Installation, Operation and Maintenance Manual	IOMM ALS-1
	Group: **Chiller**
	Part Number: **070774401**
	Date: **June 1999**
	Supersedes: **IOMM ALS**

Air-Cooled Screw Compressor Chiller

ALS 070A through 425A

60 Hertz

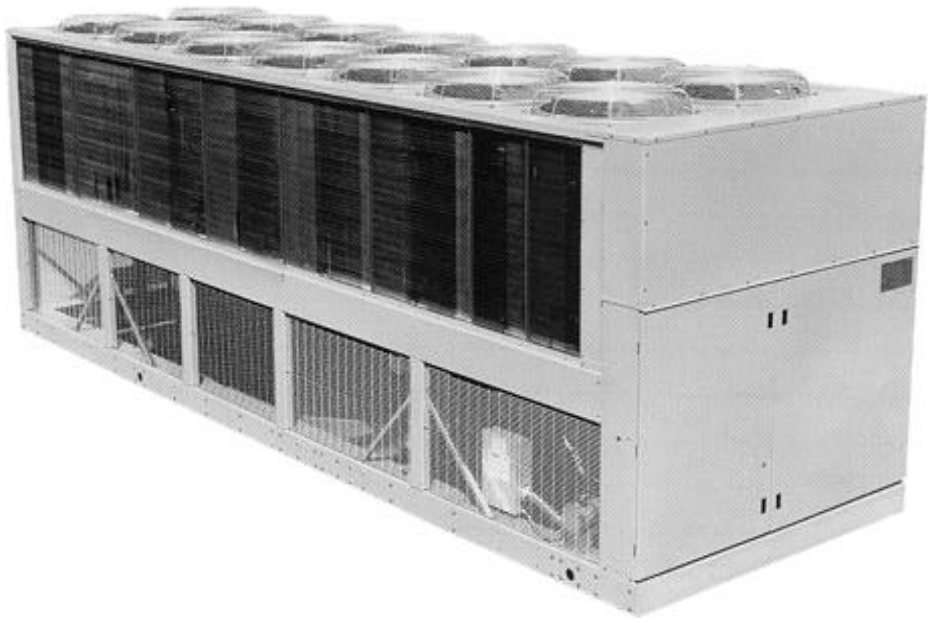


Table Of Contents

Our facility is **ISO 9002 Certified**

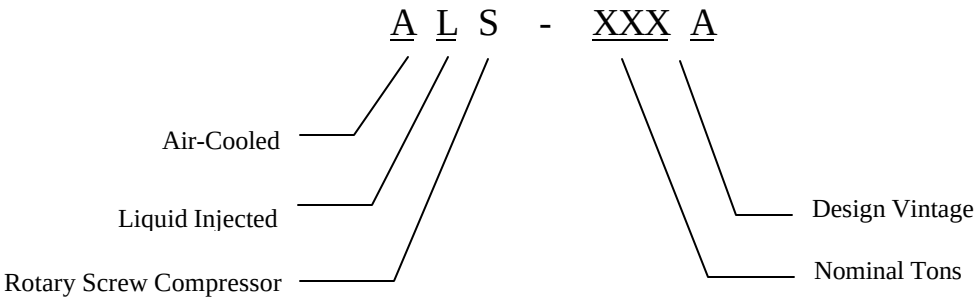
Initial Issue January 1998

Introduction

General Description

McQuay air-cooled water chillers are complete, self-contained automatic refrigerating units that include the latest in engineering components arranged to provide a compact and efficient unit. Each unit is completely assembled, factory wired, evacuated, charged, tested and comes complete and ready for installation. Each unit consists of multiple air-cooled condensers with integral subcooler sections, multiple accessible semi-hermetic single-screw compressors, replaceable tube multiple circuit shell-and-tube evaporator, and complete refrigerant piping. Liquid line components included are manual liquid line shutoff valves, charging valves, filter-driers, liquid line solenoid valves, sightglass/moisture indicators, and electronic expansion valves. Other features include compressor heaters, an evaporator heater for low ambient water freeze protection, automatic one time pumpdown of refrigerant circuit upon circuit shutdown, and an advanced fully integrated microprocessor control system.

Nomenclature



Inspection

When the equipment is received, all items should be carefully checked against the bill of lading to insure a complete shipment. All units should be carefully inspected for damage upon arrival. All shipping damage must be reported to the carrier and a claim must be filed with the carrier. The unit's serial plate should be checked before unloading the unit to be sure that it agrees with the power supply available. Physical damage to unit after acceptance is not the responsibility of McQuay International.

Note: Unit shipping and operating weights are available in the Physical Data Tables.

Installation and Start-up

Note: Installation and maintenance are to be performed only by qualified personnel who are familiar with local codes and regulations, and experienced with this type of equipment.

CAUTION

Sharp edges and coil surfaces are a potential injury hazard. Avoid contact with them.

Start-up by McQuayService is included on all units sold for installation within the USA and Canada. Two week prior notification of start-up is required. The contractor should obtain a copy of the Start-up Scheduled Request Form from the sales representative or from the nearest office of McQuayService.

Handling

Care should be taken to avoid rough handling or shock due to impact or dropping the unit. Do not push or pull the unit from anything other than the base, and block the pushing vehicle away from the unit to prevent damage to the sheetmetal cabinet and end frame (see Figure 1).

Never allow any part of the unit to fall during unloading or moving as this may result in serious damage.

To lift the unit, 2⅛ " (64 mm) diameter lifting holes are provided in the base of the unit. Spreader bars and cables should be arranged to prevent damage to the condenser coils or unit cabinet (see Figures 2 through 5).

Figure 1, Suggested Pushing Method

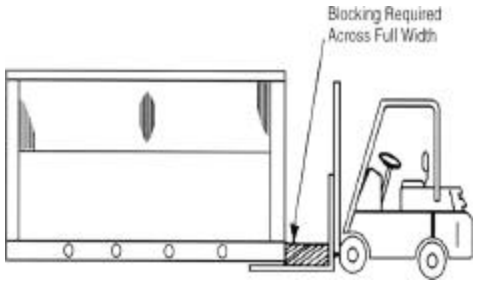


Figure 2, Suggested Lifting Method, ALS 070-204

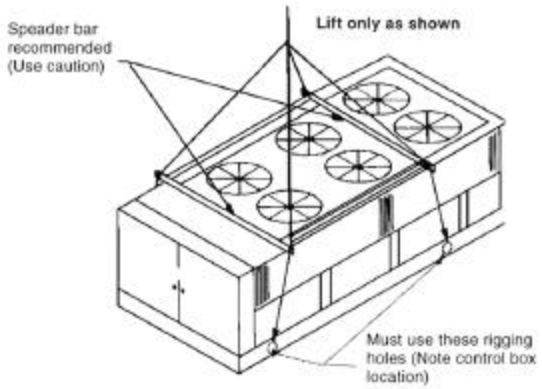


Figure 3, Suggested Lifting Method, ALS 205-280

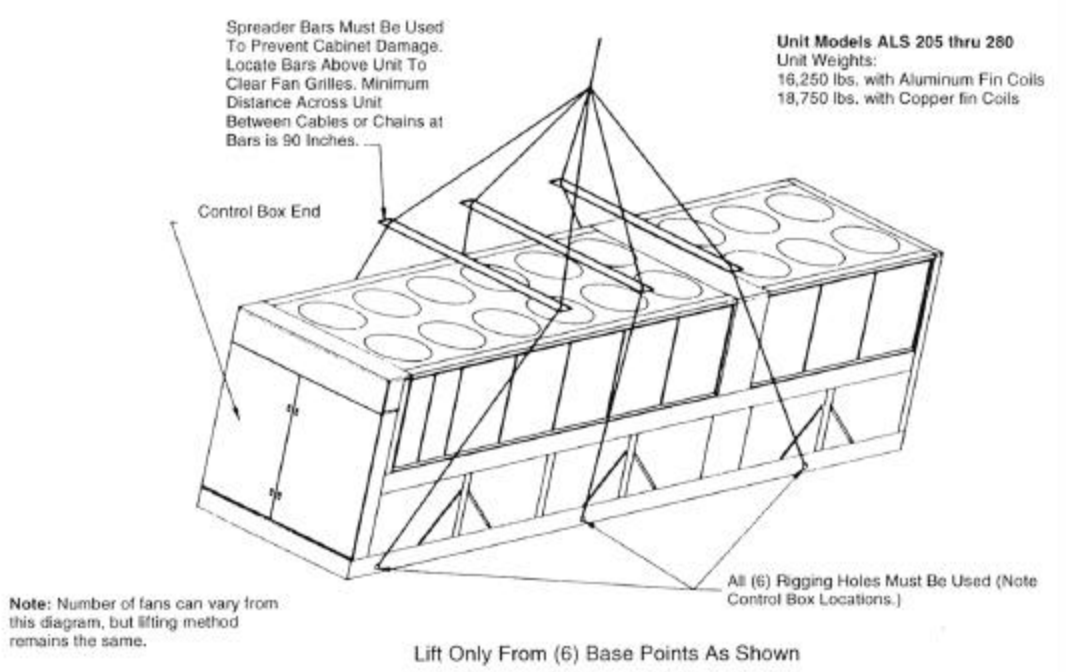


Figure 4, Suggested Lifting Method, ALS 300-340

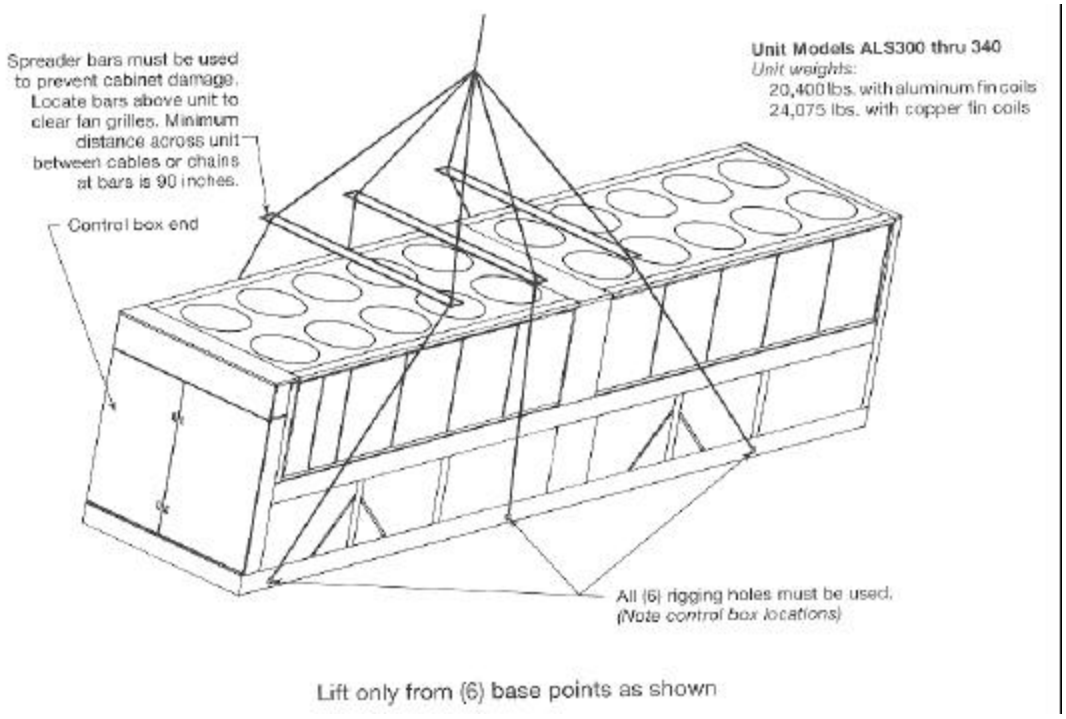
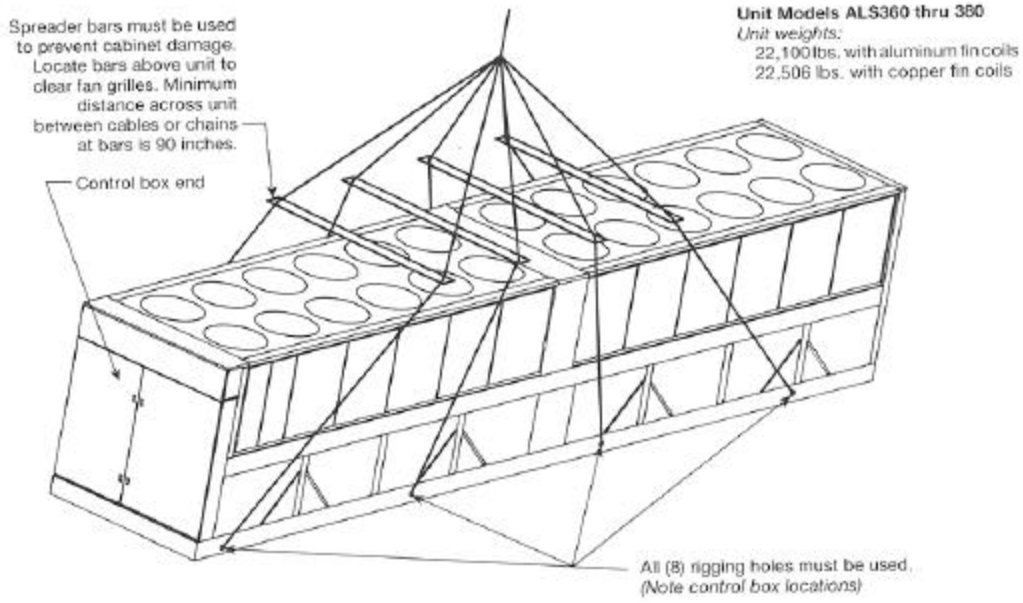


Figure 5, Suggested Lifting Method, ALS 360-425



Location

Care should be taken in the location of the unit to provide proper airflow to the condenser. (See Figures 6 through 8 for required clearances).

Due to the vertical condenser coil design of the ALS 070A through ALS 425A chillers, it is recommended that the unit be oriented so that prevailing winds blow parallel to the unit length, thus minimizing the wind effect on condensing pressure and performance. If the unit is installed with no protection against prevailing winds it is recommended that wind baffles be installed.

Using less clearances than shown in Figure 6, Figure 7, and Figure 8 will cause discharge air recirculation to the condenser and could have a significant and detrimental effect on unit performance. McQuay Application Manual, *AM ALS/WHS*, contains more detail on this subject.

Service Access

Each end of the unit must be accessible after installation for periodic service work. Compressors, filter-driers, and manual liquid line shutoff valves are accessible on each side of the unit adjacent to the control box. High pressure and low pressure transducers are mounted on the compressor. The cooler barrel heater thermostat is located on the cooler. Compressor overloads, microprocessor, and most other operational, safety and starting controls are located in the unit control box.

On all ALS units the condenser fans and motors can be removed from the top of the unit. The complete fan/motor assembly can be removed for service. The fan blade and fan motor rain shield must be removed for access to wiring terminals at the top of the motor.

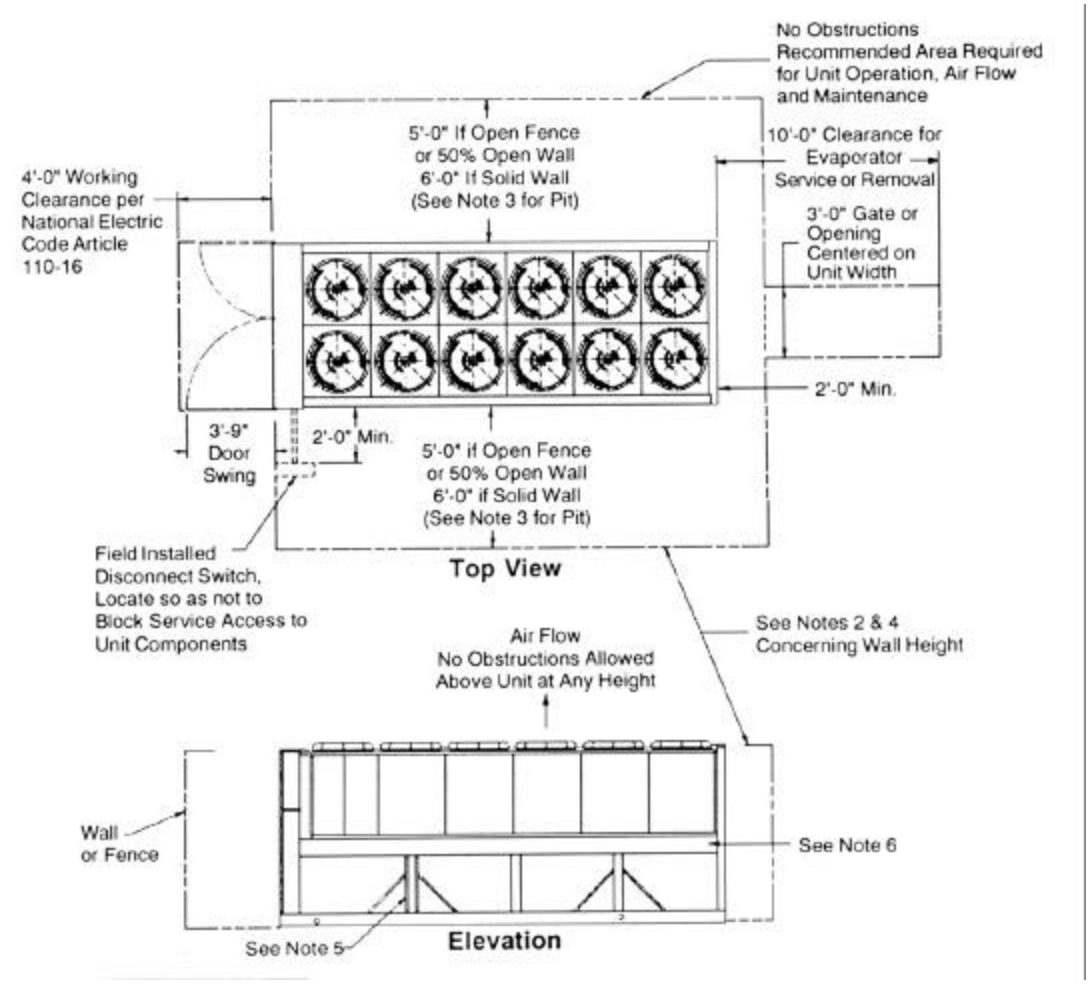
WARNING

Disconnect all power to the unit while servicing condenser fan motors.
Failure to do so may cause bodily injury or death.

Do not block access to the sides or ends of the unit with piping or conduit. These areas must be open for service access.

Clearance Requirements

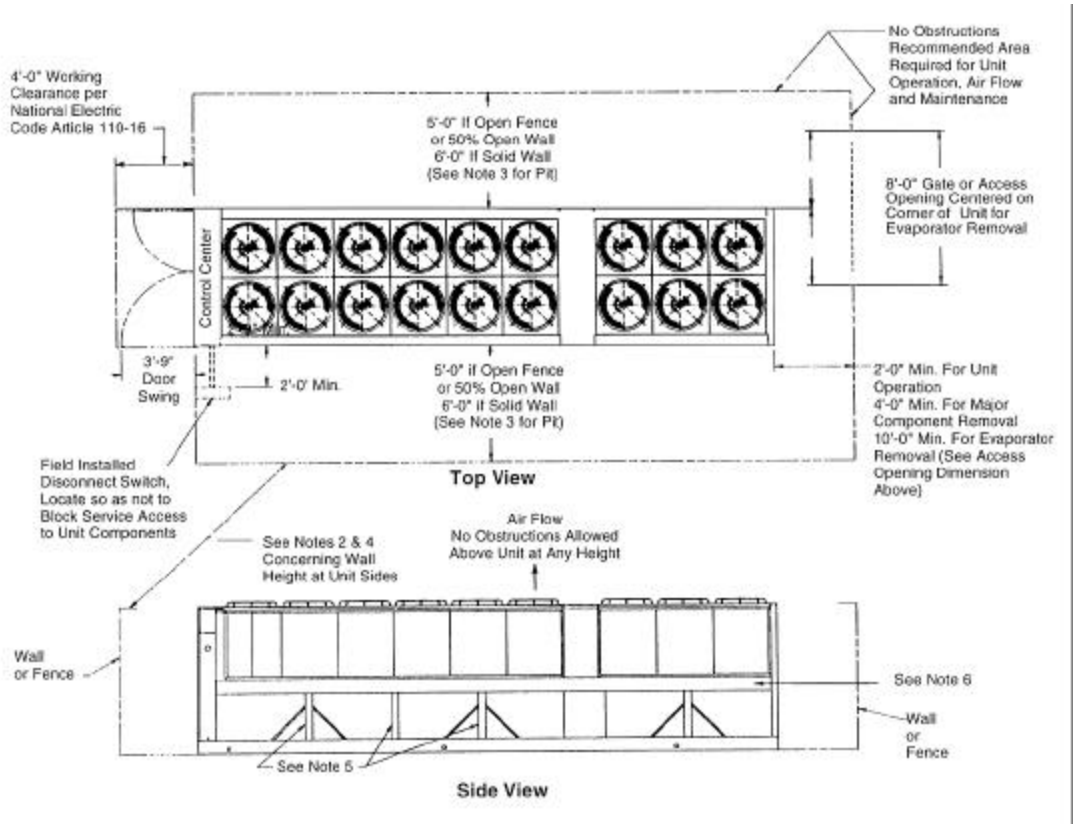
Figure 6, Clearance Requirements, ALS 070-204



Notes:

1. Minimum side clearance between two units is 12 feet.
2. Unit must not be installed in a pit or enclosure that is deeper or taller than the height of the unit unless extra clearance is provided per note 4.
3. Minimum clearance on each side is 8 feet when installed in a pit no deeper than the unit height.
4. Minimum side clearance to a side wall or building taller than the unit height is 8 feet provided no solid wall above 6 feet is closer than 12 feet to the opposite side of the unit.
5. The removable post for compressor service access must not be blocked at either side of the unit.
6. Do not mount electrical conduits, etc, above the side rail on either side if the unit.
7. There must be no obstruction of the fan discharge.

Figure 7, Clearance Requirements, ALS 205-280



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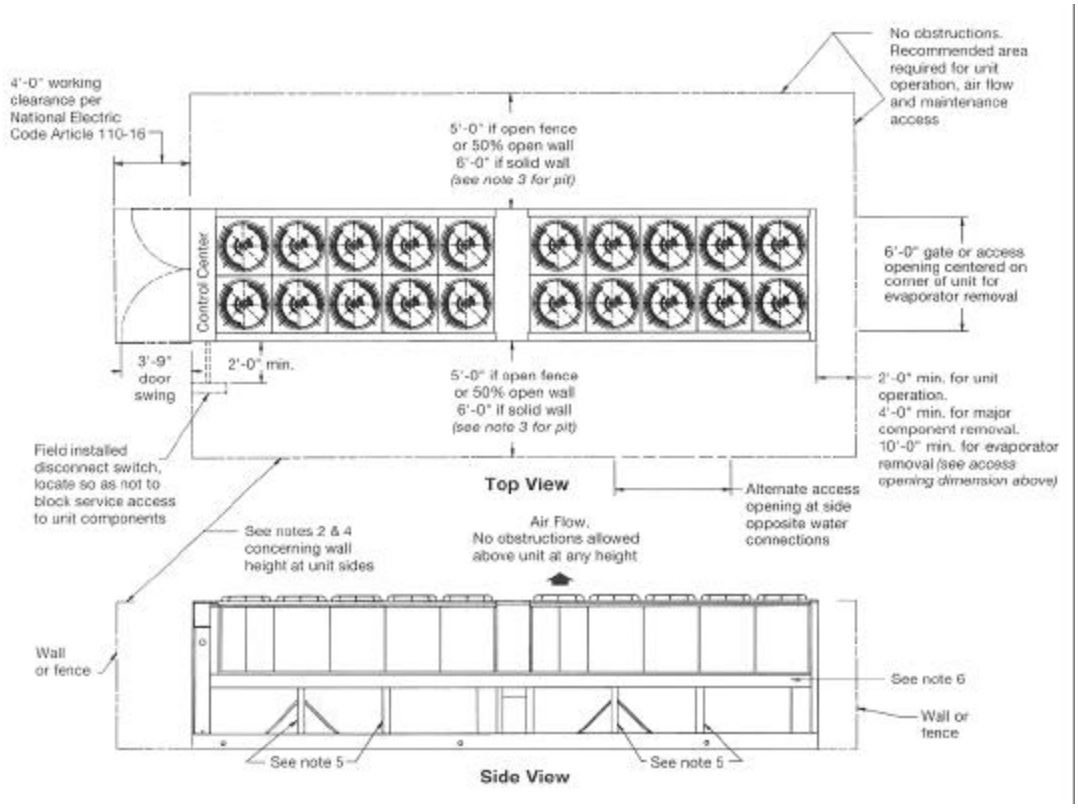
5. The removable post for compressor service access must not be blocked at either side of the unit.
6. Do not mount electrical conduits, etc, above the side rail on either side if the unit.
7. There must be no obstruction of the fan discharge.

Figure 8, Clearance Requirements, ALS 300-425



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Vibration Isolators

Vibration isolators are recommended for all roof mounted installations or wherever vibration transmissions is a consideration. Figure 9,*(070 thru 204)*, Figure 10 *(205 thru 280)*, Figure 12 *(300 thru 340)* and Figure 13 *(360 thru 425)* give isolator locations in relation to the unit control center. Table 2 *(070 thru 204)*, Table 3 *(205 thru 280)*, Table 4 *(300 thru 340)* and Table 6 *(360 thru 425)* give the isolator loads at each location shown in Figures 9, 10, 12 and 13. Figure 11 gives dimensions that are required to secure each McQuay isolator section to the mounting surface.

Table 1, Vibration Isolators (Spring)

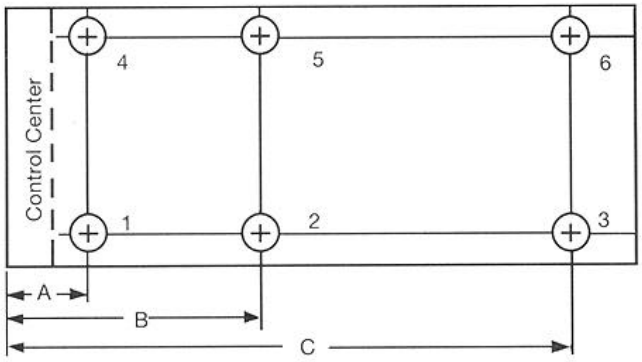
ALS UNIT SIZE	TYPE	COLOR OF STRIPE	McQUAY PART NUMBER	RECOMMENDED MAXIMUM LOAD LBS. (KG)
125-280	CP2-32	White	0047792932	2600 (1180)

Note: The same isolators are used when the chiller is supplied with the optional copper finned condenser coils. The spring is fully compressed at approximately 3900 lbs *(1769 kg)*.

Table 2, Isolator Loads, ALS 070-204

ALS UNIT SIZE	ISOLATOR LOADS AT EACH MOUNTING LOCATION LBS (KG)											
	1		2		3		4		5		6	
070	1920	(871)	N/A	N/A	1332	(604(	1460	(662)	N/A	N/A	1013	(460)
080	2071	(939)	N/A	N/A	1437	(652)	1575	(715)	N/A	N/A	1092	(495)
090	1092	(495)	1229	(557)	1092	(495)	1092	(495)	1229	(557)	1092	(495)
100	1168	(529)	1314	(595)	1168	(529)	1168	(529)	1314	(595)	1168	(529)
125A	1625	(737)	2065	(937)	1270	(576)	1625	(737)	2065	(937)	1270	(576)
140A	1680	(762)	2145	(973)	1350	(612)	1680	(762)	2145	(973)	1350	(612)
155A	1720	(780)	2205	(1000)	1410	(640)	1720	(780)	2205	(1000)	1410	(640)
170A	1760	(785)	2220	(1007)	1425	(647)	1730	(785)	2220	(1007)	1425	(647)
175A	1880	(853)	2350	(1066)	1395	(633)	1880	(853)	2350	(1066)	1395	(633)
185A	1880	(853)	2350	(1066)	1395	(633)	1880	(853)	2350	(1066)	1395	(633)
195A	1920	(871)	2440	(1107)	1440	(653)	1920	(871)	2440	(1107)	1440	(653)
204A	2081	(944)	2644	(1199)	1560	(707)	2081	(944)	2644	(1199)	1560	(707)

Figure 9, Isolator Locations, ALS 070-204

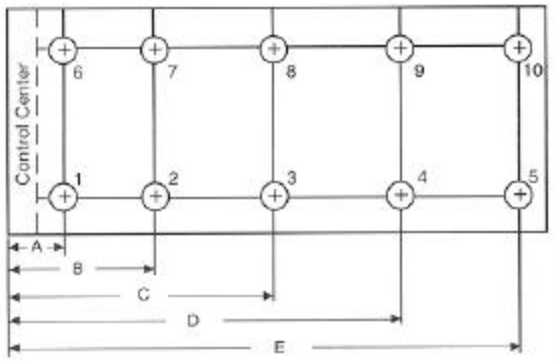


A = 13" (330 mm)
B = 95" (2413 mm)
C = 215" (5461 mm) ALS125A-155A
250" (6350 mm) ALS170A-204A

Table 3, Isolator Loads, ALS 205-280

ALS UNIT SIZE	ISOLATOR LOADS AT EACH MOUNTING LOCATION LBS (KG)																			
	1		2		3		4		5		6		7		8		9		10	
205A	1790	(812)	1840	(834)	2040	(925)	1370	(621)	950	(431)	1630	(739)	2020	(916)	1640	(744)	1650	(748)	1000	(454)
220A	1790	(812)	1850	(839)	2050	(930)	1370	(621)	950	(431)	1630	(739)	2030	(921)	1650	(748)	1660	(753)	1000	(454)
235A	1820	(825)	1880	(853)	5080	(943)	1370	(621)	960	(435)	1670	(757)	2060	(934)	1680	(762)	1660	(753)	1000	(454)
250A	1820	(825)	1880	(853)	2080	(943)	1380	(626)	960	(435)	1670	(757)	2060	(934)	1680	(762)	1670	(757)	1000	(454)
265A	1820	(825)	1880	(853)	2080	(943)	1380	(626)	960	(435)	1670	(757)	2060	(934)	1680	(762)	1670	(757)	1000	(454)
280A	1830	(830)	1890	(857)	2080	(943)	1380	(626)	960	(435)	1680	(762)	2070	(939)	1690	(766)	1670	(757)	1000	(454)

Figure 10, Isolator Locations, ALS 205-280



A = 13" (330 mm)
B = 95" (2413 mm)
C = 177" (4496 mm)
D = 259" (6579 mm)
E = 341" (8661 mm)

Figure 11, Spring Flex Isolators

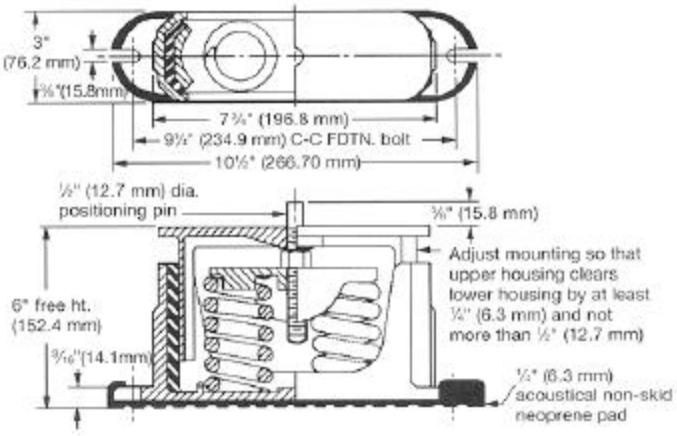


Table 4, Isolator Loads, ALS 300 - 340

ALS UNIT SIZE	ISOLATOR LOADS AT EACH MOUNTING LOCATIONS, lb (kg)																				OPERATING WEIGHT LBS (KGS)	
	1		2		3		4		5		6		7		8		9		10			
300A	1780	(807)	2060	(934)	2530	(1147)	2530	(1147)	2560	(1161)	2560	(1161)	2170	(984)	2170	(984)	1445	(655)	1445	(655)	21250	(9637)
315A	1780	(807)	2060	(934)	2530	(1147)	2530	(1147)	2560	(1161)	2560	(1161)	2170	(984)	2170	(984)	1445	(655)	1445	(655)	21250	(9637)
330A	1780	(807)	2060	(934)	2540	(1152)	2540	(1152)	2570	(1166)	2570	(1166)	2180	(989)	2180	(989)	1450	(658)	1450	(658)	21320	(9669)
340A	1780	(807)	2060	(934)	2540	(1152)	2540	(1152)	2570	(1166)	2570	(1166)	2180	(989)	2180	(989)	1450	(658)	1450	(658)	21320	(9669)

Note:
1. Unit to be supported at (5) isolator mounting locations per side, 10 total, as indicated.
2. Add approximately 370 lbs (168 kgs) at each isolator location for unit with optional copper finned condenser coils.
3. Unit to be level in both directions within 1/8 inch (3 mm) per 10 feet (3 m).
4. See dimensional drawing 073124701 for exact location of isolator support holes in base frame.

Figure 12, Vibration Isolators, ALS 300-340

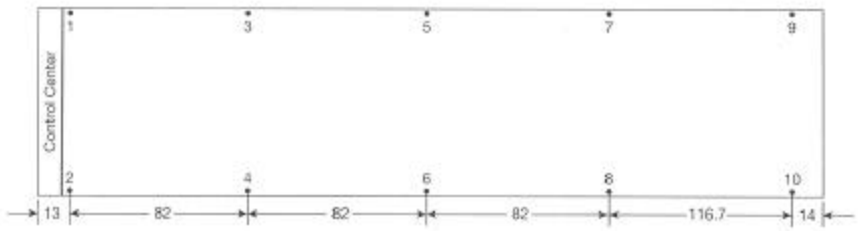


Table 5, Vibration Isolators (Springs)

ALS UNIT SIZE	TYPE	COLOR OF STRIPE	McQUAY PART NUMBER	RECOMMENDED MAXIMUM LOAD LB (KG)
300A-340A	CP2-32	White	047792932	3000 (1360)

Note: The same isolators are used when the chiller is supplied with the optional copper finned condenser coils. The spring is fully compressed at approximately 3900 lbs (1769 kgs).

Table 6, Isolator Loads, ALS 360-425

ALS UNIT SIZE	ISOLATOR LOAD AT EACH MOUNTING LOCATIONS, lb (kg) .																							
	1		2		3		4		5		6		7		8		9		10		11		12	
360A	1780	807	2060	934	2530	1147	2530	(1147)	2540	1152	2540	(1152)	1670	(757)	1670	(757)	1720	(780)	1720	(780)	1080	(490)	1080	(490)
370A	1780	807	2060	934	2540	1152	2540	(1152)	2550	1156	2550	(1156)	1675	(760)	1675	(760)	1720	(780)	1720	(780)	1080	(490)	1080	(490)
380A	1780	807	2060	934	2550	1156	2550	(1156)	2560	1161	2560	(1161)	1680	(762)	1680	(762)	1720	(780)	1720	(780)	1080	(490)	1080	(490)
425A	1846	837	2126	964	2616	1186	2616	(1186)	2626	1190	2626	(1190)	1746	(791)	1746	(791)	1768	(801)	1768	(801)	1146	(520)	1146	(520)

Note:
1. Unit to be supported at (6) isolator mounting locations per side, 12 total, as indicated.
2. Add approximately 370 lbs (168 kgs) at each isolator location for units with optional copper finned condenser coils.

3. Unit to be level in both directions within 1/8 inch (3mm) per 10 feet (3 m).
4. See dimensional drawing 073124801 for exact location of isolator support holes in base frame.

Figure 13, Vibration Isolators, ALS 360-425

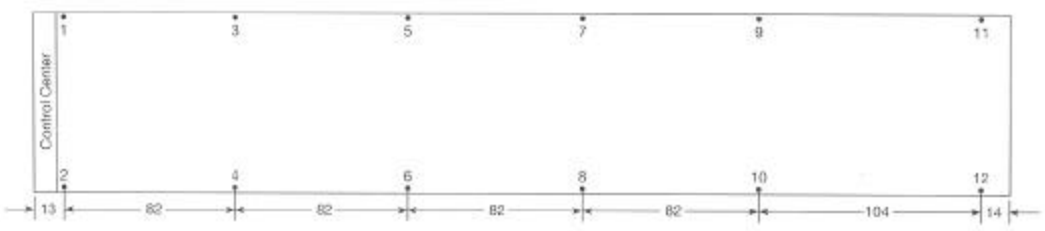


Table 7, Vibration Isolators (Spring)

ALS UNIT SIZE	TYPE	COLOR OF STRIPE	MCQUAY PART NUMBER	RECOMMENDED MAXIMUM LOAD LBS (KG)
360A	CP2-32	White	047792932	3000 (1360)

Note: The same isolators are used when the chiller is supplied with the optional copper finned condenser coils. The spring is fully compressed at approximately 3900 lbs (1769 kgs).

Water Piping

Due to the variety of piping practices, it is advisable to follow the recommendations of local authorities. They can supply the installer with the proper building and safety codes required for a safe and proper installation.

