Installation, Operation and Maintenance Manual

IOMM ACZB1-1
Group: **Chiller**
Part Number**: 331975101**
Effective: **October 2008**
Supersedes: **October 2007**

Air-Cooled Scroll Condensing Units

ACZ 010B – ACZ 039B

10 to 43 Tons, 35 to 150 kW

R-22, R-407C

60 Hertz

Software Version: **ACZSU0102B**

McQuay®
Air Conditioning

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MODEL CODE

A C Z XXX B

- A — Air-Cooled
- C — Condensing Unit
- Z — Scroll Compressor
- XXX — Nominal Tons
- B — Vintage

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Introduction

General Description

McQuay air-cooled condensing units are complete, self-contained automatic refrigerating units. Every unit is completely assembled, factory wired, and tested. Each unit consists of an air-cooled condenser, Copeland Compliant Scroll® hermetic compressor, control center and internal refrigerant piping, ready to be piped to a field supplied low side.

The electrical control center includes all equipment protection and operating controls necessary for automatic operation except for the staging control for the steps of capacity in the unit. Condenser fan motors are three-phase (except single-phase on No.1 fan with SpeedTrol option) and started by their own contactors with inherent overload protection. The compressor has solid-state motor protection for inherent thermal overload protection except Models ACZ 010 and 013 that have internal line breakage.

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 nameplate before unloading to be sure it agrees with the power supply available. Units are shipped FOB factory and McQuay is not responsible for physical damage after the unit leaves the factory.

Note: Unit shipping and operating weights are listed on pages 20 and 21.

Installation

Note: Installation is to be performed by qualified personnel who are familiar with local codes and regulations, especially concerning refrigerant release to the atmosphere.

⚠ WARNING

Sharp edges and coil surfaces can cause personal injury. Wear protective gear and 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, lifting slots 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).

HAZARD IDENTIFICATION INFORMATION

⚠ WARNING

Warnings indicate potentially hazardous situations, which can result in property damage, severe personal injury, or death if not avoided.

⚠ CAUTION

Cautions indicate potentially hazardous situations, which can result in personal injury or equipment damage if not avoided.

Figure 1, Suggested Pushing Arrangement

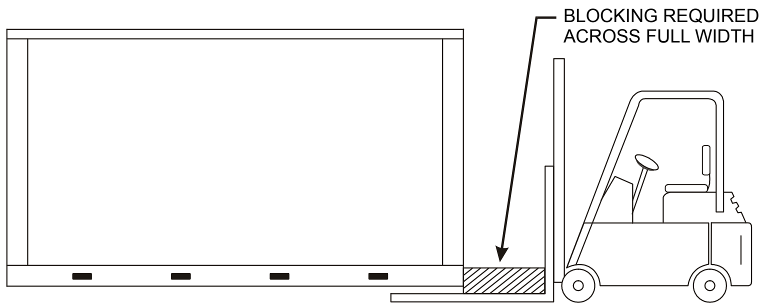
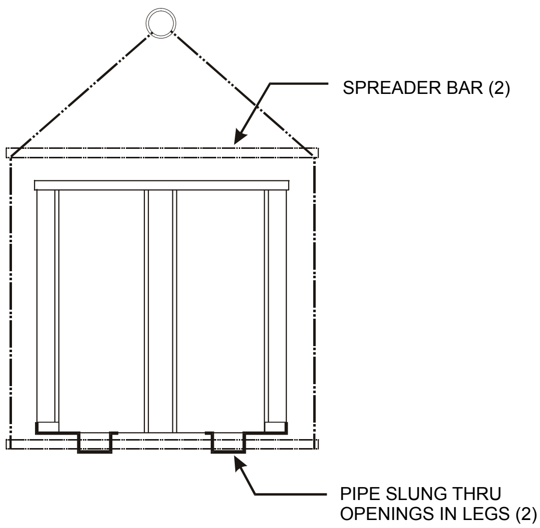


Figure 2, Suggested Lifting Arrangement



NOTE: The fork lift slots can be used for lifting by inserting sufficiently strong pipe through them as shown in Figure 2.
Use the outboard slots on three-fan units and the only two on two-fan units.

Location

Unit Placement

ACZ units are for outdoor applications and can be mounted on a roof or at ground level. Set units on a solid and level foundation. For roof-mounted applications, install the unit on a steel channel or I-beam frame to support the unit above the roof. For ground level applications, install the unit on a substantial base that will not settle. A one-piece concrete slab with footings extended below the frost line is recommended. Be sure the foundation is level (within 1/2" [13 mm] over its length and width). The foundation must support the operating weights listed in the Physical Data Tables on pages 20 and 21.

Since its operation is affected by wind, the unit should be located so that its length is parallel with the prevailing wind. If this is not practical, field fabricated wind deflectors may be required.

Service Access

Each end of the unit must be accessible after installation for periodic service. Compressors, filter-driers, and liquid line solenoid valve are accessible from the end of the unit. Motor protector controls are on the compressor. Most operating, equipment protection, and starting controls are located in the unit control box.

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

Clearances

The flow of air to and from the condenser coil must not be limited. Restricting airflow 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.

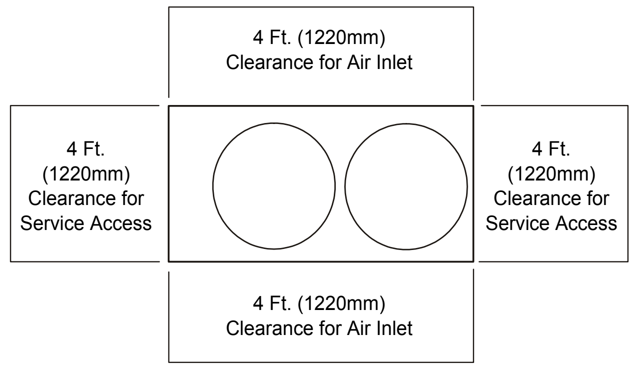
Install the unit with enough side clearance for air entrance to the coil and for servicing. Provide service access to the compressors, electrical control panel and piping components as shown in Figure 3. Do not block access to the unit with piping or conduit.

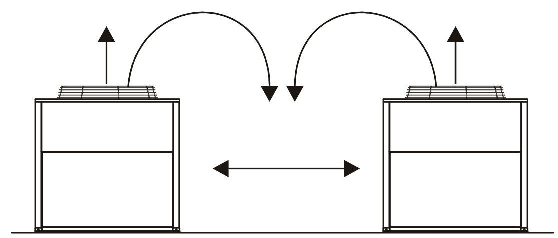
Do not allow debris to accumulate near the unit. Air movement can draw debris into the condenser coil causing air starvation. Give special consideration to low ambient operation where snow can accumulate. Keep condenser coils and fan discharge free of snow or other obstructions to permit adequate airflow.

Sound Isolation

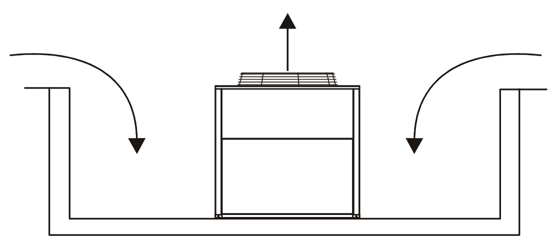
The low sound levels of the ACZ units are suitable for most applications. When additional sound reduction is necessary, locate the unit away from sound sensitive areas. Avoid locations beneath windows or between structures where normal-operating sounds may be objectionable. Reduce structurally transmitted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

Figure 3, Clearance requirements

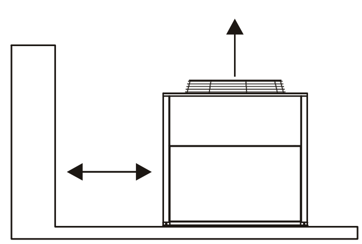




The recommended minimum side clearance between two units is 8 feet (2440mm).



The unit must not be installed in a pit or enclosure that is deeper or taller than the height of the unit unless extra space is provided. The minimum clearance on each side of the unit is 6 feet (1828mm) when installed in a pit. The pit cannot be deeper than the unit.



The minimum clearance to a side wall or building taller than the unit height is 6 feet (1828mm) provided no solid wall above 6 feet (1828mm) tall is closer than 12 feet (3658mm) to the opposite side of the unit.

