Installation Guidelines Manual

EQR, SQR, LQR, and TS Series Remote Air-Cooled Condensers

Scroll Compressor Chillers
3 to 100 Tons

Table of Contents

Foreword

The intent of this manual is to serve as a guide for placing your remote condenser in service and operating and maintaining it properly. Improper installation can lead to poor equipment performance or severe equipment damage. Failure to follow the installation instructions may result in damage not covered by your warranty. It is extremely important that a qualified refrigeration installation contractor perform all installation line sizing and piping. Please supply these instructions to your authorized refrigeration contractor. This manual is for our standard product line with supplements as required to accommodate any special items provided for a specific application. The written information contained in this manual, as well as various drawings, are intended to be general in nature. The drawings included in this manual are typical only and may not represent the actual unit purchased. Actual drawings are included with the equipment for troubleshooting and servicing of the unit. Additional copies of drawings are available upon request. We strive to maintain an accurate record of all equipment during the course of its useful life. Every effort was made to standardize the design features of these chillers, the various options may make it necessary to rearrange some of the components; therefore, some of the general drawings in this manual may differ from your specific unit.

Due to the ever-changing nature of applicable codes, ordinances, and other local laws pertaining to the use and operation of this equipment we do not reference them in this manual. There is no substitute for common sense and good operating practices when placing any mechanical equipment into operation. We encourage all personnel to familiarize themselves with this manual's contents. Failure to do so may unnecessarily prolong equipment down time.

The chilling equipment uses chemical refrigerants for heat transfer purposes. This chemical is sealed and tested in a pressurized system containing ASME coded vessels; however, a system failure will release it. Refrigerant gas can cause toxic fumes if exposed to fire. Place these units in a well-ventilated area, especially if open flames are present.

Failure to follow these instructions could result in a hazardous condition. We strongly recommend our customers implement a refrigerant management program including a survey of all equipment to document the type and quantity of refrigerant in each machine. We recommend all refrigeration service technicians be licensed and certified by an EPA approved organization. Follow good piping practices and the information in this manual to insure a successful installation and operation of this equipment. We are not responsible for liabilities created by substandard piping methods and installation practices external to the chiller.

We trust your equipment will have a long and useful life. If you should have any questions, please contact our Customer Service Department specifying the serial number and model number of the unit as indicated on the nameplate.

Installation

Receiving Inspection

Each remote condenser unit has a holding charge of nitrogen. Before accepting delivery, check the overall equipment condition for any visible damage and document any evident on the delivery receipt. Shipping damage is the responsibility of the carrier. In order to expedite payment for damages, it is important to follow proper procedures and record keeping. Photographs of damaged equipment are excellent documentation for your records.

Inspect for hidden damage after removing the packing. Refrigerant lines can be susceptible to damage in transit. Check for broken lines, oil leaks, damaged controls, or any other major component torn loose from its mounting point.

Our Customer Service Department will provide assistance in preparation and filing of your claims, including arranging for an estimate and quotation on repairs; however, filing the claim is the responsibility of the receiving party.

Rigging, Handling, and Locating Equipment

The condenser coil should be pressurized to 350 PSI (2413 kPa) with dry nitrogen gas and leak-checked prior to rigging. This will ensure no coil damage has occurred after the unit left the factory. The condenser ships with the legs removed. Mount the legs to the condenser using the provided nuts, bolts, and washers.

Follow proper rigging methods to prevent damage to components. Avoid impact loading caused by sudden jerking when lifting or lowering the condenser. Use pads on any abrasive surface contact area.

CAUTION: Do not use the condenser manifolds, control panel, or return bends of the condenser coil for lifting or moving the condenser as this can result in significant damage to the unit.

The condenser is for outdoor use. A primary concern when designing your unit was serviceability; therefore, the condenser should be located in an accessible area. Install the unit on a firm, level base no closer than their width from walls or other condensers. Avoid locations near exhaust fans, plumbing vents, flues, or chimneys. Fasten the mounting legs at their base to the steel or concrete of the supporting structure. For units mounted on a roof structure, the steel support base holding the condenser should be elevated above the roof and attached to the building.

Interconnecting Refrigerant Piping

The chiller unit has a nitrogen holding charge and must be properly evacuated before charging with refrigerant. The chiller is for use only with the air-cooled condenser provided with the unit. The following section covers the required piping between the chiller and the provided air-cooled condenser.

The chiller may consist of multiple evaporators, compressors, liquid line solenoid valves, expansion valves, sight glasses, filter driers, and receivers. If the chiller is to operate in lower ambient air temperatures, the chiller may also contain head pressure control valves. The discharge and liquid lines leaving the chiller have caps. These line sizes do not necessarily reflect the actual line sizes required for the piping between the chiller and the air-cooled condenser. The installing contractor need only provide the interconnecting piping between the chiller and the air-cooled condenser.