Basically, the piping should be designed with a minimum number of bends and changes in elevation to keep system cost down and performance up. It should contain:

1. Vibration eliminators to reduce vibration and noise transmission to the building.
2. Shutoff valves to isolate the unit from the piping system during unit servicing.
3. Manual or automatic air vent valves at the high points of the system. Drains at the low parts in the system. The evaporator should not be the highest point in the piping system.
4. Some means of maintaining adequate system water pressure (e.g., expansion tank or regulating valve).
5. Water temperature and pressure indicators located at the unit to aid in unit servicing.
6. A strainer or some means of removing foreign matter from the water before it enters the pump. The strainer should be placed far enough upstream to prevent cavitation at the pump inlet (consult pump manufacturer for recommendations). The use of a strainer will prolong pump life and help maintain high system performance levels.
7. A strainer should also be placed in the supply water line just prior to the inlet of the evaporator. This will aid in preventing foreign material from entering and decreasing the performance of the evaporator.
8. The shell-and-tube evaporator has a thermostat and heating cable to prevent freeze-up down to -20°F (-28.8°C). It is suggested that the heating cable be wired to a separate 110V supply circuit. As shipped from the factory, it is factory wired to the control circuit. Any water piping to the unit must also be protected to prevent freezing.

9. If the unit is used as a replacement chiller on a previously existing piping system, the system should be thoroughly flushed prior to unit installation and then regular chilled water analysis and chemical water treatment is recommended immediately at equipment start-up.

10. The total water quantity in the system should be sufficient to prevent frequent "on-off" cycling. A reasonable minimum quantity would allow for a complete water system turnover in not less than 15 minutes. See Application Manual, *AM ALS/WHS* for more detail on this subject.

11. In the event glycol is added to the water system, as an afterthought for freeze protection, recognize that the refrigerant suction pressure will be lower, cooling performance less, and water side pressure drop greater. If the percentage of glycol is large, or if propylene is employed in lieu of ethylene glycol, the added pressure drop and loss of performance could be substantial.

12. For operations requiring the ice mode feature, logic in MicroTech will adjust the freezestat to a pressure equivalent to 13.5°F (7.5°C) below the leaving evaporator water temperature. However, if a different freezestat pressure value is desired, the freezestat can be manually changed through MicroTech. Refer to *IM549-1* for additional information.

WARNING

If a separate disconnect is used for the 110V supply to the cooler heating cable, it should be clearly marked so that it is not accidentally shut off during cold seasons.

Prior to insulating the piping and filling the system, a preliminary leak check should be made.

Piping insulation should include a vapor barrier to prevent moisture condensation and possible damage to the building structure. It is important to have the vapor barrier on the outside of the insulation to prevent condensation within the insulation on the cold surface of the pipe.

Evaporator Freeze Protection

All evaporators come equipped with thermostatically controlled heat tape. When power is applied to terminals 13 and 16, the heat tape will provide freeze protection down to -20°F (-28.8°C). However, this should not be the only method of freeze protection. Unless the evaporator is flushed and drained as is described below in note 4, two or more of the remaining three recommendations must be followed as part of the system design:

1. Continuous circulation of water through the piping and the heat exchanger.

2. The inclusion of glycol solution in the chilled water circuit.

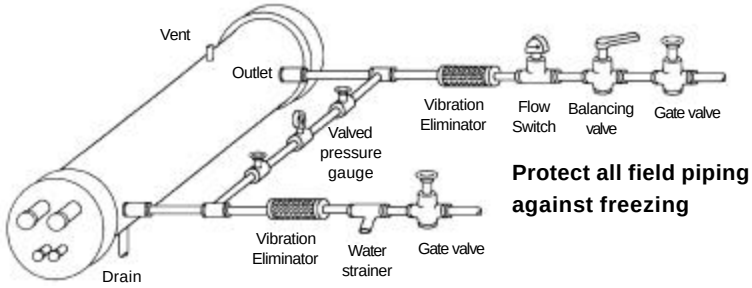
3. The addition of insulation and heat to the exposed piping.

4. Draining and flushing the chiller vessel with glycol during subfreezing weather.

It is the responsibility of the installing contractor and/or on-site maintenance personnel to insure that this additional protection is provided. Routine checks should be made to insure adequate freeze protection is maintained.

Failure to do so may result in damage to unit components. Freeze damage is not considered a warranty failure.

Figure 14, Typical Field Water Piping



Flow Switch

A water flow switch must be mounted in either the entering or leaving water line to insure that there will be adequate water flow to the evaporator before the unit can start. This will safeguard against slugging the compressors on start-up. It also serves to shut down the unit in the event that water flow is interrupted to guard against evaporator freeze-up.

A flow switch is available from McQuay under ordering number 0017503300. It is a "paddle" type switch and adaptable to any pipe size from 1" (25mm) to 8" (203mm) nominal.

Certain minimum flow rates are required to close the switch and are listed in Table 8. Installation should be as shown in Figure 15.

Electrical connections in the unit control center should be made at terminals 62 and 63. The normally open contacts of the flow switch should be wired between these two terminals. Flow switch contact quality must be suitable for 24 VAC, low current (16ma). Flow switch wire must be in separate conduit from any high voltage conductors (115 VAC and higher).

Figure 15, Flow Switch

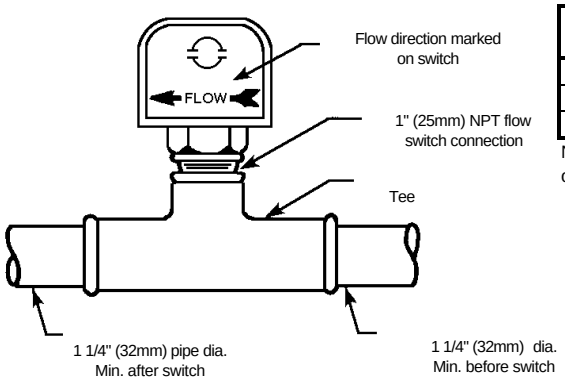


Table 8, Switch Minimum Flow Rates

NOMINAL PIPE SIZE INCHES (MM)	MINIMUM REQUIRED FLOW TO ACTIVATE SWITCH - GPM (LPS)
5 (127)	58.7 (3.7)
6 (152)	79.2 (5.0)
8 (203)	140 (8.8)

Note: Water pressure differential switch is not recommended for outdoor applications.

Water Connections

Water piping to the cooler can be brought up through the bottom of the unit or through the side between the vertical supports. The dimensional data in Figure 23 through Figure 27 give the necessary dimensions and locations for all piping connections.

Note: On unit size 175A through 204A there is a diagonal brace off of a vertical support which will interfere with the water connection if brought in from the side. This brace can be removed, but only after the unit is in place.

Refrigerant Charge

All units are designed for use with HCFC-22 (and are compatible with some HCFC alternatives) and are shipped with a full operating charge. The operating charge for each unit is shown in the Physical Data Tables.

Glycol Solutions

The chiller's capacity when using glycols, glycol solution flow rate and pressure drop through the cooler may be calculated using the following formulas and tables.

Note: The procedure below does not specify the type of glycol. Use the derate factors found in Table 9 for corrections when using propylene glycol and those in Table 10 for ethylene glycol.

1. **Capacity** - Cooling capacity is reduced from that with plain water. To find the reduced value multiply the chiller's water system tonnage by the capacity correction factor to find the chiller's capacity when using glycol.
2. **Flow** - To determine flow (or delta-T) knowing delta-T (or flow) and capacity:

$$GPM = \frac{(24)(tons)(flowfactor)}{Delta - T}$$

3. **Pressure drop** - To determine pressure drop through the cooler, when using glycol, enter the water pressure drop curve, Figure 21 or Figure 22,at the actual glycol flow. Multiply the water pressure drop found there by the PD factor to obtain corrected glycol pressure drop.
4. To determine glycol system kW, multiply the water system kW by factor called Power.

Test coolant with a clean, accurate glycol solution hydrometer (similar to that found in service stations) to determine the freezing point. Obtain percent glycol from the freezing point table below. On glycol applications the supplier normally recommends that a minimum of 25% solution by weight be used for protection against corrosion.

CAUTION

Do not use automotive grade antifreeze. Industrial grade glycols must be used. Automotive antifreeze contains inhibitors that will cause plating on the copper tubes within the chiller evaporator. The type and handling of glycol used must be consistent with local codes.

Table 9, Propylene Glycol

% E.G.	FREEZE PT. °F	FREEZE PT. °C	CAP	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	0.965	0.965	1.116	1.481

Table 10, Ethylene Glycol

% E.G.	FREEZE PT. °F	FREEZE PT. °C	CAP	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

Remote Evaporator

General

The multiple compressor ALS air-cooled chillers are available with remote evaporator. 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. Applies to Models ALS 125 through ALS 425.
2. R-22 only.
3. Maximum line length of 50 ft (15 m) and Total Equivalent Length (TEL) of 120 ft (37 m).
4. Evaporator not more than 6 ft (1.8 m) above the compressor or 16 ft (5 m) below compressor.
5. No underground piping.
6. No hot gas bypass.
7. 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. All refrigerant accessories such as liquid-vapor line shut-off valves, replaceable core filter-driers, liquid line solenoid valves, electronic expansion valves, and sightglasses are already included on the ALS condensing unit. The evaporator is equipped with entering and leaving chilled water temperature sensor wells. The sensors are pre-wired to the ALS unit with 75 feet long sensor leads that must be field connected to the evaporator thermowells. Suction pressure transducers and temperature sensors must also be relocated to the evaporator. ALS units are factory charged with a full unit charge including 10 feet (3 meters) of refrigerant line. Field piping must be leak tested, evacuated and charged during installation. Do not exceed 150 psig test pressure unless the unit is blanked off from the piping.

Performance Derate Factors

All performance tables and adjustment factors found in the air-cooled screw chiller catalog (PM ALS-1) 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

Suction Lines

General

Careful design of the refrigerant piping is necessary for efficient system operation. The refrigerant piping should be designed for a low pressure drop to obtain maximum capacity and efficiency while maintaining adequate velocity. Lines should slope in the direction of flow to assure good oil return to the compressors. Cost considerations favor keeping line sizes as small as possible while not exceeding acceptable pressure drops in order to maintain unit performance.

NOTE

All refrigerant piping must be reviewed by McQuay Application Engineers prior to order entry and will be verified by McQuay startup technicians.

Suction line sizing

Pressure drop in the suction line reduces system capacity and efficiency because it forces the compressor to operate at lower suction pressure. The suction line should be sized for a pressure drop approximately equivalent of 2°F (1°C) change in saturation temperature. For suction line sizing see Table 11 through Table 13. For applications with the evaporator below the ALS unit, the vertical section of the suction lines must be sized to return oil to the compressors at the minimum compressor capacity step.

Example of Suction Line Size Calculation

ALS140A condensing unit with refrigerant R-22

Evaporator located 5 feet below the ALS compressor.

Lineal length of horizontal suction line is 25 feet

Suction line requires 7 long radius (90°) elbows; 3 in the horizontal, 4 in the riser

From Table 11, the nominal circuit capacities for circuit 1 and 2 are 65 and 80 tons respectively

Total lineal suction line length = 30 feet each circuit (25 feet horizontal plus 5 feet vertical riser). For the first try, assume that the total equivalent suction line length is twice the lineal suction line length.

Therefore the estimated total equivalent suction line length = 60 feet

From Table 12 and Table 13, For nominal circuit capacities of 65 & 80 tons and equivalent line length of 60 ft, the suction line size = 2 5/8" for horizontal lines and 2 1/8" for vertical lines.

From Table 16, Fitting loss for 2 5/8" long radius (90°) elbow = 4.1 ft, and 3.3 ft for the 2 1/8 elbows.

Therefore fitting loss in equivalent feet of pipe for (3) 2 5/8" long radius (90°) elbow = 12.3 ft, and 13.2ft for (4) 2 1/8" elbows.

Therefore the actual equivalent suction line length = 30 + 12.3 + 13.2 = 55.5 feet

From Table 12 and Table 13, For nominal circuit capacities of 65 & 80 tons and equivalent line length of 55.5 ft the suction line size is correct.

Table 11, **ALS 125A-280A Nominal Circuit Capacities**

ALS Model	Circuit 1	Circuit 2	Circuit 3	Circuit 4
	Tons (kW)	Tons (kW)	Tons (kW)	Tons (kW)
125A	65 (229)	65 (229)	-	-
140A	65 (229)	80 (262)	-	-
155A	80 (262)	80 (262)	-	-
170A	80 (262)	95 (334)	-	-
175A	80 (262)	95 (334)	-	-
185A	95 (334)	95 (334)	-	-
195A	95 (334)	95 (334)	-	-
204A	95 (334)	95 (334)	-	-
205A	65 (229)	65 (229)	80 (262)	-
220A	65 (229)	80 (262)	80 (262)	-
235A	80 (262)	80 (262)	80 (262)	-
250A	80 (262)	80 (262)	95 (334)	-
265A	80 (262)	95 (334)	95 (334)	-
280A	95 (334)	95 (334)	95 (334)	-
300A	65 (229)	65 (229)	80 (262)	80 (262)
315A	65 (229)	80 (262)	80 (262)	80 (262)
330A	80 (262)	80 (262)	80 (262)	80 (262)
340A	80 (262)	80 (262)	80 (262)	95 (334)
360A	80 (262)	80 (262)	95 (334)	95 (334)
370A	80 (262)	95 (334)	95 (334)	95 (334)
380A	95 (334)	95 (334)	95 (334)	95 (334)
425A	95 (334)	95 (334)	95 (334)	95 (334)

Table 12, Vertical Upflow Suction Line Sizes

Nominal Circuit Capacity Tons (kW)	Vertical Upflow Suction Lines	
	Equivalent Line Length Ft (m)	Suction Line Size (in.)
65 (2290	40 (12)	2 1/8
	75 (23)	2 1/8
80 (262)	40 (12)	2 1/8
	75 (23)	2 1/8
95 (334)	40 (12)	2 5/8
	75 (23)	2 5/8

Table 13, Horizontal and Vertical Downflow Suction Line Sizes

Nominal Circuit Capacity Tons (kW)	Vertical Downflow and Horizontal Suction Lines	
	Equivalent Line Length Ft (m)	Suction Line Size, in.
65 (229)	40 (12)	2 5/8
	75 (23)	2 5/8
	115 (35)	2 5/8
80 (262)	40 (12)	2 5/8
	75 (23)	2 5/8
	115 (35)	3 1/8
95 (334)	40 (12)	2 5/8
	75 (23)	3 1/8
	115 (35)	3 1/8

Liquid-Vapor Lines

The liquid-vapor line from the ALS condensing unit to the evaporator liquid connection is not a conventional liquid line since it carries both liquid and vapor. The compressors on the ALS units utilize a liquid cooled motor and an economizer. Therefore the expansion valve which feeds the full flow of liquid refrigerant into the compressor for motor cooling is mounted in the liquid line between the condenser sub-cooling coil and the compressor inlet; not at the evaporator inlet. The liquid-vapor line to the evaporator is a low pressure line downstream of the expansion valve and the size is slightly larger than a normal liquid line. For liquid line sizing see Table 14 and Table 15.

Table 14, Vertical Upflow Liquid-Vapor Line Sizes

Nominal Circuit Capacity Tons (kW)	Vertical Upflow Liquid-Vapor Lines	
	Equivalent Line Length Ft (m)	Liquid-Vapor Line Size o.d (in.)
65 (2290	40 (12)	1 3/8
	75 (23)	1 3/8
80 (262)	40 (12)	1 3/8
	75 (23)	1 3/8
95 (334)	40 (12)	1 5/8
	75 (23)	1 5/8

Table 15, Horizontal and Vertical Downflow Liquid-Vapor Line Sizes

Nominal Circuit Capacity Tons (kW)	Vertical Downflow and Horizontal Liquid-Vapor Lines	
	Equivalent Line Length Ft (m)	Liquid-Vapor Line Size o.d (in.)
65 (229)	40 (12)	1 3/8
	75 (23)	1 3/8
	115 (35)	1 3/8
80 (262)	40 (12)	1 3/8
	75 (23)	1 5/8
	115 (35)	1 5/8
95 (334)	40 (12)	1 5/8
	75 (23)	1 5/8
	115 (35)	1 5/8

Insulation

All piping joints and fittings must be thoroughly leak tested before insulation is applied. Suction lines must be insulated and should not be installed underground. Suction line insulation must be selected to prevent condensation under local ambient conditions with the lines at 40°F to 50°F (4.4°C to 10°C) operating temperatures. The liquid-vapor lines will operate at 40°F to 60°F (4.4°C to 15.6°C) and **must** also be insulated to prevent sweating and heat gain.

Location and Arrangement

Refrigerant lines should be as short and direct as possible to minimize tubing and fittings. Long radius elbows must be used (except for traps) to minimize the pressure drops. Traps should be as short as possible to minimize oil accumulation. Refrigerant piping should be arranged so that normal inspection of the equipment is not hindered. Adequate clearance should be provided between refrigerant piping and adjacent walls for insulation. Piping should be run so that it does not interfere with compressor service access, passages or obstruct headroom, windows and doors. Suction line hangers must be sized and located to support the weight of the piping in accordance with good piping practice.

Suction and liquid-vapor connection points for each circuit are labeled to facilitate field piping. Care must be exercised in routing the piping to avoid mixing piping from different circuits. The circuits on the outdoor ALS unit must match the circuits on the evaporator (i.e. circuit #1 on the outdoor ALS unit must be connected with circuit #1 on the evaporator).

Horizontal portions of the suction lines must be downward sloping toward the compressors. Slope all piping in the direction of flow. Vertical portions of the suction lines must be sized for oil return at minimum compressor load.

Note: Double section risers must not be utilized on any circuit. Traps must be provided as shown on Figure 16 and Figure 17.

Equivalent Line Lengths

Recommended refrigerant line sizes are based on equivalent line lengths of straight pipe, that is, a combination of straight pipe, fittings and valves. The pressure drop through valves and fittings is determined by establishing the equivalent straight length of pipe of the same size with the same friction loss. The "Total Equivalent Length" is the sum of the "Lineal Line Length" and the appropriate "Valve and Fitting Losses in Equivalent Feet of Pipe for Field Supplied Piping" given in Table 16

***Table 16,* Fitting Equivalent Feet of Pipe**

Line Size (in.)	Angle Valve	Globe Valve	90° Std. Radius Elbow	90° Long Radius Elbow
1 1/8	12	29	2.6	1.7
1 3/8	15	38	3.3	2.3
1 5/8	18	43	4.0	2.6
2 1/8	24	55	5.0	3.3
2 5/8	29	69	6.0	4.1
3 1/8	35	84	7.5	5.0

Figure 16, Evaporator Above ALS Unit

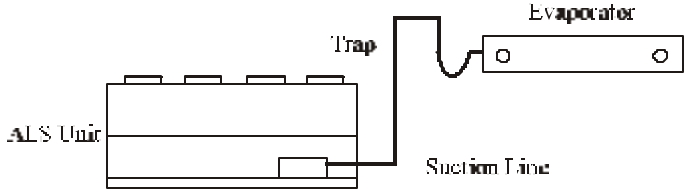
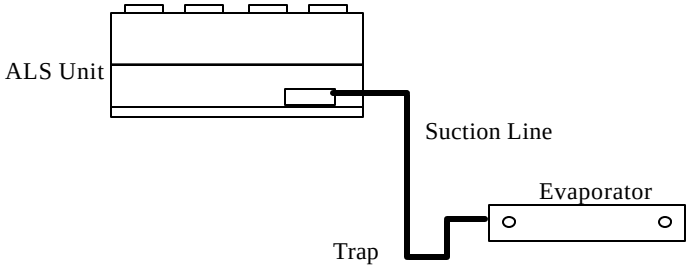


Figure 17, Evaporator Below ALS Unit



NOTE: Keep the trap width at a minimum to avoid trapping excessive oil.

Startup Procedures

NOTE: McQuayService or an authorized McQuay service agent must do initial start-up and commissioning.

Filter Driers

Following an initial 24 hour operation the pressure drop across the replaceable core, filter drier should be checked. If this pressure drop exceeds the values given in Table 17 at the various load conditions the filter drier cores must be replaced. Also if the moisture indicating sight glass shows a wet system condition after 24 hours of operation the filter cores must be changed. This should remove any contaminants introduced during field piping. The filter drier cores must also be changed anytime the system is opened for servicing.

***Table 17,* Filter Drier Pressure Drop**

Percent Circuit Loading (%)	Maximum Recommended Pressure Drop Across Filter Drier psig (kPa)
100	10 (69.0)
75	8 (55.2)
50	5 (34.5)
25	4 (27.6)

Refrigerant and Oil Charge

The relative position of the ALS unit and the evaporator and the distance between them plays a critical role in determining suction and liquid line sizes and the field refrigerant and oil charges. ALS units with the remote evaporator option are shipped with a factory refrigerant and oil charge suitable for the normal packaged unit. It will be necessary to add refrigerant and oil for the added connecting piping to the remote evaporator. See Table 18 for refrigerant charge for suction and liquid-vapor lines. McQuayService will supply and add the additional oil required by the refrigerant piping. The correct oil is Planetelf® ACD68AW, McQuay Part No. 735030439 (5 gal.), 735030438 (1 gal.).

Charging Procedure

The calculated refrigerant and oil charge must be added through the factory supplied charging valve located on the liquid-vapor line coming out of the compressor. Sufficient charge must be added to clear the liquid line sight glass located at the outlet of the condenser. Add an extra 10 lb. of refrigerant after the sight glass is clear.

Note: Charge must never be added through the compressor suction line.

Table 18, **Refrigerant Charge for Suction and Liquid-Vapor Lines**

Lineal Tubing Length Ft (m)	Suction Line Refrigerant Charge lb (kg)		Liquid-Vapor Line Refrigerant Charge lb (kg)	
	Line (in.)	R-22	Line (in.)	R-22
10 (3)	2 1/8	0.33 (0.15)	1 3/8	3.6 (1.6)
	2 5/8	0.51 (0.23)	1 5/8	5.0 (2.3)
	3 1/8	0.71 (0.32)		
20 (6)	2 1/8	0.66 (0.30)	1 3/8	7.2 (3.3)
	2 5/8	1.02 (0.46)	1 5/8	10.0 (4.5)
	3 1/8	1.42 (0.64)		
30 (9)	2 1/8	0.99 (0.45)	1 3/8	10.8 (4.9)
	2 5/8	1.53 (0.69)	1 5/8	15.0 (6.8)
	3 1/8	2.13 (0.96)		
40 (12)	2 1/8	1.32 (0.60)	1 3/8	14.4 (6.5)
	2 5/8	2.04 (0.92)	1 5/8	20.0 (9.0)
	3 1/8	2.84 (1.29)		

Oil Charge Calculation

Total Field Oil Charge = 4% by weight of the field refrigerant charge added to the suction and liquid-vapor lines.

Note: For every 10 lb. (160 oz) of refrigerant charge added, a 6.4 oz (equal to 0.4 pint fluid measure) oil charge is required.

Example: (In I-P Units)

Total suction line lineal length = 20 ft.; Suction line size = 2 5/8 in.

Total liquid-vapor line lineal length = 30 ft.; Liquid-Vapor line size = 1 5/8

From Table 18 obtain the suction and liquid-vapor line refrigerant charge

Refrigerant charge required in the suction line = 1.0 lb.

Refrigerant charge required in the liquid-vapor line = 15.0 lb.

Total Refrigerant charge required in the suction and liquid-vapor line = 16.0 lb.

Total Oil Charge = 4% by weight of the total field refrigerant charge added to the suction and liquid-vapor lines = 10.3 oz (0.6 pint)

Notes:

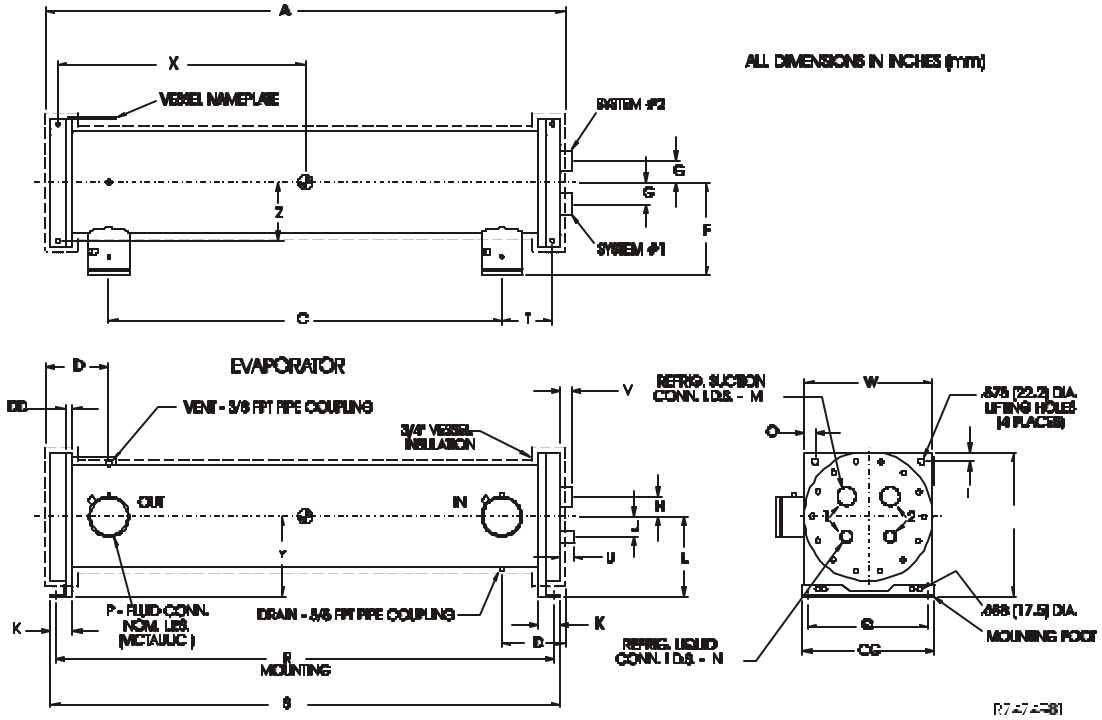
1. The only approved oil is that identified on the label attached to the compressors. All POE oils are hygroscopic and care should be exercised in handling the oil to avoid absorption and retention of moisture.
2. Do not leave the oil container open for more than a minute while charging oil. Do not use oil that has not been properly sealed and stored.
3. The evaporator is supplied without heater.

Dimensions

Use the ALS dimension drawings Figure 23 to Figure 27 for the ALS 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 Figure 18 through Figure 20.

Dimensions, Remote Evaporator

Figure 18, Evaporator for ALS 125 - ALS 204



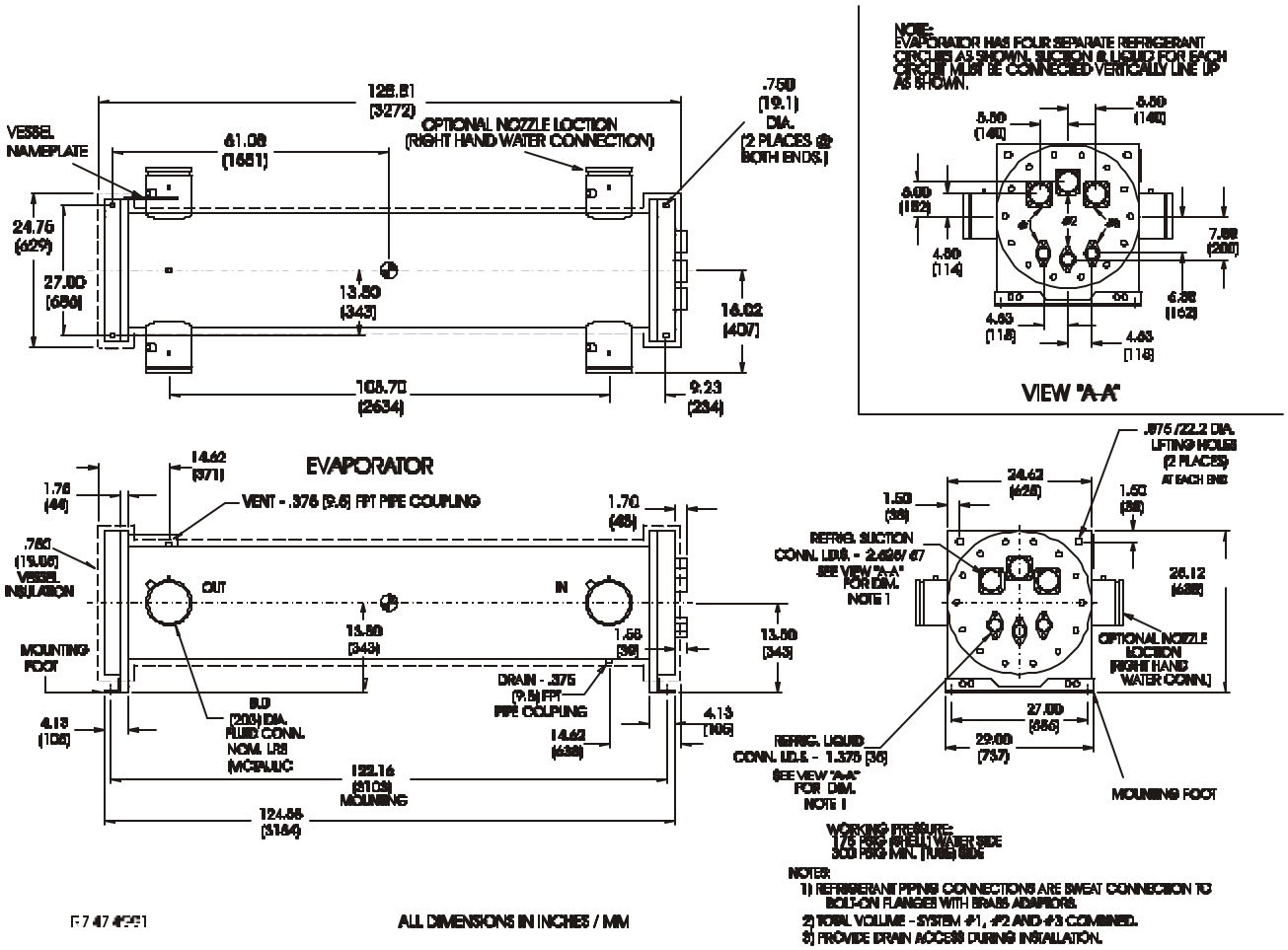
ALS Model Number	CDE Model Number	Water Connection - Inches (mm)				Refrigerant Connection		Water Volume Gallons(Litre)	Refrig. Volume Cu.Ft. (cu.mm)
		C	L	P	T	M	N		
125	**CDE-1410-1**	103.80 (2637)	13.00 (330)	6.0 (152)	9.01 (229)	2 5/8 (67)	1 3/8 (35 0)	36.1 (136.6)	4.71 (.13)
155,170,175,185	**CDE-1610-1**	105.58 (2682)	13.00 (330)	6.0 (152)	8.12 (206)	2 5/8 (67)	1 3/8 (35 0)	45.6 (172.6)	6.37 (.18)
140	**CDE-1610-2**	105.58 (2682)	13.00 (330)	6.0 (152)	8.12 (206)	2 5/8 (67)	1 3/8 (35 0)	50.3 (190.4)	5.82 (.16)
195	**CDE-1810-1**	105.58 (2682)	14.00 (356)	6.0 (152)	8.12 (206)	2 5/8 (67)	1 3/8 (35 0)	58.4 (221.1)	8.16 (.23)
204	**CDE-2010-1**	103.70 (2634)	13.50 (343)	8.0 (203)	9.23 (234)	2 5/8 (67)	1 3/8 (35 0)	72.3 (273.7)	10.10 (.29)

CDE Model Number	Dimensional Data - Inches (mm)							
	A	D	E	F	G	H	I	J
CDE-1410-1	128.31 (3259)	14.37 (365)	22.63 (575)	13.00 (330)	2.45 (62)	4.13 (105)	1.50 (38)	4.88 (124)
CDE-1610-1	128.31 (3259)	14.62 (371)	22.63 (575)	13.00 (330)	2.75 (70)	5.12 (130)	1.50 (38)	5.50 (140)
CDE-1610-2	128.31 (3259)	14.62 (371)	22.63 (575)	13.00 (330)	2.75 (70)	5.12 (130)	1.50 (38)	5.50 (140)
CDE-1810-1	129.32 (3285)	14.87 (378)	24.62 (625)	14.37 (365)	2.75 (70)	5.12 (130)	1.00 (25)	5.50 (140)
CDE-2010-1	128.81 (3272)	14.62 (371)	25.12 (638)	16.02 (407)	3.25 (83)	5.25 (133)	1.50 (38)	7.12 (181)

CDE Model Number	Dimensional Data - Inches (mm)								
	K	O	R	S	U	V	W	CC	DD
CDE-1410-1	3.25 (83)	1.50 (38)	121.81 (3094)	123.81 (3145)	1.53 (39)	1.70 (43)	19.25 (489)	19.25 (489)	125 (32)
CDE-1610-1	3.25 (83)	1.50 (38)	121.81 (3094)	123.81 (3145)	1.53 (39)	1.70 (43)	19.25 (489)	19.25 (489)	125 (32)
CDE-1610-2	3.25 (83)	1.50 (38)	121.81 (3094)	123.81 (3145)	1.53 (39)	1.70 (43)	19.25 (489)	19.25 (489)	125 (32)
CDE-1810-1	3.25 (83)	2.50 (64)	121.81 (3094)	123.81 (3145)	1.53 (39)	1.70 (43)	21.25 (540)	21.25 (540)	125 (32)
CDE-2010-1	4.13 (105)	1.50 (38)	122.61 (3103)	124.58 (3164)	1.53 (39)	1.70 (43)	24.62 (625)	29.00 (737)	1.75 (44)

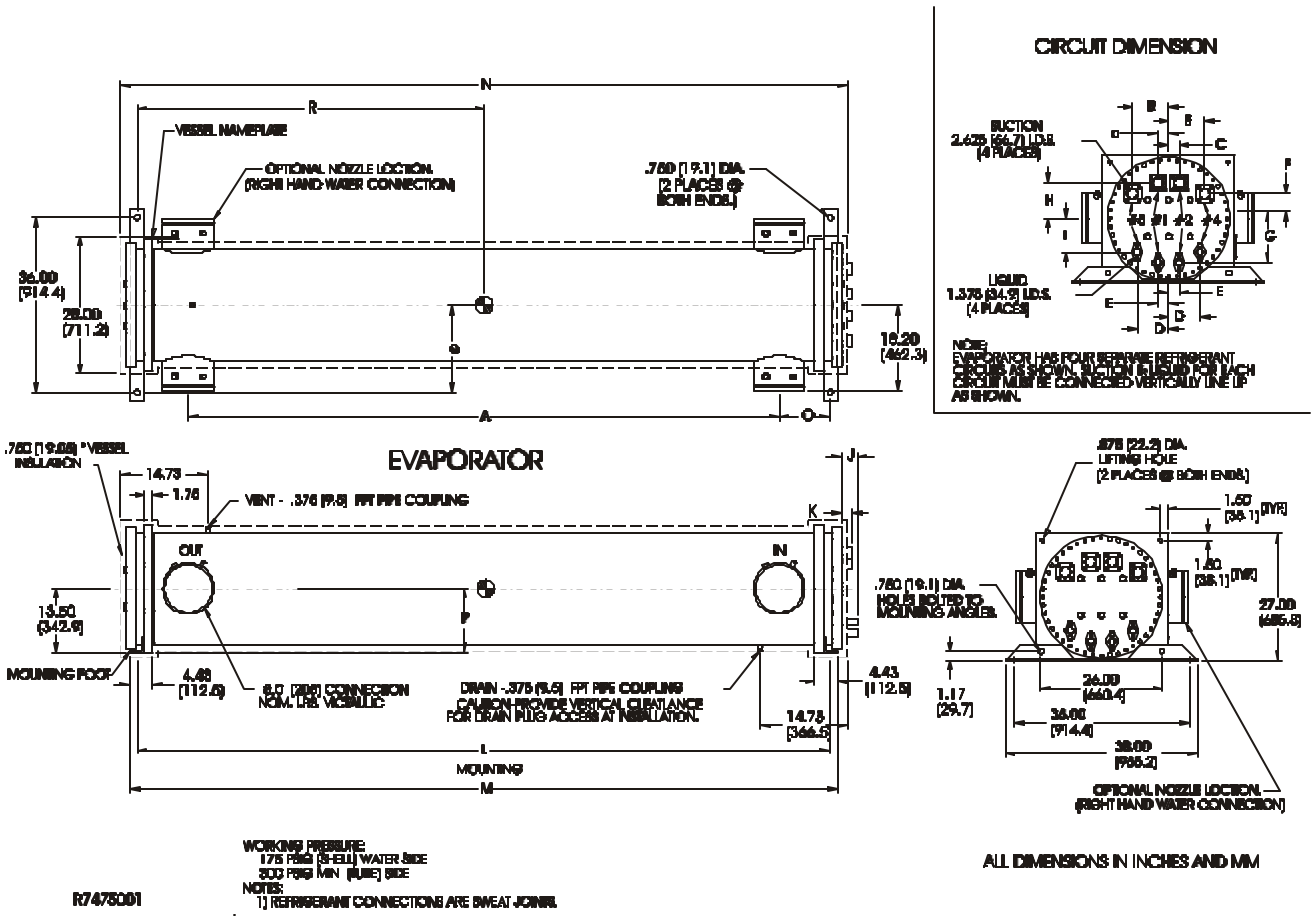
CDE Model Number	Center of Gravity - Inches (mm)			Operating Charge - Lbs. (kgs) R-22		Unit Weights - Lbs. (kgs)	
	X	Y	Z	System #1	System #2	Operating	Shipping
CDE-1410-1	60.91 (1547)	13.00 (330)	8.00 (203)	10.3 (4.7)	10.3 (4.7)	1845 (837)	1790 (812)
CDE-1610-1	60.91 (1547)	13.00 (330)	8.00 (203)	13.9 (6.3)	13.9 (6.3)	2285 (1036)	2145 (973)
CDE-1610-2	60.91 (1547)	13.00 (330)	8.00 (203)	12.7 (5.8)	12.7 (5.8)	2285 (1036)	2110 (957)
CDE-1810-1	60.91 (1547)	14.00 (356)	8.00 (203)	17.8 (8.1)	17.8 (801)	2750 (1247)	2475 (1123)
CDE-2010-1	61.08 (1551)	13.50 (343)	13.50 (343)	22.8 (10.3)	22.8 (10.3)	3158 (1432)	2819 (1279)

Figure 19, Evaporator for ALS 205 - ALS 280



ALS Model Number	CDE Model Number	Water Volume Cu.Ft. (cu. mm)	Refrig. Volume Cu. Ft. (cu. mm)	Operating Charge - Lbs. (kgs)			Unit Weights - Lbs. (kgs)	
				System #1	System #2	System #3	Operating	Shipping
250, 265, 280	**CDE-2010-1**	72.3 (274)	10.1 (0.29)	15.2 (6.9)	15.2 (6.9)	15.2 (6.9)	3165 (1435)	2825 (1281)
205, 220, 235	**CDE-2010-2**	80.9 (306)	9.4 (0.26)	14.0 (6.4)	14.0 (6.4)	14.0 (6.4)	3165 (1435)	2775 (1258)

Figure 20, Evaporator for ALS 300 - ALS 425



ALS Model Number	CDE Model Number	Dimensional Data - Inches (mm)							
		A	B	C	D	E	F	G	H
330,340,360,370,380	CDE-2410-1	103.70 (2634)	7.68 (195)	2.30 (58)	6.66 (169)	2.22 (56)	5.25 (133)	9.38 (238)	7.50 (191)
300,315	CDE-2410-2	103.70 (2634)	7.68 (195)	2.30 (58)	6.66 (169)	2.22 (56)	5.25 (133)	9.38 (238)	7.50 (191)
425	CDE-2412-1	125.28 (3182)	7.68 (195)	2.30 (58)	6.66 (169)	2.22 (56)	5.25 (133)	9.38 (238)	7.50 (191)

CDE Model Number	Dimensional Data - Inches (mm)						
	I	J	K	L	M	N	O
CDE-2410-1	7.12 (181)	1.53 (39)	4.13 (105)	122.73 (3117)	125.17 (3179)	129.05 (3278)	9.52 (242)
CDE-2410-2	7.12 (181)	1.53 (39)	4.13 (105)	122.73 (3117)	125.17 (3179)	129.05 (3278)	9.52 (242)
CDE-2412-1	7.12 (181)	1.53 (39)	4.13 (105)	146.73 (3727)	149.17 (3789)	153.05 (3887)	10.73 (273)

CDE Model Number	Center of Gravity - Inches (mm)			Water Volume Gallons (Litre)	Refrig. Volume Cu. Feet (Cu. M)	Unit Weights - Lbs. (kgs)	
	P	Q	R			Operating	Shipping
CDE-2410-1	13.50 (343)	18.00 (457)	61.37 (1559)	107 (405)	13.5 (0.38)	4250# (1927)	3700# (1678)
CDE-2410-2	13.50 (343)	18.00 (457)	61.37 (1559)	112 (424)	12.8 (0.36)	4290# (1946)	3640# (1651)
CDE-2412-1	13.50 (343)	18.00 (457)	73.37 (1863)	128 (485)	15.5 (0.44)	5100# (2313)	4400# (1996)

CDE Model Number	Operating Charge - Lbs. (kgs.) R-22			
	System #1	System #2	System #3	System #4
CDE-2410-1	15 (6.8)	15 (6.8)	15 (6.8)	15 (6.8)
CDE-2410-2	14 (6.4)	14 (6.4)	14 (6.4)	14 (6.4)
CDE-2412-1	20 (9.1)	20 (9.1)	20 (9.1)	20 (9.1)

Water Flow and Pressure Drop

Balance the chilled water flow through the evaporator. The flow rates must fall between the minimum and maximum values shown in Table 19 and Table 20. Flow rates below the minimum values shown will result in laminar flow that will reduce efficiency, cause erratic operation of the electronic expansion valve and could cause low temperature cutouts. On the other hand flow rates exceeding the maximum values shown can cause erosion on the evaporator water connections and tubes.

