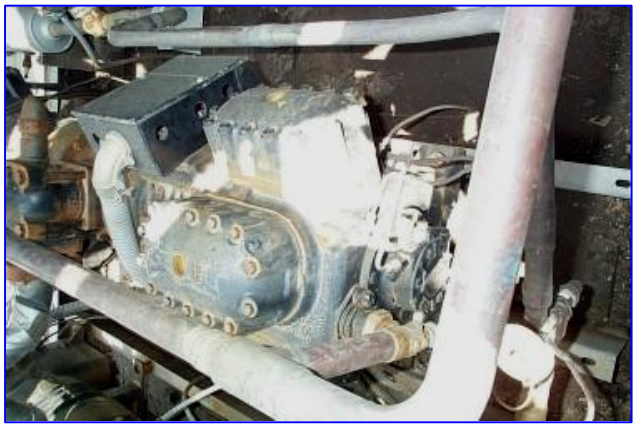
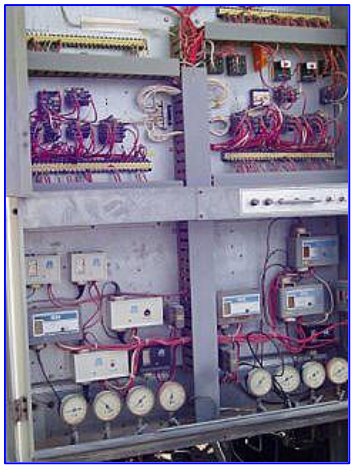
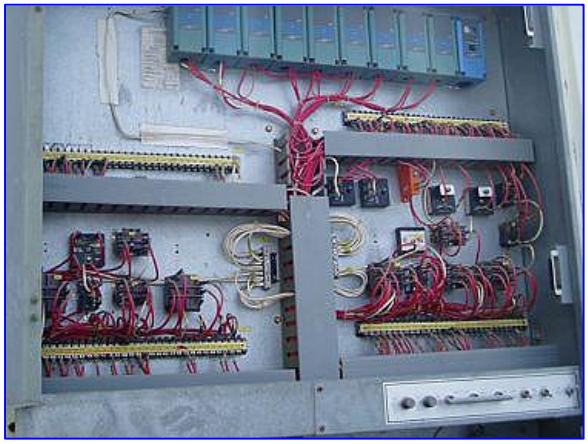
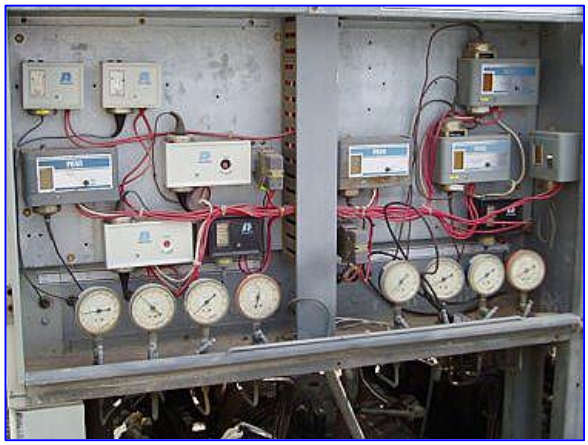
McQuay Air Cooled Chiller 130 Ton	
Mfg: McQuay	**Model: ALR130BD**
Stock No. ACEU07	**Serial No. 3NB0014312**

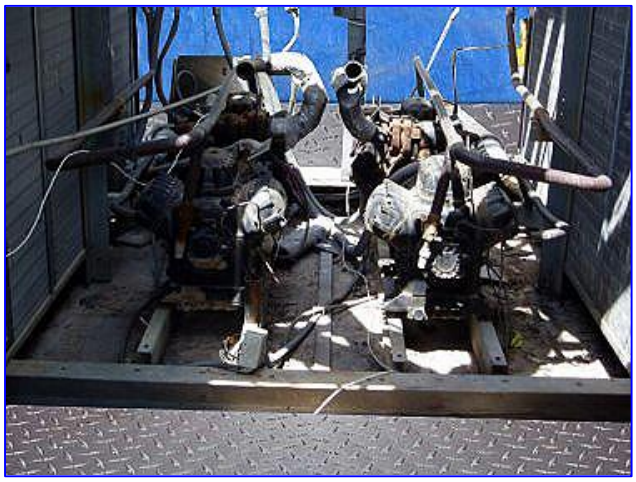
McQuay Air Cooled Chiller 130 Ton. Model ALR130BD. S/N 3NB0014312. Barrels were replaced in 1993 with newer models. Model CDE1410, S/N 5YM0015300. (4) compressors, 40 hp, 69 rla, 297 lra, 460 V, 60 hz, 3 phase. Copeland compressor. Model 6RJ-4000-TSN. S/N 960717. Copeland compressor. Model 6RJ-4000-TSN. S/N 93115. Copeland compressor. Model 6RJ-4000-TSN. S/N 931095. Copeland Compressor. Model 6RJ-4000-TSN. S/N 970758.



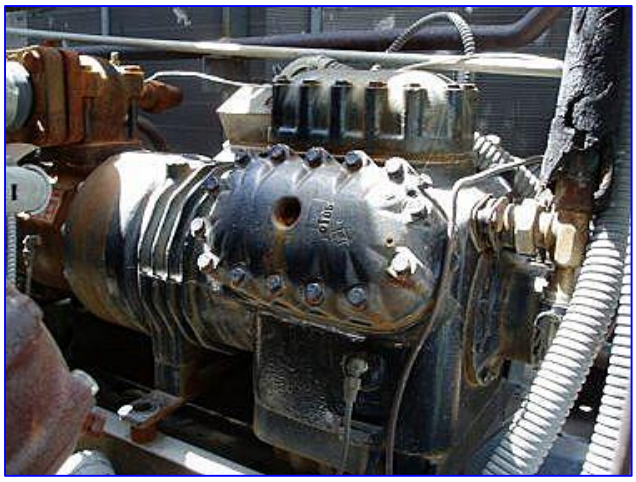


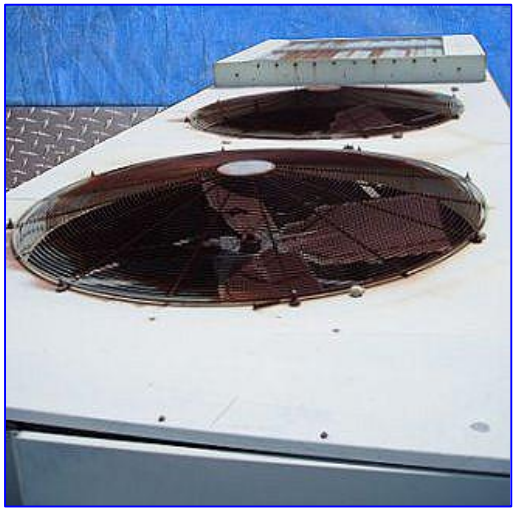


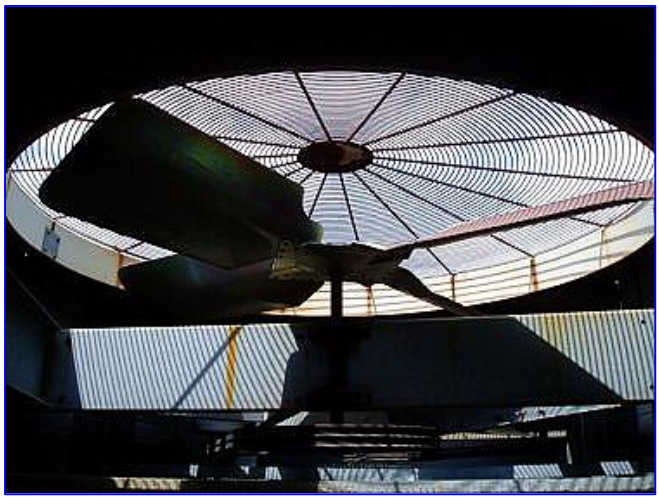





HIGH VOLTAGE
K*FP AWAY







Air-Cooled Reciprocating Water Chillers

ALR 110F through 150F
110 to 150 Tons, 380 to 525 kW
R-22
60 Hertz

McQuay Air Conditioning

Table of Contents

Remote evaporator arrangement
is not in ARI certification

Our facility is **ISO Certified**

Document Number:	PM ALR2-4
Revision:	April 2001
Replaces:	PM ALR2-3

Introduction

McQuay International offers a complete line of air-cooled chillers from 10 to 425 tons (35 to 1500 kW) utilizing scroll, reciprocating, and rotary screw compressors.

The McQuay ALR reciprocating compressor, air-cooled chiller is a product of the McQuay commitment to offer reliable, energy efficient equipment design. A design approach incorporating high quality compressors and uncompromised operating efficiency. McQuay International will provide its customers with products and services that meet or exceed their expectations in terms of quality, availability and competitiveness.

ARI 550/590-98 Certified

FEATURES-BENEFITS

Efficiency

- Cross-circuit compressor unloading
- Copeland DISCUS® compressors
- High efficiency lanced fin condenser coils

Reliability

- Rugged compressor design
- Factory installed operating and equipment protection controls
- Factory run tested with water hookup
- Code and agency approval

Flexibility

- Complete factory assembly
- Large size availability in small capacity increments
- A wide variety of field and factory installed options
- Available with remote evaporator (R-22 only)

Serviceability

- Semi-hermetic compressors
- Suction and discharge service valves
- Dual refrigerant circuits

Design Advantages

Construction

The ALR 110F through 150F are factory assembled and mounted on a rugged steel channel base. The channel base distributes the unit weight for low roof loading. Lifting holes in the base simplify rigging. Optional wire mesh base guards are available to prevent intrusion to the area under the coils.

The units pass the ASTM B117 500 hour salt spray test.

Compressors

ALR 110F through 150F chillers use Copeland DISCUS® semi-hermetic compressors. These compressors are designed for Refrigerant 22 and the high loading associated with air-cooled applications.

Semi-hermetic, 1750 rpm induction type motors are used. The motors are refrigerant-gas cooled. Solid-state modules in the motor terminal box respond to temperature sensors imbedded in all three motor windings, providing inherent thermal overload protection for all run and start conditions.

The compressor housing is constructed from closed grained, high nickel content, alloy cast-iron with no bolted joint between the motor and compressor. The housing includes a cast-iron cylinder head and stator cover, and a crankcase oil sightglass. A suction strainer built into the compressor in the gas stream between the suction service valve and the motor, filters out foreign and abrasive particles. An internal relief valve relieves discharge pressure to the suction side for safety protection at high compression ratios as required by ANSI/ASHRAE 15 Safety Code.

Main bearings are solid cast bronze insert type with oversized bearing area that result in ultra-low bearing loading.

The crankshaft is die-forged, high strength iron alloy with integral counterweights, statically and dynamically balanced for smooth operation.

Connecting rods are lightweight aluminum with integral bearing surfaces on the crankshaft and piston ends. Pistons are close grain cast iron with oil and compression rings. Piston pins are full floating type for long life.

Compressors have a forced-feed lubrication system with positive oil displacement, a reversible oil pump, and an operating oil charge. The pump feeds oil through rifle drilled passages in the crankshaft to all bearing surfaces. Magnetic plugs trap magnetic particles that enter the crankcase. The oil supply filters through a large area oil strainer. A crankcase heater minimizes oil dilution by refrigerant at start-up.

Condenser Coils

Condenser coils have internally enhanced seamless copper tubes arranged in a staggered row pattern. The tubes are mechanically expanded into McQuay lanced and rippled aluminum fins with full fin collars. See the Application Section of this manual for optional corrosive resistant fin material and coatings. An integral subcooler circuit provides subcooling to reduces the possibility of liquid flashing. Vinyl coated wire mesh coil guards for fin protection are supplied as standard.

Condenser Fans and Motors

Multiple direct drive propeller fans operate in formed bell shaped orifices at low tip speeds for maximum efficiency and minimum noise and vibration. A heavy-gauge close mesh fan guard protects each fan.

Each condenser fan motor is heavy-duty, 3-phase with permanently lubricated ball bearings and inherent overload protection.

Hot Gas Mufflers

Hot gas discharge line mufflers are installed in each refrigerant circuit to reduce the overall sound levels.

Evaporator

The evaporator is direct expansion, shell-and-tube type with water flowing in the baffled shell side and refrigerant flowing through the tubes. Two independent refrigerant circuits within the evaporator serve the unit's dual refrigerant circuits.

The evaporator has a carbon steel shell and seamless high efficiency copper tubes roller expanded into a carbon steel tube sheet.

Refrigerant heads are carbon steel with multi-pass baffles to provide oil return and are removable to permit access to the tubes from either end. For water removal and venting, 1/2" (12.7mm) vent and drain plugs are provided on the top and bottom of the shell.

The evaporator is wrapped with an electric resistance heater cable and insulated with 3/4" (19mm) thick vinyl nitrate polymer sheet insulation, protecting against water freeze-up at ambient air temperatures to -20°F (-29°C). An ambient thermostat controls the heater cable.

The insulation has a K factor of 0.28 at 75°F (23°C). The fitted and cemented in place insulation is painted with a resilient vinyl base paint to resist cracking.

The tube side maximum working pressure is 315 psig (2170 kPa). The water side working pressure is 152 psig (1047 kPa). Each evaporator is designed, constructed, inspected, and stamped according to the requirements of the ASME Boiler and Pressure Vessel Code.

NOTE: A chilled water pump starter interlock, water flow switch or both, must be field installed to protect against evaporator freeze-up under low water flow conditions.

Electrical Control Center

Operating and equipment protection controls, control transformer, and motor starting equipment is factory wired, operationally tested, and ready for service. All centrally located controls are in a weather-resistant, hinged control center with key-locked doors. Panel access doors include steel rod door retainers to secure the doors when open.

A fixed 5-minute, solid-state lockout timer delays compressor restart after a safety cutout, power interruption, or thermostat cycling.

Power connection to the unit can be single-point or multiple-point. Single point is usually more economical. Multiple point provides separate power for each of two compressor circuits plus a third circuit for the fans and control power.

Part winding start is standard on 208 and 230 volt compressor motors. Across-the-line start is standard on 380, 460 and 575 volts.

Circuit Breakers

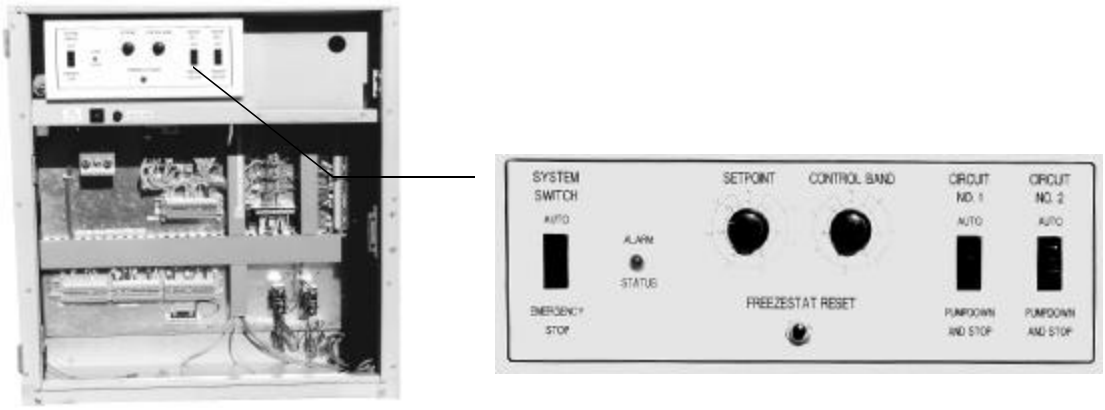
Circuit breakers are factory installed, providing unit compressor short circuit protection.

Standard UNT Controller

This microprocessor based control accomplishes unit capacity control by staging compressors and by cylinder unloading based on leaving chilled water temperature. Setpoint and control band are easily field adjusted. Anti-cycling and stage delay timers are included. Equipment protective controls include low refrigerant pressure, low evaporator flow (field installed flow switch), low oil pressure, and sensor failures. Outside air temperature sensor is standard. Reset options are; outside air, return water, remote reset, demand limit, zone temperature reset. The optional Zone Terminal and Display control is required to adjust the reset setpoints.

Thirty feet of sensor cable is included, rolled up in the control panel, on remote evaporator models. The cable can be field spliced for a total run not to exceed 75 feet.

Figure 1, Standard UNT Controller

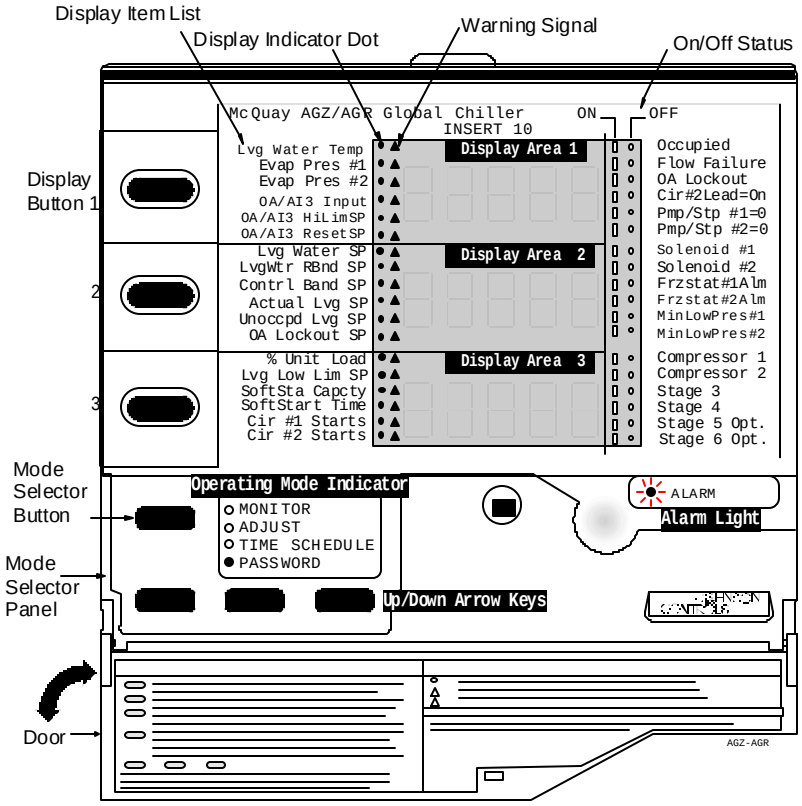


UNT with Optional Zone Terminal and Display

The optional Zone Terminal and Display can be mounted in the chiller control panel or remotely located providing monitoring and adjusting of certain functions.

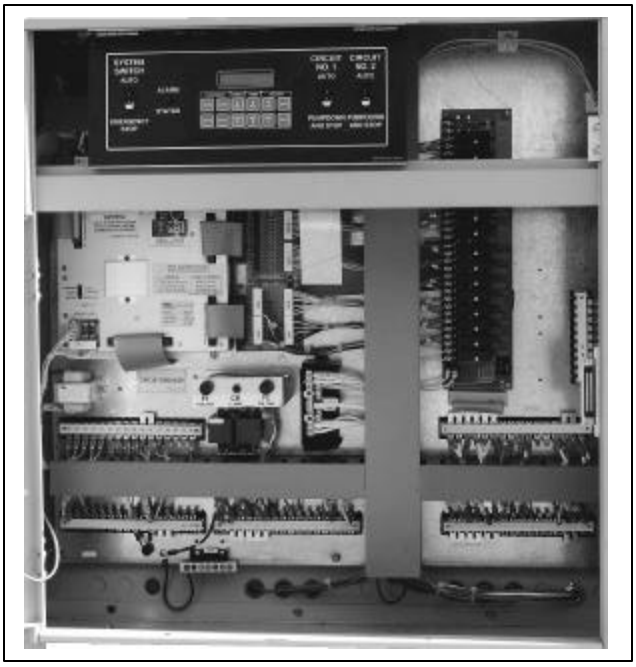
- Monitoring
  - Monitor up to three setting or sensed values
  - Monitor 18 different on/off inputs
  - Monitor alarm status via a flashing alarm light and flashing symbol
- Adjusting allows adjustment of any flashing set points, three at a time, typically set up so that the relationship between values can be viewed simultaneously. For example:
  - Display 1 = Lvg Water temp, Display 2 = Lvg Water SP, Display 3 = % Unit Load

Figure 2, Zone Terminal Configuration



Optional MicroTech Control

Figure 3, Optional MicroTech Control Panel



The exclusive MicroTech microprocessor control is common throughout McQuay equipment. The interface is a 12 key keypad and 2-line, 32 character backlit liquid crystal display. The MicroTech continuously performs self-diagnostic checks on all system temperatures, pressures, and safeties, and will automatically shut down a circuit or the entire unit if a fault condition occurs. The cause, time, and date of the occurrence is recorded and can be displayed. The seven previous incidents are kept in memory for service reference.

