Installation, Operation and Maintenance Manual	IOMM ACZ/AGZ-2
	Group: **Chiller**
	Part Number: **074644102**
	Effective: **June 2002**
	Supersedes: **IOMM ACZ/AGZ-1**

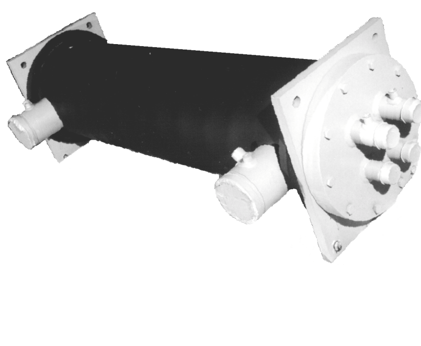
AIR-COOLED, SCROLL COMPRESSOR, SPLIT SYSTEMS

Chiller w/ Remote Evaporator, AGZ 035AM-050AM

Condensing Units, ACZ 045A-055A

DX Evaporators, CDE

60 Hertz, R-22
Global Chiller Line



McQuay®
Air Conditioning

Table of Contents

Our facility is **ISO9002 Certified**

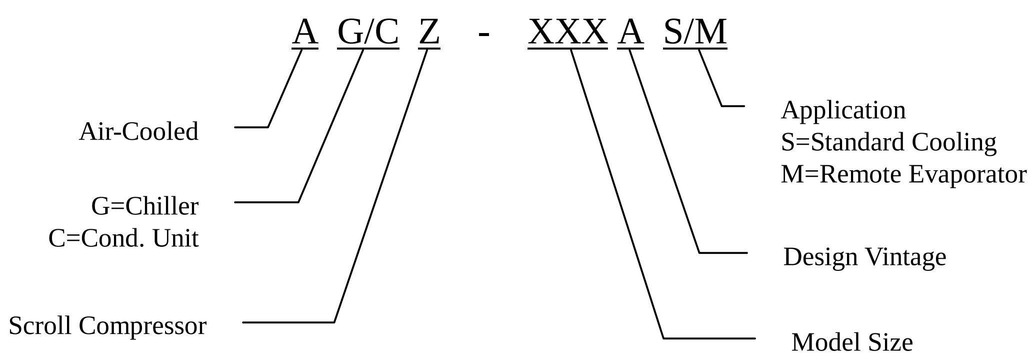
Introduction

IMPORTANT INFORMATION

This Installation and Operating Manual contains information on three different McQuay product lines

- **Model AGZ-AM** This is a split packaged chiller consisting of an outdoor unit and an evaporator shipped loose for remote mounting. Liquid line specialties are field supplied and mounted. Capacity control is either Johnson UNT or McQuay's MicroTech Control. The outdoor unit is basically the same as an ACZ condensing unit, the difference being in how it is packaged and in the control furnished.
- **Model ACZ** This is an air-cooled condensing unit for use with a remote evaporator, typically a water chiller or DX coil. No capacity control is supplied, nor are any liquid line specialties nor evaporator.
- **Model CDE** This is a DX water chiller that can be used in conjunction with the Model ACZ condensing unit. No controls or specialties are included.

Nomenclature



Inspection

Check all items carefully against the bill of lading. Inspect all units for damage upon arrival. Report shipping damage and file a claim with the carrier. Check the unit name plate before unloading, making certain it agrees with the power supply available. McQuay is not responsible for physical damage after unit leaves the factory.

Note: Unit shipping and operating weights are available in the Physical Data tables beginning on page 18.

Installation

Note: Installation is to be performed by qualified personnel who are familiar with local codes and regulations.

> ⚠ **WARNING**
>
> Sharp edges and coil surfaces are a potential hazard. Avoid contact with them.

Handling

Be careful to avoid rough handling of the unit. Do not push or pull the unit from anything other than the base. Block the pushing vehicle away from the unit to prevent damage to the sheet metal cabinet and end frame (see Figure 1).

To lift the unit, 2 1/2" (64mm) diameter lifting holes are provided in the base of the unit. Arrange spreader bars and cables to prevent damage to the condenser coils or cabinet (see Figure 2).

Figure 1, Suggested Pushing Arrangement

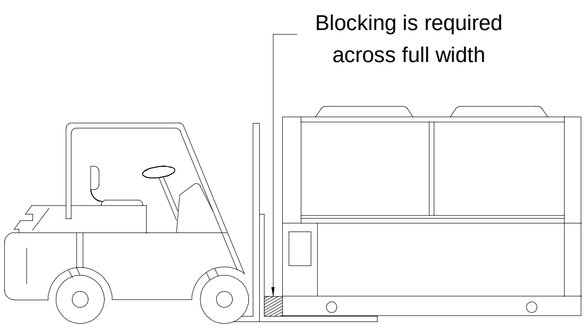
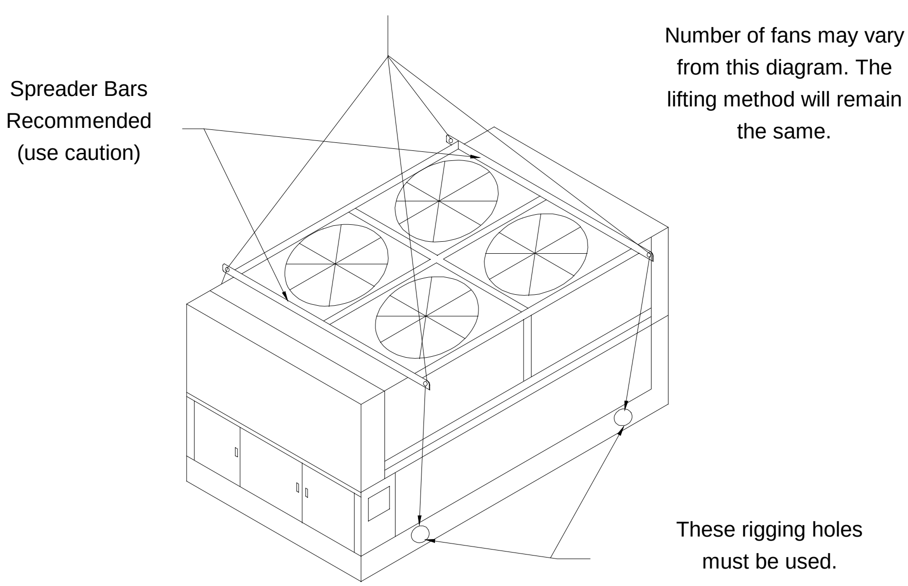


Figure 2, Suggested Lifting Arrangement



Location

Unit Placement

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

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

The remote evaporator on the AGZ-AM can be mounted indoors, or if precautions against freeze-up are taken where subjected to below freezing temperatures, can be mounted outdoors It is equipped with a heating element.

Clearances

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

Install the unit with enough side clearance for air entrance to the coil and for servicing. Provide service access to the evaporator, compressors, electrical control panel and piping components as shown in Figure 3.

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

Sound Isolation

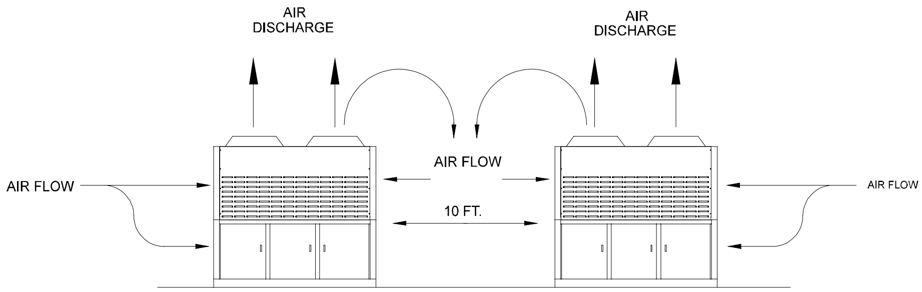
The ultra-low sound levels of the AGZ outdoor unit and the ACZ condensing unit is suitable for most applications. When additional sound reduction is necessary, locate the unit away from sound sensitive areas. Avoid locations beneath windows or between structures where normal operating sounds may be objectionable. Reduce structurally transmitted sound by isolating water lines, electrical conduit and the unit itself. Use wall sleeves and rubber isolated piping hangers to reduce transmission of water or pump noise into occupied spaces. Use flexible electrical conduit to isolate sound transmission through electrical conduit. Spring isolators are effective in reducing the low amplitude sound generated by scroll compressors and for unit isolation in sound sensitive areas.

Service Access

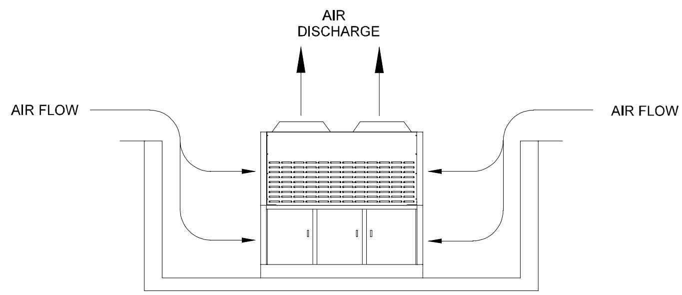
Each end of the unit must be accessible after installation for periodic service. Compressors, filter-driers, and manual liquid line shutoff valves are accessible. The high pressure control is located in the control panel when using the Global UNT controller, and on the compressor when using the MicroTech controller. Low pressure, and motor protector controls are on the compressor. Most other operational, safety and starting controls are located in the unit control box.

The condenser fan and motors can be removed from the top of the unit.

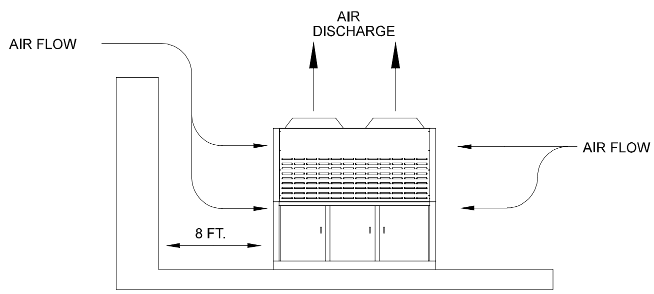
Figure 3, Clearance Requirements



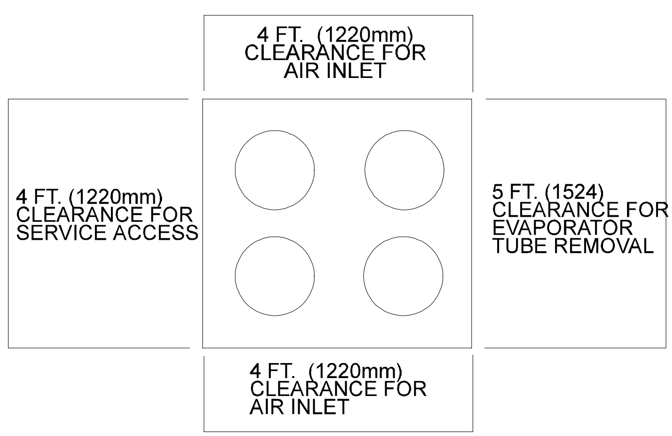
The recommended minimum side clearance between two units is 10 feet (3048mm). Distance less than 10 feet (3048mm) can result in air recirculation.



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



The minimum clearance to a side wall or building taller than the Unit height is 6 feet (1828mm) provided no solid wall above 6 feet (1830mm) tall is closer than 8 feet (2438mm) to the opposite Side of the unit. (consult factory for special situations.)



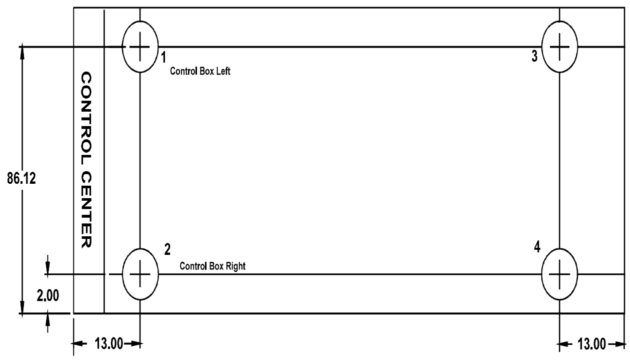
Vibration Isolators

Vibration isolators are recommended for all roof mounted installations or wherever vibration transmission is a consideration.

Table 1 and Table 2 list isolator point loads for all unit sizes, Figure 4 shows isolator locations. See Dimensional Data for detailed dimensions required to secure each isolator to the mounting surface.

The spring flex isolators are white type CP2-32, McQuay part number 047792932. A total of four per unit is required.

Figure 4, Isolator Locations



Spring Isolator Dimensions

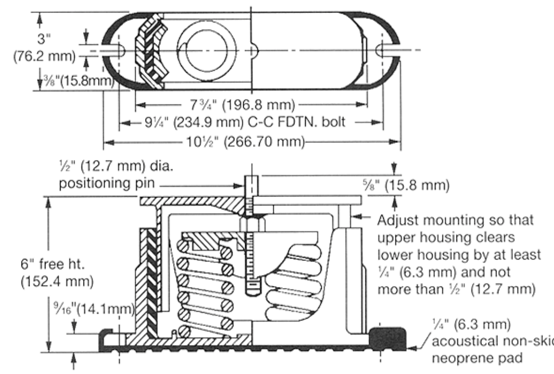


Table 1 , Isolator Loads At Each Mounting Location With Aluminum Fins

ACZ Size	AGZ-AM Size	1		2		3		4		Total Unit	
		lb	kg	lb	kg	lb	kg	lb	kg	lb	kg
030A	-	838	380	944	428	773	351	870	395	3425	1554
035A	030AM	838	380	944	428	773	351	870	395	3425	1554
040A	035AM	850	386	960	435	785	356	885	401	3480	1579
045A	040AM	864	392	974	442	797	362	900	408	3535	1603
050A	045AM	928	421	1048	475	858	389	966	438	3800	1724
055A	050AM	940	426	1062	482	868	394	980	445	3850	1746

Table 2, Isolator Loads At Each Mounting Location With Copper Fins

ACZ Size	AGZ-Am Size	1		2		3		4		Total Unit	
		lb	kg	lb	kg	lb	kg	lb	kg	lb	kg
030A	-	946	429	1066	484	873	396	985	447	3870	1755
035A	030AM	946	429	1066	484	873	396	985	447	3870	1755
040A	035AM	960	435	1082	491	886	402	997	452	3925	1780
045A	040AM	973	441	1096	497	899	408	1012	459	3980	1805
050A	045AM	1038	471	1170	531	958	435	1079	489	4245	1926
055A	050AM	1050	476	1184	537	970	440	1091	495	4295	1948

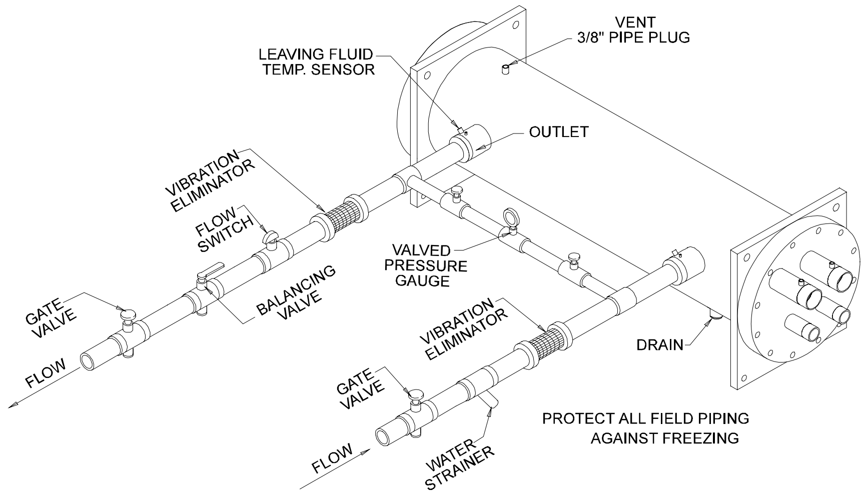
Water Piping

Local authorities can supply the installer with the proper building and safety codes required for safe and proper installation.

Install piping with minimum bends and changes in elevation to minimize pressure drop. Consider the following when installing water piping:

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. Install drains at the lowest points in the system.
4. A means of maintaining adequate system water pressure (expansion tank or regulating valve).
5. Temperature and pressure indicators located at the unit to aid in unit servicing.
6. A strainer or other means of removing foreign matter from the water before it enters the pump. Place the strainer 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 keep system performance up.
7. Place a strainer in the water line just before the inlet of the evaporator. This will help prevent foreign material from entering and decreasing the performance of the evaporator.
8. The remote shell-and-tube evaporator has a thermostat and heating cable to prevent freeze-up down to -20°F (-29°C). It is suggested that the heating cable be used and wired to a separate 110V supply circuit should the evaporator be located in an area subject to freezing temperatures. If used, all 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, flush the system thoroughly before unit installation. Regular water analysis and chemical water treatment for the evaporator loop is recommended immediately at equipment start-up.
10. The total water volume in the system should be sufficient to prevent frequent “on-off” cycling. Turnover rate should not be less than 15 minutes for normal variable cooling loads. Turnover rate for process cooling or a constant load, should not be less than 6 minutes.
11. When glycol is added to the water system for freeze protection, the refrigerant suction pressure will be lower, cooling performance less, and water side pressure drop greater. If the percentage of glycol is high, or if propylene is used instead of ethylene glycol, the added pressure drop and loss of performance could be substantial. Reset the freezestat and low leaving water alarm temperatures. The freezestat is factory set to default at 36°F (2.2°C). Reset the freezestat setting to approximately 4 to 5 degrees F (2.3 to 2.8 degrees C) below the leaving chilled water setpoint temperature. See the section titled “Glycol Solutions” for additional information concerning glycol.
12. Perform a preliminary leak check before insulating the piping and filling the system.
13. Piping insulation should include a vapor barrier to prevent condensation and possible damage to the building structure.

Figure 5, Typical Evaporator Field Water Piping



Flow Switch

Mount a water flow switch in either the entering or leaving water line to shut down the unit when water flow is interrupted.

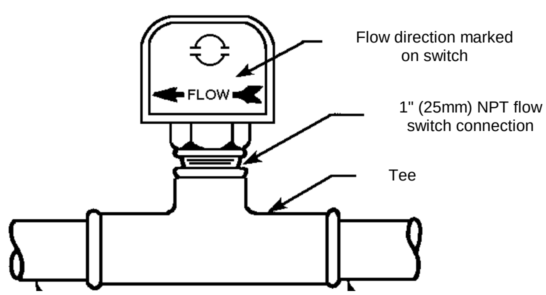
A flow switch is available from McQuay (part number 017503300). It is a "paddle" type switch and adaptable to any pipe size from 3" (76mm) to 8" (203mm) nominal. Certain minimum flow rates are required to close the switch and are listed in Table 3. Installation should be as shown in Figure 6. Connect the normally open contacts of the flow switch in the unit control center at terminals 5 and 6. There is also a set of normally closed contacts on the switch that can be used for an indicator light or an alarm to indicate when a "no flow" condition exists. Freeze protect any flow switch that is installed outdoors.

NOTE: Differential pressure switches are not recommended for outdoor installation.

Table 3, Flow Switch Minimum Flow Rates

NOMINAL PIPE SIZE INCHES (mm)	MINIMUM REQUIRED FLOW TO ACTIVATE SWITCH - GPM (L/S)
1 (25.4)	6.00 (0.38)
1 1/4 (31.8)	9.80 (0.62)
1 1/2 (38.1)	12.70 (0.80)
2 (50.8)	18.80 (1.20)
2 1/2 (63.50	24.30 (1.50)
3 (76.20	30.00 (1.90)
4 (101.6)	39.70 (2.50)
5 (127.0)	58.70 (3.70)
6 (152.4)	79.20 (5.00)

Figure 6, Flow Switch Installation



Glycol Solutions

The use of a glycol/water mixture in the CDE evaporator to prevent freezing will reduce system capacity and efficiency and increase pressure drop. The system capacity, required glycol solution flow rate, and pressure drop with glycol may be calculated using the following formulas and Table 4 and Table 5.

***Note:** The procedure does not specify the type of glycol. Use the derate factors found in Table 4 for corrections when using ethylene glycol and those in Table 5 for propylene glycol.*

1. **Capacity** – Multiply the capacity based on water by the *Capacity* correction factor from or Table 4 and Table 5 to
2. **Flow** – Multiply the water evaporator flow by the *Flow* correction factor from and Table 4 or Table 5 determine the increased evaporator flow due to glycol

   If the flow is unknown, it can be calculated from the following equation:

   $$Glycol\ \ Flow\,(gpm) = \frac{24 \times Tons\ Capacity\,(glycol)}{Delta - T} \times Flow\ Correction\ Factor$$

   For Metric Applications – Use the following equation for metric applications:

   $$\text{Glycol Flow (l/s)} = \frac{kW\ Capacity}{4.18 \times Delta - T} \times Flow\ Correction\ Factor$$

3. **Pressure drop** -- Multiply the water pressure drop from Figure 7 by *Pressure Drop* correction factor from Table 4 or Table 5 to obtain corrected glycol pressure drop. High concentrations of propylene glycol at low temperatures may cause unacceptably high pressure drops.
4. **Power** -- Multiply the water system power by *Power* correction factor from Table 4 or Table 5.

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. It is recommended that a minimum of 25% solution by weight be used for protection against corrosion.

CAUTION

Do not use an automotive grade antifreeze. Industrial grade glycols must be used. Automotive antifreeze contains inhibitors which 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 4, Ethylene Glycol Correction Factors

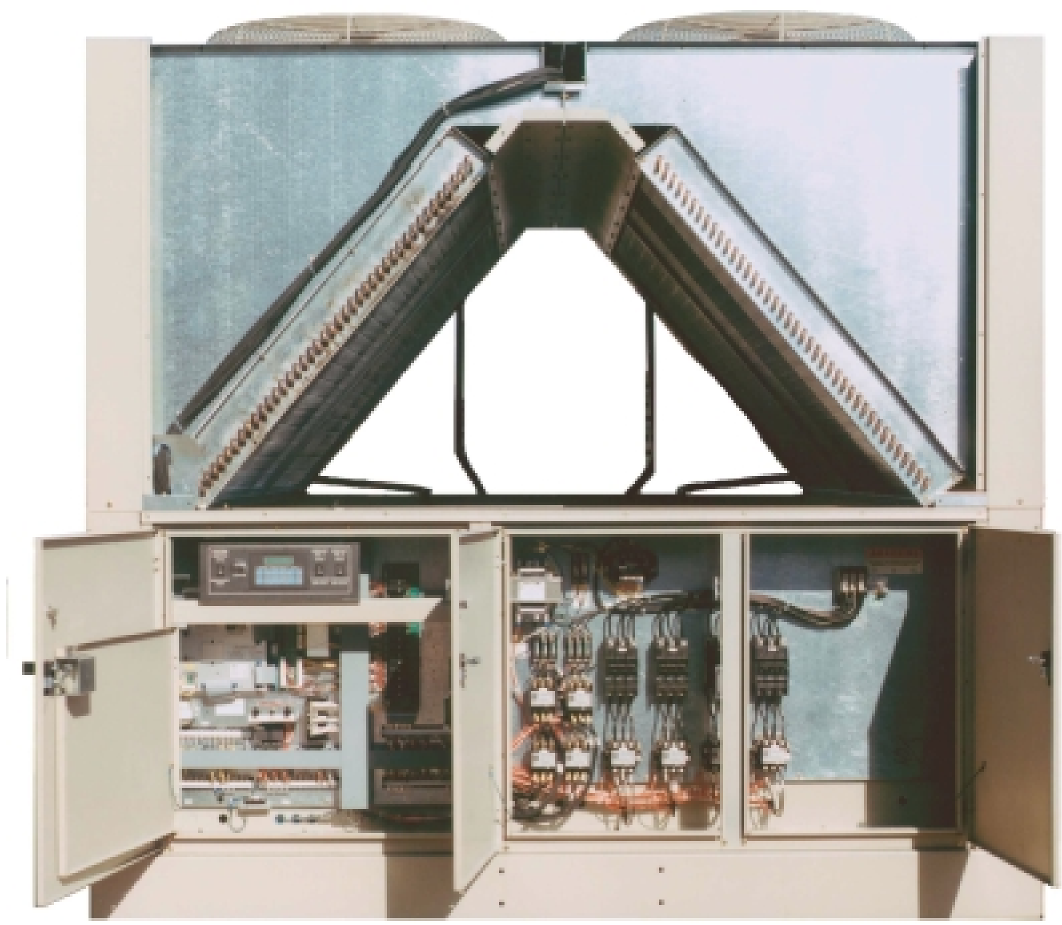
% E.G.	Freeze Point		Capacity	Power	Flow	Pressure Drop
	°F	°C				
10	**26**	**-3**	**0.991**	**0.996**	**1.013**	**1.070**
20	**18**	**-8**	**0.982**	**0.992**	**1.040**	**1.129**
30	**7**	**-14**	**0.972**	**0.986**	**1.074**	**1.181**
40	**-7**	**-22**	**0.961**	**0.976**	**1.121**	**1.263**
50	**-28**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

Table 5, Propylene Glycol Correction Factors

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

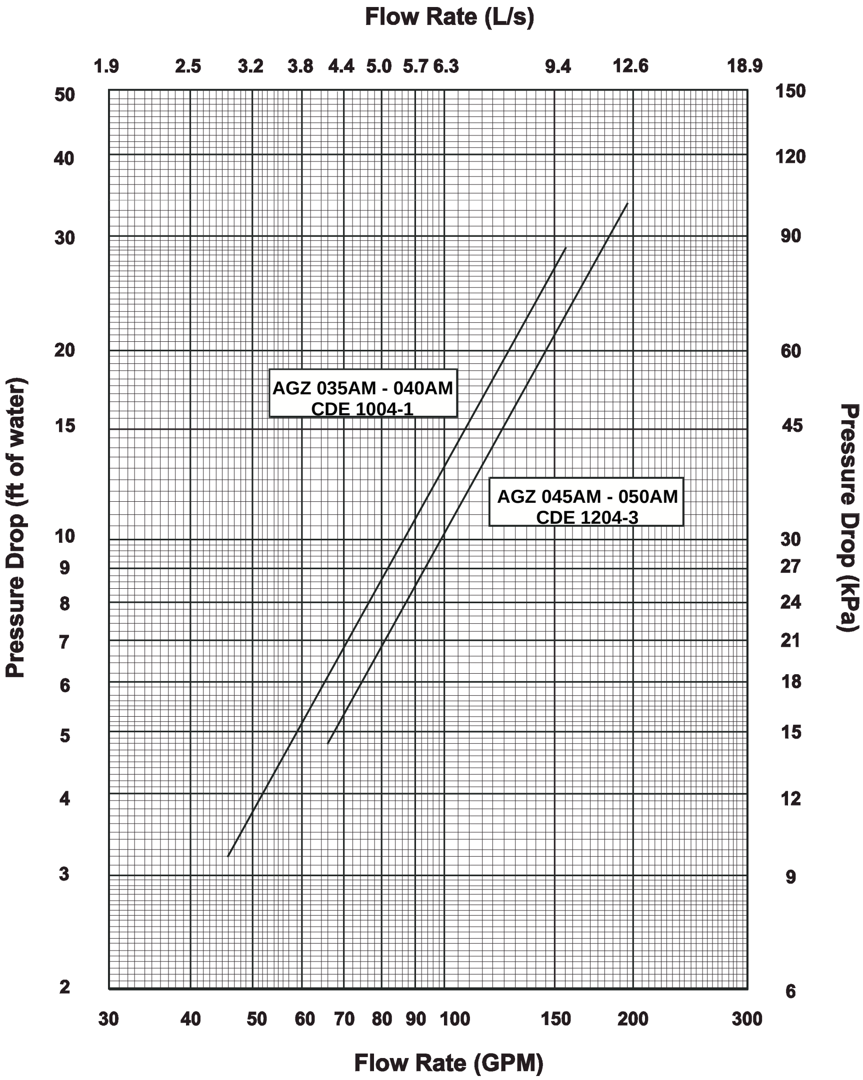
Table 6, Capacity and Power Derates

ALTITUDE	Chilled Water Delta-T		Fouling Factor					
			0.00025 (0.044)		0.00075 (0.132)		0.00175 (0.308)	
	°F	°C	Cap.	kW	Cap.	kW	Cap.	kW
SEA LEVEL	6	3.3	0.992	0.995	0.996	0.982	0.911	0.935
	8	4.4	0.995	0.997	0.969	0.984	0.914	0.937
	10	5.6	1.000	1.000	0.975	0.986	0.919	0.939
	12	6.7	1.005	1.002	0.980	0.989	0.923	0.941
	14	6.8	1.010	1.005	0.985	0.991	0.928	0.943
	16	8.9	1.014	1.007	0.989	0.993	0.930	0.944
2000 ft. 610 m	6	3.3	0.978	1.005	0.957	0.990	0.903	0.943
	8	4.4	0.982	1.007	0.961	0.993	0.905	0.945
	10	5.6	0.986	1.009	0.965	0.995	0.909	0.947
	12	6.7	0.992	1.011	0.970	0.998	0.914	0.949
	14	6.8	0.997	1.014	0.973	1.001	0.919	0.952
	16	8.9	1.000	1.016	0.975	1.002	0.921	0.953
4000 ft. 1220 m	6	3.3	0.966	1.016	0.944	0.999	0.894	0.951
	8	4.4	0.969	1.018	0.947	1.001	0.896	0.953
	10	5.6	0.973	1.021	0.952	1.005	0.900	0.956
	12	6.7	0.978	1.025	0.956	1.008	0.904	0.958
	14	6.8	0.982	1.027	0.959	1.011	0.909	0.960
	16	8.9	0.986	1.028	0.961	1.015	0.911	0.961
6000 ft. 1830 m	6	3.3	0.953	1.025	0.930	1.009	0.884	0.961
	8	4.4	0.955	1.028	0.934	1.011	0.887	0.962
	10	5.6	0.959	1.031	0.939	1.013	0.890	0.964
	12	6.7	0.963	1.034	0.942	1.017	0.895	0.966
	14	6.8	0.968	1.036	0.946	1.020	0.899	0.968
	16	8.9	0.972	1.037	0.949	1.024	0.902	0.969



AGZ-AM with Upper Panels Removed

Figure 7, Pressure Drop Curve



CDE Unit Size	AGZ-AM Unit Size	NOMINAL			MAXIMUM			MINIMUM		
		Pressure Drop	Flow		Pressure Drop	Flow		Pressure Drop	Flow	
		(ft) of Water	(gpm)	(lps)	(ft) of Water	(gpm)	(lps)	(ft) of Water	(gpm)	(lps)
1004-1	035AM	9.2	82	5.17	23.1	137	8.62	3.9	51	3.23
x	040AM	11.5	93	5.87	28.8	155	9.78	4.9	58	3.67
1204-3	045AM	11.2	106	6.69	28.2	177	11.15	4.8	66	4.18
x	050AM	13.4	117	7.38	33.6	195	12.30	5.7	73	4.61

Minimum and maximum flows are established to ensure the Delta-T for each unit size falls within the 6 - 16°F range for proper unit control.

Evaporator Flow and Pressure Drop

Evaporator flow rate must fall between the minimum and maximum values shown in the evaporator pressure drop table on Figure 7.

Measure the chilled water pressure drop through the evaporator at factory installed pressure taps. It is important not to include the effect of valves or strainers in these readings.

Varying chilled water flow through the evaporator while the compressor(s) are operating is not recommended.

Refrigerant Piping

Introduction

Proper refrigerant piping can represent the difference between a reliable, trouble free system and months or years of inefficient, problematic performance.

System concerns related to piping are:

1. Refrigerant pressure drop
2. Solid liquid feed to the expansion valve(s)
3. Continuous oil return

The most important and least understood is number 3. "Continuous oil return". The failure of oil to return at or close to the rate of displacement from the compressor can result in oil trapping and ultimate compressor failure.

On the other hand, the instantaneous return of a large volume of compressor oil (slug) can be equally damaging to a compressor.

All compressors displace some oil during operation. Reciprocating compressors displace more than centrifugals, scroll and McQuay screw compressors. Oil is carried into compressor cylinders with suction gas; and that same gas entrains oil present on cylinder walls as it is being compressed. The sum of the two is then pumped into the discharge piping.

More oil is displaced at compressor start-up than during the normal running periods. If a compressor experiences excessive starts because of recycling pumpdown control, the oil may be pumped out and trapped in the condenser with the refrigerant charge. This oil may not return regardless of the adequacy of the piping system.

A similar problem to a lesser extent occurs when the equipment is oversized for the available cooling load.

In short, extreme care should be exercised to assure that both piping and controls are suitable for the application such that displaced oil is returned to the compressor moderately. Note that oil loss to the system can be due to a hang up in the evaporator, as well as in the piping.

Suction Lines

McQuay recommends the use of ASHRAE for guidelines in sizing and routing piping with one exception. See the 1998 ASHRAE Handbook Refrigeration Edition, Chapter 2 for tables and guidelines. The single exception is to the piping of direct expansion cooling coils located above the compressors. In all cases, regardless of whether the equipment has pumpdown control or not, a trap in the suction line equal to the height of the coil section is recommended. In its absence, upon a power failure, all of the liquid in the coil will fall by gravity to the compressor below.

Suction line gas velocities may range between 900 and 4000 feet per minute. Consideration should be given to the possibility of objectionable noise in or adjacent to occupied space. Where this is a concern, gas velocities on the low side are recommended.

Routing must also take into account the requirement established in the latest ANSI/ASHRAE 15.

To size the suction line, determine:

a. The maximum tons for the circuit
b. The actual length in feet
c. The equivalent length contributed by elbows, fittings, valves or other refrigerant specialties. ASHRAE Tables 2-10, 11 & 12
d. If a vertical riser exists including the trap at the coil, determine the minimum tons for the circuit.

Add b and c above to obtain the total equivalent feet. Use ASHRAE Table 3 (for R22) or Table 4 (for R134a). Suction line selections are based upon the pressure equivalent of a 2ºF loss per 100 equivalent feet.

Select a line size that displays an equal or slightly larger tons then that determined in 1a) above.

To determine the actual line loss:

1. Modify the table tons by the value in Note 4 of Table 3 or 4 for the design condensing temperature.
2. Use the formula in Note 3 to calculate the line loss in terms of the saturation temperature.
3. Convert the saturation temperature loss calculated to a pressure drop equivalent using the (Delta) listed in the table for the comparable delta temperature.

Caution: Excessive pressure drop is undesirable because:

- It reduces available compressor capacity.
- It increases power consumed for the net tons realized.
- It may affect the performance of both the evaporator and the expansion valve previously selected for the application.

The line loss calculated, expressed in temperature, or PSID pressure drop will be used to establish the temperature required at the evaporator to produce the required cooling, as well as, the suction pressure that the compressor must operate at to deliver the required capacity.

Having selected the suction line size, based upon total equivalent length and maximum tons, verify the line size selected will maintain entrainment of the lubricating oil up any vertical risers at the minimum tons for the circuit. See d above, and ASHRAE Table 2-13.