Measure the chilled water pressure drop through the evaporator at field installed pressure taps. It is important not to include valve or strainer pressure drop in these readings.

Variable chilled water flow through the evaporator while the compressor(s) are operating is not recommended. MicroTech control set points are based upon a constant flow and variable temperature.

Table 19, ALS 070 - 100, and ALS 220 - 265 Min/Max Flow Rates

ALS UNIT	MIN. FLOW RATE		MAX FLOW RATE		ALS UNIT	MIN. FLOW RATE		MAX. FLOW RATE	
SIZE	GPM	LPS	GPM	LPS	SIZE	GPM	LPS	GPM	LPS
070	102	6.5	272	17.2	220	335	21.2	893	56.4
080	122	7.7	324	20.5	235	356	22.5	950	60.0
090	139	8.8	369	23.4	250	376	23.8	1000	63.2
100	147	9.3	391	24.8	265	391	24.7	1043	66.0

Figure 21, ALS 070 - 100, Evaporator Pressure Drop

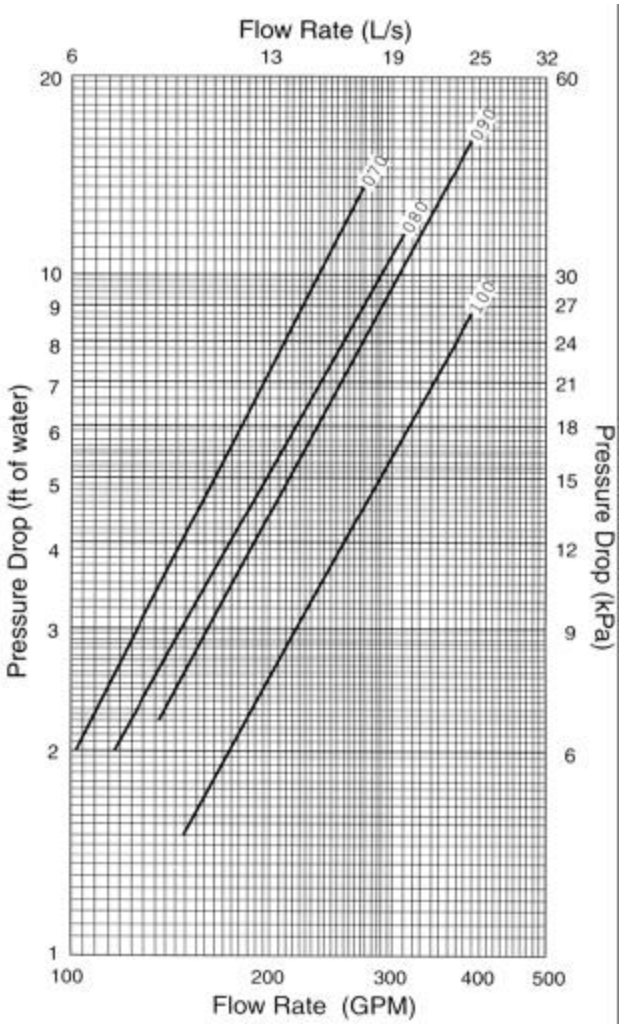
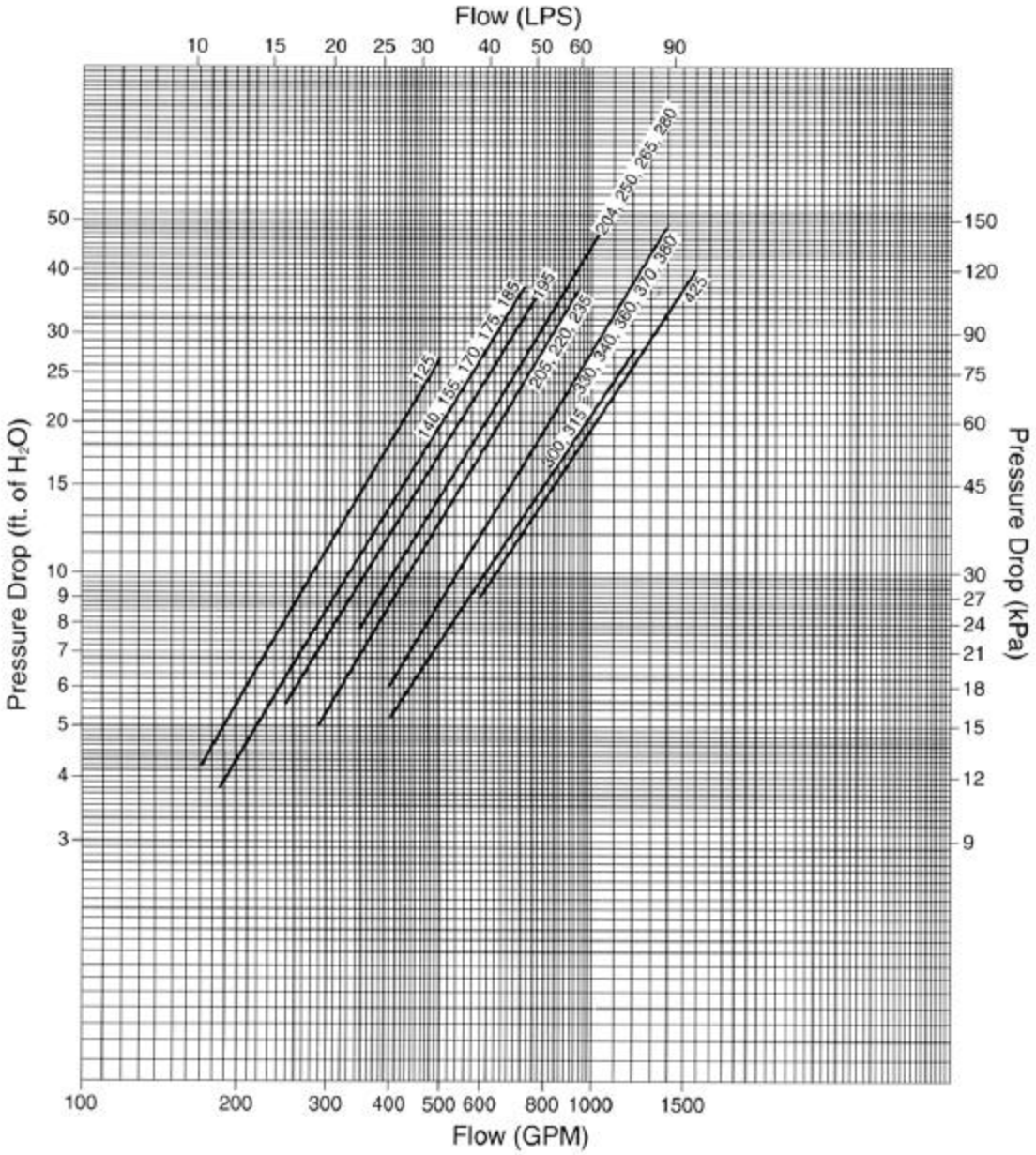


Table 20, ALS 125 – 205 and ALS 280 - 425 Min/Max Flow Rates

ALS UNIT	MIN. FLOW RATE		MAX FLOW RATE		ALS UNIT	MIN. FLOW RATE		MAX. FLOW RATE	
SIZE	GPM	LPS	GPM	LPS	SIZE	GPM	LPS	GPM	LPS
125	186	11.8	497	31.4	280	408	25.8	1088	68.8
140	209	13.2	557	35.2	300	440	27.8	1173	74.1
155	231	14.6	617	39.0	315	459	29.0	1222	77.1
170	253	16.0	675	42.7	330	479	30.2	1276	80.6
175	256	16.2	683	43.2	340	493	31.1	1313	82.9
185	274	17.3	730	46.1	360	523	33.0	1395	88.1
195	284	18.0	767	48.5	370	540	34.1	1438	90.8
204	303	19.1	808	51.0	380	559	35.3	1490	94.1
205	309	19.5	825	52.1	425	616	38.9	1650	104.2

Figure 22, ALS 125 - 425, Evaporator Pressure Drop



Physical Data

Table 21, ALS 070-100

DATA	ALS MODEL NUMBER			
	070A	080A	090A	100A
BASIC DATA				
Unit capacity @ ARI conditions, tons (kW)	68.1 (239)	77.9 (274)	90.6 (319)	96.4 (339)
Unit operating charge R-22, lbs (kg)	150 (68)	160 (73)	180 (82)	190 (87)
Cabinet dimensions L x W x H, in. (mm)	124.7 X 83.4 X 92.5 (3167 X 2118 X 2350)	124.7 X 83.4 X 92.5 (3167 X 2118 X 2350)	159.4 X 83.4 X 92.5 (4049 X 2118 X 2350)	159.4 X 83.4 X 92.5 (4049 X 2118 X 2350)
Unit operating weight, lbs. (kg)	5725 (2597)	6175 (2801)	6825 (3096)	7300 (3311)
Unit shipping weight, lbs. (kg)	5500 (2495)	5900 (2676)	6500 (2948)	6900 (3130)
COMPRESSORS, SCREW, SEMI-HERMETIC				
Nominal tons, (kW0	65 (230)	80(280)	95 (335)	95 (335)
CONDENSERS, HIGH EFFICIENCY FIN & TUBE TYPE WITH INTEGRAL SUBCOOLER				
Coil face area, sq. ft. (m^2)	115.6 (10.7)	115.6 (10.7)	154.1 (14.3)	154.1 (14.3)
Finned height x finned length, in. (mm)	160 x 104 (4064 x 2642)	161 x 104 (4064 x 2642)	160 x 138.7) 4064 x 3523)	160 x 138.7) 4064 x 3523)
Fins per inch x rows deep	16 x 3	16 x 3	16 x 3	16 x 3
CONDENSER FANS, DIRECT DRIVE PROPELLER TYPE				
No. of fans - fan diameter, in. (mm)	6-28 (711)	6-28 (711)	8-28 (711)	8-28 (711)
No. of motors - hp (kW)	6-1.5 (1.1)	6-1.5 (1.1)	6-1.5 (1.1)	6-1.5 (1.1)
Fan & motor rpm, 60/50Hz	1140	1140	1140	1140
60 Hz fan tip speed, fpm 50 Hz fan tip speed, (m/sec)	8357	8357	8357	8357
60 Hz total unit airflow, cfm 50 Hz total unit airflow, (m2/sec	54120	54120	72160	72160
EVAPORATOR, DIRECT EXPANSION, BAFFLED SHELL & THRU TUBE				
Shell diameter - tube length in (mm) - ft. (mm)	12-08 (305-2439)	14008 (356-2439)	14-10 (356-3048)	16-10 (407-3048)
Water volume, gallons (L)	24.3 (92.0)	32.6 (123.4)	41.3 (156.3)	43.6 (165)
Max. water pressure, psi (kPa)	175 (1207)	175 (1207)	175 (1207)	175 (1207)
Max. refrigerant pressure, psi (kPa)	225 (1552)	225 (1552)	225 (1552)	225 (1552)

Table 22, ALS 125-170

DATA	ALS MODEL NUMBER							
	125A		140A		155A		170A	
	CKT.1	CKT.2	CKT.1	CKT.2	CKT.1	CKT.2	CKT.1	CKT.2
BASIC DATA								
Unit capacity @ ARI conditions, tons (kW)	62.2 (218)	62.2 (218)	64.4 (226)	75 (263)	77.1 (271)	77.1 (271)	79 (278)	89.7 (315)
Unit operating charge R-22, lbs (kg)	140 (63.5)	140 (63.5)	140 (63.5)	150 (68.1)	150 (68.1)	150 (68.1)	150 (68.1)	160 (72.6)
Cabinet dimensions L x W x H, in. (mm)	228.7 x 83.4 x 92.5 (5809 x 2118 x 2350)		228.7 x 83.4 x 92.5 (5809 x 2118 x 2350)		228.7 x 83.4 x 92.5 (5809 x 2118 x 2350)		228.7 x 83.4 x 92.5 (5809 x 2118 x 2350)	
Unit operating weight, lbs. (kg)	9920 (4500)		10350 (4700)		10670 (4840)		10750 (4880)	
Unit shipping weight, lbs. (kg)	9600 (4355)		9900 (4450)		10250 (4650)		10350 (4700)	
COMPRESSORS, SCREW, SEMI-HERMETIC								
Nominal tons, (kW0	65 (230)	65 (230)	65 (230)	80 (280)	80 (280)	80 (280)	80 (280)	95 (335)
CONDENSERS, HIGH EFFICIENCY FIN & TUBE TYPE WITH INTEGRAL SUBCOOLER								
Coil face area, sq. ft. (m^2)	115.6 (10.7)	115.6 (10.7)	115.6 (10.7)	115.6 (10.7)	115.6 (10.7)	115.6 (10.7)	115.6 (10.7)	115.6 (10.7)
Finned height x finned length, in. (mm)	80 x 208 (2032 x 5283)	80 x 208 (2032 x 5283)	80 x 208 (2032 x 5283)	80 x 208 (2032 x 5283)	80 x 208 (2032 x 5283)	80 x 208 (2032 x 5283)	80 x 208 (2032 x 5283)	80 x 208 (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
CONDENSER FANS, DIRECT DRIVE PROPELLER TYPE								
No. of fans - fan diameter, in. (mm)	10 - 28 (711)		10 - 28 (711)		12 - 28 (711)		12 - 28 (711)	
No. 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 & motor rpm, 60/50Hz	1140/950		1140/950		1140/950		1140/950	
60 Hz fan tip speed, fpm 50 Hz fan tip speed, (m/sec)	8357 (35.4)		8357 (35.4)		8357 (35.4)		8357 (35.4)	
60 Hz total unit airflow, cfm 50 Hz total unit airflow, (m2/sec	90200 (35.5)		90200 (35.5)		108240 (42.6)		108240 (42.6)	
EVAPORATOR, DIRECT EXPANSION, BAFFLED SHELL & THRU TUBE								
Shell diameter - tube length in (mm) - ft. (mm)	14 - 10 (356 - 3048)		16 - 10 (406 - 3048)		16 - 10 (406 - 3048)		16 - 10 (406 - 3048)	

Water volume, gallons (L)	36.1 (136.7)	45.6 (172.6)	45.6 (172.6)	45.6 (172.6)
Max. water pressure, psi (kPa)	175 (1207)	175 (1207)	175 (1207)	175 (1207)
Max. refrigerant pressure, psi (kPa)	225 (1552)	225 (1552)	225 (1552)	225 (1552)

Table 23, ALS 175-204

DATA	ALS MODEL NUMBER							
	175A		185A		195A		204A	
	CKT.1	CKT.2	CKT.1	CKT.2	CKT.1	CKT.2	CKT.1	CKT.2
Unit capacity @ ARI conditions, tons (kW)	80.4 (282)	90.6 (318)	91.2 (320)	91.2 (320)	94.6 (332)	94.6 (332)	101 (355)	101 (355)
Unit operating charge R-22, lbs (kg)	160 (72.6)	160 (72.6)	160 (72.6)	160 (72.6)	170 (77.1)	170 (77.1)	195 (88.4)	195 (88.4)
Cabinet dimensions L x W x H, in. (mm)	263.4 x 83.4 x 92.5 (6690 x 2118 x 2350)		263.4 x 83.4 x 92.5 (6690 x 2118 x 2350)		263.4 x 83.4 x 92.5 (6690 x 2118 x 2350)		263.4 x 83.4 x 92.5 (6690 x 2118 x 2350)	
Unit operating weight, lbs. (kg)	11250 (5100)		11250 (5100)		11500 (5218)		12570 (5701)	
Unit shipping weight, lbs. (kg)	10850 (4920)		10850 (4920)		11100 (5036)		11980 (5433)	
COMPRESSORS, SCREW, SEMI-HERMETIC								
Nominal tons, (kW)	80 (280)	95 (335)	95 (335)	95 (335)	95 (335)	95 (335)	95 (335)	95 (335)
CONDENSERS, HIGH EFFICIENCY FIN & TUBE TYPE WITH INTEGRAL SUBCOOLER								
Coil face area, sq. ft. (m^2)	135.0 (12.5)	135.0 (12.5)	135.0 (12.5)	135.0 (12.5)	135.0 (12.5)	135.0 (12.5)	135.0 (12.5)	135.0 (12.5)
Finned height x finned length, in. (mm)	80 x 243 (2032 x 6172)	80 x 243 (2032 x 6172)	80 x 243 (2032 x 6172)	80 x 243 (2032 x 6172)	80 x 243 (2032 x 6172)	80 x 243 (2032 x 6172)	80 x 243 (2032 x 6172)	80 x 243 (2032 x 6172)
Fins per inch x rows deep	16 x 3	16 x 3	16 x 3	16 x 3	16 x 3	16 x 3	12 x 4	12 x 4
CONDENSER FANS, DIRECT DRIVE PROPELLER TYPE								
No. of fans - fan diameter, in. (mm)	14 - 28 (711)		14 - 28 (711)		14 - 28 (711)		14 - 28 (711)	
No. of motors - hp (kW)	14 - 1.5 (1.1)		14 - 1.5 (1.1)		14 - 1.5 (1.1)		14 - 2.0 (1.5)	
Fan & motor rpm, 60/50Hz	1140/950		1140/950		1140/950		1140/950	
60 Hz fan tip speed, fpm 50 Hz fan tip speed, (m/sec)	8357 (35.4)		8357 (35.4)		8357 (35.4)		8357 (35.4)	
60 Hz total unit airflow, cfm 50 Hz total unit airflow, (m2/sec	126280 (49.7)		12680 (49.7)		12680 (49.7)		138908 (54.7)	
EVAPORATOR, DIRECT EXPANSION, BAFFLED SHELL & THRU TUBE								
Shell diameter - tube length in (mm) - ft. (mm)	16 - 10 (406 - 3048)		16 - 10 (406 - 3048)		18 - 10 (457 - 3048)		20 - 10 (508 - 3048)	
Water volume, gallons (L)	43.6 (165.0)		43.6 (165.0)		57.3 (216.9)		69.6 (263.5)	
Max. water pressure, psi (kPa)	175 (1207)		175 (1207)		175 (1207)		175 (1207)	
Max. refrigerant pressure, psi (kPa)	225 (1552)		225 (1552)		225 (1552)		225 (1552)	

Table 24, ALS 205-235

DATA	ALS MODEL NUMBER								
	205A			220a			235A		
	CKT.1	CKT.2	CKT.3	CKT.1	CKT.2	CKT.3	CKT.1	CKT.2	CKT.3
Unit capacity @ ARI conditions, tons (kW)	64.4 (226)	66.1 (232)	75.8 (266)	66.1 (232)	78.2 (275)	79.0 (277)	79.3 (279)	79.3 (279)	79.0 (277)
Unit operating charge R-22, lbs (kg)	140 (63.5)	140 (63.5)	150 (68.1)	140 (63.5)	150 (68.1)	150 (68.1)	150 (68.1)	150 (68.1)	150 (68.1)
Cabinet dimensions L x W x H, in. (mm)	355 x 83.4 x 94.5 (9017 x 2118 x 2400)			355 x 83.4 x 94.5 (9017 x 2118 x 2400)			355 x 83.4 x 94.5 (9017 x 2118 x 2400)		
Unit operating weight, lbs. (kg)	15930 (7224)			15930 (7224)			15930 (7224)		
Unit shipping weight, lbs. (kg)	15250 (6916)			15330 (6952)			15330 (6952)		
COMPRESSORS, SCREW, SEMI-HERMETIC									
Nominal tons, (kW0	65 (230)	65 (230)	80 (280)	65 (230)	80 (280)	80 (280)	80 (280)	80 (280)	80 (280)
CONDENSERS, HIGH EFFICIENCY FIN & TUBE TYPE WITH INTEGRAL SUBCOOLER									
Coil face area, sq. ft. (m^2)	115.6 (10.7)	115.6 (10.7)	115.6 (10.7)	115.6 (10.7)	115.6 (10.7)	115.6 (10.7)	115.6 (10.7)	115.6 (10.7)	115.6 (10.7)
Finned height x finned length, in. (mm)	80 x 208 (2032 x 5283)	80 x 208 (2032 x 5283)	160 x 104 (4064 x 2642)	80 x 208 (2032 x 5283)	80 x 208 (2032 x 5283)	160 x 104 (4064 x 2642)	80 x 208 (2032 x 5283)	80 x 208 (2032 x 5283)	160 x 104 (4064 x 2642)
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	16 x 3
CONDENSER FANS, DIRECT DRIVE PROPELLER TYPE									
No. of fans - fan diameter, in. (mm)	16 - 28 (711)			16 - 28 (711)			18 - 28 (711)		
No. of motors - hp (kW)	16 - 1.5 (1.1)			16 - 1.5 (1.1)			18 - 1.5 (1.1)		
Fan & motor rpm, 60/50Hz	1140/950			1140/950			1140/950		
60 Hz fan tip speed, fpm 50 Hz fan tip speed, (m/sec)	8357 (35.4)			8357 (35.4)			8357 (35.4)		
60 Hz total unit airflow, cfm	144320			144320			162360		

50 Hz total unit airflow, (m2/sec	(56.8)	(56.8)	(63.9)
EVAPORATOR, DIRECT EXPANSION, BAFFLED SHELL & THRU TUBE			
Shell diameter - tube length in (mm) - ft. (mm)	20 - 10 (508 - 3048)	20 - 10 (508 - 3048)	20 - 10 (508 - 3048)
Water volume, gallons (L)	81 (306.6)	76 (287.7)	76 (287.7)
Max. water pressure, psi (kPa)	175 (1207)	175 (1207)	175 (1207)
Max. refrigerant pressure, psi (kPa)	225 (1552)	225 (1552)	225 (1552)

Table 25, ALS 250-280

DATA	250A			265A			280A		
	CKT.1	CKT.2	CKT.3	CKT.1	CKT.2	CKT.3	CKT.1	CKT.2	CKT.3
Unit capacity @ ARI conditions, tons (kW)	80.2 (282)	79.0 (277)	91 (320)	80.2 (282)	89.7 (315)	91 (320)	91.4 (321)	89.7 (315)	91 (320)
Unit operating charge R-22, lbs (kg)	150 (68.1)	150 (68.1)	160 (72.6)	150 (68.1)	160 (72.6)	160 (72.6)	160 (72.6)	160 (72.6)	160 (72.6)
Cabinet dimensions L x W x H, in. (mm)	355 x 83.4 x 94.5 (9017 x 2118 x 2400)			355 x 83.4 x 94.5 (9017 x 2118 x 2400)			355 x 83.4 x 94.5 (9017 x 2118 x 2400)		
Unit operating weight, lbs. (kg)	16200 (7347)			16200 (7347)			16250 (7370)		
Unit shipping weight, lbs. (kg)	15600 (7075)			15600 (7075)			15650 (7098)		
COMPRESSORS, SCREW, SEMI-HERMETIC									
Nominal tons, (kW0	80 (280)	80 (280)	95 (335)	80 (280)	95 (335)	95 (335)	95 (335)	95 (335)	95 (335)
CONDENSERS, HIGH EFFICIENCY FIN & TUBE TYPE WITH INTEGRAL SUBCOOLER									
Coil face area, sq. ft. (m^2)	115.6 (10.7)	115.6 (10.7)	115.6 (10.7)	115.6 (10.7)	115.6 (10.7)	115.6 (10.7)	115.6 (10.7)	115.6 (10.7)	115.6 (10.7)
Finned height x finned length, in. (mm)	80 x 208 (2032 x 5283)	80 x 208 (2032 x 5283)	160 x 104 (4064 x 5283)	80 x 208 (2032 x 5283)	80 x 208 (2032 x 5283)	160 x 104 (4064 x 5283)	80 x 208 (2032 x 5283)	80 x 208 (2032 x 5283)	160 x 104 (4064 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	16 x 3
CONDENSER FANS, DIRECT DRIVE PROPELLER TYPE									
No. of fans - fan diameter, in. (mm)	18 - 28 (711)			18 - 28 (711)			18 - 28 (711)		
No. of motors - hp (kW)	18 - 1.5 (1.1)			18 - 1.5 (1.1)			18 - 1.5 (1.1)		
Fan & motor rpm, 60/50Hz	1140/950			1140/950			1140/950		
60 Hz fan tip speed, fpm 50 Hz fan tip speed, (m/sec)	8357 (35.4)			8357 (35.4)			8357 (35.4)		
60 Hz total unit airflow, cfm 50 Hz total unit airflow, (m2/sec	162360 (63.9)			162360 (63.9)			162360 (63.9)		
EVAPORATOR, DIRECT EXPANSION, BAFFLED SHELL & THRU TUBE									
Shell diameter - tube length in (mm) - ft. (mm)	20 - 10 (508 - 3048)			20 - 10 (508 - 3048)			20 - 10 (508 - 3048)		
Water volume, gallons (L)	69.6 (263.5)			69.6 (263.5)			69.6 (263.5)		
Max. water pressure, psi (kPa)	175 (1207)			175 (1207)			175 (1207)		
Max. refrigerant pressure, psi (kPa)	225 (1552)			225 (1552)			225 (1552)		

Table 26, ALS 300-340

DATA	300A				315A				330A				340A			
	CKT.1	CKT.2	CKT.3	CKT.4	CKT.1	CKT.2	CKT.3	CKT.4	CKT.1	CKT.2	CKT.3	CKT.4	CKT.1	CKT.2	CKT.3	CKT.4
Unit capacity @ ARI conditions, tons (kW)	66.9 (235)	66.9 (235)	79.7 (280)	79.7 (280)	66.9 (235)	79.7 (280)	79.7 (280)	79.7 (280)	79.2 (278)	79.7 (280)	80.3 (282)	80.3 (282)	79.2 (278)	79.7 (280)	80.3 (282)	89.4 (314)
Unit operating charge R-22, lbs (kg)	155 (70.3)	155 (70.3)	160 (72.6)	160 (72.6)	155 (70.3)	160 (72.6)	160 (72.6)	160 (72.6)	160 (72.6)	160 (72.6)	160 (72.6)	160 (72.6)	160 (72.6)	160 (72.6)	160 (72.6)	170 (77.1)
Cabinet dimensions L x W x H, in. (mm)	389.7 x 83.4 x 94.5 (9898 x 2118 x 2400)				389.7 x 83.4 x 94.5 (9898 x 2118 x 2400)				389.7 x 83.4 x 94.5 (9898 x 2118 x 2400)				389.7 x 83.4 x 94.5 (9898 x 2118 x 2400)			
Unit operating weight, lbs. (kg)	21250 (9637)				21250 (9637)				21320 (9669)				21320 (9669)			
Unit shipping weight, lbs. (kg)	20300 (9206)				20300 (9206)				20400 (9252)				20400 (9252)			
COMPRESSORS, SCREW, SEMI-HERMETIC																
Nominal tons, (kW0	65 (230)	65 (230)	80 (280)	80 (280)	65 (230)	80 (280)	80 (280)	80 (280)	80 (280)	80 (280)	80 (280)	80 (280)	80 (280)	80 (280)	80 (280)	95 (335)
CONDENSERS, HIGH EFFICIENCY FIN & TUBE TYPE WITH INTEGRAL SUBCOOLER																
Coil face area, sq. ft. (m^2)	96.3 (8.9)	96.3 (8.9)	96.3 (8.9)	96.3 (8.9)	96.3 (8.9)	96.3 (8.9)	96.3 (8.9)	96.3 (8.9)	96.3 (8.9)	96.3 (8.9)	96.3 (8.9)	96.3 (8.9)	96.3 (8.9)	96.3 (8.9)	96.3 (8.9)	96.3 (8.9)
Finned height x finned length, in. (mm)	80 x 173 (2032 x 4394)	80 x 173 (2032 x 4394)	80 x 173 (2032 x 4394)	80 x 173 (2032 x 4394)	80 x 173 (2032 x 4394)	80 x 173 (2032 x 4394)	80 x 173 (2032 x 4394)	80 x 173 (2032 x 4394)	80 x 173 (2032 x 4394)	80 x 173 (2032 x 4394)	80 x 173 (2032 x 4394)	80 x 173 (2032 x 4394)	80 x 173 (2032 x 4394)	80 x 173 (2032 x 4394)	80 x 173 (2032 x 4394)	80 x 173 (2032 x 4394)
Fins per inch x rows deep	12 x 4	12 x 4	12 x 4	12 x 4	12 x 4	12 x 4	12 x 4	12 x 4	12 x 4	12 x 4	12 x 4	12 x 4	12 x 4	12 x 4	12 x 4	12 x 4
CONDENSER FANS, DIRECT DRIVE PROPELLER TYPE																
No. of fans - fan diameter, in. (mm)	20 - 28 (711)				20 - 28 (711)				20 - 28 (711)				20 - 28 (711)			

No. of motors - hp (kW)	20 - 2.0 (1.5)	20 - 2.0 (1.5)	20 - 2.0 (1.5)	20 - 2.0 (1.5)
Fan & motor rpm, 60/50Hz	1140/950	1140/950	1140/950	1140/950
60 Hz fan tip speed, fpm 50 Hz fan tip speed, (m/sec)	8357 (35.4)	8357 (35.4)	8357 (35.4)	8357 (35.4)
60 Hz total unit airflow, cfm 50 Hz total unit airflow, (m2/sec	198440 (93.6)	198440 (93.6)	198440 (93.6)	198440 (93.6)
EVAPORATOR, DIRECT EXPANSION, BAFFLED SHELL & THRU TUBE				
Shell diameter - tube length in (mm) - ft. (mm)	24 - 10 (609 - 3048)	24 - 10 (609 - 3048)	24 - 10 (609 - 3048)	24 - 10 (609 - 3048)
Water volume, gallons (L)	112 (424)	112 (424)	107 (405.0)	107 (405.0)
Max. water pressure, psi (kPa)	175 (1207)	175 (1207)	175 (1207)	175 (1207)

Table 27, ALS 360-425

DATA	360A				370A				380A				425A			
	CKT.1	CKT.2	CKT.3	CKT.4	CKT.1	CKT.2	CKT.3	CKT.4	CKT.1	CKT.2	CKT.3	CKT.4	CKT.1	CKT.2	CKT.3	CKT.4
BASIC DATA																
Unit capacity @ ARI conditions, tons (kW)	80.9 (284)	80.9 (284)	93.4 (328)	93.4 (328)	80.9 (284)	91.8 (323)	93.4 (328)	93.4 (328)	92.3 (325)	92.3 (325)	93.4 (328)	93.4 (328)	100.3 (353)	100.3 (353)	100.3 (353)	100.3 (353)
Unit operating charge R-22, lbs (kg)	175 (79.4)	175 (79.4)	180 (81.6)	180 (81.6)	175 (79.4)	180 (81.6)	180 (81.6)	180 (81.6)	180 (81.6)	180 (81.6)	180 (81.6)	180 (81.6)	190 (86.2)	190 (86.2)	190 (86.2)	190 (86.2)
Cabinet dimensions L x W x H, in. (mm)	459 x 83.4 x 94.5 (11659 x 2118 x 2400)				459 x 83.4 x 94.5 (11659 x 2118 x 2400)				459 x 83.4 x 94.5 (11659 x 2118 x 2400)				459 x 83.4 x 94.5 (11659 x 2118 x 2400)			
Unit operating weight, lbs. (kg)	22920 (10395)				22970 (10417)				23020 (10440)				23813 (10800)			
Unit shipping weight, lbs. (kg)	22000 (9977)				22050 (10000)				22100 (10023)				22715 (10302)			
COMPRESSORS, SCREW, SEMI-HERMETIC																
Nominal tons, (kW0	80 (280)	80 (280)	95 (335)	95 (335)	80 (280)	95 (335)	95 (335)	95 (335)	95 (335)	95 (335)	95 (335)	95 (335)	95 (335)	95 (335)	95 (335)	95 (335)
CONDENSERS, HIGH EFFICIENCY FIN & TUBE TYPE WITH INTEGRAL SUBCOOLER																
Coil face area, sq. ft. (m^2)	115.6 (10.7)	115.6 (10.7)	115.6 (10.7)	115.6 (10.7)	115.6 (10.7)	115.6 (10.7)	115.6 (10.7)	115.6 (10.7)	115.6 (10.7)	115.6 (10.7)	115.6 (10.7)	115.6 (10.7)	115.6 (10.7)	115.6 (10.7)	115.6 (10.7)	115.6 (10.7)
Finned height x finned length, in. (mm)	80 x 208 (2032 x 5283)	80 x 208 (2032 x 5283)	80 x 208 (2032 x 5283)	80 x 208 (2032 x 5283)	80 x 208 (2032 x 5283)	80 x 208 (2032 x 5283)	80 x 208 (2032 x 5283)	80 x 208 (2032 x 5283)	80 x 208 (2032 x 5283)	80 x 208 (2032 x 5283)	80 x 208 (2032 x 5283)	80 x 208 (2032 x 5283)	80 x 208 (2032 x 5283)	80 x 208 (2032 x 5283)	80 x 208 (2032 x 5283)	80 x 208 (2032 x 5283)
Fins per inch x rows deep	12 x 4	12 x 4	12 x 4	12 x 4	12 x 4	12 x 4	12 x 4	12 x 4	12 x 4	12 x 4	12 x 4	12 x 4	12 x 4	12 x 4	12 x 4	12 x 4
CONDENSER FANS, DIRECT DRIVE PROPELLER TYPE																
No. of fans - fan dia., in. (mm)	24 - 28 (711)				24 - 28 (711)				24 - 28 (711)				24 - 28 (711)			
No. of motors - hp (kW)	24 - 2.0 (1.5)				24 - 2.0 (1.5)				24 - 2.0 (1.5)				24 - 2.5 (1.9)			
Fan & motor rpm, 60/50Hz	1140/950				1140/950				1140/950				1140/950			
60 Hz fan tip speed, fpm 50 Hz fan tip speed, (m/sec)	8357 (35.4)				8357 (35.4)				8357 (35.4)				8357 (35.4)			
60 Hz total unit airflow, cfm 50 Hz total unit airflow, (m2/sec	238128 (112.4)				238128 (112.4)				238128 (112.4)				257180 (121.4)			
EVAPORATOR, DIRECT EXPANSION, BAFFLED SHELL & THRU TUBE																
Shell diameter - tube length in (mm) - ft. (mm)	24 - 10 ((609 - 3048)				24 - 10 ((609 - 3048)				24 - 10 ((609 - 3048)				24 - 12 (609 - 3658)			
Water volume, gallons (L)	107 (405.0)				107 (405.0)				107 (405.0)				129 (488)			
Max. water pressure, psi (kPa)	175 (1207)				175 (1207)				175 (1207)				175 (1207)			
Max. refrigerant pressure, psi (kPa)	225 (1552)				225 (1552)				225 (1552)				225 (1552)			

