THERMAL CARE

EQR, SQR, LQR, TSR & TXR Series Chiller Remote Air Cooled Condenser

Installation Guidelines Manual

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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 enclosed installation instructions may result in damage that will not be 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 supplemented as required to accommodate any special items that may have been 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 schematics included in this manual are typical only. Actual schematics are included in the electrical enclosure of the remote condenser and should be referred to for troubleshooting and servicing of the unit. Additional copies of wiring diagrams are available upon request. We strive to maintain an accurate record of all equipment during the course of its useful life. While every effort is made to standardize the design features of these condensers, 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.

Specific references to current applicable codes, ordinances, and other local laws pertaining to the use and operation of this equipment are avoided due to their ever-changing nature. 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 condenser is designed for use with chemical refrigerants for heat transfer purposes. This chemical is sealed and tested in a pressurized system containing ASME coded vessels; however, refrigerant gas can be released if there is a system failure. Refrigerant gas can cause toxic fumes if it is exposed to fire. These units must be placed in a well-ventilated area, especially if open flames are present.

Failure to follow these instructions could result in a hazardous condition. The standard refrigerant used in these units is a hydrochloro-fluorocarbon (HCFC) trade named R-22. The EPA has enacted laws regarding the handling of refrigerants and eventual phase-out of HCFC refrigerants. HCFC refrigerant production will continue until January 1, 2010 for new equipment and until January 1, 2020 for service purposes. Customers are advised to immediately implement a refrigerant management program including a survey of all equipment to document the type and quantity of refrigerant in each machine. All refrigeration service technicians must be certified by an EPA approved organization. It is recommended that good piping practices are followed and that the information in this manual is adhered to. We cannot be held responsible for liabilities created by substandard piping methods and installation practices external to the chiller or condenser(s).

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

Each unit is shipped with a holding charge of nitrogen. Before accepting delivery, check the condenser to ensure the coils are still full of the nitrogen holding charge and check the entire unit for visible damage. If damage is evident, it should be properly documented on the delivery receipt and the box or crate should be immediately removed to allow for detailed inspection of the unit. Check for broken refrigerant lines, oil leaks, damaged controls, or any other major component torn loose from its mounting point. Any sign of damage should be recorded and a claim filed immediately with the shipping company. In order to expedite payment for damages it is important to record and document damage. An excellent way to do this is by taking pictures. Our Customer Service Department will provide assistance with the preparation and filing of your claims, including arranging for an estimate and quotation on repairs.

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 is shipped with the legs removed. The legs must be mounted to the condenser using the provided nuts, bolts and washers.

Proper rigging methods must be followed to prevent damage to components. Avoid impact loading caused by sudden jerking when lifting or lowering the condenser. Use pads where abrasive surface contact is anticipated.

CAUTION: Under no circumstances should the condenser manifolds, control panel or return bends of the condenser coil be used for lifting or moving the condenser.

The condenser is designed for outdoor use. A primary concern when designing your unit was serviceability; therefore, the condenser should be located in an accessible area. The unit must be installed 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. Mounting legs should be securely fastened 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 is shipped with a full charge of oil, excluding the additional charge for field piping, and a refrigerant holding charge. The chiller is designed 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 designed to operate in lower ambient air temperatures, the chiller may also contain head pressure control valves. The discharge and liquid lines leaving the chiller are capped. 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 is properly sized and that the piping runs are properly laid out. 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 flow dry nitrogen through the system prior to charging with refrigerant. This prevents scale formation and the possible formation of an explosive mixture of HCFC-22 and air. This will also prevent the formation of toxic phosgene gas, which occurs when HCFC-22 is exposed to open flame. Soft solders are not to be used. For copper-to-copper joints use a phos-copper solder with 6% to 8% silver content. A high silver content brazing rod must be used for copper-to-brass or copper-to-steel joints. Only use oxy-acetylene brazing.