If the line size selected will not maintain satisfactory oil return in a suction riser, the following options are available:

The vertical length can be sized smaller to accommodate the lower circuit tons at reduced load.

Minimum compressor capacity can be increased by eliminating the lowest step of compressor capacity.

Hot gas bypass can be introduced at the distributor to the evaporator, increasing the volume of gas available in the suction line to entrain the oil.

An oil separator may be installed in the discharge line.

With reciprocating compressor units only, and only as a last resort, double suction risers can be utilized. Since a double suction riser works by providing an oil trap to assure the return of some oil, with refrigerant, up the smaller diameter line, a) the trap must be as small as possible, b) there must not be multiple traps, and c) whenever double risers are used in a suction line, a suction accumulator with a controlled oil return must be installed in the line ahead of the compressor.

Note: In horizontal refrigerant gas lines, oil return to compressors is assured by sizing lines at a velocity above the minimum recommended and pitching the lines in the direction of refrigerant flow.

Sizing A Double Riser

At maximum circuit tons, the line size should be selected from the table based upon the recommended maximum line loss.

With the minimum tons known, a smaller line size should be selected from ASHRAE Chapter 2, Table 13 or 14 capable of entraining oil at the reduced tons. The smaller sized line should be the one installed to be always active.

The net internal area of this smaller sized line (see Table 13 or 14) should be deducted from the area of the size selected in paragraph 1) immediately above. The remainder represents the area of the other riser. From Table 13 or 14, select a line size with an area equal, or close, to the calculated net area. The combination of these two risers will provide the required performance at full circuit tons. The line selected for the minimum load should always be active; and both lines should enter the overhead horizontal line in a manner to prevent spillage of oil back down the other riser.

Underground Refrigerant Lines

McQuay does not recommend the installation of suction lines underground. If job conditions require that they be located below ground, a suitable sized suction accumulator must be installed ahead of the compressor to interrupt liquid refrigerant slugs at start-up.

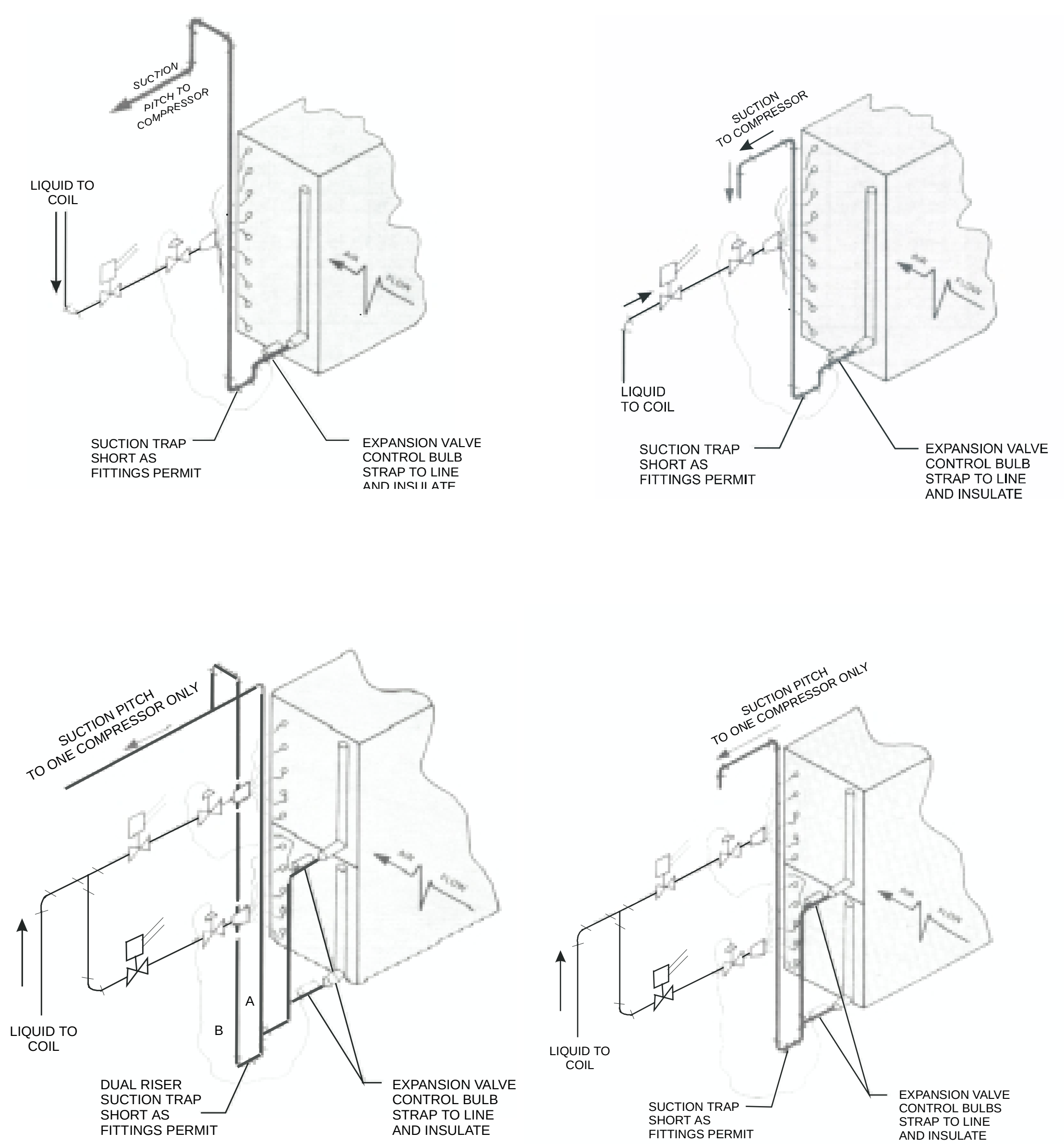
Long Vertical Riser Installation

Where job conditions require refrigerant gas lifts of more than 25 feet, McQuay recommends the installation of a short trap half-way up the riser or at not more than 20 feet intervals. These traps are required to capture and hold small quantities of oil during off cycles.

Figure 8, DX Coil Piping

Condensing Unit Above Coil

Condensing Unit Below Coil



Liquid Lines

Liquid lines are generally sized for 1 to 2 degree F line losses or their equivalent in pressure drop. Actual selection can vary based upon the pressure drop expected from refrigerant specialties such as solenoids, refrigerant driers, valves, etc. piping lifts or risers and the amount of condenser sub-cooling expected.

The principal concern in sizing and routing liquid lines is assurance that liquid is present in the line at start-up of the compressor, and that liquid and not vapor is available at the inlet to the expansion valve during system operation.

Liquid may not be available in a liquid line at start-up if:

1. The solenoid valve is located adjacent to the condenser or condensing unit; remote from the expansion valve.
2. An excessive length of liquid line is located in a heated ambient and the application permits migration of the refrigerant to a cold air-cooled condenser.
3. Liquid refrigerant is permitted to gravitate from the liquid line to the condenser because of the relative location of components.
4. Liquid line solenoid valves should be located adjacent to the expansion valve with possibly only a sight glass interposing the two.

In the event 2) or 3) above are possible, the application should include a check valve at the condenser end of the liquid line. The check valve should be a low pressure drop valve. The line between the check valve and the solenoid valve can be comparable to a pressure vessel and as the line becomes heated refrigerant trapped in the confined space will increase in pressure. The check valve should include a pressure relief devise, relieving from the line side to the condenser side of the circuit. The relief can be sized for a pressure differential from 80 to 180 psi, but not more than 180 psi, and should be auto-resetting as the pressure is relieved.

⚠ **CAUTION**: The liquid line should not include a check valve unless the line also includes an automatic resetting pressure relief device.

⚠ **CAUTION**: If the relief device being used is relieving from the line to the condenser side of the check valve, the maximum desirable pressure differential with R-22 refrigerant is 180 psi. With 134a, 100 psi.

If liquid lines are short, they may be of smaller diameter than the size indicated in the ASHRAE Refrigerant Handbook, 1998 Edition, Chapter 2, Tables 3 or 4. As indicated above, the designer must size the liquid line to assure that pure liquid will reach the inlet of the expansion valve. If the condenser is sized to produce 10ºF of subcooling, and each degree represents 3.05 psi with R-22 (or 2.2. psi with R-134a), the liquid line and its refrigerant specialties may have pressure losses totaling 10 x 3.05 psi (or 10 x 2.2) and still satisfy the objective of believing pure liquid to the expansion valve.

In calculating the pressure losses, or gains, note that each foot of rise in a liquid line results in an approximate 0.5 psi loss. Thus a 10 foot rise represent 5 pounds per square inch loss in refrigerant pressure, or the equivalent of 1.6ºF subcooling with R-22. Total line losses will include values for line friction, equivalents for valves and elbows and pressure losses from manufacturers' catalogs for driers, solenoids, sight glasses, etc.

In estimating condenser subcooling, note that saturated condensing pressure should be read, or estimated, at the same point in the system where the liquid refrigerant temperature is obtained. That condensing pressure is not the discharge pressure read at the compressor outlet. Because it is less, the net value of subcooling will be lower than might otherwise be assumed.

Where rises in liquid lines result in a 0.5 psi loss per foot of lift, a drop in the liquid line results in a rise in the refrigerant pressure. A substantial drop in the liquid line can assure the existence of pure liquid at the valve. If it is a substantial increase because of a large drop, the expansion valve selection must be re-checked to confirm that the valve to be used is not radically oversized.

Liquid Lines from Condensers to Receivers

Receivers in a refrigerant system have both liquid and gas contained within the same vessel. In air-cooled condenser applications, the condensing temperature can change rapidly resulting in the requirement for more liquid at a lower temperature and pressure to be introduced into the receiver.

In order for this flow of lower temperature and pressure refrigerant to enter the receiver:

1) The receiver must be located below the condenser outlet with no restrictions in the line.

2) The liquid line connecting the condenser and the receiver must be sized for a maximum velocity of 100 fpm. Piping sizes for this are shown in the ASHRAE tables.

Note: If the interconnecting piping described above contains a SeasonTrol type head pressure control valve representing a restriction in the liquid line, a separate vent from the top of the receiver to the discharge line entering the condenser is required.

Liquid Line Components

To assist in laying out and specifying split systems, the following recommended (or equal) components can be used.

Table 7, Liquid Line Components

Unit Model	Circuit	Nom.R-22 Tons (mbh)	Sporlan Part Number Shown - (Equivalents Are Acceptable)				
			Filter Drier	Solenoid Valve	Sight Glass	Expansion Valve	Unit Conn. In/Out
ACZ030A	Circuit #1&#2	15.9 (191)	C-487	E19S270	SA-17S	OVE-20	7/8-1-3/8
ACZ035A	Circuit #1	15.9 (191)	C-487	E19S270	SA-17S	OVE-20	7/8-1-3/8
	Circuit #2	19.1 (229)	C-487	E19S270	SA-17S	OVE-20	7/8-1-3/8
ACZ040A	Circuit #1&#2	19.2 (230)	C-487	E19S270	SA-17S	OVE-20	7/8-1-3/8
ACZ045A	Circuit #1&#2	21.8 (262)	C-487	E19S270	SA-17S	OVE-20	7/8-1-3/8
ACZ050A	Circuit #1	22.1 (265)	C-487	E19S270	SA-17S	OVE-20	7/8-1-3/8
	Circuit #2	26.8 (322)	C-967	E19S270	SA-17S	OVE-30	7/8-1-3/8
ACZ055A	Circuit #1&#2	26.8 (322)	C-967	E19S270	SA-17S	OVE-30	7/8-1-3/8

Physical Data

AGZ-AM

Table 8, AGZ 035AM - 050AM

PHYSICAL DATA	AGZ-AM MODEL NUMBER							
STANDARD EFFICIENCY	035AM		040AM		045AM		050AM	
CAPACITY @ **ARI Conditions (1), Tons (kW)**	**34.3 (120.5)**		**38.9 (136.7)**		**44.3 (156.0)**		**48.9**	
OUTDOOR UNIT BASIC DATA	**Ckt.1**	**Ckt.2**	**Ckt.1**	**Ckt.2**	**Ckt.1**	**Ckt.2**	**Ckt.1**	**Ckt.2**
Number Of Refrigerant Circuits	**2**		**2**		**2**		**2**	
Unit Operating Charge, R-22, Lbs.(2)	**36**	**36**	**40**	**40**	**42**	**42**	**44**	**44**
Unit Operating Charge, R-22, (kg) (2)	**(16.3)**	**(16.3)**	**(18.1)**	**(18.1)**	**(19.0)**	**(19.0)**	**(19.9)**	**(19.9)**
Cabinet Dimensions, LxWxH, In.	**94.0 x 88.2 x 86.2**		**94.0 x 88.2 x 86.2**		**94.0 x 88.2 x 86.2**		**94.0 x 88.2 x 86.2**	
Cabinet Dimensions, LxWxH, (mm)	**2388 x 2241 x 2190**		**2388 x 2241 x 2190**		**2388 x 2241 x 2190**		**2388 x 2241 x 2190**	
Unit Operating Weight, Lb (kg)	**2925 (1330)**		**2980 (1355)**		**3025 (1375)**		**3075 (1395)**	
Unit Shipping Weight, Lb (kg)	**2865 (1300)**		**2920 (1325)**		**2950 (1340)**		**3000 (1360)**	
Add'l Weight If Copper Finned Coils, Lb (kg)	**445 (200)**		**445 (200)**		**445 (200)**		**445 (200)**	
COMPRESSORS								
Type	**Tandem Scrolls**		**Tandem Scrolls**		**Tandem Scrolls**		**Tandem Scrolls**	
Nominal tonnage of each Compressor	**9.0**	**9.0**	**10.0**	**10.0**	**10.0**	**13.0**	**13.0**	**13.0**
Number Of Compressors per Circuit	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**
Oil Charge Per Compressor, Oz.	**140**	**140**	**140**	**140**	**140**	**140**	**140**	**140**
Oil Charge Per Compressor, (g)	**(496)**	**(496)**	**(496)**	**(496)**	**(496)**	**(496)**	**(496)**	**(496)**
CAPACITY REDUCTION STEPS - PERCENT OF COMPRESSOR DISPLACEMENT								
Standard Staging - Circuit #1 in Lead Standard 4 Stages	**0-25-50-75-100**		**0-25-50-75-100**		**0-22-50-72-100**		**0-25-50-75-100**	
Standard Staging - Circuit #2 in Lead Standard 4 Stages	**0-25-50-75-100**		**0-25-50-75-100**		**0-28-50-78-100**		**0-25-50-75-100**	
CONDENSERS - HIGH EFFICIENCY FIN AND TUBE TYPE WITH INTEGRAL SUBCOOLING								
Coil Face Area,Sq. Ft.	**46.4**	**46.4**	**46.4**	**46.4**	**46.4**	**46.4**	**46.4**	**46.4**
Coil Face Area, (M^2)	**(4.3)**	**(4.3)**	**(4.3)**	**(4.3)**	**(4.3)**	**(4.3)**	**(4.3)**	**(4.3)**
Finned Height x Finned Length, In.	**80 x 83.5**	**80 x 83.5**	**80 x 83.5**	**80 x 83.5**	**80 x 83.5**	**80 x 83.5**	**80 x 83.5**	**80 x 83.5**
Finned Height x Finned Length, (mm)	**2032 x 2121**	**2032 x 2121**	**2032 x 2121**	**2032 x 2121**	**2032 x 2121**	**2032 x 2121**	**2032 x 2121**	**2032 x 2121**
Fins Per Inch x Rows Deep	**16 x 2**	**16 x 2**	**16 x 2**	**16 x 2**	**16 x 2**	**16 x 2**	**16 x 2**	**16 x 2**
Maximum Relief Valve Pressure Setting, psig (kPa)	**450 (3103)**	**450 (3103)**	**450 (3103)**	**450 (3103)**	**450 (3103)**	**450 (3103)**	**450 (3103)**	**450 (3103)**
CONDENSER FANS - DIRECT DRIVE PROPELLER TYPE								
Number Of Fans - Fan Diameter, In. (mm)	**4 - 28 (712)**		**4 - 28 (712)**		**4 - 28 (712)**		**4 - 28 (712)**	
Number Of Motors - HP (kW) (3)	**4 - 1.0 (0.7)**		**4 - 1.0 (0.7)**		**4 - 1.5 (1.1)**		**4 - 1.5 (1.1)**	
Fan And Motor RPM, 60Hz	**1140**		**1140**		**1140**		**1140**	
60 Hz Fan Tip Speed, FPM (M/Sec)	**8357 (35.4)**		**8357 (35.4)**		**8357 (35.4)**		**8357 (35.4)**	
60 Hz Total Unit Airflow, CFM (M^3/sec)	**34400 (16.2)**		**34400 (16.2)**		**388000 (17.9)**		**388000 (17.9)**	
REMOTE DIRECT EXPANSION EVAPORATOR - BAFFLED SHELL AND THRU-TUBE								
Model Number	**1004-1**		**1004-1**		**1204-3**		**1204-3**	
Diameter, in. - Length, Ft.	**10 - 04**		**10 - 04**		**12 - 04**		**12 - 04**	
Diameter, (mm) - Length, (mm)	**(254) - (1220)**		**(254) - (1220)**		**(305) - (1220)**		**(305) - (1220)**	
Unit Operating Weight, Lb (kg)	**555 (250)**		**555 (250)**		**777 (350)**		**777 (350)**	
Unit Shipping Weight, Lb (kg)	**540 (245)**		**540 (245)**		**745 (340)**		**745 (340)**	
Water Volume, Gallons, (L)	**9.1 (34.5)**		**9.1 (34.5)**		**12.8 (48.5)**		**12.8 (48.5)**	
Maximum Water Pressure, psig (kPa)	**175 (1207)**		**175 (1207)**		**175 (1207)**		**175 (1207)**	
Maximum Refrigerant Working Pressure, psig (kPa)	**225 (1552)**		**225 (1552)**		**225 (1552)**		**225 (1552)**	
Water Inlet / Outlet Victaulic Connections, In. (mm)	**4 (101.6)**		**4 (101.6)**		**4 (101.6)**		**4 (101.6)**	
Drain - NPT int, In. (mm)	**.375 (9.5)**		**.375 (9.5)**		**.375 (9.5)**		**.375 (9.5)**	
Vent - NPT int, In. (mm)	**.375 (9.5)**		**.375 (9.5)**		**.375 (9.5)**		**.375 (9.5)**	

NOTES:

1. Nominal capacity based on 95°F ambient air and 54°F/44°F water range, no refrigerant line loss.
2. Includes evaporator. Does not include suction and liquid line charge. Outdoor unit and evaporator are shipped with R-22 holding charge.
3. Units with 1.0 Hp Fan Motors, Uses 1.5 Hp Fan Motors when unit is 380V / 60 Hz and 575V / 60Hz.

ACZ Condensing Units

Table 9, ACZ 030A - 040A

PHYSICAL DATA	ACZ MODEL NUMBER					
STANDARD EFFICIENCY	030A		035A		040A	
UNIT CAPACITY @ **ARI Conditions (1), Tons (kW)**	**31.8 (111.7)**		**35.0 (123.0)**		**38.4 (134.9)**	
BASIC DATA	Ckt.1	Ckt.2	Ckt.1	Ckt.2	Ckt.1	Ckt.2
Number Of Refrigerant Circuits	**2**		**2**		**2**	
Unit Operating Charge, R-22, Lbs. (2)	**30**	**30**	**30**	**30**	**30**	**30**
Unit Operating Charge, R-22, (kg) (2)	**(13.6)**	**(13.6)**	**(13.6)**	**(13.6)**	**(13.6)**	**(13.6)**
Cabinet Dimensions, LxWxH, In.	**94.0 x 88.2 x 86.2**		**94.0 x 88.2 x 86.2**		**94.0 x 88.2 x 86.2**	
Cabinet Dimensions, LxWxH, (mm)	**2388 x 2241 x 2190**		**2388 x 2241 x 2190**		**2388 x 2241 x 2190**	
Unit Operating Weight, Lbs. (kg)	**2945**	**(1336)**	**2945**	**(1336)**	**3000**	**(1361)**
Unit Shipping Weight, Lbs. (kg)	**2885**	**(1309)**	**2885**	**(1309)**	**2940**	**(1334)**
Add'l Weight If Copper Finned Coils, Lbs. (kg)	**445 (200)**		**445 (200)**		**445 (200)**	
COMPRESSORS						
Type	**Tandem Scrolls**		**Tandem Scrolls**		**Tandem Scrolls**	
Nominal Horsepower of each Compressor	**7.5**	**7.5**	**7.5**	**9.0**	**9.0**	**9.0**
Number Of Compressors per Circuit	**2**	**2**	**2**	**2**	**2**	**2**
Oil Charge Per Compressor, Oz.	**140**	**140**	**140**	**140**	**140**	**140**
Oil Charge Per Compressor, (g)	**(496)**	**(496)**	**(496)**	**(496)**	**(496)**	**(496)**
CAPACITY REDUCTION STEPS - PERCENT OF COMPRESSOR DISPLACEMENT						
Standard Staging - Circuit #1 in Lead Standard 4 Stages	**0-25-50-75-100**		**0-23-50-73-100**		**0-25-50-75-100**	
Standard Staging - Circuit #2 in Lead Standard 4 Stages	**0-25-50-75-100**		**0-27-50-77-100**		**0-25-50-75-100**	
CONDENSERS - HIGH EFFICIENCY FIN AND TUBE TYPE WITH INTEGRAL SUBCOOLING						
Coil Face Area,Sq. Ft.	**46.4**	**46.4**	**46.4**	**46.4**	**46.4**	**46.4**
Coil Face Area, (M^2)	**(4.3)**	**(4.3)**	**(4.3)**	**(4.3)**	**(4.3)**	**(4.3)**
Finned Height x Finned Length, In.	**80 x 83.5**	**80 x 83.5**	**80 x 83.5**	**80 x 83.5**	**80 x 83.5**	**80 x 83.5**
Finned Height x Finned Length, (mm)	**2032 x 2121**	**2032 x 2121**	**2032 x 2121**	**2032 x 2121**	**2032 x 2121**	**2032 x 2121**
Fins Per Inch x Rows Deep	**16 x 2**	**16 x 2**	**16 x 2**	**16 x 2**	**16 x 2**	**16 x 2**
Pumpdown Capacity @ 90% Full (lbs)	**51**	**51**	**51**	**51**	**51**	**51**
Pumpdown Capacity @ 90% Full (kgs)	**(23.1)**	**(23.1)**	**(23.1)**	**(23.1)**	**(23.1)**	**(23.1)**
Maximum Relief Valve Pressure Setting, psig (kPa)	**450 (3103)**	**450 (3103)**	**450 (3103)**	**450 (3103)**	**450 (3103)**	**450 (3103)**
CONDENSER FANS - DIRECT DRIVE PROPELLER TYPE						
Number Of Fans - Fan Diameter, In. (mm)	**4 - 28 (712)**		**4 - 28 (712)**		**4 - 28 (712)**	
Number Of Motors - HP (kW) (3)	**4 - 1.0 (0.7)**		**4 - 1.0 (0.7)**		**4 - 1.0 (0.7)**	
Fan And Motor RPM, 60Hz	**1140**		**1140**		**1140**	
60 Hz Fan Tip Speed, FPM (m/Sec)	**8357 (35.4)**		**8357 (35.4)**		**8357 (35.4)**	
60 Hz Total Unit Airflow, CFM (m^3/sec)	**34400 (16.2)**		**34400 (16.2)**		**34400 (16.2)**	

NOTES:

1. Nominal capacity based on 95°F ambient air and 45°F saturated suction temperature, no refrigerant line loss.
2. Does not include evaporator, suction or liquid line charge. Unit shipped with R-22 holding charge.
3. Units with 1.0 Hp Fan Motors, Uses 1.5 Hp Fan Motors when unit is 380V / 60 Hz and 575V / 60Hz.

Table 10, ACZ 045A - 055A

PHYSICAL DATA	ACZ MODEL NUMBER					
STANDARD EFFICIENCY	045AS		050AS		055AS	
BASIC DATA	**Ckt.1**	**Ckt.2**	**Ckt.1**	**Ckt.2**	**Ckt.1**	**Ckt.2**
Unit Capacity @ ARI Conditions (1), Tons (kW)	**43.6 (153.2)**		**48.8 (171.4)**		**53.5 (188.0)**	
Number Of Refrigerant Circuits	**2**		**2**		**2**	
Unit Operating Charge, R-22, Lbs. (2)	**30**	**30**	**35**	**35**	**35**	**35**
Unit Operating Charge, R-22, (kg) (2)	**(13.6)**	**(13.6)**	**(15.9)**	**(15.9)**	**(15.9)**	**(15.9)**
Cabinet Dimensions, LxWxH, In.	**94.0 x 88.2 x 86.2**		**94.0 x 88.2 x 86.2**		**94.0 x 88.2 x 86.2**	
Cabinet Dimensions, LxWxH, (mm)	**2388 x 2241 x 2190**		**2388 x 2241 x 2190**		**2388 x 2241 x 2190**	
Unit Operating Weight, Lbs. (kg)	**3055**	**(1386)**	**3095**	**(1404)**	**3145**	**(1427)**
Unit Shipping Weight, Lbs. (kg)	**2995**	**(1359)**	**3025**	**(1372)**	**3075**	**(1395)**
Add'l Weight If Copper Finned Coils, Lbs. (kg)	**445 (200)**		**445 (200)**		**445 (200)**	
COMPRESSORS						
Type	**Tandem Scrolls**		**Tandem Scrolls**		**Tandem Scrolls**	
Nominal Horsepower of each Compressor	**10.0**	**10.0**	**10.0**	**13.0**	**13.0**	**13.0**
Number Of Compressors per Circuit	**2**	**2**	**2**	**2**	**2**	**2**
Oil Charge Per Compressor, Oz.	**140**	**140**	**140**	**140**	**140**	**140**
Oil Charge Per Compressor, (g)	**(496)**	**(496)**	**(496)**	**(496)**	**(496)**	**(496)**
CAPACITY REDUCTION STEPS - PERCENT OF COMPRESSOR DISPLACEMENT						
Standard Staging - Circuit #1 in Lead Standard 4 Stages	**0-25-50-75-100**		**0-22-50-72-100**		**0-25-50-75-100**	
Standard Staging - Circuit #2 in Lead Standard 4 Stages	**0-25-50-75-100**		**0-28-50-78-100**		**0-25-50-75-100**	
CONDENSERS - HIGH EFFICIENCY FIN AND TUBE TYPE WITH INTEGRAL SUBCOOLING						
Coil Face Area,Sq. Ft.	**46.4**	**46.4**	**46.4**	**46.4**	**46.4**	**46.4**
Coil Face Area, (M^2)	**(4.3)**	**(4.3)**	**(4.3)**	**(4.3)**	**(4.3)**	**(4.3)**
Finned Height x Finned Length, In.	**80 x 83.5**	**80 x 83.5**	**80 x 83.5**	**80 x 83.5**	**80 x 83.5**	**80 x 83.5**
Finned Height x Finned Length, (mm)	**2032 x 2121**	**2032 x 2121**	**2032 x 2121**	**2032 x 2121**	**2032 x 2121**	**2032 x 2121**
Fins Per Inch x Rows Deep	**16 x 2**	**16 x 2**	**16 x 2**	**16 x 2**	**16 x 2**	**16 x 2**
Pumpdown Capacity @ 90% Full (lbs)	**51**	**51**	**63**	**63**	**63**	**63**
Pumpdown Capacity @ 90% Full (kgs)	**(23.1)**	**(23.1)**	**(28.6)**	**(28.6)**	**(28.6)**	**(28.6)**
Maximum Relief Valve Pressure Setting, psig (kPa)	**450 (3103)**	**450 (3103)**	**450 (3103)**	**450 (3103)**	**450 (3103)**	**450 (3103)**
CONDENSER FANS - DIRECT DRIVE PROPELLER TYPE						
Number Of Fans - Fan Diameter, In. (mm)	**4 - 28 (712)**		**4 - 28 (712)**		**4 - 28 (712)**	
Number Of Motors - HP (kW) (3)	**4 - 1.0 (0.7)**		**4 - 1.5 (1.1)**		**4 - 1.5 (1.1)**	
Fan And Motor RPM, 60Hz	**1140**		**1140**		**1140**	
60 Hz Fan Tip Speed, FPM (M/Sec)	**8357 (35.4)**		**8357 (35.4)**		**8357 (35.4)**	
60 Hz Total Unit Airflow, CFM (M^3/sec)	**34400 (16.2)**		**36800 (17.4)**		**36800 (17.4)**	

NOTES:

1. Nominal capacity based on 95°F ambient air and 45°F saturated suction temperature, no refrigerant line loss.
2. Does not include evaporator, suction or liquid line charge. Unit shipped with R-22 holding charge.
3. Units with 1.0 Hp Fan Motors, Uses 1.5 Hp Fan Motors when unit is 380V / 60 Hz and 575V / 60Hz.

Electrical Data

Field Wiring

Power Wiring

CAUTION

Internal power wiring to the compressors for single and multiple point option are different. Field wiring must be installed according to unit wiring diagram.

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

AGZ-AM and ACZ units have internal power wiring for single point power connection. A single large power terminal block is provided and wiring within the unit is sized in accordance with the National Electrical Code. A single field supplied fused disconnect is required. An optional factory mounted transformer may be installed.

AGZ-AM remote water chillers and CDE chillers are equipped with a 420W electric heater to provide freeze protection if mounted in locations subject to below freezing temperatures. The heater comes with a receptacle plug which can be used as is, or removed to hard wire to a power supply.

Control Wiring

AGZ-AM chillers are equipped with either a Johnson Controls UNT control or a McQuay MicroTech microprocessor control mounted in the outdoor unit. The control sensor for capacity control must be mounted in the leaving chilled water line in a thermowell provided in the water chiller nozzle. A sensor well is also located in the entering nozzle for use with some control options. The sensor is wired to the control with 30 ft. of cable. If a longer length is required, it is necessary to field splice the cable.

ACZ condensing units are not equipped with a capacity control device and one must be field furnished and installed. Refer to Figure 20. Up to four steps of control are available.

AGZ-AM and ACZ units connected to water chillers must have a flow switch mounted in the chilled water line and wired to the control panel per the field wiring diagram. It is recommended that ACZ units connected to DX air coils have an interlock to prevent compressor operation when there is no air flow.

Electrical Data AGZ-AM

Electrical Data ACZ

Table 11, AGZ-030AM - 050AM, ACZ 030A - 055A,

60 Hz, Single Point Power Electrical Data

ACZ Unit Size	AGZ-AM Unit Size	Volts	Minimum Circuit Ampacity (MCA)	POWER SUPPLY				Max. Fuse or HACR Breaker Size
				Field Wire		Hub		
				Quantity	Wire Gauge	Quantity	Nominal Size	
	035AM	208	146	3	1/0	1	1.50 (38)	175
		230	146	3	1/0	1	1.50 (38)	175
		380	93	3	3	1	1.25 (32)	110
		460	76	3	4	1	1.00 (25)	90
		575	58	3	6	1	1.00 (25)	70
045A	040AM	208	166	3	2/0	1	1.50 (38)	200
		230	166	3	2/0	1	1.50 (38)	200
		380	111	3	2	1	1.25 (32)	125
		460	78	3	4	1	1.00 (25)	90
		575	67	3	4	1	1.00 (25)	80
050A	045AM	208	187	3	3/0	1	2.00 (51)	225
		230	187	3	3/0	1	2.00 (51)	225
		380	122	3	1	1	1.25 (32)	150
		460	94	3	3	1	1.25 (32)	110
		575	76	3	4	1	1.00 (25)	90
055A	050AM	208	200	3	3/0	1	2.00 (51)	225
		230	200	3	3/0	1	2.00 (51)	225
		380	133	3	1	1	1.25 (32)	150
		460	104	3	2	1	1.25 (32)	125
		575	83	3	4	1	1.00 (25)	100

All Electrical Data notes are on page 23

Table 12, AGZ-AM, ACZ A, 60 Hz, Compressor & Condenser Fan Motor Amp Draw

ACZ Unit Size	AGZ-AM Unit Size	Volts	Rated Load Amps			No. Of Fan Motors	Locked Rotor Amps		
			Compressors		Fan Motors (Each)		Fan Motors (Each)	Compressors	
								Across-The-Line	
			No. 1 & 3 (Each)	No. 2 & 4 (Each)				No.1 & 3 (Each)	No.2 & 4 (Each)
	035AM	208	30.5	30.5	4.0	4	17.0	232	232
		230	30.5	30.5	4.0	4	17.0	232	232
		380	18.6	18.6	3.4	4	14.4	144	144
		460	15.8	15.8	2.0	4	8.5	125	125
		575	11.6	11.6	2.2	4	10.3	100	100
045A	040AM	208	35.2	35.2	4.0	4	17.0	255	278
		230	35.2	35.2	4.0	4	17.0	255	278
		380	22.8	22.8	3.4	4	14.4	151	151
		460	16.5	16.5	2.0	4	8.5	127	127
		575	13.7	13.7	2.2	4	10.3	100	100
050A	045AM	208	35.2	41.5	5.8	4	23.7	255	350
		230	35.2	41.5	5.8	4	23.7	255	350
		380	22.8	28.0	3.4	4	14.4	151	195
		460	16.5	21.8	2.8	4	10.7	127	158
		575	13.7	17.3	2.3	4	11.5	100	125
055A	050AM	208	41.5	41.5	5.8	4	23.7	318	350
		230	41.5	41.5	5.8	4	23.7	318	350
		380	28.0	28.0	3.4	4	14.4	195	195
		460	21.8	21.8	2.8	4	10.7	158	158
		575	17.3	17.3	2.3	4	11.5	125	125

All Electrical Data notes are on page 23

Table 13, AGZ-AM, ACZ A, 60 Hz Single Point Power, Field Wiring Data

ACZ Unit Size	AGZ-AM Unit Size	Volts	Wiring to Standard Power Block		Wiring to Optional Non-Fused Disconnect Switch	
			Terminal Amps	Connector Wire Range (Copper Wire Only)	Terminal Amps	Connector Wire Range (Copper Wire Only)
	035AM	208	335	# 4 - 400 MCM	225	# 3 - 300 MCM
		230	335	# 4 - 400 MCM	225	# 3 - 300 MCM
		380	175	#12 - 2/0	100	#14 - 1/0
		460	175	#12 - 2/0	100	#14 - 1/0
		575	175	#12 - 2/0	100	#14 - 1/0
045A	040AM	208	335	# 4 - 400 MCM	225	# 3 - 300 MCM
		230	335	# 4 - 400 MCM	225	# 3 - 300 MCM
		380	175	#12 - 2/0	150	#4 - 4/0
		460	175	#12 - 2/0	100	#14 - 1/0
		575	175	#12 - 2/0	100	#14 - 1/0
050A	045AM	208	335	# 4 - 400 MCM	225	# 3 - 300 MCM
		230	335	# 4 - 400 MCM	225	# 3 - 300 MCM
		380	175	#12 - 2/0	150	#4 - 4/0
		460	175	#12 - 2/0	100	#14 - 1/0
		575	175	#12 - 2/0	100	#14 - 1/0
055A	050AM	208	335	# 4 - 400 MCM	225	# 3 - 300 MCM
		230	335	# 4 - 400 MCM	225	# 3 - 300 MCM
		380	335	# 4 - 400 MCM	150	#4 - 4/0
		460	175	#12 - 2/0	150	#4 - 4/0
		575	175	#12 - 2/0	150	#4 - 4/0

All Electrical Data notes are on page 23

Electrical Notes

Notes for “Electrical Data Single Point” Power:

1. Unit wire size ampacity (MCA) is equal to 125% of the largest compressor-motor RLA plus 100% of RLA of all other loads in the circuit including the control transformer.
2. If the control transformer option is furnished, no separate 115V power is required.
3. If a separate 115V power supply is used for the control circuit, then the wire sizing amps is 10 amps for all unit sizes.
4. Recommended power lead wire sizes for 3 conductors per conduit are based on 100% conductor ampacity in accordance with NEC. Voltage drop has not been included. Therefore, it is recommended that power leads be kept short. All terminal block connections must be made with copper (type THW) wire.
5. “Recommended Fuse Sizes” are selected at approximately 150% to 175% of the largest compressor RLA, plus 100% of all other loads in the circuit.
6. “Maximum Fuse or HACR breaker size” is selected at approximately 225% of the largest compressor RLA, plus 100% of all other loads in the circuit.
7. The recommended power lead wire sizes are based on an ambient temperature of 86°F (30°C). Ampacity correction factors must be applied for other ambient temperatures. Refer to the National Electrical Code Handbook.
8. Must be electrically grounded according to national and local electrical codes.
9. MCA may vary slightly due to fan motor options such as SpeedTrol, TEFC.