Major Components

Table 28, ALS 070-425

UNIT SIZE	COMPRESSOR IDENTIFICATION				EVAPORATOR VESSEL SIZE	ELECTRONIC EXPANSION VALVE SIZE				CONTACTOR DESIGNATION FOR COMPRESSOR			
070	155				1208-1	100				M1-M5			
080	167				1408-1	140				M1-M5			
090	175				1410-1	170				M1-M5			
100	175				1610-1	170				M1-M5			
125A	155	155	-	-	1410-1	100	100	-	-	M1-M5	M2-M6	-	-
140A	155	167	-	-	1610-1	140	140	-	-	M1-M5	M2-M6		
155A	167	167	-	-	1610-1	140	140	-	-	M1-M5	M2-M6		
170A	167	175	-	-	1610-1	170	170	-	-	M1-M5	M2-M6		
175A	167	175	-	-	1610-1	170	170	-	-	M1-M5	M2-M6		
185A	175	175	-	-	1610-1	170	170	-	-	M1-M5	M2-M6		
195A	175	175	-	-	1810-1	170	170	-	-	M1-M5	M2-M6		

204A	175	175	-	-	2010-1	170	170	-	-	M1-M5	M2-M6		
205A	155	155	167	-	2010-3	140	140	140	-	M1-M5	M2-M6	M3-M7	
220A	155	167	167	-	2010-2	140	140	140	-	M1-M5	M2-M6	M3-M7	
235A	167	167	167	-	2010-2	140	140	140	-	M1-M5	M2-M6	M3-M7	
250A	167	167	167	-	2010-1	140	140	140	-	M1-M5	M2-M6	M3-M7	
265A	167	175	175	-	2010-1	170	170	170	-	M1-M5	M2-M6	M3-M7	
280A	175	175	175	-	2010-1	170	170	170	-	M1-M5	M2-M6	M3-M7	
300A	155	155	167	167	2410-2	140	140	140	140	M1-M5	M2-M6	M3-M7	M4-M8
315A	155	167	167	167	2410-2	140	140	140	140	M1-M5	M2-M6	M3-M7	M4-M8
330A	167	167	167	167	2410-1	140	140	140	140	M1-M5	M2-M6	M3-M7	M4-M8
340A	167	167	167	175	2410-1	140	140	170	170	M1-M5	M2-M6	M3-M7	M4-M8
360A	167	167	175	175	2410-1	140	140	170	170	M1-M5	M2-M6	M3-M7	M4-M8
370A	167	175	175	175	2410-1	170	170	170	170	M1-M5	M2-M6	M3-M7	M4-M8
380A	175	175	175	175	2410-1	170	170	170	170	M1-M5	M2-M6	M3-M7	M4-M8
425A	175	175	175	175	2412-1	170	170	170	170	M1-M5	M2-M6	M3-M7	M4-M8

Compressor Staging

ALS 125-204 (Does not apply to ALS 070-100)

Table 29, Two Compressors Available

STAGE UP	LEAD COMPRESSOR	LAG 1 COMPRESSOR	UNIT CAPACITY
1	-	-	0%
2	50%	0%	25.0%
3	75%	0%	37.5%
4	50%	50%	50.0%
5	75%	50%	62.5%
6	75%	75%	75.0%
7	100%	75%	87.5%
8	100%	100%	100.0%

STAGE DOWN	LEAD COMPRESSOR	LAG 1 COMPRESSOR	UNIT CAPACITY
1	25%	0%	12.5%
2	50%	0%	25.0%
3	75%	0%	37.5%
4	50%	50%	50.0%
5	75%	50%	62.5%
6	75%	75%	75.0%
7	100%	75%	87.5%
8	100%	100%	100.0%

Table 30, One Compressor Available

STAGE UP	LEAD COMPRESSOR	LAG 1 COMPRESSOR	UNIT CAPACITY
1	-	-	0%
2	50%	0%	25.0%
3	75%	0%	37.5%
4	50%	0%	50.0%

STAGE Down	LEAD COMPRESSOR	LAG 1 COMPRESSOR	UNIT CAPACITY
1	25%	0%	12.5%
2	50%	0%	25.0%
3	75%	0%	37.5%
4	100%	0%	50.0%

ALS 205-280

Table 31, Three Compressors Available

STAGE UP	LEAD COMP.	LAG 1 COMP.	LAG 2 COMP.	UNIT CAPACITY
1	-	-	-	0%
2	50%	0%	0%	16.7%
3	75%	0%	0%	25.0%
4	50%	50%	0%	33.3%
5	75%	50%	0%	41.7%
6	75%	75%	0%	50.0%
7	75%	50%	50%	58.3%
8	75%	75%	50%	66.7%
9	75%	75%	75%	75.0%
10	100%	75%	75%	83.3%
11	100%	100%	75%	91.6%
12	100%	100%	100%	100.0%

STAGE DOWN	LEAD COMP.	LAG 1 COMP.	LAG 2 COMP.	UNIT CAPACITY
1	25%	0%	0%	8.3%
2	50%	0%	0%	16.7%
3	75%	0%	0%	25.0%
4	50%	50%	0%	33.3%
5	75%	50%	0%	41.7%
6	50%	50%	50%	50.0%
7	75%	50%	50%	58.3%
8	75%	75%	50%	66.7%
9	75%	75%	75%	75.0%
10	100%	75%	75%	83.3%
11	100%	100%	75%	91.6%
12	100%	100%	100%	100.0%

Table 32, Two compressors available

STAGE UP	LEAD COMP.	LAG 1 COMP.	LAG 2 COMP.	UNIT CAPACITY
1	-	-	-	0%
2	50%	0%	0%	16.7%
3	75%	0%	0%	25.0%
4	50%	50%	0%	33.3%
5	75%	50%	0%	41.7%
6	75%	75%	0%	50.0%
7	100%	75%	0%	58.3%
8	100%	100%	0%	66.7%

STAGE DOWN	LEAD COMP.	LAG 1 COMP.	LAG 2 COMP.	UNIT CAPACITY
1	25%	0%	0%	8.3%
2	50%	0%	0%	16.7%
3	75%	0%	0%	25.0%
4	50%	50%	0%	33.3%
5	75%	50%	0%	41.7%
6	75%	75%	0%	50.0%
7	100%	75%	0%	58.3%
8	100%	100%	0%	66.7%

Table 33, One Compressor Available

STAGE UP	LEAD COMP.	LAG 1 COMP.	LAG 2 COMP.	UNIT CAPACITY
1	-	-	-	0%
2	50%	0%	0%	16.7%
3	75%	0%	0%	25.0%
4	100%	0%	0%	33.3%

STAGE DOWN	LEAD COMP.	LAG 1 COMP.	LAG 2 COMP.	UNIT CAPACITY
1	25%	0%	0%	8.3%
2	50%	0%	0%	16.7%
3	75%	0%	0%	25.0%
4	100%	0%	0%	33.3%

ALS 300-425

Table 34, Four Compressors Available

STAGE UP	LEAD COMP.	LAG 1 COMP.	LAG 2 COMP.	LAG 3 COMP.	UNIT CAPACITY	STAGE DOWN	LEAD COMP.	LAG 1 COMP.	LAG 2 COMP.	LAG 3 COMP.	UNIT CAPACITY
1	-	-	-	-	0.0%	1	25%	0%	0%	0%	6.3%
2	50%	0%	0%	0%	12.5%	2	50%	0%	0%	0%	12.5%
3	75%	0%	0%	0%	18.8%	3	75%	0%	0%	0%	18.8%
4	50%	50%	0%	0%	25.0%	4	50%	50%	0%	0%	25.0%
5	75%	50%	0%	0%	31.3%	5	75%	50%	0%	0%	31.3%
6	75%	75%	0%	0%	37.5%	6	50%	50%	50%	0%	37.5%
7	75%	50%	50%	0%	43.8%	7	75%	50%	50%	0%	43.8%
8	75%	75%	50%	0%	50.0%	8	50%	50%	50%	50%	50.0%
9	75%	75%	75%	0%	56.3%	9	75%	50%	50%	50%	56.3%
10	75%	75%	50%	50%	62.5%	10	75%	75%	50%	50%	62.5%
11	75%	75%	75%	50%	68.8%	11	75%	75%	75%	50%	68.8%
12	75%	75%	75%	75%	75.0%	12	75%	75%	75%	75%	75.0%
13	100%	75%	75%	75%	81.3%	13	100%	75%	75%	75%	81.3%
14	100%	100%	75%	75%	87.5%	14	100%	100%	75%	75%	87.5%
15	100%	100%	100%	75%	93.8%	15	100%	100%	100%	75%	93.8%
16	100%	100%	100%	100%	100.0%	16	100%	100%	100%	100%	100.0%

Table 35, Three Compressors Available

STAGE	LEAD COMP.	LAG 1 COMP.	LAG 2 COMP.	LAG 3 COMP.	UNIT CAPACITY	LEAD COMP.	LAG 1 COMP.	LAG 2 COMP.	LAG 3 COMP.	UNIT CAPACITY
1	-	-	-	-	0.0%	25%	0%	0%	0%	6.3%
2	50%	0%	0%	0%	12.5%	50%	0%	0%	0%	12.5%
3	75%	0%	0%	0%	18.8%	75%	0%	0%	0%	18.8%
4	50%	50%	0%	0%	25.0%	50%	50%	0%	0%	25.0%
5	75%	50%	0%	0%	31.3%	75%	50%	0%	0%	31.3%
6	75%	75%	0%	0%	37.5%	50%	50%	50%	0%	37.5%
7	75%	50%	50%	0%	43.8%	75%	50%	50%	0%	43.8%
8	75%	75%	50%	0%	50.0%	75%	75%	50%	0%	50.0%
9	75%	75%	75%	0%	56.3%	75%	75%	75%	0%	56.3%
10	100%	75%	75%	0%	62.5%	100%	75%	75%	0%	62.5%
11	100%	100%	75%	0%	68.8%	100%	100%	75%	0%	68.8%
12	100%	100%	100%	0%	75.0%	100%	100%	100%	0%	75.0%

Table 36, Two Compressors Available

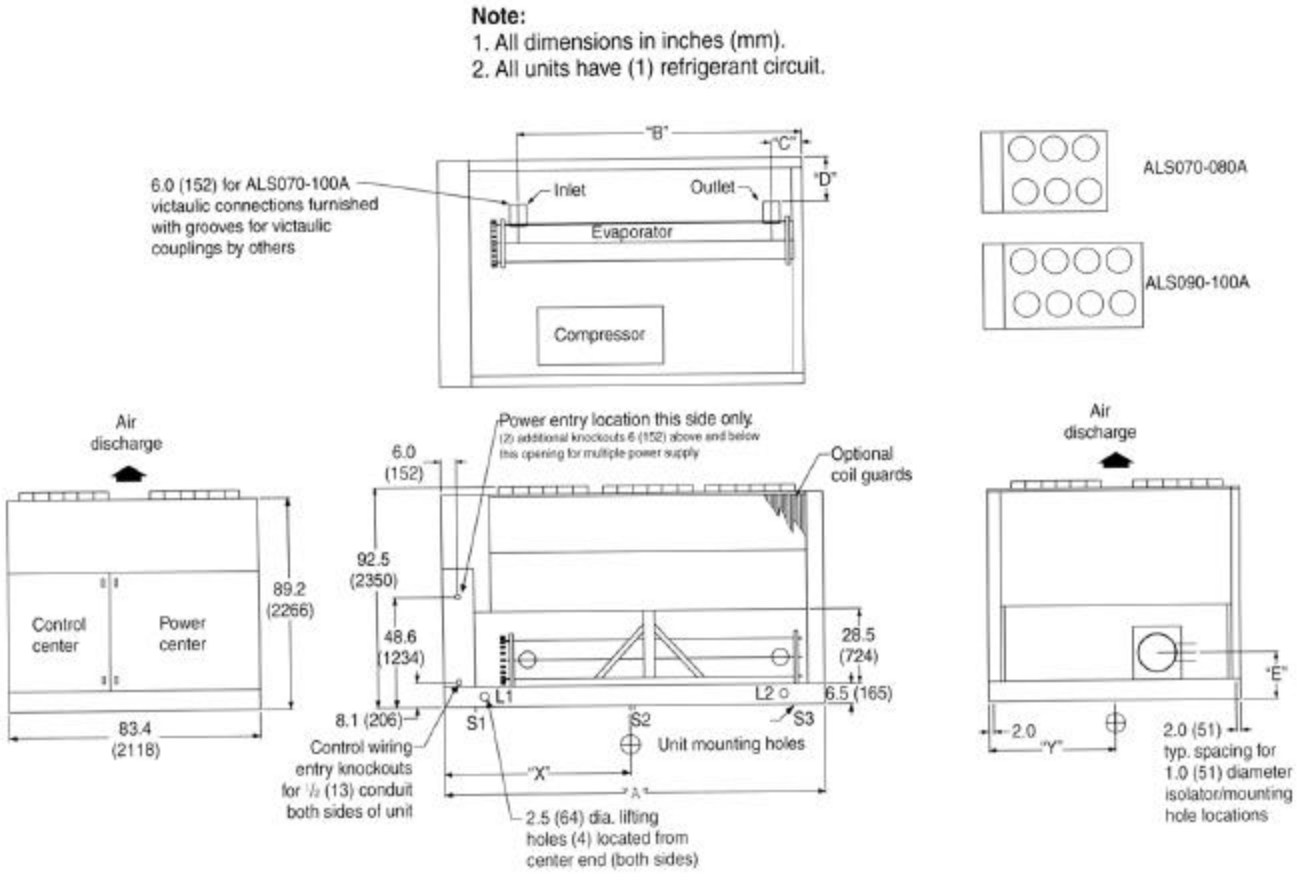
STAGE	LEAD COMP.	LAG 1 COMP.	LAG 2 COMP.	LAG 3 COMP.	UNIT CAPACITY	LEAD COMP.	LAG 1 COMP.	LAG 2 COMP.	LAG 3 COMP.	UNIT CAPACITY
1	-	-	-	-	0.0%	25%	0%	0%	0%	6.3%
2	50%	0%	0%	0%	12.5%	50%	0%	0%	0%	12.5%
3	75%	0%	0%	0%	18.8%	75%	0%	0%	0%	18.8%
4	50%	50%	0%	0%	25.0%	50%	50%	0%	0%	25.0%
5	75%	50%	0%	0%	31.3%	75%	50%	0%	0%	31.3%
6	75%	75%	0%	0%	37.5%	75%	75%	0%	0%	37.5%
7	100%	75%	0%	0%	43.8%	100%	75%	0%	0%	43.8%
8	100%	100%	0%	0%	50.0%	100%	100%	0%	0%	50.0%

Table 37, One Compressors Available

STAGE	LEAD COMP.	LAG 1 COMP.	LAG 2 COMP.	LAG 3 COMP.	UNIT CAPACITY	LEAD COMP.	LAG 1 COMP.	LAG 2 COMP.	LAG 3 COMP.	UNIT CAPACITY
1	-	-	-	-	0.0%	25%	0%	0%	0%	6.3%
2	50%	0%	0%	0%	12.5%	50%	0%	0%	0%	12.5%
3	75%	0%	0%	0%	18.8%	75%	0%	0%	0%	18.8%
4	100%	0%	0%	0%	25.0%	100%	0%	0%	0%	25.0%

Dimensional Data

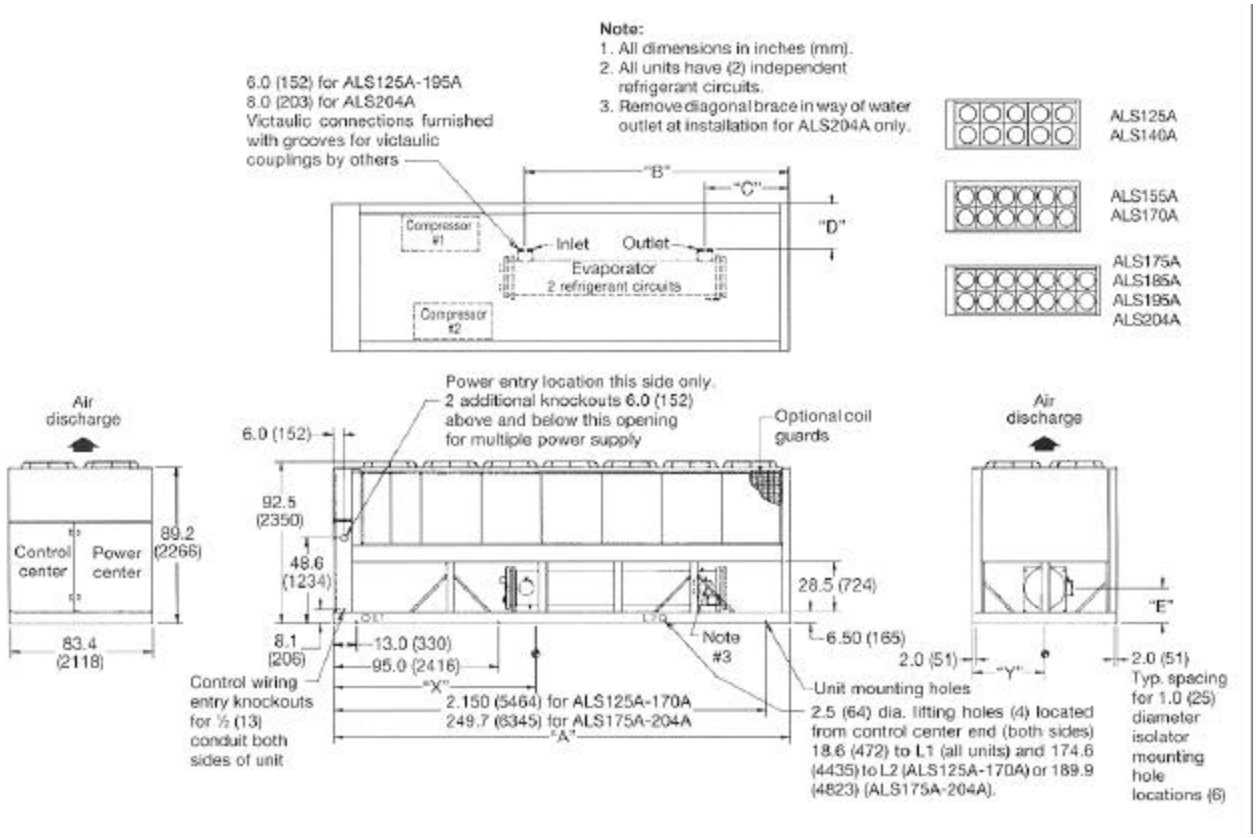
Figure 23, ALS 070A-100A



ALS UNIt SIZE	LENGTH A	EVAPORATOR				CENTER OF GRAVITY		UNIT WEIGHTS lb (kg)		
		B	C	D	E	X	Y	OPERATING	SHIPPING	COPPER FIN ADD
070A	124.7 (3167)	93.7 (2380)	9.9 (252)	15.0 (381)	15.9 (404)	52.9 (1344)	39.0 (991)	5725 (2597)	5500 (2495)	850 (387)
080A	124.7 (3167	93.7 (2380)	9.9 (252)	15.0 (381)	19.5 (495)	52.9 (1344)	39.0 (991)	6175 (2801)	5900 (2676)	850 (387)
090A	159.4 (4049)	128.4 (3261)	20.6 (524)	15.0 (381)	19.5 (495)	64.9 (1649)	39.0 (991)	6825 (3096)	6500 (2948)	1150 (523)
100A	159.4 (4049)	128.4 (3261)	20.6 (524)	15.0 (381)	19.5 (495)	64.9 (1649)	39.0 (991)	7300 (3311)	6900 (3130)	1150 (523)

ALS UNIT	COMPRESSOR		FANS		REFRIGERANT CHARGE lb (kg)	LIFTING HOLES		ISOLATOR MOUNTING		
SIZE	Qty.	Nom. Tons	Qty.	H.P.	System #1	L1	L2	S1	S2	S3
070A	1	65	6	1.5	150 (68)	18.6 (473)	107.9 (2740)	13.0 (330)	N/A	110.4 (2805)
080A	1	80	6	1.5	160 (73)	18.6 (473)	107.9 (2740)	13.0 (330)	N/A	110.4 (2805)
090A	1	95	8	1.5	180 (82)	18.6 (473)	131.9 (3350)	13.0 (330)	95.0 (2416)	146.9 (3731)
100A	1	95	8	1.5	190 (87)	18.6 (473)	131.9 (3350)	13.0 (330)	95.0 (2416)	146.9 (3731)

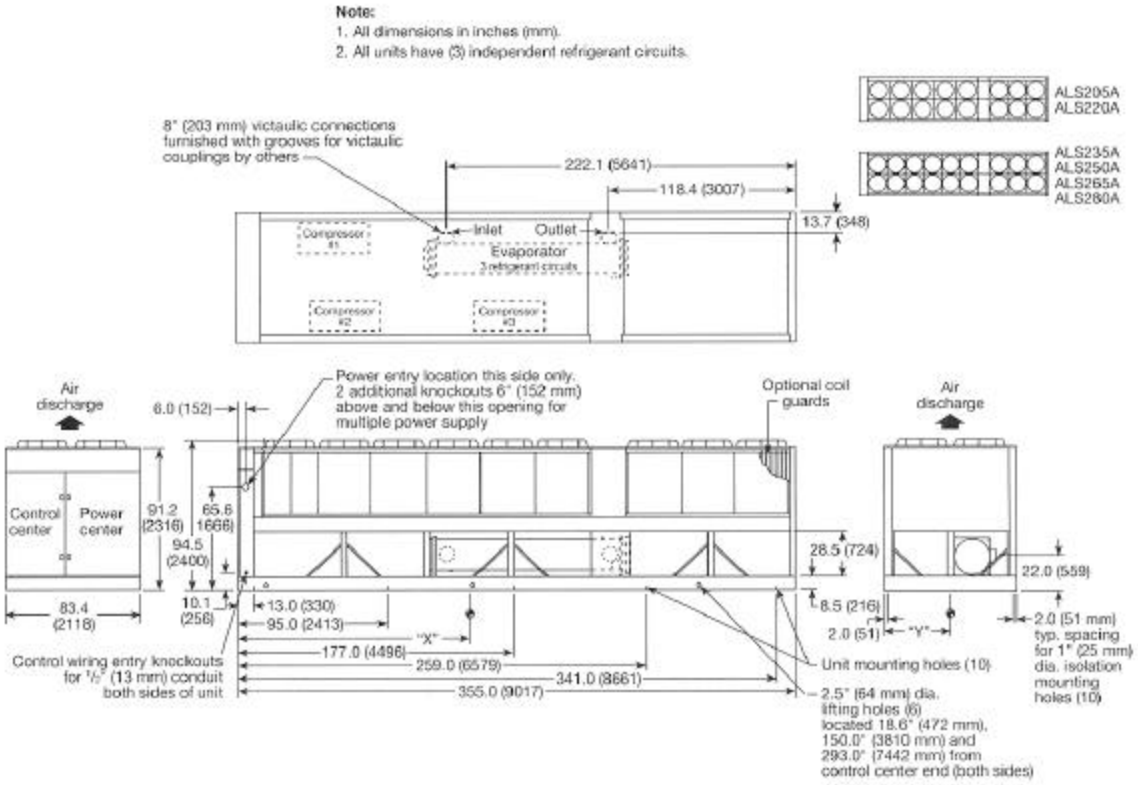
Figure 24, ALS 125A-204A



ALS UNIT SIZE	LENGTH A	EVAPORATOR				CENTER OF GRAVITY		UNIT WEIGHTS lb (kg)		
								STANDARD UNIT		ADD'L WT.
		B	C	D	E	X	Y	OPERATING	SHIPPING	FOR COPPER FINS
125A	228.7 (5809)	117.6 (2987)	13.8 (351)	28.7 (729)	19.4 (493)	104.3 (2649)	41.7 (1059)	9920 (4500)	9600 (4355)	1652 (750)
140A	228.7 (5809)	118.5 (3010)	12.9 (328)	28.7 (729)	19.4 (493)	104.3 (2649)	41.7 (1059)	10350 (4700)	9900 (4355)	1652 (750)
155A	228.7 (5809)	118.5 (3010)	12.9 (328)	28.7 (729)	19.4 (493)	105.2 (2672)	41.7 (1059)	10670 (4840)	10250 (4650)	1652 (750)
170A	228.7 (5809)	118.5 (3010)	12.9 (328)	28.7 (729)	19.4 (493)	105.2 (2672)	41.7 (1059)	10750 (4880)	10350 (4700)	1652 (750)
175A	263.4 (6690)	153.2 (3891)	47.6 (1209)	28.7 (729)	19.4 (493)	113.1 (2873)	41.7 (1059)	11250 (5100)	10850 (4920)	1930 (876)
185A	263.4 (6690)	153.2 (3891)	47.6 (1209)	28.7 (729)	19.4 (493)	113.1 (2873)	41.7 (1059)	11250 (5100)	10850 (4920)	1930 (876)
195A	263.4 (6690)	153.2 (3891)	47.6 (1209)	27.3 (693)	20.4 (518)	115.2 (2926)	41.7 (1059)	11500 (5218)	11100 (5036)	1930 (876)
204A	263.4 (6690)	152.2 (3866)	48.5 (1232)	25.7 (653)	20.2 (513)	116.5 (2959)	41.7 (1059)	12570 (5701)	11980 (5433)	2025 (918)

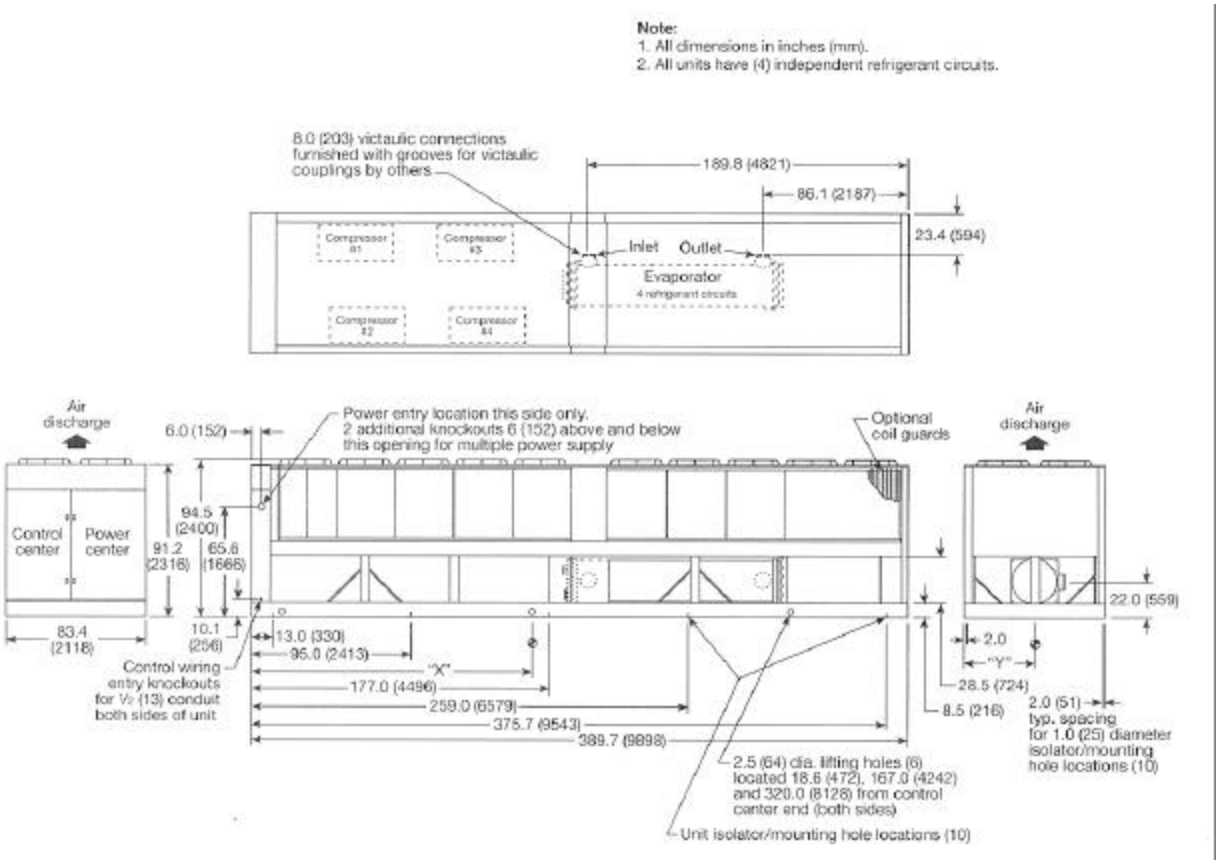
ALS UNIT SIZE	COMPRESSOR		FANS		OPERATING REFRIGERANT CHARGE (R-22) lb (kg))	
	QTY.	NOM. TONS	QTY.	H.P.	SYSTEM #1	SYSTEM #2
125A	2	65/65	10	1.5	140 (63.5)	140 (63.5)
140A	2	65/80	10	1.5	140 (63.5)	150 (68.1)
155A	2	80/80	12	1.5	150 (68.1)	150 (68.1)
170A	2	80/95	12	1.5	150 (68.1)	160 (72.6)
175A	2	80/95	14	1.5	160 (72.6)	160 (72.6)
185A	2	95/95	14	1.5	160 (72.6)	160 (72.6)
195A	2	95/95	14	1.5	170 (77.1)	170 (77.1)
204A	2	95/95	14	2.0	195 (88.5)	195 (88.5)

Figure 25, ALS 205A-280A



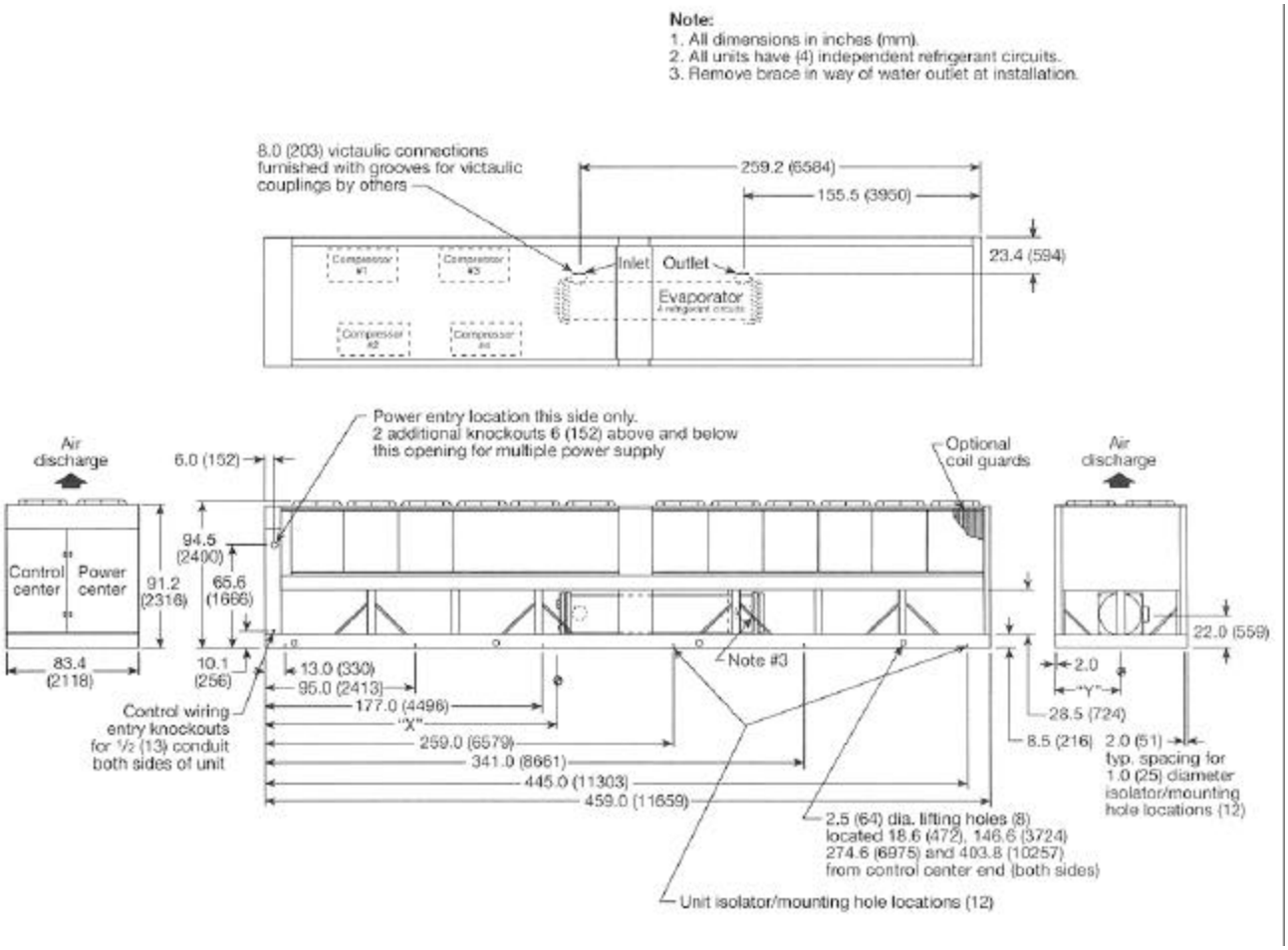
ALS UNIT	CENTER OF GRAVITY				UNIT WEIGHTS lb (kg)				ADD'L WEIGHT FOR COPPER FIN COILS		COMPRESORS		FANS		OPERATING REFREGERANT CHARGE (R-22) lb (kg)					
SIZE	X		Y		OPERATING		SHIPPING								SYSTEM #1		SYSTEM #2		SYSTEM #3	
205A	146.7	3,726	41.7	1,059	15,930	7,224	15,250	6,916	2,478	1,124	3	65/65/80	16	1.5	140	63.5	140	63.5	150	68.1
220A	146.7	3,726	41.7	1,059	15,980	7,247	15,330	6,952	2,478	1,124	3	65/80/80	16	1.5	140	63.5	150	68.1	150	68.1
235A	146.7	3,726	41.7	1,059	16,180	7,338	15,630	7,043	2,478	1,124	3	80/80/80	18	1.5	150	68.1	150	68.1	150	68.1
250A	146.7	3,726	41.7	1,059	16,200	7,347	15,530	7,075	2,478	1,124	3	80/80/95	18	1.5	150	68.1	150	68.1	160	72.6
265A	146.7	3,726	41.7	1,059	16,200	7,347	15,600	7,075	2,478	1,124	3	80/95/95	18	1.5	150	68.1	160	72.6	160	72.6
280A	146.7	3,726	41.7	1,059	16,250	7,370	15,650	7,098	2,478	1,124	3	95/95/95	18	1.5	160	72.6	160	72.6	160	72.6

Figure 26, ALS 300-340



ALS UNIT SIZE	CENTER OF GRAVITY				UNIT WEIGHTS lb (kg)				ADD'L WEIGHT FOR COPPER FIN COILS		COMPRESSORS		FANS		REFRIGERANT CHARGE (R-22) lb (kg)							
	X		Y		OPERATING		SHIPPING				QTY	NOM.TONS	QTY	HP	SYST. #1		SYST. #2		SYST. #3		SYST. #4	
300A	166.9	4239	41.7	1059	21,250	9637	20,300	9206	3,671	1665	4	65/65/80/80	20	2.0	155	70.3	155	70.3	160	72.6	160	72.6
315A	166.9	4239	41.7	1059	21,250	9637	20,300	9206	3,671	1665	4	65/80/80/80	20	2.0	155	70.3	160	72.6	160	72.6	160	72.6
330A	166.9	4239	41.7	1059	21,320	9669	20,400	9252	3,671	1665	4	80/80/80/80	20	2.0	160	72.6	160	72.6	160	72.6	160	72.6
340A	166.9	4239	41.7	1059	21,230	9669	20,400	9252	3,671	1665	4	80/80/80/95	20	2.0	160	72.6	160	72.6	160	72.6	170	77.1

Figure 27, ALS 360-425



ALS UNIT SIZE	CENTER OF GRAVITY				UNIT WEIGHTS lb (kg)				ADD'L WEIGHT FOR COPPER FIN COILS		COMPRESSORS		FANS		REFRIGERANT CHARGE (R-22) lb (kg)							
	X		Y		OPERATING		SHIPPING					NOM.			SYST. #1		SYST. #2		SYST. #3		SYST. #4	
360A	185.0	4699	41.7	1059	22,920	10395	22,000	9977	4,406	1998	4	80/80/95/95	24	2.0	175	79.4	175	79.4	180	81.6	180	81.6
370A	185.0	4699	41.7	1059	22,970	10417	22,050	10000	4,406	1998	4	80/95/95/95	24	2.0	175	79.4	180	81.6	180	81.6	180	81.6
380A	185.0	4699	41.7	1059	23,020	10440	22,100	10023	4,406	1998	4	95/95/95/95	24	2.0	180	81.6	180	81.6	180	81.6	180	81.6
425A	192.4	4887	41.1	1044	23813	10800	22715	10302	4406	1998	4	95/95/95/95	24	2.5	190	86.2	190	86.2	190	86.2	190	86.2

Electrical Data

Field Wiring

General

Wiring must comply with all applicable codes and ordinances. Warranty is voided if wiring is not in accordance with specifications. An open fuse indicates a short, ground, or overload. Before replacing a fuse or restarting a compressor or fan motor, the trouble must be found and corrected.

