	1 3/8	1 3/8	1 5/8	1 5/8	3/8	1/2	1/2	1/2	1/2	1/2
42,000	1 1/8	1 3/8	1 3/8	1 3/8	1 5/8	1 5/8	1 1/8	1 3/8	1 3/8	1 3/8	1 5/8	1 5/8	3/8	1/2	1/2	1/2	1/2	5/8
48,000	1 1/8	1 3/8	1 3/8	1 3/8	1 5/8	1 5/8	1 1/8	1 3/8	1 3/8	1 3/8	1 5/8	1 5/8	1/2	1/2	1/2	1/2	1/2	5/8
54,000	1 3/8	1 3/8	1 3/8	1 5/8	1 5/8	2 1/8	1 3/8	1 3/8	1 3/8	1 5/8	1 5/8	2 1/8	1/2	1/2	1/2	1/2	5/8	5/8
60,000	1 3/8	1 3/8	1 5/8	1 5/8	1 5/8	2 1/8	1 3/8	1 3/8	1 5/8	1 5/8	1 5/8	2 1/8	1/2	1/2	1/2	5/8	5/8	5/8
66,000	1 3/8	1 5/8	1 5/8	1 5/8	1 5/8	2 1/8	1 3/8	1 5/8	1 5/8	1 5/8	1 5/8	2 1/8	1/2	1/2	5/8	5/8	5/8	5/8
72,000	1 3/8	1 5/8	1 5/8	1 5/8	1 5/8	2 1/8	1 3/8	1 5/8	1 5/8	1 5/8	1 5/8	2 1/8	1/2	1/2	5/8	5/8	5/8	5/8
78,000	1 5/8	1 5/8	1 5/8	1 5/8	2 1/8	2 1/8	1 5/8	1 5/8	1 5/8	1 5/8	2 1/8	2 1/8	1/2	1/2	5/8	5/8	5/8	7/8
84,000	1 5/8	1 5/8	1 5/8	2 1/8	2 1/8	2 1/8	1 5/8	1 5/8	1 5/8	2 1/8	2 1/8	2 1/8	1/2	5/8	5/8	5/8	5/8	7/8
90,000	1 5/8	2 1/8	2 1/8	2 1/8	2 1/8	2 5/8	1 5/8	1 5/8	2 1/8	2 1/8	2 1/8	2 5/8	1/2	5/8	5/8	5/8	7/8	7/8
120,000	1 5/8	2 1/8	2 1/8	2 1/8	2 5/8	2 5/8	1 5/8	2 1/8	2 1/8	2 1/8	2 5/8	2 5/8	5/8	5/8	5/8	7/8	7/8	7/8
150,000	2 1/8	2 1/8	2 1/8	2 5/8	2 5/8	2 5/8	2 1/8	2 1/8	2 5/8	2 5/8	2 5/8	2 5/8	5/8	7/8	7/8	7/8	7/8	7/8
180,000	2 1/8	2 1/8	2 5/8	2 5/8	2 5/8	3 1/8	2 1/8	2 1/8	2 5/8	2 5/8	2 5/8	3 1/8	5/8	7/8	7/8	7/8	7/8	1 1/8
210,000	2 1/8	2 5/8	2 5/8	2 5/8	3 1/8	3 1/8	2 1/8	2 5/8	2 5/8	2 5/8	3 1/8	3 1/8	7/8	7/8	7/8	7/8	7/8	1 1/8
240,000	2 5/8	2 5/8	2 5/8	3 1/8	3 1/8	3 5/8	2 5/8	2 5/8	2 5/8	3 1/8	3 1/8	3 5/8	7/8	7/8	7/8	7/8	1 1/8	1 1/8
300,000	2 5/8	2 5/8	3 1/8	3 1/8	3 5/8	4 1/8	2 5/8	2 5/8	3 1/8	3 5/8	3 5/8	4 1/8	7/8	7/8	1 1/8	1 1/8	1 1/8	1 1/8
360,000	2 5/8	3 1/8	3 5/8	3 5/8	3 5/8	4 1/8	2 5/8	3 1/8	3 5/8	3 5/8	4 1/8	4 1/8	7/8	7/8	1 1/8	1 1/8	1 1/8	1 1/8
480,000	3 1/8	3 5/8	3 5/8	4 1/8	4 1/8	4 1/8	3 1/8	3 5/8	3 5/8	4 1/8	4 1/8	4 1/8	1 1/8	1 1/8	1 1/8	1 1/8	1 3/8	1 3/8
600,000	3 1/8	3 5/8	3 5/8	4 1/8	4 1/8	5 1/8	3 1/8	3 5/8	3 5/8	4 1/8	4 1/8	5 1/8	1 1/8	1 1/8	1 1/8	1 3/8	1 3/8	1 3/8

*** NOTES:**

1. Sizes that are highlighted indicate maximum suction line sizes that should be used for risers. Riser size should not exceed horizontal size. Properly placed suction traps must also be used for adequate oil return.