Compressor Phasing

During manufacturing, chillers with remote condensers are put through a *limited* testing program since the condenser is not connected to the chiller. When the refrigeration circuit is constructed at the factory, it is capped and sealed at the remote condenser connections to prevent contamination. Because of this, the refrigeration circuit cannot be run and the compressor cannot be tested for proper phasing. After the refrigerant piping is connected to the remote condenser and the circuit is properly charged, check the phasing of the compressor to make sure there is proper rotation. The compressor may need to be re-wired to have proper phasing.

Refrigeration Piping Design

The system can be configured in any of the primary arrangements as shown in Figures 1, 2 and 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 and oil charges. Consequently, there are physical limits that must not be violated if the system is to operate 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 4).
3. Discharge line risers cannot exceed an elevation difference greater than 100 actual feet (31 meters) without a minimum of 2% efficiency decrease.

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 plus the added friction loss of elbows, valves, etc. Table 1 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 Tables 2 and 3 for a first approximation of line size.

3. Check the line size by calculating the actual equivalent length.

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

Table 1 - Equivalent Lengths (in feet)

Line Size OD (inches)	Angle Valve	Short Radius EL	Long Radius EL
3/8	24	4	2.8
1/2	24	4.7	3.2
5/8	25	5.7	3.9
3/4	25	6.5	4.5
7/8	28	7.8	5.3
1-1/8	29	2.7	1.9
1-3/8	33	3.2	2.2
1-5/8	34	3.8	2.6
2-1/8	39	5.2	3.4
2-5/8	44	6.5	4.2

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 15 feet (5 meters) in height

from the condenser liquid line connection (see Figure 3). The liquid line does not have to be pitched.

Liquid lines are not typically insulated. However, if the lines are exposed to solar heat gain or temperatures exceeding 110 °F (43°C), sub-cooling may be effected. In these situations, insulate the liquid lines.