Copper wire is required for all power lead terminations at the unit and copper must be used for all other wiring to the unit.

ALS units may be ordered with main 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 disconnect is required. An optional factory mounted transformer for the 115 volt control circuit may be provided.

If multiple point power wiring is ordered, two power connections (125 through 204 and 300 through 425) or three power connections (205 through 280) are required and wiring within the unit is sized in accordance with the National Electrical Code. A separate circuit is required for the 115 volt control circuit. Separate field supplied disconnects are required for each electrical circuit.

It may be desirable to have the unit evaporator heater on a separate disconnect switch from the main unit power supply so that the unit may be shut down without defeating the freeze protection provided by the cooler heater.

CAUTION

ALS unit compressors are single direction rotation compressors. For this reason proper phasing of electrical power is important. Electrical phasing must be A, B, C for electrical phases 1, 2 and 3 (A=L1, B=L2, C=L3). Units supplied with single point, factory power connections will include one MotorSaver phase failure/phase reversal protective device that will prevent operation of the unit with incorrect power phasing. The MotorSaver is factory wired and tested. **Do not alter the wiring to the MotorSaver.**

Multiple point power wired units will include two (125 through 204) and (300 through 425) or three (205 through 280) MotorSaver safety controls (one for each power supply), and the contractor is cautioned to not apply power until the phasing is verified with a phase sequence meter.

WARNING

Internal power wiring to the compressors for the single point versus the multiple point option are different. It is imperative that the proper field wiring be installed according to the way the unit is built.

Overload Dial Setting

For units with 1 contactor and 1 overload per compressor: The Overload must be set at a "Must Hold Dial Setting" equal to 125% of the compressor RLA listed on the unit data plate.

For units with 2 contactors and 2 overloads per compressor: The Overload must be set at a "Must Hold Dial Setting" equal to 125% of half the compressor RLA listed on the unit data plate.

Note: The "Must Trip Amps" is 12% higher than the "Must Hold Dial Setting". The accuracy of the Overload Setting is ±2%.

Wire Sizing Ampacities

Table 38, Single Point Connection, ALS 070-100

ALS UNIT SIZE	VOLTS	HZ	MINIMUM CIRCUIT AMPACITY (MCA)	POWER SUPPLY				FIELD FUSE SIZE	
				FIELD WIRE		HUB		RECOM-MENDED	MAXIMUM
				QTY.	WIRE GUAGE	QTY.	NOMINAL SIZE		
070A	208	60	335	3	400	1	3.0	500	500
	230		307	3	350	1	2.5	400	500
	380		185	3	3/0	1	2.0	250	300
	460		153	3	2/0	1	1.5	200	250
	575		124	3	#1	1	1.5	175	200
080A	208	60	410	3	600	1	3.0	500	700
	230		375	3	500	1	3.0	500	600
	380		227	3	4/0	1	2.0	300	350
	460		187	3	3/0	1	1.5	250	300
	575		150	3	1/0	1	1.5	200	250
090A	208	60	475	3	350	2	2.5	600	800
	230		434	3	300	2	2.5	600	700
	380		262	3	300	1	2.5	350	450
	460		216	3	4/0	1	2.0	300	350
	575		173	3	2/0	1	1.5	225	250
100A	208	60	475	3	350	2	2.5	600	800
	230		434	3	300	2	2.5	600	700
	380		262	3	300	1	2.5	350	450
	460		216	3	4/0	1	2.0	300	350
	575		173	3	2/0	1	1.5	225	250

(*) Table based on 75°C field wire per NEC

Table 39, Single Point Connection, ALS 125-204

ALS UNIT SIZE	VOLTS	HZ	MINIMUM CIRCUIT AMPACITY (MCA)	POWER SUPPLY				FIELD FUSE SIZE	
				FIELD WIRE		HUB		RECOM-MENDED	MAXIMUM
				QTY.	WIRE GUAGE	QTY.	NOMINAL SIZE		
125A	208	60	598	6	350	2	2.5	700	800
	230		548	6	300	2	2.5	600	700
	380		331	3	400	1	3.0	400	450
	460		273	3	300	1	2.5	300	350
	575		221	3	4/0	1	2.0	250	300
140A	208	60	673	6	500	2	3.0	800	800
	230		616	6	350	2	2.5	700	800
	380		372	3	500	1	3.0	450	500
	460		307	3	350	1	2.5	400	400
	575		247	3	250	1	2.5	300	350
155A	208	60	745	6	500	2	3.0	800	1000
	230		682	6	500	2	3.0	800	800
	380		412	6	#4/0	2	2.0	500	500
	460		340	3	500	1	3.0	400	450
	575		273	3	300	1	2.5	300	350
170A	208	60	799	6	600	2	3.0	1000	1000
	230		730	6	500	2	3.0	800	1000
	380		441	6	#4/0	2	2.0	500	600
	460		364	3	500	1	3.0	450	500
	575		292	3	350	1	2.5	350	400
175A	208	60	810	6	600	2	3.0	1000	1000
	230		741	6	500	2	3.0	1000	1000
	380		448	6	250	2	2.5	500	600
	460		369	3	500	1	3.0	450	500
	575		296	3	350	1	2.5	350	400
185A	208*	60	853*	6	600*	2	3.0	1000	1000
	230		779	6	600	2	3.0	1000	1000
	380		471	6	250	2	2.5	500	600
	460		388	6	#3/0	2	2.0	450	500
	575		311	3	400	1	2.5	350	400
195A	208*	60	853*	6	600*	2	3.0	1000	1000
	230		779	6	600	2	3.0	1000	1000
	380		471	6	250	2	2.5	500	600
	460		388	6	#3/0	2	2.0	450	500
	575		311	3	400	1	2.5	350	400
204A	208*	60	881*	6	600*	2	3.0	1000	1200
	230		799	6	600	2	3.0	1000	1000
	380		481	6	250	2	2.5	500	600
	460		399	6	#3/0	2	2.0	500	500
	575		321	3	400	1	2.5	400	400

(*) Field wire size values apply to 90°C rated wire per NEC

Table 40, Single Point Connection, ALS 205-425

ALS UNIT SIZE	VOLTS	HZ	MINIMUM CIRCUIT AMPACITY (MCA)	POWER SUPPLY				FIELD FUSE SIZE	
				FIELD WIRE		HUB		RECOM-MENDED	MAXIMUM
				QTY.	WIRE GUAGE	QTY.	NOMINAL SIZE		
205A	380	60	525	6	300	2	2.0	600	600
	460		433	6	#4/0	2	2.0	500	500
	575		349	2	#3/0	2	1.5	400	450
220A	380	60	558	6	300	2	2.0	700	700
	460		460	6	#4/0	2	2.0	500	500
	575		370	6	#3/0	2	1.5	450	450
235A	380	60	597	6	350	2	2.5	700	700
	460		492	6	250	2	2.0	600	600
	575		395	6	#3/0	2	1.5	450	500
250A	380	60	626	6	400	2	2.5	700	800
	460		516	6	300	2	2.0	600	600
	575		414	6	#4/0	2	2.0	500	500
265A	380	60	649	6	400	2	2.5	800	800
	460		535	6	300	2	2.0	600	600
	575		429	6	#4/0	2	2.0	500	500
280A	380	60	672	6	500	2	3.0	800	800
	460		554	6	300	2	2.0	600	700
	575		444	6	#4/0	2	2.0	500	500
300A	380	60	723	6	500	2	3.0	800	800
	460		596	6	350	2	2.5	700	700
	575		481	6	250	2	2.0	500	500
315A	380	60	756	6	500	2	3.0	800	800
	460		623	6	400	2	2.5	700	700
	575		502	6	250	2	2.0	600	600
330A	380	60	789	6	600	2	3.0	800	800
	460		650	6	400	2	2.5	700	700
	575		523	6	300	2	2.0	600	600
340A	380	60	818	6	600	2	3.0	1000	1000
	460		674	6	500	2	3.0	800	800
	575		542	6	300	2	2.0	600	600
360A	380*	60	859	6	600	2	3.0	1000	1000
	460		707	6	500	2	3.0	800	800
	575		569	6	300	2	2.0	600	600
370A	380*	60	882	6	600	2	3.0	1000	1000
	460		726	6	500	2	3.0	800	800
	575		584	6	350	2	2.5	700	700
380A	380*	60	905	6	600	2	3.0	1000	1000
	460		745	6	500	2	3.0	800	800
	575		599	6	350	2	2.5	700	700
425A	380*	60	931	6	600	2	3.0	1000	1000
	460		770	6	600	2	3.0	800	800
	575		619	6	350	2	2.5	700	700

Note: Table based on 75°C field wire except for 380V ALS 360, 370, and 425 which require 90°C field wire,

Table 41, Multiple Point Connection, ALS 125-204

ALS UNIT SIZE	VOLTS	HZ	ELECTRICAL CIRCUIT #1							ELECTRICAL CIRCUIT #2						
			MINIMUM CIRCUIT AMPS (MCA)	POWER SUPPLY				FIELD FUSING		MINIMUM CIRCUIT AMPS (MCA)	POWER SUPPLY				FIELD FUSING	
				FIELD WIRE		HUB		REC Fuse SIZE	MAX FUSE SIZE		FIELD WIRE		HUB		REC FUSE SIZE	MAX FUSE SIZE
				QTY	WIRE GAUGE	QTY	HUB SIZE				QTY	WIRE GAUGE	QTY	HUB SIZE		
125A	208	60	329	3	400	1	3.0	400	500	329	3	400	1	3.0	400	500
	230		301	3	350	1	2.5	400	500	301	3	350	1	2.5	400	500
	380		182	3	#3/0	1	2.0	225	300	182	3	#3/0	1	2.0	225	300
	460		150	3	#1/0	1	1.5	200	250	150	3	#1/0	1	1.5	200	250
	575		122	3	#1	1	1.5	150	200	122	3	#1	1	1.5	150	200
140A	208	60	329	3	400	1	3.0	400	500	404	6	#4/0	2	2.0	500	700
	230		301	3	350	1	2.5	400	500	369	3	500	1	3.0	500	600
	380		182	3	#3/0	1	2.0	225	300	223	3	#4/0	1	2.0	300	350
	460		150	3	#1/0	1	1.5	200	250	184	3	#3/0	1	2.0	250	300
	575		122	3	#1	1	1.5	150	200	148	3	#1/0	1	1.5	200	250
155A	208	60	410	6	#4/0	2	2.0	500	700	410	6	#4/0	2	2.0	500	700
	230		375	3	500	1	3.0	500	600	375	3	500	1	3.0	500	600
	380		226	3	#4/0	1	2.0	300	350	226	3	#4/0	1	2.0	300	350
	460		187	3	#3/0	1	2.0	250	300	187	3	#3/0	1	2.0	250	300
	575		150	3	#1/0	1	1.5	200	250	150	3	#1/0	1	1.5	200	250
170A	208	60	410	6	#4/0	2	2.0	500	700	464	6	250	2	2.5	600	800
	230		375	3	500	1	3.0	500	600	423	6	#4/0	2	2.0	500	700
	380		226	3	#4/0	1	2.0	300	350	255	3	250	1	2.5	350	400
	460		187	3	#3/0	1	2.0	250	300	211	3	#4/0	1	2.0	250	350
	575		150	3	#1/0	1	1.5	200	250	169	3	#2/0	1	1.5	225	250
175A	208	60	416	6	#4/0	2	2.0	500	700	470	6	250	2	2.5	600	800
	230		381	6	#3/0	2	2.0	500	600	429	6	#4/0	2	2.0	500	700
	380		230	3	#4/0	1	2.0	300	350	259	3	300	1	2.5	350	400
	460		190	3	#3/0	1	2.0	250	300	214	3	#4/0	1	2.0	250	350
	575		152	3	#2/0	1	1.5	200	250	171	3	#2/0	1	1.5	225	250
185A	208	60	470	6	250	2	2.5	600	800	470	6	250	1	2.5	600	800
	230		429	6	#4/0	2	2.0	500	700	429	6	#4/0	1	2.0	500	700
	380		259	3	300	1	2.5	350	400	259	3	300	1	2.5	350	400
	460		214	3	#4/0	1	2.0	250	350	214	3	#4/0	1	2.0	250	350
	575		171	3	#2/0	1	1.5	225	250	171	3	#2/0	1	1.5	225	250
195A	208	60	470	6	250	2	2.5	600	800	470	6	250	1	2.5	600	800
	230		429	6	#4/0	2	2.0	500	700	429	6	#4/0	1	2.0	500	700
	380		259	3	300	1	2.5	350	400	259	3	300	1	2.5	350	400
	460		214	3	#4/0	1	2.0	250	350	214	3	#4/0	1	2.0	250	350
	575		171	3	#2/0	1	1.5	225	250	171	3	#2/0	1	1.5	225	250
204A	208	60	484	6	250	2	2.5	700	800	484	6	250	2	2.5	700	800
	230		439	6	#4/0	2	2.0	600	700	439	6	#4/0	2	2.0	600	700
	380		284	3	300	1	2.5	400	450	264	3	300	1	2.5	400	450
	460		219	3	#4/0	1	2.0	300	350	219	3	#4/0	1	2.0	300	350
	575		176	3	#3/0	1	2.0	250	300	176	3	#3/0	1	2.0	250	300

Table 42, Multiple Point Connection, ALS 205-280, (Circuit #3 continued on next page)

ALS UNIT SIZE	VOLTS	HZ	ELECTRICAL CIRCUIT #1							ELECTRICAL CIRCUIT #2						
			MIN. CIRCUIT AMPS (MCA)	POWER SUPPLY				FIELD FUSING		MIN. CIRCUIT AMPS (MCA)	POWER SUPPLY				FIELD FUSING	
				FIELD WIRE		HUB		REC FUSE SIZE	MAX FUSE SIZE		FIELD WIRE		HUB		REC FUSE SIZE	MAX FUSE SIZE
				QTY	WIRE GAUGE	QTY	HUB SIZE				QTY	WIRE GAUGE	QTY	HUB SIZE		
205A	208	60	329	3	400	1	2.5	400	500	329	3	400	1	2.5	400	500
	230		302	3	350	1	2.5	400	500	302	3	350	1	2.5	400	500
	380		182	3	#3/0	1	1.5	250	300	182	3	#3/0	1	1.5	250	300
	460		150	3	#1/0	1	1.25	200	250	150	3	#1/0	1	1.25	200	250
	575		122	3	#1/0	1	1.25	175	200	122	3	#1/0	1	1.25	175	200
220A	208	60	329	3	400	1	2.5	400	500	410	6	300	1	3	600	700
	230		302	3	350	1	2.5	400	500	375	6	250	1	3	500	600
	380		182	3	#3/0	1	1.5	250	300	223	3	#4/0	1	2	300	350
	460		150	3	#1/0	1	1.25	200	250	187	3	#3/0	1	1.5	250	300
	575		122	3	#1/0	1	1.25	175	200	150	3	#1/0	1	1.25	200	250
235A	208	60	410	6	300	1	3	600	700	410	6	300	1	3	600	700
	230		375	6	250	1	3	500	600	375	6	250	1	3	500	600
	380		227	3	#4/0	1	2	300	350	227	3	#4/0	1	2	300	350
	460		184	3	#3/0	1	1.5	250	300	187	3	#3/0	1	1.5	250	300
	575		150	3	#1/0	1	1.25	200	250	150	3	#1/0	1	1.25	200	250
250A	208	60	410	6	300	1	3	600	700	410	6	300	1	3	600	700
	230		375	3	250	1	3	500	600	375	6	250	1	3	500	600
	380		227	3	#4/0	1	2	300	350	227	3	#4/0	1	2	300	350
	460		187	3	#3/0	1	1.5	250	300	187	3	#3/0	1	1.5	250	300
	575		150	3	#1/0	1	1.25	200	250	150	3	#1/0	1	1.25	200	250
265A	208	60	410	6	300	1	3	600	700	464	6	350	1	3.5	700	800
	230		375	6	250	1	3	500	600	423	6	300	1	3	600	700
	380		227	3	#4/0	1	2	300	350	256	3	250	1	2	350	400
	460		187	3	#3/0	1	1.5	250	300	211	3	#4/0	1	2	300	350
	575		150	3	#1/0	1	1.25	200	250	170	3	#2/0	1	1.5	250	250
280A	208	60	464	6	350	1	3.5	700	800	464	6	350	1	3.5	700	800
	230		423	6	300	1	3	600	700	423	6	300	1	3	600	700
	380		256	3	250	1	2	350	400	256	3	250	1	2	350	400
	460		211	3	#4/0	1	2	300	350	211	3	#4/0	1	2	300	350
	575		170	3	#2/0	1	1.5	250	250	170	3	#2/0	1	1.5	250	250

Table 42, Multiple Point Connection, ALS 205-280 (Continued)

ALS UNIT SIZE	VOLTS	HZ	ELECTRICAL CIRCUIT #3						
			MINIMUM CIRCUIT AMPS (MCA)	POWER SUPPLY				FIELD FUSING	
				FIELD WIRE		HUB		REC FUSE SIZE	MAX FUSE SIZE
				QTY	WIRE GAUGE	QTY	HUB SIZE		
205A	208	60	410	6	300	1	3.0	600	700
	230		375	6	250	1	3.0	500	600
	380		227	3	#4/0	1	2.0	300	350
	460		187	3	#3/0	1	1.5	250	300
	575		150	3	#1/0	1	1.25	200	250
220A	208	60	410	6	300	1	3.0	600	700
	230		375	6	250	1	3.0	500	600
	380		227	3	#4/0	1	2.0	300	350
	460		187	3	#3/0	1	1.5	250	300
	575		150	3	#1/0	1	1.25	300	250
235A	208	60	410	6	300	1	3.0	600	700
	230		375	6	250	1	3.0	500	600
	380		227	3	#4/0	1	2.0	300	350
	460		187	3	#3/0	1	1.5	250	300
	575		150	3	#1/0	1	1.25	200	250
250A	208	60	464	6	350	1	3.5	700	800
	230		423	6	300	1	3.0	600	700
	380		256	3	250	1	2.0	350	400
	460		211	3	#4/0	1	2.0	300	350
	575		170	3	#2/0	1	1.5	250	250
265A	208	60	464	6	350	1	3.5	700	800
	230		423	6	300	1	3.0	600	700
	380		256	3	250	1	2.0	350	400
	460		211	3	#4/0	1	2.0	300	350
	575		170	3	#2/0	1	1.5	250	250
280A	208	60	464	6	350	1	3.5	700	800
	230		423	6	300	1	3.0	600	700
	380		256	3	250	1	2.0	350	400
	460		211	3	#4/0	1	2.0	300	250
	575		170	3	#2/0	1	1.5	250	250

Table 43, Multiple Point Connection, ALS 300-425

ALS UNIT SIZE	VOLTS	HZ	ELECTRICAL CIRCUIT #1 & 3							ELECTRICAL CIRCUIT #2 & 4						
			MIN. CIRCUIT AMPS (MCA)	POWER SUPPLY				FIELD FUSING		MIN. CIRCUIT AMPS (MCA)	POWER SUPPLY				FIELD FUSING	
				FIELD WIRE		HUB		REC	MAX		FIELD WIRE		HUB		REC	MAX
				QTY	WIRE GAUGE	QTY	HUB SIZE	FUSE SIZE	FUSE SIZE		QTY	WIRE GAUGE	QTY	HUB SIZE	FUSE SIZE	FUSE SIZE
300A	208	60	693	6	500	2	3.0	800	800	693	6	500	2	3.0	800	800
	230		630	6	400	2	2.5	800	800	630	6	400	2	2.5	800	800
	380		382	6	250	1	3.0	450	500	382	6	250	1	3.0	450	500
	460		315	3	400	1	2.5	400	450	315	3	400	1	2.5	400	450
	575		254	3	250	1	2.0	350	350	254	3	250	1	2.0	350	350
315A	208	60	693	6	500	2	3.0	800	800	753	6	500	2	3.0	1000	1000
	230		630	6	400	2	2.5	800	800	684	6	400	2	3.0	800	800
	380		382	6	250	1	3.0	450	500	415	6	300	1	3.0	500	500
	460		315	3	400	1	2.5	400	450	342	3	400	1	3.0	400	450
	575		254	3	250	1	2.0	350	350	275	3	250	1	2.0	350	350
330A	208	60	753	6	500	2	3.0	1000	1000	753	6	500	2	3.0	1000	1000
	230		684	6	500	2	3.0	800	800	684	6	500	2	3.0	800	800
	380		415	6	300	1	3.0	500	500	415	6	300	1	3.0	500	500
	460		342	3	500	1	3.0	400	450	342	3	500	1	3.0	400	450
	575		275	3	300	1	2.0	350	350	275	3	300	1	2.0	350	350
340A	208	60	753	6	500	2	3.0	1000	1000	807	6	600	2	3.0	1000	1000
	230		684	6	500	2	3.0	800	800	732	6	500	2	3.0	1000	1000
	380		415	6	300	1	3.0	500	500	444	6	300	1	3.0	500	600
	460		342	3	500	1	3.0	400	450	366	3	500	1	3.0	450	500
	575		275	3	300	1	2.0	350	350	294	3	350	1	2.5	350	400
360A	208	60	822	6	600	2	3.0	1000	1000	822	6	600	2	3.0	1000	1000
	230		746	6	500	2	3.0	1000	1000	746	6	500	2	3.0	1000	1000
	380		453	6	300	1	3.0	500	600	453	6	300	1	3.0	500	600
	460		373	3	500	1	3.0	450	500	373	3	500	1	3.0	450	500
	575		300	3	350	1	2.5	400	400	300	3	350	1	2.5	400	400
370A	208*	60	822	6	600	2	3.0	1000	1000	865	6	600	2	3.0	1000	1000
	230		746	6	500	2	3.0	1000	1000	784	6	600	2	3.0	1000	1000
	380		453	6	300	1	3.0	500	600	476	6	350	1	3.5	500	600
	460		373	3	500	1	3.0	450	500	392	3	600	1	3.0	450	500
	575		300	3	350	1	2.5	400	400	315	3	400	1	2.5	400	400
380A	208*	60	865	6	600	2	3.0	1000	1000	865	6	600	2	3.0	1000	1000
	230		784	6	600	2	3.0	1000	1000	784	6	600	2	3.0	1000	1000
	380		476	6	350	1	3.5	500	600	476	6	350	1	3.5	500	600
	460		392	3	600	1	3.0	450	500	392	3	600	1	3.0	450	500
	575		315	3	400	1	2.5	400	400	315	3	400	1	2.5	400	400
425A	208*	60	892	6	600	2	3.0	1200	1200	892	6	1200	2	3.0	1200	1200
	230		808	6	600	2	3.0	1000	1000	808	6	1000	2	3.0	1000	1000
	380		489	6	350	1	3.0	500	600	489	6	600	1	3.0	600	600
	460		404	3	600	1	3.0	500	500	404	3	500	1	3.0	500	500
	575		325	3	400	1	2.5	400	400	325	3	400	1	2.5	400	400

Note: Table based on 75°C field wire except 208V ALS 370 and 380 which require 90°C field wire

Compressor and Condenser Fan Motors

Table 44, Amp Draw, ALS 070-100

ALS UNIT SIZE	VOLTS	HZ	RATED LOAD AMPS	FAN MOTORS FLA (EACH)	NUMBER OF FAN MOTORS	LOCKED ROTOR AMPS		
			COMPRESSOR			FAN MOTORS (EACH)	COMPRESSOR	
							ACROSS-THE-LINE	REDUCED INRUSH
070A	208	60	240	5.8	6	23.7	1459	934
	230		218	5.8	6	21.4	1628	1042
	380		132	3.4	6	14.4	943	604
	460		109	2.8	6	10.7	764	489
	575		88	2.3	6	11.5	589	377
080A	208	60	300	5.8	6	23.7	1459	934
	230		272	5.8	6	21.4	1628	1042
	380		165	3.4	6	14.4	943	604
	460		136	2.8	6	10.7	764	489
	575		109	2.3	6	11.5	589	377
090A	208	60	343	5.8	8	23.7	1459	934
	230		310	2.8	8	21.4	1628	1042
	380		188	3.4	8	14.4	943	604
	460		155	2.8	8	10.7	764	489
	575		124	2.3	8	11.5	589	377
100A	208	60	343	5.8	8	23.7	1459	934
	230		310	2.8	8	21.4	1628	1042
	380		188	3.4	8	14.4	943	604
	460		155	2.8	8	10.7	764	489
	575		124	2.3	8	11.5	589	377

Table 45, Amp Draw, ALS 125-170

ALS UNIT SIZE	VOLTAGE	HZ	RATED LOAD AMPS		FAN MOTORS FLA (EACH)	NO. OF FAN MOTORS	LOCKED ROTOR AMPS		
			COMPRESSORS				FAN MOTORS (EACH)	PER COMPRESSORP	
			NO. 1	NO. 2				ACROSS-THE-LINE	REDUCED INRUSH
125A	208	60	240	240	5.8	10	23.7	1459	934
	230		218	218	5.8	10	21.4	1628	1042
	380		132	132	3.4	10	14.4	943	604
	460		109	109	2.8	10	10.7	764	489
	575		88	88	2.3	10	11.5	589	377
140A	208	60	240	300	5.8	10	23.7	1459	934
	230		218	272	5.8	10	21.4	1628	1042
	380		132	165	3.4	10	14.4	943	604
	460		109	136	2.8	10	10.7	764	489
	575		88	109	2.3	10	11.5	589	377
155A	208	60	300	300	5.8	12	23.7	1459	934
	230		272	272	5.8	12	21.4	1628	1042
	380		165	165	3.4	12	14.4	943	604
	460		136	136	2.8	12	10.7	764	489
	575		109	109	2.3	12	11.5	589	377
170A	208	60	300	343	5.8	12	23.7	1459	934
	230		272	310	5.8	12	21.4	1628	1042
	380		165	188	3.4	12	14.4	943	604
	460		136	155	2.8	12	10.7	764	489
	575		109	124	2.3	12	11.5	589	377

Table 46, Amp Draw, ALS 175-204

ALS UNIT SIZE	VOLTAGE	HZ	RATED LOAD AMPS COMPRESSORS NO. 1	RATED LOAD AMPS COMPRESSORS NO. 2	FAN MOTORS FLA (EACH)	NO. OF FAN MOTORS	LOCKED ROTOR AMPS FAN MOTORS (EACH)	LOCKED ROTOR AMPS PER COMPRESSORP ACROSS-THE-LINE	LOCKED ROTOR AMPS PER COMPRESSORP REDUCED INRUSH
175A	208	60	300	343	5.8	14	23.7	1459	934
	230		272	310	5.8	14	21.4	1628	1042
	380		165	188	3.4	14	14.4	943	604
	460		136	155	2.8	14	10.7	764	489
	575		109	124	2.3	14	11.5	589	377
185A	208	60	343	343	5.8	14	23.7	1459	934
	230		310	310	5.8	14	21.4	1628	1042
	380		188	188	3.4	14	14.4	943	604
	460		155	155	2.8	14	10.7	764	489
	575		124	124	2.3	14	11.5	589	377
195A	208	60	343	343	5.8	14	23.7	1459	934
	230		310	310	5.8	14	21.4	1628	1042
	380		188	188	3.4	14	14.4	943	604
	460		155	155	2.8	14	10.7	764	489
	575		124	124	2.3	14	11.5	589	377
204A	208	60	343	343	7.8	14	30.5	1459	934
	230		310	310	7.2	14	27.6	1628	1042
	380		188	188	4.1	14	20.0	943	604
	460		155	155	3.6	14	13.8	764	489
	575		124	124	3.0	14	11.5	589	377

Table 47, Amp Draw, ALS 205-280

ALS UNIT SIZE	VOLTAGE	HZ	RATED LOAD AMPS COMPRESSORS NO. 1	RATED LOAD AMPS COMPRESSORS NO. 2	RATED LOAD AMPS COMPRESSORS NO. 3	FAN MOTORS FLA (EACH)	NO. OF FAN MOTORS	LOCKED ROTOR AMPS FAN MOTORS (EACH)	LOCKED ROTOR AMPS PER COMPRESSORP ACROSS-THE-LINE	LOCKED ROTOR AMPS PER COMPRESSORP REDUCED INRUSH
205A	208	60	240	240	300	5.8	16	23.7	1459	934
	230		218	218	272	5.8	16	21.4	1628	1042
	380		132	132	165	3.4	16	14.4	943	604
	460		109	109	136	2.8	16	10.7	764	489
	575		88	88	109	2.3	16	11.5	589	377
220A	208	60	240	300	300	5.8	16	23.7	1459	934
	230		218	272	272	5.8	16	21.4	1628	1042
	380		132	165	165	3.4	16	14.4	943	604
	460		109	136	136	2.8	16	10.7	764	489
	575		88	109	109	2.3	16	11.5	589	377
235A	208	60	300	300	300	5.8	18	23.7	1459	934
	230		272	272	272	5.8	18	21.4	1628	1042
	380		165	165	165	3.4	18	14.4	943	604
	460		136	136	136	2.8	18	10.7	764	489
	575		109	109	109	2.3	18	11.5	589	377
250A	208	60	300	300	343	5.8	18	23.7	1459	934
	230		272	272	310	5.8	18	21.4	1628	1042
	380		165	165	188	3.4	18	14.4	943	604
	460		136	136	155	2.8	18	10.7	764	489
	575		109	109	124	2.3	18	11.5	589	377
265A	208	60	300	343	343	5.8	18	23.7	1459	934
	230		272	310	310	5.8	18	21.4	1628	1042
	380		165	188	188	3.4	18	14.4	943	604
	460		136	155	155	2.8	18	10.7	764	489
	575		109	124	124	2.3	18	11.5	589	377
280A	208	60	343	343	343	5.8	18	23.7	1459	934
	230		310	310	310	5.8	18	21.4	1628	1042
	380		188	188	188	3.4	18	14.4	943	604
	460		155	155	155	2.8	18	10.7	764	489
	575		124	124	124	2.3	18	11.5	589	377

Table 48, Motor Amps, ALS 300-425

ALS UNIT SIZE	VOLTAGE	HZ	RATED LOAD AMPS COMPRESSORS NO. 1	NO. 2	NO. 3	NO. 4	FAN MOTORS FLA (EACH)	NO. OF FAN MOTORS	LOCKED ROTOR AMPS FAN MOTORS (EACH)	PER COMPRESSORP ACROSS-THE-LINE	REDUCED INRUSH
300A	208	60	240	240	300	300	7.8	20	30.5	1459	934
	230		218	218	272	272	7.2	20	27.6	1628	1042
	380		132	132	165	165	4.1	20	20.0	943	604
	460		109	109	136	136	3.6	20	13.8	764	489
	575		88	88	109	109	3.0	20	11.5	589	377
315A	208	60	240	300	300	300	7.8	20	30.5	1459	934
	230		218	272	272	272	7.2	20	27.6	1628	1042
	380		132	165	165	165	4.1	20	20.0	943	604
	460		109	136	136	136	3.6	20	13.8	764	489
	575		88	109	109	109	3.0	20	11.5	589	377
330A	208	60	300	300	300	300	7.8	20	30.5	1459	934
	230		272	272	272	272	7.2	20	27.6	1628	1042
	380		165	165	165	165	4.1	20	20.0	943	604
	460		136	136	136	136	3.6	20	13.8	764	489
	575		109	109	109	109	3.0	20	11.5	589	377
340A	208	60	300	300	300	343	7.8	20	30.5	1459	934
	230		272	272	272	310	7.2	20	27.6	1628	1042
	380		165	165	165	188	4.1	20	20.0	943	604
	460		136	136	136	155	3.6	20	13.8	764	489
	575		109	109	109	124	3.0	20	11.5	589	377
360A	208	60	300	300	343	343	7.8	24	30.5	1459	934
	230		272	272	310	310	7.2	24	27.6	1628	1042
	380		165	165	188	188	4.1	24	20.0	943	604
	460		136	136	155	155	3.6	24	13.8	764	489
	575		109	109	124	124	3.0	24	11.5	589	377
370A	208	60	300	343	343	343	7.8	24	30.5	1459	934
	230		272	310	310	310	7.2	24	27.6	1628	1042
	380		165	188	188	188	4.1	24	20.0	943	604
	460		136	155	155	155	3.6	24	13.8	764	489
	575		109	124	124	124	3.0	24	11.5	589	377
380A	208	60	343	343	343	343	7.8	24	30.5	1459	934
	230		310	310	310	310	7.2	24	27.6	1628	1042
	380		188	188	188	188	4.1	24	20.0	943	604
	460		155	155	155	155	3.6	24	13.8	764	489
	575		124	124	124	124	3.0	24	11.5	589	377
425A	208	60	343	343	343	343	10.0	24	48.1	1459	934
	230		310	310	310	310	9.2	24	43.5	1628	1042
	380		188	188	188	188	5.5	24	26.4	943	604
	460		155	155	155	155	4.6	24	21.8	764	489
	575		124	124	124	124	3.8	24	17.4	589	377

Customer Wiring

Table 49, Customer Wiring with Single Point Connection (ALS 070-204)

ALS UNIT SIZE	VOLTS	HZ	WIRING TO UNIT POWER BLOCK		WIRING TO DISCONNECT SWITCH	
			POWER BLOCK		OPTIONAL DISCONNECT SWITCH	
			TERMINAL SIZE AMPS	CONNECTOR WIRE RANGE (COPPER WIRE ONLY)	SIZE	CONNECTOR WIRE RANGE (COPPER WIRE ONLY)
070A	208	60	840	(2) #2 to 600 MCM	400	(1) 250 to 500 MCM
	230		840	(2) #2 to 600 MCM	400	(1) 250 to 500 MCM
	380		840	(2) #2 to 600 MCM	400	(1) 250 to 500 MCM
	460		840	(2) #2 to 600 MCM	150	(1) #2 to 3/0
	575		840	(2) #2 to 600 MCM	150	(1) #2 to 3/0
080A	208	60	840	(2) #2 to 600 MCM	400	(1) 250 to 500 MCM
	230		840	(2) #2 to 600 MCM	400	(1) 250 to 500 MCM
	380		840	(2) #2 to 600 MCM	250	(1) #4 to 350 MCM
	460		840	(2) #2 to 600 MCM	250	(1) #4 to 350 MCM
	575		840	(2) #2 to 600 MCM	250	(1) #2 to 3/0
090A	208	60	840	(2) #2 to 600 MCM	600	(1) 250 to 500 MCM
	230		840	(2) #2 to 600 MCM	400	(1) 250 to 500 MCM
	380		840	(2) #2 to 600 MCM	250	(1) #4 to 350 MCM
	460		840	(2) #2 to 600 MCM	250	(1) #4 to 350 MCM
	575		840	(2) #2 to 600 MCM	250	(1) #4 to 350 MCM
100A	208	60	840	(2) #2 to 600 MCM	600	(1) 250 to 500 MCM
	230		840	(2) #2 to 600 MCM	400	(1) 250 to 500 MCM
	380		840	(2) #2 to 600 MCM	250	(1) #4 to 350 MCM
	460		840	(2) #2 to 600 MCM	250	(1) #4 to 350 MCM
	575		840	(2) #2 to 600 MCM	250	(1) #4 to 350 MCM
125A	208	60	840	(2) #2 TO 600 MCM	-	See note 9
	230		840	(2) #2 TO 600 MCM	-	See note 9
	380		840	(2) #2 TO 600 MCM	400	(1) 250 to 500 MCM
	460		840	(2) #2 TO 600 MCM	400	(1) 250 to 500 MCM
	575		840	(2) #2 TO 600 MCM	250	(1) #4 to 350 MCM
140A	208	60	840	(2) #2 TO 600 MCM	-	See note 9
	230		840	(2) #2 TO 600 MCM	-	See note 9
	380		840	(2) #2 TO 600 MCM	400	(1) 250 to 500 MCM
	460		840	(2) #2 TO 600 MCM	400	(1) 250 to 500 MCM
	575		840	(2) #2 TO 600 MCM	400	(1) 250 to 350 MCM
155A	208	60	840	(2) #2 TO 600 MCM	-	See note 9
	230		840	(2) #2 TO 600 MCM	-	See note 9
	380		840	(2) #2 TO 600 MCM	600	(2) 250 to 500 MCM
	460		840	(2) #2 TO 600 MCM	400	(1) 250 to 500 MCM
	575		840	(2) #2 TO 600 MCM	400	(1) 250 to 350 MCM
170A	208	60	840	(2) #2 TO 600 MCM	-	See note 9
	230		840	(2) #2 TO 600 MCM	-	See note 9
	380		840	(2) #2 TO 600 MCM	600	(2) 250 to 500 MCM
	460		840	(2) #2 TO 600 MCM	400	(1) 250 to 500 MCM
	575		840	(2) #2 TO 600 MCM	400	(1) 250 to 350 MCM
175A	208	60	840	(2) #2 TO 600 MCM	-	See note 9
	230		840	(2) #2 TO 600 MCM	-	See note 9
	380		840	(2) #2 TO 600 MCM	600	(2) 250 to 500 MCM
	460		840	(2) #2 TO 600 MCM	400	(1) 250 to 500 MCM
	575		840	(2) #2 TO 600 MCM	400	(1) 250 to 350 MCM
185A	208	60	950	(2) #2 TO 600 MCM	-	See note 9
	230		840	(2) #2 TO 600 MCM	-	See note 9
	380		840	(2) #2 TO 600 MCM	600	(2) 250 to 500 MCM
	460		840	(2) #2 TO 600 MCM	600	(2) 250 to 500 MCM
	575		840	(2) #2 TO 600 MCM	400	(1) 250 to 350 MCM
195A	208	60	950	(2) #2 TO 600 MCM	-	See note 9
	230		840	(2) #2 TO 600 MCM	-	See note 9
	380		840	(2) #2 TO 600 MCM	600	(2) 250 to 500 MCM
	460		840	(2) #2 TO 600 MCM	600	(2) 250 to 500 MCM
	575		840	(2) #2 TO 600 MCM	400	(1) 250 to 350 MCM
204A	208	60	950	(2) #2 TO 600 MCM	-	See note 9
	230		840	(2) #2 TO 600 MCM	-	See note 9
	380		840	(2) #2 TO 600 MCM	600	(2) 250 to 500 MCM
	460		840	(2) #2 TO 600 MCM	600	(2) 250 to 500 MCM