If a fault occurs, the controller takes preventive measures in an effort to keep the unit operating; staging down capacity, activating a pre-alarm signal, and automatically switching to the alarm menu on the display. Pre-alarms are self-clearing when the fault condition is no longer present.

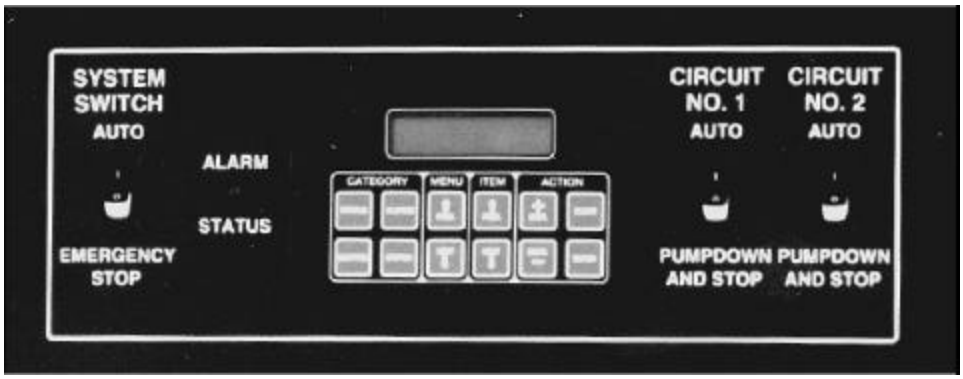
Critical shutdown alarms such as high condenser pressure (with mechanical back up), freeze protection, oil pressure (with mechanical back up), and low evaporator pressure are manual reset and must be cleared at the keypad to resume operation.

Choose the MicroTech control and Open Protocol options to interface with virtually any building management system and perform remote monitoring and control by hard wiring or modem. A nominal site license fee is required for a Building Automation System (BAS) interface.

A single chiller can connect directly to the BAS. Two or more units will require an Open Protocol Panel (OPM) for connection.

Thirty feet of sensor cable is included, rolled up in the control panel, on remote evaporator models. The cable can be field spliced for a total run not to exceed 75 feet.

Figure 4, MicroTech Control



Selection Procedure

Table 4 (R-22) covers the range of leaving evaporator water temperatures and ambient air temperatures encompassed under ARI 550/590-98. Table 5 covers SI units. The tables are based on a 10 degree F temperature drop through the evaporator (2.4 gpm/ton). Adjustment factors for applications having other than a 10 degree F drop can be found in Table 3. The minimum leaving chilled water temperature setpoint without glycol is 42°F at 2.4 gpm/ton. For brine selections, see Table 1 for ethylene glycol or Table 2 for propylene glycol adjustment factors. Ratings are based on a 0.0001 fouling factor in the evaporator at sea level operation. See Table 3 for other fouling factors, derates for different delta-Ts, or altitude correction factors. For applications outside the catalog ratings contact your local McQuay sales representative.

Selection example

Given:

R-22, 110 tons minimum.
95°F ambient temperature
264 gpm, 54°F - 44°F chilled water
0.0001 evaporator fouling factor

1. From Performance Table 4, an ALR 110F at the given conditions will produce 110.9 tons with a compressor kW input of 120.6 and a unit EER of 9.8
2. Use the following formula (for water) to calculate missing elements:

$$\text{gpm} = \frac{tons \times 24}{\Delta T°F}$$

3. Determine the evaporator pressure drop. Using Figure 5, enter at 264 gpm and follow up to the ALR 110 line intersect. Read horizontally to obtain an evaporator pressure drop of 14.3 feet of water.

Selection example using ethylene glycol

Given:

R-22, 105 tons minimum
95°F ambient air temperature
54°F - 44°F chilled water temperature
0.0001 evaporator fouling factor
Protect from freezing down to 0°F

1. From Table 1, select an ethylene glycol concentration of 40% to protect against freezing at 0°F.
2. At 40% glycol: Capacity = 0.961, kW = 0.976,
   flow = 1.121, pressure drop = 1.263
3. Consider the ALR 110F and correct with 40% ethylene glycol factors.
4. Correct capacity = 0.961 x 110.9 tons = 106.6 tons
5. Correct compressor kW = 0.976 x 120.6 kW = 119.5 kW
6. Correct chilled water flow for flow required for the glycol solution:

$$\text{Water flow (at corrected capacity)} = \frac{106.6\ tons \times 24}{\Delta T 10°F} = 256\ \text{gpm}$$

Glycol flow (at 40% solution) = 1.121 x 256 gpm = 286.8 gpm

Determine the evaporator pressure drop. Using Figure 5, enter at 256 gpm (water flow rate) and follow up to the ALR 110F line intersect. Read horizontally to obtain an evaporator pressure drop of 13.6 feet. The pressure drop for 40% solution = 1.263 x 13.6 feet = 17.2 feet of water

Performance Adjustment Factors

Ethylene and Propylene Glycol Factors

ALR units can operate with a leaving chilled fluid temperature range of 20°F (-6°C) to 60°F (10°C). A glycol solution is required when leaving chilled fluid temperature is below 40°F (4.6°C). The use of glycol will reduce the performance of the unit depending on concentration. Manufacturers do not recommend the use of solutions of less than 25 percent due to the possibility of insufficient corrosion protection.

Altitude Correction Factors

Performance tables are based at sea level. Elevations other than sea level affect the performance of the unit. The decreased air density will reduce condenser capacity, consequently reducing the unit's performance. For performance at elevations other than sea level refer to Table 3.

Evaporator Temperature Drop Factors

Performance tables are based on a 10 degree F (5.5 degree C) temperature drop through the evaporator. Adjustment factors for applications having temperature drops from 6 degree F to 16 degree F (3.3 degree C to 8.9 degree C) are in Table 3. Temperature drops outside this range can affect the control system's capability to maintain acceptable control and are not recommended.

The maximum water temperature that can be circulated through the evaporator in a non-operating mode is 100°F (37.8°C).

Table 1, Ethylene Glycol

% E.G.	Freeze Point °F	Freeze Point °C	Capacity	Power	Flow	PD
10	26	-3	0.991	0.996	1.013	1.070
20	18	-8	0.982	0.992	1.040	1.129
30	7	-14	0.972	0.986	1.074	1.181
40	-7	-22	0.961	0.976	1.121	1.263
50	-28	-33	0.946	0.966	1.178	1.308

Table 2, Propylene Glycol

% P.G.	Freeze Point °F	Freeze Point °C	Capacity	Power	Flow	PD
10	26	-3	0.987	0.992	1.010	1.068
20	19	-7	0.975	0.985	1.028	1.147
30	9	-13	0.962	0.978	1.050	1.248
40	-5	-21	0.946	0.971	1.078	1.366
50	-27	-33	0.929	0.965	1.116	1.481

Units operating with glycol solutions are not included in the ARI Certification Program.

Fouling factor

Performance tables are based on a fouling factor of 0.0001 ft^2 x hr x °F/Btu (0.0176 m^2 x °C/kW) per ARI Standard 550/590-98. As fouling is increased, performance decreases. Refer to Table 3 for performance at other than 0.0001 (.0176) fouling factor.

Foreign matter in the chilled water system will adversely affect the heat transfer capability of the evaporator, and could increase the pressure drop and reduce the water flow. To provide optimum unit operation, proper water treatment must be maintained.

Table 3, Capacity and Power Derates

ALTITUDE	Chilled Water Delta-T		Fouling Factor							
			0.0001 (0.0176)		0.00025 (0.044)		0.00075 (0.132)		0.00175 (0.308)	
	°F	°C	Cap.	Power	Cap.	Power	Cap.	Power	Cap.	Power
SEA LEVEL	6	3.3	0.992	0.995	0.985	0.993	0.962	0.986	0.919	0.972
	8	4.4	0.995	0.997	0.988	0.995	0.965	0.988	0.922	0.974
	10	5.6	1.000	1.000	0.993	0.998	0.970	0.991	0.927	0.977
	12	6.7	1.005	1.002	0.998	1.000	0.975	0.993	0.932	0.979
	14	6.8	1.010	1.005	1.003	1.003	0.980	0.996	0.936	0.982
	16	8.9	1.014	1.007	1.007	1.005	0.984	0.998	0.940	0.984
2000 feet (610 m)	6	3.3	0.978	1.005	0.971	1.003	0.949	0.996	0.906	0.982
	8	4.4	0.982	1.007	0.975	1.005	0.953	0.998	0.910	0.984
	10	5.6	0.986	1.009	0.979	1.007	0.956	1.000	0.914	0.986
	12	6.7	0.992	1.011	0.985	1.009	0.962	1.002	0.919	0.988
	14	6.8	0.997	1.014	0.990	1.012	0.967	1.005	0.924	0.991
	16	8.9	1.000	1.016	0.993	1.014	0.970	1.007	0.927	0.993
4000 feet (1220 m)	6	3.3	0.966	1.016	0.959	1.014	0.937	1.007	0.895	0.993
	8	4.4	0.969	1.018	0.962	1.016	0.940	1.009	0.898	0.995
	10	5.6	0.973	1.021	0.966	1.019	0.944	1.012	0.902	0.998
	12	6.7	0.978	1.025	0.971	1.023	0.949	1.016	0.906	1.002
	14	6.8	0.982	1.027	0.975	1.025	0.953	1.018	0.910	1.004
	16	8.9	0.986	1.028	0.979	1.026	0.956	1.019	0.914	1.005
6000 feet (1830 m)	6	3.3	0.953	1.025	0.946	1.023	0.924	1.016	0.883	1.002
	8	4.4	0.955	1.028	0.948	1.026	0.926	1.019	0.885	1.005
	10	5.6	0.959	1.031	0.952	1.029	0.930	1.022	0.889	1.008
	12	6.7	0.963	1.034	0.956	1.032	0.934	1.024	0.893	1.011
	14	6.8	0.968	1.036	0.961	1.034	0.939	1.026	0.897	1.013
	16	8.9	0.972	1.037	0.965	1.035	0.943	1.027	0.901	1.014

NOTE: Contact McQuay sales office for applications above 6,000 feet.

Performance Data

Table 4, ALR 110F - 150F, R-22, I-P Units

ALR SIZE	LWT (°F)	75.0°F			85.0°F			95.0°F			105.0°F			115.0°F		
		Capac. Tons	PWR kWi	EER	Capac. Tons	PWR kWi	EER	Capac. Tons	PWR kWi	EER	Capac. Tons	PWR kWi	EER	Capac. Tons	PWR kWi	EER
110F	40.0	115.8	99.7	12.1	109.6	108.3	10.8	103.4	116.7	9.4	96.8	125.1	8.4	90.9	133.5	7.3
	42.0	118.9	101.0	12.4	113.3	110.0	10.9	106.9	118.6	9.6	100.3	127.4	8.5	94.0	136.1	7.5
	44.0	123.4	102.4	12.6	116.9	111.6	11.1	**110.9**	**120.6**	**9.8**	103.8	129.6	8.5	97.1	138.6	7.6
	46.0	127.5	103.7	12.9	120.8	113.2	11.3	114.5	122.5	10.0	107.2	131.8	8.8	100.3	141.2	7.7
	48.0	130.8	104.9	13.2	123.9	114.8	11.6	117.5	124.4	10.1	110.0	133.9	8.9	103.0	143.8	7.9
	50.0	136.0	106.2	13.5	129.1	116.5	11.8	122.0	126.2	10.4	114.7	136.2	9.1	107.5	146.4	8.0
120F	40.0	127.7	106.9	11.8	120.9	116.1	10.5	114.1	125.1	9.2	106.7	134.1	8.2	100.2	143.1	7.2
	42.0	131.2	108.3	12.1	124.9	117.9	10.7	117.8	127.2	9.4	110.6	136.6	8.3	103.7	145.9	7.3
	44.0	136.1	109.7	12.3	129.0	119.7	10.9	**122.2**	**129.2**	**9.6**	114.4	138.9	8.3	107.1	148.6	7.4
	46.0	140.6	111.1	12.6	133.2	121.3	11.1	126.3	131.3	9.8	118.2	141.3	8.6	110.6	151.3	7.6
	48.0	144.2	112.4	12.9	136.7	123.0	11.3	129.6	133.4	9.9	121.3	143.6	8.7	113.6	154.2	7.7
	50.0	150.0	113.9	13.2	142.4	124.8	11.6	134.6	135.3	10.1	126.5	146.0	8.9	118.6	156.9	7.8
130F	40.0	135.4	117.1	12.2	128.2	127.2	10.8	120.9	137.1	9.5	113.1	147.0	8.4	106.3	156.8	7.4
	42.0	139.1	118.7	12.4	132.5	129.1	11.0	124.9	139.3	9.6	117.3	149.7	8.5	109.9	159.9	7.5
	44.0	144.2	120.2	12.5	136.7	131.1	11.0	**129.6**	**141.6**	**9.7**	121.3	152.2	8.4	113.5	162.8	7.5
	46.0	149.0	121.8	12.8	141.3	133.0	11.2	133.9	143.9	9.9	125.3	154.8	8.7	117.3	165.8	7.6
	48.0	152.9	123.2	13.0	144.9	134.8	11.4	137.4	146.1	10.0	128.6	157.3	8.8	120.4	168.9	7.8
	50.0	159.0	124.7	13.3	151.0	136.8	11.7	142.7	148.3	10.2	134.1	160.0	9.0	125.7	171.9	7.9
135F	40.0	139.7	123.8	11.8	132.2	134.4	10.5	124.7	144.9	9.2	116.7	155.4	8.2	109.6	165.7	7.2
	42.0	143.5	125.4	12.1	136.6	136.5	10.7	128.9	147.3	9.4	121.0	158.2	8.3	113.4	169.0	7.3
	44.0	148.8	127.1	12.3	141.1	138.6	10.8	**133.7**	**149.7**	**9.6**	125.1	160.9	8.3	117.1	172.2	7.4
	46.0	153.8	128.7	12.6	145.7	140.6	11.1	138.1	152.1	9.8	129.3	163.6	8.6	121.0	175.3	7.6
	48.0	157.8	130.2	12.9	149.5	142.5	11.3	141.7	154.5	9.9	132.6	166.3	8.7	124.2	178.6	7.7
	50.0	164.0	131.9	13.2	155.8	144.6	11.5	147.2	156.7	10.1	138.4	169.2	8.9	129.7	181.7	7.8
140F	40.0	145.9	129.9	11.6	138.1	141.1	10.3	130.3	152.1	9.0	121.9	163.1	8.0	114.5	173.9	7.0
	42.0	149.9	131.7	11.8	142.7	143.3	10.5	134.6	154.6	9.2	126.4	166.1	8.1	118.4	177.4	7.1
	44.0	155.4	133.4	12.3	147.3	145.5	10.8	**139.7**	**157.1**	**9.6**	130.7	168.9	8.3	122.3	180.7	7.4
	46.0	160.6	135.1	12.6	152.2	147.5	11.1	144.3	159.6	9.8	135.1	171.7	8.6	126.4	184.0	7.6
	48.0	164.8	136.7	12.9	156.1	149.6	11.3	148.0	162.1	9.9	138.5	174.5	8.7	129.7	187.4	7.7
	50.0	171.4	138.4	13.2	162.7	151.8	11.5	153.8	164.5	10.1	144.6	177.5	8.9	135.5	190.7	7.8
145F	40.0	149.7	132.5	11.9	141.6	143.9	10.6	133.6	155.1	9.3	125.0	166.3	8.2	117.4	177.3	7.2
	42.0	153.7	134.2	12.2	146.4	146.1	10.7	138.1	157.6	9.4	129.6	169.3	8.4	121.4	180.9	7.3
	44.0	159.4	136.0	12.4	151.1	148.3	10.9	**143.2**	**160.2**	**9.6**	134.1	172.2	8.4	125.5	184.2	7.5
	46.0	164.7	137.8	12.7	156.1	150.4	11.1	147.9	162.8	9.8	138.5	175.1	8.6	129.6	187.6	7.6
	48.0	169.0	139.4	13.0	160.1	152.5	11.4	151.8	165.3	9.9	142.1	178.0	8.8	133.0	191.1	7.7
	50.0	175.7	141.1	13.2	166.8	154.7	11.6	157.7	167.7	10.2	148.2	181.0	8.9	138.9	194.5	7.9
150F	40.0	156.2	138.7	11.9	147.8	150.6	10.6	139.5	162.3	9.3	130.5	174.0	8.2	122.6	185.6	7.2
	42.0	160.4	140.5	12.2	152.8	152.9	10.7	144.1	165.0	9.4	135.3	177.2	8.4	126.8	189.3	7.3
	44.0	166.4	142.3	12.4	157.7	155.3	10.9	**149.5**	**167.7**	**9.6**	139.9	180.2	8.4	130.9	192.8	7.5
	46.0	171.9	144.2	12.7	162.9	157.4	11.1	154.4	170.3	9.8	144.5	183.2	8.6	135.3	196.3	7.6
	48.0	176.4	145.9	13.0	167.1	159.6	11.4	158.4	173.0	9.9	148.3	186.3	8.8	138.9	200.0	7.7
	50.0	183.4	147.7	13.2	174.1	162.0	11.6	164.6	175.5	10.2	154.7	189.5	8.9	145.0	203.5	7.9

NOTES:

1. Bold box areas certified in accordance with ARI Standard 550/590-98.
2. Ratings based on HCFC-22, evaporator fouling of 0.0001, evaporator temperature drop of 10°F and sea level altitude.
3. For 208V units multiply capacity and EER by 0.98. For units with SpeedTrol option multiply capacity and EER by 0.99.
4. Interpolation is allowed; extrapolation is not permitted. Consult McQuay for performance outside the cataloged ratings.
5. kWi input is for compressors only. EER is for the entire unit, including compressors, fan motors and control power.
6. For LWT of 42°F and below please refer to application considerations for reciprocating chillers located in this manual.