Refrigerant piping size and piping design has a significant effect on system performance and reliability. Refer to the Refrigeration Line Sizing section of this manual to ensure the refrigerant piping and runs are proper. All piping should conform to the applicable local and state codes. Use refrigerant grade copper tubing only and isolate the refrigeration lines from building structures to prevent transfer of vibration. Do not use a saw to remove end caps. This might allow copper chips to contaminate the system. Use a tube cutter or heat to remove the caps. When sweating copper joints it is important to evacuate all refrigerant present if any and flow dry nitrogen through the system. This prevents the formation of toxic gases, corrosive acids, and the formation of scale within the copper tube. Do not use soft solders. For copper-to-copper joints use a phos-copper solder with 6% to 8% silver content. Only use a high silver content brazing rod for copper-to-brass or copper-to-steel joints. Only use oxy-acetylene brazing.

CAUTION: When HFC refrigerant is utilized, the POE oil contained within the compressor is hygroscopic and has the ability to absorb water vapor from the atmosphere. Take necessary steps to prevent an open system from exposure to the atmosphere for extended time periods while installing the interconnecting refrigerant piping.

System and Piping Evacuation

The chiller and the remote condenser are shipped with a holding charge of nitrogen and must be properly evacuated before charging with refrigerant. Once the field piping is installed and pressure tested, the complete system, including the chiller, remote condenser and field piping must be evacuated. All solenoids and service valves including, service ball valves, receiver rotalock valves, compressor rotalock valves, liquid line solenoid valve, and etc. should be open during evacuation to ensure complete system evacuation. The system must be evacuated to 500 microns or less and not rise more than 100 microns for a minimum of 10 minutes after the vacuum pump is turned off and isolated from the system. Once evacuation is complete and the system has been charged with refrigerant, return all valves to their normal operating position. The chiller may be pre-evacuated while the field piping is being installed as long as the discharge and liquid line service valves remain closed to isolate the chiller from the field piping.

Electrical Power

All wiring must comply with local codes and the National Electric Code. Minimum circuit ampacities and other unit electrical data are on the unit nameplate. Measure each leg of the main power supply voltage at the main power source. Voltage must be within the voltage utilization range shown in the unit nameplate. If the measured voltage on any leg is not within the specified range, notify the supplier and correct before operating the unit. Voltage imbalance must not exceed two percent. Excessive voltage imbalance between the phases of a three-phase system can cause motors to overheat and eventually fail. Voltage imbalance is determined using the following calculations:

%Imbalance = (Vavg – Vx) x 100 / Vavg

Vavg = (V1 + V2 + V3) / 3
Vx = phase with greatest difference from Vavg

For example, if the three measured voltages are 442, 460, and 454 volts, the average would be:

(442 + 460 + 454) / 3 = 452

The percentage of imbalance is then:

(452 – 442) x 100 / 452 = 2.2 %

This exceeds the maximum allowable of 2%.

There is a terminal block for main power connection to the main power source. The main power source should be connected to the terminal block through an appropriate disconnect switch. There is also a separate lug in the main control panel for grounding the unit. Check the phase sequence at installation and prior to start-up with a phase sequence meter prior to applying power. The proper sequence should read “ABC” on the meter. If the meter reads “CBA”, open the main power disconnect and switch two line leads on the line power terminal blocks (or the unit mounted disconnect). All components requiring electric power are in-phase at the factory. Do not interchange any load leads that are from the unit contactors or the motor terminals.

Refrigeration Piping Design

The system can be configured in any of the primary arrangements as shown in Figures 1 through 3. The configuration and its associated elevation, along with the total distance between the chiller and the air-cooled condenser are important factors in determining the liquid line and discharge line sizes. This will also affect the field refrigerant charges. Consequently, it is important to adhere to certain physical limitations to ensure the system operates as designed.

General Design Considerations

1. The total distance between the chiller and the air-cooled condenser must not exceed 200 actual feet (61 meters) or 300 equivalent feet (91 meters).
2. Liquid line risers must not exceed 15 feet (5 meters) in height from the condenser liquid line connection. (see Figure 3 - Condenser Located Below Chiller Unit)
3. Discharge line risers cannot exceed an elevation difference greater than 100 actual feet (31 meters) without a minimum of 2% efficiency decrease.