All sizes shown are for O.D. Type L copper tubing.

2. Suction line sizes selected at pressure drop equivalent to 2˚F. Reduce estimate of system capacity accordingly.
3. Recommended liquid line size may increase with reverse cycle hot gas systems.
4. If system load drops below 40% of design, consideration to installing double suction risers should be made.

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EQUIVALENT LENGTH ALLOWANCE FOR FITTINGS
EQUIVALENT LENGTH IN FEET

FITTING SIZE	90° Ell	45° Ell	Tee (Line)	Tee (Branch)
1/2"	.9	.4	.8	2.0
5/8"	1.0	.5	1.0	2.5
7/8"	1.5	.7	1.5	3.5
1-1/8"	1.8	.9	1.5	4.5
1-3/8"	2.4	1.2	1.8	6.0
1-5/8"	2.8	1.4	2.0	7.0
2-1/8"	3.9	1.8	3.8	10.0

Chart A

GENERAL INFORMATION

1. Suction lines should be pitched down in direction of flow, 1/2" per 10 feet of line.

2. Refrigerant lines should be supported and fastened properly to prevent leaks and for a professional-looking installation. Supports should be every 5 feet for lines to 7/8" OD, 7 feet for 1-1/8" to 1-3/8" OD lines, and 10 feet for 1-5/8" and 2-1/8" OD lines.

3. Where condensation dripping would be objectionable, insulate suction lines, and where the sun could adversely affect performance, insulate both the liquid and suction lines. Insulation thickness of 1/2" will usually be adequate. Liquid line should be insulated for reverse cycle defrost as well

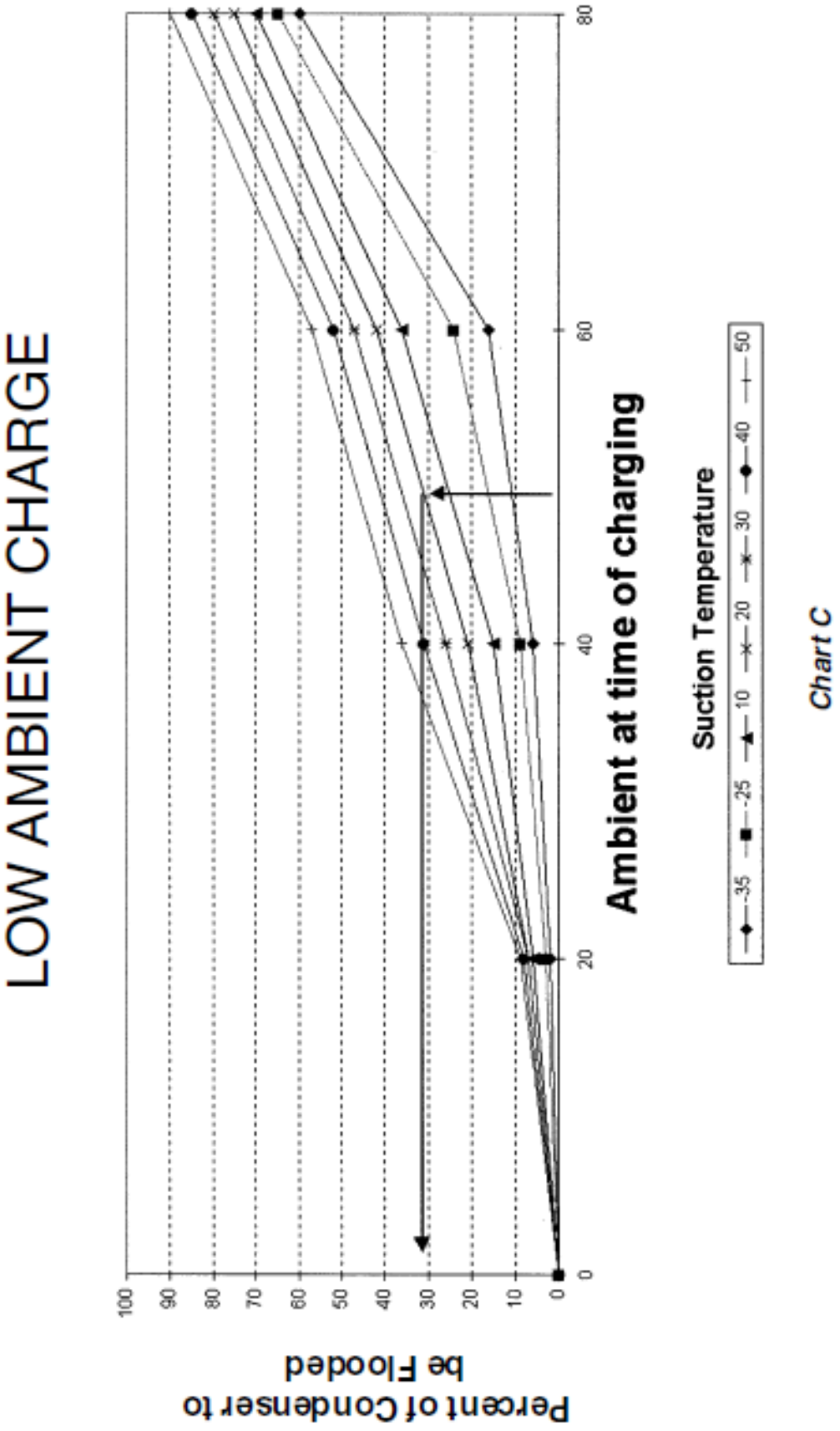
4. A “P” trap must be installed at the bottom of the riser in all vertical suction lines rising 4" or more. To ensure proper oil return to the condensing unit, the trap should be the same size as the horizontal line and the riser should be sized per the line sizing charts on pages 14-17.