Vibration Isolators

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

The unit should be initially on shims or blocks at the listed free height. When all piping, wiring, flushing, charging, etc. is completed, the springs are adjusted upward to loosen the blocks or shims that are then removed.

A rubber anti-skid pad is part of the isolator. Installation of spring isolators requires flexible piping connections and at least three feet of flexible conduit to avoid straining the piping and transmitting vibration and noise. These units cannot be bolted to isolators.

Table 1, R-I-S Isolator Location and Kit Number, Aluminum Fins

R-I-S, ALUMINUM FINS						KIT PART NUMBER
UNIT SIZE	**OPER. WGT LBS.**	**LF**	**RF**	**LB**	**RB**	
010	1000	RP-3 Red	RP-3 Red	RP-3 Red	RP-3 Red	331987901
013	1000	RP-3 Red	RP-3 Red	RP-3 Red	RP-3 Red	
016	1065	RP-3 Red	RP-3 Red	RP-3 Red	RP-3 Red	
020	1150	RP-3 Red	RP-3 Red	RP-3 Red	RP-3 Red	
025	1370	RP-3 Green	RP-3 Green	RP-3 Red	RP-3 Red	350014857
028	1390	RP-3 Green	RP-3 Green	RP-3 Red	RP-3 Red	
033	1565	RP-3 Green	RP-3 Green	RP-3 Red	RP-3 Red	
039	1975	RP-3 Gray	RP-3 Gray	RP-3 Red	RP-3 Red	331987903

Note: See dimension drawing for location of isolators

Table 2, R-I-S Isolator Location and Kit Number, Copper Fins

R-I-S, COPPER FINS						KIT PART NUMBER
UNIT SIZE	**OPER. WGT LBS.**	**LF**	**RF**	**LB**	**RB**	
010	1000	RP-3 Red	RP-3 Red	RP-3 Red	RP-3 Red	331987901
013	1000	RP-3 Red	RP-3 Red	RP-3 Red	RP-3 Red	
016	1065	RP-3 Red	RP-3 Red	RP-3 Red	RP-3 Red	
020	1150	RP-3 Red	RP-3 Red	RP-3 Red	RP-3 Red	
025	1370	RP-3 Green	RP-3 Green	RP-3 Red	RP-3 Red	350014857
028	1390	RP-3 Green	RP-3 Green	RP-3 Red	RP-3 Red	
033	1565	RP-3 Green	RP-3 Green	RP-3 Red	RP-3 Red	
039	1975	RP-3 Gray	RP-3 Gray	RP-3 Red	RP-3 Red	331987903

Note: See dimension drawing for location of isolators

Table 3, Spring Isolator Location and Kit Number, Aluminum Fins

SPRINGS, ALUMINUM FINS						KIT PART NUMBER
UNIT SIZE	OPER. WGT LBS.	SPRING-FLEX MOUNTINGS				
		LF	RF	LB	RB	
010	1000	C1PE-1D-340 Red	C1PE-1D-340 Red	C1PE-1D-340 Red	C1PE-1D-340 Red	332320001
013	1000	C1PE-1D-340 Red	C1PE-1D-340 Red	C1PE-1D-340 Red	C1PE-1D-340 Red	
016	1065	C1PE-1D-340 Red	C1PE-1D-340 Red	C1PE-1D-340 Red	C1PE-1D-340 Red	
020	1150	C1PE-1D-340 Red	C1PE-1D-340 Red	C1PE-1D-340 Red	C1PE-1D-340 Red	
025	1370	C1PE-1D-510 Black	C1PE-1D-510 Black	C1PE-1D-340 Red	C1PE-1D-340 Red	332320002
028	1390	C1PE-1D-510 Black	C1PE-1D-510 Black	C1PE-1D-340 Red	C1PE-1D-340 Red	
033	1565	C1PE-1D-510 Black	C1PE-1D-510 Black	C1PE-1D-340 Red	C1PE-1D-340 Red	
039	1975	C1PE-1D-900 Dark Green	C1PE-1D-900 Dark Green	C1PE-1D-510 Black	C1PE-1D-510 Black	332320006

Note: See dimension drawing for location of isolators

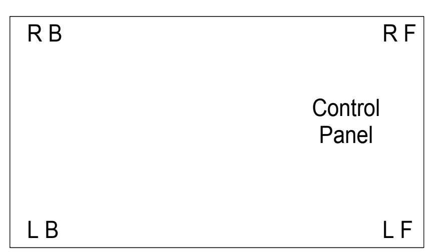
Table 4, Spring Isolator Location and Kit Number, Copper Fins

SPRINGS, COPPER FINS						KIT PART NUMBER
UNIT SIZE	OPER. WGT LBS.	SPRING-FLEX MOUNTINGS				
		LF	RF	LB	RB	
010	1000	C1PE-1D-340 Red	C1PE-1D-340 Red	C1PE-1D-340 Red	C1PE-1D-340 Red	332320001
013	1000	C1PE-1D-340 Red	C1PE-1D-340 Red	C1PE-1D-340 Red	C1PE-1D-340 Red	
016	1065	C1PE-1D-510 Black	C1PE-1D-510 Black	C1PE-1D-510 Black	C1PE-1D-510 Black	332320003
020	1150	C1PE-1D-510 Black	C1PE-1D-510 Black	C1PE-1D-510 Black	C1PE-1D-510 Black	
025	1370	C1PE-1D-900 Dark Green	C1PE-1D-900 Dark Green	C1PE-1D-510 Black	C1PE-1D-510 Black	332320006
028	1390	C1PE-1D-900 Dark Green	C1PE-1D-900 Dark Green	C1PE-1D-510 Black	C1PE-1D-510 Black	
033	1565	C1PE-1D-900 Dark Green	C1PE-1D-900 Dark Green	C1PE-1D-510 Black	C1PE-1D-510 Black	
039	1975	C1PE-1D-900 Dark Green	C1PE-1D-900 Dark Green	C1PE-1D-510 Black	C1PE-1D-510 Black	

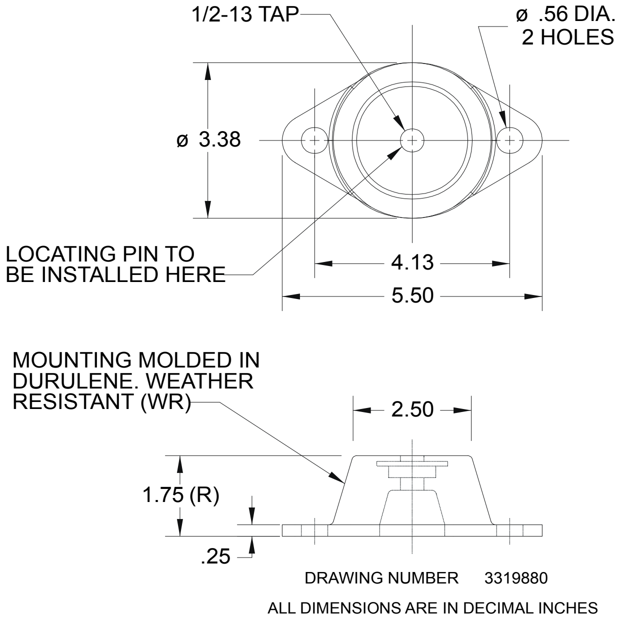
Note: See dimension drawing for location of isolators

Corner Operating Weights

ACZ Unit Model	RF	LF	RB	LB	Total
010-013	257	264	236	243	257
016	290	286	246	243	290
020	312	309	266	263	312
025	446	443	241	240	446
028	453	449	245	243	453
033	488	487	296	295	488
039	656	703	297	318	656