Figure 1 – Condenser Located with No Elevation Difference

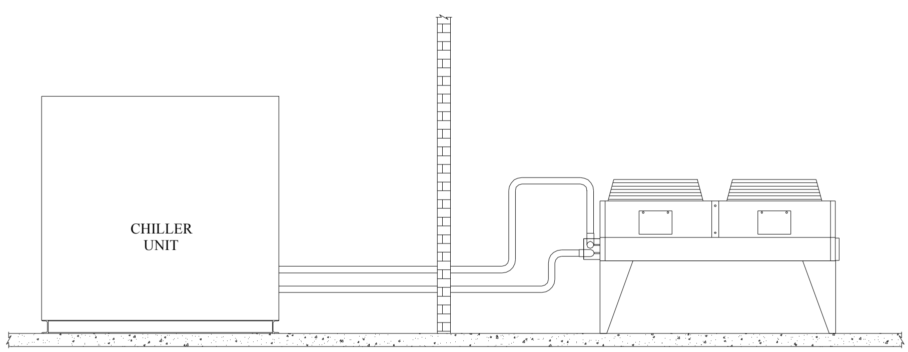


Figure 2 – Condenser Located above Chiller Unit

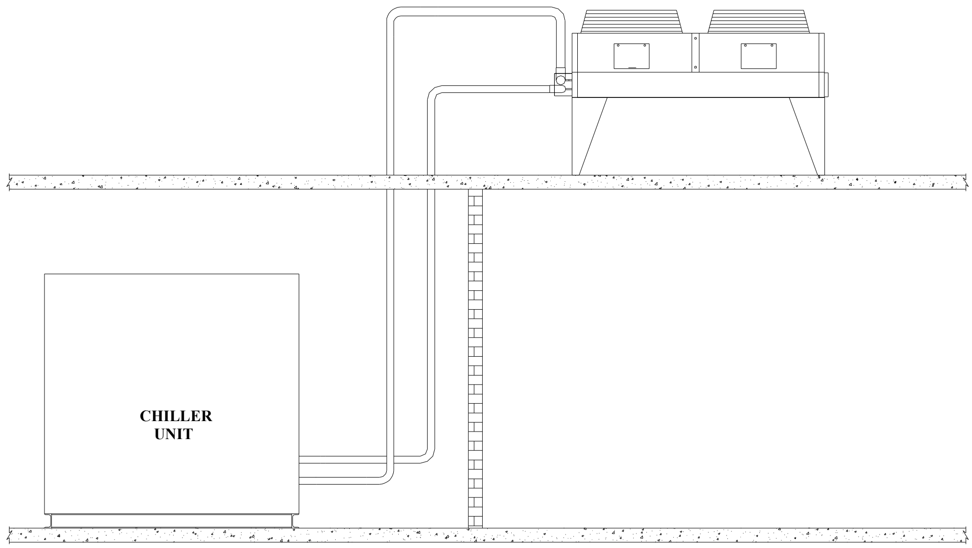
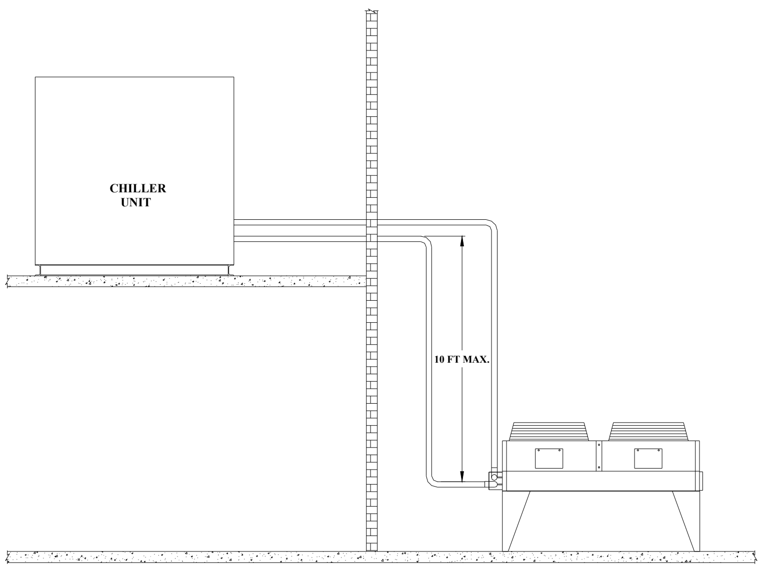


Figure 3 - Condenser Located Below Chiller Unit



Note: Liquid line sizing for each chiller capacity is in Table 2 – Liquid Line Sizes. These line sizes are listed per circuit and apply where leaving water temperature (LWT) is 40°F (4.4°C) or higher. For applications where the LWT is below 40°F (4.4°C), size lines using the ASHRAE Refrigeration Handbook or other suitable design guide.

Determining Equivalent Line Length

To determine the appropriate size for field installed liquid and discharge lines, it is first necessary to establish the equivalent length of pipe for each line. The equivalent length is the actual friction loss from the linear run of pipe and the added friction loss of elbows, valves, etc. shows the equivalent length of pipe for various nonferrous valves and fittings.

Follow these steps when calculating line size:

1. Start with an initial approximation of equivalent length by assuming that the equivalent length of pipe is 1.5 times the actual pipe length.
2. Refer to Table 2 – Liquid Line Sizes, Table 3 - Horizontal or Downflow Discharge Line Sizes (inches OD), and Table 4 - Upflow Discharge Line Sizes (inches OD) Table 2 – Liquid Line Sizesfor a first approximation of line size.
3. Check the line size by calculating the actual equivalent length using Table 1 – Equivalent Lengths of Fittings**.**

Note: When calculating the equivalent length, do not include piping of the chiller unit. Only field piping must be considered.

Table 1 – Equivalent Lengths of Fittings

Line Size OD (in)	Equivalent Lengths of Refrigerant Pipe (feet)				
	Elbow 90° Standard	Elbow 90° Long Radius	Elbow 90° Street	Elbow 45° Standard	Elbow 45° Long Radius
7/8	2.0	1.4	3.2	0.9	1.6
1 1/8	2.6	1.7	4.1	1.3	2.1
1 3/8	3.3	2.3	5.6	1.7	3.0
1 5/8	4.0	2.6	6.3	2.1	3.4
2 1/8	5.0	3.3	8.2	2.6	4.5
2 5/8	6.0	4.1	10.0	3.2	5.2
3 1/8	7.5	5.0	12.0	4.0	6.4
3 5/8	9.0	5.9	15.0	4.7	7.3
4 1/8	10.0	6.7	17.0	5.2	8.5

Liquid Line Sizing

The liquid line diameter should be as small as possible while maintaining acceptable pressure drop. This is necessary to minimize refrigerant charge. The total length between the chiller unit and the air-cooled condenser must not exceed 200 actual feet (61 meters) or 300 equivalent feet (91 meters).