	575		840	(2) #2 TO 600 MCM	400	(1) 250 to 350 MCM

Table 50, Customer Wiring With Single Point Connection, ALS 205-425

ALS UNIT SIZE	VOLTS	HZ	WIRING TO UNIT POWER BLOCK		WIRING TO DISCONNECT SWITCH	
			POWER BLOCK		OPTIONAL DISCONNECT SWITCH	
			TERMINAL SIZE AMPS	CONNECTOR WIRE RANGE (COPPER WIRE ONLY)	SIZE	CONNECTOR WIRE RANGE (COPPER WIRE ONLY)
205A	380	60	840	(2) #2 TO 600 MCM	600	(2) 250 to 500 MCM
	460		840	(2) #2 TO 600 MCM	600	(2) 250 to 500 MCM
	575		840	(2) #2 TO 600 MCM	400	(1) 250 to 350 MCM
220A	380	60	840	(2) #2 to 600 MCM	600	(2) 250 to 500 MCM
	460		840	(2) #2 to 600 MCM	600	(2) 250 to 500 MCM
	575		840	(2) #2 to 600 MCM	400	(1) 250 to 500 MCM
235A	380	60	840	(2) #2 to 600 MCM	600	(2) 250 to 500 MCM
	460		840	(2) #2 to 600 MCM	600	(2) 250 to 500 MCM
	575		840	(2) #2 to 600 MCM	400	(1) 250 to 500 MCM
250A	380	60	840	(2) #2 to 600 MCM	800	(2) 500 to 750 MCM
	460		840	(2) #2 to 600 MCM	600	(2) 250 to 500 MCM
	575		840	(2) #2 to 600 MCM	600	(2) 250 to 500 MCM
265A	380	60	840	(2) #2 to 600 MCM	800	(2) 500 to 750 MCM
	460		840	(2) #2 to 600 MCM	600	(2) 250 to 500 MCM
	575		840	(2) #2 to 600 MCM	600	(2) 250 to 500 MCM
280A	380	60	840	(2) #2 to 600 MCM	800	(2) 500 to 750 MCM
	460		840	(2) #2 to 600 MCM	600	(2) 250 to 500 MCM
	575		840	(2) #2 to 600 MCM	600	(2) 250 to 500 MCM
300A	380	60	840	(2) #2 to 600 MCM	800	(2) 400 to 700 MCM
	460		840	(2) #2 to 600 MCM	800	(2) 400 to 700 MCM
	575		840	(2) #2 to 600 MCM	600	(2) 250 to 500 MCM
315A	380	60	840	(2) #2 to 600 MCM	1200	(2) 500 to 750 MCM
	460		840	(2) #2 to 600 MCM	800	(2) 400 to 700 MCM
	575		840	(2) #2 to 600 MCM	600	(2) 250 to 500 MCM
330A	380	60	840	(2) #2 to 600 MCM	1200	(2) 500 to 750 MCM
	460		840	(2) #2 to 600 MCM	800	(2) 400 to 700 MCM
	575		840	(2) #2 to 600 MCM	600	(2) 250 to 500 MCM
340A	380	60	840	(2) #2 to 600 MCM	1200	(2) 500 to 750 MCM
	460		840	(2) #2 to 600 MCM	800	(2) 400 to 700 MCM
	575		840	(2) #2 to 600 MCM	600	(2) 250 to 500 MCM
360A	380	60	950	(2) #2 to 600 MCM	1200	(3) 500 to 750 MCM
	460		840	(2) #2 to 600 MCM	800	(2) 400 to 700 MCM
	575		840	(2) #2 to 600 MCM	800	(2) 250 to 500 MCM
370A	380	60	950	(2) #2 to 600 MCM	1200	(3) 500 to 750 MCM
	460		840	(2) #2 to 600 MCM	800	(2) 400 to 700 MCM
	575		840	(2) #2 to 600 MCM	800	(2) 400 to 700 MCM
380A	380	60	950	(2) #2 to 600 MCM	1200	(3) 500 to 750 MCM
	460		840	(2) #2 to 600 MCM	1200	(3) 500 to 750 MCM
	575		840	(2) #2 to 600 MCM	800	(2) 400 to 700 MCM
425A	380	60	950	(2) #2 to 600 MCM	1200	(3) 500 to 750 MCM
	460		840	(2) #2 to 600 MCM	1200	(3) 500 to 750 MCM
	575		840	(2) #2 to 600 MCM	800	(2) 400 to 700 MCM

Table 51, Customer Wiring With Multiple Point Power, ALS 125-204

ALS UNIT SIZE	VOLTS	HZ	WIRING TO UNIT POWER BLOCK			
			POWER BLOCK			
			TERMINAL SIZE (AMPS)		CONNECTOR WIRE RANGE (COPPER WIRE ONLY)	
			CKT 1	CKT 2	CKT 1	CKT 2
125A	208	60	840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	230		840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	380		840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	460		840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	575		840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
140A	208	60	840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	230		840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	380		840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	460		840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	575		840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
155A	208	60	840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	230		840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	380		840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	460		840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	575		840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
170A	208	60	840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	230		840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	380		840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	460		840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	575		840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
175A	208	60	840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	230		840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	380		840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	460		840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	575		840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
185A	208	60	840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	230		840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	380		840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	460		840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	575		840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
195A	208	60	840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	230		840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	380		840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	460		840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	575		840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
204A	208	60	840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	230		840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	380		840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	460		840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	575		840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM

Table 52, Customer Wiring With Multiple Point Power, ALS 205A-280A

ALS UNIT SIZES	VOLTS	HZ	WIRING TO UNIT POWER BLOCK					
			POWER BLOCK					
			TERMINAL SIZE (AMPS)			CONNECTOR WIRE RANGE (COPPER WIRE ONLY)		
			CKT 1	CKT 2	CKT 3	CKT 1	CKT 2	CKT 3
205A	208	60	840	840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	230		840	840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	380		840	840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	460		840	840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	575		840	840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
220A	208	60	840	840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	230		840	840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	380		840	840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	460		840	840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	575		840	840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
235A	208	60	840	840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	230		840	840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	380		840	840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	460		840	840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	575		840	840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
250A	208	60	840	840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	230		840	840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	380		840	840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	460		840	840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	575		840	840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
265A	208	60	840	840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	230		840	840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	380		840	840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	460		840	840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	575		840	840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
280A	208	60	840	840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	230		840	840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	380		840	840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	460		840	840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	575		840	840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM

Table 53, Customer Wiring With Multiple Point Wiring, ALS 300A-425A

ALS UNIT SIZE	VOLTS	HZ	WIRING TO UNIT POWER BLOCK			
			POWER BLOCK			
			TERMINAL SIZE (AMPS)		CONNECTOR WIRE RANGE (COPPER WIRE ONLY)	
			CKT 1	CKT 2	CKT 1	CKT 2
300A	208	60	840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	230		840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	380		840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	460		840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	575		840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
315A	208	60	840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	230		840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	380		840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	460		840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	575		840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
330A	208	60	840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	230		840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	380		840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	460		840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	575		840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
340A	208	60	840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	230		840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	380		840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	460		840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	575		840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
360A	208	60	840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	230		840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	380		840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	460		840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	575		840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
370A	208	60	950	950	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	230		840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	380		840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	460		840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	575		840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
380A	208	60	950	950	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	230		840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	380		840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	460		840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	575		840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
425A	208	60	950	950	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	230		840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	380		840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	460		840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM
	575		840	840	(2) #2 TO 600 MCM	(2) #2 TO 600 MCM

Electrical Data Notes

1. Allowable voltage limits:

   Unit nameplate plus or minus 10 percent.

2. 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 control transformer. Wire size ampacity for separate 115V control circuit power is 15 amps for ALS125A through ALS280A.

3. Compressor RLA values are for wire sizing purposes only but do reflect normal operating current draw at unit rated capacity. If unit is equipped with SpeedTrol condenser fan motors, the first motor on each refrigerant circuit is a single phase, 1 hp motor, with a FLA of 2.8 amps at 460 volts (5.6 amps at 208/230 volts). If the unit is not equipped with SpeedTrol, the standard fan motor will be 1 1/2 hp, 3-phase (for ALS070A-280A) with a FLA as shown in the electrical tables. For ALS300A-425A the standard fan motor will be 2 hp, 3-phase.

4. Compressor LRA for reduced inrush start is for the first winding. If the unit is equipped with SpeedTrol motors, the first motor on each refrigerant circuit is a single phase, 1 hp motor, with a LRA of 7.3 amps at 460 volts (14.5 amps at 208/230 volts). If the unit is not equipped with SpeedTrol, the standard fan motor will be 1« hp, 3-phase with a LRA as shown in the electrical tables.

5. Single point power supply requires a single disconnect to supply electrical power to the unit. This power must be fused.

6. Multiple point power supply requires two independent power circuits on ALS125A-ALS195A, ALS300-ALS425 and three independent power circuits on ALS205A-ALS280A each with separate fused disconnects and a separate control circuit.

7. All field wiring to unit power block or optional non-fused disconnect switch must be copper.

8. Field wire size values given in tables apply to 75°C rated wire per NEC except for ALS185A-ALS204A and ALS370A, ALS425A for 208V application or as noted.

9. Disconnect switches must be field supplied.

10. All wiring must be done in accordance with applicable local and national codes.

11. Recommended time delay fuse size or circuit breakers (Canadian units only) is equal to 150% of the largest compressor-motor RLA plus 100% of remaining compressor RLAs and the sum of condenser fan FLAs.

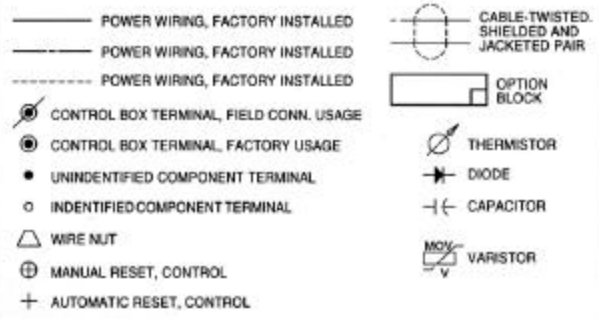
12. Maximum time delay fuse size or circuit breakers (Canadian units only) is equal to 225% of the largest compressor-motor RLA plus 100% of remaining compressor RLAs and the sum of condenser fan FLAs.

Electrical Legend

Table 54

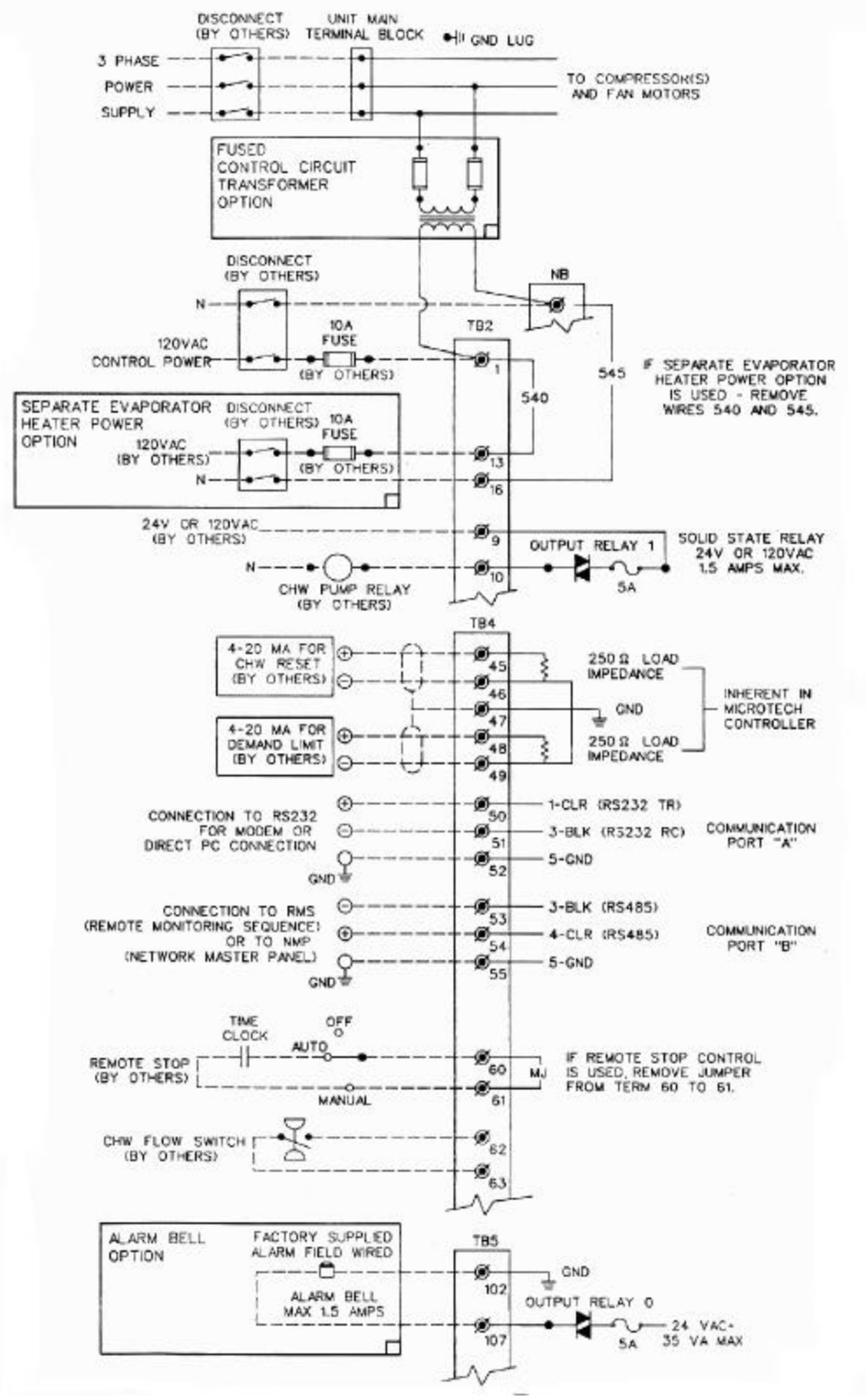
AB	ALARM BELL	BACK OR SIDE OF CTRL BOX
RESI,RES2	RESISTOR, CURRENT TRANSFORMER	CTRL BOX, POWER PANEL
ADI	ANALOG DIGITAL INPUT BOARD	CTRL BOX, CTRL PANEL
CI-C3	SURGE CAPACITOR, COMPRESSOR	CTRL BOX, POWER PANEL
CII,C2I	CAPACITOR, SPEEDTROL	INSIDE SPEEDTROL BOX
CBI-CB6	CIRCUIT BREAKER (POWER)	CTRL BOX, POWER PANEL
CB9	CIRCUIT BREAKER (MICROTECH)	CTRL BOX, CTRL PANEL
CBIO	CIRCUIT BREAKER (FAX ALARM)	CTRL BOX, CTRL PANEL
CHWI	CHILLED WATER INTERLOCK	FIELD INSTALLED
COMPR I-3	COMPRESSORSI-3	ON BASE RAIL
CSII-CS33	COMPRESSOR SOLENOID	ON COMPRESSOR
CTI,CT2	CURRENT TRANSFORMER	CTRL BOX, POWER PANEL
DS1,DS2	DISCONNECT SWITCH, MAIN	CTRL BOX, POWER PANEL
EXV	ELECTRONIC EXPANSION VALVE	CTRL BOX, CTRL PANEL
FI	FUSE, CONTROL CIRCUIT	CTRL BOX, SWITCH PANEL
F2	FUSE, COOLER HEATER	CTRL BOX, SWITCH PANEL
FB5	FUSEBLOCK, CONTROL POWER	CTRL BOX, POWER PANEL
FB6-FBI5	FUSEBLOCKS, FAN MOTORS	CTRL BOX, POWER PANEL
GDI-GD3	GUARDISTOR RELAY	CTRL BOX, CTRL PANEL
GFP	GROUND FAULT PROTECTOR	CTRL BOX, POWER PANEL
GRD,GND	GROUND	CTRL BOX, POWER PANEL
HTRI-HTR3	COMPRESSOR HEATER	ON COMPRESSORS
HTR5	HEATER,EVAPORATOR	WRAPPED AROUND EVAP.
JI-JI3	JUMPERS (LEAD)	CTRLBOX, CTRLPANEL
JB5	JUNCTION BOX, EVAP. HEATER	NEAR EVAP, ON BASE RAIL
KEYPAD	KEYPAD SWITCH & DISPLAY	CTRL BOX, KEYPAD PANEL
LPSI-LPS3	LIQUID PRESENCE SENSOR	ON COMPRESSOR
MI-M6	CONTACTORS, COMPRESSOR	CTRLBOX, POWERPANEL
MI-M37	CONTACTOR, FAN MOTORS	CTRL BOX, POWER PANEL
MCB250	MICROTECH CONTROL BOARD-250	CTRL BOX, CTRL PANEL
MHPRI-MHPR3	MECH. HIGH PRESSURE RELAY	CONTROL BOX, CTRL PANEL
MJ	MECHANICAL JUMPER	CTRL BOX, CTRL PANEL
MODEMI	MODEM, MICROTECH	CTRL BOX, CTRL PANEL
MODEM2	MODEM, FAX	CTRL BOX, CTRL PANEL
MPRI-MPR3	MOTOR PROTECTOR RELAY	CONTROL BOX, CTRL PANEL
MTRJI-MTR37	MOTORS, CONDENSER FANS	CONDENSER SECTION
NB	NEUTRAL BLOCK	CTRL BOX, CTRL PANEL
OB	OUTPUT BOARD, MICROTECH	CTRL BOX, CTRL PANEL
OLI-OL6	OVERLOADS	CTRL BOX, POWER PANEL
OSI-OS3	OIL SAFETY SWITCH	CTRL BOX, CTRL PANEL
PBI-PB3	POWER BLOCK, MAIN	CTRL BOX, POWER PANEL
PSI-PS3	PUMPDOWN SWITCHES	CTRL BOX, SWITCH PANEL
PVMI-PVM3	PHASE VOLTAGE MONITOR	CTRL BOX, POWER

RES1,RES2	RESISTOR, CURRENT TRANSFORMER	CTRL BOX, POWER PANEL
SI	SWITCH, MANUAL START/STOP	CTRL BOX, KEYPAD PANEL
SCII,SC21,SC31	SPEED CONTROL	INSIDE SPEEDTROL BOX
SIG.CONV(SC)	SIGNAL CONVERTER	CTRL BOX, CTRL PANEL
SVI,SV2,SV7	SOLENOID VALVE, LIQ. LINES	ON LIQUID LINES
SV3,SV4,SV8	SOLENOID VALVE, LIQ. INJECTION	ON COMPR LIQ. INJ. LINE
SV5,SV6,SV9	SOLENOID VALVE, HG BYPASS	ON LINE TO HOT GAS VALVE
TI	TRANSFORMER, MAIN CONTROL	CTRL BOX, POWER PANEL
T2, T5	TRANSFORMER, 120 TO 24V CONTROL	CTRL BOX, CTRL PANEL
T3	TRANSFORMER, 575 TO 208-230V SPEEDTROL	CTRL BOX, CTRL PANEL
T4,T6	TRANSFORMER, 24 TO 18V CONTROL	CTRL BOX, CTRL PANEL
TIO	TRANSFORMER, 208-240 TO 24V OR 460 TO 24V -SPEEDTROL	CTRL BOX, CTRL PANEL
TB2	TERMINAL BLOCK, 120V FIELD	CTRL BOX, CTRL PANEL
TB3	TERMINAL BLOCK, 24V FIELD	CTRL BOX, CTRL PANEL
TB4-TB6	TERMINAL BLOCK, CONTROL	CTRL BOX, CTRL PANEL
TB7	TERM114AL BLOCK, FIELD CONN. (LESS THAN 24V ONLY)	CTRL BOX, CTRL PANEL
TB9	TERMINAL BLOCK, MICROTECH ONLY	CTRL BOX, CTRL PANEL
TBIO	TERMINAL BLOCK, FAX ALARM	CTRL BOX, CTRL PANEL
TD5-TD7	TIME DELAY, COMPR. REDUCED INRUSH	CTRL BOX, CTRL PANEL



Typical Field Wiring Diagram

Figure 28, Field Wiring, ALS 070A-425A



Major Component Location

Figure 29, ALS 125-204

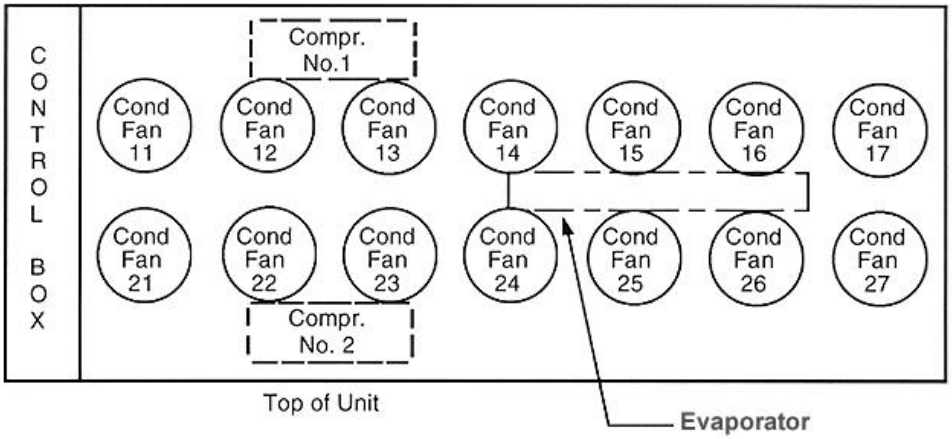


Figure 30, ALS 205-280

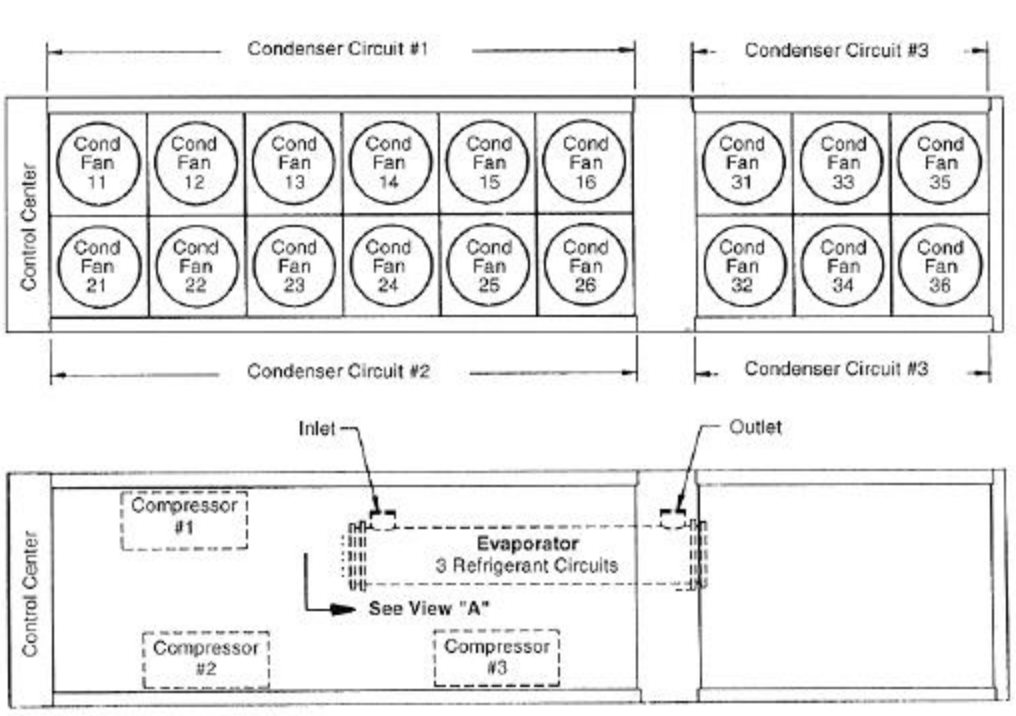
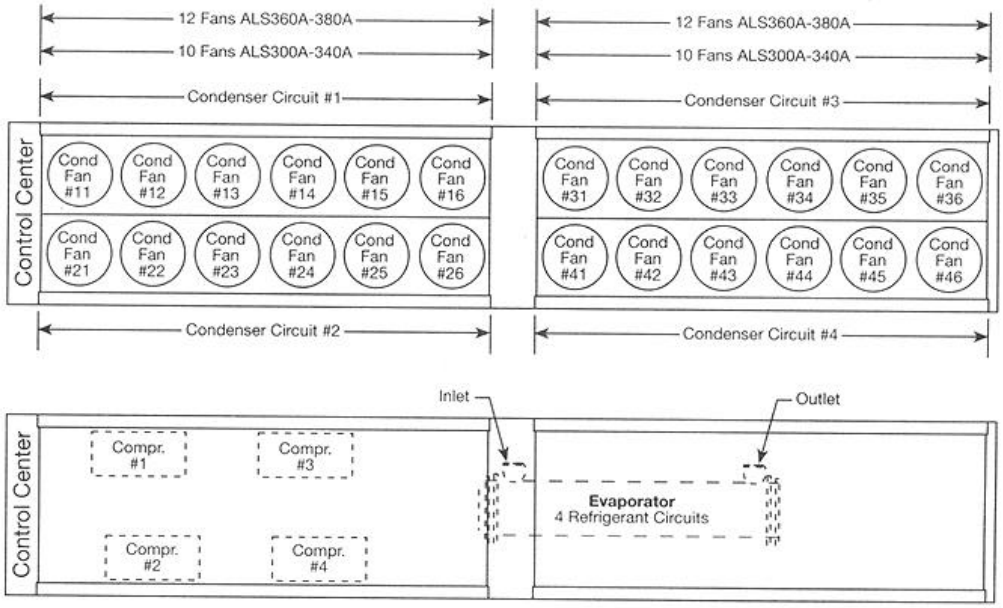


Figure 31, ALS 300-425



Control Center

All electrical controls are enclosed in a weather resistant control center with keylocked, hinged access doors. The control center is composed of two separate compartments, high voltage and low voltage. All of the high voltage components are located in the compartment on the right side of the unit.

The low voltage components are located on the left side with the 115 VAC terminals located behind the deadfront panel. This protects service personnel from 115 VAC terminals when accessing the adjustable and resettable controls.

Figure 32, Control Center Layout, ALS 125A-204

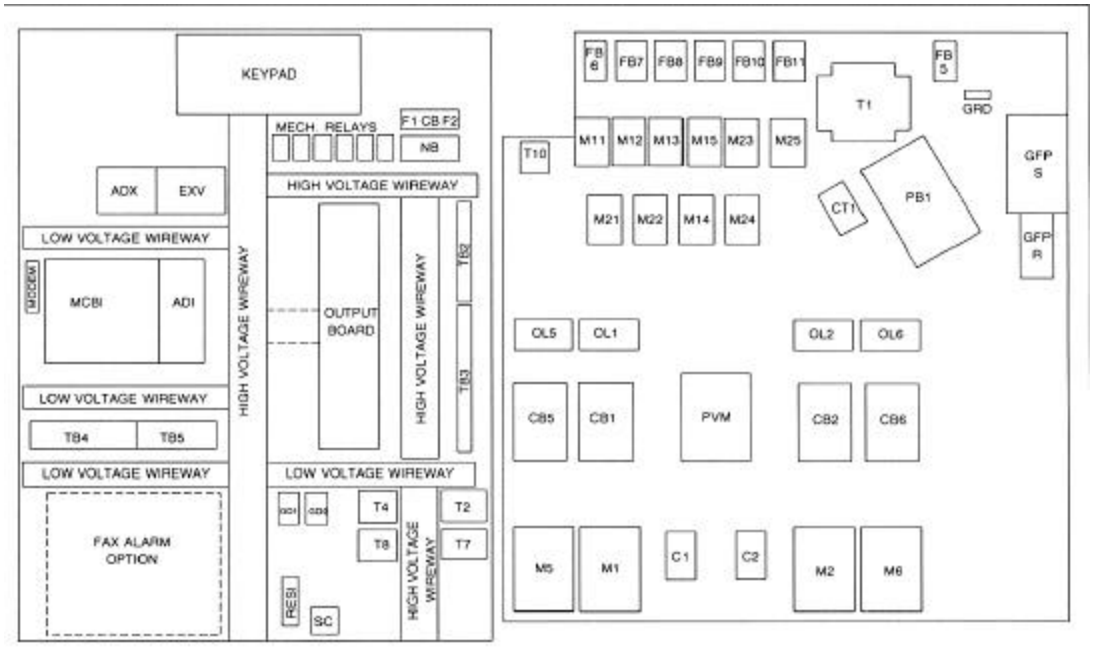


Figure 33, Control Center Layout, ALS 205A-280A

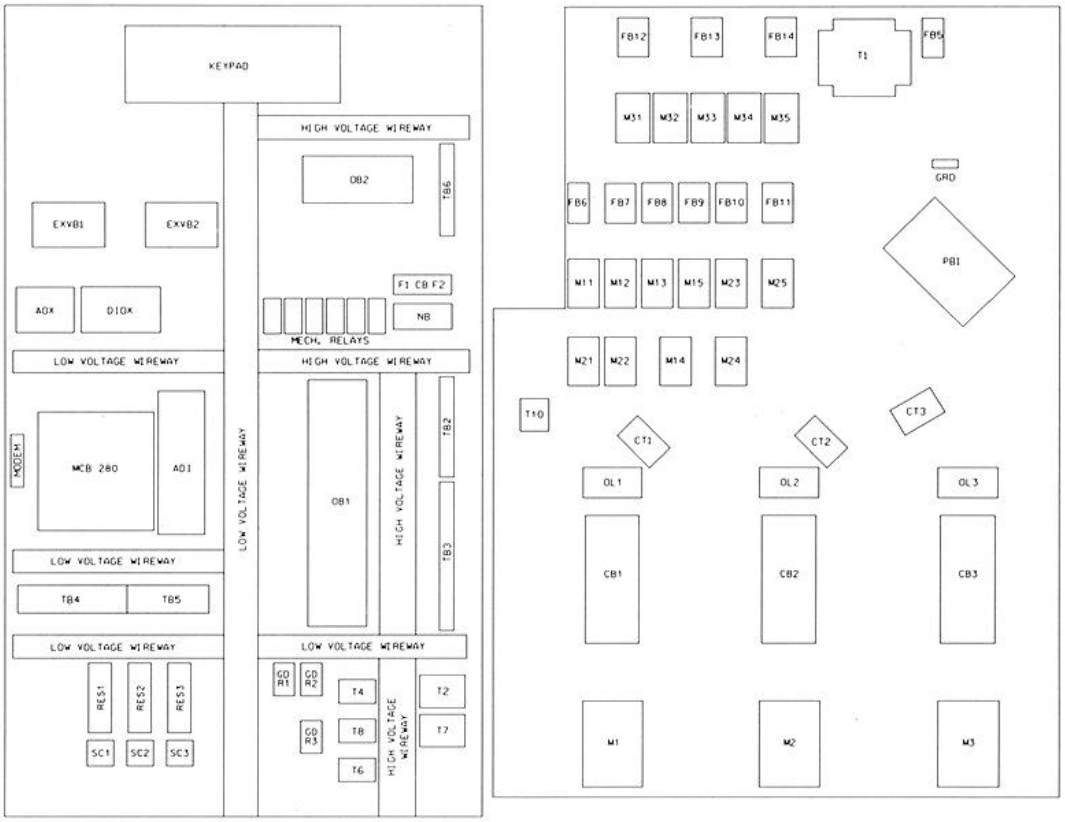
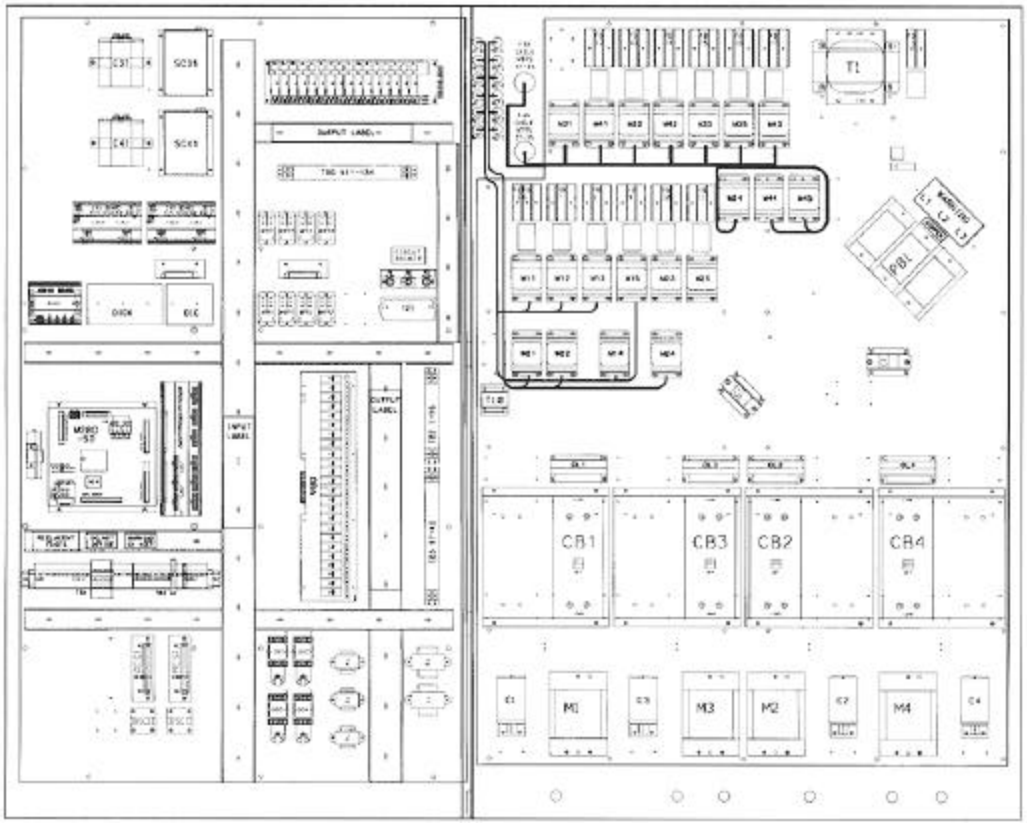


Figure 34, Control Center Layout, ALS 300A-425A



Sequence of Operation

The following sequence of operation is typical for McQuay models ALS chillers. The sequence may vary depending on the software revision or various options which may be installed on the chiller.

Off conditions

With power supplied to the unit, 115 VAC power is applied through the control fuse F1 to the compressor heaters (HTR1, HTR2, HTR3, HTR4 and evaporator heater) and the primary of the 24V control circuit transformer. **Note: Compressor heaters must be on for at least 12 hours prior to start-up.** The 24V transformer provides power to the MicroTech controller and related components. With 24V power applied, the controller will check the position of the front panel system switch. If the switch is in the "stop" position the chiller will remain off and the display will indicate the operating mode to be **OFF: System Sw.** The controller will then check the pumpdown switches. If any of the switches is in the "stop" position, that circuit's operating mode will be displayed as **OFF: PumpDwnSw.** If the switches for both circuits are in the "Stop" position the unit status will display **OFF: PumpdownSw's**. If the remote start/stop switch is open the chiller will be **OFF: RemoteSw**. The chiller may also be commanded off via communications from a separate communicating panel such as the Remote Monitoring and Sequencing Panel or an Open Protocol interface. The display will show **OFF: RemoteComm** if this operating mode is in effect. If an alarm condition exists which prevents normal operation of both refrigerant circuits, the chiller will be disabled and the display will indicate **OFF: Alarm**. If the control mode on the keypad is set to "Manual Unit Off," the chiller will be disabled and the unit status will display **OFF: ManualMode**. Assuming none of the above stop conditions are true, the controller will examine the internal time schedule to determine whether the chiller should be permitted to start. The operating mode will be **OFF: TimeClock** if the time schedule indicates time remaining in an "off" time period.