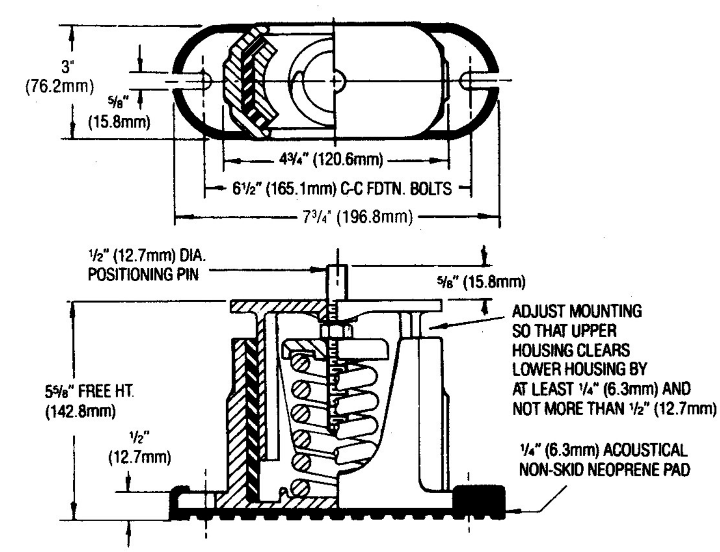


RP-3, Rubber-in Shear Isolator



NOTE: Locating pin is factory installed

CP-1, Spring Isolator



Chilled Water System

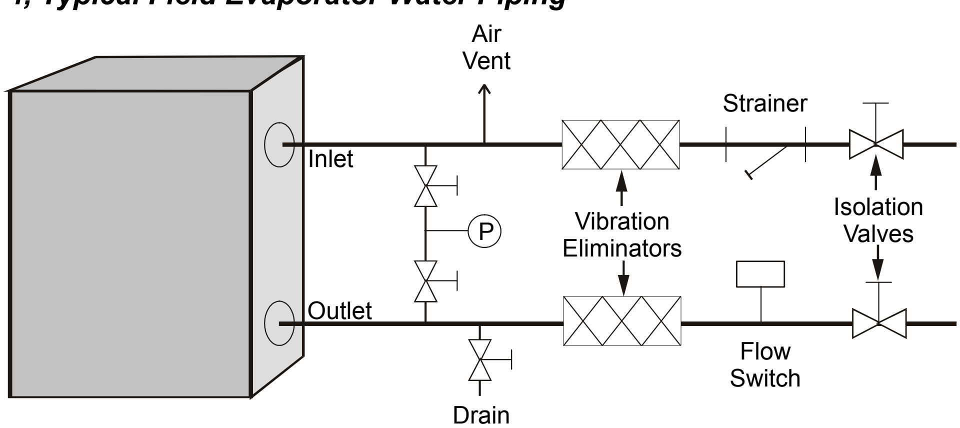
Water Piping (Applicable when the Unit is Field Connected to a Water Type Evaporator)

Local authorities can supply the installer with the proper building and safety codes required for 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. Installed pressure gauge taps in the chilled water inlet and outlet piping or as shown in Figure 4.
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 help prolong pump life and keep system performance up.
7. A 40-mesh strainer *is required* 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. 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 on the evaporator is recommended immediately at equipment start-up.
9. 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 38°F (3.3°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.
10. Perform a preliminary leak check before insulating the piping and filling the system.
11. Piping insulation should include a vapor barrier to prevent condensation and possible damage to the building structure.

Figure 4, Typical Field Evaporator Water Piping



System Volume

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

For normal comfort cooling applications, where the cooling load changes relatively slowly, we recommend a minimum system volume of three to four times the flow rate (GPM). For example, if the design chiller flow rate is 120 GPM, we recommend a minimum system volume of 360 to 480 gallons.

Since there are many other factors that can influence performance, systems can successfully operate below these suggestions. However, as the water volume decreases below these suggestions, the possibility of problems increases.

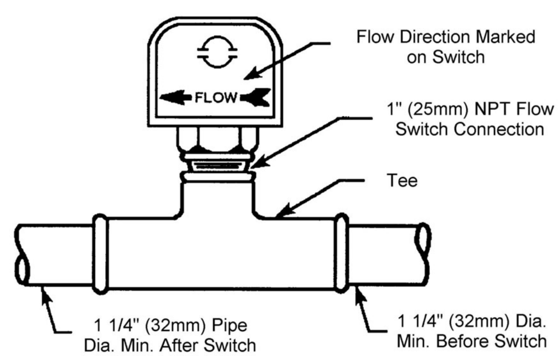
Variable Chilled Water flow

Variable chilled water flow systems are not recommended for this class of equipment due to limited unloading capability.

Flow Switch

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

Figure 5, Flow Switch Installation



A flow switch is available from McQuay (part number 017503300). It is a "paddle" type switch and adaptable to pipe sizes down to 1 1/4" (32mm) nominal. Certain minimum flow rates are required to close the switch and are listed in Table 5. Install the switch as shown in Figure 5. Connect the normally open contacts of the flow switch in the unit control center at terminals 4 and 5. 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. Follow installation instructions provided with the flow switch. Calibrate the flow switch to open at one-half of nominal flow rate.

⚠ CAUTION

Differential pressure switches are not recommended for outdoor installation. They are subject to freezing-up at low ambient temperatures and can become inoperative.

Table 5, Flow Switch Settings

Pipe Size (NOTE !)		inch	1 1/4	1 1/2	2	2 1/2	3	4	5	6	8
		mm	32 (2)	38 (2)	51	63 (3)	76	102 (4)	127 (4)	153 (4)	204 (5)
Min. Adjst.	Flow	gpm	5.8	7.5	13.7	18.0	27.5	65.0	125.0	190.0	205.0
		Lpm	1.3	1.7	3.1	4.1	6.2	14.8	28.4	43.2	46.6
	No Flow	gpm	3.7	5.0	9.5	12.5	19.0	50.0	101.0	158.0	170.0
		Lpm	0.8	1.1	2.2	2.8	4.3	11.4	22.9	35.9	38.6
Max. Adjst.	Flow	gpm	13.3	19.2	29.0	34.5	53.0	128.0	245.0	375.0	415.0
		Lpm	3.0	4.4	6.6	7.8	12.0	29.1	55.6	85.2	94.3
	No Flow	gpm	12.5	18.0	27.0	32.0	50.0	122.0	235.0	360.0	400.0
		Lpm	2.8	4.1	6.1	7.3	11.4	27.7	53.4	81.8	90.8

NOTES:

1. A segmented 3-inch paddle (1, 2, and 3 inches) is furnished mounted, plus a 6-inch paddle loose.
2. Flow rates for a 2-inch paddle trimmed to fit the pipe.
3. Flow rates for a 3-inch paddle trimmed to fit the pipe.
4. Flow rates for a 3-inch paddle.
5. Flow rates for a 6-inch paddle

Refrigerant Piping, R-22, R-407C

Introduction

NOTE: All field piping, wiring, and procedures must be performed in accordance with ASHRAE, EPA, and industry standards. 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
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. Oil is carried into the compressor with suction gas; and that same gas entrains oil present on the compressor 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 can be pumped out and trapped in the condenser with the refrigerant charge. This oil can 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 ASHRAE Handbook Refrigeration Edition 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 can 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 the ASHRAE table for R22. 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 a) above.

To determine the actual line loss:

1. Modify the table tons by the value for the design condensing temperature.
2. Use the formula in the notes 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.

NOTE: Excessive pressure drop is undesirable because:

- It reduces available compressor capacity.
- It increases power consumed for the net tons realized.
- It can 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 Tables.

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.
- 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 can be installed in the discharge line.