Table 5, ALR 110F - 150F, R-22, SI Units

ALR SIZE	LWT (°C)	AMBIENT AIR TEMPERATURE														
		25°C (77°F)			30°C (86°F)			35°C (95°F)			40°C (104°F)			45°C (113°F)		
		Capac. kW	PWR kWi	COP	Capac. kW	PWR kWi	COP	Capac. kW	PWR kWi	COP	Capac. kW	PWR kWi	COP	Capac. kW	PWR kWi	COP
110F	5.0 (41.0°F)	412.8	100.4	3.6	392.0	109.1	3.2	369.8	117.7	2.8	346.6	126.3	2.5	325.1	134.8	2.2
	6.0 (42.8°F)	424.5	101.6	3.7	403.6	110.6	3.2	381.4	119.4	2.8	357.6	128.3	2.5	335.0	137.1	2.2
	7.0 (44.6°F)	438.2	102.8	3.7	415.4	112.1	3.3	393.7	121.1	2.9	368.5	130.3	2.5	344.9	139.4	2.2
	8.0 (46.4°F)	450.7	103.9	3.8	427.1	113.5	3.3	404.8	122.9	2.9	378.9	132.2	2.6	354.7	141.7	2.3
	9.0 (48.2°F)	461.9	105.0	3.9	437.7	114.9	3.4	414.8	124.6	3.0	388.4	134.2	2.6	363.8	144.1	2.3
	10.0 (50.0°F)	478.3	106.2	3.9	454.2	116.5	3.5	429.2	126.2	3.0	403.5	136.2	2.7	378.2	146.4	2.3
120F	5.0 (41.0°F)	455.3	107.6	3.5	432.3	117.0	3.1	407.8	126.1	2.7	382.2	135.4	2.4	358.5	144.5	2.1
	6.0 (42.8°F)	468.2	108.9	3.6	445.0	118.6	3.2	420.6	128.0	2.8	394.4	137.5	2.4	369.4	147.0	2.2
	7.0 (44.6°F)	483.3	110.1	3.6	458.1	120.2	3.2	434.2	129.9	2.8	406.4	139.6	2.5	380.3	149.4	2.2
	8.0 (46.4°F)	497.0	111.4	3.7	471.0	121.7	3.3	446.4	131.7	2.9	417.9	141.7	2.5	391.1	151.9	2.2
	9.0 (48.2°F)	509.3	112.6	3.8	482.7	123.2	3.3	457.5	133.6	2.9	428.3	143.8	2.6	401.1	154.4	2.3
	10.0 (50.0°F)	527.5	113.9	3.9	500.8	124.8	3.4	473.3	135.3	3.0	445.0	146.0	2.6	417.0	156.9	2.3
130F	5.0 (41.0°F)	482.7	117.9	3.6	458.3	128.1	3.2	432.3	138.2	2.8	405.2	148.3	2.5	380.1	158.3	2.2
	6.0 (42.8°F)	496.3	119.3	3.6	471.8	129.9	3.2	445.9	140.2	2.8	418.1	150.7	2.5	391.6	161.1	2.2
	7.0 (44.6°F)	512.3	120.7	3.7	485.6	131.7	3.2	460.3	142.3	2.9	430.8	153.0	2.5	403.2	163.7	2.2
	8.0 (46.4°F)	526.9	122.1	3.8	499.3	133.3	3.3	473.3	144.3	2.9	443.0	155.3	2.6	414.7	166.4	2.2
	9.0 (48.2°F)	540.0	123.3	3.8	511.7	135.0	3.4	485.0	146.3	2.9	454.1	157.6	2.6	425.3	169.2	2.3
	10.0 (50.0°F)	559.2	124.7	3.9	531.0	136.8	3.4	501.8	148.3	3.0	471.7	160.0	2.6	442.1	171.9	2.3
135F	5.0 (41.0°F)	497.9	124.6	3.5	472.8	135.5	3.1	446.0	146.1	2.7	418.0	156.8	2.4	392.1	167.4	2.1
	6.0 (42.8°F)	512.0	126.1	3.6	486.7	137.4	3.2	460.0	148.3	2.8	431.4	159.3	2.4	404.0	170.3	2.2
	7.0 (44.6°F)	528.5	127.6	3.6	501.0	139.2	3.2	474.9	150.4	2.8	444.5	161.7	2.5	416.0	173.1	2.2
	8.0 (46.4°F)	543.5	129.0	3.7	515.1	141.0	3.3	488.3	152.6	2.9	457.0	164.2	2.5	427.8	176.0	2.2
	9.0 (48.2°F)	557.0	130.4	3.8	527.9	142.7	3.3	500.3	154.7	2.9	468.5	166.6	2.6	438.7	178.9	2.3
	10.0 (50.0°F)	576.9	131.9	3.9	547.8	144.6	3.4	517.7	156.7	3.0	486.7	169.2	2.6	456.1	181.7	2.3
140F	5.0 (41.0°F)	520.1	130.8	3.4	493.9	142.2	3.0	465.9	153.3	2.7	436.7	164.6	2.4	409.6	175.6	2.1
	6.0 (42.8°F)	534.9	132.3	3.5	508.5	144.2	3.1	480.6	155.6	2.7	450.6	167.2	2.4	422.0	178.7	2.1
	7.0 (44.6°F)	552.1	133.9	3.6	523.3	146.1	3.2	496.0	157.9	2.8	464.3	169.7	2.5	434.5	181.7	2.2
	8.0 (46.4°F)	567.8	135.4	3.7	538.1	147.9	3.3	510.0	160.1	2.9	477.4	172.3	2.5	446.9	184.7	2.2
	9.0 (48.2°F)	581.9	136.9	3.8	551.4	149.8	3.3	522.7	162.4	2.9	489.4	174.8	2.6	458.3	187.8	2.3
	10.0 (50.0°F)	602.7	138.4	3.9	572.2	151.8	3.4	540.8	164.5	3.0	508.4	177.5	2.6	476.4	190.7	2.3
145F	5.0 (41.0°F)	533.4	133.4	3.5	506.4	145.0	3.1	477.7	156.4	2.7	447.8	167.8	2.4	420.1	179.1	2.1
	6.0 (42.8°F)	548.5	134.9	3.6	521.4	147.0	3.2	492.8	158.7	2.8	462.1	170.5	2.4	432.8	182.2	2.2
	7.0 (44.6°F)	566.2	136.5	3.7	536.7	149.0	3.2	508.7	161.0	2.8	476.1	173.1	2.5	445.6	185.2	2.2
	8.0 (46.4°F)	582.2	138.1	3.7	551.8	150.8	3.3	523.0	163.3	2.9	489.6	175.7	2.5	458.2	188.3	2.2
	9.0 (48.2°F)	596.7	139.5	3.8	565.5	152.7	3.3	536.0	165.6	2.9	501.8	178.3	2.6	470.0	191.4	2.3
	10.0 (50.0°F)	618.0	141.1	3.9	586.8	154.7	3.4	554.5	167.7	3.0	521.3	181.0	2.6	488.6	194.5	2.3
150F	5.0 (41.0°F)	556.7	139.6	3.5	528.6	151.7	3.1	498.6	163.6	2.7	467.3	175.6	2.4	438.4	187.4	2.1
	6.0 (42.8°F)	572.5	141.2	3.6	544.2	153.8	3.2	514.3	166.0	2.8	482.3	178.4	2.4	451.7	190.7	2.2
	7.0 (44.6°F)	590.9	142.9	3.7	560.1	155.9	3.2	530.9	168.5	2.8	496.9	181.1	2.5	465.1	193.9	2.2
	8.0 (46.4°F)	607.7	144.5	3.7	575.9	157.9	3.3	545.9	170.9	2.9	511.0	183.9	2.5	478.3	197.1	2.2
	9.0 (48.2°F)	622.8	146.0	3.8	590.2	159.8	3.3	559.4	173.3	2.9	523.7	186.6	2.6	490.5	200.4	2.3
	10.0 (50.0°F)	645.0	147.7	3.9	612.4	162.0	3.4	578.8	175.5	3.0	544.1	189.5	2.6	509.9	203.5	2.3

NOTES:

1. Ratings based on HCFC-22, evaporator fouling of 0.0176, evaporator temperature drop of 5.6°C and sea level altitude.
2. For 208V units multiply capacity and COP by 0.98.
3. For units with SpeedTrol option multiply capacity and COP by 0.99.
4. Interpolation is allowed; extrapolation is not permitted. Consult McQuay for performance outside the cataloged ratings.
5. kWi input is for compressors only. COP is for the entire unit, including compressors, fan motors and control power.
6. For LWT of 5.6°C and below please refer to application considerations for reciprocating chillers.

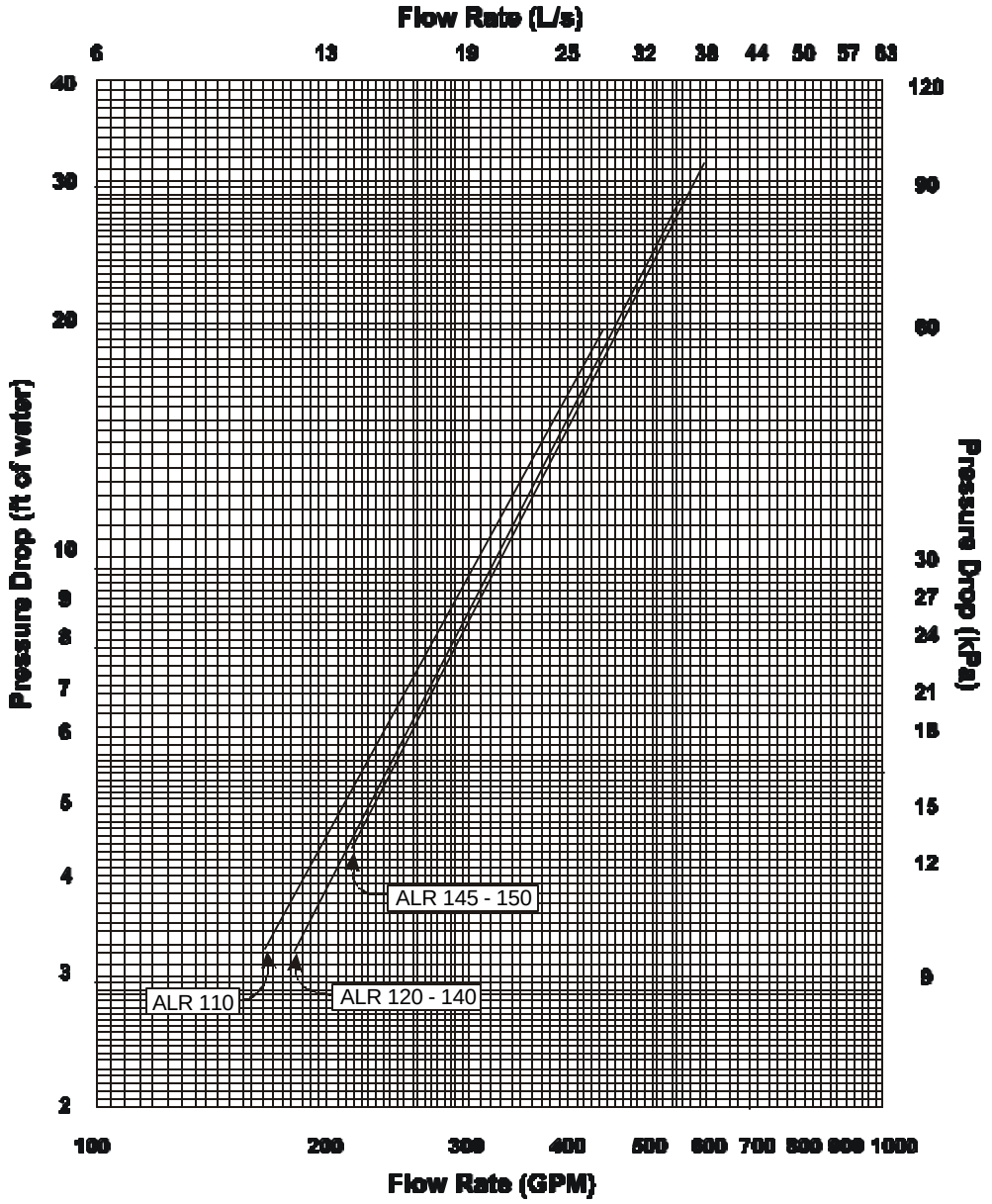
Part Load Data

Table 6, Part Load Data R-22,

Unit Size	% Load	Capacity Tons	Unit Power kW	EER	IPLV
110F	100.00	110.9	135.6	9.8	14.0
	75.00	83.5	79.9	12.5	
	50.00	55.6	44.9	14.9	
	25.00	27.9	21.1	15.9	
120F	100.00	122.2	152.8	9.6	14.0
	75.00	92.4	89.9	12.3	
	50.00	61.6	48.7	15.2	
	25.00	30.8	24.1	15.3	
130F	100.00	129.6	161.0	9.7	13.6
	75.00	97.2	95.9	12.2	
	50.00	64.8	54.0	14.4	
	25.00	32.4	24.8	15.7	
135F	100.00	133.7	168.0	9.6	13.4
	75.00	100.3	100.3	12.0	
	50.00	66.8	55.3	14.5	
	25.00	33.4	28.2	14.2	
140F	100.00	139.7	174.8	9.6	13.7
	75.00	104.7	102.5	12.3	
	50.00	69.8	56.9	14.7	
	25.00	34.9	27.0	15.5	
145F	100.00	143.2	178.2	9.6	13.5
	75.00	107.5	104.4	12.4	
	50.00	71.6	61.3	14.0	
	25.00	35.9	27.7	15.5	
150F	100.00	149.5	186.0	9.6	13.4
	75.00	112.1	109.4	12.3	
	50.00	74.7	64.4	13.9	
	25.00	37.4	29.4	15.3	

Pressure Drops

Figure 5, 110F through 150F Evaporator Pressure Drop Curve



Minimum/Maximum Flow Rates

ALR Unit Size	Minimum Flow gpm (l/s)	Pressure Drop ft. (kPa)	Maximum Flow gpm (l/s)	Pressure Drop ft. (kPa)
110	166 (10.5)	3.3 (9.8)	444 (28.0)	19.6 (58.4)
120	183 (11.5)	3.2 (9.6)	489 (30.9)	22.0 (65.6)
130	194 (12.2)	3.6 (10.7)	518 (32.7)	24.6 (73.3)
135	200 (12.6)	3.8 (11.3)	535 (33.8)	26.2 (78.1)
140	210 (13.3)	4.2 (12.5)	559 (35.3)	28.6 (85.2)
145	215 (13.6)	4.3 (12.8)	573 (36.2)	29.0 (86.4)
150	224 (14.1)	4.7 (14.0)	598 (37.8)	31.6 (94.2)

Sound Data

Table 7, ALR 110F - 150F, Sound Pressure

ALR Unit Size	Octave Band Sound Pressure Levels Per ARI Standard 370 (dB)								Overall "A" Weighted
	63 hz	125 hz	250 hz	500 hz	1000 hz	2000 hz	4000 hz	8000 hz	
110	65	68	69	66	62	60	57	53	68.5
120	65	68	69	66	62	60	57	53	68.5
130	66	69	70	67	63	61	58	54	69.5
135	66	69	70	67	63	61	58	54	69.5
140	67	70	71	68	63	61	59	54	70.0
145	67	70	71	68	63	61	59	54	70.0
150	68	71	72	69	64	62	59	55	71.0

NOTES
1. Based on Q=2
2. Sound pressure at 30 feet from unit.

Table 8, ALR 110F - 150F, Sound Power

ALR Unit Size	Octave Band Sound Power Levels Per ARI Standard 370 (dB)								Overall "A" Weighted
	63 hz	125 hz	250 hz	500 hz	1000 hz	2000 hz	4000 hz	8000 hz	
110	95	98	99	96	92	90	87	83	98.5
120	95	98	99	96	92	90	87	83	98.5
130	96	99	100	97	93	91	89	84	99.5
135	96	99	100	97	93	91	89	84	99.5
140	97	100	101	98	93	91	89	84	100.0
145	97	100	101	98	93	91	89	84	100.0
150	98	101	102	99	94	92	89	85	101.0

Per ARI 370 - Sound Rating of Large Outdoor Refrigerating and Air-Conditioning Equipment

Sound levels can be as important as unit cost and efficiency, and must be addressed before the start of any development program. Efforts by McQuay Design Engineers to design chillers that are sensitive to the sound requirements of the market have paid off.

Background Information

Sound is a vibration in an elastic medium and is essentially a pressure and particle displacement phenomena. A vibrating body produces compression waves and as the waves are emitted from the vibrating body, molecules are ultimately compressed. These waves are transmitted through gases, liquids, or solids-anything that is elastic or viscous.

The sound data provided in this section is presented with both sound pressure (Q=1 and 30 feet from unit) and sound power levels. Sound power is the total sound energy radiated by a source per unit of time integrated over the surface through which the sound is radiated. Sound power is a calculated quantity and cannot be measured directly like sound pressure. Sound power is not dependent on the surrounding environment or distance from the source, as is sound pressure.

Sound pressure varies with the distance from the source and is dependent on its surroundings. For example, a brick wall located 10 feet from a unit will affect the sound pressure measurements differently than a brick wall at 20 feet. Sound pressure is measured in decibels (dB), which is a dimensionless ratio (on a logarithmic scale) between measured sound pressure and a reference sound pressure level.

Sound Pressure Levels - Full Load

Sound pressure tables give the overall "A" weighted sound pressure levels which are considered typical of what can be measured in a free field with a hand held sound meter, in the absence of any nearby reflective surfaces. The sound pressure levels (Table 7) are measured at 30 feet from the side of the unit at 100% unit load, no reflecting walls Q=1, and ARI conditions, 95°F (35°C) ambient air temperature and 54/44°F (12/7°C) evaporator water temperatures for air-cooled units.

Sound Power Levels

Acoustical consultants can require sound power octave band data to perform a detailed acoustical analysis. The previous tables present sound power levels per ARI Standard 370 “Sound Rating of Large Outdoor Refrigerating and Air Conditioning Equipment”. These standards were developed to establish uniform methods of determining the sound power radiated by large outdoor and indoor equipment. The aforementioned methods are based on providing sound power levels by octave band and the overall ‘A’ weighted value. Sound pressure measurements are taken over a prescribed area around the unit and the data is mathematically calculated to give the sound power, dB.

Sound Reduction Due to Distance from the Unit

The distance between a source of sound and the location of the sound measurement plays an important role in minimizing sound problems. The equation below can be used to calculate the sound pressure level at any distance if the sound power is known.

$$Lp = Lw - (20 \log r) + (10 \log Q) - .5$$

Lp = sound pressure

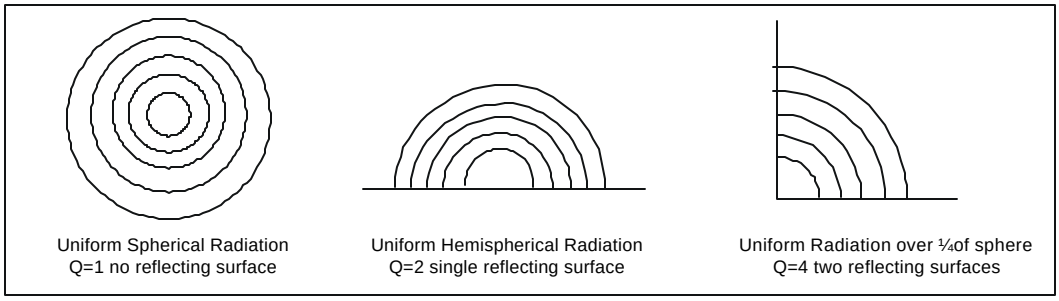
Lw = sound power

r = distance from unit in feet

Q = directionality factor

The directionality factor, "Q", is a dimensionless number that compensates for the type of sound reflection from the source. For example, a unit sitting on a flat roof or ground with no other reflective surfaces or attenuation due to grass, snow, etc., between source and receiver: Q=1.

Figure 6, "Q" Definition, Plan View, Unit Located in Center



With Q=1, no reflecting walls, the equation simplifies to: $Lp = Lw - (20)(\log r) - 0.5$

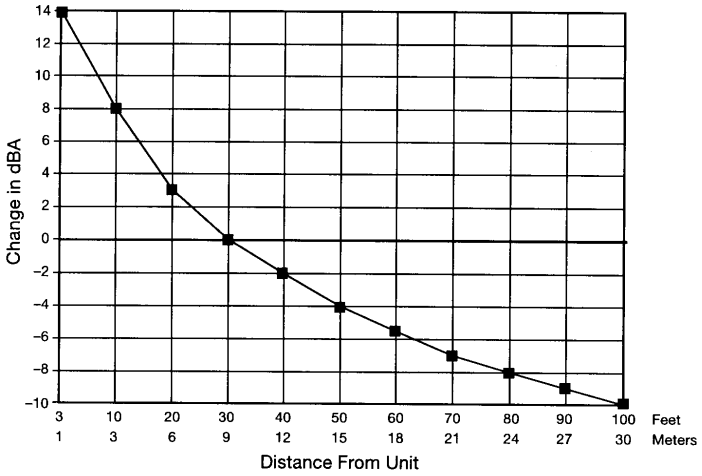
With Q=2, for a unit sitting on a flat roof or ground with one wall as a reflective surface the equation simplifies to: $Lp = Lw - (20)(\log r) + 2.5$

The equations are reduced to table form in Table 9 for various distances and the three most usual cases of "Q" type of location.

Table 9, dB Conversion of Sound Power to Pressure for Distance

Distance From Sound Source ft (m)	dB Reduction from Sound Power at the Source to Sound Pressure at Referenced Distance		
	Q=1	Q=2	Q=4
30 (9)	30.0	27.1	24.0
50 (15)	34.5	31.6	28.5
75 (23)	38.0	35.1	32.0
100 (30)	40.5	37.6	34.5
150 (46)	44.0	41.1	38.0
200 (61)	46.5	43.6	40.5
300 (91)	50.0	47.6	44.0

Figure 7, Sound Pressure Attenuation Due to Distance from Unit (Plus or Minus from Table 7)

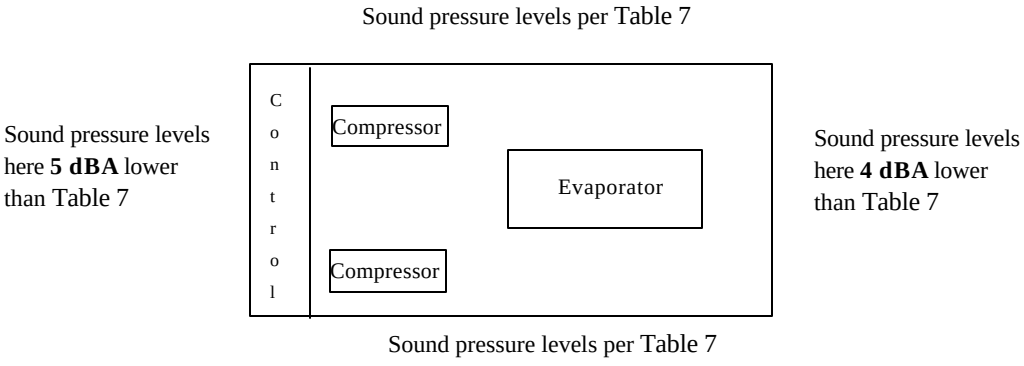


Air-Cooled Unit Orientation to Minimize Sound

The ALR chiller's sound is directional in nature allowing the contractor/engineer to position the unit to minimize potential noise problems. Because the sound pressure levels are lower at both ends of the unit than at the sides, the chiller should be oriented such that the control box end or end opposite the control box faces the direction where the lowest sound level is required.