Voltage Limitations:

Within ± 10 percent of nameplate rating.

Notes for “Compressor and Condenser Fan Amp Draw”:

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

Notes for “Field Wiring Data”

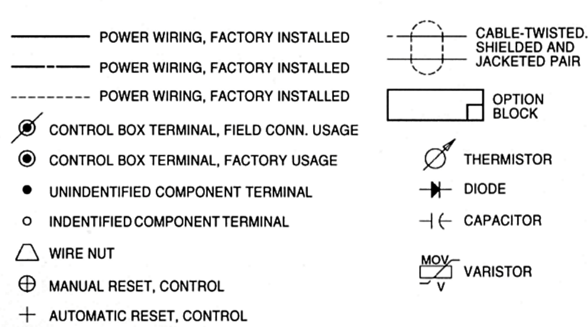
1. Requires a single disconnect to supply electrical power to the unit. This power supply must either be fused or use an HACR type circuit breaker.
2. All field wiring to unit power block or optional non-fused disconnect switch must be copper.
3. All field wire size values given in table apply to 75°C rated wire per NEC.

Electrical Legend

Figure 9, Electrical Legend

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



Wiring Diagrams

Figure 10, AGZ-AM, Typical Field Wiring with Global UNT Controller

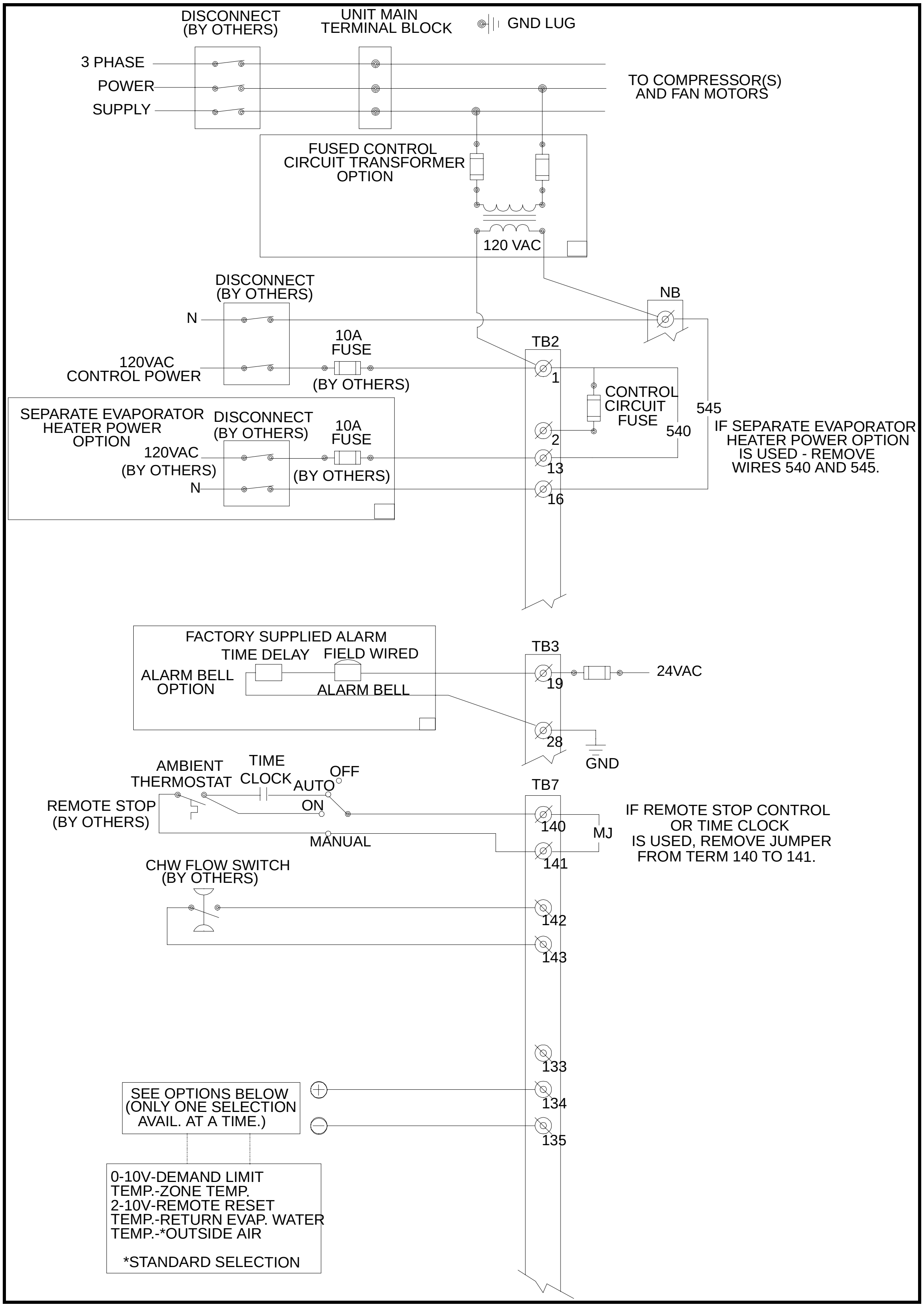


Figure 11, AGZ-AM, Typical Field Wiring Diagram with MicroTech Controller

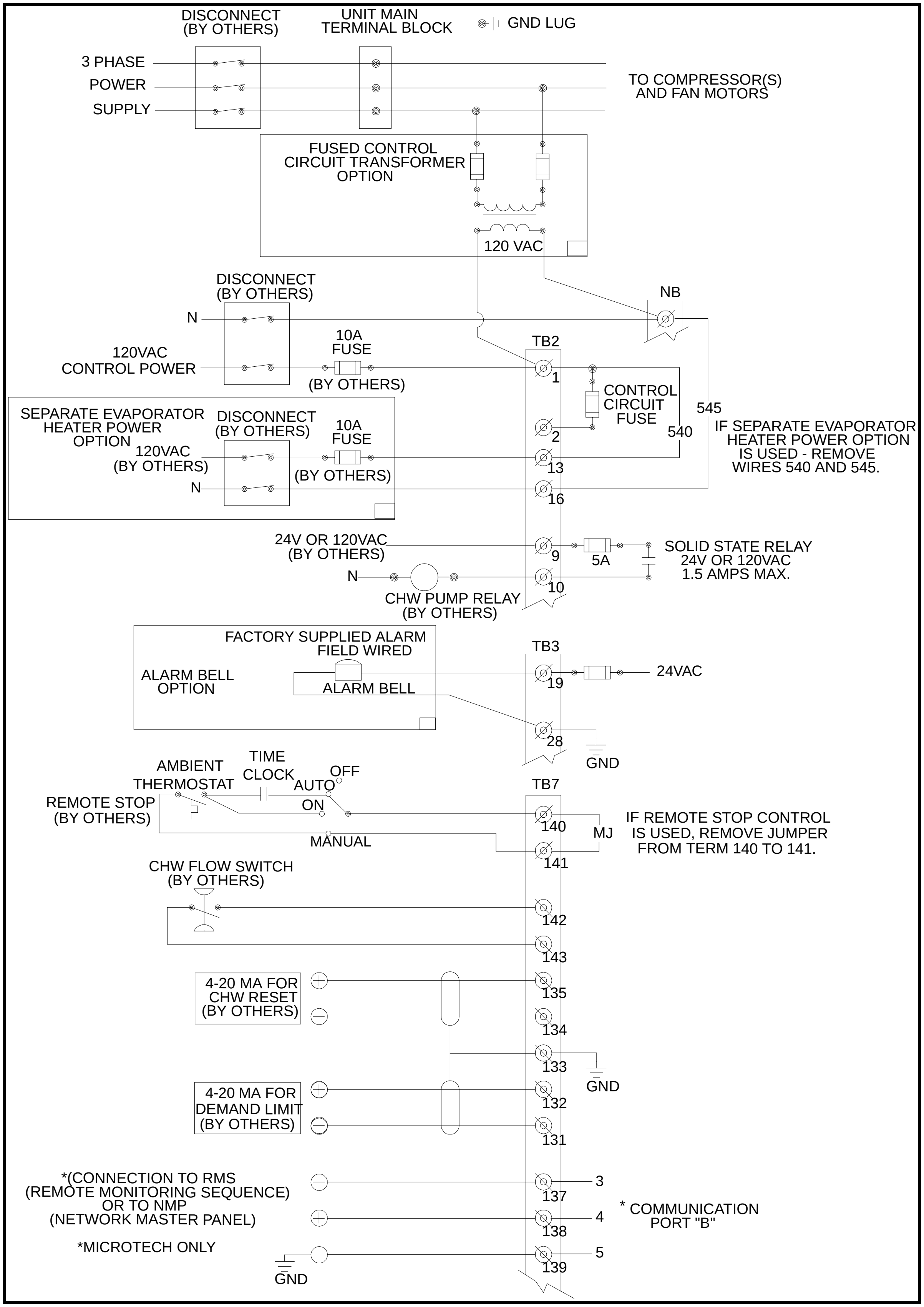


Figure 12, AGZ-AM, Single-point Connection with FanTrol

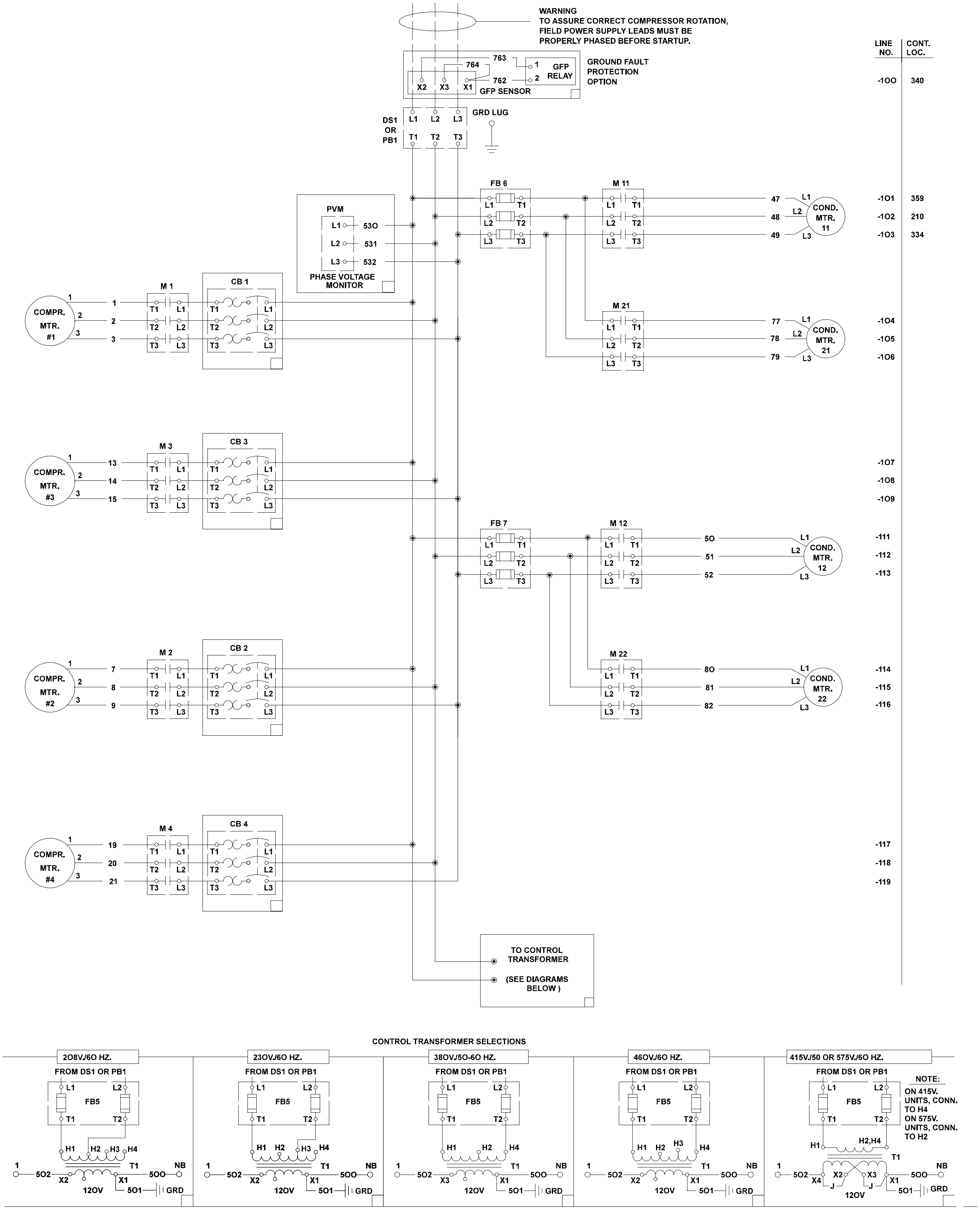


Figure 13, AGZ-AM, Single-point Connection with SpeedTrol

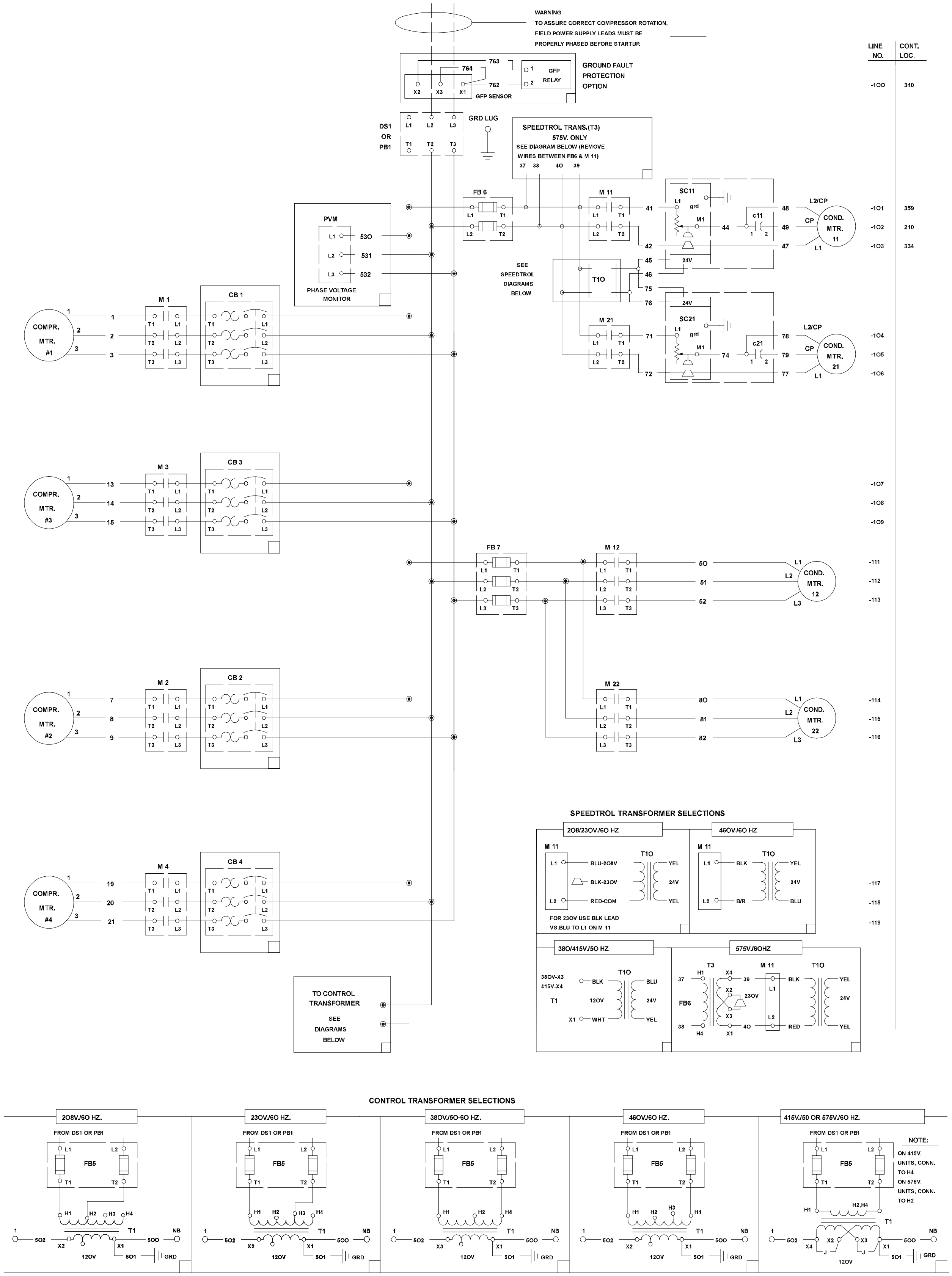


Figure 14, AGZ-AM, Unit Control Schematic (UNT)

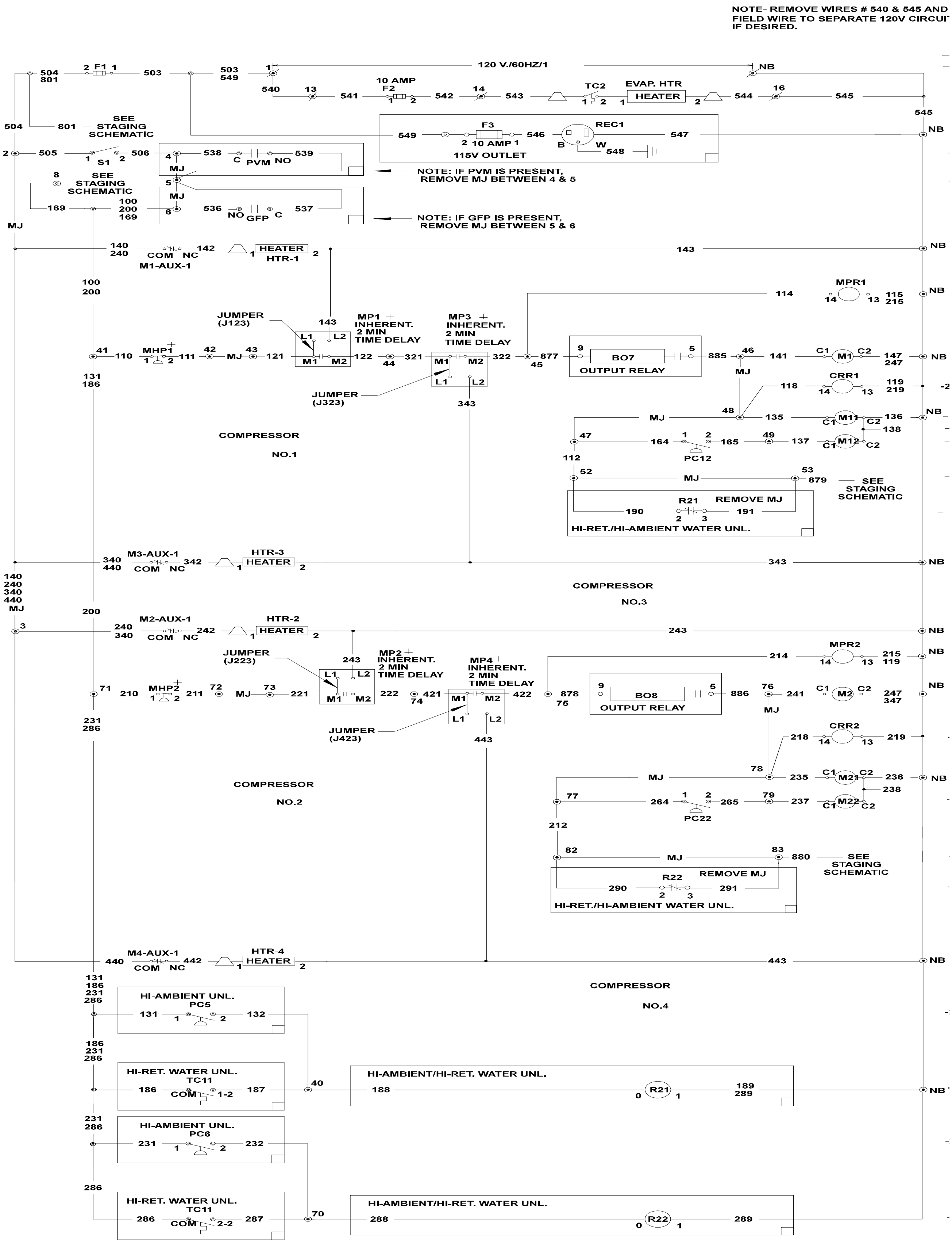


Figure 15, AGZ-AM, Staging Schematic (UNT)

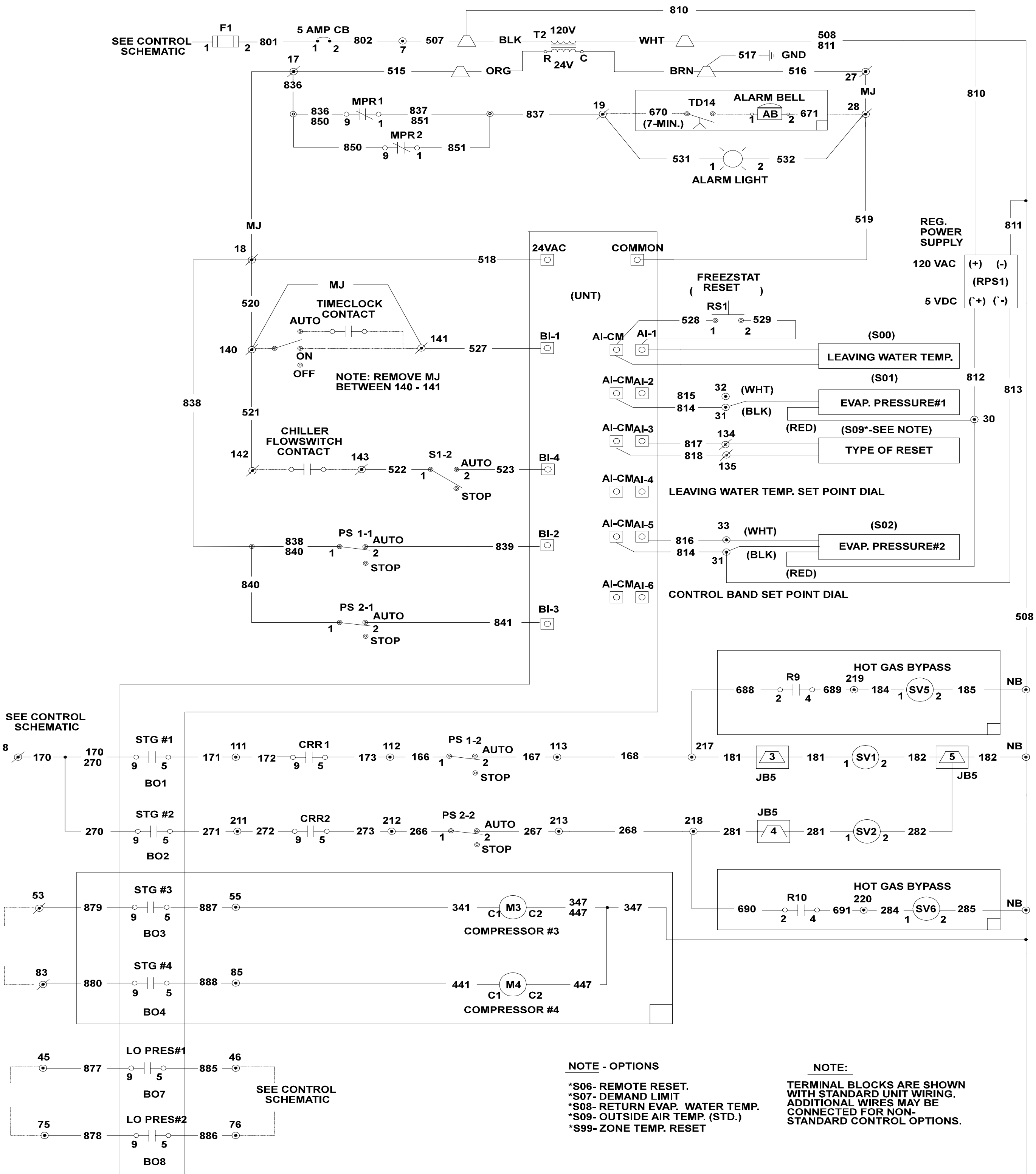


Figure 16, AGZ-AM, MicroTech Controller Schematic

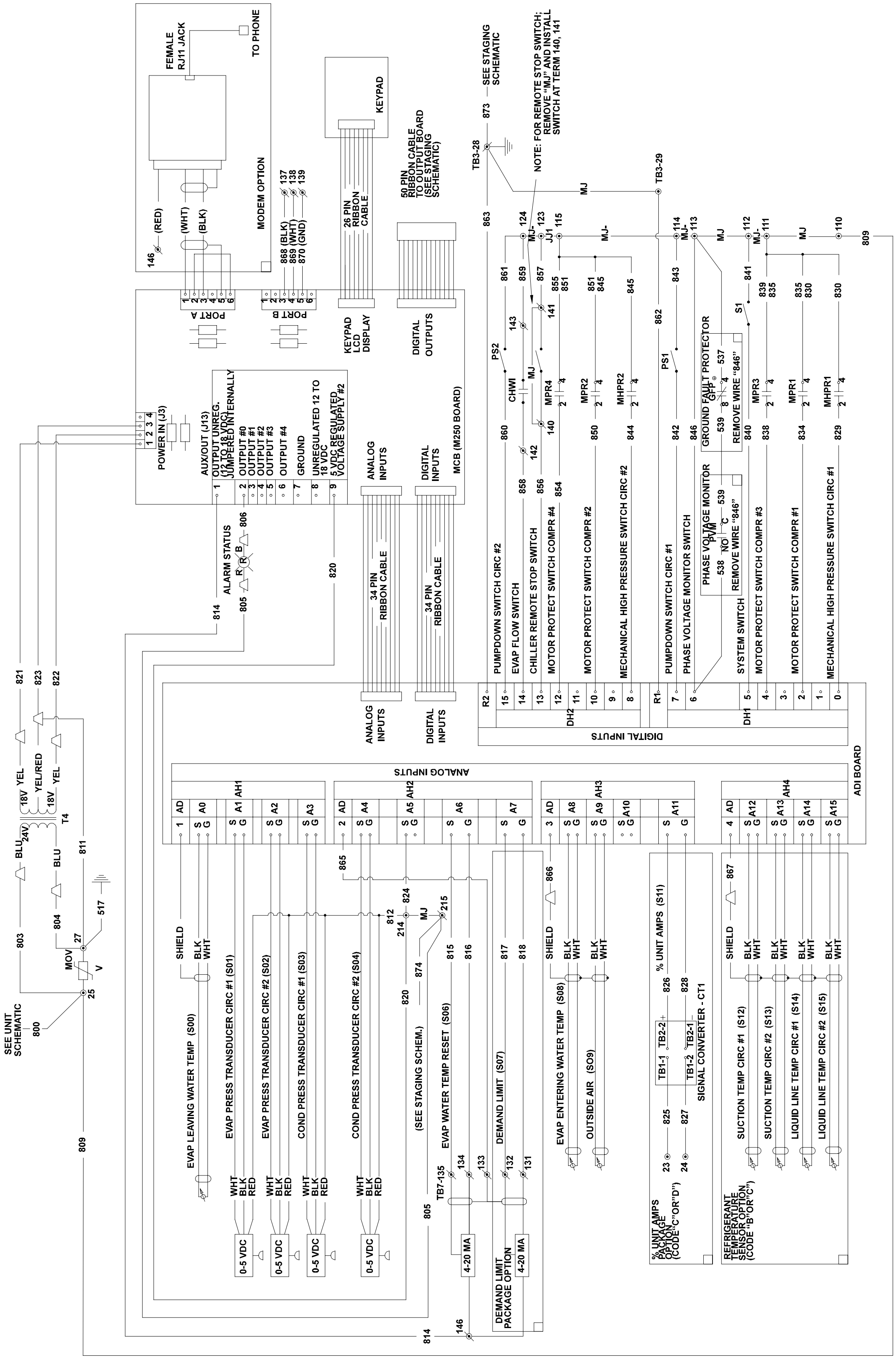


Figure 17, AGZ-AM, Unit Control Schematic (MicroTech)

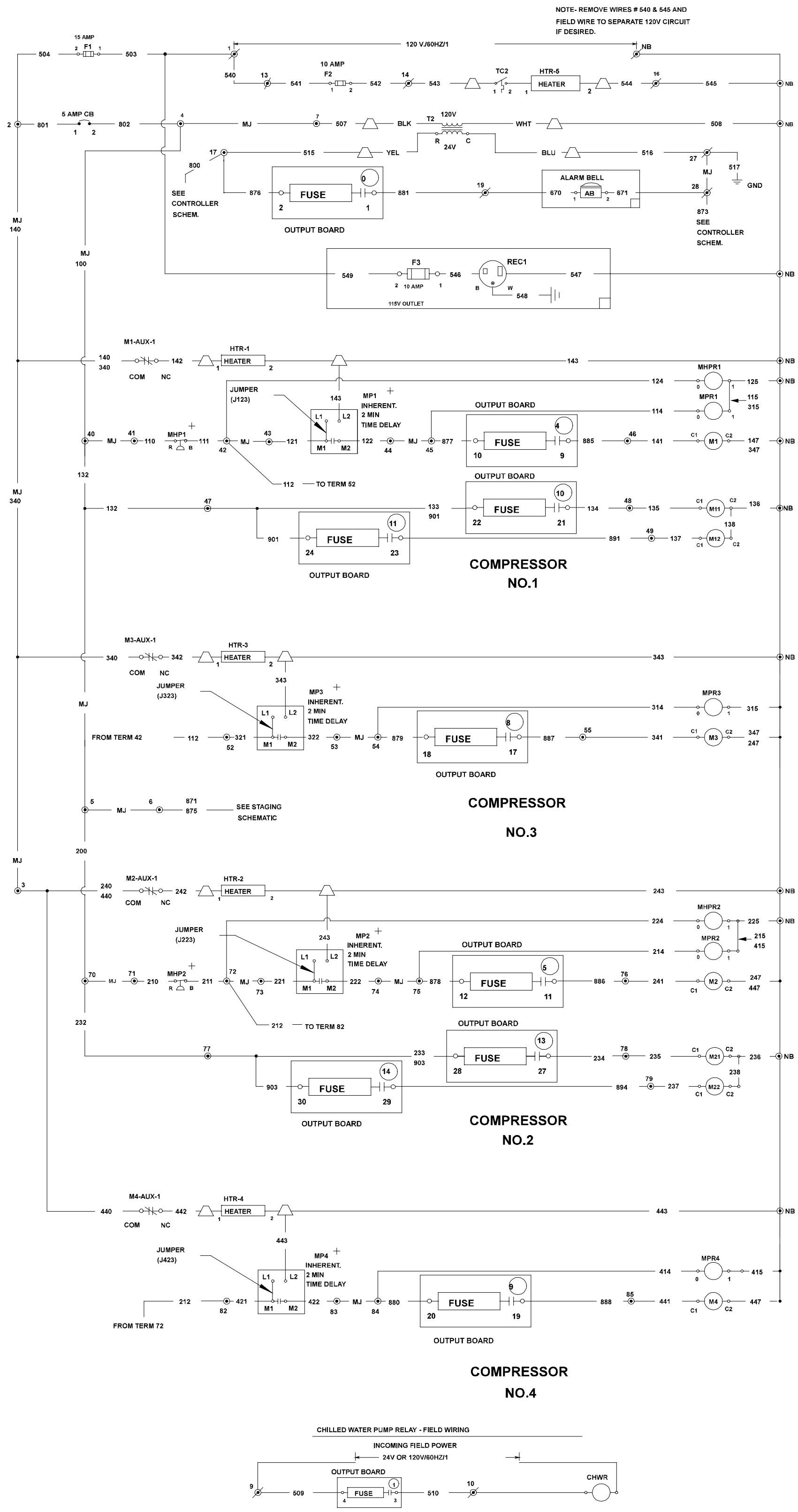


Figure 18, AGZ-AM, Staging Schematic (MicroTech)