Alarm

The alarm light on the front panel will be illuminated when one or more of the cooling circuits has an active alarm condition which results in the circuit being locked out. Unless the alarm condition affects all circuits the remaining circuits will operate as required. Refer to IM 549 for details.

Start-up

If none of the above "off" conditions are true, the MicroTech controller will initiate a start sequence and energize the chiller water pump output relay. The chiller will remain in the **WaitForFlow** mode until the field installed flow switch indicates the presence of chilled water flow. If flow is not proven within 30 seconds, the alarm output will be turned on, the keypad display will be **WaitForFlow** and the chiller will continue to wait for proof of chilled water flow. Once flow is established, the controller will sample the chilled water temperature and compare it against the Leaving Chilled Water Set Point, the Control Band, and the Start-up Delta Temperature, which have been programmed into the controller's memory. If the leaving chilled water temperature is above the Leaving Chilled Water Set Point plus ½ the Control Band plus the adjustable Start-up Delta Temperature, the controller will select the refrigerant circuit with the lowest number of starts as the lead circuit and energize the first stage of the Cool Staging mode. The controller will start the compressor and energize the compressor liquid injection solenoid along with the main liquid line solenoid. The controller will delay the opening of the electronic expansion valve until the evaporator pressure decreases to a preset value. This is the evaporator prepurge mode and the display will show **Pre-Purge**. The valve will then open allowing refrigerant to flow through the expansion valve and into the evaporator and the display will show **Opened EXV**. If additional cooling capacity is required, the controller will energize the additional cooling capacity by activating the first compressor's capacity control solenoids. As the system load increases, the controller will start the lag refrigerant circuit in the same manner after interstage timers are satisfied. The compressors and capacity control solenoids will automatically be controlled as required to meet the cooling needs of the system. The electronic expansion valves are operated by the MicroTech controller to maintain precise refrigerant control to the evaporator at all conditions.

Condenser Control

The first condenser fan stage will be started along with the first compressor to provide initial condenser head pressure control. The MicroTech controller will activate the remaining condenser fans as needed to maintain proper condenser pressure. The MicroTech controller continuously monitors the condenser minus evaporator lift pressure and will adjust the number of operating condenser fans as required. The number of condenser fans operating will vary with outdoor temperature and system load. The condenser fans are matched to the operating compressors so that when a compressor is off all fans for that circuit will also be off. On units with the fan speed control option (SpeedTrol) the lead fan on each circuit will vary in speed to maintain condenser pressure at lower outdoor temperatures.

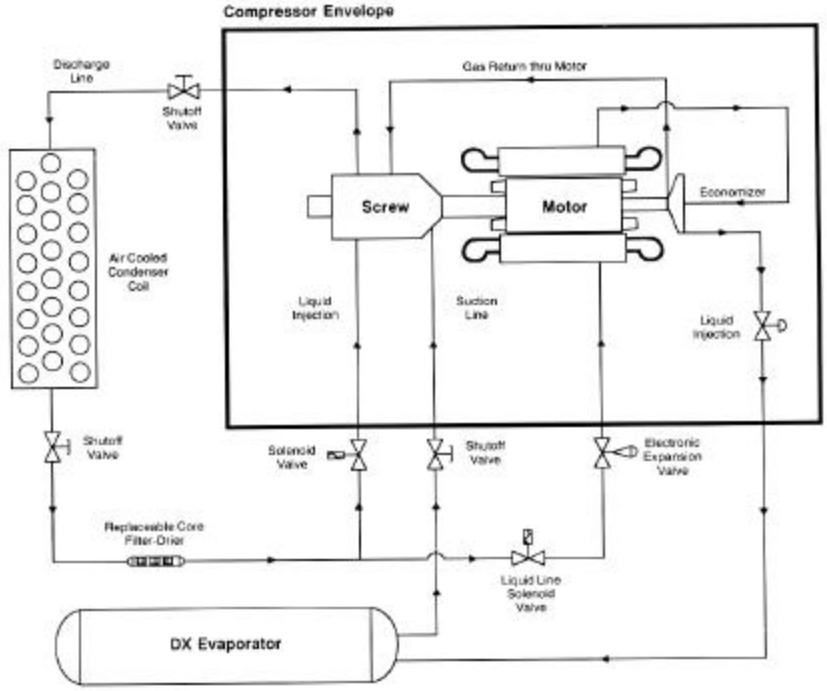
Pumpdown

As the system chilled water requirements diminish. The compressors will be unloaded. As the system load continues to drop, the electronic expansion valves will be stepped closed and the refrigerant circuits will go through a pumpdown sequence. As the evaporator pressure falls below the pumpdown pressure set point while pumping down, the compressor(s) and condenser fans will stop. The unit has a one time pumpdown control logic; therefore, if the evaporator pressure rises while the refrigerant circuit is in a pumpdown mode, the controller will not initiate another pumpdown sequence. The controller will keep the unit off until a call for cooling occurs. Refer to the pumpdown control section in IM549 for additional details. The chilled water pump output relay will remain energized until the time schedule's "on" time expires, the remote stop switch is opened, the system switch is moved to the stop position, or a separate communications panel such as the Remote Monitoring and Sequencing Panel or an Open Protocol interface deactivates the chilled water pump output.

Warning

The screw compressor must not be used as a pump out compressor for service work involving removal of refrigerant from the compressor or evaporator. That is, the compressor must not be run with the liquid line valve (king valve) closed. Portable recovery equipment must be used to remove the refrigerant.

Figure 35, ALS Piping Schematic



WARNING

McQuayService personnel or authorized service agency

must perform initial start-up.

CAUTION

Most relays and terminals in the unit control center are powered when S1 is closed and the control circuit disconnect is on. Therefore do not close S1 until ready for start-up.

Seasonal Start-up

Note: PS1, PS2, PS3, and PS4 will vary depending on the number of circuits.

1. Double check that the compressor suction and discharge shutoff valves are backseated. Always replace valve seal caps.
2. Insure that the ball valves are open on the lines entering the evaporator.
3. Insure that the manual liquid line shutoff valve at the outlet of the subcooler is open.
4. Adjust the leaving chilled water temperature set point on the MicroTech controller to the desired chilled water temperature. The control band is preset for 10 degrees Delta-T between the entering and leaving evaporator water temperature at full load. If the Delta-T is outside an 8°-12°F range, at full load, reset the control band as per the instructions found in the MicroTech IM Manual 549-1.
5. Start the auxiliary equipment for the installation by turning on the time clock, and/or remote on/off switch, and chilled water pump.
6. Check to see that pumpdown switches PS1, PS2, PS3 and PS4 are in the "Pumpdown and Stop" (open) position. Throw the S1 switch to the "auto" position.
7. Under the "Control Mode" menu of the keypad place the unit into the automatic cool mode.
8. Start the system by moving pumpdown switch PS1 to the "auto" position.
9. After running circuit #1 for a short time, check for flashing in the refrigerant sightglass under stable conditions.
10. Repeat steps 8 and 9 for PS2, PS3 and PS4 and the second, third and fourth refrigerant circuits.
11. Superheat is factory adjusted to maintain between 6° and 12°F.

CAUTION

The superheat should be between 6°F and 12°F, with the liquid line sightglass full, once the system temperatures have stabilized at the MicroTech set point temperatures.

Temporary Shutdown

Move pumpdown switches PS1, PS2, PS3 and PS4 to the "Pumpdown and Stop" position. After the compressors have pumped down, turn off the chilled water pump. Caution: Do not turn the unit off using the "S1" switch, without first moving PS1, PS2, PS3 and PS4 to the "Stop" position, unless it is an emergency as this will prevent the unit from going through a pumpdown.

IMPORTANT

The unit has one time pumpdown operation. When PS1, PS2, PS3 and PS4 are in the "Pumpdown and Stop" position the unit will pumpdown once and not run again until the PS1, PS2, PS3 and PS4 switches are moved to the auto position. If PS1, PS2, PS3 and PS4 are in the auto position and the load has been satisfied the unit will go into one time pumpdown and will remain off until MicroTech senses a call for cooling and starts the unit. Under no circumstance use the compressors for pumpdown with the liquid line valves closed.

CAUTION

The unit must not be cycled off by using the evaporator pump or the disconnect switch.

It is important that the water flow to the unit is not interrupted before the compressors pumpdown to avoid freeze-up in the evaporator.

If all power is turned off to the unit the compressor heaters will become inoperable. Once power is resumed to the unit it is important that the compressor heaters are energized a minimum of 12 hours before attempting to start the unit. Failure to do so could damage the compressors due to excessive accumulation of liquid in the compressor.

Start-up After Temporary Shutdown

1. Insure that the compressor heaters have been energized for at least 12 hours prior to starting the unit.
2. Start the chilled water pump.
3. With System switch S1 in the "on" position, move pumpdown switches PS1, PS2, PS3 and PS4 to the "auto" position.
4. Observe the unit operation until the system has stabilized.

WARNING

If shutdown occurs or will continue through periods below freezing ambient temperatures, protect the chiller vessel from freezing.

Extended Shutdown

1. Move the PS1, PS2, PS3 and PS4 switches to the manual pumpdown position.
2. After the compressors have pumped down, turn off the chilled water pump.
3. Turn off all power to the unit and to the chilled water pump.
4. Move the emergency stop switch S1 to the "off" position.
5. Close the compressor suction and discharge valves as well as the liquid line shutoff valves.
6. Tag all opened disconnect switches to warn against start-up before opening the compressor suction and discharge valves and liquid line shutoff valves.
7. If glycol is not used in the system drain all water from the unit evaporator and chilled water piping if the unit is to be shutdown during winter. Do not leave the vessels or piping open to the atmosphere over the shutdown period.
8. Leave power applied to the evaporator heating cable if a separate disconnect is used.

Start-up After Extended Shutdown

1. With all electrical disconnects open, check all screw or lug type electrical connections to be sure they are tight for good electrical contact.
2. Check the voltage of the unit power supply and see that it is within the ±10% tolerance that is allowed. Voltage unbalance *between* phases must be within ±3%.
3. See that all auxiliary control equipment is operative and that an adequate cooling load is available for start-up.
4. Check all compressor valve connections for tightness to avoid refrigerant loss. Always replace valve seal caps.
5. Make sure system switch S1 is in the "Stop" position and pumpdown switches PS1, (PS2, PS3 and PS4) are set to "Pumpdown and Stop," throw the main power and control disconnect switches to "on." This will energize crankcase heaters. Wait a minimum of 12 hours before starting up unit. Turn compressor circuit breakers to "off" position until ready to start unit.
6. Vent the air from the evaporator water side as well as from the system piping. Open all water flow valves and start the chilled water pump. Check all piping for leaks.

System Maintenance

General

On initial start-up and periodically during operation, it will be necessary to perform certain routine service checks. Among these are checking the liquid line sightglasses and taking condensing and section pressure readings. Through the MicroTech keypad, check to see that the unit has normal superheat and subcooling readings. A recommended maintenance schedule is located at the end of this section.

A Periodic Maintenance Log is located at the end of this manual. It is suggested that the report be completed on a weekly basis. The log will serve as a useful tool for a service technician in the event service is required.

Compressor Maintenance

Since the compressor is semi-hermetic requiring no oil separator, oil heaters nor pumps; no yearly maintenance is normally required. However, vibration is an excellent check for proper mechanical operation. Compressor vibration is an indicator of the requirement for maintenance and contributes to a decrease in unit performance and efficiency. It is recommended that the compressor be checked with a vibration analyzer at or shortly after start-up and again on an annual basis. When performing the test the load should be maintained as closely as possible to the load of the original test. The initial vibration analyzer test provides a benchmark of the compressor and when performed routinely can give a warning of impending problems.

The compressor is supplied with a lifetime oil filter under normal operating conditions. However, it is a good policy to replace this filter anytime the compressor is opened for servicing.

Lubrication

No routine lubrication is required on ALS units. The fan motor bearings are permanently lubricated. No further lubrication is required. Excessive fan motor bearing noise is an indication of a potential bearing failure.

Compressor oil must be Planetelf® ACD68AW. McQuay Part Number 735030439 in a 5 gallon container, 735030438 in 1 gallon size. This is synthetic polyolester oil with anti-wear additives and is highly hygroscopic. Care must be taken to minimize exposure of the oil to air when charging oil into the system.

Electrical Terminals

WARNING

Electric shock hazard. Turn off all power before continuing with following service.

Periodically check electrical terminals for tightness and tighten as required.

Condensers

The condensers are air-cooled and constructed of 3/8" (9.5mm) O.D. internally finned copper tubes bonded in a staggered pattern into louvered aluminum fins. No maintenance is ordinarily required except the routine removal of dirt and debris from the outside surface of the fins. McQuay recommends the use of foaming coil cleaners available at most air conditioning supply outlets. Use caution when applying such cleaners as they may contain potentially harmful chemicals. Care should be taken not to damage the fins during cleaning.

If the service technician has reason to believe that the refrigerant circuit contains noncondensables, purging may be required strictly following Clean Air Act regulations governing refrigerant discharge to the atmosphere. The purge Schrader valve is located on the vertical coil header on both sides of the unit at the control box end of the coil. Access panels are located at the end of the condenser coil directly behind the control panel. Purge with the unit off, after shutdown of 15 minutes or longer, to allow air to collect at the top of the coil. Restart and run the unit for a brief period. If necessary, shut unit off and repeat the procedure. Follow accepted environmentally sound practices when removing refrigerant from the unit.

Refrigerant Sightglass

The refrigerant sightglasses should be observed periodically. (A weekly observation should be adequate.) A clear glass of liquid indicates that there is adequate refrigerant charge in the system to insure proper feed through the expansion valve. Bubbling refrigerant in the sightglass, during stable run conditions, indicates that the system may be short of refrigerant charge. Refrigerant gas flashing in the sightglass could also indicate an excessive pressure drop in the liquid line, possibly due to a clogged filter-drier or a restriction elsewhere in the liquid line (see Table 61 for maximum allowable pressure drops). If subcooling is low add charge to clear the sightglass. If subcooling is normal (10°-15°F) and flashing is visible in the sightglass check the pressure drop across the filter-drier. Subcooling should be checked at full load with 70°F (21.1°C) outdoor air temperature and all fans running.

An element inside the sightglass indicates the moisture condition corresponding to a given element color. If the sightglass does not indicate a dry condition after about 12 hours of operation, the circuit should be pumped down and the filter-drier changed.

Lead-Lag

A feature on all McQuay ALS air-cooled chillers is a system for alternating the sequence in which the compressors start to balance the number of starts and run hours. Lead-Lag of the refrigerant circuits is accomplished automatically through the MicroTech Controller. When in the auto mode the circuit with the fewest number of starts will be started first. If all circuits are operating and a stage down in the number of operating compressors is required, the circuit with the most operating hours will cycle off first. The operator may override the MicroTech controller, and manually select the lead circuit as circuit #1, #2, #3 or circuit #4.

Preventative Maintenance Schedule

PREVENTATIVE MAINTENANCE SCHEDULE			
OPERATION	WEEKLY	MONTHLY (Note 1)	ANNUAL (Note 2)
General			
Complete unit log and review (Note 3)	X		
Visually inspect unit for loose or damaged components		X	
Inspect thermal insulation for integrity			X
Clean and paint as required			X
Electrical			
Check terminals for tightness, tighten as necessary			X
Clean control panel interior			X
Visually inspect components for signs of overheating		X	
Verify compressor heater operation		X	
Megger compressor motor every five years			
Refrigeration			
Leak test		X	
Check sight glasses for clear flow	X		
Check filter-drier pressure drop (see manual for spec)		X	
Perform compressor vibration test			X
Condenser (air-cooled)			
Clean condenser coils (Note 4)			X
Check fan blades for tightness on shaft (Note 5)			X
Check fans for loose rivets and cracks			X
Check coil fins for damage			X

Notes:

1. Monthly operations include all weekly operations.
2. Annual (or spring start-up) operations includes all weekly and monthly operations.
3. Log readings may be taken daily for a higher level of unit observation.
4. Coil cleaning may be required more frequently in areas with a high level of airborne particles.
5. Be sure fan motors are electrically locked out.

CAUTION

1. Service on this equipment is to be performed by qualified refrigeration personnel familiar with equipment operation, maintenance, correct servicing procedures, and the safety hazards inherent in this work. Causes for repeated tripping of safety controls must be investigated and corrected.
2. Disconnect all power before doing any service inside the unit.
3. Anyone servicing this equipment shall comply with the requirements set forth by the EPA in regards to refrigerant reclamation and venting.

Compressor Solenoids

The ALS unit screw compressors are equipped with 3 solenoids to control compressor unloading. The solenoids are controlled by MicroTech outputs. See unit wiring diagrams. The solenoids are energized at various compressor load conditions as indicated in the table below.

Table 55, Compressor Unloading

COMPRESSOR LOADING %	COMPRESSOR UNLOADING SOLENOID STATUS		
	TOP SOLENOID	BOTTOM FRONT SOLENOID	BOTTOM REAR SOLENOID
100%	Energized	Off	Energized
75%	Energized	Energized	Off
50%	Off	Off	Energized
25%	Off	Energized	Off

Location of the solenoids is as follows:

The top solenoid is on top of the compressor near the discharge end.

The bottom solenoids are on the lower side of the compressor on the opposite side from the terminal box. The bottom front solenoid is the one closest to the discharge end of the compressor. The bottom rear solenoid is the one closest to the motor end of the compressor.

If the compressor is not loading properly check the solenoids to see if they are energized per the above chart. A complete check will include a check of the MicroTech output, the wiring to the solenoid and the solenoid coil itself.

Filter-Driers

A replacement of the filter-drier is recommended any time excessive pressure drop is read across the filter-drier and/or when bubbles occur in the sightglass with normal subcooling. A partially clogged filter can also cause trips on the **no liquid run** sensor. The maximum recommended pressure drops across the filter-drier are as follows:

Table 56, Filter-Drier Pressure Drop

PERCENT CIRCUIT LOADING (%)	MAXIMUM RECOMMENDED PRESSURE DROP ACROSS FILTER DRIER PSIG (KPA)
100%	10 (69)
75%	8 (55.2)
50%	5 (34.5)
25%	4 (27.6)

The filter-drier should also be changed if the moisture indicating liquid line sightglass indicates excess moisture in the system.

During the first few months of operation the filter-drier replacement may be necessary if the pressure drop across the filter-drier exceeds the values listed in the paragraph above. Any residual particles from the condenser tubing, compressor and miscellaneous components are swept by the refrigerant into the liquid line and are caught by the filter-drier.

The following is the procedure for changing the filter-drier core:

This procedure is slightly different from a typical reciprocating compressor unit due to the use of a liquid injection feature on the ASL screw compressor unit. Anytime the compressor contactor is closed, liquid from the liquid line is injected into the screw for cooling and sealing the rotor. This liquid injection also occurs during normal pumpdown and limits how low a pumpdown pressure can be achieved.

The standard unit pumpdown is set to stop pumpdown when 34 psig (235 kPa) suction pressure is reached. To fully pump down a circuit beyond 34 psig (235kPa) for service purposes a "Full Pumpdown" service mode can be activated using the keypad. Go to the "Alarm Spts" Menu on the MicroTech keypad, step through the menu items until "FullPumpDwn" is displayed. Change the setting from "No" to "Yes".

The next time either circuit is pumped down, the pumpdown will continue until the evaporator pressure reaches 2 psig (14 kPa) or 60 seconds have elapsed, whichever occurs first. Upon completing the pumpdown, the "FullPumpDwn" set point is automatically changed back to "No".

The procedure to perform a full service pumpdown for changing the filter-drier core is as follows:

1. Perform a normal pumpdown to 34 psig (235 kPa) by moving the pumpdown switch to the "Pumpdown" position. This step will pump down the evaporator with compressor liquid injection still active.
2. Under the "Alarm Spts", change the "FullPumpDwn" set point from "No" to "Yes".
3. The circuit status should be "Off:PumpDwnSw". Move the circuit pumpdown switch from "Pumpdown and Stop" to "Auto". Also clear the anticycle timers through the MicroTech keypad.
4. The compressor should pump down the circuit until the evaporator pressure reaches 2 psig (14 kPa) or 60 seconds has elapsed, whichever occurs first.
5. Upon completing the full pumpdown per step 5, the "FullPumpDwn" set point is automatically changed back to "No" which reverts back to standard 34 psig (235 kPa) stop pumpdown pressure.
6. If the pumpdown does not go to 2 psig (14 kPa) on the first attempt, one more attempt can be made by repeating steps 3, 4 and 5 above. Do not repeat "FullPumpDwn" more than once to avoid excessive screw temperature rise under this abnormal condition. A no liquid start alarm and shutdown may occur during this procedure. Proceed as noted in step number 8.
7. The circuit is now in the deepest pumpdown which can safely be achieved by the use of the compressor. Close the liquid line shutoff valve above the filter-drier, on the circuit to be serviced. Any remaining refrigerant must be removed from the circuit by the use of a refrigerant recovery unit.

Remove and replace the filter-drier(s). If the refrigerant circuit is opened for more than 10 minutes evacuate the lines through the liquid line manual shutoff valve(s) to remove noncondensables that may have entered during filter replacement. A leak check is recommended before returning the unit to operation.

Liquid Line Solenoid Valve

The liquid line solenoid valves that shut off refrigerant flow in the event of a power failure does not normally require any maintenance. (O*n a sudden power failure the electronic expansion valve remains open at the position it was at when the power failure occurred. During normal operation the EEV closes for automatic pumpdown and the liquid line solenoid valve closes only when the compressor stops.*) The solenoids may, however, require replacement of the solenoid coil or of the entire valve assembly.

The solenoid coil can be checked to see that the stem is magnetized when energized by touching a screwdriver to the top of the stem. If there is no magnetization either the coil is bad or there is no power to the coil.

The solenoid coil may be removed from the valve body without opening the refrigerant piping after first moving pumpdown switches PS1, PS2, and PS3 to the "manual pumpdown" position and opening the S1 switch. For personal safety shut off and lock out the unit power.

The coil can then be removed from the valve body by simply removing a nut or snap-ring located at the top of the coil. The coil can then be slipped off its mounting stud for replacement. Be sure to replace the coil on its mounting stud before returning pumpdown switches PS1, PS2 and PS3 to the "auto pumpdown" position. Failure to do so will lead to solenoid coil failure.

To replace the entire solenoid valve follow the steps involved when changing a filter-drier.

Liquid Injection Solenoid Valve

Liquid injection is required during compressor operation to seal and cool the rotor. A liquid injection sensor is installed on the compressor to assure that liquid injection occurs whenever the compressor is running. A failure of the liquid injection solenoid valve to open will cause the compressor to shut down due to lack of liquid injection.

The liquid injection solenoid valve, like the liquid line solenoid valve, only closes when the compressor stops. Since this valve is open during pumpdown the refrigerant in the line will cause the suction pressure to rise 10 to 20 psig (69 to 138 kPa) after shutdown occurs. The solenoid coil and valve body can be removed as in the same procedure as the liquid line solenoid valve but it is important that the S1 switch be opened first.

Electronic Expansion Valve

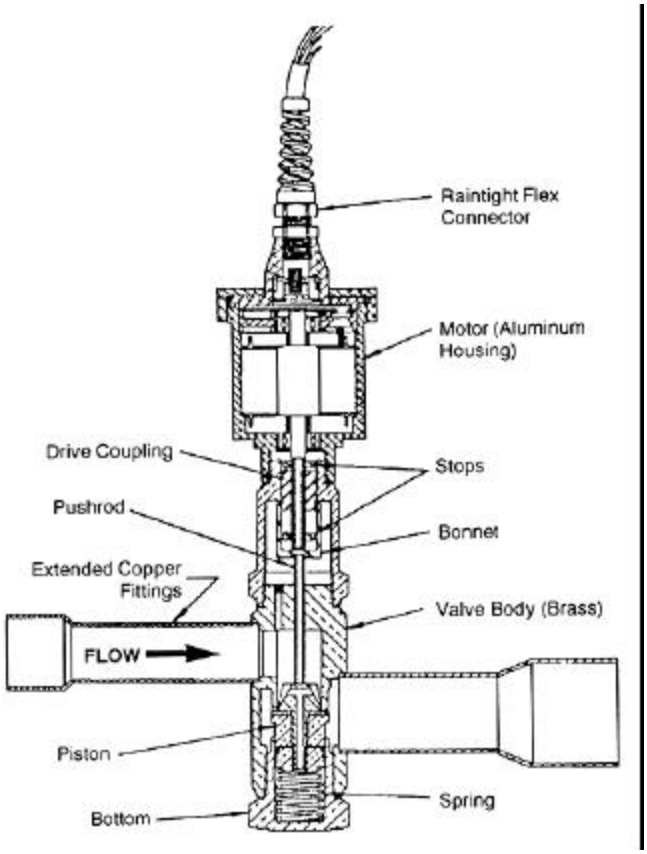
The electronic expansion valve is located adjacent to the compressor. The refrigerant is piped to first pass through the electronic expansion valve, then through the motor housing cooling the motor before going into the evaporator. Refer to the Figure 35, ALS Piping Schematic.

The expansion valve meters the amount of refrigerant entering the evaporator to match the cooling load. It does this by maintaining a constant superheat. (Superheat is the difference between the actual refrigerant temperature of the vapor as it leaves the evaporator and the saturation temperature corresponding to the evaporator pressure.) All ALS chillers are factory set between 8°F (4.5°C) and 12°F (6.6°C) superheat at 75% to 100% load and between 6°F (3.3°C) and 10°F (5.6°C) below 75% load. The superheat is controlled by the microprocessor and is not adjustable.

The expansion valve, like the solenoid valve, should not normally require maintenance, but if it requires replacement, the unit must be pumped down by following the steps involved when changing a filter-drier.

If the problem can be traced to the electric motor only, it can be unscrewed from the valve body without removing the valve but only after pumping the unit down. Disassemble valve at the brass hex nut. Do not disassemble valve at the aluminum housing.

Figure 36,. Electronic expansion valve



Electronic Expansion Valve Operation

There are three colored indicator LEDs (green, red, yellow) located in the control panel on the electronic expansion valve (EXV) board. When the control panel is first powered the microprocessor will automatically step the valve to the fully closed (shut) position and the indicator lights on the EXV will blink in sequence. The valve can also be heard closing as it goes through the steps. The valve will take approximately 14 seconds to go from a full open position to a full closed position.

The position of the valve can be viewed at any time by using the MicroTech keypad through the circuit pressure menus. There are a total of 760 steps between closed and full open.

A feature of the electronic expansion valve is a maximum operating pressure setting (MOP). This setting limits the load on the compressor during start-up periods where high return evaporator water temperatures may be present. The valve will limit the maximum suction pressure at start-up to approximately 85 psig (586 kPa). The valve will close to a point necessary to maintain the 85 psig (586 kPa). During this time the superheat will rise above 12°F (6.6°C) and not drop below 12°F (6.6°C) until the suction pressure drops below 85 psig (586 kPa). The valve will maintain evaporator pressure close to 85 psig (586 kPa) until the evaporator water temperature decreases to approximately 55°F to 60°F (12.7°C to 15.6°C).

When the circuit starts the valve opens as soon as the evaporator pressure decreases to 40 psig (275 kPa). At the end of the cooling cycle the valve closes causing the system to pump down. The valve closes at the rate of approximately 55 steps per second, or from full open to full closed in approximately 14 seconds. The valve closing during pumpdown will occur in approximately 20-30 seconds after the pumpdown switch is moved to the "Pumpdown and Stop" position.

Evaporator

The evaporator is the direct expansion, shell-and-tube type with refrigerant flowing through the tubes and water flowing through the shell over the tubes. The tubes are internally finned to provide extended surface as well as turbulent flow of refrigeration through the tubes. Normally no service work is required on the evaporator.

Refrigerant Charging

ALS air-cooled screw chillers are shipped factory charged with a full operating charge of refrigerant but there may be times that a unit must be recharged at the job site. Follow these recommendations when field charging. Refer to the unit operating charge found in the Physical Data Tables, Table 21 through Table 27.

ALS air-cooled screw chillers are more sensitive to undercharging than to overcharging, therefore it is preferable to be slightly overcharged rather than undercharged. The optimum charge is the charge which allows the unit to run with a solid stream of liquid in the liquid line at all operating conditions. When the liquid line temperature does not drop with the addition of 5 to 10 lbs of refrigerant, the correct maximum charge has been reached. If the liquid line temperature does not drop and the discharge pressure goes up 3-5 psig (20.7-34.5 kPa) as 5-10 lbs of refrigerant is added the correct maximum charge has been reached.

Unit charging can be done at any steady load condition (preferably at 75 to 100% load) and at any outdoor temperature (preferably higher than 70°F (21.1°C). Unit must be allowed to run 5 minutes or longer so that the condenser fan staging is stabilized at normal operating discharge pressure. For best results charge with two or more condenser fans operating on each refrigerant circuit.

The ALS units have a condenser coil design with approximately 15% of the coil tubes located in a subcooler section of the coil to achieve liquid cooling to within 5°F (3°C) of the outdoor air temperature when all condenser fans are operating. This is equal to about 15°F-20°F (8.3°C-11.1°C) subcooling below the saturated condensing temperature when the pressure is read at the liquid valve between the condenser coil and the liquid line filter drier. Once the subcooler is filled, extra charge will not lower the liquid temperature and does not help system capacity or efficiency. However, a little extra (10-15 lbs) will make the system less sensitive.

Note: As the unit changes load or fans cycle on and off, the subcooling will vary but should recover within several minutes and should never be below 6°F (3.3°C) subcooling at any steady state condition. Subcooling will vary somewhat with evaporator leaving water temperature and suction superheat. As the evaporator superheat decreases the subcooling will drop slightly.

Excessive refrigerant losses can also leak oil from the system. When adding more than 25 lbs of charge or if there is visible evidence of a significant oil leakage, add an additional oil equivalent to 0.04 pints for each pound of refrigerant required. (**Example**: For every 10 lbs. of refrigerant charge add .4 pints of oil.). The oil charge is 10% of the refrigerant charge by weight. The only acceptable oil is Planetelf® ACD68AW.

One of the following three scenarios will be experienced with an undercharged unit:

1. If the unit is slightly undercharged the unit will show bubbles in the sightglass. Recharge the unit as described in the charging procedure below.
2. If the unit is moderately undercharged it will normally trip on freeze protection. Recharge the unit as described in the charging procedure below.

3. If the unit is severely undercharged it will trip due to lack of liquid injection. In this case either remove the remaining charge by means of a proper reclamation system and recharge the unit with the proper amount of refrigerant as stamped on the unit nameplate, or add refrigerant through the suction valve on the compressor. Feed liquid into the suction valve when the compressor is running. If the unit is severely undercharged the unit may nuisance trip during this charging procedure. If this happens close off the refrigerant from the tank and restart the unit. Once the unit has enough charge so that it does not trip out, continue with step 2 of the charging procedure below.

Procedure to charge a moderately undercharged ALS unit:

1. If a unit is low on refrigerant you must first determine the cause before attempting to recharge the unit. Locate and repair any refrigerant leak. Evidence of oil is a good indicator of leakage, however oil may not be visible at all leaks. Liquid leak detector fluids work well to show bubbles at medium size leaks but electronic leak detectors may be needed to locate small leaks.
2. Add the charge to the system through the suction shutoff valve or through the Schrader fitting on the tube entering the evaporator between the compressor and the evaporator head.
3. The charge can be added at any load condition between 25-100% load per circuit but at least two fans should be operating per refrigerant circuit if possible. The suction superheat should be in the 6°F-12°F (3.3°C-6.6°C) range.
4. Add sufficient charge to clear the liquid line sightglass and until all flashing stops in the sightglass. Add an extra 15-20 lbs. of reserve to fill the subcooler if the compressor is operating at 50-100% load.
5. Check the unit subcooling value on the MicroTech display or by reading the liquid line pressure and temperature at the liquid line near the filter-drier. The subcooling values should be between 6°F-20°F (6.6°C-11.1°C). The subcooling values will be highest at 75-100% load, approximately 12°F-20°F (6.6°C-11.1°C) and lowest at 50% load, approximately 6°F-12°F (3.3°C-6.6°C).
6. With outdoor temperatures above 60°F (15.6°C) all condenser fans should be operating and the liquid line temperature should be within 5°F-10°F (2.8°C-5.6°C) of the outdoor air temperature. At 25-50% load the liquid line temperature should be within 5°F (2.8°C) of outdoor air temperature with all fans on. At 75-100% load the liquid line temperature should be within 10°F (5.6°C) of outdoor air temperature with all fans on.
7. Overcharging of refrigerant will raise the compressor discharge pressure due to filling of the condenser tubes with excess refrigerant.

In-Warranty Return Material Procedure

In the U.S. and Canada

Compressor: In the event of a failure contact the nearest McQuayService office for assistance.

Components Other Than Compressors: Material may be returned only with permission from authorized factory service personnel of McQuay International in Staunton, Virginia. A "return goods" tag will be sent that is to be included with the returned material. Enter the required information on the tag in order to expedite handling at our factories.

The return of the part does not constitute an order for replacement. Therefore, a purchase order must be entered through your nearest McQuay representative. The order should include part name, part number, model number and serial number of the unit involved.

Following McQuay's inspection of the returned part, and if it is determined that the failure is due to faulty material or workmanship, and it is within the warranty period, credit will be issued against the customer’s purchase order.

All parts shall be returned to the designated McQuay factory with transportation charges prepaid.

Thermistor sensors

Note: Refer to IM 549 for a more complete description of the controls application, settings, adjustments, and checkout procedures.

All sensors are premounted and connected to the MicroTech field wiring strip with shielded cable. A description of each sensor is listed here.

Evaporator leaving water temperature - This sensor is located on the evaporator water outlet connection and is used for capacity control of the chiller and low water temperature freeze protection.

Evaporator entering water temperature - This sensor is located on the evaporator water inlet connection and is used for monitoring purposes and return water temperature control.

Evaporator pressure transducer circuit #1 - This sensor is located on the suction side of compressor #1 and is used to determine saturated suction refrigerant pressure and temperature. It also provides low pressure freeze protection for circuit #1.

Evaporator pressure transducer circuit #2 - This sensor is located on the section side of compressor #2 and is used to determine saturated suction refrigerant pressure and temperature. It also provides low pressure freeze protection for circuit #2.

Evaporator pressure transducer circuit #3 - This sensor is located on the suction side of compressor #3 and is used to determine saturated suction refrigerant pressure and temperature. It also provides low pressure freeze protection for circuit #3.

Evaporator pressure transducer circuit #4 - This sensor is located on the suction side of compressor #4 and is used to determine saturated suction refrigerant pressure and temperature. It also provides low pressure freeze protection for circuit #4.

Condenser pressure transducer circuit #1 - the sensor is located on the discharge of compressor #1 and is used to read saturated refrigerant pressure and temperature. The transducer will unload the compressor should a rise in head pressure occur which is outside the MicroTech set point limits. The signal is also used in the calculation of circuit #1 subcooling.

Condenser pressure transducer circuit #2 - The sensor is located on the discharge of compressor #2 and is used to read saturated refrigerant pressure and temperature. The transducer will unload the compressor should a rise in head pressure occur which is outside the MicroTech set point limits. The signal is also used in the calculation of circuit #2 subcooling.

Condenser pressure transducer circuit #3 - the sensor is located on the discharge of compressor #3 and is used to read saturated refrigerant pressure and temperature. The transducer will unload the compressor should a rise in head pressure occur which is outside the MicroTech set point limits. The signal is also used in the calculation of circuit #3 subcooling.

Condenser pressure transducer circuit #4 - The sensor is located on the discharge of compressor #4 and is used to read saturated refrigerant pressure and temperature. The transducer will unload the compressor should a rise in head pressure occur which is outside the MicroTech set point limits. The signal is also used in the calculation of circuit #4 subcooling.

Outside air - This sensor is located on the back of the control box on compressor #1 side. It measures the outside air temperature, is used to determine if low ambient start logic is necessary and can be the reference for low ambient temperature lockout.

Suction temperature circuit #1 - The sensor is located in a well brazed to circuit #1 suction line. The purpose of the sensor is to measure refrigerant temperature to control and maintain proper superheat.