Liquid line risers in the system will require an additional 0.5 PSIG (3.5 kPa) pressure drop per foot (31 cm) of vertical rise. When it is necessary to have a liquid line riser, make the vertical run immediately after the condenser before any additional restrictions. The liquid line risers must not exceed 10 feet (3 meters) in height from the condenser liquid line connection (see Figure 3 - Condenser Located Below Chiller Unit). The liquid line does not require pitching. Install a pressure tap valve at the condenser to facilitate measuring pressure for service.

Liquid lines do not typically require insulation. However, if exposing the lines to solar heat gain or temperatures exceeding 110 °F (43°C), there is a negative effect on sub-cooling. In these situations, insulate the liquid lines.

Table 2 – Liquid Line Sizes

3 Ton Circuit					5 Ton Circuit				
Total Equivalent Length (Ft)	Liquid Line Size (Inch OD)				Total Equivalent Length (Ft)	Liquid Line Size (Inch OD)			
	Horizontal or Downflow	Upflow 1 to 5 Feet	Upflow 6 to 10 Feet	Upflow 6 to 10 Feet		Horizontal or Downflow	Upflow 1 to 5 Feet	Upflow 6 to 10 Feet	Upflow 6 to 10 Feet
25	1/2	1/2	1/2	1/2	25	1/2	1/2	1/2	3/4
50	1/2	1/2	1/2	1/2	50	1/2	1/2	5/8	3/4
75	1/2	1/2	1/2	1/2	75	1/2	1/2	5/8	3/4
100	1/2	1/2	1/2	1/2	100	1/2	1/2	5/8	3/4
125	1/2	1/2	1/2	1/2	125	1/2	5/8	5/8	3/4
150	1/2	1/2	1/2	1/2	150	1/2	5/8	3/4	3/4
175	1/2	1/2	1/2	1/2	175	5/8	5/8	3/4	3/4
200	1/2	1/2	1/2	1/2	200	5/8	5/8	3/4	3/4
225	1/2	1/2	1/2	1/2	225	5/8	5/8	3/4	3/4
250	1/2	1/2	1/2	1/2	250	5/8	5/8	3/4	3/4
275	1/2	1/2	1/2	1/2	275	5/8	5/8	3/4	3/4
300	1/2	1/2	1/2	1/2	300	5/8	5/8	3/4	3/4
7.5 Ton Circuit					**10 Ton Circuit**				
Total Equivalent Length (Ft)	Liquid Line Size (Inch OD)				Total Equivalent Length (Ft)	Liquid Line Size (Inch OD)			
	Horizontal or Downflow	Upflow 1 to 5 Feet	Upflow 6 to 10 Feet	Upflow 6 to 10 Feet		Horizontal or Downflow	Upflow 1 to 5 Feet	Upflow 6 to 10 Feet	Upflow 6 to 10 Feet
25	5/8	5/8	5/8	7/8	25	3/4	3/4	3/4	3/4
50	5/8	5/8	5/8	7/8	50	3/4	3/4	3/4	3/4
75	5/8	5/8	5/8	7/8	75	3/4	3/4	3/4	3/4
100	5/8	5/8	5/8	7/8	100	3/4	3/4	3/4	7/8
125	5/8	5/8	3/4	7/8	125	3/4	3/4	3/4	7/8
150	5/8	5/8	3/4	7/8	150	3/4	3/4	3/4	7/8
175	5/8	5/8	3/4	7/8	175	3/4	3/4	3/4	7/8
200	5/8	5/8	3/4	7/8	200	3/4	3/4	3/4	1 1/8
225	5/8	3/4	3/4	7/8	225	3/4	3/4	3/4	1 1/8
250	5/8	3/4	3/4	7/8	250	3/4	3/4	7/8	1 1/8
275	5/8	3/4	3/4	7/8	275	3/4	3/4	7/8	1 1/8
300	5/8	3/4	3/4	7/8	300	3/4	3/4	7/8	1 1/8

Table 2 – Liquid Line Sizes (continued)

15 Ton Circuit				
Total Equivalent Length (Ft)	Liquid Line Size (Inch OD)			
	Horizontal or Downflow	Upflow 1 to 5 Feet	Upflow 6 to 10 Feet	Upflow 6 to 10 Feet
25	7/8	7/8	7/8	7/8
50	7/8	7/8	7/8	7/8
75	7/8	7/8	7/8	7/8
100	7/8	7/8	7/8	1 1/8
125	7/8	7/8	7/8	1 1/8
150	7/8	7/8	7/8	1 1/8
175	7/8	7/8	7/8	1 1/8
200	7/8	7/8	7/8	1 1/8
225	7/8	7/8	7/8	1 1/8
250	7/8	7/8	1-1/8	1 1/8
275	7/8	7/8	1-1/8	1 1/8
300	7/8	7/8	1-1/8	1 1/8