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

Underground Refrigerant Lines

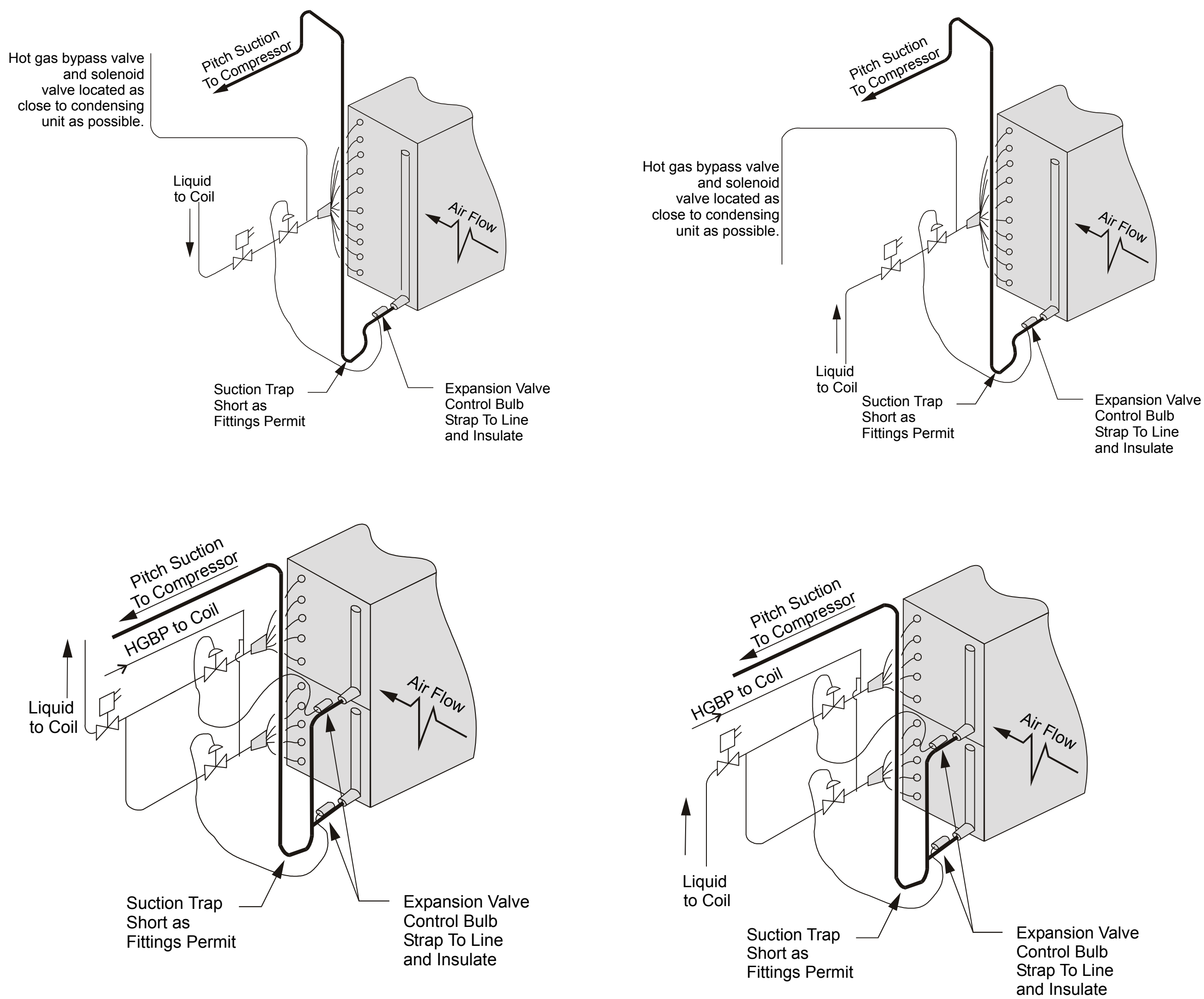
McQuay does not recommend the installation of suction lines underground. If job conditions require that they be located below ground, a suitable sized suction accumulator must be installed ahead of the compressor to interrupt possible liquid refrigerant slugs at start-up.

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 6, 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 can 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.

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.

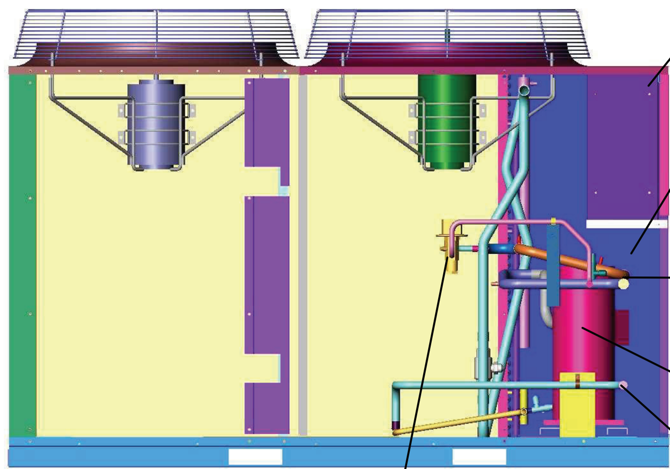
Liquid line solenoid valves should be located adjacent to the expansion valve with possibly only a sight glass interposing the two.

If liquid lines are short, they may be of smaller diameter than the size indicated in the current ASHRAE Refrigerant Handbook. 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, the liquid line and its refrigerant specialties can have pressure losses totaling 10 x 3.05 psi (or 10 x 2.2) and still satisfy the objective of delivering 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.

When calculating condenser subcooling, note that saturated condensing pressure should be read at the same point in the system where the liquid refrigerant temperature is obtained.

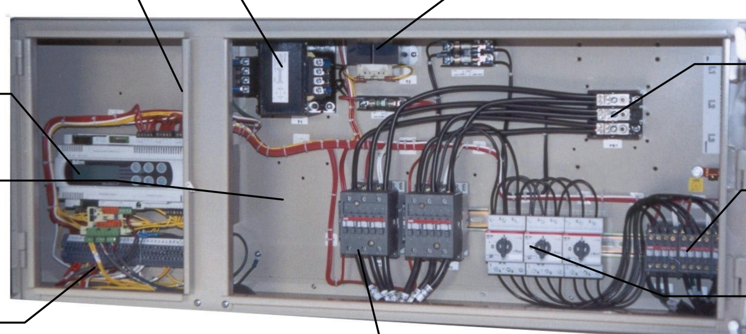
Unit Component Location



Control Layout and Operation

Control Center

All electrical controls are enclosed in a weather resistant control center with tool-locked, hinged access doors. The left-hand section contains the microprocessor controller and control input and output terminals. All high-voltage components are located on the right side of the panel.



R-407C Units

AGZ chillers are available with R-407C refrigerant as non-ARI certified units. R-407C is a zeotropic blend of three compounds, and as such exhibits the characteristic of glide. It does not behave as one substance like R-22 does. Glide is the difference (in degrees F) between the beginning and end phase-change process in either the evaporator or condenser. During these processes, different ratios of the refrigerant's components change phase from the beginning to the end of the process. The following functions, conditions and settings will differ from units charged with R-22.

1. Different physical data and electrical data
2. Polyolester lubricants are used instead of mineral oil.
3. The saturated pressure/temperature relationship
4. Control and alarm settings
5. Charging procedures

1. Lubrication. The units are factory-charged with polyoester (POE) lubricant and one of the following lubricants must be used if lubricant is to be added to the system:

Copeland Ultra 22 CC
Mobil EAL™ Arctic 22 CC
ICI EMKARATE RL RL™ 32CF

POEs are very hygroscopic and will quickly absorb moisture if exposed to air. Pump the lubricant into the unit through a closed transfer system. Avoid overcharging the unit.

2. Pressure/temperature relationship. See Table 6 on page 17 for the saturated pressure-temperature chart. Due to refrigerant glide, use the following procedures for superheat and subcooling measurement.

To determine superheat, only vapor must be present at the point of measurement, no liquid. Use the temperature reading, the pressure reading and the Saturated P/T Chart. If the pressure is measured at 78 psig, the chart shows the saturated vapor temperature to be 50.6°F. If the temperature is measured at 60°F, the superheat is 9.4 degrees F.

To determine subcooling, only liquid must be present, no vapor. Use the temperature reading, the pressure reading and the Saturated P/T Chart. If the pressure is measured at 250 psig, the chart shows the saturated liquid temperature to be 108.2°F. If the temperature is measured at 98°F, the subcooling is 10.2 degrees F.

The P/T relationship between R-407C and R-22 is similar enough to allow the use of R-22 expansion valves. The valves may be marked as "R-22' or "R-22/R-407C".

3. Control and alarm settings. The software that controls the operation of the unit is factory-set for operation with R-407C, taking into account that the pressure/temperature relationship differs from R-22. The software functionality is the same for either refrigerant.

4. Charging procedure. R-22 are shipped with holding charge of R-22, R-407C units have a holding charge of nitrogen. Use the following procedure for charging R-407 in the field:

Whether topping off a charge or replacing the circuit's entire charge, always remove the refrigerant from the charging vessel as a liquid. Many of the cylinders for the newer refrigerants have a dip tube so that liquid is drawn off when the cylinder is in the upright position. Do not vapor charge out of a cylinder unless the entire contents will be charged into the system.

With the system in a 250-micron or lower vacuum, liquid can be charged into the high side. Initially charge about 80 percent of the system total charge.

Start the system and observe operation. Use standard charging procedures (liquid only) to top off the charge.

It may be necessary to add refrigerant through the compressor suction. Because the refrigerant leaving the cylinder must be a liquid, exercise care to avoid damage to the compressor. A sight glass can be connected between the charging hose and the compressor. It can be adjusted to have liquid leave the cylinder and vapor enter the compressor.