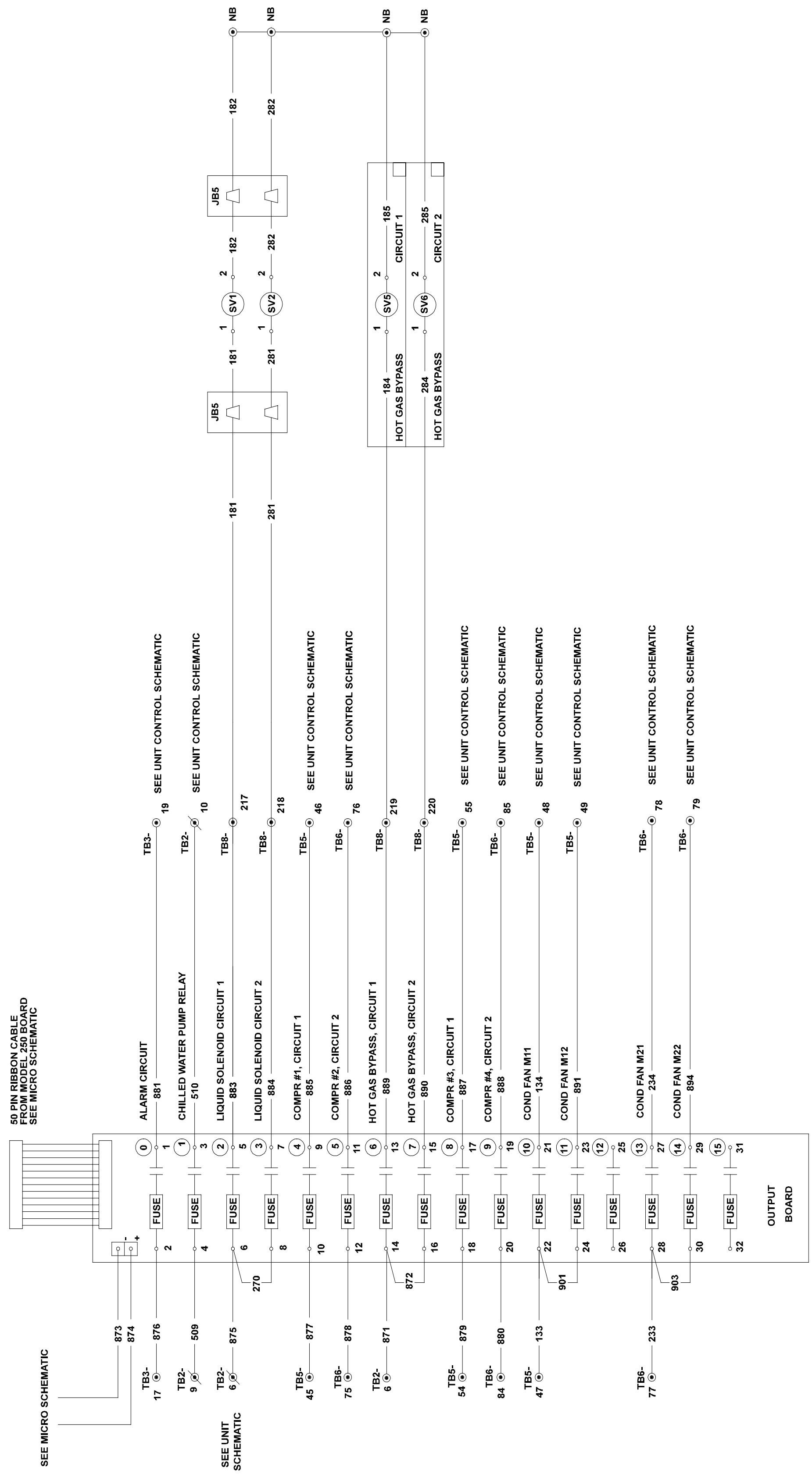


Figure 19, ACZ Field Connection Diagram (No Capacity Control)

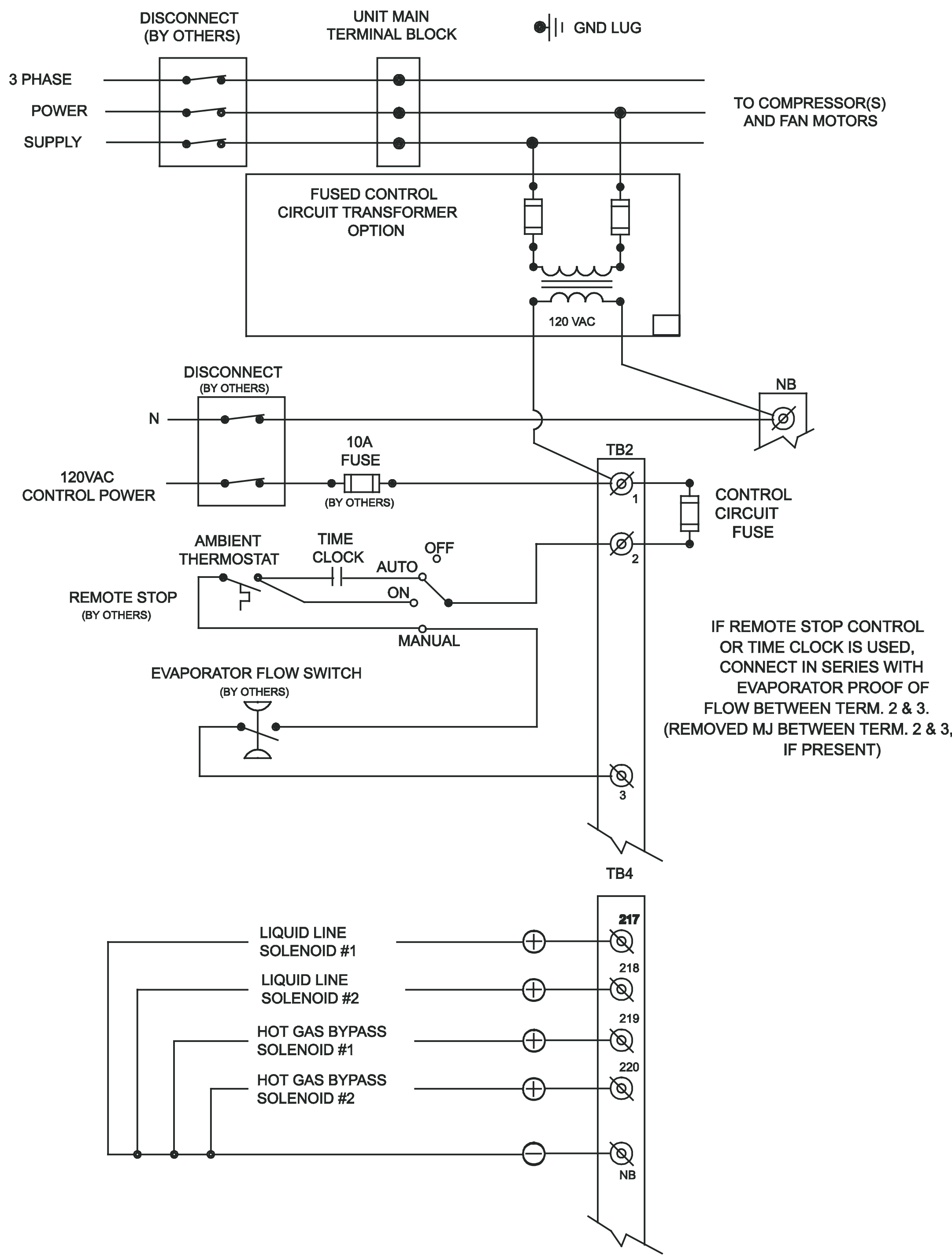
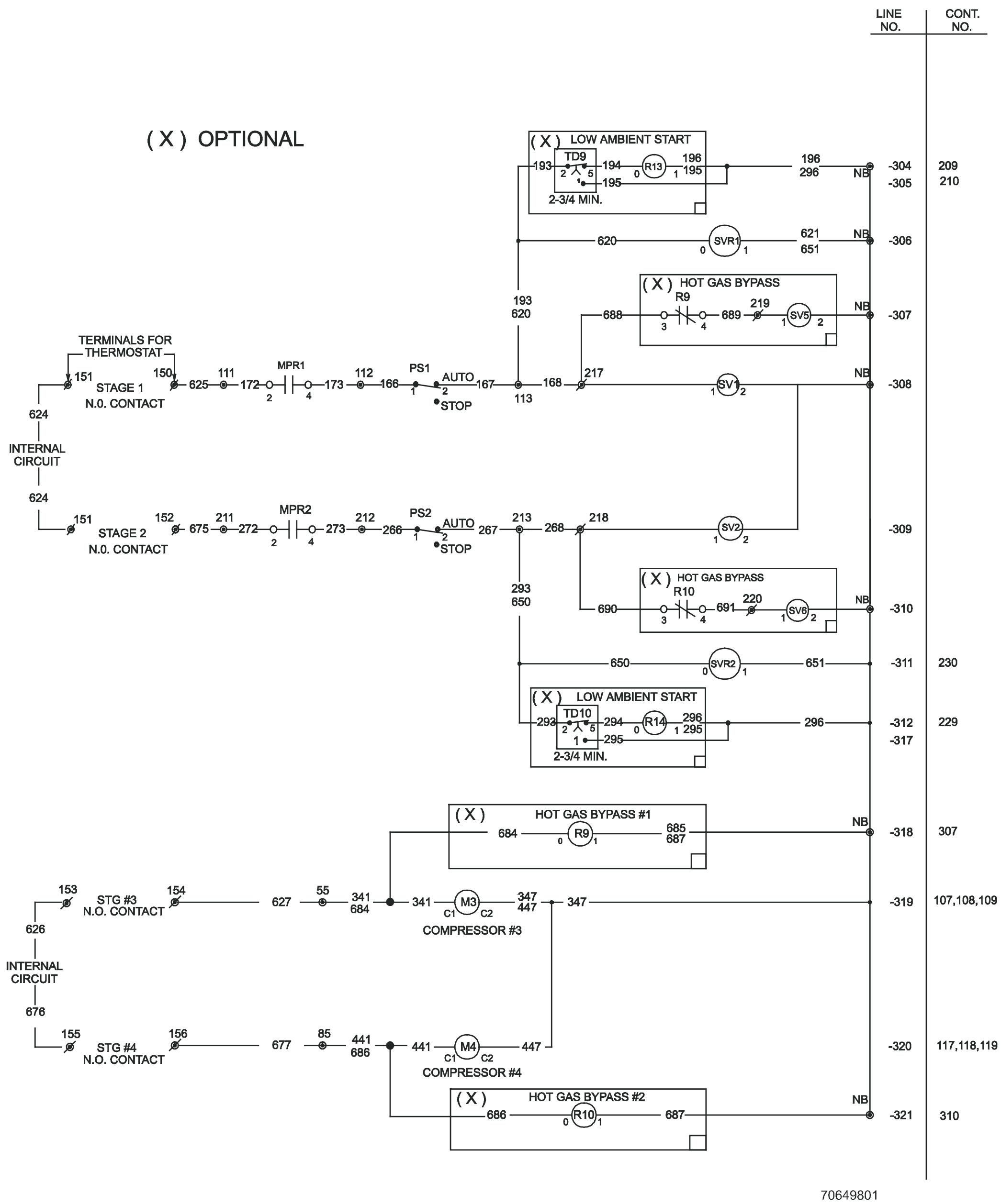


Figure 20, ACZ Field Wiring Diagram (Capacity Control Staging)

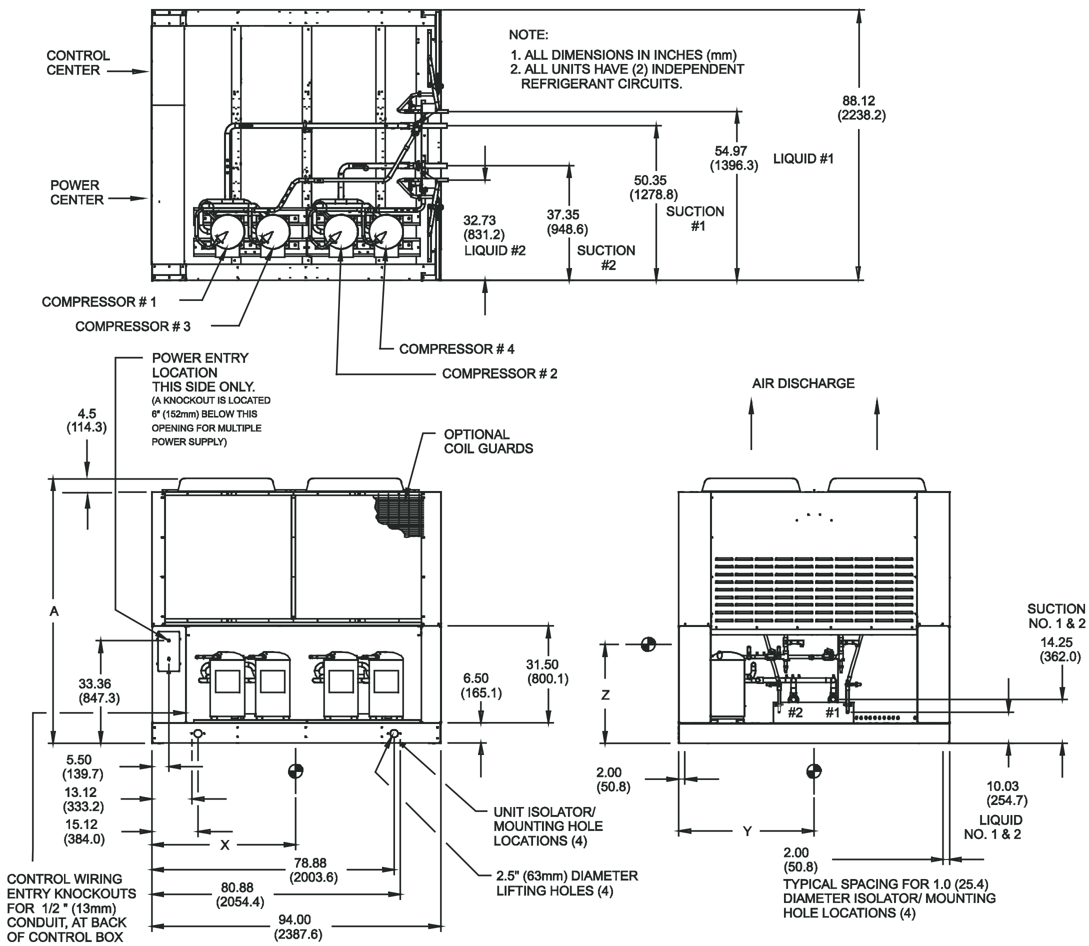


Dimensional Data

AGZ-AM

ACZ

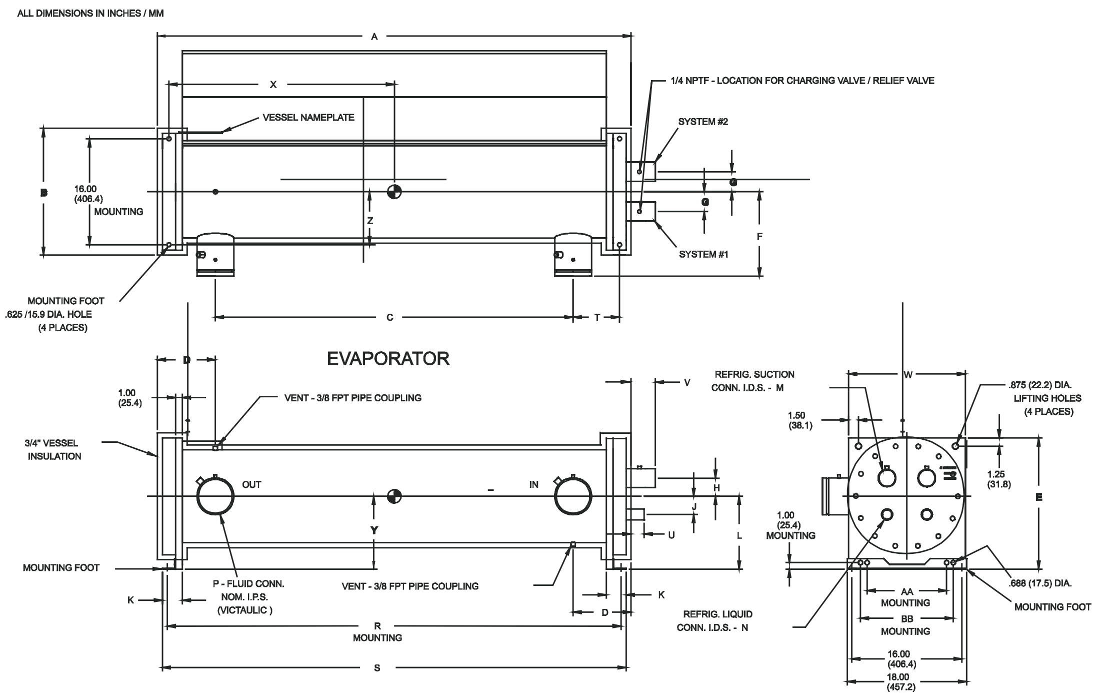
Figure 21, Dimensions AGZ 035AM - 050AM and ACZ 045A - 055A



ACZ MODEL NUMBER	AGZ MODEL NUMBER	DIMENSIONS inches (mm)		CENTER OF GRAVITY inches (mm)			UNIT WEIGHTS lbs (kgs)		ADD'L. WEIGHT FOR COPPER FINS lbs (kgs)
		A	B	X	Y	Z	OPERATING	SHIPPING	
	035AM	86.2 (2190)	81.7 (2075)	42.8 (1087)	35.9 (911)	40.0 (1016)	3000 (1361)	2940 (1334)	445 (200)
045A	040AM	86.2 (2190)	81.7 (2075)	42.8 (1087)	36.0 (914)	39.9 (1013)	3055 (1386)	2995 (1359)	445 (200)
050A	045AM	86.2 (2190)	81.7 (2075)	42.8 (1087)	35.2 (894)	40.3 (1024)	3095 (1404)	3025 (1372)	445 (200)
055A	050AM	86.2 (2190)	81.7 (2075)	42.8 (1087)	35.3 (897)	40.3 (1024)	3145 (1427)	3075 (1395)	445 (200)

CDE

Figure 22, CDE 1004-1 - 1204-3



CDE MODEL NUMBER	WATER CONNECTION INCHES (mm)				REFRIGERANT CONNECTION INCHES (mm)	
	C	L	P	T	M	N
CDE-1004-1	39.3 (998)	8.5 (216)	4.0 (102)	5.4 (137)	1 5/8 (41)	1 3/8 (35)
CDE-1204-3	39.3 (998)	9.5 (241)	4.0 (102)	5.4 (137)	1 5/8 (41)	1 3/8 (35)
CDE-1204-2	39.3 (998)	9.5 (241)	4.0 (102)	5.4 (137)	2 1/8 (54)	1 3/8 (35)

CDE MODEL NUMBER	DIMENSIONAL DATA INCHES (mm)							
	A	B	D	E	F	G	H	J
CDE-1004-1	52.5 (1334)	15.5 (394)	6.6 (168)	16.3 (414)	11.1 (282)	2.0 (51)	2.0 (51)	2.0 (51)
CDE-1204-3	53.5 (1359)	17.5 (445)	7.1 (180)	17.5 (445)	12.1 (307)	2.3 (58)	2.0 (51)	2.0 ((51)
CDE-1204-2	53.5 (1359)	17.5 (445)	7.1 (180)	17.5 (445)	12.1 (307)	2.3 (58)	2.0 (51)	2.5 (64)

CDE MODEL NUMBER	DIMENSIONAL DATA INCHES (mm)						
	K	R	S	U	V	W	AA	BB
CDE-1004-1	3.0 (76)	50.0 (1270)	52.0 (1321)	1.8 (45)	2.8 (71)	14.0 (356)	12.0 (305)	----
CDE-1204-3	3.0 (76)	50.0 (1270)	52.0 (1321)	1.8 (45)	2.8 (71)	16.0 (406)	----	14.0 (356)
CDE-1204-2	3.0 (76)	50.0 (1270)	52.0 (1321)	1.8 (45)	2.8 (71)	16.0 (406)	----	14.0 (356)

CDE MODEL NUMBER	WATER VOLUME	REFRIGERANT VOLUME	OPERATING CHARGE R-22 LBS (kgs)		UNIT WEIGHTS LBS (kgs)	
	GAL (litre)	CU. FT. (cu.m)	SYSTEM #1	SYSTEM #2	OPERATING	SHIPPING
CDE-1004-1	9.1 (34.4)	0.83 (.0235)	1.9 (.86)	1.9 (.86)	555 (252)	540 (245)
CDE-1204-3	12.8 (48.4)	1.25 (.0353)	2.8 (1.27)	2.8 (1.27)	777 (352)	745 (338)
CDE-1204-2	12.8 (48.4)	1.25 (.0353)	2.8 (1.27)	2.8 (1.27)	777 (352)	745 (338)

Pre Start-up

The system components must be inspected to ensure that nothing has became loose or damaged during shipping or installation.

Start-Up

For AGZ-AM units refer to the Global UNT Controller or MicroTech Controller sections to become familiar with the operation before starting chiller.

For ACZ units, the field furnished and installed capacity control system should be thoroughly understood prior to starting the unit.

There should be adequate stable building load (50% of unit capacity minimum) to properly check the operation of the system's refrigerant circuits.

Record all operating parameters required by the "Compressorized Equipment Warranty Form". Return this information within 10 working days to McQuay International as instructed on the form to obtain full warranty benefits.

1. Verify chilled water pressure drop across the evaporator or air flow for DX coil.
2. Verify remote start / stop or time clock has requested the chiller to start.
3. For UNT control, set the chilled water or leaving air control setpoint to required temperature. (The system water temperature must be greater than the total of the leaving water temperature setpoint plus 1/2 the control band before the Global UNT controller will stage on cooling.)
4. Set the control band to 4°F as a starting point.
5. Put both circuit switches to the AUTO position.
6. Put switch S1 to AUTO position.
7. There will be a delay of 2 minutes after closing S1. The time delay is due to the compressor inherent motor protection. This may allow more than one compressor to start after this time period. This should only occur on initial start-up or when power to the chiller has been turned off and back on. The panel Alarm Light will turn off.
8. After the system has been operating for a period of time and has become stable, check the following:
   - Compressor oil level. (Some Scroll compressors do not have oil sight glasses)
   - Refrigerant sight glass for flashing.
   - Rotation of condenser fans.
9. Complete the "Compressorized Equipment Warranty Form".

Shutdown

Temporary

1. Put both circuit switches to Pumpdown and Stop.
2. After compressors have stopped, put System Switch (S1) to Emergency Stop.
3. Turn off chilled water pump on water chilling applications. Chilled water pump to operate while compressors are pumping down.

To start the chiller after a temporary shutdown follow the start up instructions.

Extended

1. Front seat both condenser liquid line service valves.
2. Put both circuit switches in Pumpdown and Stop position.
3. After the compressors have stopped, put System Switch (S1) in Emergency Stop position.
4. Front seat both refrigerant circuit discharge valves.
5. If chilled water system is not drained, maintain power to the evaporator heater to prevent freezing. Maintain heat tracing on the chilled water lines.
6. Drain evaporator and water piping to prevent freezing.
7. If electrical power is on to unit, the compressor crankcase heaters will keep the liquid refrigerant out of the compressor oil. This will minimize start up time when putting the unit back into service. The evaporator heater will be able to function.
8. If electrical power is off, make provisions to power the evaporator heater (if chilled water system is not drained). Tag all opened electrical disconnect switches to warm against startup before the refrigerant valves are in the correct operating position. When starting the unit, electrical power must be on for 24 hours before starting the chiller.

To start the chiller after an extended shutdown, follow the pre startup and startup instructions.

Water Piping Checkout

1. Check the pump operation and vent all air from the system.
2. Circulate evaporator water checking for proper system pressure and pressure drop across the chiller barrel. Compare the pressure drop to the Evaporator water pressure drop curve.
3. Clean all water strainers before placing the chiller into service.

Refrigerant Piping Checkout

1. Check all exposed brazed joints for evidence of leaks. Unit joints may have been damaged during shipping or when the unit was installed.
2. Check that all refrigerant valves are either opened or closed as required for proper operation of the chiller.
3. Check all valve stem packing for leaks. Replace all refrigerant valve caps and tighten.
4. Check all refrigerant lines to insure that they will not vibrate against each other or against other chiller components.
5. Check all flare connections and all refrigerant threaded connectors.
6. Look for any signs of refrigerant leaks around the condenser coils and for damage during shipping or installation.
7. Leak detector is applied externally to refrigerant joints at the factory. Do not confuse this residue with an oil leak.
8. Connect refrigerant service gauges to each refrigerant circuit before starting unit.

Refrigerant Charging

Liquid line subcooling at the liquid shut-off valve should be between 15 and 20 degrees F at full load. If the unit is at steady full load operation and bubbles are visible in the sightglass, then check liquid subcooling. The charge for lines, outdoor units, and CDE evaporators are shown below. The charge for DX evaporators is usually small but should be added in.

Table 14, Refrigerant Charge in Lines

Tubing Size (inches)	Refrigerant Charge lb of R-22	
	Suction Line Per 100 ft. lb (kg)	Liquid Line Per 100 Ft. @ 100°F
7/8	N/A	24.0 (10.9)
1 1/8	N/A	40.8 (18.5)
1 3/8	N/A	62.2 (28.2)
1 5/8	1.7 (0.77)	88.0 (39.8)
2 1/8	2.9 (1.3)	153.1 (69.3)
2 5/8	4.5 (2.0)	N/A
3 1/8	6.4 (2.9)	N/A

Table 15, Refrigerant Charge in Outdoor Unit

AGZ-AM Model	ACZ, Model	Circuit #1 R-22 Charge lb (kg)	Circuit #2 R-22 Charge lb (kg)
	030A	15.9 (7.2)	15.9 (7.2)
030AM	035A	15.9 (7.2)	19.1 (8.6)
035AM	040A	19.2 (8.7)	19.2 (8.7)
040AM	045A	21.8 (9.9)	21.8 (9.9)
045AM	050A	22.1 (10.0)	26.8 (12.1)
050AM	055A	26.8 (12.1)	26.8 (12.1)

Table 16, Refrigerant Charge in CDE

CDE Model	R-22 Charge lb (kg)
1004-1	1.9 (0.86)
1204-3	2.8 (1.27)

Electrical Check Out

CAUTION

Electrical power must be applied to the compressor crankcase heaters 24 hours before starting unit.

1. Open all electrical disconnects and check all power wiring connections. Start at the power block and check all connections through all components to and including the compressor terminals. These should be checked again after 3 months of operations and at least yearly thereafter.
2. Check all control wiring by pulling on the wire at the spade connections and tighten all screw connections. Check plug-in relays for proper seating and to insure retaining clips are installed.
3. Put System Switch (S1) to the Emergency Stop position.
4. Put both circuit #1 & #2 switches to the Pumpdown and Stop position.
5. Apply power to the unit. The panel Alarm Light will stay on until S1 is closed. Ignore the Alarm Light for the check out period. If you have the optional Alarm Bell, you may wish to disconnect it.
6. Check at the power block or disconnect for the proper voltage and proper voltage between phases.
7. Check for 120Vac at the optional control transformer and at TB-2 terminal #1 and the neutral block (NB).
8. Check between TB-2 terminal #7 and NB for 120Vac supply for transformer #2.
9. Check between TB-2 terminal #2 and NB for 120Vac control voltage. This supplies the compressor crank case heaters.
10. Check between TB-3 terminal #17 and #27 for 24Vac control voltage.
11. Check on the Global UNT controller between terminals marked 24Vac and common for 24Vac control voltage. Green light on Global UNT controller should be flashing.

Sequence of Operation

Starting

With control power on, 115Vac power is applied through F1 to the compressor crankcase heaters and control transformer T2. T2 supplies 24Vac to the Global UNT controller. The green light on the Global UNT controller will begin to flash. The panel Alarm Light will illuminate. Put the System Switch S1 into the AUTO position. This applies power to the control circuit and a digital input to the Global UNT controller. Control power is applied through the MHP's to the compressor inherent motor protectors. After approximately a two (2) minute time delay, the MP's are energized and the panel Alarm Light will turn off. If this is a first start, depress the Freezestat Reset Button for 1 seconds. There is a default time delay of 5 minutes on the Freezestat reset.

Start the chiller water pump and put the chiller into the run mode by closing the remote start / stop input or time clock input. After the flow switch has made, the Global UNT controller will begin to ramp up if the chilled water temperature is above the leaving water setpoint dial plus 1/2 the control band dial. Internal timing functions will vary the stage up time.

The refrigerant circuit starting is switched between circuits every ten (10) starts. This maintains equal starts on the first compressor of each refrigerant circuit. Refrigerant circuit #1 is assumed as the starting circuit for the following.

When the first stage of cooling is required, relay BO1 will be energized and if the evaporator pressure is above the LPSS (low pressure starting setpoint), relay BO7 will be energized starting Compressor #1 and energizing the liquid line solenoid valve (SV1) through control relay CCR1.

As additional cooling is required, relay BO2 will be energized and if the evaporator pressure is above the LPSS (low pressure starting setpoint), relay BO8 will be energized starting Compressor #2 and energizing the liquid line solenoid valve (SV2) through control relay CCR2.

As additional cooling is required, relays BO3 and BO4 will start compressor #3 and #4 respectively.

The reverse will occur as the cooling requirements are reduced. Relays BO4 and BO3 will open stopping compressors #4 and #3. Relay BO2 will open closing the #2 refrigerant liquid line solenoid valve. Compressor #2 will continue to operate until the LPLL (low pressure low limit) is reached or the PDTD (pumpdown delay time period) timer times out. Relay BO8 will open stopping compressor #2. Relay BO1 will open closing the #1 refrigerant liquid line solenoid valve. Compressor #1 will continue to operate until the LPLL is reached or the PDTD timer times out. Relay BO7 will open stopping compressor #1. The compressors will not cycle on if the evaporator pressure exceeds the LPSS setpoint. The Global Scroll Chiller has a one time pumpdown.

Standard Controller Setpoints (optional Zone Terminal required to change values)

TEMPLATE NAME	VALUES	
	FACTORY SETPOINT	RANGE
OA/AI3 Lim SP	**80°F**	**0 to 100°F**
OA/AI3 Reset SP	**-40°F**	**-100 to 100°F**
LvgWtr Rband SP	**0°F**	**0 to 15°F**
Unoccpd Lvg SP	**70°F**	**40 to 90°F**
OA Lockout SP	**-10°F**	**-20 to 65°F**
Lvg Low Lim SP	**20°F**	**20 to 40°F**
SoftSta Capcty	**50%**	**0 to 100%**
SoftStart Time	**2 min**	**0 to 20 minutes**

Software Description (Global UNT Interface Kit required to read or change variables)

Variable Name	Description	Default Value	Range
LPSS	**Low Pressure Starting Setpoint**	**10 psi**	**5 to 15 psi**
SLPT	**Starting Low Pressure Time**	**260 sec**	**90 to 300 seconds**
MLPS	**Minimum Low Pressure Setpoint**	**5 psi**	**Calculated (LPSS-LPSD) 5 psi**
LPSD	**Low Pressure Starting Differential**	**5 psi**	**3 to 10 psi**
LPFS	**Low Pressure Freezestat setpoint**	**54 psi**	**30 to 55 psi**
LPHL	**Low Pressure High Limit**	**57 psi**	**40 to 60 psi**
LPLL	**Low Pressure Low Limit**	**55 psi**	**40 to 55 psi**
FSTP	**Freezestat Time Period**	**60 sec**	**60 seconds fixed**
PDTD	**Pumpdown Delay Time Period**	**60 sec**	**60 seconds fixed**

Hot Gas Bypass (Optional)

This option allows the system to operate at low loads without the ON-OFF cycling of the compressor. When the hot gas bypass option is used it is required to be on both refrigerant circuits because of the lead / lag feature of the Global UNT controller.

This option allows passage of discharge gas into the evaporator inlet (between the TX valve and the evaporator) which generates a false load to supplement the actual chilled water load.

The valve that is supplied is sized for operation in chilled water systems or DX systems above 40°F saturated suction temperatures.

A solenoid valve in the hot gas bypass lines is wired in parallel with both circuit's liquid line solenoid valves SV1 and SV2. The hot gas bypass is available whenever a refrigerant circuit is operating. The hot gas valve is regulating by the evaporator pressure and the remote adjustable bulb. The pressure regulating valve is factory set to begin opening at 58 psig (32°F for R-22). This setting can be changed by adjusting the remote adjustable bulb. Remove the cap on the remote bulb and raise the pressure by turning the adjustment screw clockwise. Lower the pressure by turning the adjusting screw counterclockwise. This changes the pressure that the hot gas bypass valve will start to open. Do not force the adjusting screw as this can damage the adjusting assembly.

⚠ WARNING

The hot gas line may become hot enough to cause injury. Be careful during valve checkout.

Note: The remote adjusting bulb must be installed on the outside of the suction line insulation. The bulb has to have a stable ambient air temperature for proper operation. Placing the bulb in contact with the evaporator refrigerant line will limit the operation of the hot gas bypass valve.

Filter Driers

Each refrigerant circuit is furnished with a full flow filter drier or an optional replaceable core type filter-drier. The core assembly of the replaceable core drier consists of a filter core held tightly in the shell in a manner that allows full flow without bypass.

Pressure drop across the filter drier at full load conditions must not exceed 10 psig. If pressure drop is more than 10 psig, then replace the filter drier. See Table 58 for maximum pressure drop at other load points.

> ⚠ **CAUTION**
>
> Pump out refrigerant before removing end flange for replacement of core(s).

A condenser liquid line service valve is provided for isolating the charge in the condenser, but also serves as the point from which the liquid line can be pumped out. With the line free of liquid, the filter-drier core(s) can be easily replaced.

System Adjustment

To maintain peak performance at full load operation, the system superheat and liquid subcooling may require adjustment. Read the following subsections closely to determine if adjustment is required.

Liquid Sightglass and Moisture Indicator

The color of the moisture indicator is an indication of the dryness of the system and is extremely important when the system has been serviced. Immediately after the system has been opened for service, the element may indicate a wet condition. It is recommended that the equipment operate for about 12 hours to allow the system to reach equilibrium before deciding if the system requires a change of drier cores.

Bubbles in the sightglass to expansion valve at constant full load conditions indicates a shortage of refrigerant, a plugged filter-drier, or a restriction in the liquid line. However, it is not unusual to see bubbles in the sightglass during changing load conditions.

Thermostatic Expansion Valve

The expansion valve performs one specific function. It keeps the evaporator supplied with the proper amount of refrigerant to satisfy the load conditions.

The sensing bulb of the expansion valve is installed in the closest straight run of suction line from the evaporator. The bulb is held on by clamps around the suction line and is insulated to reduce the effect of surrounding ambient temperatures. In case the bulb must be removed, simply slit the insulation on each side of the bulb, remove the clamps and then remove the capillary tubing that runs along the suction line from the valve.

The power element is removable from the valve body without removing the valve from the line.

Note: The superheat is factory set and adjustment is not needed unless operation is outside the 8°F to 12°F range.

⚠ CAUTION

Before adjusting superheat, check unit charge is correct and liquid line sightglass is full with no bubbles.

The suction superheat for the suction leaving the evaporator is set at the factory for 8° to 12°F at full load. To have full rated unit performance the superheat must be about 8°F at 95°F outdoor ambient.

Crankcase Heaters

The scroll compressors are equipped with externally mounted band heaters located at the oil sump level. The function of the heater is to keep the temperature in the crankcase high enough to prevent refrigerant from migrating to the crankcase and condensing in the oil during off-cycle.

Power must be supplied to the heaters 24 hours before starting the compressors.

Water Cooler

The water cooler is of the direct expansion type with removable internally finned tubes. The copper tubes are individually rolled into heavy duty steel tube sheets and sealed by a steel refrigerant head.

The water connection nozzles which enter and leave the shell are on the same side of the unit. No special attention is required for the cooler except that clean, filtered water should be supplied.

Global UNT Controller, AGZ-AM

This section provides installation, setup and troubleshooting information for the Global UNT controller.

All operational descriptions are based on the Global UNT software SUZE4-2A. Operational characteristics may vary with other versions of software.

General Description

The Global UNT is a microprocessor based leaving water controller designed for multiple stage operation.

The Global UNT's operation is based on an adjustable setpoint and control band. Controller software is available for different reset options, refrigerants and metric units. Optional equipment includes a Zone Terminal that can be installed in the unit or remotely. The Zone Terminal provides a user interface to all reset options and adjusts specific setpoints. Downloading of software or changing selected operating parameters requires the Global UNT Interface Kit.