20 Ton Circuit				
Total Equivalent Length (Ft)	Liquid Line Size (Inch OD)			
	Horizontal or Downflow	Upflow 1 to 5 Feet	Upflow 6 to 10 Feet	Upflow 6 to 10 Feet
25	7/8	7/8	7/8	1 3/8
50	7/8	7/8	7/8	1 3/8
75	7/8	7/8	7/8	1 3/8
100	7/8	7/8	7/8	1 3/8
125	7/8	7/8	1 1/8	1 3/8
150	7/8	7/8	1 1/8	1 3/8
175	7/8	7/8	1 1/8	1 3/8
200	7/8	1 1/8	1 1/8	1 3/8
225	7/8	1 1/8	1 1/8	1 3/8
250	7/8	1 1/8	1 1/8	1 3/8
275	1-1/8	1 1/8	1 1/8	1 3/8
300	1-1/8	1 1/8	1 1/8	1 3/8

25 Ton Circuit				
Total Equivalent Length (Ft)	Liquid Line Size (Inch OD)			
	Horizontal or Downflow	Upflow 1 to 5 Feet	Upflow 6 to 10 Feet	Upflow 6 to 10 Feet
25	1 1/8	1 1/8	1 1/8	1 3/8
50	1 1/8	1 1/8	1 1/8	1 3/8
75	1 1/8	1 1/8	1 1/8	1 3/8
100	1 1/8	1 1/8	1 1/8	1 3/8
125	1 1/8	1 1/8	1 1/8	1 3/8
150	1 1/8	1 1/8	1 1/8	1 3/8
175	1 1/8	1 1/8	1 1/8	1 3/8
200	1 1/8	1 1/8	1 1/8	1 3/8
225	1 1/8	1 1/8	1 1/8	1 3/8
250	1 1/8	1 1/8	1 1/8	1 3/8
275	1 1/8	1 1/8	1 1/8	1 3/8
300	1 1/8	1 1/8	1 1/8	1 3/8

30 Ton Circuit				
Total Equivalent Length (Ft)	Liquid Line Size (Inch OD)			
	Horizontal or Downflow	Upflow 1 to 5 Feet	Upflow 6 to 10 Feet	Upflow 6 to 10 Feet
25	1 1/8	1 1/8	1 1/8	1 1/8
50	1 1/8	1 1/8	1 1/8	1 1/8
75	1 1/8	1 1/8	1 1/8	1 1/8
100	1 1/8	1 1/8	1 1/8	1 3/8
125	1 1/8	1 1/8	1 1/8	1 3/8
150	1 1/8	1 1/8	1 1/8	1 3/8
175	1 1/8	1 1/8	1 1/8	1 3/8
200	1 1/8	1 1/8	1 1/8	1 3/8
225	1 1/8	1 1/8	1 1/8	1 3/8
250	1 1/8	1 1/8	1 3/8	1 5/8
275	1 1/8	1 1/8	1 3/8	1 5/8
300	1 1/8	1 1/8	1 3/8	1 5/8

35 Ton Circuit				
Total Equivalent Length (Ft)	Liquid Line Size (Inch OD)			
	Horizontal or Downflow	Upflow 1 to 5 Feet	Upflow 6 to 10 Feet	Upflow 6 to 10 Feet
25	1 1/8	1 1/8	1 1/8	1 1/8
50	1 1/8	1 1/8	1 1/8	1 1/8
75	1 1/8	1 1/8	1 1/8	1 3/8
100	1 1/8	1 1/8	1 1/8	1 3/8
125	1 1/8	1 1/8	1 1/8	1 3/8
150	1 1/8	1 1/8	1 1/8	1 3/8
175	1 1/8	1 1/8	1 1/8	1 3/8
200	1 1/8	1 1/8	1 1/8	1 5/8
225	1 1/8	1 1/8	1 3/8	1 5/8
250	1 1/8	1 1/8	1 3/8	1 5/8
275	1 1/8	1 1/8	1 3/8	1 5/8
300	1 1/8	1 1/8	1 3/8	1 5/8

40 Ton Circuit				
Total Equivalent Length (Ft)	Liquid Line Size (Inch OD)			
	Horizontal or Downflow	Upflow 1 to 5 Feet	Upflow 6 to 10 Feet	Upflow 6 to 10 Feet
25	1 1/8	1 1/8	1 1/8	1 5/8
50	1 1/8	1 1/8	1 1/8	1 5/8
75	1 1/8	1 1/8	1 1/8	1 5/8
100	1 1/8	1 1/8	1 3/8	1 5/8
125	1 1/8	1 1/8	1 3/8	1 5/8
150	1 1/8	1 1/8	1 3/8	1 5/8
175	1 1/8	1 1/8	1 3/8	1 5/8
200	1 1/8	1 3/8	1 3/8	1 5/8
225	1 1/8	1 3/8	1 3/8	1 5/8
250	1 1/8	1 3/8	1 5/8	1 5/8
275	1 3/8	1 3/8	1 5/8	1 5/8
300	1 3/8	1 3/8	1 5/8	1 5/8

Table 2 – Liquid Line Sizes (continued)