Table 6, R-407C Saturated Pressure/Temperature Chart

Pressure (PSIG)	Liquid Temp (°F)	Vapor Temp (°F)	Pressure (PSIG)	Liquid Temp (°F)	Vapor Temp (°F)
20	-10.7	1.5	150	74.8	84.9
22	-8.2	4.0	155	76.8	86.8
24	-5.7	6.4	160	78.7	88.7
26	-3.4	8.7	165	80.6	90.5
28	-1.1	11.0	170	82.5	92.3
30	1.1	13.1	175	84.3	94.0
32	3.2	15.2	180	86.1	95.8
34	5.3	17.2	185	87.8	97.5
36	7.3	19.2	190	89.6	99.1
38	9.2	21.0	195	91.3	100.7
40	11.1	22.9	200	92.9	102.3
42	12.9	24.7	205	94.6	103.9
44	14.7	26.4	210	96.2	105.4
46	16.4	28.1	215	97.7	107.0
48	18.1	29.7	220	99.3	108.4
50	19.7	31.3	225	100.8	109.9
52	21.3	32.9	230	102.3	111.4
54	22.9	34.4	235	103.8	112.8
56	24.4	35.9	240	105.3	114.2
58	25.9	37.4	245	106.7	115.6
60	27.4	38.8	250	108.2	116.9
62	28.8	40.2	255	109.6	118.2
64	30.2	41.6	260	111.0	119.6
66	31.6	43.0	265	112.3	120.9
68	33.0	44.3	270	113.7	122.1
70	34.3	45.6	275	115.0	123.4
72	35.6	46.9	280	116.3	124.7
74	36.9	48.1	285	117.6	125.9
76	38.2	49.3	290	118.9	127.1
78	39.4	50.6	295	120.2	128.3
80	40.6	51.8	300	121.4	129.5
82	41.9	52.9	305	122.7	130.7
84	43.0	54.1	310	123.9	131.8
86	44.2	55.2	315	125.1	133.0
88	45.4	56.3	320	126.3	134.1
90	46.5	57.4	325	127.5	135.2
92	47.6	58.5	330	128.7	136.3
94	48.7	59.6	335	129.8	137.4
96	49.8	60.7	340	131.0	138.5
98	50.9	61.7	345	132.1	139.6
100	51.9	62.7	350	133.2	140.6
105	54.5	65.2	355	134.3	141.7
110	57.0	67.7	360	135.4	142.7
115	59.5	70.0	365	136.5	143.7
120	61.8	72.3	370	137.6	144.7
125	64.1	74.6	375	138.7	145.7
130	66.4	76.7	380	139.8	146.7
135	68.5	78.8	385	140.8	147.7
140	70.7	80.9	390	141.8	148.7
145	72.8	82.9	395	142.9	149.6

Start-up and Shutdown

Pre Start-up

1. The chilled-water system should be flushed and cleaned or air filters checked for cleanliness on DX systems.
2. Open all electric disconnects and check all electric connections for tightness.
3. Inspect all water piping for flow direction and correct connections at the evaporator or ductwork for tightness and completeness.
4. Verify that thermostat connections for two stages of control have been connected to unit terminals 23 / J5-ID7 and 28 / J5- ID-8.
5. Check compressor oil level. The oil level should be visible in the oil sightglass.
6. Check voltage of the unit power supply and make certain voltage is within ±10% of nameplate rating. Check unit power supply wiring for proper ampacity and a minimum insulation temperature of 75°C. Check for proper phasing using a phase sequence meter.
7. Verify all mechanical and electrical inspections have been completed according to local codes.
8. Open control stop switch S1(off). Turn on the main power and control disconnect switches. This will energize crankcase heaters. Wait at least 24 hours before starting up unit.

Start-up

1. Start auxiliary equipment by turning on the following: time clock (if present), ambient thermostat and/or remote on/off switch, chilled water pump or air handler.
2. If the field supplied staging control calls for cooling, the unit will begin the start-up sequence.
3. After running the unit for a short time, check the oil level in the compressor (1/4 to 1/3 of the glass), rotation of fans, and flashing in refrigerant sight glass.
4. Verify superheat temperature is at the factory setting of 8 to 12 degrees F (4.4 to 6.7 degrees C).
5. After system performance has stabilized, complete the current ACZ Start-Up Form (obtainable from the local McQuay sales office) to establish inception of warranty benefits. Return the form to McQuay International through your sales representative.

Sequence of Operation

The following sequence of operation is typical for ACZ Models. It can vary depending upon options.

Start-Up

With the control circuit power on, 115V power is applied through the control circuit fuse F1 to the compressor crankcase heaters, the compressor motor protections and the primary of the 24V control circuit transformer. The 24V transformer provides power to the microprocessor controller.

If an optional remote time clock or remote manual switch is field wired to the unit (terminals 25 and 35), it must be closed in order to start the unit. The operation of the unit is then under the control of the field supplied staging thermostat. A water or air flow switch is recommended across terminals 26 and 36 to prove flow before starting compressors. If not used, a jumper is required across the terminals. The two compressors will start when the normally open staging contacts close.

Equipment Protection Alarms

The following conditions will shut down the unit and activate the alarm circuit:

- No water or air flow
- High condenser pressure
- Phase voltage protection (Optional)
- Sensor failures
- Low evaporator pressure
- Motor protection system
- Outside ambient temperature

The following alarms will limit unit operation:

- Condenser pressure stage down, unloads unit at high discharge pressures
- Low ambient lockout, shuts off unit at low ambient temperatures
- Low evaporator pressure hold, holds stage #1 until pressure rises
- Low evaporator pressure unload, shuts off stage #2

Unit Enable Selection

Enables unit operation from local keypad, digital input, or Building Automation System.

Unit Mode Selection

Selects standard cooling or test operation mode. (Test is for service personnel only.)

Condenser Fan Control

Control of condenser fans is provided by the MicroTech II controller. The control steps condenser fans based on discharge pressure.

Shutdown

As the Stage #2 external staging thermostat is satisfied, it will stage off the lag compressor unloading the unit. The Stage #1 will de-energize the liquid line solenoid valve SV1 and the lead compressor will pump down the unit and shut off on Low Suction Pressure at 40 psig. If the low pressure cutoff point cannot be reached in 120 seconds, the compressor will time off. The compressor crankcase heaters will energize when the compressors shut off, keeping the small amount of refrigerant in the plate heat exchanger from migrating to the compressor. See page 43 for detailed explanation of compressor staging.

Physical Data

Table 7, Physical Data, ACZ 010BS through 020BS, R-22/R-407C

PHYSICAL DATA	ACZ MODEL NUMBER			
	010B	013B	016B	020B
BASIC DATA				
Number Of Refrigerant Circuits	1	1	1	1
Operating Charge, R-22/R-407C, Lb. (kg), Note	22.0 (10.0)	22.0 (10.0)	24.0 (10.9)	31.0 (14.1)
Cabinet Dimensions, LxWxH, In.	73.6 x 46.3 x 50.8	73.6 x 46.3 x 50.8	73.6 x 46.3 x 50.8	73.6 x 46.3 x 50.8
Cabinet Dimensions, LxWxH, (mm)	(1869) x (1176) x (1289)	(1869) x (1176) x (1289)	(1869) x (1176) x (1289)	(1869) x (1176) x (1289)
Unit Operating Weight, Lbs. (kg)	1015 (461)	1015 (461)	1090 (495)	1190 (541)
Unit Shipping Weight, Lbs. (kg)	1000 (454)	1000 (454)	1065 (484)	1150 (523)
Add'l Weight If Copper Finned Coils, Lb. (kg) R-22 and [R-407C]	176 (80.0) [176 (80.0)]	176 (80.0) [176 (80.0)]	176 (80.0) [176 (80.0)]	264 (120.0) [264 (120.0)]
COMPRESSORS				
Type	Scroll	Scroll	Scroll	Scroll
Nominal Horsepower	4.0 / 4.0	6.0 / 6.0	7.5 / 7.5	9.0 / 9.0
Oil Charge Per Compressor of a Tandem Set, oz. (g)	57 (1616)	60 (1701)	140 (3969)	140 (3969)
CAPACITY REDUCTION STEPS - PERCENT OF COMPRESSOR DISPLACEMENT				
Standard Staging	0 – 50 – 100	0 – 50 – 100	0 – 50 – 100	0 – 50 – 100
CONDENSERS - HIGH EFFICIENCY FIN AND TUBE TYPE WITH INTEGRAL SUBCOOLING				
Coil Face Area,Sq. Ft. (M^2)	30.3 (2.8)	30.3 (2.8)	30.3 (2.8)	30.3 (2.8)
Finned Height x Finned Length, In.	84 x 52	84 x 52	84 x 52	84 x 52
Finned Height x Finned Length, (mm)	(2134) x (1321)	(2134) x (1321)	(2134) x (1321)	(2134) x (1321)
Fins Per Inch x Rows Deep**:** R-22 and R-407C	16 x 2	16 x 2	16 x 2	16 x 3
Pumpdown Capacity lb. (kg)	35.3 (16.0)	35.3 (16.0)	35.3 (16.0)	50.3 (22.8)
CONDENSER FANS - DIRECT DRIVE PROPELLER TYPE				
Number Of Fans - Fan Diameter, In. (mm)	2 – 26 (660)	2 – 26 (660)	2 – 26 (660)	2 – 26 (660)
Number Of Motors - HP (kW)	2 – 1.0 (0.75)	2 – 1.0 (0.75)	2 – 1.0 (0.75)	2 – 1.0 (0.75)
Fan And Motor RPM, 60 Hz	1140	1140	1140	1140
Total Unit Airflow, CFM (l/s), 60 Hz	13950 (6584)	13950 (6584)	13950 (6584)	12000 (5664)