Optional Sensors

- Return water temperature sensor
- Zone temperature sensor

Sensors and Transducers

Sensors and transducers are mounted and connected to the Global UNT controller with sensor cable. The evaporator pressure transducers depress the Schrader fittings and can be replaced without pumping the unit down. The pressure transducers are connected to the Global UNT controller analog inputs with IDC connectors (Insulation Displacement Connectors). The low pressure transducers have a blue dot. The leaving water sensor is in a thermal well for easy replacement without draining the water system. As standard, an outside air sensor is provided on the back of the control box. When other reset options are selected, the outside air sensor is not provided as only one (1) type of reset is available.

Control Wiring

Low voltage control wiring is installed, labeled and tested by the factory before shipment.

External Voltage Inputs

The signal for remote reset option (2 to 10Vdc) or demand limit (0 to 10Vdc) is provided by the installing contractor. Connect to TB -7 terminals #134 (+) and #135 (-) as indicated by the unit wiring diagram. A 4 to 20mA signal conditioned by a 500 ohm resistor can provide the 2 to 10Vdc input for the remote reset option. Polarity of the external DC signal must match the controller polarity.

Interlock Wiring

All interlock wiring to field devices (such as a flow switch or time clock) is provided by the installing contractor. All interlocking wiring must be connected to the Global UNT 24Vac power supply. External power supplies connected to the Global UNT controller can damage the controller. See unit wiring diagram.

Unit Set Points and Calibration

The control software is installed and tested by the factory before shipping. No periodic calibration of the controller is necessary. All control and safety set points must be checked by the installing contractor and adjusted as necessary before starting the unit.

The “setpoint” control knob adjusts the leaving water setpoint. The “Control Band” knob adjusts the controller temperature control band. To set, divide the chilled water temperature range by the number of unloading steps and add 0.5°F.

Optional Sensors

Optional sensor kits, available from the factory, can be installed in the field. The optional sensor kits have the same characteristics as the leaving water sensor.

Field Wiring

Interconnecting wiring for the control panel may consist of the following:

- 115Vac power wiring
- Analog input signals
- Digital input signals
- Digital output signals
- Communications to a personal computer

Power Wiring

The installing contractor provides the unit voltage power source, disconnect, fuses and necessary wiring for these circuits. All wiring must conform to the National Electrical Code and applicable local building codes. If the evaporator heater power source (120Vac) is supplied from a separate external supply, remove wires 540 and 545 as indicated on the unit wiring diagram.

Power Supplies

There are several internal power supplies used by the controller and related circuitry. The regulated 5Vdc power is supplied by RSP1 and provides power to pressure transducers. Do not use this power supply to operate external devices. A 24Vac power supply is available for the alarm bell option. Wire according to the unit wiring diagram.

Analog input signals

All sensors and transducers required for normal chiller operation are installed and wired at the factory. All optional analog input signal wiring is provided by the installing contractor must be twisted, shielded pair (Belden #8760 or equal). The optional demand limit and remote reset signals are 0 to 10Vdc signals. The controlling range of the remote reset signal is from 2Vdc to 10Vdc.

Digital input signals

Remote contacts for all digital inputs into the Global UNT controller must be dry contacts suitable for the 24Vac control signals from the control panel. Do not connect 120Vac power to the digital inputs or 24Vac from an external power source.

Remote Stop/Start

If remote stop/start control is selected, remove the jumper between terminals #140 and #141 on TB-7 and install the input between these terminals. When the remote stop/start switch is open, the controller will be in the unoccupied mode.

Chilled Water Flow Switch

The chilled water flow switch is connected to field wiring terminals #142 and #143 on TB-7. When the chilled water pump is enabled, the Global UNT controller checks for proof-of-flow through the flow switch digital input.

Digital Outputs

The digital outputs are controlled by the Global UNT controller. The outputs are double pole double throw plug-in type relays, with a 24Vac holding coil and 120Vac - 7.0 amp rated contacts. These relays are field replaceable. Only one contact is used per relay. The contact that is used can be normally open or normal closed and is dependent on the relay function.

External Alarm Annunciator Circuitry

An audible alarm can be connected to the Alarm Output terminals #19 and #28 of TB-3 of the control panel and is highly recommended to make certain the operator is alerted to any alarm condition. This output can also be used to alert a building automation system by paralleling a 24Vac control relay with the alarm light. This circuit is a 24Vac 1.8 amp maximum load output. The alarm output will be activated when an alarm condition occurs. Refer to the unit schematic.

Note: The alarm signal is not active during a power failure and will not provide a “Loss of Power” alarm.

PC Connection

The Global UNT controller can be connected to an IBM or IBM compatible computer for setpoint changes and downloading of different software’s. A Global UNT Interface Kit is available from your local McQuay Sales Representative.

Software Identification

Control software is factory installed and tested in each panel prior to shipment. The software is identified by a program code which is printed on the a small label attached to the controller.

Controller Inputs /Outputs

Analog Inputs

Analog inputs are used to read the various temperatures and pressures on the chiller as well as any customer supplied reset signals. The regulated 5Vdc power supply provides correct operating voltage for the pressure transducers. This 5Vdc supply cannot be used for other inputs.

Table 17, Analog Inputs

Input	Description	Location	Range
AI-1	**Leaving Chilled Water Temp**	**Leaving Chw nozzle**	**0 to 120°F(0 - 49°C)**
AI-2	**Circuit #1 Evap Pressure**	**Circuit #1 Suction Line**	**0 to 150 psi (0 - 1034kPa)**
AI-3	**Optional Reset input**	**TB-7 #134 and #135**	**0/2 to 10VDC / temp sensor**
AI-4	**Leaving Water Temp Setpoint Dial**	**Control Panel**	**10 to 60°F (-12 to 15° C)**
AI-5	**Circuit #2 Evap Pressure**	**Circuit #2 Suction Line**	**0 to 150 psi (0 - 1034kPa)**
AI-6	**Control Band Setpoint Dial**	**Control Panel**	**0 to 10°F (-17 to -12°C)**

Digital Inputs

Note: All Digital Inputs are 24Vac supplied by transformer T2 in the control panel. Do not use inputs from another power supply external to the unit. This can cause failure of the Global UNT controller.

Table 18, Digital Inputs

Input	Description	Location	Closed	Open
BI-1	**Time Clock**	**Field Installed to TB-7 #140 & #141**	**Run**	**Stop**
BI-2	**Auto / Pumpdown and Stop Switch Circuit #1**	**Control Panel**	**Run**	**Pumpdown Stop**
BI-3	**Auto / Pumpdown and Stop Switch Circuit #2**	**Control Panel**	**Run**	**Pumpdown Stop**
BI-4	**Chilled Water Flow Switch**	**Field Installed to TB-7 #142 & #143**	**Run**	**Stop**

Relay Outputs

All of the relay outputs are controlled by the Global UNT controller. The relays are double pole double throw relays with contacts rated for 120Vac - 7.0 amp and a 24Vac holding coil. Refer to the unit staging schematic.

Table 19, Relay Board Outputs

Relay Output Number	Output Description
1	**Circuit #1 Liquid Line Solenoid Valve**
2	**Circuit #2 Liquid Line Solenoid Valve**
3	**Compressor #3 Contactor M3**
4	**Compressor #4 Contactor M4**
5	**Spare**
6	**Spare**
7	**Low Pressure Relay Circuit #1**
8	**Low Pressure Relay Circuit #2**

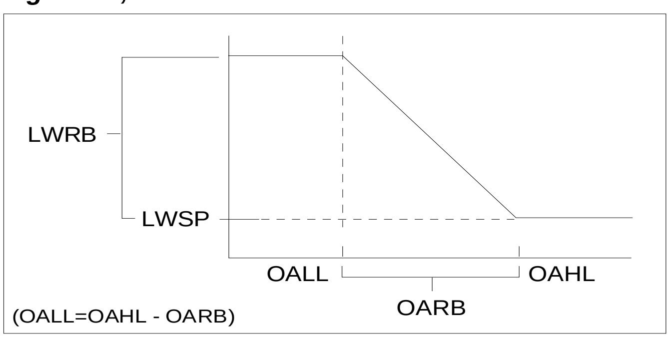
Reset Options

The Global UNT controller is capable of one reset option. The reset option should be selected at the time of purchase. Outside Air is the standard option and a Zone Terminal is necessary to activate this option or any other reset option. Other reset options, such as chilled water, are available and requires a software download. Field modifications can be accomplished with the Global UNT Interface Kit Part Number 0074642001; consisting of cable supply, cable pro, and connector board.

Outside Air Reset

When selected, a Outdoor Air Temperature (OAT) sensor is connected to TB-7 terminals #134 and #135. Four variables are used to setup the reset ramp that calculates the Actual Leaving Water Setpoint. These are: Leaving Water Setpoint (AI-4), Reset Band selected with a Zone Terminal, Outdoor Air High Limit (OAHL), and Outdoor Air Reset Band (OARB).

Figure 23, Outside Air Reset

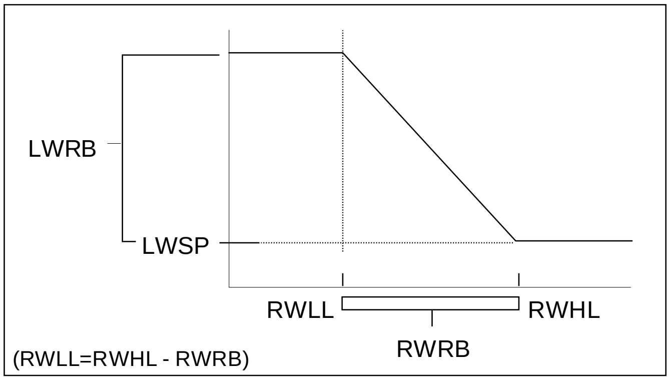


As the OAT increases above the Outdoor Air Low Limit (OALL), the Actual Leaving Water Setpoint is decreased from its Leaving High Limit (Leaving Water Setpoint plus Leaving Reset Band) to the Leaving Water Setpoint. When OAT reaches the OAHL, the Actual Leaving Water Setpoint equals the Leaving Water Setpoint (AI4). If the OAT sensor is missing or unreliable, no reset occurs and the Actual Leaving Water Setpoint equals the Leaving Water Setpoint. If the Leaving Water Sensor (AI1) becomes unreliable, the compressor command is forced to 0%.

Return Water Reset (optional Return Water Sensor is required)

When selected, a Return Water Temperature (RWT) sensor is connected to TB-7 terminals #134 and #135. Four variables are used to setup the reset ramp that calculates the Actual Leaving Water Setpoint. These are: Leaving Water Setpoint (AI-4), Reset Band selected with a Zone Terminal, Return Water High Limit (RWHL), and Return Water Reset Band (RWRB).

Figure 24, Return Water Reset



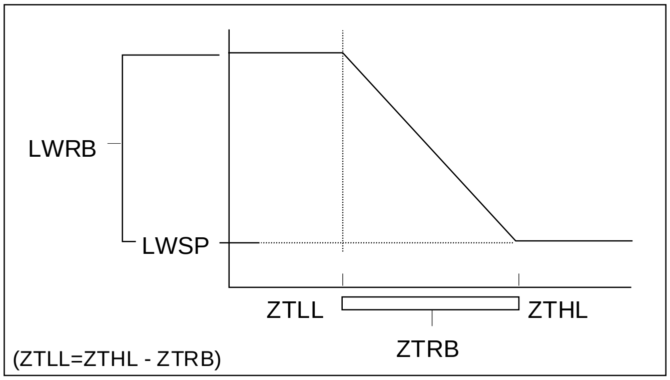
As the RWT increases above the Return Water Low Limit (RWLL), the controller decreases the Actual Leaving Water Setpoint from its Leaving High Limit (Leaving Water Setpoint plus Leaving Reset Band) to the Leaving Water Setpoint. When RWT reaches the RWHL, the Actual Leaving Water Setpoint equals the Leaving Water Setpoint (AI-4). If the RWT sensor is missing or unreliable, no reset occurs and the Actual Leaving Water Setpoint equals the Leaving Water Setpoint. If the Leaving Water Sensor (AI-1) becomes unreliable, the compressor command is forced to 0%.

When Return Water Reset is chosen, a Fail Smart Logic option is also available. This option works as follows. If the Leaving Water Sensor (AI-1) becomes unreliable, the controller switches from Leaving Water control to Return Water control. Actual Return Water Setpoint equals Leaving Water Setpoint (AI-4) plus an adjustable Leaving Water Setpoint Offset. This value takes into account the temperature differential between Leaving and Return water temperatures, which is typically about 10°F. If both the Leaving and Return water sensors are unreliable, the compressor is forced to 0%.

Zone Temperature (optional Zone Temperature Sensor)

When selected, a Zone Temperature Sensor is connected to TB-7 terminals #134 and #135. Four variables are used to setup the reset ramp that calculates the Actual Leaving Water Setpoint. These are: Leaving Water Dial Setpoint (AI-4), Reset Band SP selected with the Zone Terminal, Zone Temperature High Limit (ZTHL), and Zone Temperature Reset Band (ZTRB).

Figure 25, Zone Temperature Reset



As the Zone Temperature increases above the Zone Temperature Low Limit (ZTLL), the controller decreases the Actual Leaving Water Setpoint from its Leaving High Limit (Leaving Water Setpoint plus Leaving Reset Band) to the Leaving Water Setpoint. When the Zone Temperature reaches the ZTHL, the Actual Leaving Water Setpoint equals the Leaving Water Setpoint (AI-4). If the Zone Temperature sensor is missing or unreliable, no reset occurs and the Actual Leaving Water Setpoint equals the Leaving Water Setpoint. If the Leaving Water Sensor (AI-1) becomes unreliable, the compressor command is forced to 0%.

The Zone Terminal is required to activate and change the reset values.

Remote Reset (2 to 10Vdc input)

When selected, a 2 to 10Vdc signal is connected to TB-7 terminals #134 and #135. This input can be achieved by using a 4-20mA signal and conditioning it with a 500 ohm resistor. This input resets the leaving water temperature to a higher value based on the reset input signal magnitude. At a 2Vdc (4mA) chiller signal input, the controller uses the Setpoint Dial setting. At a 10Vdc (20mA) signal input, the controller adds the reset value to the Dial Setpoint for the controlling temperature. Between 2Vdc and 10Vdc, a proportional value is added to the Dial Setpoint for the controlling temperature. The leaving water temperature can be reset upwards an additional 15°F. The Zone Terminal is required to change the reset values. Requires different dip switch settings.

Demand Limit (0 to 10Vdc input)

When selected, a 0 to 10Vdc signal is connected to TB-7 terminals #134 and #135. This input limits the cooling capacity (0 to 100%). At 0Vdc signal input, the controller does not limit compressor staging. At 10Vdc signal input, the chiller would be off. Between 0Vdc and 10Vdc, a proportional percentage capacity is available. Requires different dip switch settings.

Additional UNT Features

Remote Stop/Start

In the occupied mode, when the remote stop/start switch is open, the controller will be in the unoccupied mode. The unit will be enabled when the remote start / stop switch is closed and will control at the leaving water temperature setpoint.

Unoccupied Mode

When the remote start / stop input is opened, the unoccupied mode is initiated. The chiller will maintain a higher leaving water temperature setpoint (default 70°F) if the chilled water circulation is maintained. The unoccupied leaving water setpoint can be changed from the Zone Terminal.

Soft Start

Soft loading limits the number of available stages when the unit is started to prevent excessive power consumption and possible overshoot of the leaving water temperature set point. Soft loading is in effect whenever the unit is started from an “off” cycle. When stage up starts, the controller starts a countdown timer to indicate how long the unit has been in the cool stage mode. The number of stages allowed during soft loading is determined by the Soft Start Capacity. The duration of the soft load sequence is determined by the Soft Start Timer. If the Soft Start Timer is set to zero, no soft loading will take place. The Zone Terminal is required to change the Soft Start values.

Compressor Staging

The AGZ Scroll chiller has two refrigerant circuits and each circuit has two scroll compressors. When the first stage of cooling is required, the #1 refrigerant circuit will start. This circuit will be the first to start for the next ten Starts. The Global UNT controller will then select the #2 refrigerant circuit to start first for the next ten starts. This cycle will continue and balance the number of starts between the refrigerant circuits. This is an automatic lead / lag control.

The compressors are always started in a fixed order. Refrigerant circuit #1 has compressor #1 and compressor #3. Compressor #1 will always start first on refrigerant circuit #1. Refrigerant circuit #2 has compressor #2 and compressor #4. Compressor #2 will always start first on refrigerant circuit #2.

There are four stages of cooling capacity on the Global Scroll chiller unit. The first stage of cooling will be the first compressor of the lead refrigerant circuit. The second stage of cooling will be the first compressor of the lag refrigerant circuit. Cooling stage three will always be compressor #3 and cooling stage four will always be compressor #4.

Stage down is the reverse of the above paragraph.

Pumpdown Control

The AGZ units have a one time pump down. The pump down is activated when a circuit’s liquid line solenoid valve is de-energized. After the circuit’s liquid line solenoid valve is de-energized, the operating compressor(s) on that refrigerant circuit will operate until the Low Pressure Low Limit (LPLL) setting is reached or the Pump Down Time Delay (PDTD) expires and stops that compressor(s). The compressor will not cycle on if the evaporator pressure exceeds the low pressure cut-in value. The compressor will start if the Global UNT controller calls for cooling.

The Pumpdown and Stop switch will open its respective circuit’s digital input to the Global UNT controller. This will open the associate circuit’s output and open the circuit’s solenoid valve. If a compressor is operating on that circuit, the compressor will operate until the low pressure switch stops the compressor. If a compressor is not running, the switch does not activate a pumpdown for that circuit but will not allow the circuit to stage on and operate.

Certain alarm conditions will not permit chiller pumpdown. These alarm conditions are:

- High Condenser Pressure
- Bad Evap Pressure Sensor
- Compressor Motor Protect
- Freezestat Alarm
- Flow Failure

Freezestat Control

On startup the Global UNT controller will check the evaporator pressure after the SLPT (starting low pressure time) timer times out. If the evaporator pressure is greater than the low pressure high limit (LPHL) value, the Global UNT controller will continue to stage up as additional cooling is required. If the evaporator pressure is less than the LPHL, the Global UNT controller will de-energize BO7 or BO8 (depends on circuit starting) which will stop the compressor. This is a Freezestat alarm (alarm will indicate on the optional Zone Terminal) and will require the resetting by depressing the FREEZESTAT RESET on the control panel. The circuit will not go through a pumpdown.

If the chiller has been operating and the evaporator pressure in either circuit is less than the low pressure Freezestat setpoint (LPFS) the Global UNT controller starts the Freezestat time period (FSTP). If the evaporator pressure is below the LPHL after the FSTP times out, BO7 or BO8 (depends on evaporator circuit with the low pressure) will be de-energized stopping the operating compressor(s) and closing that refrigerant circuit's liquid line solenoid valve. This is a Freezestat alarm (alarm will indicate on the optional Zone Terminal) and will require the resetting by depressing the FREEZESTAT RESET on the control panel. There is a five minute time delay after the freezestat reset switch has been depressed. The circuit will not go through a pumpdown upon alarm.

Starting Timers

The Global UNT controller has a starting timer which delays checking the evaporator pressure for 260 seconds. After the timer times out, the evaporator pressure is checked. If the pressure is above the low pressure high limit (LPHL), the controller stages up on leaving water temperature requirements. If the evaporator pressure is below the LPHL, then the controller will stop that circuit and indicate a freezestat alarm on the (optional) Zone Terminal.

Head Pressure Control

There are two condenser fans per refrigerant circuit. These fans are cycled on and off according to the circuit's condenser pressure. Fan #1 of a refrigerant circuit will start when number one compressor of that refrigerant circuit has started. This fan will not cycle off until the circuit is stopped. The second fan on a refrigerant circuit will cycle on and off according to its head pressure controller (PC12 or PC22).

Optional Head Pressure Control (SpeedTrol)

The first condenser fan on each circuit can have the SpeedTrol option. The fan rpm's is varied to maintain a minimum condenser head pressure for stable operation at low ambient temperatures. Wind baffles may be required in addition to the SpeedTrol option for low ambient operation.

Alarms

Circuit Alarm Conditions

The "Circuit Alarm Conditions" are those alarms which only affect one circuit and can stop the compressors of that circuit. These alarms are:

- Compressor Motor Protection
- High Condenser Pressure
- Freezestat Protection

The Alarm Light on the control panel will illuminate if either circuit has a high head pressure occurrence or a compressor motor protection occurrence. Freeze protection would be indicated on the optional Zone Terminal. If a circuit is off and the panel alarm light is not on, try depressing the Freezestat reset on the control panel. There is a five minute time delay after depressing the reset button.

The chiller must have the manual reset system alarm conditions cleared before normal operation can resume. If the alarm which occurred is an auto-clearing alarm, once the condition has corrected, the chiller will resume normal operation provided the anti-cycle timers have cleared and sufficient load exists.

System Alarm Conditions

The "System Alarm Conditions" are those alarms which are common to both refrigeration circuits and require all compressors to be temporarily shut off or locked out, whichever applies.

System alarm conditions are:

- Loss of Water Flow
- Phase Voltage Monitor PVM (Optional)
- Ground Fault Protection GFP (Optional)

The Alarm Light on the control panel will illuminate if either the PVM or GFP has a fault occurrence. Loss of water flow is indicated on the optional Zone Terminal.

The chiller must have the manual reset system alarm conditions cleared before normal operation can resume. If the alarm which occurred is an auto-clearing alarm, once the condition has corrected, the chiller will resume normal operation provided the anti-cycle timers have cleared and sufficient load exists.

ZONE TERMINAL (optional)

The Zone Terminal (ZT) is a hand-held or unit mounted device that monitors and adjusts your McQuay Global Scroll Chiller information.

A standard telephone-style jack directly connects the ZT to the McQuay Global UNT controller.

Features

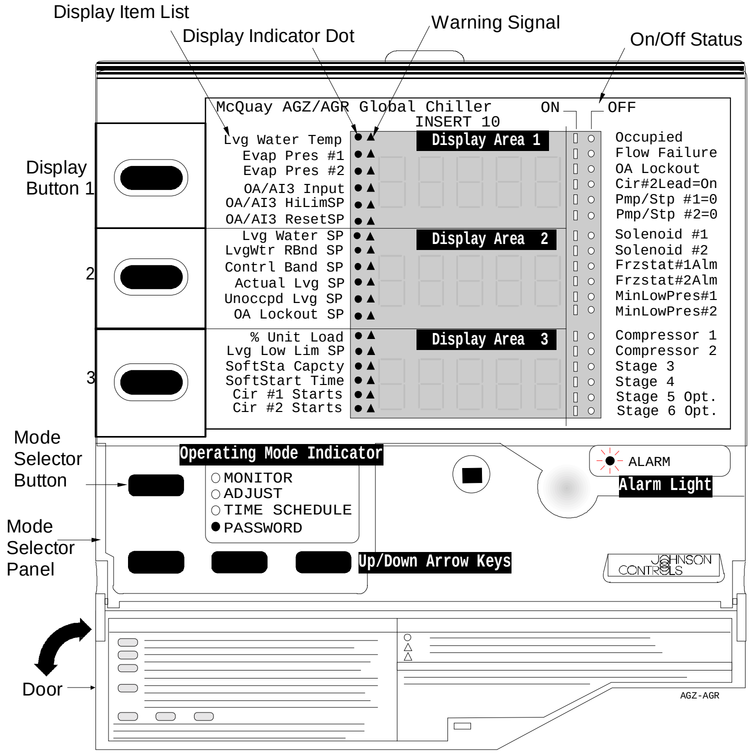
- Portability
- Simultaneous monitoring of three different settings or values
- Easy operation with only seven buttons
- Flashing numbers to show which items are ZT adjustable
- Flashing symbols to notify you of alarm conditions

Capabilities

With the ZT, you can:

- Quickly identify a chiller alarm and its location
- Monitor and adjust up to 18 different settings

Figure 26, Zone Terminal



OPERATING MODES

Two operating modes are included: Monitor and Adjust.

Monitor Mode

As soon as the ZT is connected, it completes a self-check, and starts up in the Monitor Mode. Monitor Mode lets you view up to three of chiller settings/sensed values at a time.

To allow you to monitor your system, a clear plastic Insert (factory made and installed) relates the ZT's output to your McQuay Global UNT controller.

You can simultaneously monitor the chiller in three ways:

- Monitor up to three settings/sensed values. A maximum of six items are accessible in each of the three displays.
- Read the symbols to the right of the display numbers to learn the on/off status of various inputs, outputs, or modes (| = On status; m = Off status). This provides continuous monitoring of 18 different status (on/off).
- Monitor alarm status–a flashing red alarm light and any flashing symbol (|, m, s) visually notifies you when your chiller has an alarm condition.

Adjust Mode

In Adjust Mode, the ZT displays information in each of the three numerical displays. Typically, the displays are set up so that the relationship between the values can be viewed simultaneously. For example:

Display 1 = Lvg Water Temp

Display 2 = Lvg Water SP

Display 3 = % Unit Load

This operating mode allows you to adjust any flashing setpoints. Setpoints adjusted by the ZT remain in effect until you change them.

DISPLAYS, SYMBOLS, KEYS, AND BUTTONS

The Zone Terminal simultaneously displays three set points or sensed values. In addition, flashing symbols indicate when items are in a state of alarm. The keys, buttons, displays, and symbols are explained below.

Table 20, Displays, Symbols, Keys, Buttons

DISPLAYS, SYMBOLS, KEYS, BUTTONS	DESCRIPTION
Display Button 1, 2, 3	Select the value you want to monitor or adjust.
Enter Key	Use to commit your changes. Adjustments are not processed unless you press Enter.
Flashing Numbers	Appear in Display 1, 2, or 3 to indicate numbers you can adjust. Numbers that do not flash are monitor only numbers.
Flashing s, m, (|)	Shows an item is in alarm.
Mode Selector Button	Press this button to select Operating Modes: Monitor, Adjust, Password, Time Scheduling. A green Mode Indicator light moves through the modes.
On/Off Status Symbols(|) for On/a circle (m) for Off	Observe On/Off conditions of a point in the HVAC controller with these symbols. A bar (|) for On, a circle (m) for Off. These are always monitor only items. If the symbol flashes, item is in alarm.
Red Alarm Light	Flashes anytime a problem exists regardless of which Operating Mode you have entered.
Up (↑) or Down (↓) Arrow Keys	Use these keys to adjust a flashing number.
l	Appears in the displays, and corresponds to the item you are monitoring or adjusting.

INSTALLING THE PLASTIC LABELS

Note: The insert is normally factory-installed. These steps are required only if the insert is not already installed.

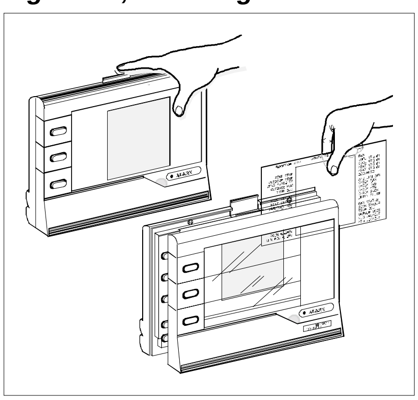
To use the ZT, you'll need the plastic label which is included with your ZT.

Insert

The clear plastic Insert is a custom-made label unique to your chiller. Use this Insert when monitoring or adjusting specific items of your system:

1. With the ZT on a flat surface, press the white tab with your index finger (Figure 27).
2. Pull the front cover of the ZT away from the back and slide the Insert into position.
3. Press the ZT together. With the Insert in place and the ZT connected, the l in the top position of each display lines up with the first word.

Figure 27, Installing the Insert



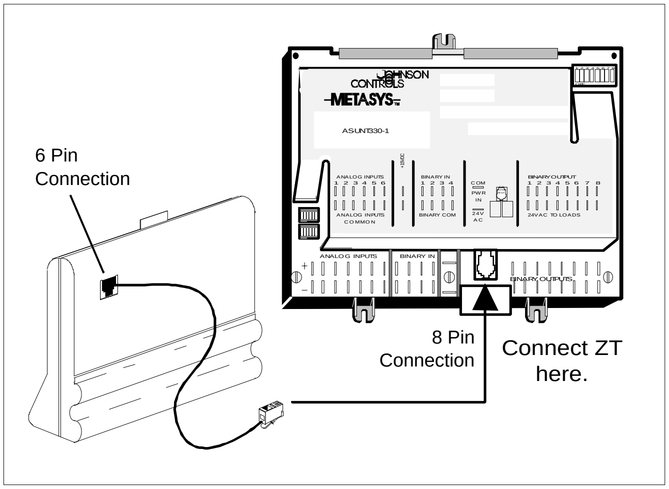
CONNECTING THE ZONE TERMINAL

You can unit mount the ZT, or use it as a portable tool for convenient access to any chiller information.

McQuay Global Scroll Controller Connection

A standard telephone-style jack connects the ZT to a McQuay Chiller Controller directly.

Figure 28, Connecting ZT to a Global UNT Controller Using 6 to 8 Pin Cable



ALARM STATUS

The ZT indicates an alarm as follows:

- The warning signal (s) flashes to the right of the Display Indicator dot (l) if the system operating values are in alarm.
- The On/Off Status bar (|) or circle (m) flashes when an On/Off status is in alarm.
- The red alarm light to the right of the Mode Selector Panel flashes when any of the above items are in alarm.

Alarms cannot be cleared with the ZT. The problem must be corrected by maintenance or repair of the affected item.

MAKING ZONE TERMINAL ADJUSTMENTS

Adjusting Control Settings

1. You can adjust only a flashing number with the ZT. If the number does not flash, that item is a monitor only item. Adjust Control Settings in Display 1, 2, or 3 as follows:
2. Press the Mode Selector Button until the green Mode Indicator Light moves next to the word Adjust.
3. Press either Display Button 1, 2, or 3 to locate adjustable items, which are indicated by flashing numbers.

   If you continue pressing the display buttons, the dot (|) in each display changes positions and the corresponding number appears.
4. Press the Up (↑) or Down (↓) Arrow key until you reach the number you want to enter. If you hold down the Up (↑) or Down (↓) Arrow keys, you can speed through the numbers more quickly.
   Press Enter. After you press Enter, the numbers stop flashing for a few seconds. This pause tells you the ZT has processed your adjustment.
5. Press any of the Display Buttons to make other adjustments, and repeat Steps 2 and 3.

Adjustable Points

The following McQuay Global Scroll Chiller points are adjustable by the Zone Terminal.

Table 21, Adjustable Points

TEMPLATE NAME	VALUES	
	FACTORY SETPOINT	RANGE
OA/AI3 HiLim SP	80°F	0 to 100°F
OA/AI3 Reset SP	-40°F	-100 to 100°F
LvgWtr Rband SP	0°F	0 to 15°F
Unoccpd Lvg SP	76°F	40 to 90°F
OA Lockout SP	-10°F	-20 to 65°F
Lvg Low Lim SP	20°F	20 to 40°F
SoftSta Capcty	50%	0 to 100%
SoftStart Time	2 min	0 to 20 minutes

Zone Terminal Glossary

Lvg Water Temp - Shows the temperature of the water leaving the evaporator.

Evap Pres #1 - Shows the evaporator pressure for refrigerant circuit #1.

Evap Pres #2 - Shows the evaporator pressure for refrigerant circuit #2.

OA/AI3 Input - Reset input signal (Outdoor Air Temp. is standard), non-adjustable

OA/AI3 HiLimSP - Used in algorithm for Outside Air Reset. Adjusts Outdoor Air High Limit (OAHL)(default is 80°F).

OA/AI3 Reset SP - Used in algorithm for Outside Air Reset. Adjusts Outdoor Air Reset Band (OARB)(default is -40°F; therefore outdoor air reset is 40-80 DegF).

Lvg Water SP - Shows the dial adjustment setpoint. Non-adjustable from ZT.

LvgWtr Rbnd SP - Can be adjusted through the ZT, 0° - 15°F (default is 0°F). Used in algorithm for Outside Air Reset. (For an example of 10°F reset; 45 DegF Leaving Water Setpoint reset up to 55°F).

Contrl Band SP - Indicates what the Control Band Knob is set at. Non-adjustable from ZT.

Actual Lvg SP - Shows the actual setpoint, including any reset that is occurring.

Unoccpd Lvg SP - Adjustable from 40°F - 90°F (default is 70°F). The setpoint is activated by a timeclock in unoccupied mode.

OA Lockout SP - Adjustable from -20°F to 65°F (default is -10°F). Shuts the unit off when the Outside Air reaches the setpoint. (Differential = 5°F).

% Unit Load - Indicates the % of the unit load.

Lvg Low Lim SP - Adjustable from 20°F - 40°F (default is 20°F). This safety that will shut the chiller off based on the leaving water temperature going below this setpoint.

NOTE: Some models may have substitute **Freezstat SP**.at 54 psig

SoftSta Capcty - Adjusts the ramping of steps from 0% - 100% (default is 50%).

SoftStart Time - Adjustable ramping time from 0 - 20 minutes (default is 2 minutes).

Cir #1 Starts - Counts the number of starts for circuit #1.

-

Cir #2 Starts - Counts the number of starts for circuit #2. Note: If power is lost to the controller, this data is lost and will start counting over. When power is applied and kept on, the controller will allow 10 starts for circuit #1 as the lead circuit, then will switch to circuit #2 for the next 10 starts, etc (Automatic Lead/Lag).

Occupied - |= On, 0 = Off

Flow Failure - |= Alarm, 0 = Normal

OA Lockout - Indicates whether your in OA lockout (see OA Lockout SP). No alarm.

Cir#2Lead=On - Indicates which circuit is in the lead e.g., ½= On, 0 = Off indicates that circuit #2 is in the lead.

Pmp/Stp #1=0 - |= Auto, circuit #1 allowed to run if cooling capacity is needed, 0 = Pump down circuit #1 and stop.

Pmp/Stp #2=0 - |= Auto, circuit #2 allowed to run if cooling capacity is needed, 0 = Pump down circuit #2 and stop.

Solenoid #1 - On a call for cooling on circuit 1, the solenoid is energized and opened.

Solenoid #2 - On a call for cooling on circuit 2, the solenoid is energized and opened.

Frzstat#1Alm - If circuit #1 fails on freeze, the alarm light on the ZT will light. To clear the alarm, the Freez-Stat Reset button (located on the Control Panel) must be pushed once to clear.

Frzstat#2Alm - If circuit #2 fails on freeze, the alarm light on the ZT will light. To clear the alarm, the Freez-Stat Reset button (located on the Control Panel) must be pushed once to clear.

MinLowPres#1 - If circuit #1 falls below the Minimum Low Pressure Setpoint (default is 10 psig) - Differential (default is 5 psig) the ZT alarm will light. Once it increases above the Minimum Low Pressure Setpoint, the alarm will clear.

MinLowPres#2 - If circuit #2 falls below the Minimum Low Pressure Setpoint (default is 10 psig) - Differential (default is 5 psig) the ZT alarm will light. Once it increases above the Minimum Low Pressure Setpoint, the alarm will clear.

Compressor #1 - Compressor 1 is On or Off

Compressor #2 - Compressor 2 is On or Off

Stage 3 to 6 - Indicates how many additional compressor (or unloading) stages are on at the time.