The control box end provides an excellent acoustic barrier to the compressor sound as it covers one full end of the unit. The sound pressure levels at the control box end will be 5 dBA less than on the sides. On the end opposite the control box, the compressor sound is blocked by the coil structure, evaporator and naturally attenuated by distance as the compressors are located approximately ¾the length of the unit away from this end. The sound pressure levels at the end opposite the control box will be 4 dBA less than on the sides.

Figure 8, Sound Directionality



Sound Pressure Levels, Low Ambient Operation

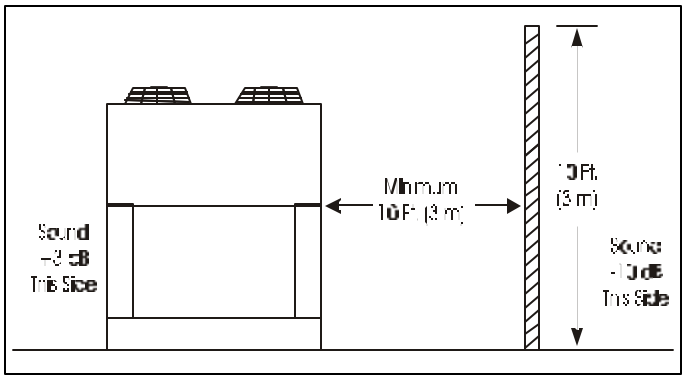
Air-cooled unit operation below 95°F (35°C) will also result in lower sound pressure levels. The sound pressure level will decrease 3 dB proportionally from 95°F to 65°F. For example, at 95°F the sound pressure is per Table 7, at 85°F one dB can be subtracted, at 75°F two dB can be subtracted, and so on for any temperature between 65°F and 95°F.

Sound Pressure Levels, Multiple Units

Multiple air-cooled unit installations will have a higher sound level than a single unit on a doubling basis. Two units will have approximately 3 dB higher sound level of one unit, 4 units will be approximately 6 dB louder, and 8 units approximately 9 dB louder than one unit.

Sound Control

Walls adjacent to a unit (20 feet {6.1 meters} or less) will reflect sound outwards, increasing the sound pressure on the side away from the wall. This sound increase could be as high as 3 dB for one wall and as high as 6 dB for a corner location. Unit orientation and/or distance as noted above will decrease sound levels.



Sound levels can also be controlled by the installation of barrier walls. To be effective as sound blockers, walls must be solid with no open penetrations. Sound tends to leak out of openings. Block walls with filler material and slots on the side facing the unit are especially effective. The wall should be about 10 feet high (two feet higher than the unit) and located at least 10 feet away so as not to affect unit performance. A three-sided enclosure will be the most effective solution and will reduce sound levels by about 10 dB. Remember that the wall will increase the sound level on the side opposite it by 3 to 6 dB (one or three sided wall). Note: The effect of adjacent walls on air recirculation and restriction must always be considered when employing sound barrier walls.

Electrical Data

Wiring must comply with all applicable codes and ordinances. Warranty is void if wiring is not in accordance with specifications. Copper wire is required for all power lead terminations at the unit. Aluminum or copper can be used for all other wiring.

ALR units can be ordered with internal power wiring for either single or multiple point power connection. If single point power connection is ordered, a single large power terminal block is provided and wiring within the unit is sized in accordance with the National Electrical Code. A single field supplied fused disconnect is required. If multiple point power wiring is ordered, three power connections, one per compressor circuit, one for condenser fans, and control circuit, are required. Separate field supplied fused disconnects are required for each of the three circuits. A single power block is provided for all of the condenser fans and the 115V control transformer.

If the evaporator heater is on a separate disconnect switch from the main unit power supply, the unit can be shut down without defeating the freeze protection provided by the cooler heater.

Table 10, ALR 110F – 150F Electrical Data, Single Point

ALR Unit Size	Volts	Hz	Min. Circuit Ampacity (MCA)	Field Wire		Hub (Conduit Connection)		Fuse or HACR Breaker Size	
				Quantity	Wire Gauge	Quantity	Size	Recommended	Maximum
110F	208	60	503	6	400	1	4.00 (102)	600	600
	230		492	6	350	1	4.00 (102)	600	600
	460		248	3	250	1	2.50 (64)	300	300
	575		188	3	3/0	1	2.00 (51)	200	225
120F	208	60	555	6	500	1	4.00 (102)	600	600
	230		526	6	400	1	4.00 (102)	600	500
	460		274	3	300	1	2.50 (64)	300	300
	575		200	3	4/0	1	2.00 (51)	225	225
130F	208	60	592	6	500	1	4.00 (102)	700	700
	230		554	6	500	1	4.00 (102)	600	600
	460		293	3	350	1	2.50 (64)	300	350
	575		210	3	4/0	1	2.00 (51)	225	250
135F	208	60	626	6	400	2	2.50 (64)	700	700
	230		590	6	350	2	2.50 (64)	700	700
	460		302	3	350	1	2.50 (64)	350	350
	575		224	3	4/0	1	2.00 (51)	250	250
140F	208	60	656	6	400	2	3.00 (76)	700	700
	230		622	6	400	2	3.00 (76)	700	700
	460		310	3	400	1	2.50 (64)	350	350
	575		236	3	250	1	2.50 (64)	250	250
145F	208	60	656	6	400	2	3.00 (76)	700	700
	230		622	6	400	2	3.00 (76)	700	700
	460		310	3	400	1	2.50 (64)	350	350
	575		236	3	250	1	2.50 (64)	250	250
150F	208	60	690	6	500	2	3.00 (76)	800	800
	230		666	6	500	2	3.00 (76)	800	800
	460		334	3	400	1	3.00 (76)	350	400
	575		261	3	300	1	2.50 (64)	300	300

1. See page 26 for all Electrical Data notes.
2. A “HACR” breaker is designed for use on equipment with multiple motors. It stands for Heating, Air Conditioning, Refrigeration

Table 11, ALR 110F – 150F Electrical Data, Multiple Point

ALR Unit Size	Volts	Min. Ckt. Amp MCA	Power Supply Fans and Controls				Field Fusing(1)		Min. Ckt Amp MCA	Power Supply Circuit #1				Field Fusing (1)		Min. Ckt Amp MCA	Power Supply Circuit #2				Field Fusing (1)	
			Field Wire		Hub		Rec. Fuse Size	Max. Fuse Size		Field Wire		Hub		Rec. Fuse Size	Max. Fuse Size		Field Wire		Hub		Rec. Fuse Size	Max. Fuse Size
			Qty.	Wire Size	Qty.	Hub Size				Qty.	Wire Size	Qty	Hub Size				Qty.	Wire Size	Qty.	Hub Size		
110F	208	60	3	6	1	1.50 (38)	60	60	218	3	4/0	1	2.00 (51)	250	300	251	3	250	1	2.50 (64)	300	350
	230	60	3	6	1	1.50 (38)	60	60	218	3	4/0	1	2.00 (51)	250	300	240	3	250	1	2.50 (64)	225	350
	460	29	3	10	1	1.00 (25)	30	30	108	3	2	1	1.25 (32)	125	150	124	3	1	1	1.25 (32)	150	175
	575	24	3	10	1	1.00 (25)	25	25	83	3	4	1	1.00 (25)	100	110	91	3	3	1	1.25 (32)	110	125
120F	208	60	3	6	1	1.50 (38)	60	60	251	3	250	1	2.50 (64)	300	300	277	3	300	1	2.50 (64)	300	400
	230	60	3	6	1	1.50 (38)	60	60	240	3	250	1	2.50 (64)	300	300	257	3	300	1	2.50 (64)	250	350
	460	29	3	10	1	1.00 (25)	30	30	124	3	1	1	1.25 (32)	150	150	137	3	1/0	1	1.50 (38)	175	175
	575	24	3	10	1	1.00 (25)	25	25	91	3	3	1	1.25 (32)	110	125	97	3	3	1	1.25 (32)	110	125
130F	208	71	3	4	1	2.00 (51)	80	80	277	3	300	1	2.50 (64)	350	400	277	3	300	1	2.50 (64)	300	400
	230	71	3	4	1	2.00 (51)	80	80	257	3	300	1	2.50 (64)	300	350	257	3	300	1	2.50 (64)	250	350
	460	35	3	8	1	1.25 (32)	35	35	137	3	1/0	1	1.50 (38)	175	175	137	3	1/0	1	1.50 (38)	175	175
	575	28	3	10	1	1.00 (25)	30	30	97	3	3	1	1.25 (32)	110	125	97	3	3	1	1.25 (32)	110	125
135F	208	71	3	4	1	2.00 (51)	80	80	296	3	350	1	2.50 (64)	350	400	296	3	350	1	2.50 (64)	350	400
	230	71	3	4	1	2.00 (51)	80	80	277	3	300	1	2.50 (64)	350	350	277	3	300	1	2.50 (64)	300	400
	460	35	3	8	1	1.25 (32)	35	35	142	3	1/0	1	1.50 (38)	175	200	142	3	1/0	1	1.50 (38)	175	200
	575	28	3	10	1	1.00 (25)	30	30	104	3	2	1	1.25 (32)	125	125	104	3	2	1	1.25 (32)	125	150
140F	208	71	3	4	1	2.00 (51)	80	80	311	3	400	1	2.50 (64)	350	400	311	3	400	1	3.00 (76)	350	400
	230	71	3	4	1	2.00 (51)	80	80	293	3	350	1	2.50 (64)	350	400	293	3	350	1	2.50 (64)	300	400
	460	35	3	8	1	1.25 (32)	35	35	146	3	1/0	1	1.50 (38)	175	200	146	3	1/0	1	1.50 (38)	175	200
	575	28	3	10	1	1.00 (25)	30	30	110	3	2	1	1.25 (32)	125	150	110	3	2	1	1.25 (32)	125	150
145F	208	71	3	4	1	2.00 (51)	80	80	311	3	400	1	2.50 (64)	350	400	311	3	400	1	3.00 (76)	350	400
	230	71	3	4	1	2.00 (51)	80	80	293	3	350	1	2.50 (64)	350	400	293	3	350	1	2.50 (64)	300	400
	460	35	3	8	1	1.25 (32)	35	35	146	3	1/0	1	1.50 (38)	175	200	146	3	1/0	1	1.50 (38)	175	200
	575	28	3	10	1	1.00 (25)	30	30	110	3	2	1	1.25 (32)	125	150	110	3	2	1	1.25 (32)	125	150
150F	208	71	3	4	1	2.00 (51)	80	80	311	3	400	1	2.50 (64)	350	400	344	3	500	1	3.00 (76)	400	500
	230	71	3	4	1	2.00 (51)	80	80	293	3	350	1	2.50 (64)	350	400	336	3	500	1	3.00 (76)	350	500
	460	35	3	8	1	1.25 (32)	35	35	146	3	1/0	1	1.50 (38)	175	200	170	3	2/0	1	2.00 (51)	200	250
	575	28	3	10	1	1.00 (25)	30	30	110	3	2	1	1.25 (32)	125	150	135	3	1/0	1	1.50 (38)	175	200

Table 12, ALR 110F –150F Compressor and Condenser Fan Motor Amp Draw

ALR Unit Size	Volts	Rated Load Amps					No. Of Fan Motor	Locked Rotor Amps							
		Compressors				Fan Motors (Each)		Fan Motors (Each)	Compressors							
									Across-The-Line				Reduced Inrush			
		No. 1	No. 2	No. 3	No. 4				No. 1	No. 2	No. 3	No. 4	No. 1	No. 2	No. 3	No. 4
110F	208	97	97	97	123	5.8	10	23.7	565	565	565	650	340	340	340	400
	230	97	97	97	114	5.8	10	21.4	565	565	565	594	340	340	340	340
	460	48	48	48	61	2.8	10	10.7	283	283	283	297	156	156	156	195
	575	37	37	37	43	2.3	10	11.5	230	230	230	245	138	138	138	152
120F	208	97	123	123	123	5.8	10	23.7	565	650	650	650	340	400	400	400
	230	97	114	114	114	5.8	10	21.4	565	594	594	594	340	340	340	340
	460	48	61	61	61	2.8	10	10.7	283	297	297	297	156	195	195	195
	575	37	43	43	43	2.3	10	11.5	230	245	245	245	138	152	152	152
130F	208	123	123	123	123	5.8	12	23.7	650	650	650	650	400	400	400	400
	230	114	114	114	114	5.8	12	21.4	594	594	594	594	340	340	340	340
	460	61	61	61	61	2.8	12	10.7	297	297	297	297	195	195	195	195
	575	43	43	43	43	2.3	12	11.5	245	245	245	245	152	152	152	152
135F	208	123	123	138	138	5.8	12	23.7	650	650	754	754	400	400	463	463
	230	114	114	130	130	5.8	12	21.4	594	594	594	594	340	340	340	340
	460	61	61	65	65	2.8	12	10.7	297	297	297	297	195	195	195	195
	575	43	43	49	49	2.3	12	11.5	245	245	245	245	152	152	152	152
140F	208	138	138	138	138	5.8	12	23.7	754	754	754	754	463	463	463	463
	230	130	130	130	130	5.8	12	21.4	594	594	594	594	340	340	340	340
	460	65	65	65	65	2.8	12	10.7	297	297	297	297	195	195	195	195
	575	49	49	49	49	2.3	12	11.5	245	245	245	245	152	152	152	152
145F	208	138	138	138	138	5.8	12	23.7	754	754	754	754	463	463	463	463
	230	130	130	130	130	5.8	12	21.4	594	594	594	594	340	340	340	340
	460	65	65	65	65	2.8	12	10.7	297	297	297	297	195	195	195	195
	575	49	49	49	49	2.3	12	11.5	245	245	245	245	152	152	152	152
150F	208	138	138	138	165	5.8	12	23.7	754	754	754	1070	463	463	463	654
	230	130	130	130	165	5.8	12	21.4	594	594	594	1070	340	340	340	654
	460	65	65	65	84	2.8	12	10.7	297	297	297	510	195	195	195	330
	575	49	49	49	69	2.3	12	11.5	245	245	245	405	152	152	152	262

See page 26 for all Electrical Data notes.

Table 13, ALR 110F – 150F Field Wiring Data, Single Point Power

ALR Unit Size	Volts	Wiring to Standard Power Block		Wiring to Optional Factory Mounted Disconnect Switch	
		Terminal Amps	Connector Wire Range/Phase (Copper Wire Only)	Terminal Amps	Connector Wire Range/Phase (Copper Wire Only)
110F	208	840	(2 qty.) 1/0 - 600 MCM	600	(2 qty.) 400 - 500 MCM
	230	840	(2 qty.) 1/0 - 600 MCM	600	(2 qty.) 250 - 350 MCM
	460	380	(1 qty.) #4 - 500 MCM	400	(1 qty.) 250 - 500 MCM
	575	380	(1 qty.) #4 - 500 MCM	250	(1 qty.) #4 - 350 MCM
120F	208	840	(2 qty.) 1/0 - 600 MCM	600	(2 qty.) 250 - 500 MCM
	230	840	(2 qty.) 1/0 - 600 MCM	600	(2 qty.) 400 - 500 MCM
	460	380	(1 qty.) #4 - 500 MCM	400	(1 qty.) 250 - 500 MCM
	575	380	(1 qty.) #4 - 500 MCM	250	(1 qty.) #4 - 350 MCM
130F	208	840	(2 qty.) 1/0 - 600 MCM	800	(2 qty.) 500 - 700 MCM
	230	840	(2 qty.) 1/0 - 600 MCM	800	(2 qty.) 500 - 700 MCM
	460	380	(1 qty.) #4 - 500 MCM	400	(1 qty.) 250 - 500 MCM
	575	380	(1 qty.) #4 - 500 MCM	250	(1 qty.) #4 - 350 MCM
135F	208	840	(2 qty.) 1/0 - 600 MCM	800	(2 qty.) 500 - 700 MCM
	230	840	(2 qty.) 1/0 - 600 MCM	800	(3 qty.) 3/0 - 400 MCM
	460	380	(1 qty.) #4 - 500 MCM	400	(1 qty.) 250 - 500 MCM
	575	380	(1 qty.) #4 - 500 MCM	250	(1 qty.) #4 - 350 MCM
140F	208	840	(2 qty.) 1/0 - 600 MCM	800	(2 qty.) 500 - 700 MCM
	230	840	(2 qty.) 1/0 - 600 MCM	800	(2 qty.) 500 - 700 MCM
	460	380	(1 qty.) #4 - 500 MCM	400	(1 qty.) 250 - 500 MCM
	575	380	(1 qty.) #4 - 500 MCM	400	(1 qty.) 250 - 500 MCM
145F	208	840	(2 qty.) 1/0 - 600 MCM	800	(2 qty.) 500 - 700 MCM
	230	840	(2 qty.) 1/0 - 600 MCM	800	(2 qty.) 500 - 700 MCM
	460	380	(1 qty.) #4 - 500 MCM	400	(1 qty.) 250 - 500 MCM
	575	380	(1 qty.) #4 - 500 MCM	400	(1 qty.) 250 - 500 MCM
150F	208	840	(4 qty.) 1/0 - 600 MCM	800	(2 qty.) 500 - 700 MCM
	230	840	(4 qty.) 1/0 - 600 MCM	800	(2 qty.) 500 - 700 MCM
	460	840	(2 qty.) 1/0 - 600 MCM	400	(1 qty.) 250 - 500 MCM
	575	840	(2 qty.) 1/0 - 600 MCM	400	(1 qty.) 250 - 500 MCM

See page 26 for all other Electrical Data notes.