Note: Operating charge is for the condensing unit only. Refrigerant lines and evaporator charge must be added.

Table 8, Physical Data, ACZ 025BS through 039BS, R-22/R-407C

PHYSICAL DATA	ACZ MODEL NUMBER			
	025B	028B	033B	039B
BASIC DATA				
Number Of Refrigerant Circuits	1	1	1	1
Operating Charge, R-22/R-407C, Lb. (kg), Note	34.0 (15.4)	36.0 (16.3)	47.0 (21.3)	50.0 (22.7)
Cabinet Dimensions, LxWxH, In.	106.2x 46.3 x 50.8	106.2x 46.3 x 50.8	106.2x 46.3 x 58.8	106.2x 46.3 x 58.8
Cabinet Dimensions, LxWxH, (mm)	(2697) x (1176) x (1289)	(2697) x (1176) x (1289)	(2697) x (1176) x (1493)	(2697) x (1176) x (1493)
Unit Operating Weight, Lbs. (kg)	1470 (667)	1490 (676)	1760 (799)	1960 (890)
Unit Shipping Weight, Lbs. (kg)	1580 (717)	1600 (726)	1890 (858)	2090 (949)
Add'l Weight If Copper Finned Coils, Lb. (kg)	350 (159) [426 (194)]	426 (194) [426 (194)]	435 (197) [435 (197)]	435 (197) [435 (197)]
COMPRESSORS				
Type	Scroll	Scroll	Scroll	Scroll
Nominal Horsepower	12.0 / 12.0	13.0 / 13.0	15.0 / 15.0	20.0 / 20.0
Oil Charge Per Compressor of a Tandem Set, oz. (g)	110 (3119)	110 (3119)	110 (3119)	158 (4479)
CAPACITY REDUCTION STEPS - PERCENT OF COMPRESSOR DISPLACEMENT				
Standard Staging	0 – **50** - 100	0 – 50 – 100	0 – 50 – 100	0 – 50 – 100
CONDENSERS - HIGH EFFICIENCY FIN AND TUBE TYPE WITH INTEGRAL SUBCOOLING				
Coil Face Area,Sq. Ft. (M^2)	49.0 (4.6)	49.0 (4.6)	58.3 (5.4)	58.3 (5.4)
Finned Height x Finned Length, In.	84 x 84	84 x 84	100 x 84	100 x 84
Finned Height x Finned Length, (mm)	(2134) x (2134)	(2134) x (2134)	(2545) x (2134)	(2545) x (2134)
Fins Per Inch x Rows Deep: R-22 and R-407C	16 x 2	16 x 2	16 x 3	16 x 3
Pumpdown Capacity lb. (kg)	53.1 (24.0)	53.1 (24.0)	90.7 (41.1)	92.8 (42.0)
CONDENSER FANS - DIRECT DRIVE PROPELLER TYPE				
Number Of Fans - Fan Diameter, In. (mm)	3 – 26 (660)	3 – 26 (660)	3 – 26 (660)	3 – 26 (660)
Number Of Motors - HP (kW)	3 – 1.0 (0.75)	3 – 1.0 (0.75)	3 – 1.0 (0.75)	3 – 1.0 (0.75)
Fan And Motor RPM, 60 Hz	1140	1140	1140	1140
Total Unit Airflow, CFM (l/s), 60 Hz	20925 (9877)	20925 (9877)	19800 (9346)	19800 (9346)

Note: Operating charge is for the condensing unit only. Refrigerant lines and evaporator charge must be added.

Electrical Data

Field Wiring

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.

ACZ 010B through ACZ 039B units have single-point power connection. A single field supplied fused disconnect is required or it can be supplied as a factory-mounted option. The control transformer is factory mounted.

R-22

Table 9, Electrical Data, R-22

ACZ Unit Size	Volts	Minimum Circuit Ampacity (MCA)	Power Supply				Field Fuse or Breaker Size	
			Field Wire		Hub (Conduit Connection)			
			Quantity	Wire Gauge 75C	Quantity	Nominal Size In. (mm)	Recom-mended	Maximum
010B	208	45	3	8 AWG	1	1.00 (25)	50	50
	230	45	3	8 AWG	1	1.00 (25)	50	50
	460	22	3	10 AWG	1	1.00 (25)	25	25
	575	19	3	10 AWG	1	1.00 (25)	20	20
013B	208	56	3	6 AWG	1	1.00 (25)	70	70
	230	54	3	6 AWG	1	1.00 (25)	60	70
	460	26	3	10 AWG	1	1.00 (25)	30	30
	575	22	3	10 AWG	1	1.00 (25)	25	25
016B	208	77	3	4 AWG	1	1.00 (25)	90	100
	230	77	3	4 AWG	1	1.00 (25)	90	100
	460	39	3	8 AWG	1	1.00 (25)	45	50
	575	30	3	10 AWG	1	1.00 (25)	35	40
020B	208	82	3	4 AWG	1	1.00 (25)	110	110
	230	80	3	4 AWG	1	1.00 (25)	90	100
	460	41	3	8 AWG	1	1.00 (25)	50	50
	575	33	3	10 AWG	1	1.00 (25)	40	40
025B	208	113	3	2 AWG	1	1.25 (32)	125	150
	230	113	3	2 AWG	1	1.25 (32)	125	150
	460	50	3	8 AWG	1	1.00 (25)	60	60
	575	42	3	8 AWG	1	1.00 (25)	50	50
028B	208	126	3	1 AWG	1	1.25 (32)	150	150
	230	126	3	1 AWG	1	1.25 (32)	150	150
	460	58	3	6 AWG	1	1.00 (25)	70	70
	575	50	3	8 AWG	1	1.00 (25)	60	60
033B	208	138	3	1/0 AWG	1	1.50 (38)	175	175
	230	138	3	1/0 AWG	1	1.50 (38)	175	175
	460	69	3	4 AWG	1	1.00 (25)	80	90
	575	57	3	6 AWG	1	1.00 (25)	70	70
039B	208	182	3	3/0 AWG	1	2.00 (51)	250	250
	230	182	3	3/0 AWG	1	2.00 (51)	250	250
	460	78	3	4 AWG	1	1.00 (25)	90	100
	575	63	3	6 AWG	1	1.00 (25)	70	80

NOTE: See page 28 for all Electrical Data notes.