   In installations where condensate can accumulate on the vibrasorber, a covering of heat shrink PVC tubing or waterproof tape may be used to prevent freezing under the ferrule, causing a rupture.

NOTE: Do not complete the installation if the unit is short-cycling. If it is short-cycling and cannot

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be resolved, contact the RSG service department.



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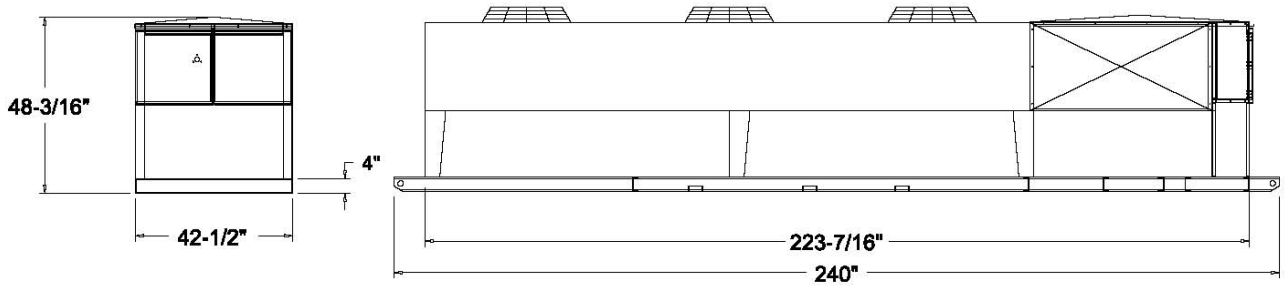
System Troubleshooting Chart