Table 14, ALR 110F – 150F, Field Wiring Data, Multiple Point Power with Power Blocks

ALR Unit Size	Volts	Wiring to Standard Power Block					
		Terminal Amps			Connector Wire Range Per Phase (Copper Wire Only)		
		Circuit 1	Circuit 2	Circuit 3	Circuit 1 (Fans)	Circuit 2	Circuit 3
110F	208	175	380	380	(1 qty.) #12 - 2/0	(1 qty.) #4 - 400 MCM	(1 qty.) #4 - 400 MCM
	230	175	380	380	(1 qty.) #12 - 2/0	(1 qty.) #4 - 400 MCM	(1 qty.) #4 - 400 MCM
	460	175	175	175	(1 qty.) #12 - 2/0	(1 qty.) #12 - 2/0	(1 qty.) #12 - 2/0
	575	175	175	175	(1 qty.) #12 - 2/0	(1 qty.) #12 - 2/0	(1 qty.) #12 - 2/0
120F	208	175	380	380	(1 qty.) #12 - 2/0	(1 qty.) #4 - 400 MCM	(1 qty.) #4 - 400 MCM
	230	175	380	380	(1 qty.) #12 - 2/0	(1 qty.) #4 - 400 MCM	(1 qty.) #4 - 400 MCM
	460	175	175	175	(1 qty.) #12 - 2/0	(1 qty.) #12 - 2/0	(1 qty.) #12 - 2/0
	575	175	175	175	(1 qty.) #12 - 2/0	(1 qty.) #12 - 2/0	(1 qty.) #12 - 2/0
130F	208	175	380	380	(1 qty.) #12 - 2/0	(1 qty.) #4 - 400 MCM	(1 qty.) #4 - 400 MCM
	230	175	380	380	(1 qty.) #12 - 2/0	(1 qty.) #4 - 400 MCM	(1 qty.) #4 - 400 MCM
	460	175	175	175	(1 qty.) #12 - 2/0	(1 qty.) #12 - 2/0	(1 qty.) #12 - 2/0
	575	175	175	175	(1 qty.) #12 - 2/0	(1 qty.) #12 - 2/0	(1 qty.) #12 - 2/0
135F	208	175	380	380	(1 qty.) #12 - 2/0	(1 qty.) #4 - 400 MCM	(1 qty.) #4 - 400 MCM
	230	175	380	380	(1 qty.) #12 - 2/0	(1 qty.) #4 - 400 MCM	(1 qty.) #4 - 400 MCM
	460	175	175	175	(1 qty.) #12 - 2/0	(1 qty.) #12 - 2/0	(1 qty.) #12 - 2/0
	575	175	175	175	(1 qty.) #12 - 2/0	(1 qty.) #12 - 2/0	(1 qty.) #12 - 2/0
140F	208	175	840	840	(1 qty.) #12 - 2/0	(2 qty.) 1/0 - 600 MCM	(2 qty.) 1/0 - 600 MCM
	230	175	840	840	(1 qty.) #12 - 2/0	(2 qty.) 1/0 - 600 MCM	(2 qty.) 1/0 - 600 MCM
	460	175	380	380	(1 qty.) #12 - 2/0	(1 qty.) #4 - 400 MCM	(1 qty.) #4 - 400 MCM
	575	175	380	380	(1 qty.) #12 - 2/0	(1 qty.) #4 - 400 MCM	(1 qty.) #4 - 400 MCM
145F	208	175	840	840	(1 qty.) #12 - 2/0	(2 qty.) 1/0 - 600 MCM	(2 qty.) 1/0 - 600 MCM
	230	175	840	840	(1 qty.) #12 - 2/0	(2 qty.) 1/0 - 600 MCM	(2 qty.) 1/0 - 600 MCM
	460	175	380	380	(1 qty.) #12 - 2/0	(1 qty.) #4 - 400 MCM	(1 qty.) #4 - 400 MCM
	575	175	380	380	(1 qty.) #12 - 2/0	(1 qty.) #4 - 400 MCM	(1 qty.) #4 - 400 MCM
150F	208	175	840	840	(1 qty.) #12 - 2/0	(2 qty.) 1/0 - 600 MCM	(2 qty.) 1/0 - 600 MCM
	230	175	840	840	(1 qty.) #12 - 2/0	(2 qty.) 1/0 - 600 MCM	(2 qty.) 1/0 - 600 MCM
	460	175	380	380	(1 qty.) #12 - 2/0	(1 qty.) #4 - 400 MCM	(1 qty.) #4 - 400 MCM
	575	175	380	380	(1 qty.) #12 - 2/0	(1 qty.) #4 - 400 MCM	(1 qty.) #4 - 400 MCM

See page 26 for all Electrical Data notes.

Table 15, ALR 110F – 150F, Field Wiring Data, Multiple Point Power with Non-fused Disconnect

ALR Unit Size	Volts	Wiring to Optional Non-Fused Disconnect					
		Terminal Amps			Connector Wire Range Per Phase (Copper Wire Only)		
		Circuit 1	Circuit 2	Circuit 3	Circuit 1 (Fans)	Circuit 2	Circuit 3
110F	208	100	225	225	(1 qty.) #14 - 1/0	(1 qty.) #4 – 4/0	(1 qty.) #4 – 4/0
	230	100	225	250	(1 qty.) #14 - 1/0	(1 qty.) #4 – 4/0	(1 qty.) #4 - 350 MCM
	460	100	150	150	(1 qty.) #4 - 1/0	(1 qty.) #4 – 4/0	(1 qty.) #4 – 4/0
	575	100	150	150	(1 qty.) #14 - 1/0	(1 qty.) #4 – 4/0	(1 qty.) #4 – 4/0
120F	208	100	400	400	(1 qty.) #14 - 1/0	(1 qty.) 250 - 400 MCM	(1 qty.) 250 - 400 MCM
	230	100	250	400	(1 qty.) #14 - 1/0	(1 qty.) #4 - 350 MCM	(1 qty.) 250 - 400 MCM
	460	100	150	150	(1 qty.) #14 - 1/0	(1 qty.) #4 – 4/0	(1 qty.) #4 – 4/0
	575	100	150	150	(1 qty.) #14 - 1/0	(1 qty.) #4 – 4/0	(1 qty.) #4 – 4/0
130F	208	100	400	400	(1 qty.) #14 - 1/0	(1 qty.) 250 - 400 MCM	(1 qty.) 250 - 400 MCM
	230	100	400	400	(1 qty.) #14 - 1/0	(1 qty.) 250 - 400 MCM	(1 qty.) 250 - 400 MCM
	460	100	150	150	(1 qty.) #14 - 1/0	(1 qty.) #4 – 4/0	(1 qty.) #4 – 4/0
	575	100	150	150	(1 qty.) #14 - 1/0	(1 qty.) #4 – 4/0	(1 qty.) #4 – 4/0
135F	208	100	400	400	(1 qty.) #14 - 1/0	(1 qty.) 250 - 400 MCM	(1 qty.) 250 - 400 MCM
	230	100	400	400	(1 qty.) #14 - 1/0	(1 qty.) 250 - 400 MCM	(1 qty.) 250 - 400 MCM
	460	100	150	150	(1 qty.) #14 - 1/0	(1 qty.) #4 – 4/0	(1 qty.) #4 – 4/0
	575	100	150	150	(1 qty.) #14 - 1/0	(1 qty.) #4 – 4/0	(1 qty.) #4 – 4/0
140F	208	100	400	400	(1 qty.) #14 - 1/0	(1 qty.) 250 - 400 MCM	(1 qty.) 250 - 400 MCM
	230	100	400	400	(1 qty.) #14 - 1/0	(1 qty.) 250 - 400 MCM	(1 qty.) 250 - 400 MCM
	460	100	225	225	(1 qty.) #14 - 1/0	(1 qty.) #4 – 4/0	(1 qty.) #4 – 4/0
	575	100	150	150	(1 qty.) #14 - 1/0	(1 qty.) #4 – 4/0	(1 qty.) #4 – 4/0
145F	208	100	400	400	(1 qty.) #14 - 1/0	(1 qty.) 250 - 400 MCM	(1 qty.) 250 - 400 MCM
	230	100	400	400	(1 qty.) #14 - 1/0	(1 qty.) 250 - 400 MCM	(1 qty.) 250 - 400 MCM
	460	100	225	225	(1 qty.) #14 - 1/0	(1 qty.) #4 – 4/0	(1 qty.) #4 – 4/0
	575	100	150	150	(1 qty.) #14 - 1/0	(1 qty.) #4 – 4/0	(1 qty.) #4 – 4/0
150F	208	100	400	400	(1 qty.) #14 - 1/0	(1 qty.) 250 - 400 MCM	(1 qty.) 250 - 400 MCM
	230	100	400	400	(1 qty.) #14 - 1/0	(1 qty.) 250 - 400 MCM	(1 qty.) 250 - 400 MCM
	460	100	225	225	(1 qty.) #14 - 1/0	(1 qty.) #4 – 4/0	(1 qty.) #4 – 4/0
	575	100	150	150	(1 qty.) #14 - 1/0	(1 qty.) #4 – 4/0	(1 qty.) #4 – 4/0

See page 26 for all Electrical Data notes.

Notes for Electrical Data

1. Unit wire size ampacity (MCA) is equal to 125% of the largest compressor-motor RLA plus 100% of RLA of all other loads in the circuit including the control transformer.
2. If the control transformer option is furnished, no separate 115V power is required.
3. If a separate 115V power supply is used for the control circuit, then the wire sizing is 12 amps.
4. Recommended power lead wire sizes for 3 conductors per conduit are based on 100% conductor ampacity in accordance with NEC. Wire sizes for 6 conductors per conduit are based on 80% conductor ampacity in accordance with NEC. Voltage drop has not been included. Therefore, it is recommended that power leads be kept short. All terminal block connections must be made with copper (type THW) wire.
5. The unit power terminal block can have 2 lugs per phase. Single or parallel conductors should be used for power connections as listed under "Recommended Power Lead Wire Size."
6. "Recommended Fuse Sizes" are selected at approximately 150% of the largest compressor RLA, plus 100% of all other loads in the circuit.
7. "Maximum Fuse Sizes" are selected at approximately 225% of the largest compressor RLA, plus 100% of all other loads in the circuit.
8. The recommended power lead wire sizes are based on an ambient temperature of 86°F. Ampacity correction factors must be applied for other ambient temperatures. Refer to the National Electrical Code Handbook.

Voltage Limitations:

Unit Nameplate - 208V/60Hz/3Ph: 187V to 220V

Unit Nameplate - 230V/60Hz/3Ph: 207V to 253V

Unit Nameplate - 460V/60Hz/3Ph: 414V to 506V

Unit Nameplate - 575V/60Hz/3Ph: 517V to 633V

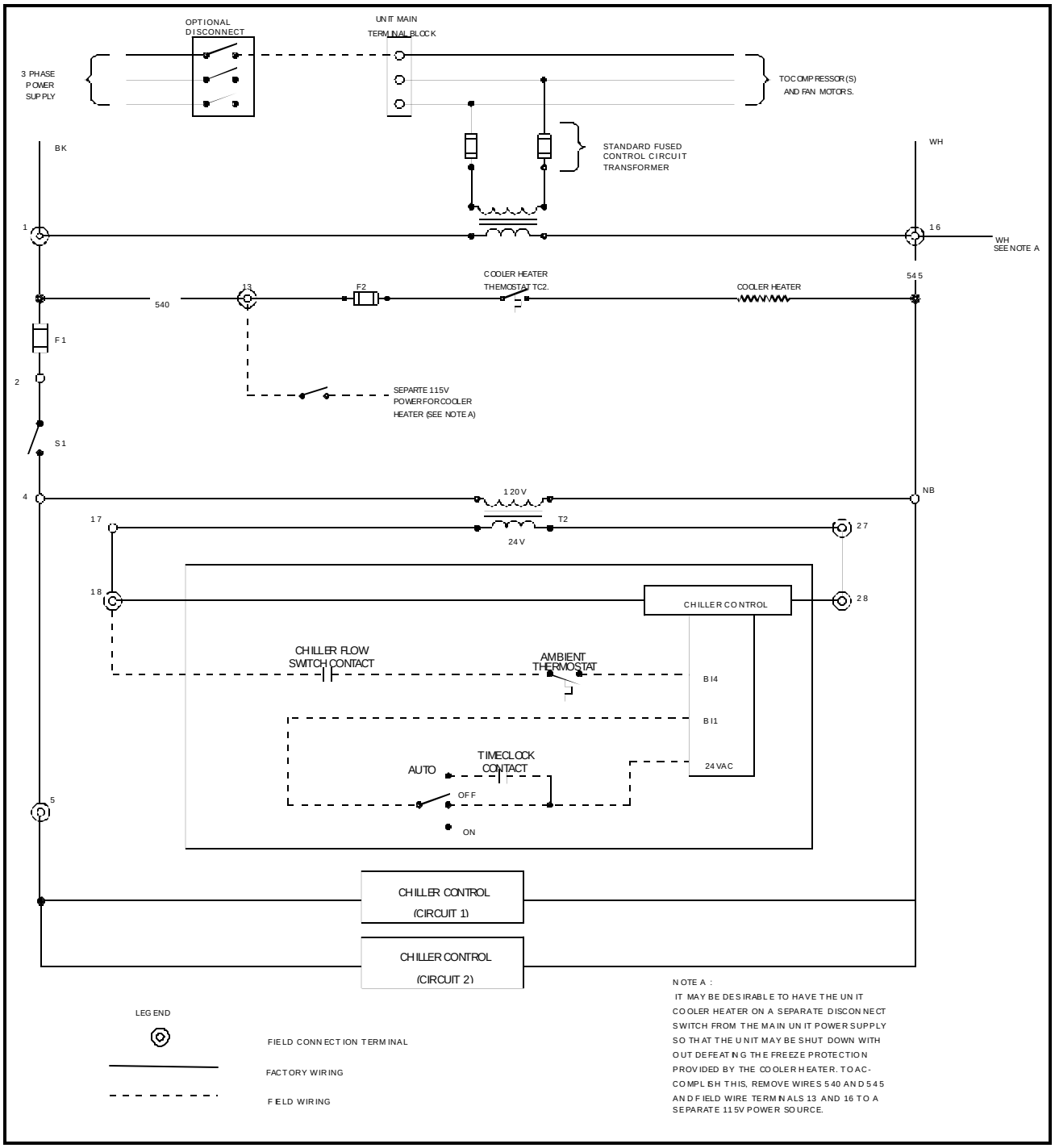
Notes for "Compressor and Condenser Fan Amp Draw":

1. Compressor RLA values are for wiring sizing purposes only but do not reflect normal operating current draw at rated capacity. If unit is equipped with SpeedTrol condenser fan motors, the first motor on each refrigerant circuit is a single phase, 1hp motor, with a FLA of 2.8 amps at 460 volts, 5.6 amps at 208, 230, and 575 volts.
2. Compressor LRA for reduced inrush start are for the first winding only. If the unit is equipped with SpeedTrol motors, the first motor is a single phase, 1 hp motor, with a LRA of 7.3 amps at 460 volts, 14.5 amps at 208, 230 and 575 volts.

Notes for "Field Wiring Data" - Both Single and Multiple Point Power:

1. Single point power supply requires a single disconnect to supply electrical power to the unit. This power must be fused.
2. Multiple point power supply requires two independent power circuits each with separate disconnects and a separate control circuit.
3. All field wiring to unit power block or optional non-fused disconnect switch must be copper.
4. All field wire size values given in table apply to 75°C rated wire per NEC.

Figure 9, ALR 110F through 150F, Typical Field Wiring Diagram



Physical Data

Table 16, Physical Data ALR 110F through 135F

PHYSICAL DATA	ALR MODEL NUMBER							
	110F		120F		130F		135F	
BASIC DATA	Ckt.1	Ckt.2	Ckt.1	Ckt.2	Ckt.1	Ckt.2	Ckt.1	Ckt.2
Unit Capacity @ ARI Conditions, Tons (kW) (1)	110.9 (388.1)		122.2 (427.7)		129.6 (453.6)		133.7 (468.0)	
Number Of Refrigerant Circuits	2		2		2		2	
Unit Operating Charge, R-22, Lbs.	115	115	120	120	120	120	120	120
Unit Operating Charge, R-22, (kg)	(52.1)	(52.1)	(54.4)	(54.4)	(54.4)	(54.4)	(54.4)	(54.4)
Cabinet Dimensions, LxWxH, In.	229 x 83 x 89		229 x 83 x 89		229 x 83 x 89		229 x 83 x 89	
Cabinet Dimensions, LxWxH, (mm)	(5809 x 2118 x 2210)		(5809 x 2118 x 2210)		(5809 x 2118 x 2210)		(5817 x 2118 x 2210)	
Unit Operating Weight, Lbs. (kg)	9700 (4394)		9880 (4476)		9880 (4476)		9880 (4476)	
Unit Shipping Weight, Lbs. (kg)	9420 (4267)		9550 (4326)		9550 (4326)		9550 (4326)	
Add'l Weight If Copper Finned Coils, Lbs. (kg)	1370 (620)		1370 (620)		1370 (620)		1370 (620)	
COMPRESSORS								
Type	Semi-Hermetic		Semi-Hermetic		Semi-Hermetic		Semi-Hermetic	
Nominal Horsepower	30-30	30-35	30-35	35-35	35-35	35-35	35-40	35-40
Number Of Cylinders Per Compressor	6 - 6	6 - 6	6 - 6	6 - 6	6 - 6	6 - 6	6 - 6	6 - 6
Oil Charge Per Compressor, oz.	140 - 140	140 - 140	140 - 140	140 - 140	140 - 140	140 - 140	140 - 255	140 - 255
Oil Charge Per Compressor, (l)	(4.1 – 4.1)	(4.1 – 4.1)	(4.1 – 4.1)	(4.1 – 4.1)	(4.1 – 4.1)	(4.1 – 4.1)	(4.1 – 6.5)	(4.1 – 6.5)
CAPACITY REDUCTION STEPS - PERCENT OF COMPRESSOR DISPLACEMENT								
Staging - Circuit #1 in Lead	0-16-32-40-48 -64-84-92-100		0-15-32-39-48 -67-84-91-100		0-17-33-42-50 -67-83-92-100		0-16-32-40-48 -66-84-92-100	
Staging - Circuit #2 in Lead	0-16-32-40-48 -68-84-92-100		0-17-32-41-48 -65-84-91-100		0-17-33-42-50 -67-83-92-100		0-16-32-40-48 -66-84-92-100	
CONDENSERS - HIGH EFFICIENCY FIN AND TUBE TYPE WITH INTEGRAL SUBCOOLING								
Coil Face Area,Sq. Ft.	115	115	115	115	115	115	115	115
Coil Face Area, (M^2)	(10.3)	(10.3)	(10.3)	(10.3)	(10.3)	(10.3)	(10.3)	(10.3)
Finned Height x Finned Length, In.	80 x 208	80 x 208	80 x 208	80 x 208	80 x 208	80 x 208	80 x 208	80 x 208
Finned Height x Finned Length, (mm)	(2032 x 5283)	(2032 x 5283)	(2032 x 5283)	(2032 x 5283)	(2032 x 5283)	(2032 x 5283)	(2032 x 5283)	(2032 x 5283)
Fins Per Inch x Rows Deep	16 x 3	16 x 3	16 x 3	16 x 3	16 x 3	16 x 3	16 x 3	16 x 3
Maximum Relief Valve Pressure Setting, psig (kPa)	450 (3103)	450 (3103)	450 (3103)	450 (3103)	450 (3103)	450 (3103)	450 (3103)	450 (3103)
CONDENSER FANS - DIRECT DRIVE PROPELLER TYPE								
Number Of Fans - Fan Diameter, In. (mm)	10 - 28 (711)		10 - 28 (711)		12 - 28 (711)		12 - 28 (711)	
Number Of Motors - HP (kW)	10 - 1.5 (1.1)		10 - 1.5 (1.1)		12 - 1.5 (1.1)		12 - 1.5 (1.1)	
Fan And Motor RPM, 60 Hz	1140		1140		1140		1140	
60 Hz Fan Tip Speed, FPM	8357		8357		8357		8357	
60 Hz Total Unit Airflow, CFM	90200		90200		108240		108240	
DIRECT EXPANSION EVAPORATOR - BAFFLED SHELL AND THRU-TUBE								
Diameter, in. - Length, in.	12.8 x 94.6		14.0 x 95.5		14.0 x 95.5		14.0 x 95.5	
Diameter, (mm) - Length, (mm)	325 x 2403		356 x 2426		356 x 2426		356 x 2426	
Water Volume, Gallons, (L)	34 (127)		40 (150)		40 (150)		40 (150)	
Maximum Water Pressure, psig (kPa)	152 (1047)		152 (1047)		152 (1047)		152 (1047)	
Maximum Refrigerant Working Pressure, psig (kPa)	300 (2066)		300 (2066)		300 (2066)		300 (2066)	
Water Inlet / Outlet Victaulic Connections, In. (mm)	5 (127)		8 (203)		8 (203)		8 (203)	
Drain - NPT int, In. (mm)	.5 (12.7)		.5 (12.7)		.5 (12.7)		.5 (12.7)	
Vent - NPT int, In. (mm)	.5 (12.7)		.5 (12.7)		.5 (12.7)		.5 (12.7)	

NOTE:

1. Nominal capacity based on R-22, 95°F ambient air and 54°F/44°F water range.

Table 17, Physical Data ALR 140F through 150F

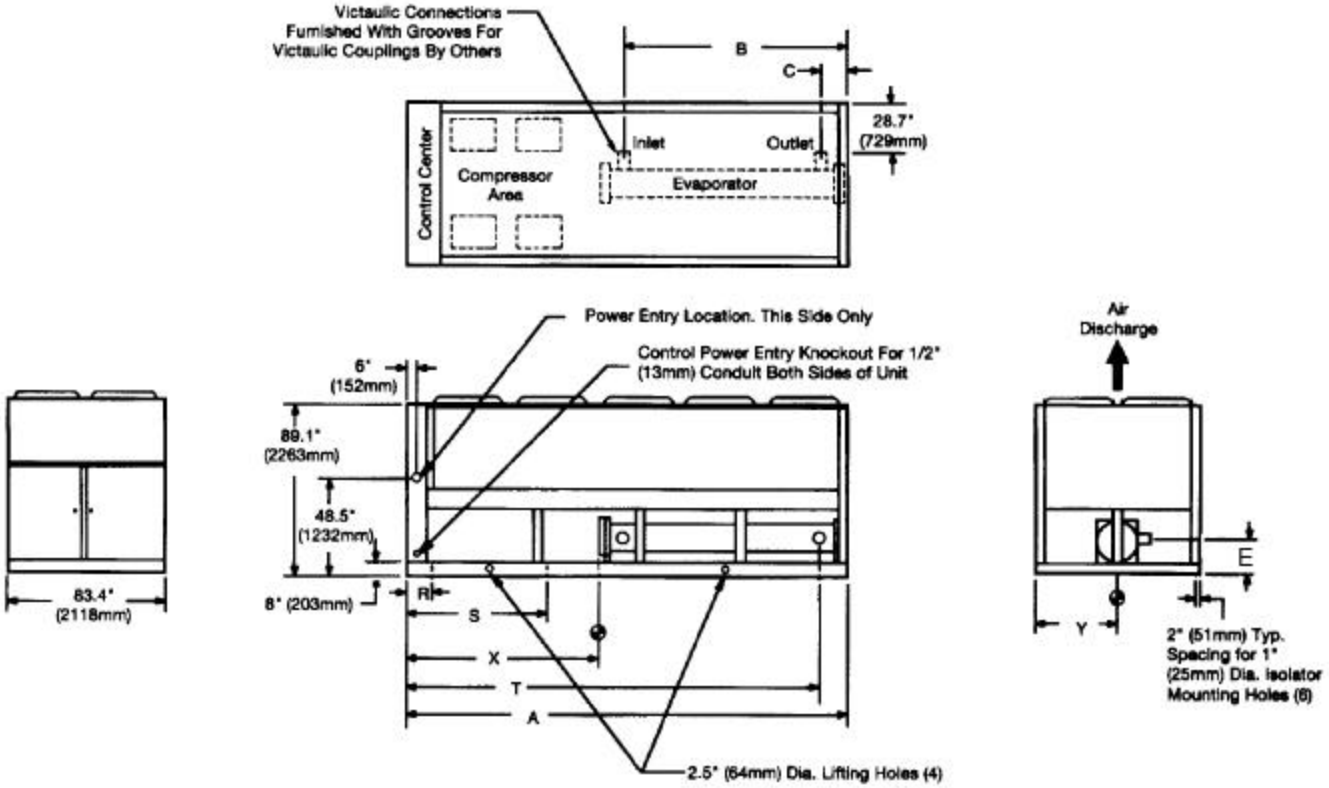
PHYSICAL DATA	ALR MODEL					
	140F		145F		150F	
BASIC DATA	Ckt.1	Ckt.2	Ckt.1	Ckt.2	Ckt.1	Ckt.2
Unit Capacity @ ARI Conditions (1), Tons (kW)	139.7 (489.0)		143.2 (501.2)		149.5 (523.3)	
Number Of Refrigerant Circuits	2		2		2	
Unit Operating Charge, R-22, Lbs.	125	125	130	130	130	130
Unit Operating Charge, R-22, (kg)	(56.6)	(56.6)	(58.9)	(58.9)	(58.9)	(58.9)
Cabinet Dimensions, LxWxH, In.	229 x 83 x 89		229 x 83 x 89		229 x 83 x 89	
Cabinet Dimensions, LxWxH, (mm)	(5817 x 2118 x 2210)		(5817 x 2118 x 2210)		(5817 x 2118 x 2210)	
Unit Operating Weight, Lbs. (kg)	9885 (4478)		9890 (4480)		10090 (4571)	
Unit Shipping Weight, Lbs. (kg)	9555 (4328)		9560 (4330)		9760 (4421)	
Add'l Weight If Copper Finned Coils, Lbs. (kg)	1370 (620)		1370 (621)		1370 (621)	
COMPRESSORS						
Type	Semi-Hermetic		Semi-Hermetic		Semi-Hermetic	
Nominal Horsepower	40-40	40-40	40-40	40-40	40-40	40-50
Number Of Cylinders Per Compressor	6 - 6	6 - 6	6 - 6	6 - 6	6 - 6	6 - 8
Oil Charge Per Compressor, oz.	255 - 255	255 - 255	255 - 255	255 - 255	255 - 255	255 - 255
Oil Charge Per Compressor, (l)	(6.5 – 6.5)	(6.5 – 6.5)	(6.5 – 6.5)	(6.5 – 6.5)	(6.5 – 6.5)	(6.5 – 6.5)
CAPACITY REDUCTION STEPS - PERCENT OF COMPRESSOR DISPLACEMENT						
Staging - Circuit #1 in Lead	0-17-33-42-50 -67-83-92-100		0-17-33-42-50 -67-83-92-100		0-15-32-40-64 -64-84-92-100	
Staging - Circuit #2 in Lead	0-17-33-42-50 -67-83-92-100		0-17-33-42-50 -67-83-92-100		0-15-32-40-48 -68-84-92-100	
CONDENSERS - HIGH EFFICIENCY FIN AND TUBE TYPE WITH INTEGRAL SUBCOOLING						
Coil Face Area,Sq. Ft.	115	115	115	115	115	115
Coil Face Area, (M^2)	(10.3)	(10.3)	(10.3)	(10.3)	(10.3)	(10.3)
Finned Height x Finned Length, In.	80 x 208	80 x 208	80 x 208	80 x 208	80 x 208	80 x 208
Finned Height x Finned Length, (mm)	(2032 x 5283)	(2032 x 5283)	(2032 x 5283)	(2032 x 5283)	(2032 x 5283)	(2032 x 5283)
Fins Per Inch x Rows Deep	16 x 3	16 x 3	16 x 3	16 x 3	16 x 3	16 x 3
Maximum Relief Valve Pressure Setting, psig (kPa)	450 (3103)	450 (3103)	450 (3103)	450 (3103)	450 (3103)	450 (3103)
CONDENSER FANS - DIRECT DRIVE PROPELLER TYPE						
Number Of Fans - Fan Diameter, In. (mm)	12 - 28 (711)		12 - 28 (711)		12 - 28 (711)	
Number Of Motors - HP (kW)	12 - 1.5 (1.1)		12 - 1.5 (1.1)		12 - 1.5 (1.1)	
Fan And Motor RPM, 60 HZ	1140		1140		1140	
60 Hz Fan Tip Speed, FPM	8357		8357		8357	
60 Hz Total Unit Airflow, CFM	108240		108240		108240	
DIRECT EXPANSION EVAPORATOR - BAFFLED SHELL AND THRU-TUBE						
Diameter, in. - Length, in.	14.0 x 95.5		16.0 x 96.8		16.0 x 96.8	
Diameter, (mm) - Length, (mm)	356 x 2426		406 x 2459		406 x 2459	
Water Volume, Gallons, (L)	40 (150)		55 (208)		55 (208)	
Maximum Water Pressure, psig (kPa)	152 (1047)		152 (1047)		152 (1047)	
Maximum Refrigerant Working Pressure, psig (kPa)	300 (2066)		300 (2066)		300 (2066)	
Water Inlet / Outlet Victaulic Connections, In. (mm)	8 (203)		8 (203)		8 (203)	
Drain - NPT int, In. (mm)	.5 (12.7)		.5 (12.7)		.5 (12.7)	
Vent - NPT int, In. (mm)	.5 (12.7)		.5 (12.7)		.5 (12.7)	

NOTES:

1. Nominal capacity based on R-22, 95°F ambient air and 54°F/44°F water range.

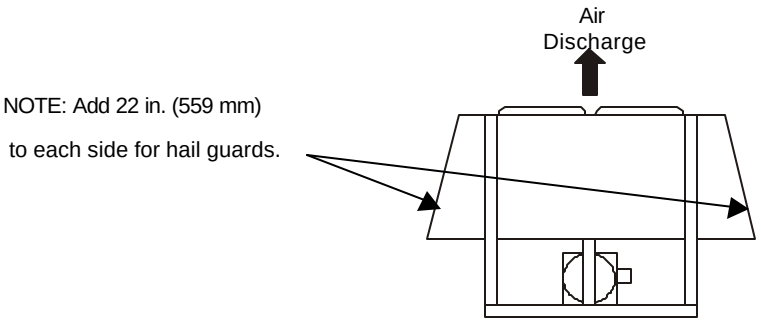
Dimensional Data

Figure 10, 110F through 150F Dimensions



ALR SIZE	"A" LENGTH	CONN. SIZE (1)	WATER CONNECTIONS				CENTER OF GRAVITY		ISOLATOR LOCATION			NO. OF FANS
			B	C	E	F	X	Y	R	S	T	
110F	229 (5809)	5 (127.0)	95.8 (2433)	17.1 (434)	16.3 (414)	31.4 (798)	95.5 (2426)	41.7 (1059)	36.0 (914)	102 (2591)	192 (4877)	10
120F	229 (5809)	8 (203.2)	94.7 (2405)	17.5 (445)	16.3 (414)	30.7 (780)	97.0 (2464)	41.7 (1059)	36.0 (914)	102 (2591)	192 (4877)	10
130F	229 (5809)	8 (203.2)	94.7 (2405)	17.5 (445)	16.3 (414)	30.7 (780)	97.0 (2464)	41.7 (1059)	36.0 (914)	102 (2591)	192 (4877)	12
135F	229 (5809)	8 (203.2)	94.7 (2405)	17.5 (445)	16.3 (414)	30.7 (780)	97.0 (2464)	41.7 (1059)	36.0 (914)	102 (2591)	192 (4877)	12
140F	229 (5809)	8 (203.2)	94.7 (2405)	17.5 (445)	16.3 (414)	30.7 (780)	97.0 (2464)	41.7 (1059)	36.0 (914)	102 (2591)	192 (4877)	12
145F	229 (5809)	8 (203.2)	94.8 (2408)	17.2 (437)	18.3 (465)	29.8 (757)	99.0 (2515)	41.7 (1059)	36.0 (914)	102 (2591)	192 (4877)	12
150F	229 (5809)	8 (203.2)	94.8 (2408)	17.2 (437)	18.3 (465)	29.8 (757)	99.0 (2515)	41.7 (1059)	36.0 (914)	102 (2591)	192 (4877)	12

NOTE: Only left hand evaporator connections (as shown) are available.



Unit Placement

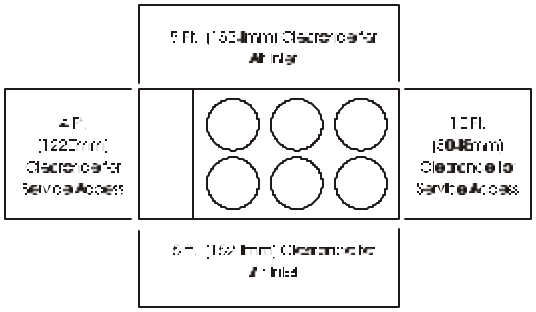
ALR units are for outdoor applications and can be mounted either on a roof or at ground level. Set units on a solid and level foundation. For roof mounted applications, install the unit on a steel channel or I-beam frame to support the unit above the roof. For ground level applications, install the unit on a substantial base that will not settle. A one-piece concrete slab with footings extended below the frost line is recommended. Be sure the foundation is level (within 1/2"(13mm) over its length and width). The foundation must be strong enough to support the operating weights listed in Table 16 and Table 17.

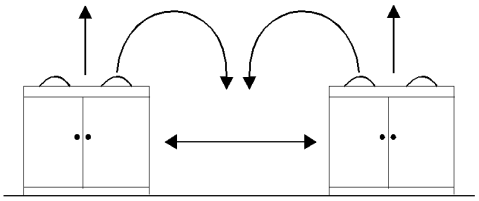
On ground level applications protect the unit against vandalism using the optional lower guard screens or by erecting a screen fence. The fence must allow free flow of air to the condenser coil for proper unit operation.

Clearances

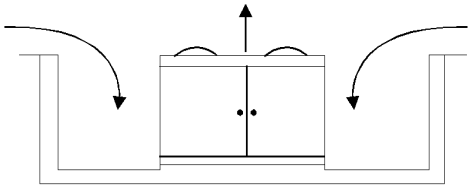
The flow of air to and from the condenser coil must not be impeded. Restricting airflow or allowing air recirculation will result in a decrease in unit performance and efficiency because discharge pressures are increased. There must be no obstruction above the unit that would deflect discharge air downward where it could be recirculated back to the inlet of the condenser coil. The condenser fans are propeller type and will not operate with ductwork on the fan outlet.

Figure 11, Clearances

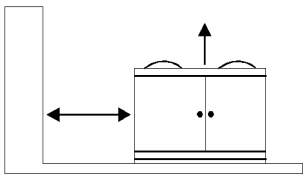




The recommended minimum side clearance between two units is 10 feet (3048mm). Distance less than 10 feet (3048mm) can result in air recirculation.



The unit must not be installed in a pit or enclosure that is deeper or taller than the height of the unit unless extra space is provided. The minimum clearance on each side of the unit is 8 feet (2438mm) when installed in a pit. The pit cannot be deeper than the unit



The minimum clearance to a side wall or building taller than the unit height is 8 feet (2438mm) provided no solid wall above 6 feet (1830mm) tall is closer than 12 feet (3658mm) to the opposite side of the unit.

Install the unit with enough side clearance for air entrance to the coil and for servicing. Provide service access to the evaporator, compressors, electrical control panel and piping components as shown in Figure 10 and Figure 11. The 10 foot clearance opposite the control panel is for evaporator tube pulling. This space can be reduced to 4 feet by removing the evaporator or providing some other means (i.e. door) for tube pulling.

Do not allow debris to accumulate near the unit. Air movement can draw debris into the condenser coil causing coil starvation. Give special consideration to low ambient operation where snow can accumulate. Keep condenser coils and fan discharge free of snow or other obstructions to permit adequate airflow for proper unit operation.

Restricted Air Flow

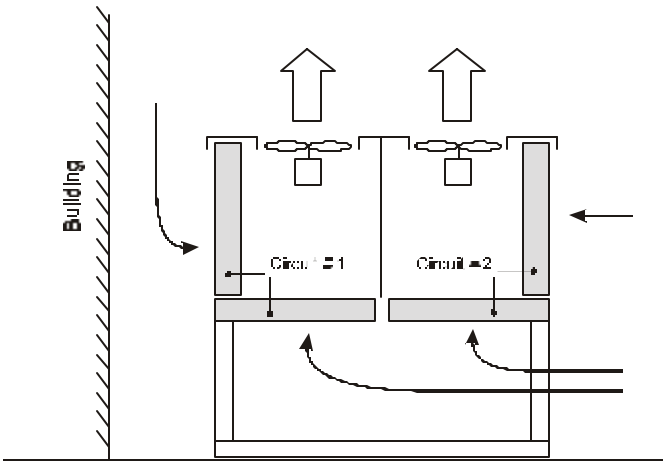
General

The clearances required for penalty-free operation of ALR air-cooled condensers are described in the previous section. Inevitably there are situations where these clearances cannot be maintained due to site restrictions such as units being too close together or a fence or wall restricting airflow, or both.

Fortunately the McQuay ALR chillers have several features that mitigate the penalties attributed to restricted airflow.

- The condenser section is "U" shaped, as shown below. This allows inlet air for these coils to come in from either side. A vertical coil and its adjacent horizontal coil are manifolded together to serve one circuit.
- The optional MicroTech control is proactive in response to "off-design conditions". In the case of single or compounded influences restricting airflow to the unit, the microprocessor will act to keep the compressor(s) running (at reduced capacity) rather than allowing a shut-off on high discharge pressure.
- The optional MicroTech control can be programmed to sequence the compressors in the most advantageous way. For example, in the diagram shown below, it might be desirable to program circuit 2 to be the lag circuit (last circuit to reach full load) during periods of high ambient temperatures.

Figure 12, Coil and Fan Arrangement



The following sections discuss the most common situations of condenser air restriction and give capacity and power adjustment factors for each. It should be noted that in unusually severe conditions the optional MicroTech controller would adjust the unit operation to remain online until a safe condition is reached.

Case 1, Building or Wall on One Side of One Unit

The existence of a screening wall or the wall of a building in close proximity to an air-cooled chiller is quite common in both rooftop and ground level applications. Hot air recirculation on the coils adjoining the wall will increase compressor discharge pressure, decreasing capacity and increasing power consumption. Only the compressors connected to these coils will be affected. Circuits opposite the wall are unaffected.

When close to a wall, it is desirable to place chillers on the North or East side of them. It is also desirable to have prevailing winds blowing parallel to the unit's long axis. The worst case is to have wind blowing hot discharge air into the wall.

Figure 13, Unit Adjacent to Wall

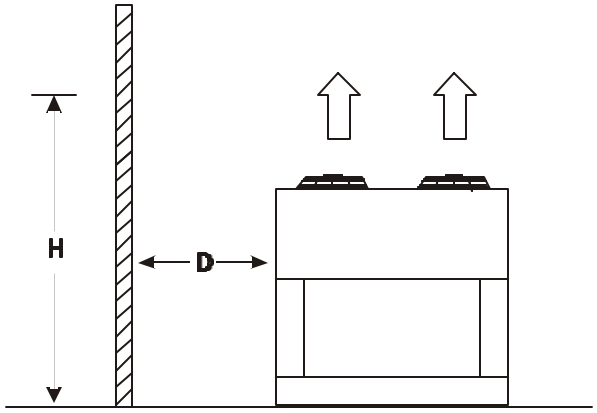
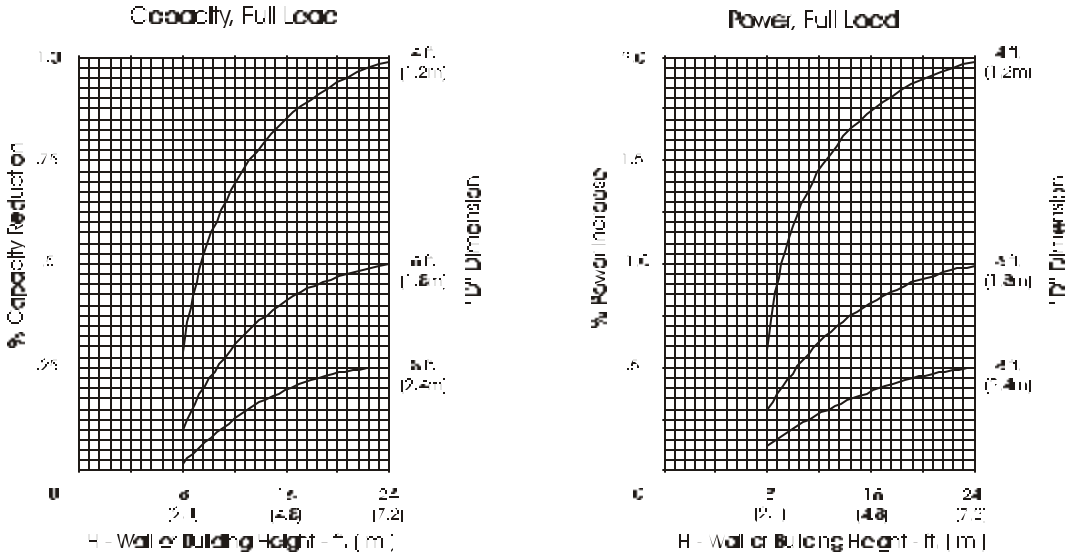


Figure 14, Adjustment Factors



Case 2, Two Units Side By Side

Two or more units sited side by side are quite common. If spaced closer than 12 feet (3.7 meters) it is necessary to adjust the performance of each unit; circuits adjoining each other are affected.

NOTE: This case applies only to *two* units side by side. See Case 3 for three or more parallel units. If one of the two units also has a wall adjoining it, see Case 1. Add the two adjustment factors together and apply to the unit located between the wall and the other unit.

Mounting units end to end will not necessitate adjusting performance. Depending on the actual arrangement, sufficient space must be left between the units for access to the control panel (door opening and/or evaporator tube removal. See "Clearance" section of this guide for requirements for specific units.

Pit or solid wall surrounds should not be used where the ambient air temperature exceeds 105°F (40°C).