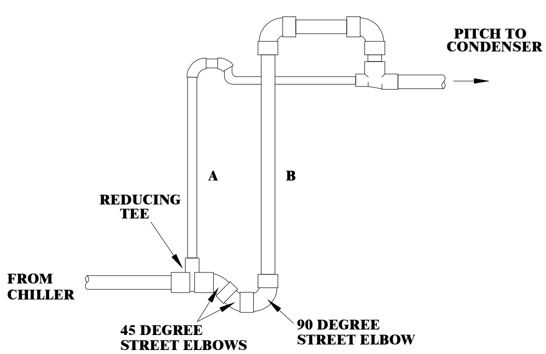
45 Ton Circuit					50 Ton Circuit				
Total Equivalent Length (Ft)	Liquid Line Size (Inch OD)				Total Equivalent Length (Ft)	Liquid Line Size (Inch OD)			
	Horizontal or Downflow	Upflow 1 to 5 Feet	Upflow 6 to 10 Feet	Upflow 6 to 10 Feet		Horizontal or Downflow	Upflow 1 to 5 Feet	Upflow 6 to 10 Feet	Upflow 6 to 10 Feet
25	1 1/8	1 1/8	1 1/8	2 1/8	25	1 1/8	1 1/8	1 5/8	2 1/8
50	1 1/8	1 1/8	1 3/8	2 1/8	50	1 1/8	1 1/8	2 1/8	2 1/8
75	1 1/8	1 1/8	1 3/8	2 1/8	75	1 1/8	1 3/8	2 1/8	2 1/8
100	1 1/8	1 1/8	1 3/8	2 1/8	100	1 1/8	1 3/8	2 1/8	2 1/8
125	1 1/8	1 3/8	1 5/8	2 1/8	125	1 1/8	1 3/8	2 1/8	2 1/8
150	1 1/8	1 3/8	1 5/8	2 1/8	150	1 3/8	1 3/8	2 1/8	2 1/8
175	1 1/8	1 3/8	1 5/8	2 1/8	175	1 3/8	1 3/8	2 1/8	2 1/8
200	1 3/8	1 3/8	1 5/8	2 1/8	200	1 3/8	1 5/8	2 1/8	2 1/8
225	1 3/8	1 3/8	1 5/8	2 1/8	225	1 3/8	1 5/8	2 1/8	2 1/8
250	1 3/8	1 3/8	1 5/8	2 1/8	250	1 3/8	1 5/8	2 1/8	2 1/8
275	1 3/8	1 3/8	1 5/8	2 1/8	275	1 3/8	1 5/8	2 1/8	2 1/8
300	1 3/8	1 3/8	1 5/8	2 1/8	300	1 3/8	1 5/8	2 1/8	2 1/8

Discharge (Hot Gas) Line Sizing

Discharge line size is based on the velocity needed to obtain sufficient oil return. Line length and restrictions should be minimized to reduce pressure drop and maximize capacity.

The discharge lines should pitch downward, in the direction of the hot gas flow, at the rate of ½ inch (1.25 cm) per each 10 foot (3 meter) of horizontal run. If the chiller unit is below condenser, loop the discharge line to at least 1 inch (2.5 cm) above the top of the condenser. A pressure tap valve should be installed at the condenser to facilitate measuring pressure for service. If the chiller is below the condenser, consideration must be taken in the design of the discharge gas riser. All of our chillers have unloading capabilities via hot gas bypass or compressor unloading; therefore, they all require a double discharge riser for proper oil management. An example of the double discharge line construction is shown in Figure 4. Refer to Table 3 to determine the size of the double discharge line riser. If the riser exceeds 25 feet (8 meters) in vertical height, the double discharge riser should be repeated for each 25 foot (8 meter) of rise.

Figure 4 - Double Discharge Riser



Note: Discharge line sizing for each chiller capacity is in Table 3. Line sizing shown in Table 3 is listed per circuit and applies where leaving water temperature (LWT) is 40°F (4.4°C) or higher. For applications where LWT is below 40°F (4.4°C), size lines using the ASHRAE Refrigeration Handbook or other suitable design guide.

Table 3 - Horizontal or Downflow Discharge Line Sizes (inches OD)

Circuit Tons	Total Equivalent Length (Ft)											
	25	50	75	100	125	150	175	200	225	250	275	300
3	5/8	5/8	3/4	3/4	3/4	3/4	7/8	7/8	7/8	7/8	7/8	7/8
5	3/4	7/8	7/8	1-1/8	1-1/8	1-1/8	1-1/8	1-1/8	1-1/8	1-1/8	1-1/8	1-1/8
7.5	7/8	7/8	1-1/8	1-1/8	1-1/8	1-1/8	1-1/8	1-1/8	1-1/8	1-3/8	1-3/8	1-3/8
10	7/8	1-1/8	1-1/8	1-1/8	1-3/8	1-3/8	1-3/8	1-3/8	1-3/8	1-3/8	1-3/8	1-3/8
15	1-1/8	1-1/8	1-1/8	1-3/8	1-3/8	1-3/8	1-3/8	1-3/8	1-3/8	1-5/8	1-5/8	1-5/8
20	1-1/8	1-3/8	1-3/8	1-3/8	1-3/8	1-5/8	1-5/8	1-5/8	1-5/8	1-5/8	1-5/8	1-5/8
25	1-3/8	1-3/8	1-5/8	1-5/8	1-5/8	1-5/8	2-1/8	2-1/8	2-1/8	2-1/8	2-1/8	2-1/8
30	1-3/8	1-3/8	1-5/8	1-5/8	1-5/8	2-1/8	2-1/8	2-1/8	2-1/8	2-1/8	2-1/8	2-1/8
35	1-3/8	1-5/8	1-5/8	1-5/8	2-1/8	2-1/8	2-1/8	2-1/8	2-1/8	2-1/8	2-1/8	2-1/8
40	1-5/8	1-5/8	1-5/8	2-1/8	2-1/8	2-1/8	2-1/8	2-1/8	2-1/8	2-1/8	2-1/8	2-1/8
45	1-5/8	1-5/8	2-1/8	2-1/8	2-1/8	2-1/8	2-1/8	2-1/8	2-1/8	2-1/8	2-5/8	2-5/8
50	1-5/8	1-5/8	2-1/8	2-1/8	2-1/8	2-1/8	2-1/8	2-1/8	2-5/8	2-5/8	2-5/8	2-5/8