Global UNT Controller Troubleshooting Chart

PROBLEM	POSSIBLE CAUSES	CORRECTIVE ACTIONS
Compressor will not run	1. Main switch, circuit breakers open. 2. Fuse blown. 3. Thermal overloads tripped or fuses blown. 4. Defective contactor or coil. 5. System shut down by safety devices. 6. No cooling required. 7. Liquid line solenoid will not open. 8. Motor electrical trouble. 9. Loose wiring.	1. Close switch. 2. Check electrical circuits and motor winding for shorts or grounds. Possible overloading. Replace fuse or reset breakers after fault is corrected. 3. Overloads are auto reset. Check unit closely when operating again. 4. Repair or replace. 5. Determine type and cause of shutdown and correct it before resetting safety. 6. None. Wait for load. 7. Repair or replace. 8. Check motor for opens, shorts circuit or burnout. 9. Check all wire junctions. Tighten all terminals.
High Discharge Pressure	1. Dirty condenser coils. 2. Fan not operating. 3. High Ambient conditions. 4. High return water temperature. 5. Overcharge of refrigerant. 6. Non condensable. 7. Discharge valve partially closed.	1. Clean. 2. Check fan motor, contactor, contactor coil, fan pressure switch. Repair or replace defective part. 3. Check against design conditions. 4. Disable a compressor on each. 5. Remove excessive amount of charge. 6. Remove non condensable. 7. Back seat valve
Low Discharge Pressure	1. Fan contactor failed in closed position. 2. Fan pressure switch defective. 3. Low ambient temps. 4. Low on refrigerant charge. 5. Reduced chilled water flow. 6. No load and on hot gas bypass.	1. Repair or replace. 2. Replace pressure switch. 3. Install SpeedTrol Kit. 4. Add refrigerant. 5. Check flow and correct. 6. Adjust hot gas bypass to maintain a higher evaporator pressure.
High Suction Pressure	1. Excessive load (high return water temp). 2. Controller not staging up. 3. Compressor capacity reduced. 4. Can be associated with high condenser pressure.	1. Check water flow, reduce load. 2. Check UNT controller. Replace if defective. 3. Replace compressor. 4. Check reasons for high condenser pressure.
Low Suction Pressure	1. Low refrigerant charge. 2. Defective expansion valve. 3. Dirty filter drier. 4. Reduced water flow. 5. Hot gas bypass valve not set properly. 6. Liquid line solenoid valve not opening. 7. UNT controller defective. 8. Gasket failure in evap head ring.	1. Add refrigerant. 2. Check operation. Repair or replace. 3. Replace cores. 4. Increase water to design GPM. 5. Set valve for a higher pressure. 6. Repair or replace. 7. Check water sensor, set point dial, control band dial. Calibrate, repair or replace. 8. Replace gasket.
Compressor Oil Loss	1. Excessive refrigerant flood back. 2. Defective crankcase heater. 3. Low refrigerant charge. 4. Hot gas bypass not set properly.	1. Check TXV. Repair or replace. 2. Replace heater. 3. Add refrigerant. 4. Increase hot gas flow.
Compressor Overloads or Circuit Breakers Open	1. Low line voltage. 2. High compressor amps. 3. Loose power wiring. 4. High condenser pressures. 5. Single phasing.	1. Check incoming voltage. Report to electrical supplier. 2. Determine cause and correct. 3. Tighten all connections. 4. Refer to High Condenser Pressure. 5. Replace fuses or breaker.
Compressor Internal Motor Switch Open	1. Compressor amps high. 2. Motor winding damaged.	1. Refer to the above concerning high compressor amps. 2. Check motor winding resistance. Replace if defective.
Freeze Protection Trips	1. Pressure transducers defective. 2. Low water flow. 3. Low loads / erratic water flow. 4. Controller stage timing. 5. Defective TXV. 6. Hot gas bypass not set properly. 7. Low ambient operation.	1. Compare output to actual refrigerant pressures. 2. Check water GPM and correct. 3. Check pump operation, water strainer, air handler control valves. 4. Check timing and reset as necessary. 5. Check and repair or replace. 6. Set hot gas bypass. 7. Install SpeedTrol, wind baffles.
Erratic Loading and Unloading	1. Chilled water flow erratic. 2. System load erratic. 3. Bad water sensor. 4. Reset function calibration. 5. Defective UNT controller.	1. Check for reasons and correct. 2. Check water flow control valve operation. 3. Replace. 4. Re-calibrate 5. Replace

MicroTech Controller, AGZ-AM

All operational descriptions are based on the MicroTech controller software versions AGZ2E01A. Operating characteristics and menu selections may vary with other versions of software. Contact McQuay Technical Support for software update information.

General Description

The MicroTech control panel contains a model 250-06 microprocessor based controller which provides all control functions. The operator can review and change operating parameters from the interface keypad which consists of twelve input keys and a two line by sixteen character display. In addition to providing all normal operating controls, the controller monitors all safety devices on the unit and will shut the system down and alarm through a set of dedicated alarm contacts. Important operating conditions at the time of the alarm are retained in the controller's memory to aid in troubleshooting and unit diagnostics. McQuay MicroTech Monitor software is available for remote adjustment and monitoring of the chiller.

The system is protected by a simple password scheme which allows access by authorized personnel. A valid password must be entered into the panel by the operator before any setpoints can be changed.

Optional Sensor Packages

- Refrigerant Sensor Package
  - Suction line temperature, circuit #1
  - Suction line temperature, circuit #2
  - Liquid line temperature, circuit #1
  - Liquid line temperature, circuit #2
- Unit amp package
  - Unit amperage - Percent total unit amperage including compressors and condenser fans. Does not include externally powered equipment such as water pumps.

Installation

The MicroTech controller is shipped factory tested with default values for the type of refrigerant. All control values must be entered for the specific application of the chiller.

Sensors and transducers

Sensors and transducers are mounted and connected to the analog / digital input (ADI) board with shielded cable. The evaporator and condenser pressure transducers depress the Schrader fittings and can be replaced without pumping the unit down. The pressure transducers are connected to the MicroTech analog inputs with IDC connectors (Insulation Displacement Connectors). High pressure transducers have a red dot and low pressure transducers have a blue dot. Water sensors are in thermal wells for easy replacement without draining the water system. Optional refrigerant line temperature sensors are in a copper sleeve brazed to the appropriated refrigerant line.

Control wiring

Low voltage control wiring is installed, labeled and tested by the factory before shipment.

Remote 4-20 milliamp signals

Signals for leaving water reset or demand limit are provided by the installing contractor and connected to the terminal block as indicated by the unit wiring diagram. See Field Wiring diagram for details.

Interlock wiring

All interlock wiring to field devices (such as flow switches and pump starters) is provided by the installing contractor. See unit wiring diagrams and field wiring diagram.

Unit set points and calibration

The control software is installed and tested by the factory before shipping. Calibration of the controller is not necessary. All control and safety set points must be checked by the installing contractor and adjusted as necessary before starting the unit. Controllers for McQuay chillers have default set points. Refer to the menu items listed below.

- Control mode
  - Leaving water temperature
  - Head pressure settings
  - Compressor staging
  - Soft loading
  - Holiday dates
  - Internal scheduling
- Alarm functions

The default settings are suitable for most installations. The control mode is factory set for “Manual Unit Off”. Check and set the control and safety settings for the application before starting the unit. For more information on menu items, see the menu description section.

Modem kit

An optional modem kit allowing remote monitoring of the chiller from an off-site PC running McQuay Monitor software is available from your local McQuay International sales representative. The modem kit comes complete with modem, mounting bracket, wiring harness, and installation instructions. The modem kit can be field installed or as an option at the factory. Modem wiring is shown on the field wiring diagram.

Lead-Lag

A feature on all McQuay AGZ 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.

Field Wiring

Interconnecting wiring for the control panel may consist of the following:

- 115Vac power wiring
- Chilled water pump relay
- Analog input signals
- Digital input signals
- Digital output signals
- Network communications
- Communications to a personal computer
- Telephone line for remote modem access

Power Wiring

The installing contractor provides the unit voltage power source, disconnect, fuses and necessary wiring for these circuits. All wiring must conform to the National Electrical Code and applicable local building codes. If the control power source (120Vac) or the evaporator heater power source (120Vac) or both are supplied from a separate external supply, remove wires 540 and 545 as indicated on the field wiring diagram.

Power Supplies

There are several internal power supplies used by the controller and related circuitry. The regulated 5Vdc power is supplied by the controller and provides power to all analog inputs into the ADI board. Do not use this power supply to operate external devices. A 24Vac power supply is available for the alarm bell option. Wire according to the field wiring diagram.

Analog Input Signals

All sensors and transducers required for normal chiller operation are installed and wired at the factory, All optional analog signal wiring provided by the installing contractor must be twisted, shielded pair (Belden #8760 or equal). The optional demand limit and leaving water reset signals are 4 to 20 milliamp DC signals. The resistive load that conditions the milliamp signal is a 249 ohm resistor mounted on the ADI board at the factory.

Digital Input Signals

Remote contacts for all digital inputs into the MicroTech controller must be dry contacts suitable for the 24Vac control signals from the control panel. Do not connect 120Vac power to the digital inputs.

Remote Stop/Start

If remote stop/start control is selected, remove the jumper between terminals #140 and #141 on TB-7. When the remote stop/start switch is open, the controller will be in the “Off: Remote Sw” mode. The unit will be enabled when the switch is closed.

Chilled Water Flow Switch

The chilled water flow switch is connected to field wiring terminals #142 and #143 on TB-7. When the chilled water pump is enabled, the MicroTech controller checks for proof-of-flow through the flow switch digital input.

Digital Outputs

The digital output board has normally open solid-state relays with an on-board replaceable 5 amp fuse. The status of all outputs are shown by the individual output red LEDs.

Chilled Water Pump Relay

The optional chilled water pump relay is connected to terminal #10 and #9 on TB-2. When the unit is enabled, the chilled water pump relay is energized. Be sure the relay coil is rated for a maximum load of 1.8 amps at 120Vac. There is a 5 amp fuse on the digital output board for this control circuit.

External Alarm Annunciator Circuitry

An audible alarm can be connected to the Alarm Output terminals #19 and #28 of TB-3 of the control panel and is highly recommended to make certain the operator is alerted to any alarm condition. This output can also be used to alert a building automation system or other controls as required. This circuit is a 24Vac 1.8 amp maximum load output but can be used as a dry contact or another voltage by rewiring the circuit. Refer to the unit schematic.

The alarm output can be programmed to activate when an alarm or pre-alarm condition is detected. The alarm signal is de-energized during normal operations. During a fault alarm condition the alarm circuit will energize and the alarm status light will be on. During a pre-alarm condition the alarm output and status light will pulse “on” for one-half second and “off” for four seconds.

Note: The alarm signal is not active during a power failure and will *not* provide a “Loss of Power” alarm.

PC Connection

The MicroTech controller can be connected to an IBM or IBM compatible computer for local or remote system monitoring. Communication network wiring uses low voltage shielded twisted pair cable (Belden 8760 or equal). The network uses the RS232 communications standard with a maximum cable length of 50 Feet. An RS232/485 adapter may be used to allow for cable runs to 5000 feet.

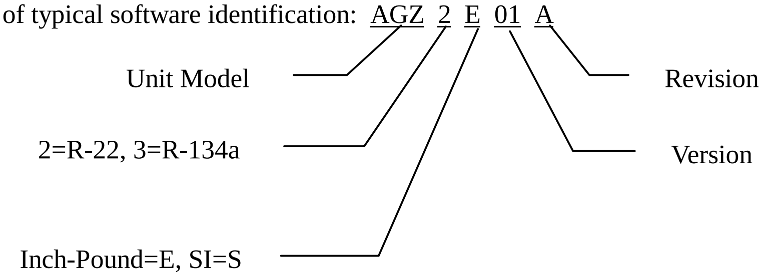
Telephone line

If remote access and monitoring of the unit is chosen, then a voice quality direct dial telephone line is required. The line must be a dedicated line and used only for modem access. The phone line must be terminated with a standard RJ-11 modular phone plug.

Software Identification

Control software is factory installed and tested in each panel before shipment. The software is identified by a program code printed on a small label attached to the controller. The software version may also be displayed on the keypad display by viewing the menu items in the Misc. Setup menu.

Example of typical software identification: AGZ 2 E 01 A



Controller Inputs /Outputs

Analog Inputs

Analog inputs are used to read the various temperatures and pressures on the chiller as well as any customer supplied 4-20mA reset signals. The controller's internal regulated 5Vdc and 12Vdc supplies provide correct operating voltage for the sensors. See Table 22 for details.

Table 22, Analog Inputs

Input	LED	Description	Location	Range	Resolution
0	0	Leaving Chilled Water Temp	Leaving Chw nozzle	-40 to 263°F	0.1°F
1	1	Circuit #1 Evap Pressure	Circuit #1 Suction Line	0 to 145 psi	0.1 psi
2	2	Circuit #2 Evap Pressure	Circuit #2 Suction Line	0 to 145 psi	0.1 psi
3	3	Circuit #1 Cond Pressure	Compressor Discharge Line-	20 to 450 psi	0.5 psi
4	4	Circuit #2 Cond Pressure	Compressor Discharge Line-	20 to 450 psi	0.5 psi
5	5	Voltage Ratio Signal	EnGinn Power Supply	4.1 to 5.1 VDC	--
6	6	Chw Water Reset	Supplied by others	4 to 20 mA DC	--
7	7	Demand Limit Signal	Supplied by others	4 to 20 mA DC	--
8	8	Entering Evap Water Temp	Entering Chw Nozzle	-40 to 263°F	0.1°F
9	9	Entering Cond Water Temp	Enter Cond Water Nozzle	-40 to 263°F	0.1°F
10	10	Leaving Cond Water Temp	Leaving Cond Water Nozzle	-40 to 263°F	0.1°F
11	11	% Total Unit Amps	Control Cabinet	0 to 4 VDC	--
12	12	Circuit #1 Suction Temp	Circuit #1 Suction Line	-40 to 263°F	0.1°F
13	13	Circuit #2 Suction Temp	Circuit #2 Suction Line	-40 to 263°F	0.1°F
14	14	Circuit #1 Liquid Line Temp	Circuit #1 Liquid Line	-40 to 263°F	0.1°F
15	15	Circuit #2 Liquid Line Temp	Circuit #2 Liquid Line	-40 to 263°F	0.1°F

Digital Inputs

All Digital Inputs are 24Vac. At 7.5Vac to 24Vac the digital input contacts are considered closed. Below 7.5Vac, the contracts are considered open. See Table 23 for details and operating characteristics.

Table 23, Digital Inputs

Input	LED	Description	Circuit	Closed	Open
0	0	Mechanical High Pressure Switch	Circuit #1	Normal	Alarm
1	1				
2	2	Motor Protect Switch Compressor	Compressor #1	Normal	Alarm
3	3				
4	4	Motor Protect Switch Compressor	Compressor #3	Normal	Alarm
5	5	System Switch	Unit	Run	Stop
6	6	Phase/Voltage Monitor	Unit	Normal	Alarm
7	7	Pumpdown Switch	Unit	Pmp Dn	Normal
8	8	Mechanical High Pressure Switch	Circuit #2	Normal	Alarm
9	9				
10	10	Motor Protection Switch	Compressor #2	Normal	Alarm
11	11				
12	12	Motor Protection Switch	Compressor #4	Normal	Alarm
13	13	Chiller Remote Stop Switch	Unit	Run	Stop
14	14	Evap Water Flow Switch	Unit	Run	Stop
15	15	Pumpdown Switch	Circuit #2	Pmp Dn	Normal

Relay Board Outputs

All of the MicroTech panel outputs are controlled by solid-state relays which are driven by the model 250 controller. The controller activates a solid-state relay by sending a "trigger" signal to the output board via the attached ribbon cable. The relay responds to the trigger by lowering it's resistance which allows current to flow through it's "contacts". When the controller removes the trigger signal, the relay's resistance becomes very high, causing the current flow to stop. The outputs are individually protected by a 5 amp fuse mounted on the output board adjacent to each relay. Table 24 provides additional information about each output. Refer to the MicroTech Staging schematic for digital output wiring.

Table 24, Relay Board Outputs

Digital Output Number	Output Description
0	Alarm Circuit
1	Chilled Water Pump Relay
2	Liquid Line Solenoid Circuit #1
3	Liquid Line Solenoid Circuit #2
4	Compressor #1 Circuit #1
5	Compressor #2 Circuit #2
6	Hot Gas Bypass Circuit #1
7	Hot Gas Bypass Circuit #2
8	Compressor #3 Circuit #1
9	Compressor #4 Circuit #2
10	Condenser Fan (M11)
11	Condenser Fan (M12)
12	Spare
13	Condenser Fan (M21)
14	Condenser Fan (M22)
15	Spare

Reset Options

User reset options are located in the “Leaving Water Setpoint” menu. The options are:

None

“None” is the default value and the leaving evaporator water temperature controls the unit.

Return

When selecting “Return” as the reset mode, the controller resets the leaving water temperature set point as required to maintain the selected return water temperature.

4 - 20 mA (remote reset signal)

When selecting “4-20mA” as the reset mode, the controller will reset the leaving water temperature to a higher value based on a percentage of the “Maximum Chilled Water Reset”. At 4mA or less, the leaving water temperature is not reset. At 20mA the leaving water temperature is reset to the maximum. Between 4 and 20mA, the leaving water temperature is reset proportionally to the reset input signal.

Outside Air

When selecting “Outside Air” as the reset mode, the controller will reset the leaving water temperature to a higher value based on the temperature of the outside air (ambient). As the outside air temperature decreases, the leaving water temperature is reset up until the maximum reset is obtained. When the outside air temperature is above the outside air temperature reset setpoint the leaving water temperature is not reset and is controlled to the leaving water temperature setpoint.

Ice (for lower ice setpoint requirements, consult McQuay Marketing Support)

When in “Ice” reset mode, and adequate amount of glycol must be added to the system to protect the evaporator from freezing. McQuay recommends a minimum of 30% solution of ethylene glycol to protect to 7°F with the minimum leaving water temperature at unit shut down of 21°F. At 21°F shut down, the saturated refrigerant temperature can approach 10°F.

The leaving water setpoint must be calculated according to the following formula;

LvgEvapSpt = Desired Ice Temperature + 1/2 Control Band + Shut down Delta T

Lvg EvapSpt = 21°F + 1/2 (4)°F + 1.5°F

Lvg Evap Spt = 21°F + 2°F + 1.5°F

Lvg Evap Spt = 24.5°F

The remote 4-20mA input must be 4mA or less and the leaving water temperature will be controlled to the calculated setpoint. When the remote reset input is above 4mA, the value "MaxChwRst" is added to the leaving water setpoint. This will be the day operating setpoint. This value cannot be reset when in the day mode by any other reset options.

The alarm setpoints must be adjusted to allow operation of the chiller at the lower temperatures. The following values should be adjusted and the example assumes 30% ethylene glycol solution with a 21°F shut down temperature:

1. "FrzStat" Set to the saturated suction pressure that corresponds to a temperature several degrees higher than the freeze point of the water / glycol solution. (10°F = 33psig.)
2. "Frz H2O" Set at least 4°F below the shut down temperature, but not lower than the freezing point of the water / glycol solution. (21°F - 4°F = 17°F)
3. "LP cutout" Set 8 to 10 psi below the "Frz State" pressure but never below 20 psig. (33psi - 10 psi = 23 psi)
4. "LP Cutin" Set to a saturated suction pressure equal to the shut down temperature plus 1/2 the control band. (21°F + 2°F = 23°F; 23°F = 46psig)

Network

A network refers to a McQuay MicroTech control panel (CSC or RMS) that can provide controlling functions to several McQuay chillers. One function is to control the chiller leaving water temperature according to some control logic in the network control panel. The network control panel will control the leaving water setpoint when the "Network" option in the chiller is selected. The network control panel will send a signal that reflects 0 to 100% reset of the leaving water set point according to the value entered into the "MaxChwRst" of the unit controller.

Soft Loading

Soft loading limits the number of available stages when the unit is started to prevent excessive power consumption and possible overshoot of the leaving water temperature set point. Soft loading is in effect whenever the unit is started from an "off" cycle. On initial start-up, the chiller will turn on the chilled water pump and sample the loop water temperature for a time equal to the Load Delay set point ("LoadDelay"). If cooling is required at the end of the time-delay, a start procedure is initiated. On entering the "Stage mode" the controller starts a countdown timer to indicate how long the unit has been in the cool stage mode. The number of stages allowed during soft loading is determined by the Soft Load Maximum Stages ("SoftLdMaxStg"). The duration of the soft load sequence is determined by the Soft Load Timer. If the Soft Load Timer is set to zero, no soft loading will take place. When the soft load option is enabled, any time remaining in the Soft Load Timer will be displayed in the menu Soft Load Set points under item "Time Left". The following set points may be adjusted in SoftLoadSpts menu:

- Soft Load: This is the amount of time soft loading will be in effect after the controller begins staging. If set to zero, soft loading is canceled.
- SoftLdMaxStg: Determines the maximum number of cooling stages which may be energized while soft loading is in effect.
- LoadDelay: The amount of time allowed for the controller to sample the loop water temperature before initiating cooling.

Manual Operation

Manual operating modes are available to simplify setup and troubleshooting of the unit. Any of the following manual modes may be selected from the Control Mode Menu.

Note: These manual settings are intended to aid in troubleshooting and should not be considered to be normal operating modes. The equipment should not be left unattended during manual operation as the automatic staging controls are disabled. The chiller will remain in the manual mode until Automatic operation is selected or a problem alarm occurs which will change back to the “Automatic mode”.

- ManualOff: Manual unit off.
- Auto1Off2: Automatic Circ#1, Circ#2 off.
- Auto2Off1: Automatic Circ#2, Circ#1 off.
- ManualStaging: Manual Staging, Circ#1 & 2.

Compressor Staging

The AGZ Scroll chiller has two (2) refrigerant circuits and each circuit has two (2) scroll compressors. When in the Automatic mode and stage 1 of cooling is required, the compressor with the lowest number of starts will be the first compressor to start. Stage 2 of cooling will start the compressor with the lowest number of starts in the other refrigerant circuit. Stage 3 of cooling will start the next compressor with the lowest number of starts regardless of refrigerant circuit. Stage 4 will start the last compressor.

If a compressor is not available for starting due to a safety, the number of cooling stages will be decreased and always equal to the number of available compressors for operation. At all times the second stage of cooling will have a compressor from each refrigerant circuit operating. The exception to this is when “LOW AMBIENT” is selected and the outside air temperature is below the low ambient setting. The staging logic will be modified to start the compressor with the lowest starts and stage 2 will start the other compressor on that refrigerant circuit. Both compressors on one refrigerant circuit will operate at low ambient to improve head pressure control. If additional cooling is required, the next refrigerant circuit will be started.

On a stage down (4 compressors operating), the compressor with the most run hours will be stopped. The next stage down will be the compressor on the other refrigerant circuit with the most run hours. The next stage down will be the compressor with the most run hours.

Head Pressure Control

There are two condenser fans per refrigerant circuit. These fans are cycled on and off according to the circuit’s condenser pressure. Fan #1 of circuit will start when a compressor in the circuit has started and the condenser pressure exceeds fan on setpoint (230psig R-22). This fan will not cycle off until the circuit is stopped. The second fan will cycle on and off to maintain minimum lift pressure. If the condenser pressure increases rapidly, the second fan will be turned on at 290psig (R-22 setpoint) and remain on until minimum lift pressure regains control.

Pumpdown Control

The AGZ units have a one time pump down. If two compressors are operating on a refrigerant circuit and the chiller is commanded to stop, the lag compressor on that circuit will stop and the lead compressor will pump the circuit down. Pump down pressure depends on the chiller’s refrigerant type.

Certain alarm conditions will not permit chiller pumpdown. These alarm conditions are:

- High Condenser Pressure
- Bad Evap Pressure Sensor
- Bad Phase Voltage
- Volts Ratio Protect
- Mechanical High Pressure
- Compressor Motor Protect

Safety Systems

MicroTech continuously performs self-diagnostic checks, monitoring all system temperatures, pressures and safeties, and will automatically shut down a refrigerant circuit or the entire unit should a fault occur. The cause of the shutdown, time and date of occurrence and conditions at the same time of alarm will be retained in memory and can be displayed for the operator to review.

The MicroTech controller has several safety systems to safeguard against potential damage of the chiller equipment. There are alarm and pre-alarm conditions. Alarm conditions cause the compressors to shut off and/or lockout. Pre-alarm conditions cause the unit to stage down in capacity in an attempt to avoid an alarm condition. For alarm conditions, the red “Alarm Status” light on the control panel will be solid. For all pre-alarm conditions, the light will pulse at the rate of 0.5 seconds on, 4 seconds off. When an alarm of pre-alarm condition exists, the MicroTech display automatically switches to the alarm menu to alert the user of the condition.

The MicroTech controller alarms can either be of the manual reset type or the auto reset type. Critical alarm conditions such as High Condenser Pressure, Refrigerant Freeze Protection, and Low Evaporator Pressure which protect against equipment damage are manual reset, which means they lockout compressor operation and must be cleared at the MicroTech keypad before operation can resume. Auto-clearing alarm conditions cause the compressors to shut off on the affected circuit until the condition is corrected. When the condition is corrected, the chiller will resume normal operation on that circuit, provided the anti-cycle timers have cleared and sufficient load exists. All pre-alarm conditions are auto-clearing. After the controller stages down the unit on an alarm condition and the potential alarm condition has been avoided, the alarm will clear y itself and the unit will resume normal operation. If the alarm condition is not avoided, the alarm will be logged on the MicroTech display, causing lockout of compressors. Thus, the alarm must be manually cleared.

When a McQuay Chiller with a MicroTech controller is used with the McQuay RMS (Remote Monitoring and Sequencing) Panel, the user must note that alarm nomenclature varies. The RMS has three possible categories of alarms: faults, problems, and warnings. The chiller alarm condition corresponds with the RMS “fault” condition. Thus, there are system and circuit faults. Chiller pre-alarm conditions correspond to the RMS “problem” designation. Reciprocating chillers do not have warning alarms.

Circuit Alarm Conditions

The “Circuit Alarm Conditions” are those alarms which only affect one circuit and can stop the compressors of that circuit. These alarms are:

- Compressor Motor Protection
- High Condenser Pressure
- Mechanical High Pressure Switch
- Low Evaporator Pressure
- Refrigerant Freeze Protection
- Bad Pressure Transducer

The chiller must have the manual reset system alarm conditions cleared before normal operation can resume. If the alarm which occurred is an auto-clearing alarm, once the condition has corrected, the chiller will resume normal operation provided the anti-cycle timers have cleared and sufficient load exists.

System Alarm Conditions

The “System Alarm Conditions” are those alarms which are common to both refrigeration circuits and require all compressors to be temporarily shut off or locked out, whichever applies. The following alarm conditions are checked continuously during all modes of operation by the controller. If one of the following alarm conditions is detected, the mode of the controller will switch to “ Off:Alarm “. The controller disables all compressor operation by turning off all Compressor Enable Outputs. Alarm Output #0 will be turned on to notify the operator of the alarm condition. The red “Alarm Status” light on the front of the control panel will be solid on the alarm condition and the MicroTech display will show the current alarm condition. System alarm conditions are:

- Loss of Water Flow
- Bad Phase /Voltage
- Chilled Water Freeze Protection
- Volts Ratio Protection
- Bad Leaving Water Sensor

The chiller must have the manual reset system alarm conditions cleared before normal operation can resume. If the alarm which occurred is an auto-clearing alarm, once the condition has corrected, the chiller will resume normal operation provided the anti-cycle timers have cleared and sufficient load exists.

Sequence of Operation

Off Conditions

With power supplied to the unit, 115Vac power is applied through the control fuse F1 to the compressor crankcase heaters (HTR1-4), the compressors motor protectors (MP1-4), the evaporator heater and the primary of the 24V control circuit transformer. 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 either switch is n the “stop” position, that circuit’s operating mode will be displayed as OFF:PumpDownSw. If the remote Start/Stop Switch is open, the chiller will be OFF:Remote Sw. The chiller may also be commanded off via the communications network if a separate System Master Panel is installed. The display will show OFF:Remote Comm 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.

Assuming none of the above “OFF” conditions are true, the controller will examine the internal time clock schedule to determine if the chiller should start. The operating mode will be OFF:TimeClock if the time schedule indicates an “OFF” time period.

Start - Up

If none of the “OFF” conditions are true, the controller will initiate a start sequence. The chilled water pump relay output is energized any time the chiller is enabled and the chiller will remain in the “Waiting For Flow” mode until the field installed flow switch indicates the presence of chilled water flow. If flow is not proven within 30 seconds, the alarm “Loss of Water Flow” will be activated and the chiller will continue to wait for proof of chilled water flow. Once flow is established, the alarm will automatically be cleared and the unit will go into the “Wait For Load” mode.

Once flow is established, the controller will sample the leaving water temperature and compare it against the leaving water temperature set point, the control band, the start up delta T and the start timers. If all values indicate a start (stage 1 cooling), the controller will start the lead circuit by energizing that circuits liquid line solenoid valve (SV). When the circuit pressure exceeds the LPCutIn pressure, the compressor on that circuit with the lowest starts will be started. If additional cooling is required (stage 2 cooling), the controller will energize the lag circuit liquid line solenoid valve (SV). When that circuit’s pressure exceeds the LPCutIn pressure, the compressor with the lowest starts will be started. If additional cooling is required (stage 3 cooling), the next compressor with the lowest starts will be started. Stage 4 cooling will start the last compressor.

When the evaporator water temperature is satisfied, the reverse will occur with the compressor with the most run hours being stopped in each stage down. If the chiller is operating at minimum capacity (stage 1) and the chilled water temperature falls below the Leaving Evap Water Set Point, control band and shut down delta T, the controller will stop the last operating compressor. The controller enters the “Waiting For Load” mode and monitor the leaving water temperature.

Low Ambient Start

If the “LOW AMBIENT” option was selected and the out side air temperature is below 50°F, the low ambient start logic will replace the normal starting logic. The compressor with the lowest starts on the lead circuit will start when the liquid line solenoid valve is energized. The LPCutIn will be ignored and the refrigerant freeze protect set point will be ignored for 180 seconds to allow time for the refrigerant pressure to build. After the 180 second time and the evaporator pressure is below the freeze stat set point, the circuit will shut down and the alarm “LoEvapPressure” will be indicated.

The chilled water freeze alarm set point is enforced during low ambient starts and will shut down the chiller if a water freeze conditions is detected. During the low ambient start period, the evaporator pressure is monitored and if the evap pressure drops to 2 psi for more than 20 seconds, the chiller will shut off and a “LoEvap Pressure” alarm will be generated. This protects the compressor from operating in a vacuum during start-up.

Pumpdown

As the system chilled water requirements diminish, the controller will stage down the compressors. As the system load continues to drop, the liquid line solenoid valve will be de-energize and the refrigerant circuit will go through a one time pump down sequence. As the evaporator pressure falls below the LPCutOut set point, the compressor and condenser fan will stop. The evaporator pump output relay will remain energized and the unit status will indicate “Waiting For Load”.

Start-Up and Shutdown

Pre-Start Checkout

Configuration default set points are entered at the factory and all values must be checked and reset for each installation. Make sure the field wiring for all flow switches, interlocks or jumpers matches the connections detailed on the field wiring drawing.

Setting of the HEX Address Switches

The controller HEX address switches for each unit determine its logical address in a MicroTech network or in an Open Protocol network. If the chiller is not connected to a RS485 communications loop, set the address switches as follows: Hi=0; Lo=1.

Network addresses are pre-assigned and will be located in the installation instructions for the particular network panel.

Control Switches

Before applying power to the unit, verify that the Unit System Switch is in the stop position and that each Circuit Switch is in the Pumpdown and Stop position. It an optional Remote Start / Stop input is installed, it should be in the start position.

Ribbon Cables

Check the ribbon cables that connect the keypad, ADI board and output board to the controller. They should be fully seated with the locking tabs engaged.

Powering the MicroTech Controller

There are three status LEDs located on the model 250 controller which will indicate the controller's operating condition. When power is first applied to the control panel through the circuit breaker (CB), the red RESET LED will illuminate for approximately 3 seconds. During this time, the controller is checking the control software and performing internal hardware tests. When these tests are completed, the RESET LED will turn off and the green RUNNING LED will illuminate indicating the controller's circuitry and software are operating correctly. If the RESET LED stays on or the RUNNING LED fails to illuminate, consult the trouble shooting section of the manual.

Any alarms showing should be cleared by pressing the alarm key then the clear key. Watch the LEDs on the output board and ADI board to determine the operating status of the controller's inputs and outputs while performing the following system checks. Initially all LEDs on the output board will be off.

Table 25, Initial condition ADI board LEDs

DH1		DH2	
0	ON	8	ON
1	OFF	9	OFF
2	ON	10	ON
3	OFF	11	OFF
4	ON	12	ON
5	OFF	13	ON
6	ON	14	** OFF
7	ON	15	ON

** Flow switch may be on if not controlled by the unit controller

Move the system switch to the Auto position. LED #5 on the ADI board will turn on. If the time schedule is in occupied, the chilled water pump relay output board #2 will turn on.

Move both pumpdown switches to the auto position. DH1-7 and DH2-15 will turn off. The controller will then activate one of the refrigerant circuit solenoids depending upon which is the lead circuit. (output relay #4 circuit #1or output relay #5 circuit #2) When the evaporator pressure rises

above the LPCutIn value, a compressor on the lead circuit will start. Refer to the unit staging schematic to determine which LED is associate to a compressor.
The controller will stage up and down to maintain the desired leaving water temperature.

Temporary Shutdown

Close both pumpdown switches. After pumpdown is completed, turn off the system switch. Open the remote start / stop input and the evaporator pump will stop. Perform the reverse to start up after a temporary shutdown.

Extended Shutdown

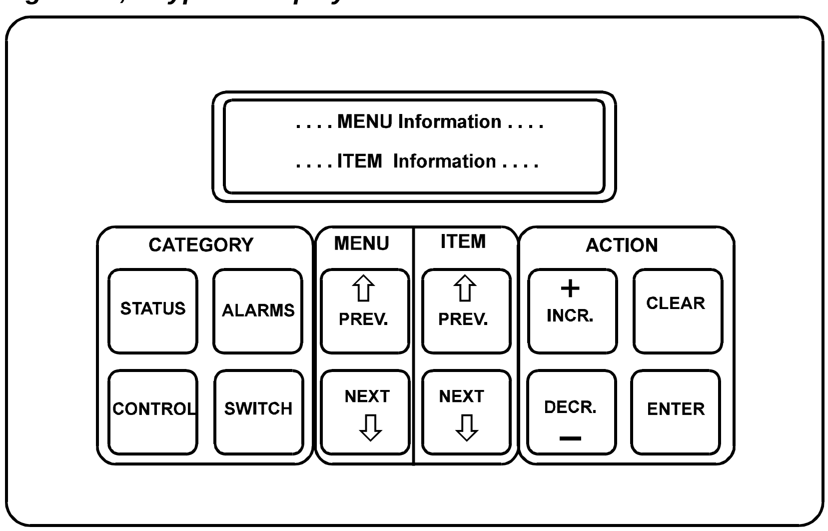
⚠ CAUTION

The operator must provide protection against water circuit freezing on all chiller units. All water must be drained form the evaporator and associated piping and power for the cooler heating cable should be applied via separate disconnect if freezing ambient conditions are expected.