Figure 15, Two Units Side by Side

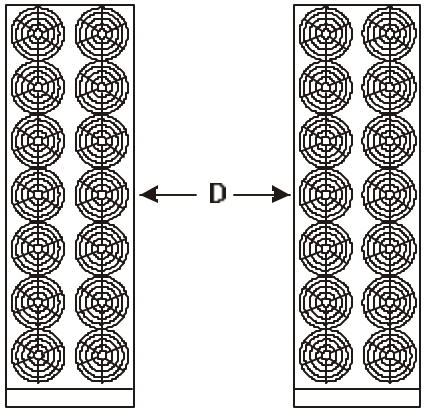
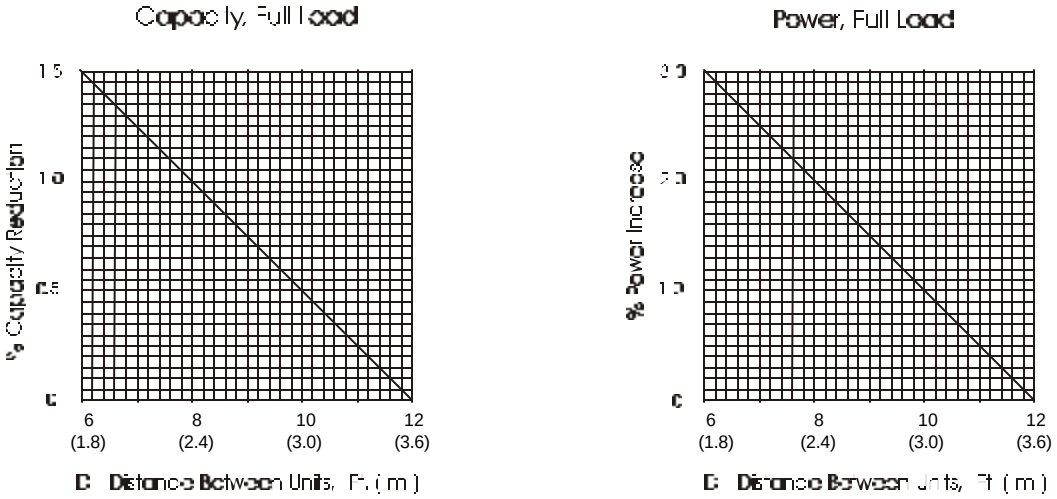


Figure 16, Adjustment Factor



Case 3, Three or More Units Side By Side

When three or more units are side by side, the outside chillers (1 and 3 in this case) are influenced by the middle unit only on their inside circuits. Their adjustment factors will be the same as Case 2. All inside units (only number 2 in this case) are influenced on both sides and must be adjusted by the factors shown below.

Figure 17, Three or More Units

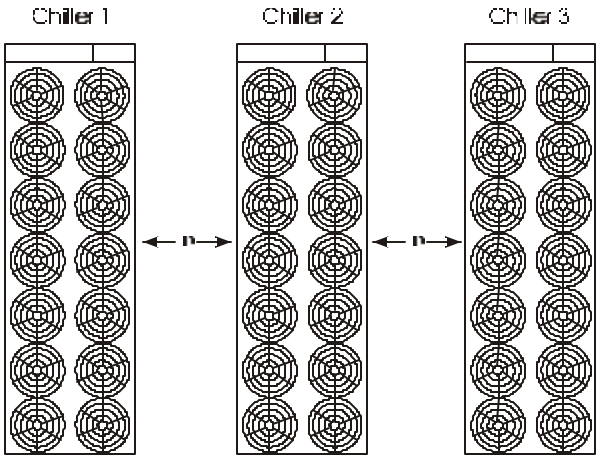
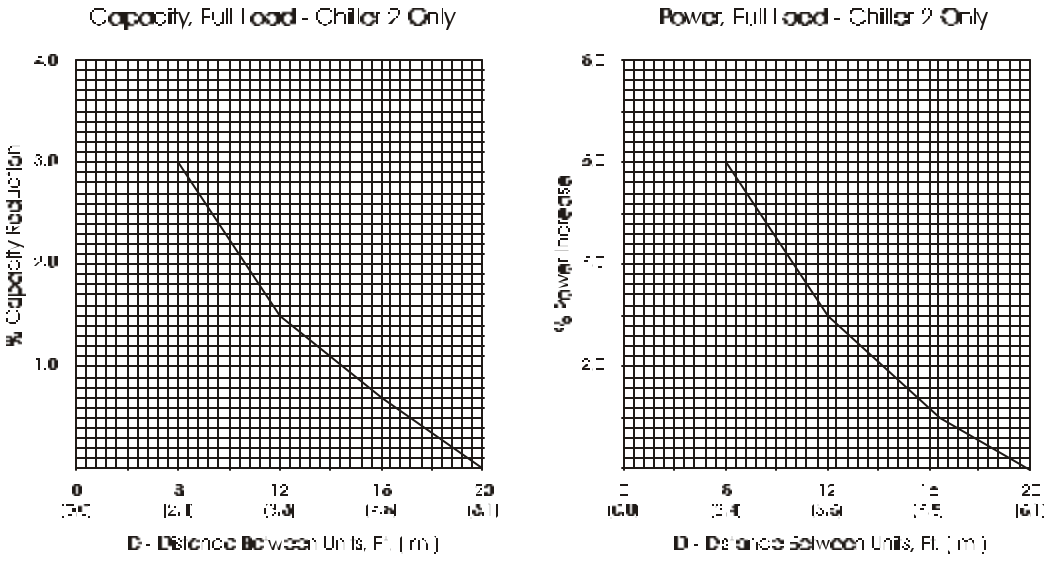


Figure 18, Adjustment Factor



Case 4, Open Screening Walls

Decorative screening walls are often used to help conceal a unit either on grade or on a rooftop. These walls should be designed such that the combination of their open area and distance from the unit do not require performance adjustment. It is assumed that the wall height is equal to or less than the unit height when mounted on its base support. This is usually satisfactory for concealment.

The distance from the ends of the unit to the end walls should be sufficient for service, opening control panel doors, and pulling evaporator tubes, as applicable.

If each side wall is different distance from the unit, the distances can be averaged providing either wall is not more than 8 feet (2.4 meters) from the unit. For example, do not average 4 feet and 20 feet to equal 12 feet.

Figure 19, Open Screening Walls

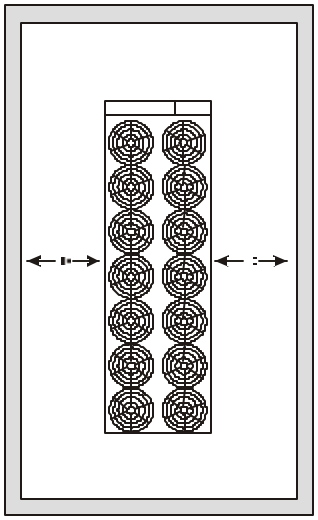
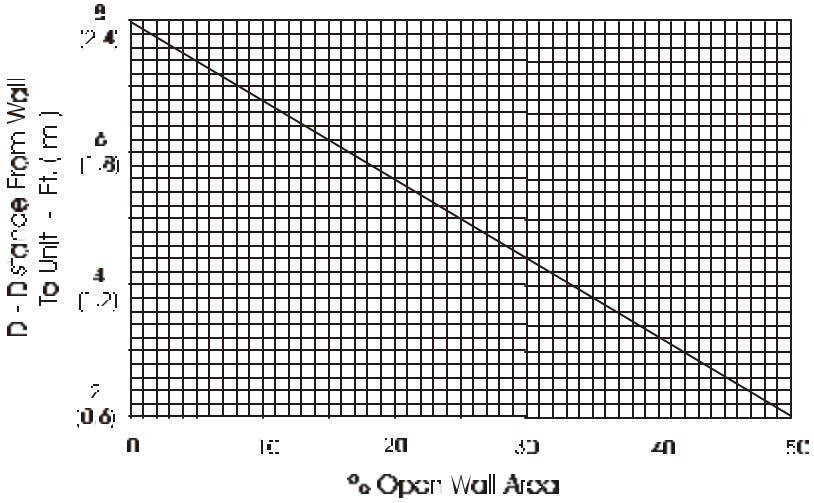


Figure 20, Wall Free Area vs. Distance



Case 5, Pit/Solid Wall Installation

Pit installations have historically caused many operating problems and great care should be exercised if they are to be used on an installation. Recirculation and restriction can both occur. A solid wall surrounding a unit is substantially the same as a pit and the data presented here should be used.

Steel grating is sometimes used to cover a pit for safety considerations. The grating material must provide abundant open area or serious recirculation problems will occur. It would be prudent to have any pit installation reviewed by McQuay application engineers prior to installation.

Figure 21, Pit Installation

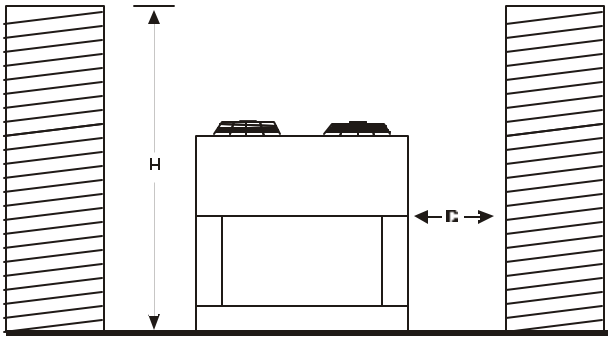
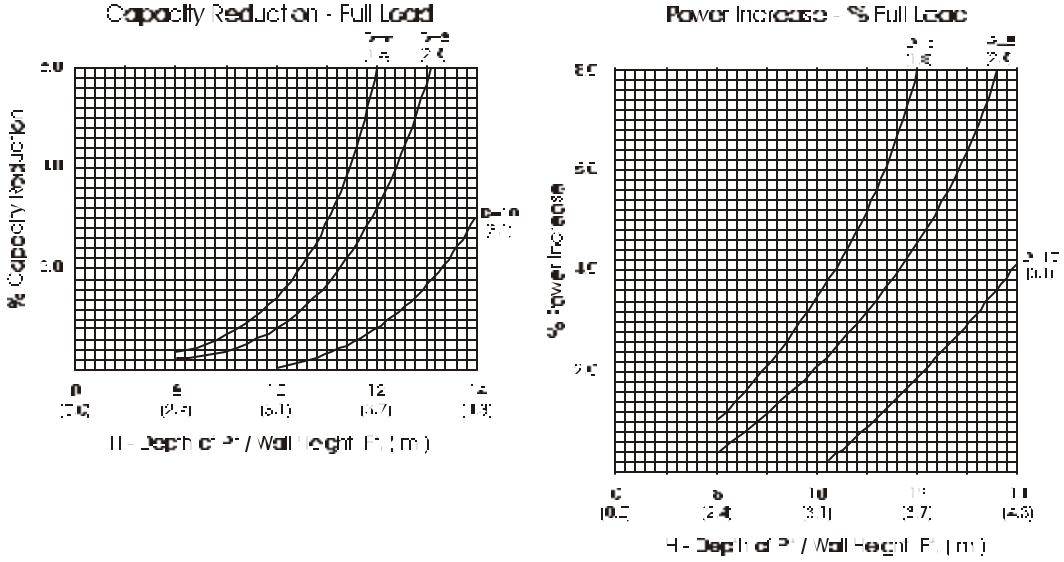


Figure 22, Adjustment Factor



Chilled Water Piping

Flush the system water piping thoroughly before making connections to the unit evaporator. A strainer of 40 mesh should be installed in the return water line before the inlet to the chiller. Design the water piping so the chilled water circulating pump discharges into the evaporator inlet.

Connect the return water line to the evaporator inlet connection (the connection closest to the compressors). Connect the supply water line to the evaporator outlet connection.

Install a flow switch in the horizontal piping of the supply (evaporator outlet) water line.

Provide drain connections at low points in the system to permit complete drainage of the system. Air vents should be located at the high points in the system to purge air out of the system. A vent connection on top of the evaporator vessel permits the purging of air out of the evaporator. Purge air from the water system before unit start-up to provide adequate flow through the evaporator.

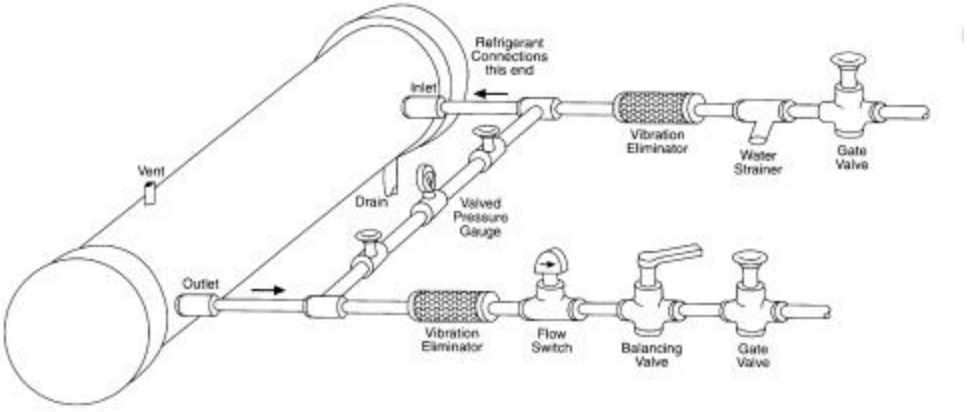
Pressure gauges should be installed in the inlet and outlet water lines to the evaporator. Pressure drop through the evaporator should be measured to calculate proper flow as determined from Figure 5. Vibration eliminators are recommended in both the supply and return water lines.

Chilled water piping should be insulated to reduce heat loss and prevent condensation. Chillers not running in the winter should have their water systems thoroughly drained to protect against freezing. If the chiller operates year round, or if the system is not drained for the winter, the chilled water piping exposed to outdoor temperature should be protected against freezing. Wrap the lines with a heater cable and add proper amount of glycol to the system to further protect the system during low ambient periods.

Chilled Water Piping

On ALR 110F through 150F the thermostat sensor is factory mounted in the leaving water well. If an optional high return water sensor is provided, install sensor bulb in a field supplied tee or strap to the outside of the water line.

Figure 23, Typical Chilled Water Piping



Series Compared to Parallel Operation

Consider system pressure drop when designing the water piping. Parallel piped systems have half of the total system flow going through the evaporator of each chiller, reducing the individual unit and total system pressure drop.

Series piped evaporators require that the total system water flows through both evaporators. Not only is the pressure drop through each evaporator increased but the pressure drops must be added together to obtain the total evaporator pressure drop. Series piped evaporators normally require larger circulating pumps for the chilled water system.

Temperature and Water Flow Limitations

ALR units are designed to operate in ambient conditions from 30°F (-1°C) to 115°F (46°C). A low ambient option with SpeedTrol allows operation down to 0°F (-18°C). The minimum ambient air temperature is based on still conditions where the wind is not greater than five mph. Greater wind velocities will result in reduced discharge pressure, increasing the minimum operating ambient temperature. The ALR air-cooled chillers are available with a field installed hail and wind baffle. The baffles allow the chiller to operate effectively down to the ambient temperature for which the unit was designed.

Evaporator flow rates below the minimum values can result in laminar flow causing freeze-up problems, scaling and poor control. Flow rates above the maximum values will result in unacceptable pressure drops and can cause excessive nozzle and tube erosion, potentially leading to failure.

System Water Volume

It is important to have adequate water volume in the system to provide an opportunity for the chiller to sense a load change, adjust to the change and stabilize. As the expected load change becomes more rapid, a greater water volume is needed. The system water volume is the total amount of water in the evaporator, air handling products and associated piping. If the water volume is too low, operational problems can occur including rapid compressor cycling, rapid loading and unloading of compressors, erratic refrigerant flow in the chiller, improper motor cooling, shortened equipment life and other undesirable occurrences.

For normal comfort cooling applications where the cooling load changes relatively slowly, we recommend a minimum system volume of seven minutes times the flow rate. For example, if the design chiller flow rate is 300 GPM, we recommend a minimum system volume of 2100 gallons (300 GPM x 7 minutes).

For process applications where the cooling load can change rapidly, additional system water volume is needed. A process example would be the cooling of hot metal objects. The load would be very stable until the hot metal is dipped into the water tank. Then, the load would increase dramatically. For this type of application, we recommend that the normal comfort cooling recommendation addressed above plus three minutes of ballast for every 10% quick change in load. For example, if the hot metal example load changes from a stable 50% load to an immediate 100% load for metal cooling, the recommended system volume would increase to 6600 gallons.

System volume = {300 GPM X 7 Minutes} + {(5 increment of 10% increase) X (3 Minutes) X 300 GPM} = 6600 Gallons

Since there are many other factors that can influence performance, systems can successfully operate below these suggestions. However, as the water volume decreases below these suggestions, the possibility of problems increases. We believe that these guidelines should be an industry standard and not just recommendations from McQuay.

Variable Water Flow

Variable water flow involves changing the water flow through the evaporator as the load changes. McQuay chillers are designed for this duty provided that the rate of change in water flow is slow and the minimum & maximum flow rates for the vessel are not exceeded.

The recommended change in water flow is 10% of the change per minute. For the ALR control logic, there are timers that limit the rate of unloading or loading allowed. A slow change allows the chiller to sense a change in load, react to the change and stabilize preventing operational problems.

For example, assume that an ALR has a design flow of 400 GPM and the minimum vessel flow rate of 250 GPM. The allowable amount of flow change is 150 GPM. Therefore, the maximum rate of change recommended would be 15 GPM/minute (150 X .10).

The water flow GPM through the vessel must remain between the minimum and maximum values listed on Figure 5. If flow drops below the minimum allowable, laminar flow can occur that reduces heat transfer. If the flow exceeds the maximum rate, excessive high pressure drops and tube erosion can occur.

Evaporator Freeze Protection

Evaporator freeze protection can be a concern in the application of air-cooled water chillers. To protect against freeze-up, insulation and an electric heater cable are furnished with the unit. This protects the evaporator down to -20°F (-29°C) ambient. Although the evaporator is equipped with freeze protection, it does not protect water piping external to the unit or the evaporator if there is a power failure or heater cable burnout. Consider the following recommendations for additional protection.

1. If the unit will not be operated during the winter, drain evaporator end chilled water piping. Drain and vent connections are provided on the evaporator to ease draining.
2. Add a glycol solution to the chilled water system to provide antifreeze protection. Freeze point should be approximately ten degrees below minimum design ambient temperature.

The evaporator heater cable is wired to the 115 volt circuit in the control box. This power should be supplied from a separate source, but it can be supplied from the control circuit. Operation of the heater cable is automatic through the ambient sensing thermostat that energizes the evaporator heater cable for protection against freeze-up. Unless the evaporator is drained in the winter, the disconnect switch to the evaporator heater must not be open.

Coil Material/Coating

The correct choice of fin material or selection of a coating can have a dramatic effect on the life and efficiency of the coil when corrosive or abrasive material is present. McQuay offers a variety of coil options to satisfy most ambient conditions.

Aluminum Fin

Lanced (slotted) 16 fpi aluminum fin is the standard fin material. It is used in non-corrosive, non-abrasive applications. Tubes are copper and completely covered by the fin shoulders on the face of the coil.

Copper Fin

Optional copper fins are a solid ripple fin design, 18 fpi. Tubes are copper and completely covered by the fin shoulders on the face of the coil. Copper fin provides good coil protection against chemicals that do not affect copper and is widely used in salt spray applications.

Black Fin

Optional Black Fin is aluminum finstock precoated with a 0.06 to 0.12 mil thick phenolic epoxy coating. It is a low cost solution for certain corrosive applications including salt spray. Passes 1000 hour salt spray test per ASTM B117.

ElectroFin™ Coating

Optional *ElectroFin*™ is a flexible dip and baked epoxy coating applied to the coil and coil frame after the coil is fabricated and prior to the coil being installed in the unit at the factory. It can be used on both aluminum and copper fins. The entire coil, including the fin edges, is covered with a uniform coating. There is no bridging of the fin slots. This coating is resistant to a wide range of chemicals including salt spray. It cannot be applied in the field after a unit is manufactured. Passes 3000 hour salt spray test per ASTM B117. Meets MIL-P-53084 (ME). It is resistant to the following chemical fumes among many others:

Acetone	Ammonia	Benzene	Boric Acid	Butyl Alcohol	$CaCl_2$
Carbon Tet	Chlorides	Chlorine Gas	Citric Acid	Diesel Fuel	Ethyl Acetate
Fluorine Gas	Gasoline	Glucose	Glycol	Hydrofluoric Acid	Hydogen Sulfide
Kerosene	Lactic Acid	Methanol	Napthol	Isobutyl Alcohol	Methyl Ketone
Oleic Acid	Ozone	Phosgene	Salt Water	Oxaloc Acid	NaCl
Sucrose	Sulfates	Sulfides	Sulfites	Urea	Vinegar

Remote Evaporator

General

NOTE: Remote evaporator arrangements are not included in the ARI Certification Program and capacities are therefore not ARI certified.

The ALR air-cooled chillers are available with remote evaporator on R-22 service only. This allows the main unit to be installed outdoors to save interior room and eliminates the need for anti-freeze solutions and heat tracing of chilled water lines since the chilled water system is indoors. There are some general guidelines to review before proceeding:

1. R-22 only.
2. Maximum line length of 100 ft (30 m) and Total Equivalent Length (TEL) of 200 ft (61 m).
3. No underground piping.
4. No hot gas bypass beyond 50 ft.
5. Units with remote evaporator are not included in the ARI Certification Program.