Figure 37, Sensor Locations, ALS 070-204

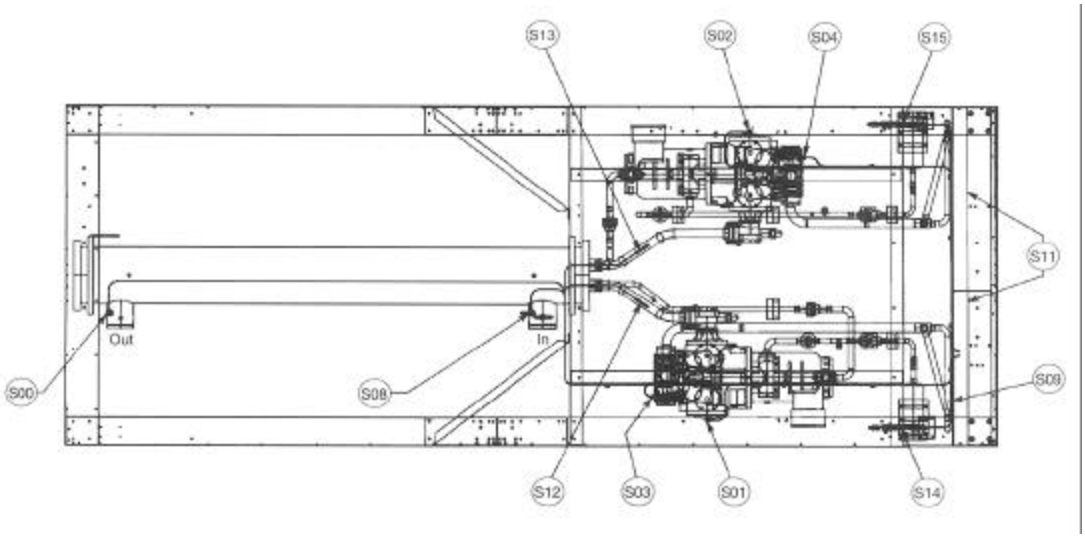


Table 57, Sensor Location, ALS 070 - 204

SENSOR NUMBER	DESCRIPTION	SENSOR NUMBER	DESCRIPTION
S00	Evap. Leaving water temp.	S13	Suction temp. circ. #2
S01	Evap. Pressure transducer circ. #1	S14	Liquid line temp. circ. #1
S02	Evap. Pressure transducer circ. #2	S15	Liquid line temp. circ. #2
S03	Cond. Pressure transducer circ. #1	S16	Evap. Pressure transducer circ. #3
S04	Cond. Pressure transducer circ. #2	S17	Cond. Pressure transducer circ. #3
S06	Evap. Water temp reset	S18	Suction temp circ. #3
S07	Demand limit	S19	Liquid line temp. Circ. #3
S08	Evap. Entering water temp.	S20	Discharge temp. circ. #1
S09	Outside air temp.	S21	Discharge temp. circ. #2
S11	Total unit amps	S22	Discharge temp. circ. #3
S12	Section temp. circ. #3		

Figure 38, Sensor Locations, ALS 205-280

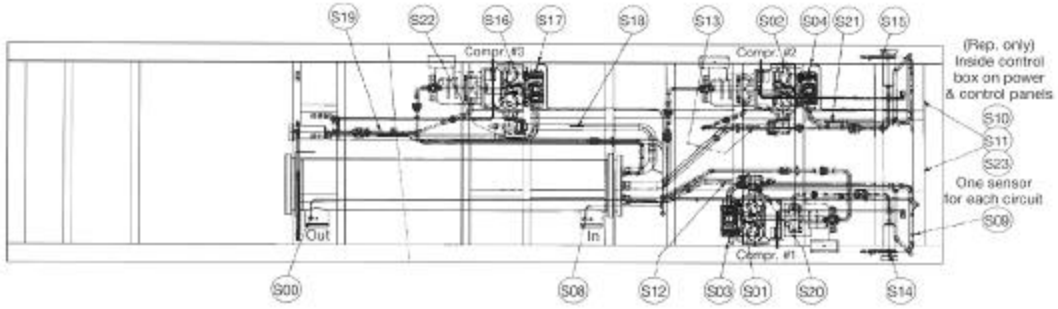


Table 58, Sensor Location, ALS 205 - 280

SENSOR NUMBER	DESCRIPTION	SENSOR NUMBER	DESCRIPTION	SENSOR NUMBER	DESCRIPTION
S00	Evap leaving water temp	S09	Outside air temp	S17	High pressure transducer circ. #3
S01	Low pressure transducer circ. #1	S10	Percent circuit amps circ. #1	S18	Suction temp circ. #3
S02	Low pressure transducer circ. #2	S11	Percent circuit amps circ. #2	S19	Liquid line temp circ. #3
S03	High pressure transducer circ. #1	S12	Suction temp circ. #1	S20	Discharge temp circ. #1
S04	High pressure transducer circ. #2	S13	Suction temp circ. #2	S21	Discharge temp circ. #2
S06	Evap water temp reset *(field supplied)*	S14	Liquid line temp circ. #1	S22	Discharge temp circ. #3
S07	Demand limit *(field supplied)*	S15	Liquid line temp circ. #2	S23	Percent circuit amps circ. #3
S08	Evap entering water temp	S16	Low pressure transducer circ. #3		

Figure 39, Sensor location, ALS 300-425

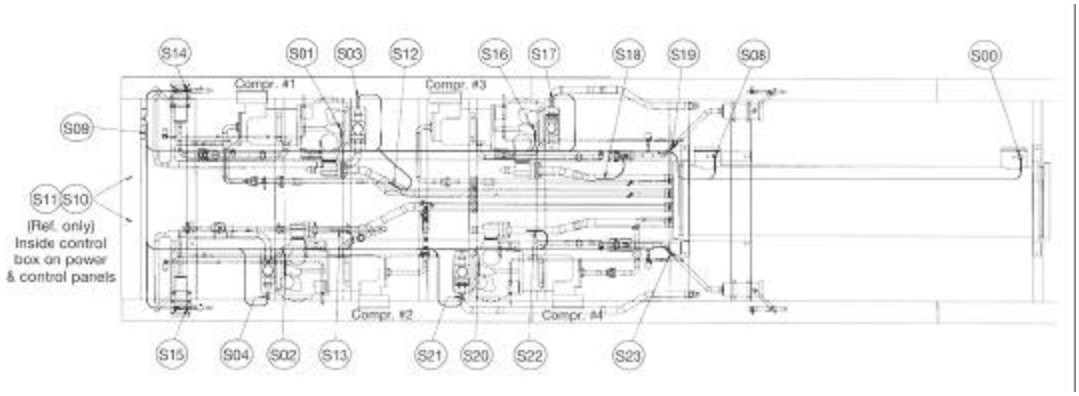


Table 59, Sensor Location, ALS 300 - 425

SENSOR NUMBER	DESCRIPTION	SENSOR NUMBER	DESCRIPTION	SENSOR NUMBER	DESCRIPTION
S00	Evap leaving water temp	S09	Outside air temp	S17	High pressure transducer circ. #3
S01	Low pressure transducer circ. #1	S10	Percent circuit amps circ. #1 & 3	S18	Suction temp circ. #3
S02	Low pressure transducer circ. #2	S11	Percent circuit amps circ. #2 & 4	S19	Liquid line temp circ. #3
S03	High pressure transducer circ. #1	S12	Suction temp circ. #1	S20	Low pressure transducer circ. #4
S04	High pressure transducer circ. #2	S13	Suction temp circ. #2	S21	High pressure transducer circ. #4
S06	Evap water temp reset *(field supplied)*	S14	Liquid line temp circ. #1	S22	Suction temp circ. #4
S07	Demand limit *(field supplied)*	S15	Liquid line temp circ. #2	S23	Liquid line temp circ. #4
S08	Evap entering water temp	S16	Low pressure transducer circ. #3		

Suction temperature circuit #2 - The sensor is located in a well brazed to circuit #2 suction line. The purpose of the sensor is to measure refrigerant temperature to control and maintain proper superheat.

Suction temperature circuit #3 - The sensor is located in a well brazed to circuit #3 suction line. The purpose of the sensor is to measure refrigerant temperature to control and maintain proper superheat.

Suction temperature circuit #4 - The sensor is located in a well brazed to circuit #4 suction line. The purpose of the sensor is to measure refrigerant temperature to control and maintain proper superheat.

Liquid line temperature circuit #1 - The sensor is located in a well brazed to circuit #1 liquid line. It measures the refrigerant temperature and is used to calculate subcooling.

Liquid line temperature circuit #2 - The sensor is located in a well brazed to circuit #2 liquid line. It measures the refrigerant temperature and is used to calculate subcooling.

Liquid line temperature circuit #3 - The sensor is located in a well brazed to circuit #3 liquid line. It measures the refrigerant temperature and is used to calculate subcooling.

Liquid line temperature circuit #4 - The sensor is located in a well brazed to circuit #4 liquid line. It measures the refrigerant temperature and is used to calculate subcooling.

Demand limit - This requires a field connection of a 4-20 milliamp DC signal from a building automation system. It will determine the maximum number of cooling stages which may be energized.

Evaporator water temperature reset - This requires a 4-20 milliamp DC signal from a building automation system or temperature transmitter to reset the leaving chilled water set point.

Percent total unit amps - (optional) this is located in the power side of the control panel. An adjustable voltage resistor and a signal converter board sends a DC signal proportional to the total compressor motor current to the microprocessor.

Liquid presence sensor

Each compressor is equipped with a liquid sensor to assure that liquid flows to the compressor for cooling and sealing during operation. The sensor will shutdown the compressor in the event no liquid is sensed. At start-up the liquid sensor checks for excessive liquid in the compressor and will delay start until the compressor heater transfers the liquid out of the compressor and into the condenser. A trip by this sensor will cause an alarm message on the MicroTech display.

High condenser pressure control

MicroTech is also supplied with high pressure transducers on each refrigerant circuit. Although the main purpose of the high pressure transducer is to maintain proper head pressure control, another purpose is to convey a signal to the MicroTech control to unload the compressor in the event of an excessive rise in discharge pressure to within 20 psi (138 kPa) of the condenser pressure control setpoint of 380 psig (2620 kPa). Also, a MicroTech control setting will not allow additional circuit loading at approximately 30 psi (207 kPa) below the high pressure switch trip setting. The high pressure alarm is in response to the signal sent by the pressure transducer. The high pressure transducer can be checked by elevating discharge pressure (see Mechanical High Pressure Safety Control) and observing the MicroTech display (or a pressure gage), and unit operation as the pressures pass the rising high pressure values noted. After the test reset the High Condenser Pressure alarm set point to 380 psig (2620 kPa).

Mechanical high pressure safety control

The high pressure safety control is a single pole pressure activated switch that opens on a pressure rise. When the switch opens, the control circuit is de-energized dropping power to the compressor and fan motor contactors. The switch is factory made to open at 400 psig (2760 kPa) (+10 psig) and reclose at 300 psig (2070 kPa). Although the high pressure switch will close again at 300 psig (2070 kPa), the control circuit will remain locked out and it must be reset through MicroTech.

The control is mounted on the compressor attached to a fitting ahead of the discharge shut off valve.

Remove wire 133 from terminal 20 of the MicroTech controller. This will disable all but one fan. Observe the cut out point of the control through the MicroTech keypad display, or by means of a service gauge on the back seat port on the discharge service valve. **Important: Closely monitor the High Pressure Control and stay within reach of the emergency stop switch. Do not let the pressure exceed 420 psig (2900 kPa) during the test. If the condenser pressure reaches 420 psig (2900 kPa) open the emergency stop switch.** The MicroTech keypad display may read slightly lower than a service gauge**. Upon completion of the test reset the High Pressure Control back to 380 psig (2620 kPa).**

To check the control on circuit #2 repeat the same procedure after removing wire 233 from terminal 30.

Compressor motor protection

The compressors are supplied with two types of motor protection. Solid state electronic overloads mounted in the control box sense motor current to within 2% of the operating amps. The MUST TRIP amps are equal to 140% of unit nameplate compressor RLA. The MUST HOLD amps are equal to 125% of unit nameplate RLA. A trip of these overloads can result from the unit operating outside of normal conditions. Repeat overload trips under normal operation may indicate wiring or compressor motor problems. The overloads are manual reset and must be reset at the overload as well as through MicroTech.

The compressors also have a solid state Guardister® circuit which provides motor over temperature protection. The Guardister® circuit has automatic reset but must also be reset through MicroTech.

FanTrol head pressure control

FanTrol is a method of head pressure control that automatically cycles the condenser fans in response to condenser pressure. This maintains head pressure and allows the unit to run at all ambient air temperatures within the control design parameters.

All ALS units have independent circuits with the fans being controlled independently by the condensing pressure of each circuit. If one circuit is off all fans on that circuit will also be off. The

use of multiple fans enables the unit to have excellent head pressure control at low outside ambient temperatures by cycling the fans to maintain the compressor discharge pressure within the desired operating band.

At outdoor temperatures above approximately 65°F (18.3°C) all of the fans for a circuit will be operating to achieve the most efficient unit operation. At any compressor load condition of 50% or above the unit has the highest overall efficiency with all fans operating. When the compressor unloads below 50% the last fan stage is cut off because the fan energy saved is more than the increase of compressor power at this light loading. Below approximately 65°F (18.3°C) outdoor temperature the fans are cycled off as needed on each refrigerant circuit by the MicroTech control to maintain the compressor discharge pressure in the optimum range for best unit operation and highest overall efficiency.

MicroTech controls fans in response to the system discharge pressure. The use of MicroTech to stage on the fans as needed allows more precise control and prevents undesirable cycling of fans.

One fan always operates with the compressor and other fans are activated one at a time as needed. The control uses 6 stages of fan control with four outputs to activate up to six additional fans per circuit. MicroTech logic sequences fan contactors to stage one fan at a time. On units with six or seven fans per circuit, a single fan is cut off when two fans are started to achieve adding one operating fan. See Table 60.

Table 60, Fan Staging

ALS070A THRU ALS 080A (FANS PER CKT=3)							
MicroTech fan stage	0	1	2	3	4		
Fan output relay on	-	1	2	1,2	1,2,3		
Total fans operating	1	2	3	4	6		
ALS090A THRU ALS 100A (FANS PER CKT=4)							
MicroTech fan stage	0	1	2	3	4	5	
Fan output relay on	-	1	2	1,2	1,2,3	1,2,3,4	
Total fans operating	1	2	3	4	6	8	
ALS125A THRU ALS140A (FANS PER CKT=5)							
MicroTech fan stage	0	1	2	3	4		
Fan output relay on	-	1	1,2	1,2,3	1,2,3,4		
Total fans operating	1	2	3	4	5		
ALS155A THRU ALS170A (FANS PER CKT=6) (Note 1)							
MicroTech fan stage	0	1	2	3	4	5	
Fan output relay on	-	1	1,2	1,2,3	1,2,4	1,2,3,4	
Total fans operating	1	2	3	4	5	6	
ALS175A THRU 204A (FANS PER CKT=7) (Note 2)							
MicroTech fan stage	0	1	2	3	4	5	6
Fan output relay on	-	1	1,2	1,3	1,2,3	1,3,4	1,2,3,4
Total fans operating	1	2	3	4	5	6	7
ALS205A THRU ALS220A (FANS PER CKT=5)							
MicroTech fan stage	0	1	2	3	4		
Fan output relay on	-	1	1,2	1,2,3	1,2,3,4		
Total fans operating	1	2	3	4	5		
ALS205A THRU ALS220A (FANS PER CKT=6) (Note 3)							
MicroTech fan stage	0	1	2	3	4	5	
Fan output relay on	-	1	1,2	1,2,3	1,2,4	1,2,3,4	
Total fans operating	1	2	3	4	5	6	
ALS235A THRU 280A (FANS PER CKT=7)							
MicroTech fan stage	0	1	2	3	4	5	
Fan output relay on	-	1	1,2	1,2,3	1,2,4	1,2,3,4	
Total fans operating	1	2	3	4	5	6	

(Continued)

(Table 60 Continued)

ALS300A THRU ALS340A (FANS PER CKT=5)							
MicroTech fan stage	0	1	2	3	4		
Fan output relay on	-	1	1,2	1,2,3	1,2,3,4		
Total fans operating	1	2	3	4	5		
ALS360A THRU ALS425A (FANS PER CKT=6)							
MicroTech fan stage	0	1	2	3	4	5	
Fan output relay on	-	1	1,2	1,2,3	1,2,4	1,2,3,4	
Total fans operating	1	2	3	4	5	6	

Notes:

1 On ALS155A thru 170A, two fans are controlled by fan output #4.

2 On ALS175A thru 204A, two fans each are controlled by fan outputs #3 and #4.

3 On ALS205A thru 220A Ckt #3 only and ALS235A thru 280A two fans are controlled by fan output #4.

Each output relay controls one fan except output relay #4 that controls two fans.

MicroTech evaluates several factors to determine the number of fans to be operated. These include:

1. The compressor loading as percent of full load.
2. The minimum lift pressure required at this load (The lift pressure equals the discharge pressure minus the suction pressure.)
3. The addition of a control pressure band to the minimum lift pressure to prevent fan cycling.
4. A target discharge pressure is determined by adding the minimum lift pressure to the suction pressure.

At any operating condition the MicroTech controller will determine the minimum lift pressure and a target discharge pressure, and will add or remove operating fans in sequence until the discharge pressure reaches the target value or falls within the control band of pressure set just above the target pressure value.

Each fan added has a decreasing percentage effect so the control pressure band is smaller when more fans are on and largest with only one or two fans on.

Unit operation, with FanTrol, is satisfactory down to outdoor temperatures of 30°F (-1.1°C). Below this temperature the SpeedTrol option is required to regulate the speed of the first fan on the system to adequately control the discharge pressure. SpeedTrol option allows unit operation to 0°F (-17.8°C) outdoor temperature assuming that no greater than 5 mph wind. If SpeedTrol is used in conjunction with wind baffles and hail guards, the unit can operate down to -10°F (-23°C).

For windy locations operating below 40°F (-1.1°C) outdoor air temperature, wind gusts must be prevented from blowing into the unit coils by either locating the unit in a protected area or by the addition of field supplied wind barriers or by mounting optional factory supplied wind barriers.

FanTrol operation example:

Unit operating at 100% load on both circuits

Suction Pressure = 65 psig (448 kPa)

Minimum lift pressure at 100% load = 12- psig (828 kPa)

Minimum discharge pressure = 65 + 120 psig = 185 psig (1276 kPa)

Discharge pressure control band = 35 psig (241 kPa)

Maximum discharge pressure = 185 + 35 = 220 psig (1517 kPa)

If the discharge pressure is between the minimum of 185 psig (1276 kPa) and maximum of 220 psig (1517 kPa) the fan stages in operation are correct and if the pressure falls outside this range the MicroTech controller will stage fans on or off to bring it within range.

CAUTION

SpeedTrol and FanTrol will provide reasonable operating refrigerant discharge pressures at the ambient temperatures listed for them provided the coil is not affected by the existence of wind. Wind baffles must be utilized for low ambient operation below 40°F if the unit is subjected to winds greater than 5 mph.

Low ambient start

Low ambient start is incorporated into the MicroTech logic. The MicroTech will measure the difference between freezestat and evaporator pressure and determine the length of time the compressor will be allowed to run (to build up evaporator pressure) before taking the compressor off line. The danger of allowing the compressor to run for to long before building up evaporator pressure is that the evaporator could freeze. The low ambient timer setting is determined by the pressure as shown in Table 61. If the low ambient timer is greater than the maximum time allowed the MicroTech will shut off the compressor and display an alarm.

Table 61, Pressure Difference vs. Time to Alarm

PRESSURE DIFFERENCE BETWEEN FREEZESTAT AND EVAPORATOR	TIME (SECONDS)
12 psig (84 kPa)	180
8 psig (56 kPa)	240
4 psig (28 kPa)	300
0 psig (0 kPa)	360

Phase/voltage monitor

The phase/voltage monitor is a device that provides protection against three-phase electrical motor loss due to power failure conditions, phase loss, and phase reversal. Whenever any of these conditions occur, a contact opens to the MicroTech controller (PVR Input) which then de-energizes all inputs.

When proper power is restored, contacts close and MicroTech enables compressors for operation.

When three-phase power has been applied, the output relay should close and the "run light" should come on. If the output relay does not close, perform the following tests.

1. Check the voltages between L1-L2, L1-L3 and L2-L3. These voltages should be approximately equal and within +10% of the rated three-phase line-to-line voltage.
2. If these voltages are extremely low or widely unbalanced check the power system to determine the cause of the problem.
3. If the voltages are within range, use a phase tester to verify that phases are in A, B, C sequence for L1, L2 and L3. Correct rotation is required for compressor operation. If incorrect phase sequence is indicated, turn off the power and interchange any two of the supply power leads at the disconnect switch.

This may be necessary as the phase/voltage monitor is sensitive to phase reversal. Turn on the power. The output relay should now close after the appropriate delay.

Compressor short cycling protection

MicroTech contains logic to prevent rapid compressor restarting. Excessive compressor starts can be hard on starting components and create excessive motor winding temperatures. The anti-cycle timers are set for a five-minute stop-to-start cycle and a 15-minute start-to-start cycle. Both are adjustable through MicroTech.

Optional Controls

SpeedTrol head pressure control (optional)

The SpeedTrol system of head pressure control operates in conjunction with MicroTech's standard head pressure control by modulating the motor speed on fans 11, 21, 31, and 41 in response to condensing temperature. By reducing the speed of the last fan as the condensing pressure falls, the unit can operate at lower ambient temperatures. Start-up with low ambient temperature is improved because the SpeedTrol fans 11, 21,31, and 41 do not start until the condenser pressure builds up.

The SpeedTrol fan motor is a single phase, 208-230/460 volt, thermally protected motor specially designed for variable speed application. The solid-state speed controls SC11, SC21, SC31, and SC41 are accessible through the panel directly above the control box. Units with 575 volt power have a transformer mounted inside the condenser fan compartment to step the voltage down to 230 volts for the SpeedTrol motor.

The SpeedTrol control starts to modulate the motor speed at less than 65°F (18.3°C) and maintains a minimum condensing pressure of 170 to 180 psig (1172 to 1241 kPa) at full circuit load. For part load operation the condensing pressure is allowed to fall below this level.

Reduced inrush (delta-delta) start (optional)

Reduced inrush start is available on all voltage units and consists of a 2-contactor arrangement with a solid state time delay wired in series with the second contactor. Its purpose is to limit current inrush to the compressors upon start-up. As each compressor starts, the power to the coil of the second contactor is delayed for 1 second. With the first compressor contactor energized the windings are connected in series to draw reduced amperage. With the second contactor energized the windings are connected in parallel.

Control checkout is best accomplished by observation as each contactor is pulled in to see that the 1-second delay occurs before the second contactor pulls in.

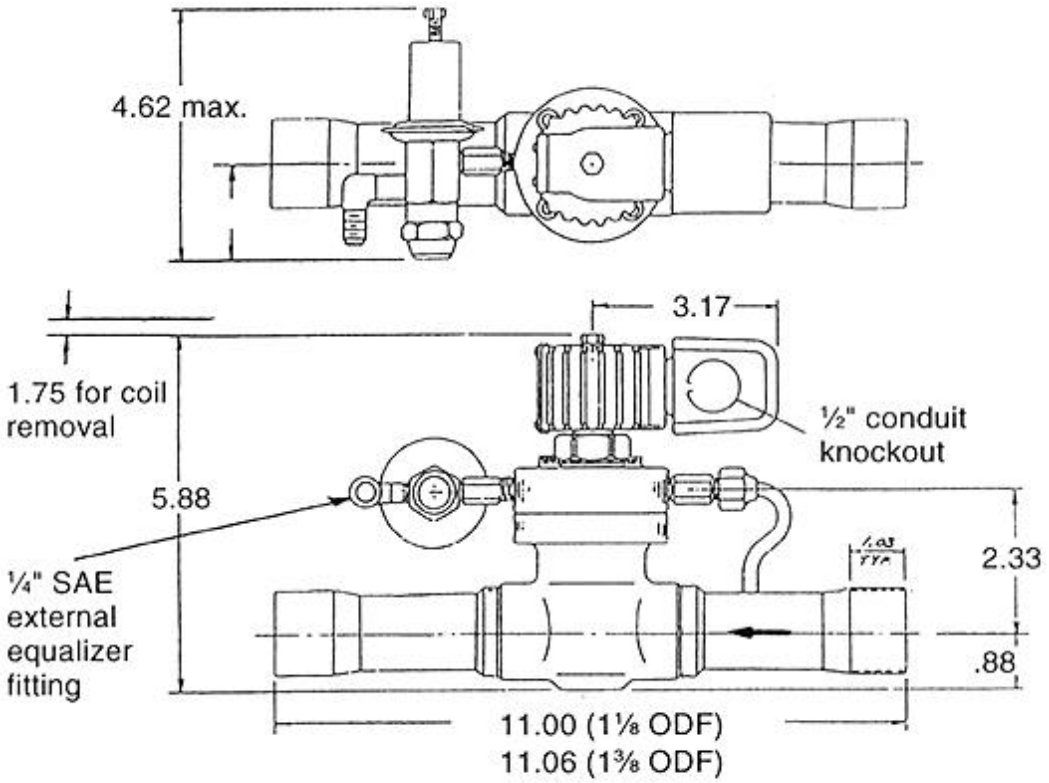
Hot gas bypass (optional)

Hot gas bypass is a system for maintaining evaporator pressure at or above a minimum value that allows continuos operation of the chiller at light load conditions. The purpose of doing this is to keep the velocity of the refrigerant as it passes through the evaporator high enough for proper oil return to the compressor when cooling load conditions are light.

The system consists of a pressure regulating valve with an integral solenoid as shown below. The solenoid valve is factory wired to open whenever the unit thermostat calls for the first stage of cooling. The pressure regulating valve is factory set to begin opening at 58 psig (400 kPa). For low temperature operation the valve must be reset. This setting can be changed with an adjustment nut. To raise the pressure setting, turn the adjustment screw clockwise. To lower the setting, turn the screw counterclockwise. Do not force the adjustment beyond the range it is designed for, as this will damage the adjustment assembly.

With the unit operating at 50% or lower circuit load the regulating valve opening can be determined. The regulating valve opening point can be determined by slowly reducing the system load or throttling the ball valve on the liquid line at the entrance to the evaporator. Observe the suction pressure with refrigerant gauges when the hot gas bypass valve cuts in. A slower but alternate method would be to lower the outlet water temperature to a value where the hot gas bypass valve starts to open. When the bypass valve starts to open, the refrigerant line on the evaporator side of the valve will begin to feel warm to the touch.

Figure 40, Hot Gas Bypass Piping



Controls, Settings and Functions

Table 62, Controls

DESCRIPTION	FUNCTION	SYMBOL	SETTING	RESET	LOCATION
Compressor Heaters	To provide heat to drive off liquid refrigerant when compressor is off.	HTR1,2,3,4	On, when compressor is off.	N/A	On the Compressor
Compressor Solenoid - Top	In circuit 1,2,3 and 4 energizes to load 50% of compressor capacity.	CS11,21, 31,41	N/A	N/A	On the Compressor
Compressor Solenoid - Bottom	In circuit 1,2,3 and 4 energizes to unload 25% of compressor capacity.	CS12,22, 32,42	N/A	N/A	On the Compressor
Compressor Solenoid - Bottom	In circuit 1,2,3 and 4 energizes to load 25% of compressor capacity.	CS13,23, 33,43	N/A	N/A	On the Compressor
Evaporator Heater	Coiled around the evaporator to prevent freezing the water inside.	HTR5	38°F (3.3°C)	N/A	On the Cooler
Electronic Expansion Valve Board	To provide power and step control to the EXV stepper motors commanded by the MCB250.	EXV (Bd)	N/A	N/A	Control Box
Electronic Expansion Valve	To provide efficient unit refrigerant flow and control superheat.	EXV	In Controller Code	N/A	On the Compressor main liquid line
Gardister Relay	To provide motor temperature protection at about 220°F (104°C).	GD1,2,3,4	None, Inherent in design	Auto	Control Box
Liquid Presence Sensor	To protect compressor from starting with liquid or running without liquid.	LPS1,2,3,4	400 psig (2760 kPa)	Auto	On the Compressor
Mechanical High High Pressure Switch	For UL, ETL, etc…safety code to prevent high pressure above the relief valve.	MHPR1,2,3,4	Refer to IM 549	Auto	Control Box
MicroTech Unit Controller	To control unit and all safeties. Refer to IM 549.	MCB250	N/A	Refer to IM 549	Control Box
Motor Protector Relay	To provide voltage isolation to the input board (ADI).	MPR1,2,3,4	Defined by application	Auto	Control Box
Overloads (Compressor)	to protect the compressor motor from over heating due to high amps.	OL1-8	N/A	Manual	Control Box
Phase Voltage Monitor	to prevent reverse rotation of the motor and protect it from under/over voltage.	PVM1,2,3,4	N/A	Auto	Control Box
Reduced Inrush Time Delay	To provide 1 sec delay for reduced inrush.	TD5,6,7,8	Set 4Vdc for full load amps	N/A	Control Box
Signal Converter	To convert AC current signal volts to DC volts.	SIG.Con V (SC)	0-75 psig (0-517 kPa)	N/A	Control Box
Solenoid Valve Hot Gas Bypass	To allow the unit to run with very low load.	SV5,6,9		N/A	Discharge LIne
Solenoid Valve Liquid Line	To provide a positive shut off of liquid refrigerant when power is lost.	SV1,2,7	N/A	N/A	Liquid Line
Solenoid Valve Liquid Injection	To only allow liquid injection when the compressor is running.	SV3,4,8	N/A	N/A	On Compressor Liquid Injection
SpeedTrol Head Pressure Control	To provide more uniform head pressure control.	SC11,21, 31,41	N/A	N/A	Above Control Box
Surge Capacitor	To protect from high voltage spikes and surges.	C1,2,3,4	N/A	N/A	Control Box Power Side

Notes: Symbol column shows application components for four-compressor units. For two and three compressor units, not all components are applicable

Troubleshooting Chart

Table 63, Troubleshooting

PROBLEM	POSSIBLE CAUSES	POSSIBLE CORRECTIVE STEPS
Compressor will not run.	1. Main power switch open. 2. Unit S1 system switch open. 3. Circuit switch PS1, PS2, PS3, PS4 in pumpdown position. 4. Evap flow switch not closed. 5. Circuit breakers open. 6. Fuse blown or circuit breakers tripped. 7. Unit phase voltage monitor not satisfied. 8. Compressor overload tripped. 9. Defective compressor contactor or contactor coil. 10. System shut down by safety devices. 11. No cooling required. 12. Motor electrical trouble. 13. Loose wiring.	1. Close switch. 2. Check unit status on MicroTech display. Close switch. 3. Check circuit status on MicroTech display. Close switch. 4. Check unit status on MicroTech display. Close switch. 5. Close circuit breakers. 6. Check electrical circuits and motor windings for shorts or grounds. Investigate for possible overloading. Check for loose or corroded connections. Reset breakers or replace fuses after fault is corrected. 7. Check unit power wiring to unit for correct phasing. Check voltage. 8. Overloads are manual reset. Reset overload at button on overload. Clear alarm on MicroTech. 9. Check wiring. Repair or replace contactor. 10. Determine type and cause of shutdown and correct problem before attempting to restart. 11. Check control settings. Wait until unit calls for cooling. 12. See 6,7,8 above. 13. Check circuits for voltage at required points. Tighten all power wiring terminals
Compressor Noisy or Vibrating	1. Compr. Internal problem. 2. Liquid injection not adequate.	1. Contact McQuayService. 2. Check to assure liquid line sightglass is full during steady operation.
Compressor Overload Relay Tripped or Circuit Breaker Trip or Fuses Blown	1. Low voltage during high load condition. 2. Loose power wiring. 3. Power line fault causing unbalanced voltage. 4. Defective or grounded wiring in the motor. 5. High discharge pressure.	1. Check supply voltage for excessive voltage drop. 2. Check and tighten all connections. 3. Check supply voltage. 4. Check motor and replace if defective. 5. See corrective steps for high discharge pressure.
Compressor Will Not Load or Unload	1. Defective capacity control solenoids. 2. Unloader mechanism defective.	1. Check solenoids for proper operation. See capacity control section. 2. Replace.
Compressor Liquid Injection Protection Trip	1. Liquid injection solenoid did not open at start. 2. Inadequate liquid to liquid injection at start due to a clogged filter drier or low charge. 3. Inadequate liquid to liquid injection during run.	1. Check and replace liquid injection solenoid. 2. Check liquid injection line sight glass. If flashing check filter drier and unit charge. 3. Check liquid injection line sightglass. If flashing check filter-drier and unit charge. Discharge pressure too low. Protect condenser coil from wind.
High Discharge Pressure	1. Discharge shutoff valve partially closed. 2. Noncondensables in the system. 3. Fans not running.	1. Open shutoff valve. 2. Purge the noncondensables from the condenser coil after shutdown. 3. Check fan fuses and electrical circuits.

High Discharge Pressure	4. Fan control out of adjustment. 5. System overcharged with refrigerant. 6. Dirty condenser coil. 7. Air recirculation from outlet into unit coils. 8. Air restriction into unit.	4. Check that unit setup in MicroTech matches the unit model number. Check MicroTech condenser pressure sensor for proper operation. 5. Check for excessive subcooling above 30oF (-1.1oC). Remove the excess charge. 6. Clean the condenser coil. 7. Remove the cause of recirculation. 8. Remove obstructions near unit.
Low Discharge Pressure	1. Wind effect a low ambient temperature. 2. Condenser fan control not correct. 3. Low section pressure. 4. Compressor operating unloaded.	1. Protect unit against excessive wind into vertical coils. 2. Check that unit setup in MicroTech matches the unit model number. Check SpeedTrol fan on units with SpeedTrol option. 3. See corrective steps for low suction pressure. 4. See corrective steps for failure to load.
Low Suction Pressure	1. Inadequate refrigerant charge quantity. 2. Inadequate liquid to liquid injection at start. Clogged liquid line filter-drier. 3. Expansion valve malfunctioning. 4. Insufficient water flow to evaporator. 5. Water temperature leaving evaporator is too low. 6. Evaporator tubes fouled. 7. Evaporator head ring gasket slippage. 8. Glycol in chilled water system	1. Check liquid line sightglass. Check unit for leaks. Repair and recharge to clear sightglass. 2. Check pressure drop across filter-drier. Replace cores. 3. Check expansion valve superheat and valve opening position. Replace valve only if certain valve is not working. 4. Check water pressure drop across the evaporator and adjust gpm. 5. Adjust water temperature to higher value. 6. Inspect by removing water piping. Clean chemically. 7. Low suction pressure and low superheat both present may indicate an internal problem. Consult factory. 8. Check glycol concentration
High Suction Pressure	1. Excessive load - high water temperature. 2. Compressor unloaders not loading compressor. 3. Superheat is too low.	1. Reduce load or add additional equipment. 2. See corrective steps below for failure of compressor to load. 3. Check superheat on MicroTech display. Check suction line sensor installation and sensor.

Periodic Maintenance Log

Date of inspection: _____ Address: _____

Facility/job name: _____ City/State: _____

Unit Model number: _____ Physical location of unit: _____

Unit serial number: _____ Service technical (name): _____

Software identification: _____

Operating hours: (Menu #10) Compressor #1 _____ Compressor #2 _____ Compressor #3 _____ Compressor #4 _____

Number of starts: (Menu #11) Compressor #1 _____ Compressor #2 _____ Compressor #3 _____ Compressor #4 _____

Follow up service required: Yes ☐ No ☐

General Actions To Be Taken:

Upper part of report completed: Yes ☐ No ☐ Fill in above

Compressor operation:	Yes	No	Explain all "No" checks
1. Mechanical operation acceptable (noise, vibration, etc.)?	☐	☐	
2. Look at cycling and cooling, is unit controlling at set points?	☐	☐	
3. No refrigerant leaks (full liquid sightglass)?	☐	☐	
4. Liquid line moisture indicator shows dry system?	☐	☐	
5. Proper condensing fan operation?	☐	☐	
6. Condenser coil clean?	☐	☐	
7. No corrosion or paint problems?	☐	☐	
Compressor electrical operation:			
8. Satisfactory electrical operation?	☐	☐	
9. MicroTech hardware operation satisfactory?	☐	☐	
10. MicroTech software operation satisfactory?	☐	☐	

Data From MicroTech:

11. Unit status _____%
12. Circuit Status 1 ____% Capacity Circuit Status 2 ____% Capacity Circuit Status 3 ____% Capacity Circuit Status 4 ____% Capacity
13. Water temperature - Evaporator: Entering/Leaving _____/_____

	Circuit #1	Circuit #2	Circuit #3	Circuit #4
14. No. of fan states active:				
15. Evaporator pressure:				
16. Condenser pressure:				
17. EXV position – Steps open or percent open:				
18. Superheat:				
19. Subcooling:				
20. Liquid line temperature:				
21. Chiller % rated load amps – Unit:				
22. Outside air temperature:				
23. Leaving evaporator set point temperature:				

24. Reset option programmed? Yes ☐ No ☐ Ice storage unit? Yes ☐ No ☐
25. Is SpeedTrol included? Yes ☐ No ☐ SpeedTrol operation OK? Yes ☐ No ☐
26. Current alarm: ___ ___ ___ Circuit #1 _____ Circuit #2 _____ Circuit #3 _____ Circuit #4 _____
27. Previous alarm – Show all:

	Alarm Type	Date		Alarm Type	Date
Circuit #1			Circuit #2		
Circuit #3			Circuit #4		

Data At Job Site:

28. Volts: L1 _____ L2 _____ L3 _____
29. Amps: Comp #1 Ph 1 ____ Ph 2 ____ Ph 3 ____ Comp#2 Ph 1 ____ Ph 2 ____ Ph 3 ____
30. Amps: Comp #3 Ph 1 ____ Ph 2 ____ Ph 3 ____ Comp#4 Ph 1 ____ Ph 2 ____ Ph 3 ____
31. Vibration – Read every six months using IRD (or equal) unfiltered at flat on top of motor end:
_____ In/Sec Comp #1
_____ In/Sec Comp #2
_____ In/Sec Comp #3
_____ In/Sec Comp #4

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