Table 4 - Upflow Discharge Line Sizes (inches OD)

Circuit Tons	Total Equivalent Length (Ft)											
	25	50	75	100	125	150	175	200	225	250	275	300
3	A-3/8 B-1/2	A-3/8 B-1/2	A-3/8 B-5/8	A-3/8 B-5/8	A-3/8 B-5/8	A-3/8 B-5/8	A-3/8 B-3/4	A-3/8 B-3/4	A-3/8 B-3/4	A-3/8 B-3/4	A-3/8 B-3/4	A-3/8 B-3/4
5	A-3/8 B-5/8	A-3/8 B-3/4	A-3/8 B-3/4	A-3/8 B-7/8	A-3/8 B-7/8	A-3/8 B-7/8	A-3/8 B-7/8	A-3/8 B-7/8	A-3/8 B-7/8	A-3/8 B-7/8	A-3/8 B-7/8	A-3/8 B-7/8
7.5	A-1/2 B-5/8	A-1/2 B-5/8	A-1/2 B-7/8	A-1/2 B-7/8	A-1/2 B-7/8	A-1/2 B-7/8	A-1/2 B-7/8	A-1/2 B-7/8	A-1/2 B-7/8	A-1/2 B-1-1/8	A-1/2 B-1-1/8	A-1/2 B-1-1/8
10	A-1/2 B-5/8	A-1/2 B-7/8	A-1/2 B-7/8	A-1/2 B-7/8	A-1/2 B-1-1/8	A-1/2 B-1-1/8	A-1/2 B-1-1/8	A-1/2 B-1-1/8	A-1/2 B-1-1/8	A-1/2 B-1-1/8	A-1/2 B-1-1/8	A-1/2 B-1-1/8
15	A-5/8 B-7/8	A-5/8 B-7/8	A-5/8 B-7/8	A-5/8 B-1-1/8	A-5/8 B-1-1/8	A-5/8 B-1-1/8	A-5/8 B-1-1/8	A-5/8 B-1-1/8	A-5/8 B-1-1/8	A-5/8 B-1-3/8	A-5/8 B-1-3/8	A-5/8 B-1-3/8
20	A-5/8 B-7/8	A-5/8 B-1-1/8	A-5/8 B-1-1/8	A-5/8 B-1-1/8	A-5/8 B-1-1/8	A-5/8 B-1-3/8	A-5/8 B-1-3/8	A-5/8 B-1-3/8	A-5/8 B-1-3/8	A-5/8 B-1-3/8	A-5/8 B-1-3/8	A-5/8 B-1-3/8
25	A-3/4 B-1-1/8	A-3/4 B-1-1/8	A-3/4 B-1-3/8	A-3/4 B-1-3/8	A-3/4 B-1-3/8	A-3/4 B-1-3/8	A-3/4 B-1-5/8	A-3/4 B-1-5/8	A-3/4 B-1-5/8	A-3/4 B-1-5/8	A-3/4 B-1-5/8	A-3/4 B-1-5/8
30	A-3/4 B-1-1/8	A-3/4 B-1-1/8	A-3/4 B-1-3/8	A-3/4 B-1-3/8	A-3/4 B-1-3/8	A-3/4 B-1-5/8	A-3/4 B-1-5/8	A-3/4 B-1-5/8	A-3/4 B-1-5/8	A-3/4 B-1-5/8	A-3/4 B-1-5/8	A-3/4 B-1-5/8
35	A-3/4 B-1-1/8	A-3/4 B-1-3/8	A-3/4 B-1-3/8	A-3/4 B-1-3/8	A-3/4 B-1-5/8	A-3/4 B-1-5/8	A-3/4 B-1-5/8	A-3/4 B-1-5/8	A-3/4 B-1-5/8	A-3/4 B-1-5/8	A-3/4 B-1-5/8	A-3/4 B-1-5/8
40	A-7/8 B-1-3/8	A-7/8 B-1-3/8	A-7/8 B-1-3/8	A-7/8 B-1-5/8	A-7/8 B-1-5/8	A-7/8 B-1-5/8	A-7/8 B-1-5/8	A-7/8 B-1-5/8	A-7/8 B-1-5/8	A-7/8 B-1-5/8	A-7/8 B-1-5/8	A-7/8 B-1-5/8
45	A-7/8 B-1-3/8	A-7/8 B-1-3/8	A-7/8 B-1-5/8	A-7/8 B-1-5/8	A-7/8 B-1-5/8	A-7/8 B-1-5/8	A-7/8 B-1-5/8	A-7/8 B-1-5/8	A-7/8 B-1-5/8	A-7/8 B-1-5/8	A-7/8 B-2-1/8	A-7/8 B-2-1/8
50	A-7/8 B-1-3/8	A-7/8 B-1-3/8	A-7/8 B-1-5/8	A-7/8 B-1-5/8	A-7/8 B-1-5/8	A-7/8 B-1-5/8	A-7/8 B-1-5/8	A-7/8 B-1-5/8	A-7/8 B-2-1/8	A-7/8 B-2-1/8	A-7/8 B-2-1/8	A-7/8 B-2-1/8