1. Close the manual liquid line shut off valves. Move the circuit #1 and #2 switches to the "Pumpdown and Stop" position. Each operating circuit will pumpdown and the compressors will stop.
2. After both circuits have been pumped down, open the "Remote Start / Stop' input and the controller will open output relay #1 to stop the evaporator pump.
3. Move the system switch to the stop position. Turn off main power to the chiller unit and to the chilled water pump.
4. Tag all open electrical switches and related water valves. This will prevent premature operation of the equipment.
5. If the chiller will be exposed to freezing ambient temperatures, drain all water from the unit evaporator and chilled water piping and leave power applied to the evaporator heating cable via separate disconnect. If external water piping is heat traced, leave power on to heat tracing to protect from freezing.

Keypad / Display

Figure 29, Keypad / Display



Menu Structure (general description)

The information stored in the MicroTech controller can be accessed through the keypad using a tree-like structure. This tree structure is divided into Categories, Menus and Menu Items. There are three Categories which make up the tree structure: STATUS, CONTROL, and ALARM. Each category is divided into Menus and each Menu into Menu Items. The three categories are described below:

- **Status category** - Menus and menu items in this category provide information on the MicroTech and unit operating conditions. The entries under each menu item in this category provide information only and are not changeable through the MicroTech keypad. Menus 1 through 12 are Status Menus.
- **Control category** - Menus and menu items in this category provide for the input of all the unit control parameters. These include cooling and heating control, compressor control and condenser fan control parameters as well as time schedules and alarm limits. The entries under these menu items are changeable through the MicroTech keypad. Menu Items 13 through 23 are Control Menus.
- **Alarm category** - Menu and menu items in this category provide information regarding current and previous alarm conditions. Menus 23 through 27 are Alarm Menus.

Display Format

The information stored in the MicroTech controller tree structure can be viewed (one menu and menu item at a time) through a two line by sixteen character LCD display. The current MENU is shown on the top line and the current MENU item is shown on the bottom line of the display.

Either U.S. or S.I. units may be displayed by installing the appropriate software.

U.S. Units

Temperature: °F

Pressure: psi, psig, psid

S.I. Units

Temperature: °C

Pressure: kPa, kPag, kPad

MicroTech Menu Structure

1. Status category - Where ore than one menu item entry is listed under a menu item, the list includes all the entries which can appear in the display for the particular item. The entry that shows in the display depends on the operating status of the unit.
2. Control category - Where more than one menu item entry is listed under a menu item, the list includes all the choices from which the user can select. The selected entry appears in the display.
3. Alarm category - The entries listed include all the possible alarm messages. The display will show the current and previous alarm conditions for each circuit.

Password Information

When changing any menu item entry, the user is prompted to enter the access password. The change will not be allowed until the correct password is entered. The password for AGZ units is always the successive pressing of the following “ACTION” group keys:

“ENTER” “ENTER” “ENTER” “ENTER”

Once this has been done, the user can make changes to the menu item entries. After entering the correct password, the controller will allow a 5 minute time period during which the operator may make any necessary setpoint adjustments. Any keypad activity will reset the timer for the full 5 minutes so the password only needs to be entered once per session. After 5 minutes of inactivity, the password access time will expire providing protection against unauthorized users.

Keypad Key Functions

The MicroTech keypad consists of twelve pressure sensitive membrane switches (refer to Figure 29). These keys are used to step through, access, and manipulate the information in the MicroTech controller tree structure. The keypad keys are divided into four groups with two or four keys in each. These groups of keys and their functions are described below.

Category Group

The keys in this group provide quick access to strategic menus throughout the menu tree-structure. This reduces the need to step through all the menus, one by one, in order to reach the desired menu. Status-Pressing the "STATUS" key at any time shifts the display to Menu #1 (Unit Status) which is the first menu of the Status category.

Control - Pressing the "CONTROL" key at any time shifts the display to Menu #13 (Control Mode) which is the first menu of the Control category. Alarms-Pressing the "ALARMS" key at any time shifts the display to Menu #24, (Circ 1 Current Alarm) which is the first menu of the Alarms category. Switch - Pressing the "SWITCH" key at any time toggles the display between the current menu (status/control) item and the related menu (control/status) item somewhere else in the tree-structure. For example, if this key is pressed while the current menu item is Menu Item 4A (Leaving Evaporator=), the display shifts to Menu 146 (Leaving Evaporator Set Point=). This provides for easy review of actual versus set point values. Tables 7, 8 and 9 include a listing of all the currently supported switching functions.

Menu Group

The keys in this group are for stepping from menu to menu in the menu tree-structure. Prev. - Pressing "PREV." shifts the display to the previous menu. Note: When Menu #I is currently in the display (the first menu in the menu tree-structure), pressing "PREV." causes an "end of menus" message to appear in the display. Pressing "PREV." again causes the display to wrap around to Menu #27 (the last menu in the tree-structure). Next- Pressing "NEXT" shifts the display to the next menu.

Note: When Menu #27 is currently in the display (the last menu in the menu tree-structure), pressing "NEXT" causes and "end of menus" message to appear in the display. Pressing "NEXT" again causes the display to wrap around to Menu #1 (the first menu in the menu tree structure).

Item Group

The keys in this group are for stepping from item to item within a menu. Prev. - Pressing "PREV." shifts the display to the previous item in a menu. Note: When the first item in a menu is currently in the display, pressing "PREV." causing an "end of items" message to appear in the display pressing "PREV." Again causes the display to wrap around to the last item in the menu.

Next—Pressing "NEXT" shifts the display to the next item in a menu. Note: When the last item in a menu is currently in the display, pressing "NEXT" causes an "end of items" message to appear in the display. Pressing "NEXT" again causes the display to wrap around to the first item in the menu.

Action Group

The keys in this group are for making changes to unit control parameters or for clearing alarm conditions.

Note: Before a change to a parameter can be made or before an alarm can be cleared, the display prompts the user with an "Enter Password" message. At this point, the password must be entered before the user can continue with the action.

"ENTER" "ENTER" "ENTER" "ENTER"

Incr—When changing the value of a menu item entry, pressing "INCR. +" shifts the menu item display line to the next higher or next available selection.

Decr.—When changing the value of a menu item entry, pressing “DECR. -” shifts the menu item display line to the next lower value or previous available selection.

Enter—Once a change has been made to a desired value, pressing “ENTER” locks in the new value.

Clear—Pressing “ALARMS” followed by “CLEAR” clears the current alarm. Also, when a change is made to a menu item pressing “CLEAR” returns the display to the original value as long as “ENTER” has not been pressed.

Note: The cause of an alarm should always be determined and corrected before resetting the alarm through the keypad.

Example of Keypad Operation -As an example of using the keypad key functions, consider reprogramming the Leaving Evaporator Set Point from 44°F to 42°F. This consists of changing the Menu Item 148 (Leaving Evaporator Set Point) entry from “44°F to 42°F”. Assume Menu #I (Unit Status) is currently in the display. The following key sequence is followed.

1. Press the ”CATEGORY” group ”CONTROL” key one time. This switches the display to Menu #I13 (the first menu in the “CONTROL” category).
2. Press the “MENU” group “NEXT” key once. This shifts the display to Menu Item 14A (Active Set Point).
3. Press the “ITEM” group “NEXT’ key once. This shifts the display to Menu Item 14B. (Leaving Evaporator setpoint).
4. Press the “ACTION” group ‘DEC -” key one time. This prompts the user to enter the password.
   “ENTER” “EN T E R” “EN T E R” “EN T E R”
5. After the “Password Verified” message, press the “ACTION” group “DEC -” key four times. This changes the menu item entry to 42°F.
6. Press the “ACTION” group “ENTER” key one time. This stores the new entry into the MicroTech controller memory.
7. Pressing the “CATEGORY” group “STATUS” key then shifts the display back to Menu #I.

Menu Descriptions

Status Menus

Menus 1 through 12 provide chiller operating information and display of sensor readings. The items listed under these status menus are affected by the settings under the associated control menus and are not directly adjusted via the keypad.

Menu #l: Unit Status—The unit operating status is displayed as item 1 within this menu. The second item is the number of seconds remaining in the unit interstage timer. The third item displays the user chosen unit operation of chiller or Templifier (heat pump). Option chosen on Menu 23.

Menu #2: Circuit #l Status—The current operating condition of refrigerant circuit #l is displayed whenever this menu is selected. There is only one item displayed in this menu.

Menu #3: Circuit #2 Status—The current operating condition of refrigerant circuit #2 is displayed whenever this menu is selected. There is only one item displayed in this menu.

Menu #4: Water Temperatures—The evaporator leaving water temperature is displayed under item #l under this menu. Additional items under this menu display the evaporator entering water temperature as well as the entering and leaving condenser temperatures if these optional sensors have been installed on the unit.

Menu #5: Circuit #l Pressures—The circuit #l evaporator and condenser refrigerant pressure readings are displayed under this menu. The calculated minimum and maximum condenser pressure values are also shown.

Menu #6: Circuit 62 Pressures—The circuit #2 evaporator and condenser refrigerant pressure readings are displayed under this menu. The calculated minimum and maximum condenser pressure values are also shown.

Menu #7: Circuit #l Temperatures—The circuit #I refrigerant temperatures are calculated from their corresponding pressure sensors and displayed here. If the optional Sensors are not present, the line item will flash “Open”.

Menu #8: Circuit #2 Temperatures—The circuit #2 refrigerant temperatures are calculated from their corresponding pressure sensors and displayed here. If the optional sensors are not present, the line item will flash “Open”,

Menu#9: Chiller Amps—Displays the present amp draw of the chiller expressed as a percentage of the unit rated load amps under full load conditions (optional feature).

Menu #10: Compressor Run Hours—The total run hours for each compressor is available under this menu.

Menu #11: Compressor Starts—The total number of starts for each compressor is available under this menu.

Menu#12: Air Temperature—Displays the current outdoor air temperature if the optional OAT sensor is installed on the air cooled chiller and “Lcl” is selected from Menu 23. Also displayed here is the air temperature received from a network if the “Rmt” OAT select option from Menu 23 is selected.

Control Menus

Menus 13 through 23 are the set point menus. All adjustable control parameters and set points, time schedules, control options, and alarm thresholds are accessed through these menus.

⚠ CAUTION

Any changes to these parameters must be determined and implemented by qualified personnel with a thorough understanding of how these parameters affect the operation of the unit. Negligent or improper adjustment of these controls may result in damage to the unit or personal injury.

Menu #13: Control Mode—One of several automatic and manual operating modes may be selected from within this menu. Typically, the selected control mode will be Automatic which will allow the MicroTech controller to handle all compressor and condenser fan staging. Refrigerant circuit #2 may be locked off while still allowing circuit #1 to stage automatically by selecting AutoCir#1 -Off#2 as the operating mode. OffCirc#1 -Auto#2 allows the normal staging of refrigerant circuit #2 but circuit #1 is locked off. Select Manual Staging if manual control is desired. In this operating mode, the condenser fans are controlled by the MicroTech but the number of stages is determined manually via the keypad. If manual staging is selected, the second item under this menu indicates the number of active cooling stages. Use the INCR or DECR keys to increase or decrease the number of active stages.

Menu#14: Leaving Water Set Points—The leaving wafer set points, control band, maximum pull down rate and water reset options are adjusted from this menu. The first menu item is The Active Set Point ("Active Spt"). The current control temperature is displayed here. The Leaving Chilled Water Set Point ("Lvg Evap") appear towards the top of this menu. These are the set points that will be maintained for chillers if no reset options are in effect. The Active Control Set Point ("Active Spt") will display the calculated chilled or heated water temperature to be maintained when one of the reset options is enabled.

If the 4-20 milliamp reset option is enabled, the controller will reset the leaving chilled water temperature to a higher value based on a percentage of the Maximum Chilled Water Reset set point ("MaxChWRst"). At 4mA or less, no reset will occur. At 20mA, the chilled water set point will be reset to a value equaling the Leaving Evaporator Water Set Point ("Lvg Evap") plus the value stored in the "MaxChWRst". Any milliamp value between 4 and 20mA will cause a proportional value of the Maximum Chilled Water Reset to be added to the Leaving Chilled Water Set Point. The external 4-20 milliamp control signal and current reset set point will be displayed under "Reset Sig" and "Active Spt", respectively, on Menu 14.

By selecting Return as the reset mode, the leaving chilled water temperature will be reset by the controller as required to maintain a constant return water temperature. The user must select the "Return" option under "ResetOpt" and select the return set point to be maintained under "ResetSpt". The current leaving chilled water reset set point will be displayed under "Active Spt".

If the chiller is to be used for ice storage, select the "Ice" option in Menu 14 "LvgWater Spt", "ResetOpt=". To calculate the leaving chilled water set point, the control band (Menu 14 "CntrlBand=") and shut down delta-T (Menu 14 ShutDn D-T=") must first be selected. The equation to determine leaving chilled water temperature is:

$$Lvg\ Evap = Desired\ Ice\ Temp + \tfrac{1}{2}\ \text{"CntrlBand ="} + \text{"ShutDn D-T ="}$$

$$Lvg\ Evap = 21°F + \tfrac{1}{2}(4) + 105°F$$

$$Lvg\ Evap = 21 + 2 + 1.5$$

$$Lvg\ Evap = 24.5$$

For day operation the maximum chilled water reset (Menu 14 "MaxChWRst=") is added to the "Lvg Evap" as calculated above to reach the desired day operating leaving chilled water temperature.

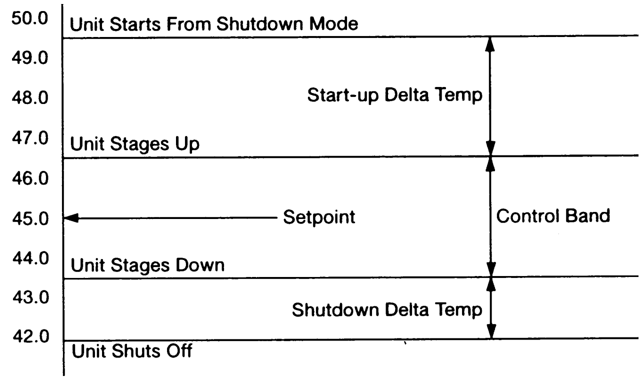
When the Ice option is selected, the resetting of the leaving chilled water set point (during day operation) via the 4-20mA input is not a functional option. To retain the option, the set points in Menu 14 must be changed by a Building Automation System through our MicroTech Open Protocol Monitor Software.

The "Network" reset option allows a signal to be sent reflecting 0-100% reset of the "Lvg Evap" set point (chillers) or "Lvg Cond" set point (THRs) based on the Maximum Chilled Water Reset set point. This function acts much like the 4-20 milliamp reset option as described above.

The Maximum Pull Down Rate set point ("MaxPullDn") will prevent overshooting the active water set point during initial start-up and normal operation. The controller will limit the rate at which the chilled water loop temperature is reduced based on an adjustable set point (default of 0.5°F/min). Every minute, the controller checks the leaving water temperature and compares it to the last reading. If the pull rate has been exceeded, the controller will delay additional unit stages.

The Control Band ("CntrlBand") set point defines the temperature range on either side of the active water set point that must be exceeded in order for a stage up or stage down to occur. The Start Up Delta-T ("StartUpD-T") and Shut Down Delta-T ("ShutDn D-T") define when the unit will start and shut down. The unit will cycle on from a shut down mode once the leaving chilled water temperature has reached the Leaving Chilled Water Set Point plus half of the Control Band plus the Start Up Delta-T. After the chiller starts, it will stage up and down according to the leaving chilled water temperature (plus or minus) half the Control Band. Once the load is met and the chiller has staged down to stage 1, the unit will shut completely off once the leaving chilled water temperature has reached the Leaving Chilled Water Set Point minus half of the Control Band minus the Shut Down Delta-T.

Figure 30, Delta-T Setpoints for Chillers



Menu #15: Softload Set Points—The controller can limit the number of available stages when the unit is initially started to prevent excessive power consumption and help control overshoot of the water temperature set point. The maximum number of stages will equal the Soft Load Maximum Stages for the time period defined in the softload timer set point. If the softload timer is set to zero, no soft loading will take place. Any time remaining in the softload timer will be displayed when the soft load option is enabled. During morning start-up, the controller will run the chilled water pump and sample the loop water temperature for a time equal to the Load Delay set point. If cooling or heating is required at the end of this time delay, the first compressor will be started.

Menu #16: Compressor Set Points—This menu is used to set the lead-lag order of the refrigerant circuits. The lead compressor may be manually set to circuit #1 or circuit #2 or the Automatic mode may be enabled. In Automatic mode, the MicroTech controller will select the refrigerant circuit with the lowest number starts as the lead. The interstage timer set point sets the delay time between the current cooling stage and the next stage up request. The stage down request time delay is a fixed ratio of the stage up delay.

The minimum Start/Start and Stop/Start timers provide protection against compressor short cycling. During normal operation the Compressor Interstage Timers provide a time delay between cooling or heating stages.

Menu #17: Head Pressure Set Points—The set points for head pressure control are adjusted from within this menu. The Minimum Lift Pressure is the minimum differential pressure to be maintained across the expansion valve. The dead band defines the pressure differential range within which no fan staging will occur. If the head pressure moves outside of the deadband, the controller will integrate the pressure error over time. When the Pound/Second exceeds the Stage Up Error or Stage Down Error set point, the controller will adjust the fan staging up or down to bring the head pressure back within the deadband. Refer to the section on head pressure control in this manual for details.

Menu #18: Demand Limit—The Demand Limit set point defines the maximum number of cooling stages allowed by an external demand limit signal. The actual remote demand limit signal level in milliamps is also displayed here.

In place of demand limit input, a 0 or 5 volts signal from a unit switch open or cool (5 volts - switch closed) modes.

Menu #19: Time/Date—The MicroTech controller uses an internal calendar and clock to provide automatic operation for each day of the year. Provision is made for Manual Override to accommodate unscheduled building occupancy. Press the Control key to enter the control area of the menu structure then press the Next Menu key until the display shows Menu Item #24, Set Date/Time. If the date is incorrect, press the Incr or Decr key and the controller will prompt you for your password. When you have entered the correct password, the controller will return to the Set Date/ Time display. Press the Incr or Decr keys to scroll the month up or down. Press the Enter key when the display shows the correct month. The cursor will advance to the Date position on the display which can be set in the same manner. After pressing the Enter key to set the Date, the cursor will advance to the Year position on the display. Use the Incr, Decr, and Enter keys to set the correct Year.

Press the Next Item key. The display will show the current Day, Hour, Minute and Second. If this information needs to be changed, follow the same procedure used to set the Date in the previous section.

Menu #20: Daily Schedule—This section will help you to set the Daily Start/Stop time for automatic operation of the chiller. Pressing the Next Menu key and the Next item key will advance the display to the Daily Time Schedule. This is where the Start and Stop times for each day of the week will be set using the 24 hour format. Beginning with Sunday, use the Incr and Decr keys to set the desired start and stop time and press the Enter key to store the information in the controller. If the chiller is to be programmed to run continuously 24 hours a day, set the stop tie for 1 minute before start time (Stop=23:59; Start=00:00). Press the Next Item key to advance through the remaining week days and Holiday Start/ Stop times.

Menu #21: Holiday Date—Up to 14 holiday dates may be entered. When the MicroTech controller's current date matches a date set in the holiday schedule, the normal daily start/stop times are replaced by the holiday start/stop ties which were set in the previous section. At the date prompt, use the Incr and Decr keys to set the first holiday month and press Enter to advance to the Day position of the display. Use the lncr, Decr and Enter keys to set the first day of the holiday. Press Next Item to advance to Holiday 1 Duration. If the scheduled holiday spans more than one day, use the lncr and Decr keys to set the holiday duration and press Enter to store the information in the controller. Use the Next Item key to set additional holiday dates and duration’s for the entire year.

Menu#22: Alarm Set Points**—**On a call for cooling or heating, the controller will open the liquid line solenoid valve. When the evaporator pressure rises above the Low Pressure Cutin set point, the first compressor will be started. The Low Pressure cut out set point determines the point at which the compressors will shut off during a pumpdown sequence. The Refrigerant Freeze and Water Freeze alarm set points may be adjusted as required. Water and refrigerant freeze alarm time delays may also be adjusted for this menu. If the condenser High Pressure set point is exceeded, the controller will shut off the unit.

Menu #23: Miscellaneous Setup—Several general operating characteristic are defined here. These are set at the factory prior to unit delivery and should not require adjustment. The control software version number is displayed form this menu. Outdoor air temperature is displayed on Menu 12.

Alarm Menus

Menus 24 through 27 are used to display any alarm conditions which may be present in the unit. All alarm messages are accompanied by the date and time when the alarm occurred. Important operating conditions at the time of the alarm are stored in the controller's memory and may be viewed within the following alarm menus.

Menu #24: Circuit #1 Current Alarm—If refrigerant circuit # 1 is in an alarm condition, the appropriate alarm message will be displayed here. The temperature and pressure readings at the time of the alarm will be stored in the controllers memory and may be displayed for analysis from this menu.

Menu #25: Circuit #2 Current Alarm—If refrigerant circuit #2 is in an alarm condition, the appropriate alarm message will be displayed here. The temperature and pressure readings at the time of the alarm will be stored in the controllers memory and may be displayed for analysis from this menu.

Menu #26: Circuit #1 Previous Alarm—The alarm type for the last recorded circuit #1 alarm may be displayed from this menu. The time and date at which the previous alarm occurred are also displayed here. This information will be replaced when a current alarm condition is cleared.

Menu #27: Circuit #2 Previous Alarm—The alarm type for the last recorded circuit #2 alarm may be displayed from this menu. The time and date at which the previous alarm occurred are also displayed here. This information will be replaced when a current alarm condition is cleared.

Menus for the AGZ MicroTech Controller

Table 26, MENU 1 Chiller Status

Screen	Display
1	OFF: Manual Mode
	OFF: System Sw
	OFF: Remote Comm
	OFF: Remote Sw
	OFF: Time Clock
	OFF: Alarm
	OFF: PumpDnSw's
	Starting
	WaitForFlow
	WaitForLoad
	StageUp
	StageDn
	Stage
	Manual
2	Capacity %
3	InterStg=xxx sec

Table 27, MENU 2 Circ #1 Status

Screen	Display
1	OFF: SystemSw
	OFF: ManualMde
	OFF: Alarm
	OFF: PumpDwnSw
	OFF: CycleTime xx
	OFF: Ready
	PumpingDown
	OpenSolenoid
	% Capacity
	Starting
	LowAmbStart

Table 28, MENU 3 Circ #2 Status

Screen	Display
1	OFF: SystemSw
	OFF: ManualMde
	OFF: Alarm
	OFF: PumpDwnSw
	OFF: CycleTime xx
	OFF: Ready
	PumpingDown
	OpenSolenoid
	% Capacity
	Starting
	LowAmbStart

Table 29, MENU 4 Water Temp's

Screen	Display
1	Lvg Evap= xxx.x °F (°C)
	Short °F (°C)
	Open °F (°C)
2	Ent Evap= xxx.x °F (°C)
	Short °F (°C)
	Open °F (°C)
3	D-T Evap
	Short °F (°C)
	Open °F (°C)
4	

Table 30, MENU 5 Circ #1 Pres's

Screen	Display
1	Evap= xxx.x psi(kPa) xx°F (°C)
	Evap 145 +psi(kPa) **°F (°C)
	Open N/A ** °F (°C)
	Short N/A **°F
2	Cond xxx.x psi (kPa) xxx°
	Cond 450+ psi (kPa) xxx°
	Open N/A ** °F (°C)
	Short N/A **°F
3	MinCondPr = 0#
4	MaxCondPr = 0#
5	LiftD-P= psi
6	Cond Fan Stage = x

Table 31, MENU 6 Circ #2 Pres's

Screen	Display
1	Evap= xxx.x psi(kPa) xx°F (°C)
	Evap 145 +psi(kPa) **°F (°C)
	Open N/A ** °F (°C)
	Short N/A **°F
2	Cond xxx.x psi (kPa) xxx°
	Cond 450+ psi (kPa) xxx°
	Open N/A ** °F (°C)
	Short N/A **°F
3	MinCondPr = 0#
4	MaxCondPr = 0#
5	LiftD-P= psi
6	Cond Fan Stage = x

Table 32, MENU 7 Circ #1 Temp's

Screen	Display
1	Satur Evap=xxx°F (°C)
	N/A **°F (°C)
2	SuctLine = xxx.x°F (°C)
	Open °F (°C)
	Short °F (°C)
3	Super Ht =xxx.x°F (°C)
	N/A ** °F (°C)
4	Satur Cond = xxx°F (°C)
	N/A **°F (°C)
5	CondD-T °F (°C)
6	Liquid Ln = xxx.x°F (°C)
	N/A ** °F (°C)
7	SubCoolg= xxx.x°F (°C)
	N/A ** °F (°C)

Table 33, MENU 8 Circ #2 Temp's

Screen	Display
1	Satur Evap=xxx°F (°C)
	N/A **°F (°C)
2	SuctLine = xxx.x°F (°C)
	Open °F (°C)
	Short
3	Super Ht =xxx.x°F (°C)
	N/A ** °F (°C)
4	Satur Cond = xxx°F (°C)
	N/A **°F (°C)
5	CondD-T °F (°C)
6	Liquid Ln = xxx.x°F (°C)
	N/A ** °F (°C)
7	SubCoolg= xxx.x°F (°C)
	N/A ** °F (°C)

Table 34, MENU 9 Chiller Amps

Screen	Display
1	PercentRLA=xxx%

Table 35, MENU 10 Comp RunHours

Screen	Display
1	Comp #1 =xxxxxx
2	Comp #2=xxxxxx
3	Comp #3=xxxxxx
4	Comp #4=xxxxxx
5	
6	
7	
8	
9	
10	

Table 36, MENU 11 Compr Starts

Screen	Display
1	Comp #1 =xxxxxx
2	Comp #2=xxxxxx
3	Comp #3=xxxxxx
4	Comp #4=xxxxxx

Table 37, MENU 12 Air Temp

Screen	Display
1	OutDoor = xxx.x °F(°C)

Table 38, MENU 13 Control Mode

Screen	Display	Factory Setpoint	Range
1	Manual Unit Off Automatic Manual Staging	Manual Unit Off	
2	Manual Stage=xx	0	1 - 8

Table 39, MENU 14 Lvg Evap Spts

Values for R-22 refrigerant, ( ) indicates Centigrade values

Screen	Display	Factory Setpoint	Range
1	Lvg Evap=xxx.x °F (°C)	44 (6.7)	10 - 80 (-12.2 - 26.7)
2	Actv Spt=xxx.x °F (°C)		Not Changeable
3	CntrlBand x.x °F (°C)	3.0 (1.6)	1.0 - 5.0 (0.5 - 2.7)
4	StartUpD-T= x.x °F (°C)	3.0 (1.6)	1.0 - 5.0 (0.5 - 2.7)
5	ShutDn D-T= x.x °F (°C)	1.5 (0.8)	0.0 - 3.0 (0.0 - 1.6)
6	MaxPullDn= x.x °F (°C)	0.5 (0.2)	0.1 - 1.0 (0.0 - 0.5)
7	ResetOpt=None Return 4-20 Ma Network Ice	None	
8	ResetSig= xx.xma		Not Changeable
9	MaxChWRst=xx.x °F (°C)	10.0 (5.5)	0.0 - 45.0 (0.0 - 25.0)
10	ReturnSpt= xx.x °F (°C)	54.0 (12.3)	15.0 - 80.0 (-9.4 - 26.7)

[ ] the minus sign is not displayed with three digit numbers

Table 40, MENU 14 Lvg Evap Spts

Values for 134a refrigerant, ( ) indicates Centigrade values

Screen	Display	Factory Setpoint	Range
1	Lvg Evap=xxx.x °F (°C)	44 (6.7)	10 - 80 (-6.6 - 26.7)
2	Actv Spt=xxx.x °F (°C)		Not Changeable
3	CntrlBand x.x °F (°C)	3.0 (1.6)	1.0 - 5.0 (0.5 - 2.7)
4	StartUpD-T= x.x °F (°C)	3.0 (1.6)	1.0 - 5.0 (0.5 - 2.7)
5	ShutDn D-T= x.x °F (°C)	1.5 (0.8)	0.0 - 3.0 (0.0 - 1.6)
6	MaxPullDn= x.x °F (°C)	0.5 (0.2)	0.1 - 1.0 (0.0 - 0.5)
7	ResetOpt=None	None	
	Return		
	4-40 Ma		
	Network		
	Ice		
8	ResetSig= xx.xma		Not Changeable
9	MaxChWRst=xx.x °F (°C)	10.0 (5.5)	0.0 - 45.0 (0.0 - 25.0)
10	ReturnSpt= xx.x °F (°C)	54.0 (12.3)	15.0 - 80.0 (-9.4 - 26.7)

[ ] the minus sign is not displayed with three digit numbers

Table 41, MENU 15 SoftLoad Spts

Screen	Display	Factory Setpoint	Range
1	Time Left= xxmin		
2	SoftLoad= xx min	20	0 - 254
3	SoftLdMaxStg= x	4	1 - 4
4	LoadDelay= xxsec	15	0 - 254

Table 42, MENU 16 CompressorSpt

Screen	Display	Factory Setpoint	Range
1	Sequence=Auto	Auto	1234 1432 2143 2341 3214 3412 4123 4321
2	StageUp= xxx sec		
3	StageDn= xxx sec		
4	MinST-ST=xx min	15	5 - 40
5	MinSP-ST xx min	5	3 - 30
	Comp #1		Disable / Enable
	Comp #2		Disable / Enable
	Comp #3		Disable / Enable
	Comp #4		Disable / Enable

Table 43, MENU 17 Head Pres Spt

Values for R-22 refrigerant, ( ) indicates Centigrade values

Screen	Display	Factory Setpoint	Range
1	MinLift 50%=xxx	90 (621)	70 - 100 (483 - 690)
2	MinLift100%=xxx	120 (828)	100 - 140 (690 - 966)
3	DeadBand 50%= x.x	50	0 - 255
4	DeadBand100% = x.x	90	0 - 255
5	Cond Pres 1 = xxx	200	180 - 220
6	Cond Pres 2 = xxx	300	280 - 320
7	StageUpErr= xxx	400 (2760)	300 - 990 (2070 - 6830)
8	StageDnErr = xxx	100 (690)	50 - 400 (340 - 2760)

Table 44, MENU 17 Head Pres Spt

Values for 134a refrigerant, ( ) indicates Centigrade values

Screen	Display	Factory Setpoint	Range
1	MinLift 50%=xxx	50 (345)	50 - 80 (345 - 552)
2	MinLift100%=xxx	70 (483)	80 - 122 (552 - 841)
3	DeadBand 50%= x.x	23	0 - 255
4	DeadBand 100% = x.x	50	0 - 255
5	CND PRS 1 = xxx	128	180 - 220
6	CND PRS 2 = xxx	201	280 - 320
7	StageUpErr= xxx	275 (1897)	300 - 990 (2070 - 6830)
8	StageDnErr = xxx	57 (393)	50 - 400 (340 - 2760)

Table 45, MENU 18 Demand Limits

Screen	Display	Factory Setpoint	Range
1	Demand Lim= xstg	3	Not Changeable at this screen
2	DemandSg= xx.x ma	Actual Value	Indicates the Magnitude of the Demand Limit Signal

Table 46, MENU 19 Time / Date

Screen	Display	Factory Setpoint	Range
1	Time= xx:xx:xx		Actual Time
2	Mon xx/xx/xx		Actual Day and Date

Table 47, MENU 20 Schedule

Screen	Display	Factory Setpoint	Range
1	Override= xx.xx hr	0.00 Hr	00:00 - 63.50
2	NMPSchedule= N/A	N/A	
3	Sun 00:00-23:59	00:00 - 23:59	00:00 - 23:59
4	Mon 00:00-23:59	00:00 - 23:59	00:00 - 23:59
5	Tue 00:00-23:59	00:00 - 23:59	00:00 - 23:59
6	Wed 00:00-23:59	00:00 - 23:59	00:00 - 23:59
7	Thu 00:00-23:59	00:00 - 23:59	00:00 - 23:59
8	Fri 00:00-23:59	00:00 - 23:59	00:00 - 23:59
9	Sat 00:00-23:59	00:00 - 23:59	00:00 - 23:59
10	Hol 00:00-23:59	00:00 - 23:59	00:00 - 23:59

Table 48, MENU 21 Holiday Date

Screen	Display	Factory Setpoint	Range
1	#1 Date = N/A 0	N/A 0	Jan - Dec 1 - 31
2	#1 Dur = 0 Day(s)	0	0 - 31
3	#2 Date = N/A 0	N/A 0	Jan - Dec 1 - 31
4	#2 Dur = 0 Day(s)	0	0 - 31
5	#3 Date = N/A 0	N/A 0	Jan - Dec 1 - 31
6	#3 Dur = 0 Day(s)	0	0 - 31
7	#4 Date = N/A 0	N/A 0	Jan - Dec 1 - 31
8	#4 Dur = 0 Day(s)	0	0 - 31
9	#5 Date = N/A 0	N/A 0	Jan - Dec 1 - 31
10	#5 Dur = 0 Day(s)	0	0 - 31
11	#6 Date = N/A 0	N/A 0	Jan - Dec 1 - 31
12	#6 Dur = 0 Day(s)	0	0 - 31
13	#7 Date = N/A 0	N/A 0	Jan - Dec 1 - 31
14	#7 Dur = 0 Day(s)	0	0 - 31
15	#8 Date = N/A 0	N/A 0	Jan - Dec 1 - 31
16	#8 Dur = 0 Day(s)	0	0 - 31
17	#9 Date = N/A 0	N/A 0	Jan - Dec 1 - 31
18	#9 Dur = 0 Day(s)	0	0 - 31
19	#10 Date = N/A 0	N/A 0	Jan - Dec 1 - 31
20	#10 Dur = 0 Day(s)	0	0 - 31
21	#11 Date = N/A 0	N/A 0	Jan - Dec 1 - 31
22	#11 Dur = 0 Day(s)	0	0 - 31
23	#12 Date = N/A 0	N/A 0	Jan - Dec 1 - 31
24	#12 Dur = 0 Day(s)	0	0 - 31
25	#13 Date = N/A 0	N/A 0	Jan - Dec 1 - 31
26	#13 Dur = 0 Day(s)	0	0 - 31
27	#14 Date = N/A 0	N/A 0	Jan - Dec 1 - 31
28	#14 Dur = 0 Day(s)	0	0 - 31

Table 49, MENU 22 Alarm Spts

Values for R-22 refrigerant, ( ) indicates Centigrade values

Screen	Display	Factory Setpoint	Range
1	FreezStat= xxpsi (kPa)	54 (372)	20 - 60 (138 - 414)
2	FreezH2O= xx.x °F (°C)	36.0 (2.3)	0.0 - 40.0 (-17.5 - 4.5)
3	FreezeTim= xxx sec		
4	Hi Press = xxxpsi (kPa)	380 (2622)	280 - 426 (1932 - 2939)

Table 50, MENU 22 Alarm Spts

Values for 134a refrigerant, ( ) indicates Centigrade values

Screen	Display	Factory Setpoint	Range
1	FreezStat= xxpsi (kPa)	26 (179)	4 - 26 (27 - 179)
2	FreezH2O= xx.x °F (°C)	36.0 (2.3)	0.0 - 40.0 (-17.5 - 4.5)
3	FreezeTim= xxx sec		
4	Hi Press = xxxpsi (kPa)	380 (2622)	280 - 426 (1932 - 2939)

Table 51, MENU 23 Misc Setup

Screen	Display	Factory Setpoint	Range
1	Unit Type= Air Cooled	-	-
2	Model AGZ 4 Stages	-	-
3	# Compressors = 4	-	-
4	# Stages = 4	-	-
5	Fan Stg/Cir = 2		
6	Begin PD = xx PSI	54	42 – 70 psi
7	End PD – xx PSI	34	20 - 40
8	Full Pump DN - NO	NO	NO - YES
9	EndFullPD = xx PSI	20 psi	10 – 30 psi
10	Low Ambi Opr = NO	NO	No - YES
11	Low Ambi Temp = xx°F	60	10 - 100
12	LvgEvapAdj = 0.0°F		-0.8 – +0.8
13	EntEvapAdj = 0.0°F		-0.8 – +0.8
14	#1 EvapAdj = 0.0 psi		-13.8 – +13.8
15	#2 EvapAdj = 0.0 psi		-13.8 – +13.8
16	#1 CondAdj= 0.0 psi		(-13.8 - 13.8)
17	#2 CondAdj= 0.0 psi		(-13.8 - 13.8)
18	OAT Select = Lc1	Lc1	NONE-LcL-Rmt
19	OAL Lockout = No	NO	NO – YES
20	Lockout T = x°F	0°F	0°F - 80°F
21	Alarm = Closed	CLOSED	CLOSED – OPEN-BLINK(N/O)
22	IDENT = GZ2E01A		

Table 52, MENU 24 #1 Curr Alarm

Screen	Display
1	Current Alarm
2	@ 0:00 0/00/00
3	Evap = x.x psi (kPa)
4	Cond = x.x psi (kPa)
5	SuctLine=xxx.x °F(°C)
6	LiquisLn=xxx.x °F(°C)
7	Evap Lvg=xxx.x °F(°C)
8	OAT=xx.xx°F(°C)
9	Capacity= xxx%
10	Fan Stage = x

Table 54, MENU 26 #1 PrevAlarm

Screen	Display
1	1 Current Alarm
2	1 x:xx x/xx/xx
3	2 Current Alarm
4	2 x:xx x/xx/xx
5	3 Current Alarm
6	3 x:xx x/xx/xx
7	4 Current Alarm
8	4 x:xx x/xx/xx
9	5 Current Alarm
10	5 x:xx x/xx/xx

Table 53, MENU 25 #2 Curr Alarm

Screen	Display
1	Current Alarm
2	@ 0:00 0/00/00
3	Evap = x.x psi (kPa)
4	Cond = x.x psi (kPa)
5	SuctLine=xxx.x °F(°C)
6	LiquisLn=xxx.x °F(°C)
7	Evap Lvg=xxx.x °F(°C)
8	OAT=xx.xx°F(°C)
9	Capacity= xxx%
10	Fan Stage = x

Table 55, MENU 27 #2 PrevAlarm

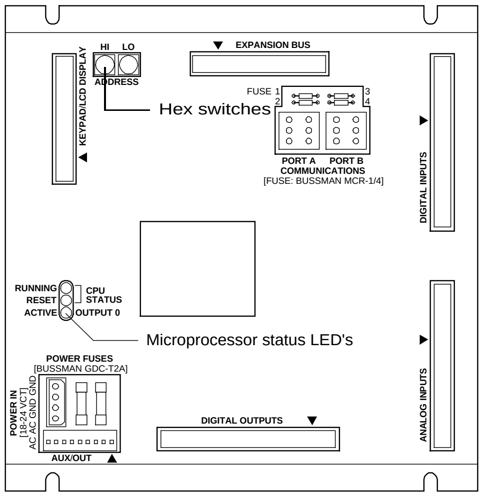
Screen	Display
1	1 Current Alarm
2	1 x:xx x/xx/xx
3	2 Current Alarm
4	2 x:xx x/xx/xx
5	3 Current Alarm
6	3 x:xx x/xx/xx
7	4 Current Alarm
8	4 x:xx x/xx/xx
9	5 Current Alarm
10	5 x:xx x/xx/xx

Trouble Analysis for the AGZ MicroTech Controller

Microprocessor Control Board

The Microprocessor Control Board (MCB) is shown in Figure 31. It contains a microprocessor that is preprogrammed with the software required to monitor and control the chiller. The various MCB connections and components are described below.