The remote evaporator is shipped separately, ready for quick and easy installation at the job site. Refrigerant accessories such as liquid line shut-off valves, replaceable core filter-driers, liquid line solenoid valves, expansion valves, and sightglasses are shipped in a kit for field installation and wiring. The evaporator water nozzles are equipped with couplings for entering and leaving chilled water temperature sensors and pressure gauge connections. The temperature sensors are pre-wired to the ALR unit and must be field connected to field furnished evaporator thermowells. The standard UNT control has 30-foot sensor leads that can be field spliced. The optional MicroTech control leads are 100 feet long.

ALR units are shipped with a holding charge of refrigerant. Field piping must be leak tested, evacuated and the entire unit charged during installation. Do not exceed 150 psig test pressure unless the unit is blanked off from the piping.

Standard insulation is ¾inch Armaflex or equal UL approved insulation. Double insulation is available as an option and is recommended in high humidity locations or for ice-making duty.

Performance Derate Factors

All performance tables and adjustment factors found in this catalog are applicable for remote evaporator installations, however, a performance derate must be applied to the R-22 performance data due to additional pressure drops in the suction and liquid lines which cause a loss of compressor performance. These derates are based on a suction line pressure drop equivalent of approximately 2°F (1°C) change in saturation temperature.

For R-22 applications:

Capacity = Tons (kW) x 0.97

Power = Compressor kW x 0.99

WARNING

A strainer must be placed in the supply water line prior to the inlet of the evaporator. This will aid in preventing foreign material from entering the evaporator and 1) causing damage or 2) decreasing its performance. Care must also be exercised if welding pipe to the evaporator water connections to prevent any weld slag from entering the vessel.

Line Sizing

Line sizing and layout should follow procedures found in the ASHRAE Handbooks or other recognized design manuals. Nominal circuit capacities are listed in Table 18. Unloading steps are found in the Physical Data tables.

***Table 18,* Nominal Circuit Capacities**

ALR Model	Circuit 1	Circuit 2
	Tons (kW)	Tons (kW)
110F	53 (185)	57 (200)
120F	60 (210)	60 (210)
130F	65 (227)	65 (227)
135F	68 (238)	68 (238)
140F	70 (245)	70 (245)
145F	73 (255)	73 (255)
150F	70 (245)	80 (280)

Dimensions

Use the ALR dimension drawing, Figure 10, for the ALR with remote evaporator. The refrigerant connections are located approximately where the refrigerant connections to the unit mounted evaporator are on a packaged chiller. The remote evaporator dimensions are on Figure 24.

Weights

Weights for the remote evaporators are listed on the following dimension page. Weights for the outdoor unit can be calculated by subtracting the evaporator weight from the total unit weight found in the Physical Data section.

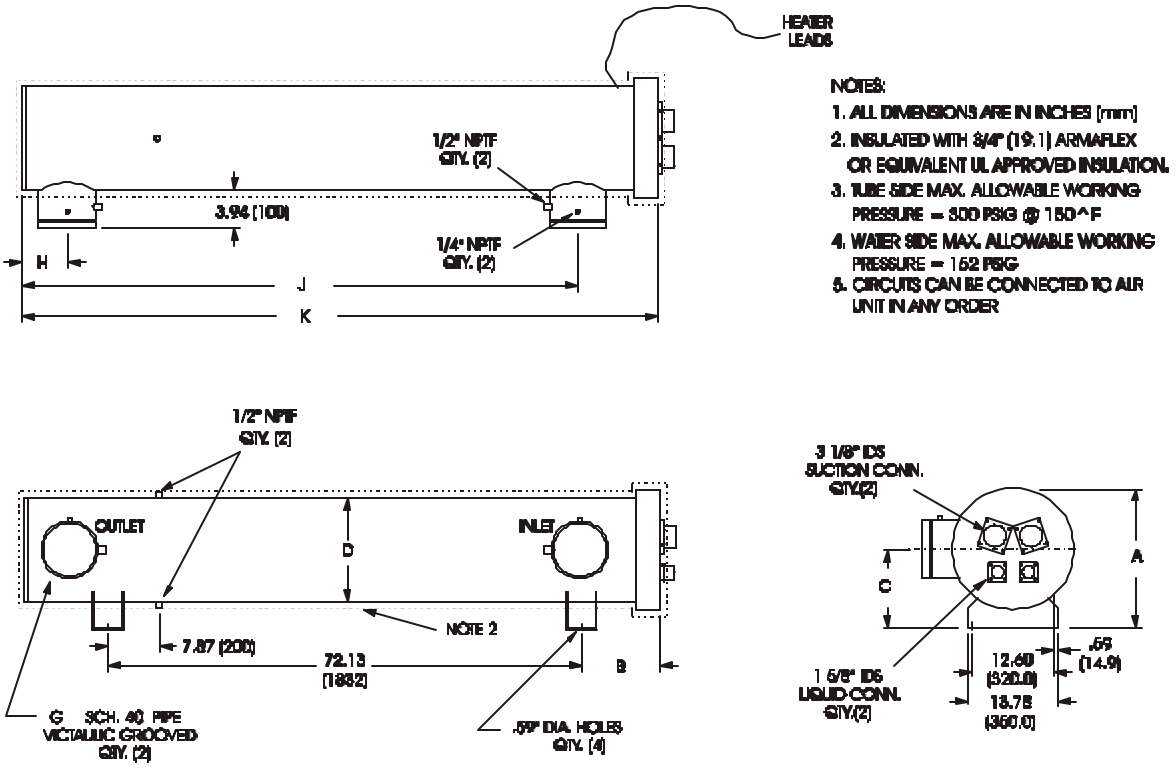
Connection Sizes

Table 19, Connection Sizes

Unit Size	ALR Unit		Remote Evaporator		
	Suction (IDS)	Liquid (IDS)	Suction (IDS)	Liquid (IDS)	Water (in.)
110	2 5/8	1 1/8	3 1/8	1 5/8	5
120	2 5/8	1 1/8	3 1/8	1 5/8	8
130	2 5/8	1 1/8	3 1/8	1 5/8	8
135	2 5/8	1 1/8	3 1/8	1 5/8	8
140	2 5/8	1 1/8	3 1/8	1 5/8	8
145	2 5/8	1 1/8	3 1/8	1 5/8	8
150	2 5/8	1 1/8	3 1/8	1 5/8	8

Dimensions, Remote Evaporator

Figure 24, Remote Evaporator for ALR 110 - ALR 150



ALR Model	Evaporator Model	Water Volume gal. (l)	Refrigerant Volume cu.ft. (L)	Unit Weights lb. (kg)		R-22 Operating Charge lb. (kg)	
				Operating	Shipping	Circuit 1	Circuit 2
110	CDE350332801	34 (128)	1.4 (40.0)	934 (423)	635 (288)	34 (15.4)	34 (15.4)
120-140	CDE350332901	40 (150)	1.8 (52.4)	1127 (510)	758 (343)	45 (20.4)	45 (20.4)
145-150	CDE350281651	55 (208)	2.4 (67.2)	1464 (663)	943 (427)	57 (25.8)	57 (25.8)

ALR Model	Overall Dimensions in. (mm)		Dimensions				Conn. "G"
	Length "K"	Height "A"	"D"	"J"	"H"	"B"	
110	94.6 (2403)	19.7 (500)	12.8 (325)	85.2 (2164)	6.4 (163)	11.0 (279)	5 (152)
120-140	95.5 (2426)	20.4 (518)	14.0 (356)	84.0 (2134)	6.8 (173)	12.0 (305)	8 (203)
145-150	96.8 (2459)	21.4 (544)	16.0 (406)	84.6 (2149)	6.9 (175)	12.8 (325)	8 (203)

Optional Features

Electrical

Part Winding Start (460V, 575V)

Part winding start is standard on 208V and 230V units and optional on 380V, 460V and 575V. It works in conjunction with the unit's standard compressor sequence start timers to reduce current inrush by providing two-step start of each compressor. This feature is not normally required on the McQuay multiple compressor, sequence start design.

Disconnect Switch (Factory Installed)

A factory installed, service use, non-fused disconnect switch with an installed through-the-door handle is available with single point power supply.

Disconnect Switch (Field Installed)

The disconnect switch is available as a field installed kit. In this case, the through-the-door handle is ordered as a separate kit for field installation. Field installation requires modification to the control panel door.

TEFC Motors

Totally enclosed fan motors are available as an option to the standard weather protected motors.

Phase Loss/Voltage Protection

Three levels of phase failure protection are available as a field installed option to guard against compressor motor burnout: (1) phase loss with under voltage protection, (2) phase loss with under/over voltage protection, and (3) phase loss with under/over voltage protection and multiple LED indication of fault type.

115 Volt Convenience Outlet

The outlet is located in the main Control panel section. Meets most code requirements for a convenience outlet located at or on the unit.

Multiple Point Wiring Connections

Special that provides separate power blocks for each of two circuits (two compressors each) and fan motors, total of three connections.

Controls

Hot Gas Bypass

Hot gas bypass permits unit operation down to 10% of full load capacity. This factory installed option includes a hot gas bypass valve, solenoid valve, and manual shutoff valve. Hot gas bypass is provided on both refrigerant circuits with the standard lead-lag switch provided.

Gauges

Optional factory mounted gauges include high side and low side refrigerant gauges for each refrigerant circuit as well as oil pressure gauges for each compressor.

High Return Water Unloader Thermostat (UNT Control Only)

Optional field installed high return temperature unloader thermostat senses high return water temperatures at startup and keeps the compressors unloaded to avoid unit shutdown due to compressor motor overload. Field location of the thermostat bulb is required.

SpeedTrol Head Pressure Control

Optional SpeedTrol head pressure control allows unit operation down to 0°F (-18°C) on all models.

Dual Setpoint Control (Ice Storage Applications)

Unit sizes ALR 110F-150F must be equipped with the optional MicroTech controls for ice duty applications.

MicroTech Controller

A complete factory installed microprocessor controller as described elsewhere in this manual.

Zone Terminal

For use with the standard UNT controller. It can be factory mounted on the unit or located remotely. See detailed description elsewhere in this manual. Not for use with the optional MicroTech control.

Alarm Bell

A 24 volt alarm bell signals safety trip of the freeze protection pressurestat or high pressure cutout. The bell is available in a field installed kit for remote installation.

Water Flow Switch

A 150 psi water flow switch is available for field installation in the chilled water piping to prevent evaporator freeze-up under low or no flow conditions. Terminals are provided in the unit control center for field hook-up of the water flow safety switch.

Unit

Protective Base Frame Guards

Optional factory installed base guards provide protection for the area under the coils on ground level installations. Coil guards for fin protection are standard.

Copper Fin Condenser Coils

Copper fin condenser coils are available as an option on all models.

Black Fin Coil

Aluminum fin stock is precoated with a phenolic epoxy coating for corrosion protection.

ElectoFin™ Coil Coating

Aluminum or copper fin coils are available with *ElectoFin*™ baked epoxy coating for additional corrosion protection. The coating is applied after coil assembly.

Vibration Isolators

Spring vibration isolators are available for field installation to reduce vibration transmission through the unit base.

Double Insulation

A second layer of ¾inch insulation is added to the standard single layer. Recommended for high humidity locations and ice making applications.

Hail/Wind Guard

Field installed sheet metal guards to protect the unit coils from hail damage and to provide more stable operation at low ambient temperatures by decreasing discharge pressure instability from wind.

Specifications

NOTE: Specifications are available on disk from the local McQuay Representative

SECTION 15XXX

AIR-COOLED RECIPROCATING CHILLERS
ALR 110F-ALR 150F

PART 1 - GENERAL

1.01 SUMMARY

Section includes design, performance criteria, refrigerants, controls, and installation requirements for air-cooled reciprocating compressor packaged chillers.

1.02 REFERENCES

Comply with applicable Standards/Codes of ARI 550/590-98, ANSI/ASHRAE 15, ETL, CETL, ASME Section VIII, ASHRAE Standard 90.1, NEC, and OSHA as adopted by the State.

1.03 SUBMITTALS

A. Submit shop drawings and product data in accordance with the specifications.

B. Submittals shall include the following:

1. Dimensioned plan and elevation view drawings, required clearances, and location of all field connections.
2. Summary of all auxiliary utility requirements such as: electricity, water, compressed air, etc. Summary shall indicate quality and quantity of each required utility.
3. Single line schematic drawing of the power field hookup requirements, indicating all items that are furnished.
4. Schematic diagram of control system indicating points for field interface/connection. Diagram shall fully delineate field and factory wiring.
5. Certification of factory run test of chiller unit signed by company officer.
6. Installation manuals.

1.04 QUALITY ASSURANCE

A. Qualifications; Equipment manufacturer must specialize in the manufacture of the products specified and have five years experience with the equipment offered.

B Regulatory Requirements: Comply with the codes and standards specified

C Chiller manufacturer must be ISO registered.

1.05 DELIVERY AND HANDLING

A. Chillers shall be delivered to the job site completely assembled and charged with refrigerant and oil by the manufacturer. For remote evaporator applications the equipment shall be shipped with a holding charge of refrigerant.

B. Comply with the manufacturers instructions for rigging and handling equipment.

1.06 WARRANTY

The refrigeration equipment manufacturer's guarantee shall be for a period of one year from date of equipment start up but not more than 18 months from shipment. The guarantee shall cover defects in material and workmanship within the above period, excluding refrigerant.

PART 2--PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. McQuay International

B. (Approved Equal)

2.02 UNIT DESCRIPTION

Provide and install as shown on the plans factory assembled, factory charged, and factory run tested, air-cooled reciprocating compressor packaged chillers in the quantity specified. Each chiller shall consist of multiple accessible-hermetic reciprocating compressors, direct expansion evaporator, air-cooled condenser section, control system and all components necessary for controlled unit operation.

2.03 DESIGN REQUIREMENTS

A. General: Provide a complete reciprocating packaged chiller as specified herein and as shown on the drawings. The unit shall be in accordance with the standards referenced in section 1.02 and any local codes in effect.

B. Performance: Refer to the schedule of performance on the drawings. The chiller shall be capable of stable operation to a minimum of 17 percent of full load without hot gas bypass. Performance shall be in accordance with applicable ARI Standard.

C. Acoustics: Sound pressure levels for the unit shall not exceed the following specified levels. The manufacturer shall provide the necessary sound treatment to meet these levels. Sound data shall be provided with the quotation. Test shall be in accordance with ARI Standard 370.

	Octave Band								
	63	125	250	500	1000	2000	4000	8000	dBA
	____	____	____	____	____	____	____	____	____

2.04 CHILLER COMPONENTS

A. Compressors: The compressors shall be accessible hermetic reciprocating type with suction and discharge service valves, crankcase oil heater and suction strainer. Compressors shall have a forced feed lubrication system with a reversible oil pump and initial oil charge. The compressor motor shall be refrigerant gas cooled, high torque, hermetic induction type, four-pole, with inherent thermal protection on all three phases and shall be mounted on RIS vibration isolator pads.

B. Evaporator: The evaporator shall be direct expansion type with carbon steel shell, water baffles, and high efficiency internally finned copper tubes rolled into steel tube sheets. Refrigerant heads shall be removable. It shall be insulated with ¾inch (19mm) closed cell polyurethane insulation and be heated with an electric heater to provide freeze protection to -20°F (-29°C) ambient temperature. The evaporator shall be designed, inspected, and stamped in accordance with ASME Code requirements.

C. Condenser: The condenser coils shall be 3/8 inch (10mm) seamless copper tubes mechanically bonded into plate type fins. The fins shall have full drawn collars to completely cover the tubes. A subcooling coil shall be an integral part of the main condenser coil. Condenser fans shall be propeller type arranged for vertical air discharge and individually driven by direct drive fan motors. Each fan shall be in its own compartment to eliminate cross flow of condenser air during fan cycling and shall be equipped with a heavy-gauge fan guard. Fan motors shall be weather protected, single-phase, direct-drive, 1140 rpm, open drip-proof type. Outside coils shall be protected by a wire mesh coil guard to prevent fin damage.

D. Refrigerant Circuit: Each refrigerant circuit shall include a liquid line shutoff valve, refrigerant filter-drier, sight glass with moisture indicator, liquid line solenoid valve (no exceptions), thermal expansion valve, discharge gas muffler, insulated suction line and a 450 psig (3104 kPa) relief valve.

E. Control System: A centrally located weather-resistant control panel shall contain the field power connection points, control interlock terminals, and control system. Power and starting components shall include factory fusing of fan motors and control circuit, individual contactors for each fan motor, solid-state start timer, solid-state compressor three-phase motor overload protection, inherent fan motor overload protection and unit power terminal blocks for connection to remote disconnect switch. Terminals shall also be provided for power supply to the evaporator heater circuit. Hinged access doors shall be lockable. Deadfront panels are required to protect against accidental contact with line voltage when

accessing the control system.

Operating control shall include unit stop switch, limited recycling pumpdown control, high and low pressure safety switches, leaving chilled water temperature controller, freeze protection pressurestats, and fan cycling controls. Unit shall provide recycling pumpdown protection at all times.

--OR--

E. Microprocessor based control system: A centrally located weather-resistant control panel shall contain the field power connection points, control interlock terminals, and control system. Power and starting components shall include factory fusing of fan motors and control circuit; individual contactors for each fan motor, solid-state start timer, solid-state compressor three-phase motor overload protection, inherent fan motor overload protection and unit power terminal blocks for connection to remote disconnect switch. Terminals shall also be provided for power supply to the evaporator heater circuit. Hinged access doors shall be lockable. Deadfront panels are required to protect against accidental contact with line voltage when accessing the control system.

The system shall stage the unit based on the leaving water temperature. Safeties controlled by the microprocessor include oil differential pressure, motor protection, high pressure, loss of refrigerant, loss of water flow, freeze protection, and low refrigerant pressure. Controls shall include auto/stop switch, chilled water setpoint adjustment, anti-recycle timer, and digital display with water temperature and setpoint, operating temperatures and pressures, and diagnostic messages. The following features and functions shall be included:

1. The LCD type display shall have a minimum of 32 characters with all messages in plain English. Coded messages and LED displays are not acceptable.
2. Critical parameters shall have their own section of control and be password protected.
3. Resetting chilled water temperature by either controlling the return water temperature or by a remote 4-20mA DC signal.
4. A soft load function to prevent the system from operating at full load during the chilled water pulldown period.
5. An electronic time clock to allow programming of a yearly schedule accommodating weekends and holidays.
6. Auto restart after a power failure, not requiring external battery back-up or auxiliary power for maintaining program memory.
7. Safety shutdowns shall be date and time stamped with system temperatures and pressures recorded. A minimum of six previous occurrences shall be kept in a revolving memory.

8. Start-to-start and stop-to-start timers to provide minimum compressor off-time with maximum motor protection.
9. Capability of communication with a PC or remote monitoring through a twisted pair RS-232 interface.
10. Lead-lag by manual selection or automatically by minimum circuit run hours.
11. Discharge pressure control through intelligent cycling of condenser fans.
12. Continuous diagnostic checks of unit operation to provide a pre-alarm signal in advance of a shutdown allowing time for remedial action to be taken.

2.05 OPTIONS AND ACCESSORIES

The following options are to be included:

- Part winding start
- Three phase power loss with under and over voltage protection
- Refrigerant and oil pressure gauges
- High return water thermostat to keep compressor unloaded with high startup water temperatures. Contractor to field mount sensor and field wire to control panel.
- High ambient unloader to unload compressor at pressures above 375 psig (2586 kPa)
- Hot gas bypass on all circuits
- Low ambient head pressure control to 0°F (-17.8°C)
- Copper fin condenser coils
- *ElectroFin*™ coated coils
- Chilled water flow switch to be field mounted in the chilled water line by the contractor and field wired to terminals in the control panel.
- Spring vibration isolators for field installation
- Disconnect switch with through-the-door handle

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install in strict accordance with manufacturer's requirements, shop drawings, and contract documents.
B. Adjust and level chiller in alignment on supports.
C. Coordinate electrical installation with electrical contractor.
D. Coordinate controls with control contractor.
E. Provide all appurtenances required to insure a fully operational and functional chiller.

3.02 START-UP

A. Ensure proper charge of refrigerant and oil.

B. Provide testing, and starting of machine, and instruct the Owner in its proper operation and maintenance.

McQuay International

Post Office Box 2510, Staunton, Virginia 24402-2510 USA • 800-432-1342 • www.mcquay.com