Figure 1 - Condenser Located with No Elevation Difference

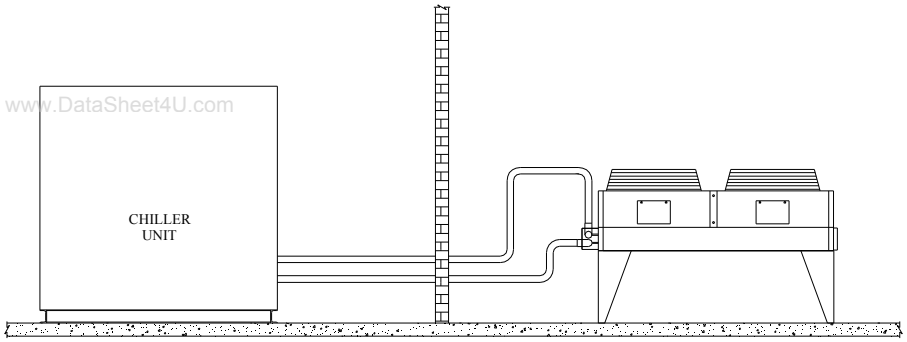


Figure 2 - Condenser Located above Chiller Unit

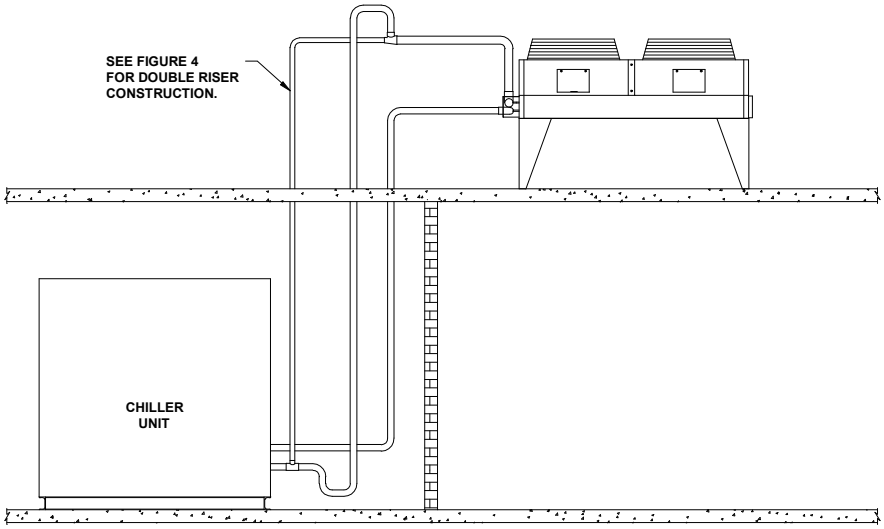
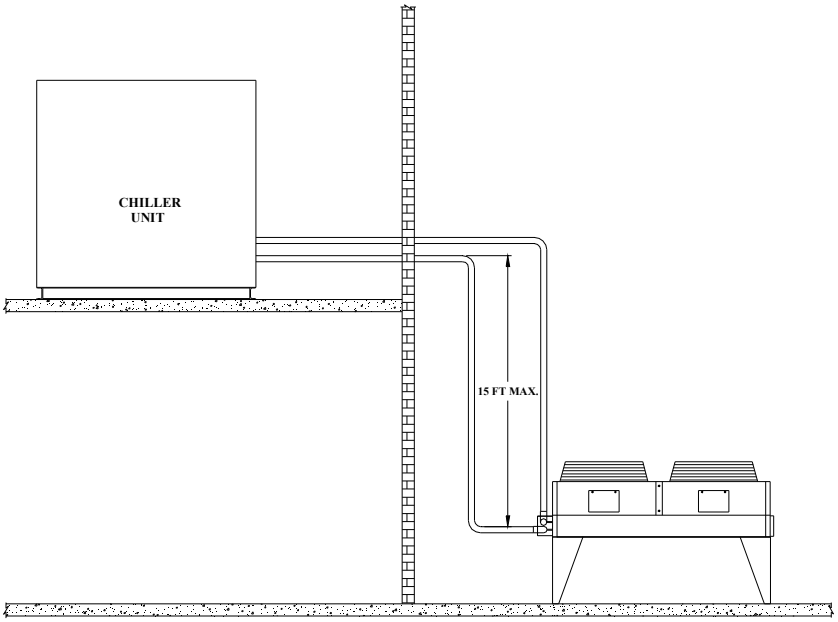


Figure 3 - Condenser Located below Chiller Unit



Note: Liquid line sizing for each chiller capacity is shown in Table 2. Line sizing shown in Table 2 is listed per circuit and applies 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.

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 11 to 15 Feet		Horizontal or Downflow	Upflow 1 to 5 Feet	Upflow 6 to 10 Feet	Upflow 11 to 15 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 11 to 15 Feet		Horizontal or Downflow	Upflow 1 to 5 Feet	Upflow 6 to 10 Feet	Upflow 11 to 15 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

15 Ton Circuit					20 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 11 to 15 Feet		Horizontal or Downflow	Upflow 1 to 5 Feet	Upflow 6 to 10 Feet	Upflow 11 to 15 Feet
25	7/8	7/8	7/8	7/8	25	7/8	7/8	7/8	1 3/8
50	7/8	7/8	7/8	7/8	50	7/8	7/8	7/8	1 3/8
75	7/8	7/8	7/8	7/8	75	7/8	7/8	7/8	1 3/8
100	7/8	7/8	7/8	1 1/8	100	7/8	7/8	7/8	1 3/8
125	7/8	7/8	7/8	1 1/8	125	7/8	7/8	1 1/8	1 3/8
150	7/8	7/8	7/8	1 1/8	150	7/8	7/8	1 1/8	1 3/8
175	7/8	7/8	7/8	1 1/8	175	7/8	7/8	1 1/8	1 3/8
200	7/8	7/8	7/8	1 1/8	200	7/8	1 1/8	1 1/8	1 3/8
225	7/8	7/8	7/8	1 1/8	225	7/8	1 1/8	1 1/8	1 3/8
250	7/8	7/8	1-1/8	1 1/8	250	7/8	1 1/8	1 1/8	1 3/8
275	7/8	7/8	1-1/8	1 1/8	275	1-1/8	1 1/8	1 1/8	1 3/8
300	7/8	7/8	1-1/8	1 1/8	300	1-1/8	1 1/8	1 1/8	1 3/8

Table 2 - Liquid Line Sizes (continued)