Table 10, Compressor & Condenser Fan Motor Amp Draw, R-22

ACZ Unit Size	Volts	Rated Load Amps			Locked Rotor Amps			
		Compressors		Fan Motor (Each)	Fan Motor		Compressors	
							Across-The-Line	
		No. 1	No. 2		Qty	Amps (Each)	No. 1	No. 2
010B	208	14.8	14.8	5.8	2	21.4	91	91
	230	14.8	14.8	5.8	2	23.7	91	91
	460	7.1	7.1	2.8	2	10.7	50	50
	575	5.8	5.8	2.5	2	11.0	37	37
013B	208	19.4	19.4	5.8	2	21.4	156	156
	230	18.6	18.6	5.8	2	23.7	156	156
	460	9.0	9.0	2.8	2	10.7	75	75
	575	7.4	7.4	2.5	2	11.0	54	54
016B	208	28.8	28.8	5.8	2	21.4	195	195
	230	28.8	28.8	5.8	2	23.7	195	195
	460	14.7	14.7	2.8	2	10.7	95	95
	575	10.8	10.8	2.5	2	11.0	80	80
020B	208	31.2	31.2	5.8	2	21.4	225	225
	230	30.1	30.1	5.8	2	23.7	225	225
	460	15.5	15.5	2.8	2	10.7	114	114
	575	12.1	12.1	2.5	2	11.0	80	80
025B	208	42.3	42.3	5.8	3	21.4	245	245
	230	42.3	42.3	5.8	3	23.7	245	245
	460	18.2	18.2	2.8	3	10.7	125	125
	575	14.9	14.9	2.5	3	11.0	100	100
028B	208	48.1	48.1	5.8	3	21.4	300	300
	230	48.1	48.1	5.8	3	23.7	300	300
	460	21.8	21.8	2.8	3	10.7	150	150
	575	18.6	18.6	2.5	3	11.0	109	109
033B	208	53.2	53.2	5.8	3	21.4	340	340
	230	53.2	53.2	5.8	3	23.7	340	340
	460	26.5	26.5	2.8	3	10.7	173	173
	575	21.7	21.7	2.5	3	11.0	132	132
039B	208	73.1	73.1	5.8	3	21.4	505	505
	230	73.1	73.1	5.8	3	23.7	505	505
	460	30.5	30.5	2.8	3	10.7	225	225
	575	24.4	24.4	2.5	3	11.0	180	180

NOTE: See page 28 for all Electrical Data notes.

Table 11, Field Wiring Data, R-22

ACZ Unit Size	Volts	Wiring to Standard Power Block Terminal		Wiring to Optional Disconnect Switch		Wiring to High Interrupt or HSCCR Circuit Breaker	
		Maximum Terminal Amps	Connector Wire Range (Copper Wire Only)	Disc. Size	Connector Wire Range (Copper Wire Only)	Max. Amps	Connector Wire Range (Copper Wire Only)
010B	208	175	14 AWG – 2/0	60	14 AWG – 1 AWG	70	10 AWG - 1/0
	230	175	14 AWG – 2/0	60	14 AWG – 1 AWG	70	10 AWG - 1/0
	460	175	14 AWG – 2/0	60	14 AWG – 1 AWG	35	10 AWG - 1/0
	575	175	14 AWG – 2/0	60	14 AWG – 1 AWG	30	10 AWG - 1/0
013B	208	175	14 AWG – 2/0	60	14 AWG – 1 AWG	90	10 AWG - 1/0
	230	175	14 AWG – 2/0	60	14 AWG – 1 AWG	80	10 AWG - 1/0
	460	175	14 AWG – 2/0	60	14 AWG – 1 AWG	40	10 AWG - 1/0
	575	175	14 AWG – 2/0	60	14 AWG – 1 AWG	35	10 AWG - 1/0
016B	208	175	14 AWG – 2/0	100	8 AWG - 1/0	125	3 AWG - 3/0
	230	175	14 AWG – 2/0	100	8 AWG - 1/0	125	3 AWG - 3/0
	460	175	14 AWG – 2/0	60	14 AWG – 1 AWG	60	10 AWG - 1/0
	575	175	14 AWG – 2/0	60	14 AWG – 1 AWG	50	10 AWG - 1/0
020B	208	175	14 AWG – 2/0	100	8 AWG - 1/0	125	3 AWG - 3/0
	230	175	14 AWG – 2/0	100	8 AWG - 1/0	125	3 AWG - 3/0
	460	175	14 AWG – 2/0	60	14 AWG – 1 AWG	70	10 AWG - 1/0
	575	175	14 AWG – 2/0	60	14 AWG – 1 AWG	50	10 AWG - 1/0
025B	208	175	14 AWG – 2/0	125	3 AWG – 3/0	175	6 AWG - 350 kcmil
	230	175	14 AWG – 2/0	125	3 AWG - 3/0	175	6 AWG - 350 kcmil
	460	175	14 AWG – 2/0	60	14 AWG – 1 AWG	80	10 AWG - 1/0
	575	175	14 AWG – 2/0	60	14 AWG – 1 AWG	70	10 AWG - 1/0
028B	208	175	14 AWG – 2/0	225	2 AWG - 4/0	200	6 AWG - 350 kcmil
	230	175	14 AWG – 2/0	225	2 AWG - 4/0	200	6 AWG - 350 kcmil
	460	175	14 AWG – 2/0	100	8 AWG - 1/0	100	10 AWG - 1/0
	575	175	14 AWG – 2/0	60	14 AWG – 1 AWG	80	10 AWG - 1/0
033B	208	175	14 AWG – 2/0	225	2 AWG - 4/0	225	6 AWG - 350 kcmil
	230	175	14 AWG – 2/0	225	2 AWG - 4/0	225	6 AWG - 350 kcmil
	460	175	14 AWG – 2/0	100	8 AWG - 1/0	125	3 AWG - 3/0
	575	175	14 AWG – 2/0	100	8 AWG - 1/0	90	10 AWG - 1/0
039B	208	335	6 AWG – 400 kcmil	225	2 AWG - 4/0	N/A	Note 1
	230	335	6 AWG – 400 kcmil	225	2 AWG - 4/0	N/A	Note 1
	460	175	14 AWG – 2/0	100	8 AWG - 1/0	150	6 AWG - 350 kcmil
	575	175	14 AWG – 2/0	100	8 AWG - 1/0	125	3 AWG - 3/0

NOTES:
1. High Interruptor or HSCCR Circuit Breakers are not available in these sizes
2. "Size" is the maximum amperage rating for the terminals or the main electrical device.
3. "Size" is the disconnect part number and not the amperage rating for the terminals or the main electrical device.
4. "Connection" is the range of wire sizes that the terminals on the electrical device will accept.
5. See page 28 for all electrical notes

R-407C

Table 12, Electrical Data, R-407C

ACZ Unit Size	Volts	Minimum Circuit Ampacity (MCA)	Power Supply				Field Fuse Size or Breaker Size	
			Field Wire		Hub (Conduit Connection)			
			Quantity	Wire Gauge 75C	Quantity	Nominal Size In. (mm)	Recom-mended	Maximum
010B	208	45	3	8 AWG	1	1.00 (25)	50	50
	230	45	3	8 AWG	1	1.00 (25)	50	50
	460	22	3	10 AWG	1	1.00 (25)	25	25
	575	19	3	10 AWG	1	1.00 (25)	20	20
013B	208	58	3	6 AWG	1	1.00 (25)	70	70
	230	54	3	6 AWG	1	1.00 (25)	60	70
	460	27	3	10 AWG	1	1.00 (25)	30	35
	575	22	3	10 AWG	1	1.00 (25)	25	25
016B	208	77	3	4 AWG	1	1.00 (25)	90	100
	230	77	3	4 AWG	1	1.00 (25)	90	100
	460	39	3	8 AWG	1	1.00 (25)	45	50
	575	30	3	10 AWG	1	1.00 (25)	35	40
020B	208	82	3	4 AWG	1	1.00 (25)	110	110
	230	80	3	4 AWG	1	1.00 (25)	90	100
	460	41	3	8 AWG	1	1.00 (25)	50	50
	575	33	3	10 AWG	1	1.00 (25)	40	40
025B	208	113	3	2 AWG	1	1.25 (32)	125	150
	230	113	3	2 AWG	1	1.25 (32)	125	150
	460	51	3	6 AWG	1	1.00 (25)	60	60
	575	41	3	8 AWG	1	1.00 (25)	50	50
028B	208	129	3	1 AWG	1	1.25 (32)	150	175
	230	129	3	1 AWG	1	1.25 (32)	150	175
	460	61	3	6 AWG	1	1.00 (25)	70	80
	575	51	3	6 AWG	1	1.00 (25)	60	60
033B	208	148	3	1/0 AWG	1	1.50 (38)	175	200
	230	139	3	1/0 AWG	1	1.50 (38)	175	175
	460	72	3	4 AWG	1	1.00 (25)	80	100
	575	58	3	6 AWG	1	1.00 (25)	80	80
039B	208	187	3	3/0 AWG	1	2.00 (51)	250	250
	230	182	3	3/0 AWG	1	2.00 (51)	250	250
	460	85	3	4 AWG	1	1.00 (25)	100	110
	575	73	3	4 AWG	1	1.00 (25)	100	100

NOTE: See page 28 for all Electrical Data notes.