PROBLEM	POSSIBLE CAUSES	POSSIBLE CORRECTIVE STEPS
Compressor will not run	1. Main switch open.	1. Close switch.
	2. Fuse blown.	2. Check electrical circuits and motor winding for shorts or grounds.
	3. Thermal overloads tripped.	Investigate for possible overloading. Replace fuse after fault is corrected.
	4. Defective contactor or coil.	3. Overloads are automatically reset. Check unit closely when unit
	5. System shut down by safety devices.	comes back on line.
	6. No cooling required.	4. Repair or replace.
	7. Liquid line solenoid will not open.	5. Determine type and cause of shutdown and correct it before
	8. Motor electrical trouble.	resetting safety switch.
	9. Loose wiring.	6. None. Wait until calls for cooling.
	10. Phase loss monitor inoperative.	7. Repair or replace coil.
		8. Check motor for open windings, short circuit or burn out.
		9. Check all wire junctions. Tighten all terminal screws.
Compressor noisy or vibrating	1. Flooding of refrigerant into crankcase.	1. Check setting of expansion valves.
	2. Improper piping support on suction or liquid line.	2. Relocate, add or remove hangers.
	3. Worn compressor.	3. Replace.
	4. Scroll compressor rotation reversed.	4. Rewire for phase change.
High discharge pressure	1. Non-condensables in system.	1. Remove the non-condensables.
	2. System overcharges with refrigerant.	2. Remove excess.
	3. Discharge shutoff valve partially closed.	3. Open valve.
	4. Fan not running.	4. Check electrical circuit.
	5. Head pressure control setting.	5. Adjust.
	6. Dirty condenser coil.	6. Clean.
Low discharge pressure	1. Faulty condenser temperature regulation.	1. Check condenser control operation.
	2. Suction shutoff valve partially closed.	2. Open valve.
	3. Insufficient refrigerant in system.	3. Check for leaks. Repair and add charge.
	4. Low suction pressure.	4. See corrective steps for low suction pressure.
	5. Variable head pressure valve.	5. Check valve setting.
High suction pressure	1. Excessive load.	1. Reduce load or add additional equipment.
	2. Expansion valve overfeeding.	2. Check remote bulb. Regulate superheat.
Low suction pressure	1. Lack of refrigerant.	1. Check for leaks. Repair and add charge.
	2. Evaporator dirty or iced.	2. Clean.
	3. Clogged liquid line filter drier.	3. Replace cartridge(s).
	4. Clogged suction line or compressor suction gas strainers.	4. Clean strainers.
	5. Expansion valve malfunctioning.	5. Check and reset for proper superheat.
	6. Condensing temperature too low.	6. Check means for regulating condensing temperature.
	7. Improper TXV.	7. Check for proper sizing.
Little or no oil pressure	1. Clogged suction oil strainer.	1. Clean.
	2. Excessive liquid in crankcase.	2. Check crankcase heater. Reset expansion valve for higher superheat.
	3. Low oil pressure safety switch defective.	Check liquid line solenoid valve operation.
	4. Worn oil pump.	3. Replace.
	5. Oil pump reversing gear stuck in wrong position.	4. Replace.
	6. Worn bearings.	5. Reverse direction of compressor rotation.
	7. Low oil level.	6. Replace compressor.
	8. Loose fitting on oil lines.	7. Add oil and/or through defrost.
	9. Pump housing gasket leaks.	8. Check and tighten system.
		9. Replace gasket.
Compressor loses oil	1. Lack of refrigerant.	1. Check for leaks and repair. Add refrigerant.
	2. Excessive compression ring blow by.	2. Replace compressor.
	3. Refrigerant flood back.	3. Maintain proper superheat at compressor.
	4. Improper piping or traps.	4. Correct piping.
Compressor thermal protector switch open	1. Operating beyond design conditions.	1. Add components to bring conditions within acceptable limits (i.e.,
	2. Discharge valve partially shut.	CPR/EPR valves, additional condenser surface, liquid injection, etc.).
	3. Blown valve plate gasket.	2. Open valve.
	4. Dirty condenser coil.	3. Replace gasket.
	5. Overcharged system.	4. Clean coil.
		5. Reduce charge.

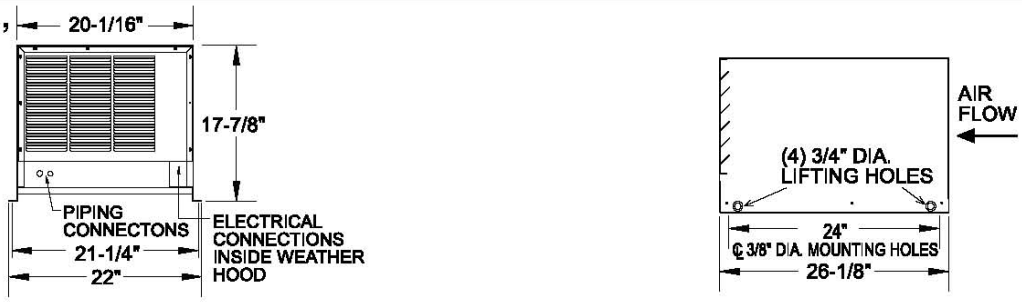
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UNIT BASE SPECIFICATIONS