25 Ton Circuit					30 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 11 to 15 Feet		Horizontal or Downflow	Upflow 1 to 5 Feet	Upflow 6 to 10 Feet	Upflow 11 to 15 Feet
25	1 1/8	1 1/8	1 1/8	1 3/8	25	1 1/8	1 1/8	1 1/8	1 1/8
50	1 1/8	1 1/8	1 1/8	1 3/8	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	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	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	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	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	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	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	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	250	1 1/8	1 1/8	1 3/8	1 5/8
275	1 1/8	1 1/8	1 1/8	1 3/8	275	1 1/8	1 1/8	1 3/8	1 5/8
300	1 1/8	1 1/8	1 1/8	1 3/8	300	1 1/8	1 1/8	1 3/8	1 5/8

35 Ton Circuit					40 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 11 to 15 Feet		Horizontal or Downflow	Upflow 1 to 5 Feet	Upflow 6 to 10 Feet	Upflow 11 to 15 Feet
25	1 1/8	1 1/8	1 1/8	1 1/8	25	1 1/8	1 1/8	1 1/8	1 5/8
50	1 1/8	1 1/8	1 1/8	1 1/8	50	1 1/8	1 1/8	1 1/8	1 5/8
75	1 1/8	1 1/8	1 1/8	1 3/8	75	1 1/8	1 1/8	1 1/8	1 5/8
100	1 1/8	1 1/8	1 1/8	1 3/8	100	1 1/8	1 1/8	1 3/8	1 5/8
125	1 1/8	1 1/8	1 1/8	1 3/8	125	1 1/8	1 1/8	1 3/8	1 5/8
150	1 1/8	1 1/8	1 1/8	1 3/8	150	1 1/8	1 1/8	1 3/8	1 5/8
175	1 1/8	1 1/8	1 1/8	1 3/8	175	1 1/8	1 1/8	1 3/8	1 5/8
200	1 1/8	1 1/8	1 1/8	1 5/8	200	1 1/8	1 3/8	1 3/8	1 5/8
225	1 1/8	1 1/8	1 3/8	1 5/8	225	1 1/8	1 3/8	1 3/8	1 5/8
250	1 1/8	1 1/8	1 3/8	1 5/8	250	1 1/8	1 3/8	1 5/8	1 5/8
275	1 1/8	1 1/8	1 3/8	1 5/8	275	1 3/8	1 3/8	1 5/8	1 5/8
300	1 1/8	1 1/8	1 3/8	1 5/8	300	1 3/8	1 3/8	1 5/8	1 5/8

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 11 to 15 Feet		Horizontal or Downflow	Upflow 1 to 5 Feet	Upflow 6 to 10 Feet	Upflow 11 to 15 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

Table 2 - Liquid Line Sizes (continued)

60 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 11 to 15 Feet
25	1 3/8	1 3/8	1 3/8	2 1/8
50	1 3/8	1 3/8	1 3/8	2 1/8
75	1 3/8	1 3/8	1 3/8	2 1/8
100	1 3/8	1 3/8	1 3/8	2 1/8
125	1 3/8	1 3/8	1 3/8	2 1/8
150	1 3/8	1 3/8	1 5/8	2 1/8
175	1 3/8	1 3/8	1 5/8	2 1/8
200	1 3/8	1 3/8	1 5/8	2 1/8
225	1 3/8	1 3/8	1 5/8	2 1/8
250	1 3/8	1 3/8	1 5/8	2 1/8
275	1 3/8	1 5/8	1 5/8	2 1/8
300	1 3/8	1 5/8	1 5/8	2 1/8

70 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 11 to 15 Feet
25	1-5/8	1-5/8	1-5/8	2-1/8
50	1-5/8	1-5/8	1-5/8	2-1/8
75	1-5/8	1-5/8	1-5/8	2-1/8
100	1-5/8	1-5/8	1-5/8	2-1/8
125	1-5/8	1-5/8	1-5/8	2-1/8
150	1-5/8	1-5/8	1-5/8	2-1/8
175	1-5/8	1-5/8	1-5/8	2-1/8
200	1-5/8	1-5/8	1-5/8	2-1/8
225	1-5/8	1-5/8	1-5/8	2-1/8
250	1-5/8	1-5/8	1-5/8	2-1/8
275	1-5/8	1-5/8	1-5/8	2-1/8
300	1-5/8	1-5/8	1-5/8	2-1/8