Figure 31, Microprocessor Control Board (MCB)



Digital Inputs Connection

The MCB receives digital inputs from the Analog Digital Input (ADI) board through the Digital Inputs connector via a plug-in ribbon cable. The ADI board conditions these inputs.

Analog Inputs Connection

The MCB receives conditioned analog inputs from the ADI board through the Analog Inputs connector via a plug-in ribbon cable. The ADI board conditions these inputs. After having been conditioned, all analog inputs enter the MCB through the Analog Inputs port as 0–5Vdc signals.

Digital Outputs Connection

After processing all input conditions, the MCB sends the appropriate output signals to output devices through the Digital Outputs port via a plug-in ribbon cable.

Power In Connector

The MCB receives 18Vac, center-tapped power from transformer T4 through the Power In connector. This power drives all logic and communications circuitry.

Power Fuses

Two identical 2-amp fuses are located to the right of the Power In connector. These fuses are in the MCB power supply circuit.

Microprocessor Status LEDs

The green, red, and amber LEDs on the MCB provide information about the operating status of the microprocessor. The amber LED also indicates the existence of alarm conditions.

Following is the normal start-up sequence that the three status LED’s should follow when power is applied to the MCB:

1. The red (“Reset”) LED turns on and remains on for approximately 5 seconds. During this period the MCB performs a self-test.
2. The red LED turns off and the green (“Running”) LED turns on. This indicates that the microprocessor has passed the self-test and is functioning properly.
3. The amber (“Active”) LED remains off continually if no alarm conditions exist in the network. If alarm conditions exist, the amber LED will flash as shown in Table 5.

If the above sequence does not occur after power is applied to the controller, there is a problem with the MCB or its power supply.

Table 56 and Table 57 summarize the green, red, and amber status LED indications.

Table 56, Green and Red Status LED Indication

Green LED State	Red LED State	Indication
Off	Off	No power to MCB
Off	On*	Self-test failure or power supply problem
On	Off	MCB operating normally

* For longer than 5 seconds.

Table 57, Amber Status LED Indication

Amber LED State	Indication
Off	Normal operation
On 1/2 second; Off 1/2 second	Alarm condition

Keypad/LCD Display Connection

The MCB receives input commands and operating parameters from the keypad and sends requested information to the display through the Keypad/LCD Display port via a plug-in ribbon cable.

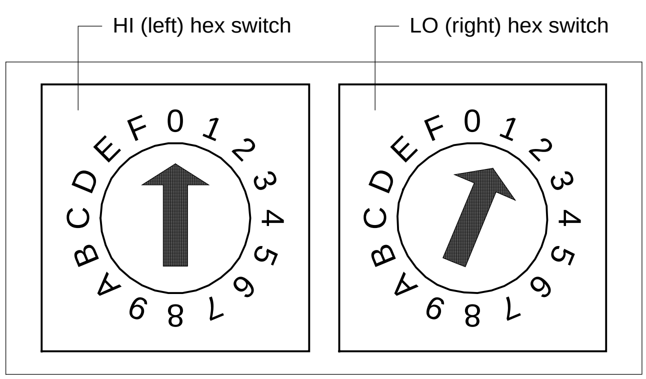
Hex Switches

The MCB includes two hex (hexadecimal) switches that are used to set the network address.

The HI and LO hex switches are shown in Figure 32. A “hex switch setting” is defined as the HI switch digit followed by the LO switch digit. For example, a hex switch setting of 2°F would have the HI switch set to “2” and the LO switch set to “F.”

Note: You can change the setting of a hex switch with a 3/32-inch tip slotted-blade screwdriver. If a hex switch setting is changed, power to the MCB must be cycled in order to enter the new setting into memory. This can be done by turning the panel’s power switch off and then back on.

Figure 32, Hex Switches



* Hex switch setting 01 shown

Communication Ports

The MCB has two communication ports: port A and port B. Each port has six terminals and is set up for both the RS-232C and RS-485 data transmission interface standards. The male and female connectors for these ports are manufactured by AMP. Therefore, they are referred to as “AMP plugs” or “AMP connectors” throughout this manual. Socket fuses located next to the ports protect the communications drivers from voltage in excess of ±12Vdc. Following are brief descriptions of each port’s function.

Port A: Port A is for communications with an IBM compatible PC using the RS-232C interface standard. The PC can be directly connected, over a limited distance, with a twisted, shielded pair cable, or it can be remotely connected via phone lines with a modem. Port A can also be used to connect a licensed building automation system to the MicroTech network via Open Protocol. The default communications rate is 9600 baud.

Port B: Port B is for MicroTech network communications using the RS-485 interface standard. A twisted, shielded pair cable should be connected to port B via terminals B+, B–, and GND on terminal block T11. The communications rate is 9600 baud.

Output Board

The Output Board (OB) accepts up to 16 digital outputs from the MCB. Each output has fused sockets and can be used to switch AC or DC power by selecting a particular relay output module. Screw terminals allow for field wiring connections to the output device. Each output has an onboard LED that illuminates when an output socket that contains a relay is activated by the MCB. Following are the Output Board’s power ratings:

- 120V ~ 50/60 Hz
- 250V ~ 50/60 Hz

Power

Above each edge card connector are field wiring terminals for 5Vdc (regulated) and 24Vac (ground referenced). These terminals can be used to power peripheral devices. The 5Vdc is also used to power the LEDs in the Output Board.

Test Procedures

Status LED Diagnostics

The MCB status LED indications can aid in controller diagnostics. If the status LEDs do not operate normally there is a problem with the MCB. Following are troubleshooting procedures for the various symptoms.

Red LED Remains On

If the red LED remains on after the 5-second self-test period, it is likely that the MCB is defective. However, this can also occur in some instances if there is a power supply problem. Refer to "Troubleshooting Power Problems" below.

Red and Green LEDs Off

If the red and green LEDs do not turn on after power is applied to the controller, there is likely a defective component or a problem in the controller's power distribution circuits. Refer to "Troubleshooting Power Problems" below.

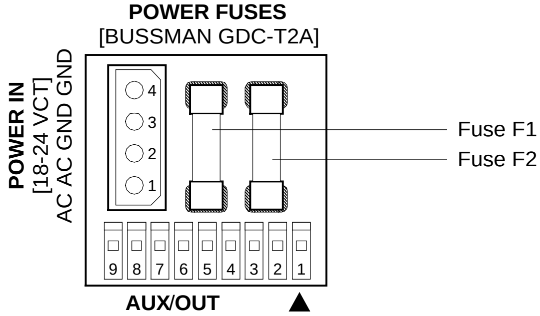
Troubleshooting Power Problems

The MCB receives 18Vac, center-tapped power from transformer T4. It then distributes both 5Vdc and 13Vdc power to various MicroTech components. A problem that exists in any of these components can affect the MCB and thus the entire control system. Power problems can be caused by an external short, which can blow a fuse, or a defective component, which can either blow a fuse or create an excessive load on the power supply. An excessive load can lower the power supply voltages to unacceptable levels. Use the following procedure to isolate the problem. Note that this procedure may require two or three spare MCB fuses . Refer to the panel wiring diagram.

1. Verify that circuit breaker CB1 is closed.
2. Remove the MCB Power In connector and check for 9Vac between the terminals on the plug corresponding to terminals 2 and 3 on the board. Then check for 9Vac between the terminals on the plug corresponding to terminals 1 and 3 on the board. (Readings of 9–12Vac are acceptable.)
   If 9Vac is present between both sets of terminals, go to step 3.
   If 9Vac is not present between both sets of terminals, check transformers T2 and T3 and all wiring between the 115Vac source and the Power In plug.
3. Remove power from the controller by opening circuit breaker CB1. Check the MCB power supply input fuses (F1 and F2) with an ohmmeter. A good fuse will have negligible resistance through it (less than 2 ohms).
   If either or both fuses are blown, replace them. Go to step 4.
   If the fuses are intact, the MCB is defective.
4. Reconnect the Power In connector and disconnect all other connectors on the MCB. Cycle power to the controller (close and then open CB1) and check the power fuses.
   If both fuses are intact, go to step 5.
   If either fuse blows, the MCB is defective.
5. Reconnect the keypad/display ribbon cable. Cycle power to the controller and check the power fuses.
   If both fuses are intact, go to step 6.
   If either fuse blows check the keypad/display and the connecting ribbon cable for shorts. Either one may be defective.

6. Reconnect the analog input ribbon cable. Cycle power to the controller and check the power fuses.
   If both fuses are intact, go to step 7.
   If either fuse blows check the ADI board, the connecting ribbon cable, and the field wiring for shorts. Any of these may be defective. Try repeating this step after removing or swapping the ADI board.
7. Reconnect the digital input ribbon cable. Cycle power to the controller and check the power fuses.
   If both fuses are intact, go to step 8.
   If either fuse blows check the ADI board, the connecting ribbon cable, and the field wiring for shorts. Any of these may be defective. Try repeating this step after removing or swapping the ADI board.
8. Reconnect the digital output ribbon cable to the MCB. Cycle power to the controller and check the power fuses.
   If both fuses are intact, go to step 9.
   If either fuse blows, check Output Board and the connecting ribbon cable. Either of these may be defective.
9. If there are any AOX-4 boards, reconnect the expansion bus ribbon cable to the MCB; otherwise, go to step 10. Cycle power to the controller and check the power fuses.
   If both fuses are intact, go to step 10.
   If either fuse blows, check the analog output expansion modules (if any), the connecting ribbon cables, and the field wiring for shorts. Any of these may be defective.
10. With circuit breaker CB1 open, measure the resistance between field terminals “DC-GRD” and “5Vdc.” It should be greater than 20 ohms.
    If the resistance is greater than 20 ohms, go to step 11 if the controller is equipped with at least one AOX-4 board or a modem. Otherwise, the problem is indeterminate. Obtain factory service.
    If the resistance is less than 20 ohms, it is likely that the keypad/display, the Output Board or an external (field supplied) load is excessively loading the MCB’s 5Vdc power supply. Isolate the problem by taking resistance measurements on each of these devices with the wiring disconnected. The resistance across the power input terminals on the keypad/display (G and 5V) should be close to infinite. The resistance across the power input terminals on the Output Board (+ and –) should not be less than 3000 ohms. If the component's resistance is proper, check the resistance of the field supplied loads (if any) and check the wiring and connections throughout the 5Vdc power supply circuit.
11. Disconnect the connector plugs from the modem and the power plug from all AOX-4 boards (as applicable). With circuit breaker CB1 open, measure the resistance between field terminals “DC-GRD” and “13Vdc.” It should be infinite.
    If the resistance is infinite, go to step 12.
    If the resistance is not infinite, a short exists somewhere in the 13Vdc power supply wiring.
12. Reconnect the Aux/Out connector plug to the MCB. If there’s a modem, reconnect its AMP plug to port A. With circuit breaker CB1 open, measure the resistance between field terminals “DC-GRD” and “13Vdc.” It should steadily rise to a value greater than 5000 ohms (within approximately 30 seconds).
    If the resistance rises above 5000 ohms, go to step 13.
    If the resistance does not rise above 5000 ohms, the MCB is defective.
13. One at a time, reconnect the modem and each AOX-4 board (as applicable). Each time a component is reconnected, measure the resistance between field terminals “DC-GRD” and “13Vdc.” It should steadily rise to a value greater than 5000 ohms.
    If the resistance rises above 5000 ohms, repeat this step until the modem and all AOX-4 boards (as applicable) have been checked out. If the problem persists, it is indeterminate. Obtain factory service.
    If the resistance does not rise above 5000 ohms, the modem or the AOX-4 board just connected is defective. (With the power plug disconnected, the resistance across an AOX-4 board’s “DC” and “G” terminals should not be less than 3 million ohms.)

Figure 33, MCB Power Supply Terminals



Troubleshooting the Keypad/Display Interface

The Keypad/Display Interface is connected to the MCB via a ribbon cable and discrete wiring for the backlight. The MCB provides operating voltages, control signal outputs for the display, and input conditioning for the keypad inputs.

Display is Hard to Read

The clarity of the LCD display can be affected by ambient temperature. Typically, less contrast will result with cooler temperatures. If the display is difficult to read, adjust the contrast trim pot, which is located on the back of the keypad/display assembly.

Back Light Not Lit

The Keypad/Display Interfaces supplied with the controller is equipped with a backlight. If the light does not come on, check for 5Vdc at terminal 9 on the IDC connector on the KDI and for 5Vdc on the CSC field wiring terminal strip.

Check for 5Vdc on the IDC connector on the To check for the 5Vdc on the IDC connector, pull back the plug about one-eighth of an inch and place the test leads against the exposed pins. If there is no voltage, check the wiring and the connections between the controller's 5Vdc field wiring terminal strip and the KDI. If the wiring is intact the MCB is probably defective.

Display is Blank or Garbled

If the MCB appears to be functioning properly and the display is completely blank or garbled, perform the following procedure:

1. Try cycling power to the controller by opening and then closing circuit breaker CB1 (see note below).
2. Try adjusting the contrast trim pot, which is located on the back of the keypad/display assembly. If the contrast trim pot has no effect, it is likely that either the keypad/display or its ribbon cable is defective.
3. After removing power from the controller, check the ribbon cable and connections between the keypad/display and the MCB. Look for bent pins. Restore power after reconnecting the ribbon cable.
4. Try swapping a known good ribbon cable and keypad/display. Swap these components separately to isolate the problem. Remove power from the controller before disconnecting the suspect component, and restore power after connecting the replacement component. If the problem persists, it is likely that the MCB is defective.

Troubleshooting Analog Inputs

An analog input, such as a temperature sensor, is connected to the ADI board. The ADI board then conditions the analog input. The conditioned input is transferred to the MCB via a ribbon cable.

Analog Input not Read by the MCB

If the MCB appears to be functioning properly and the analog input is not being read by the MCB, perform the following procedure:

1. Try cycling power to the controller by opening and then closing circuit breaker CB1.
2. Check the ribbon cable, power wiring connector, and the field wiring connections from the analog input device. Look for bent pins, cable on backwards, or incorrect-wiring. Restore power after reconnecting all cables and wires.
3. If the problem persists, try swapping a known good ribbon cable or analog input device. Swap these components separately to isolate the problem. Remove power from the controller before disconnecting the suspect component, and restore power after connecting the replacement component. If the problem persists, it is likely that the MCB is defective.

Troubleshooting Digital Inputs

A digital input device is connected to the ADI board. 24Vac, supplied by transformer T2, is sent to the digital input device via a supply wire. When a contact in the digital device makes, a return signal is sent back to the ADI board. The ADI board then conditions the signal. The conditioned digital input is then sent to the MCB via a ribbon cable.

Digital Input not Read by the MCB

If the MCB appears to be functioning properly and the digital input is not being read by the MCB, perform the following procedure:

1. Try cycling power to the controller by opening and then closing circuit breaker CB1.
2. Check the ribbon cable, power wiring connector, and the field wiring connections from the digital input device. Look for bent pins, cable on backwards, or incorrect-wiring. Restore power after reconnecting all cables and wires.
3. If the problem persists, try swapping a known good ribbon cable or a digital input device. Swap these components separately to isolate the problem. Remove power from the controller before disconnecting the suspect component, and restore power after connecting the replacement component. If the problem persists, it is likely that the MCB is defective.

Troubleshooting Output Boards

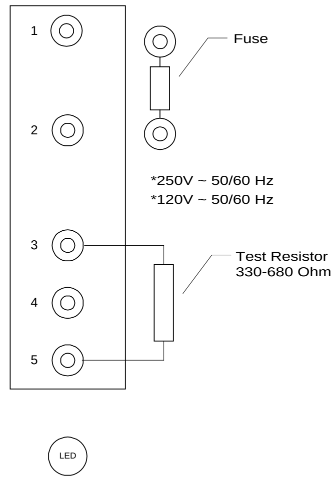
Each output on the Output Board consists of a solid-state relay, an LED, 5-amp fuse, and an MOV (metal oxide varistor).

Normally, when the MCB commands an output to energize, the solid-state relay contacts will close and the LED will glow. The contacts of each solid-state relay are in series with a 5-amp fuse. These fuses resemble small resistors and are located on the board adjacent to the relays they serve (see Figure 34). The fuses are pressed into place. They can be removed with needle nose pliers. The MOV, which is located on the underside of the output board, protects the solid-state relay from high transient voltages. MOVs are part of the output board and cannot be replaced.

Following are troubleshooting procedures for various symptoms of output board problems:

Note: It should be possible to determine whether a solid-state relay is defective by using these procedures.

Figure 34, Output Board Relay Socket



> ⚠ **WARNING**
>
> Electric shock hazard. Can cause severe injury or death. Even when power to the panel is off, solid-state relay socket terminals 1 and 2 on the output board could be connected to high voltage. Avoid them.

One LED Out

If one of the Output Board LEDs fails to illuminate when the MCB is commanding the associated output to energize, perform the following procedure:

1. Remove power from the controller by opening CB1. Swap the suspect relay with a known good relay. Try to choose a relay that will not affect unit operation. Restore power by closing CB1.
   If the LED does not light, go to step 2.
   If the LED lights, the suspect relay is defective.
2. Remove power from the controller. Check the ribbon cable and connections between the OB and the MCB. Look for bent pins.
   If the cable and connections are intact, go to step 3.
3. Remove the relay from the suspect socket. Install a 330-680 ohm resistor between terminals 3 and 5 as shown in Figure 34. Restore power by placing CB1 to the ON position. The LED should light regardless of the controller's command.
   If the output LED illuminates, it is likely that the MCB is defective.
   If the output LED does not illuminate, the output board is defective.

All LEDs Out

If the MCB is commanding at least two outputs to energize and none of the Output Board LEDs are lit, perform the following procedure:

1. Verify that 5Vdc is present at the Output Board's power terminals.
   If 5Vdc is not present, go to step 2.
   If 5Vdc is present, check the ribbon cable and connections between the output board and MCB. Look for bent pins. If the cable and connections are intact, the Output Board or the MCB is defective.

2. Remove power from the controller by placing CB1 to the OFF position. Disconnect at least one wire from the power input terminals of the Output Board. The resistance should not be less than 3000 ohms.
   If the resistance is greater than the acceptable value, go to step 3.
   If the resistance is less than the acceptable value, the Output Board is defective.
3. Check the discrete wiring and connections between the Output board and the Controller. Aux/Out terminal strip and the field wiring terminal strip.

Note: The MCB Aux/Out connector plug terminals displace wire insulation to make contact with the conductor. If a faulty Aux/Out connection is suspected, try pressing down on the wire in the terminals with a small screwdriver.

LED Lit, Output not Energized

If the LED of a suspect output is lit but the load connected to it is not energized, and everything is intact between the MCB and the coil side of the relay, perform the following procedure to isolate the problem:

1. Verify that 24 or 120Vac power is present at the suspect output's screw terminal on the Output Board.
2. Remove power from the controller by opening CB1. Pull the 5-amp fuse on the contact side of the relay and check it for continuity with an ohmmeter.
   If the fuse is not bad, reinstall it and go to step 3.
   If the fuse is bad, replace it and inspect the load and associated wiring before restoring power. Note that a fuse from an unused output can be substituted for the bad fuse.
3. Remove power from the controller by opening CB1. Swap the suspect relay with a known good relay. Try to choose a relay that will not affect unit operation. Restore power by closing CB1.
   If the output load energizes, the suspect relay is bad. Replace the relay.
   If the output load does not energize (when LED is lit again), check the load circuit wiring and components.

Output Energized, LED not Lit

If the LED of a suspect output is not lit, but the load connected to it is energized, either the Solid-State relay or the MOV is bad. The Solid-State relay contacts and the MOV, which are in parallel, can both fail closed. Perform the following procedure to isolate the problem:

1. Remove power from the controller by opening CB1. Pull the Solid-State relay from the suspect output's socket.
2. Restore power by closing CB1.
   If the output load remains energized when there is no relay in the socket, the output's MOV has failed and the Output Board must be replaced.
   If the output load de-energizes, the relay that was pulled is defective.

Contact Chatter

Contact chatter is very rapid opening and closing of contacts. It is usually caused by low voltage at the electromechanical relay or contactor coil. If contact chatter is occurring on a relay or contactor connected to one of the Output Board Solid-State relays, it is also possible that a faulty connection exists on the power supply terminals of the Aux/Out plug connector on the MCB. In very rare instances, contact chatter can be caused by a faulty Solid-State relay. Perform the following procedure to isolate the problem.

1. Verify that the voltage at the load's power supply and at the Solid-State relay contacts is adequate.
2. Remove power from the controller by opening CB1. Swap the suspect relay with a known good relay. Try to choose a relay that will not affect unit operation. Restore power by closing CB1.
   If the chatter does not stop, go to step 3.
   If the chatter stops, the suspect relay is defective. Replace the relay.

3. Remove power from the controller by opening CB1. Try to improve the connections in the Aux/Out plug insulation displacement terminals by pressing down on the wires with a small screwdriver.
4. Check all other wiring and connectors for bent pins or mis-wires.
   If the chatter does not stop, the electromechanical relay or contactor is probably defective.

Troubleshooting Solid-State Relays

As shown on the unit wiring diagrams, the Solid-State relays on the Output Boards all have normally open "contacts." Actually, these contacts do not exist as they do in an electromechanical relay. Instead of using contacts to switch the load, the Solid-State relay changes its resistance from low (closed), when it is energized, to high (open), when it is de-energized. (This high resistance is approximately 100K ohms.) Because the output circuit through the Solid-State relay remains continuous regardless of whether the relay is energized, troubleshooting a Solid-State relay with a voltmeter can be tricky.

In a typical circuit, a power source is connected across a single relay output and a load. In this circuit, a Solid-State relay will behave like an electromechanical relay. If the relay is energized, the relay output will be hot. If the relay is de-energized, voltage cannot be measured at the relay output.

The circuit shown in Figure 35 is similar to a typical circuit; the difference is that there is an open set of contacts, or a disconnection between the relay output and the load. In this circuit, a Solid-State relay will not behave like an electromechanical relay. if the Solid-State relay is energized, the relay output will be hot (as expected). However, if the Solid-State relay is de-energized, the relay output will still appear to be hot. This is because the relay output and the voltmeter form a continuous circuit in which the relay's resistance, though high, is insignificant compared to the voltmeter's resistance.

This means that nearly all the voltage is dropped across the voltmeter. Therefore, the voltmeter indicates that voltage is present. If a low wattage light bulb of the appropriate voltage is used instead of a voltmeter, the bulb's low resistance will load the circuit enough to eliminate the false voltage indication. In this situation, an incandescent test lamp is a better tool than a voltmeter.

Figure 35, Testing a Typical Relay Circuit

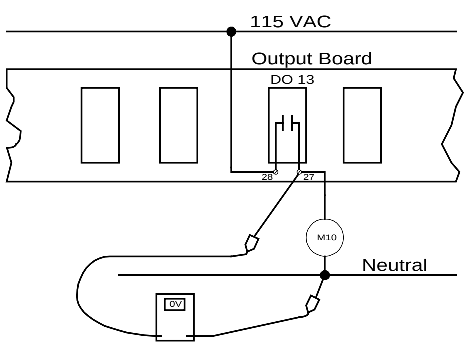
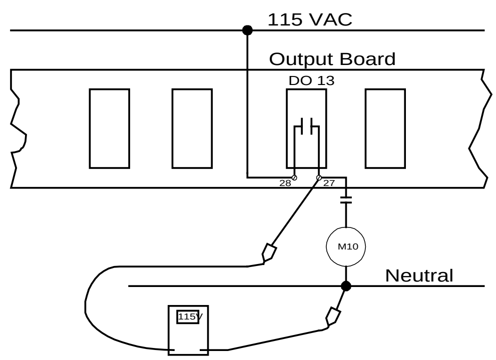


Figure 36, Testing a Relay Circuit with a Disconnection



Unit 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, taking condensing and suction pressure readings, and checking to see that the unit has normal superheat and subcooling readings. A recommended maintenance schedule is located at the end of this section.

Compressor Maintenance

The scroll compressors are fully hermetic and require no maintenance.

Lubrication

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

Compressor oil should be standard refrigeration mineral oil such as Suniso 3GS.

Electrical Terminals

⚠ WARNING

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

Check terminals for tightness on a scheduled basis.

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 58 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.

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	
Test and calibrate all safety an operating controls			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	
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.

* Never Megger motors while they are in a vacuum.

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.

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. The maximum recommended pressure drops across the filter-drier are as follows:

Table 58, 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.

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. 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 pumpdown. 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.

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

Evaporator

The remote evaporator on AGZ-AM units and CDE evaporators are 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

AGZ-AM and ACZ units are shipped with a factory holding charge of refrigerant and it is necessary to charge them at the job site after leak testing and evacuating the field installed refrigerant lines. Follow these recommendations when field charging. Refer to the unit operating charge found in the "Charging Section".

Final 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 AGZ and ACZ 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 degrees F-20 degrees F (8.3 degrees C-11.1 degrees 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.

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. However, freezestat trips can also be an indication of low flow or poor heat transfer due to tube fouling. Anti-freeze solutions may also cause freezestat trips.
3. If the unit is severely undercharged the unit will trip due to lack of liquid flow to the expansion valve. 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 slowly. 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 AGZ 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 twoF 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 by reading the liquid line pressure and temperature at the liquid line near the filter-drier. The subcooling values should be between 6 degrees F-20 degrees F (6.6 degrees C-11.1 degrees C). The subcooling values will be highest at 75-100% load, approximately 12 degrees F-20 degrees F (6.6 degrees C-11.1 degrees C) and lowest at 50% load, approximately 6 degrees F-12 degrees F (3.3 degrees C-6.6 degrees 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.

Troubleshooting Chart

PROBLEM	POSSIBLE CAUSES	POSSIBLE CORRECTIVE STEPS
Compressor will not Run	1. Main Switch. 2. Fuse Blown. Circuit breakers open 3. Thermal overloads tripped 4. Defective contactor or coil. 5. System Shutdown by safety devices 6. No cooling required 7. Liquid line solenoid will not open 8. Motor electrical trouble 9. Loose wiring	1. Close Switch. 2. Check electrical circuits and motor windings for shorts or grounds. Investigate for possible overloading. Replace fuse or reset breakers after fault is corrected. Check for loose or corroded connections. 3. Overloads are auto-reset Check unit closely when unit comes back on line. Allow time for auto-reset. 4. Repair or replace 5. Determine type and cause of shutdown and correct it before resetting safety switch 6. None. Wait until unit calls for cooling 7. Repair or replace solenoid coil. Check wiring 8. Check motor for opens, shorts, or burnout 9. Check all wire junctions. Tighten all terminal screws
Compressor noisy or vibrating	1. Compressor running in reverse 2. Improper piping support on suction or discharge 3. Worn compressor isolator bushing 4. Worn Compressor	1. Check unit and compressor for correct phasing 2. Relocate, add, or remove hangers 3. Replace 4. Replace
High Discharge Pressure	1. Noncondensables in system 2. System overcharged with refrigerant 3. Discharge shutoff valve partially closed 4. FanTrol wiring not correct 5. Fan not running 6. Dirty condenser coil	1. Purge the noncondensables 2. Remove excess, check liquid subcooling 3. Open valve 4. Check FanTrol wiring 5. Check electrical circuit, Check fan motor 6. Clean coil
Low Discharge Pressure	1. Wind blowing into coil at low ambient 2. Faulty condenser temperature regulation 3. Insufficient refrigerant in system 4. Low suction pressure 5. Only one compressor operating	1. Shield coil from direct wind 2. Check condenser control operation 3. Check for leaks. Repair and add charge 4. See corrective steps for Low Suction Pressure 5. See corrective steps for Compressor Will Not Stage Up
High Suction Pressure	1. Excessive water temperature 2. Excessive load 3. Expansion valve overfeeding 4. Compressors running in reverse	1. Check control settings 2. Reduce load or add additional equipment 3. Check remote bulb. Regulate superheat 4. Check for proper phasing
Low Suction Pressure	1. Lack of refrigerant 2. Clogged liquid line filter drier 3. Expansion valve malfunctioning 4. Condensing temperature to low 5. Compressor will not unload 6. Insufficient water flow 7. Evaporator head ring gasket slippage 8. Evaporator dirty	1. Check for leaks, Repair and add charge. Check liquid sightglass 2. Check pressure drop across filter drier. Replace 3. Check and reset for proper superheat 4. Check means for regulating condenser temperature 5. See corrective steps for Compressor Staging Intervals Too Low 6. Adjust flow 7. Take pressure drop across vessel and contact factory to obtain design pressure drop for that vessel 8. Clean chemically
Compressor will not stage up	1. Defective capacity control 2. Faulty thermostat stage or broken wire 3. Stages not set for application	1. Replace 2. Replace 3. Reset thermostat setting for application
Compressor Staging Intervals to Short	1. Thermostat control band not set properly 2. Erratic water thermostat 3. Insufficient water flow	1. Set control band wider 2. Replace 3. Adjust flow
Compressor Oil Level Too high or Too Low	1. Low oil level 2. Loose fitting on oil line 3. Level too high 4. Insufficient water flow - Level too high 5. Excessive liquid in crankcase - Level too high	1. Check and add oil 2. Check and tighten system 3. Adjust thermal expansion valve 4. Adjust flow 5. Check crankcase heater. Reset expansion valve for higher superheat. Check liquid line solenoid valve operation.
Compressor loses Oil	1. Lack of refrigerant 2. Excessive compression ring blow-by 3. Suction superheat too high 4. Crankcase heater burnout	1. Check for leaks and repair. Add refrigerant 2. Replace compressor 3. Adjust superheat 4. Replace crankcase heater
Motor Overload Relays or Circuit Breakers Open	1. Low voltage during high load conditions 2. Defective or grounded wiring in motor 3. Loose power wiring 4. High condenser temperature 5. Power line fault causing unbalanced voltage	1. Check supply voltage for excessive line drop 2. Replace compressor motor 3. Check all connections and tighten 4. See corrective steps for High Discharge Pressure 5. Check supply voltage. Notify power company. Do not start until fault is corrected.
Compressor Thermal Protection Switch Open	1. Operating beyond design conditions 2. Discharge valve partially shut 3. Blown compressor internal gasket	1. Add facilities so conditions are within allowable limits 2. Open valve 3. Replace gasket

This document contains the most current product information as of this printing. For the most up-to-date product information, please go to **www.mcquay.com.**

McQuay International

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