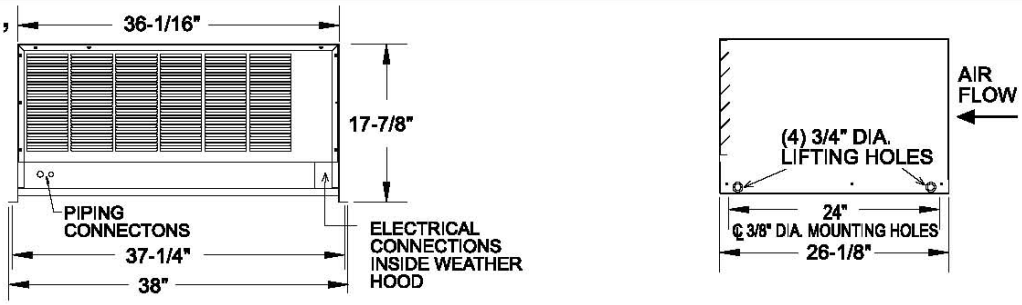
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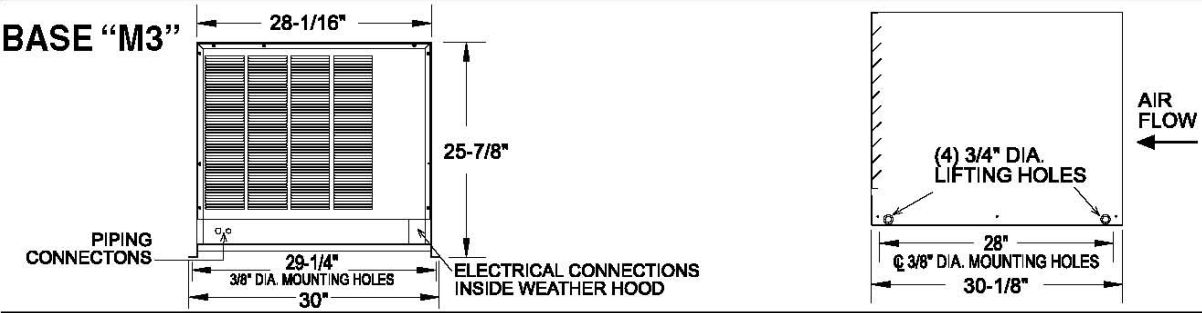
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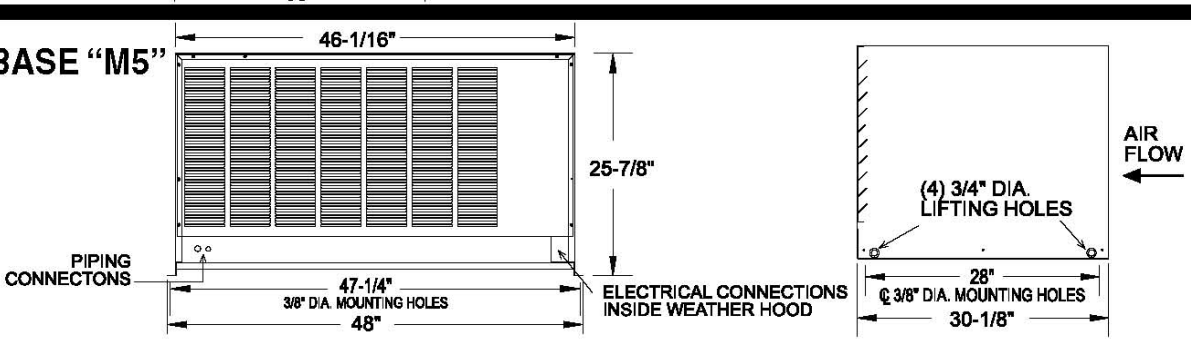
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BASE "M3"