80 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 11 to 15 Feet
25	1-5/8	1-5/8	1-5/8	2-1/8
50	1-5/8	1-5/8	1-5/8	2-1/8
75	1-5/8	1-5/8	1-5/8	2-1/8
100	1-5/8	1-5/8	1-5/8	2-1/8
125	1-5/8	1-5/8	1-5/8	2-1/8
150	1-5/8	1-5/8	1-5/8	2-1/8
175	1-5/8	1-5/8	1-5/8	2-1/8
200	1-5/8	1-5/8	1-5/8	2-1/8
225	1-5/8	1-5/8	1-5/8	2-1/8
250	1-5/8	1-5/8	1-5/8	2-1/8
275	1-5/8	1-5/8	1-5/8	2-1/8
300	1-5/8	1-5/8	1-5/8	2-1/8

90 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 11 to 15 Feet
25	1-5/8	1-5/8	1-5/8	2-1/8
50	1-5/8	1-5/8	1-5/8	2-1/8
75	1-5/8	1-5/8	1-5/8	2-1/8
100	1-5/8	1-5/8	1-5/8	2-1/8
125	1-5/8	1-5/8	1-5/8	2-1/8
150	1-5/8	1-5/8	1-5/8	2-1/8
175	1-5/8	1-5/8	1-5/8	2-1/8
200	1-5/8	1-5/8	1-5/8	2-1/8
225	1-5/8	1-5/8	1-5/8	2-1/8
250	1-5/8	1-5/8	1-5/8	2-1/8
275	1-5/8	1-5/8	2-1/8	2-1/8
300	1-5/8	1-5/8	2-1/8	2-1/8

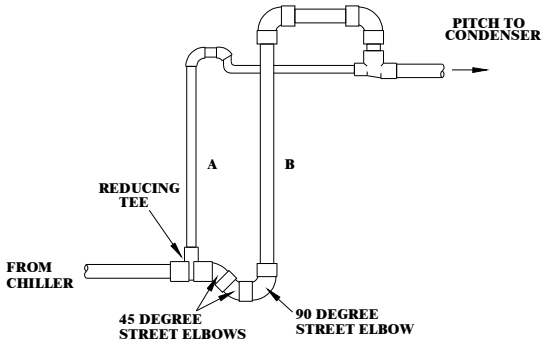
100 Ton Circuit				
Total Equivalent Length (Ft)	Liquid Line Size (Inch OD)			
	Horizontal or Downflow	Upflow 1 to 5 Feet	Upflow 6 to 10 Feet	Upflow 11 to 15 Feet
25	1-5/8	1-5/8	1-5/8	2-1/8
50	1-5/8	1-5/8	1-5/8	2-1/8
75	1-5/8	1-5/8	1-5/8	2-1/8
100	1-5/8	1-5/8	1-5/8	2-1/8
125	1-5/8	1-5/8	1-5/8	2-1/8
150	1-5/8	1-5/8	1-5/8	2-1/8
175	1-5/8	1-5/8	2-1/8	2-1/8
200	1-5/8	1-5/8	2-1/8	2-1/8
225	1-5/8	1-5/8	2-1/8	2-1/8
250	1-5/8	1-5/8	2-1/8	2-1/8
275	1-5/8	1-5/8	2-1/8	2-5/8
300	1-5/8	1-5/8	2-1/8	2-5/8