Calculating System Refrigerant and Oil Charge

The approximate amount of the refrigerant charge required by the system can be determined by using Tables 1 and 2. To verify the system charge, run the system and check the liquid line sight glasses.

To determine the approximate charge, first refer to Table 5 and establish the required charge for the condenser and chiller. Values given in Table 5 are per circuit. Then refer to Table 6 to determine the charge required for the field-installed piping per circuit. The approximate charge per circuit is therefore the sum of the values from Tables 5 and 6.

Table 5 – Combined Chiller and Remote Condenser Refrigerant Charge (Lbs. of refrigerant per Circuit)

Chiller Model	Minimum Design Ambient - °F								
	60	50	40	30	20	10	0	-10	-20
EQ2R3	9	9	10	11	12	13	13	13	14
SQ2R5	10	10	12	14	15	16	16	17	17
LQ2R8	13	13	15	17	19	20	21	21	22
LQ2R10	18	19	22	25	27	29	30	31	32
LQ2R15	25	25	25	26	31	34	36	38	40
LQ2R20	30	30	30	32	37	41	44	47	49
LQ2R25	51	51	51	52	52	58	63	67	71
LQ2R30	51	51	51	51	51	51	55	55	65
LQ2R35	70	70	70	70	70	70	76	76	88
LQ2R40	80	80	80	80	80	80	80	88	94
TSR20A	19	19	23	25	27	29	30	31	32
TSR30A	25	25	25	26	30	33	36	37	39
TSR40A	44	44	45	46	51	55	58	61	63
TSR50A	45	45	45	45	45	50	54	57	59
TSR60A	51	51	51	53	60	65	69	73	75
TSR80A	59	59	60	60	60	68	74	80	84
TSR100A	60	60	60	61	61	68	75	80	84

Table 6 - Field Piping Charge

Line Size OD (inches)	Refrigerant Charge (pounds) Per 100 Feet of Run	
	Discharge Line	Liquid Line
3/8	-	4
1/2	-	8
5/8	1	12
3/4	1	17
7/8	2	24
1-1/8	3	40
1-3/8	4	61
1-5/8	6	86
2-1/8	10	150
2-5/8	14	231
3-1/8	20	330
3-5/8	27	445
4-1/8	35	580

Oil Charge Determination

The chiller is factory charged with the amount of oil required by the chiller only and not the total system. Refer to the manual that came with the chiller to determine the type of oil used. The amount of oil required is dependent upon the amount of refrigerant that is added to the system for the field-installed piping.
Calculate the amount of oil to be added, using the following formula:

Pints of Oil = Lbs. of refrigerant added / 100

Oil level should be checked after the chiller has run for 15 minutes.

Setting Condenser Fan Controls

Depending on the number of condenser fans present in the condenser there will be different fan cycling pressure control settings requirements. It is important that these setting be correct in order to maintain proper capacity control and operation of the system. Each refrigerant circuit has a separate head pressure control circuit. The proper pressure settings are shown in Table 7.

Table 7 - Condenser Fan Control Pressure Settings

	Number of Fan Stages	1	2	3	4	5	6
Stage 1	Set Point	180	180	180	180	180	180
	Differential	40	40	40	40	40	40
	Fan ON	220	220	220	220	220	220
	Fan OFF	180	180	180	180	180	180
Stage 2	Offset		30	30	10	10	10
	Differential		40	40	40	40	40
	Fan ON		250	250	230	230	230
	Fan OFF		210	210	190	190	190
Stage 3	Offset			50	20	20	20
	Differential			40	40	40	40
	Fan ON			270	240	240	240
	Fan OFF			230	200	200	200
Stage 4	Offset				30	30	30
	Differential				40	40	40
	Fan ON				250	250	250
	Fan OFF				210	210	210
Stage 5	Offset					40	40
	Differential					40	40
	Fan ON					260	260
	Fan OFF					220	220
Stage 6	Offset						50
	Differential						40
	Fan ON						270
	Fan OFF						230

Note: Dual circuit condensers have two separate head-pressure controls circuits.

Drawings

We have prepared a custom set of drawings for your unit and placed them inside the shipping box or control panel prior to shipment. Please refer to these drawings when troubleshooting, servicing, and installing the unit. If you cannot find these drawings or wish to have additional copies sent, please contact our Customer Service Department and reference the serial number of your unit. The drawings included in this manual are typical only and may not represent the actual unit purchased.

Notes

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