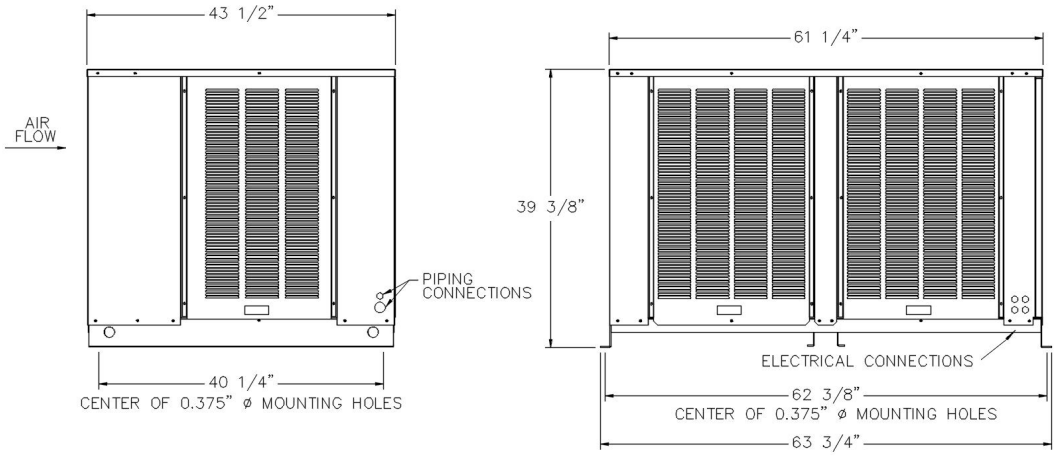


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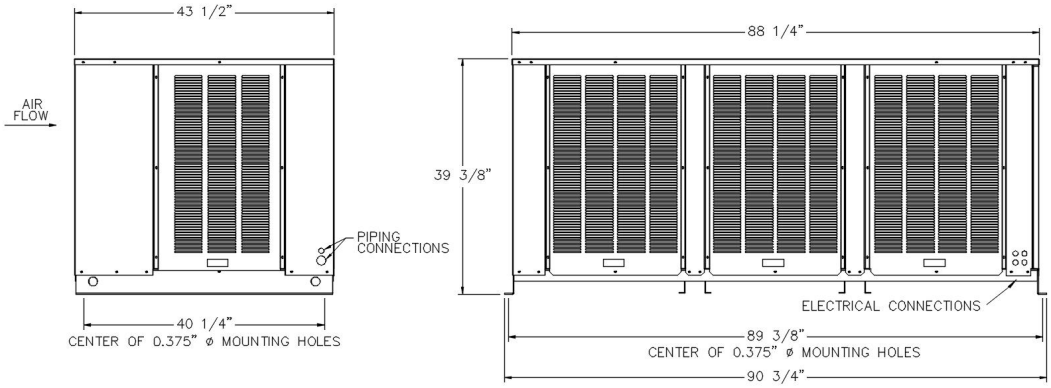


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BASE “M6”



BASE “M7”



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PREVENTATIVE MAINTENANCE

RECOMMENDED PREVENTATIVE MAINTENANCE FOR WALK-INS & REFRIGERATION SYSTEMS

This preventative maintenance is recommended to be executed on a quarterly schedule by a certified technician from an Authorized Service Provider.

Walk-In Coolers & Freezers:

- Check door alignment, door closer and hinges.
- Check door gasket for any tears or damage.
- Check and adjust door sweep.
- Inspect heated vent ports for proper operations.
- Check lighting is in working order.
- Inspect door control, alarm and/or thermometer.

Refrigeration Systems:

- Cycle unit and check operations of refrigeration and defrost modes.
- Clean and inspect evaporator and condenser coils.
- Inspect and secure all electrical connections.
- Check relays and contactors for wear or pitting.
- Check start components.
- Inspect and clean motors, especially around rear air vents.
- Inspect fan blades, shafts, and bearings.
- Check and tighten any flair, quick connect, and roto lock fittings.
- Ensure sight glass is clear.
- Blow out and flush condensate drains/lines.
- Ensure drain pans are free of debris.
- Inspect drier for restrictions by ensuring there is no temperature drop across it.
- Ensure all covers and panels are securely fastened when completed.

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SALE AND DISPOSAL

If you sell or give away your walk-in refrigeration system or components you must make sure that all safety labels and the Refrigeration Unit Installation and Operations Manual are included. If you need replacement labels or manuals, contact the parts and technical service department.

The customer service department should be contacted at the time of sale or disposal of your walk-in so records may be kept of its new location.

If you sell or give away your Unit and you evacuate the refrigerant charge before shipment, you must evacuate the refrigerant into an approved recovery and reclaim system in order to satisfy all applicable federal and state regulations regarding release of refrigerant compounds into the atmosphere.

The release of refrigerant compounds into the atmosphere is a source of ozone depletion and regulated by federal and state law.

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INSTALLATION DATA

Date System Installed _____

Installer and Address

_____

_____

_____

Phone _____

Condensing Unit

Model_____

Serial _____

Electrical _____ Volts _____ Phase_____

Evaporator(s)

Quantity_____

Model_____

Serial_____

Thermostat Setting _____°F

Defrost Setting _____ /24 hrs. _____ Min. Fail Safe

Electrical _____ Volts _____ Amps

Operating Pressures _____ Suction _____ Discharge

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