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 shown 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
60	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	2-5/8	2-5/8	2-5/8
70	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	2-5/8	2-5/8	2-5/8
80	2-1/8	2-1/8	2-1/8	2-5/8	2-5/8	2-5/8	2-5/8	2-5/8	2-5/8	2-5/8	2-5/8	2-5/8
90	2-5/8	2-5/8	2-5/8	2-5/8	2-5/8	2-5/8	2-5/8	2-5/8	2-5/8	2-5/8	2-5/8	2-5/8
100	2-5/8	2-5/8	2-5/8	2-5/8	2-5/8	2-5/8	2-5/8	2-5/8	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
60	A-1-1/8 B-1-5/8	A-1-1/8 B-1-5/8	A-1-1/8 B-1-5/8	A-1-1/8 B-1-5/8	A-1-1/8 B-1-5/8	A-1-1/8 B-1-5/8	A-1-1/8 B-1-5/8	A-1-1/8 B-2-1/8	A-1-1/8 B-2-1/8	A-1-1/8 B-2-1/8	A-1-1/8 B-2-1/8	A-1-1/8 B-2-1/8
70	A-1-1/8 B-1-5/8	A-1-1/8 B-1-5/8	A-1-1/8 B-1-5/8	A-1-1/8 B-1-5/8	A-1-1/8 B-1-5/8	A-1-1/8 B-2-1/8	A-1-1/8 B-2-1/8	A-1-1/8 B-2-1/8	A-1-1/8 B-2-1/8	A-1-1/8 B-2-1/8	A-1-1/8 B-2-1/8	A-1-1/8 B-2-1/8
80	A-1-1/8 B-1-5/8	A-1-1/8 B-1-5/8	A-1-1/8 B-1-5/8	A-1-1/8 B-2-1/8	A-1-1/8 B-2-1/8	A-1-1/8 B-2-1/8	A-1-1/8 B-2-1/8	A-1-1/8 B-2-1/8	A-1-1/8 B-2-1/8	A-1-1/8 B-2-1/8	A-1-1/8 B-2-1/8	A-1-1/8 B-2-1/8
90	A-1-1/8 B-2-1/8	A-1-1/8 B-2-1/8	A-1-1/8 B-2-1/8	A-1-1/8 B-2-1/8	A-1-1/8 B-2-1/8	A-1-1/8 B-2-1/8	A-1-1/8 B-2-1/8	A-1-1/8 B-2-1/8	A-1-1/8 B-2-1/8	A-1-1/8 B-2-1/8	A-1-1/8 B-2-1/8	A-1-1/8 B-2-1/8
100	A-1-1/8 B-2-1/8	A-1-1/8 B-2-1/8	A-1-1/8 B-2-1/8	A-1-1/8 B-2-1/8	A-1-1/8 B-2-1/8	A-1-1/8 B-2-1/8	A-1-1/8 B-2-1/8	A-1-1/8 B-2-1/8	A-1-1/8 B-2-1/8	A-1-1/8 B-2-1/8	A-1-1/8 B-2-1/8	A-1-1/8 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 - Refrigerant Charge (Lbs. of HCFC-22 per Circuit)
Combined charge for remote condenser and chiller

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
TXR40	36	36	36	37	37	40	44	46	49
TSR40A	44	44	45	46	51	55	58	61	63
TXR50	74	74	74	74	74	74	80	80	94
TSR50A	45	45	45	45	45	50	54	57	59
TXR60	89	89	89	89	89	89	89	99	105
TSR60A	51	51	51	53	60	65	69	73	75
TXR70	59	59	59	60	61	68	74	80	84
TXR85	107	107	108	108	108	119	127	134	140
TSR80A	59	59	60	60	60	68	74	80	84
TSR100A	60	60	60	61	61	68	75	80	84
TXR80	72	72	72	73	73	81	87	92	97
TXR100	147	147	147	147	147	147	160	160	188
TXR105	147	147	147	147	147	147	160	160	188
TXR120	178	178	178	178	178	178	178	197	210
TXR140	118	118	119	120	121	136	148	159	168
TXR170	214	214	215	216	217	237	254	268	279
TXR200	294	294	294	294	294	294	319	319	376

Table 6 - Field Piping Charge

Line Size OD (inches)	Discharge Line Lbs. of HCFC-22	Liquid Line Lbs. of HCFC-22
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

Note: The amounts of refrigerant listed in Table 2 are based on 100 feet (31 meters) of pipe. Actual amounts will be in direct proportion to the actual length of the piping.

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 R-22 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

Notes

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