Table 13, Compressor & Condenser Fan Motor Amp Draw, R-407C

ACZ Unit Size	Volts	Rated Load Amps Compressors No. 1	Rated Load Amps Compressors No. 2	Rated Load Amps F.L. Amps Fan Motor (Each)	No. of Fan Mtrs	Locked Rotor Amps L.R.Amps Fan Motor (Each)	Locked Rotor Amps Compressors Across-The-Line No. 1	Locked Rotor Amps Compressors Across-The-Line No. 2
010B	208	14.8	14.8	5.8	2	21.4	91	91
	230	14.8	14.8	5.8	2	23.7	91	91
	460	7.1	7.1	2.8	2	10.7	50	50
	575	5.8	5.8	2.5	2	11.0	37	37
013B	208	20.3	20.3	5.8	2	21.4	156	156
	230	18.6	18.6	5.8	2	23.7	156	156
	460	9.2	9.2	2.8	2	10.7	75	75
	575	7.4	7.4	2.5	2	11.0	54	54
016B	208	28.8	28.8	5.8	2	21.4	195	195
	230	28.8	28.8	5.8	2	23.7	195	195
	460	14.7	14.7	2.8	2	10.7	95	95
	575	10.8	10.8	2.5	2	11.0	80	80
020B	208	31.2	31.2	5.8	2	21.4	225	225
	230	30.1	30.1	5.8	2	23.7	225	225
	460	15.5	15.5	2.8	2	10.7	114	114
	575	12.1	12.1	2.5	2	11.0	80	80
025B	208	42.3	42.3	5.8	3	21.4	245	245
	230	42.3	42.3	5.8	3	23.7	245	245
	460	18.6	18.6	2.8	3	10.7	125	125
	575	14.6	14.6	2.5	3	11.0	100	100
028B	208	49.4	49.4	5.8	3	21.4	300	300
	230	49.4	49.4	5.8	3	23.7	300	300
	460	23.1	23.1	2.8	3	10.7	150	150
	575	19.2	19.2	2.5	3	11.0	109	109
033B	208	57.9	57.9	5.8	3	21.4	340	340
	230	53.8	53.8	5.8	3	23.7	340	340
	460	28.2	28.2	2.8	3	10.7	173	173
	575	22.4	22.4	2.5	3	11.0	132	132
039B	208	75.0	75.0	5.8	3	21.4	505	505
	230	73.1	73.1	5.8	3	23.7	505	505
	460	34.0	34.0	2.8	3	10.7	225	225
	575	28.8	28.8	2.5	3	11.0	180	180

NOTE: See page 28 for all Electrical Data notes.

Table 14, Field Wiring Data, R-407C

ACZ Unit Size	Volts	Wiring to Standard Power Block Terminal		Wiring to Optional Disconnect Switch		Wiring to High Interrupt or HSCCR Circuit Breaker	
		Maximum Terminal Amps	Connector Wire Range (Copper Wire Only)	Disconnect Size	Connector Wire Range (Copper Wire Only)	Max. Amps	Connector Wire Range (Copper Wire Only)
010B	208	175	14 AWG – 2/0	60	14 AWG – 1 AWG	70	10 AWG - 1/0
	230	175	14 AWG – 2/0	60	14 AWG – 1 AWG	70	10 AWG - 1/0
	460	175	14 AWG – 2/0	60	14 AWG – 1 AWG	35	10 AWG - 1/0
	575	175	14 AWG – 2/0	60	14 AWG – 1 AWG	30	10 AWG - 1/0
013B	208	175	14 AWG – 2/0	60	14 AWG – 1 AWG	90	10 AWG - 1/0
	230	175	14 AWG – 2/0	60	14 AWG – 1 AWG	80	10 AWG - 1/0
	460	175	14 AWG – 2/0	60	14 AWG – 1 AWG	40	10 AWG - 1/0
	575	175	14 AWG – 2/0	60	14 AWG – 1 AWG	35	10 AWG - 1/0
016B	208	175	14 AWG – 2/0	100	8 AWG - 1/0	125	3 AWG - 3/0
	230	175	14 AWG – 2/0	100	8 AWG - 1/0	125	3 AWG - 3/0
	460	175	14 AWG – 2/0	60	14 AWG – 1 AWG	60	10 AWG - 1/0
	575	175	14 AWG – 2/0	60	14 AWG – 1 AWG	50	10 AWG - 1/0
020B	208	175	14 AWG – 2/0	100	8 AWG - 1/0	125	3 AWG - 3/0
	230	175	14 AWG – 2/0	100	8 AWG - 1/0	125	3 AWG - 3/0
	460	175	14 AWG – 2/0	60	14 AWG – 1 AWG	70	10 AWG - 1/0
	575	175	14 AWG – 2/0	60	14 AWG – 1 AWG	50	10 AWG - 1/0
025B	208	175	14 AWG – 2/0	125	3 AWG – 3/0	175	6 AWG - 350 kcmil
	230	175	14 AWG – 2/0	125	3 AWG - 3/0	175	6 AWG - 350 kcmil
	460	175	14 AWG – 2/0	60	14 AWG – 1 AWG	80	10 AWG - 1/0
	575	175	14 AWG – 2/0	60	14 AWG – 1 AWG	70	10 AWG - 1/0
028B	208	175	14 AWG – 2/0	225	2 AWG - 4/0	200	6 AWG - 350 kcmil
	230	175	14 AWG – 2/0	225	2 AWG - 4/0	200	6 AWG - 350 kcmil
	460	175	14 AWG – 2/0	100	8 AWG - 1/0	100	10 AWG - 1/0
	575	175	14 AWG – 2/0	60	14 AWG – 1 AWG	80	10 AWG - 1/0
033B	208	175	14 AWG – 2/0	225	2 AWG - 4/0	225	6 AWG - 350 kcmil
	230	175	14 AWG – 2/0	225	2 AWG - 4/0	225	6 AWG - 350 kcmil
	460	175	14 AWG – 2/0	100	8 AWG - 1/0	125	3 AWG - 3/0
	575	175	14 AWG – 2/0	100	8 AWG - 1/0	90	10 AWG - 1/0
039B	208	335	6 AWG – 400 kcmil	225	2 AWG - 4/0	N/A	Note 1
	230	335	6 AWG – 400 kcmil	225	2 AWG - 4/0	N/A	Note 1
	460	175	14 AWG – 2/0	100	8 AWG - 1/0	150	6 AWG - 350 kcmil
	575	175	14 AWG – 2/0	100	8 AWG - 1/0	125	3 AWG - 3/0

NOTES:
1. High Interruptor or HSCCR Circuit Breakers are not available in these sizes
2. "Size" is the maximum amperage rating for the terminals or the main electrical device.
3. "Size" is the disconnect part number and not the amperage rating for the terminals or the main electrical device.
4. "Connection" is the range of wire sizes that the terminals on the electrical device will accept.
5. See page 28 for all electrical notes

Notes for Electrical Data:

1. Unit wire size ampacity (MCA) is equal to 125% of the largest compressor-motor RLA plus 100% of RLA of all other loads in the circuit.
2. The control transformer is furnished and no separate 115V power supply 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 wire.
5. "Recommended Fuse Sizes" are selected at approximately 175% of the largest compressor RLA, plus 100% of the RLA of all other loads in the circuit.
6. "Maximum Fuse or 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.

Voltage Limitations:

Within ± 10 percent of nameplate rating

Important: Voltage unbalance not to exceed 2% with a resultant current unbalance of 6 to 10 times the voltage unbalance per NEMA MG-1, 1998 Standard. This is an important restriction that must be adhered to.

Notes for "Compressor and Condenser Fan Amp Draw":

1. Compressor RLA values are for wiring sizing purposes only but may not reflect normal operating current draw at rated capacity.
2. Fan motor FLA values are approximate fan motor amp values at rated voltage.

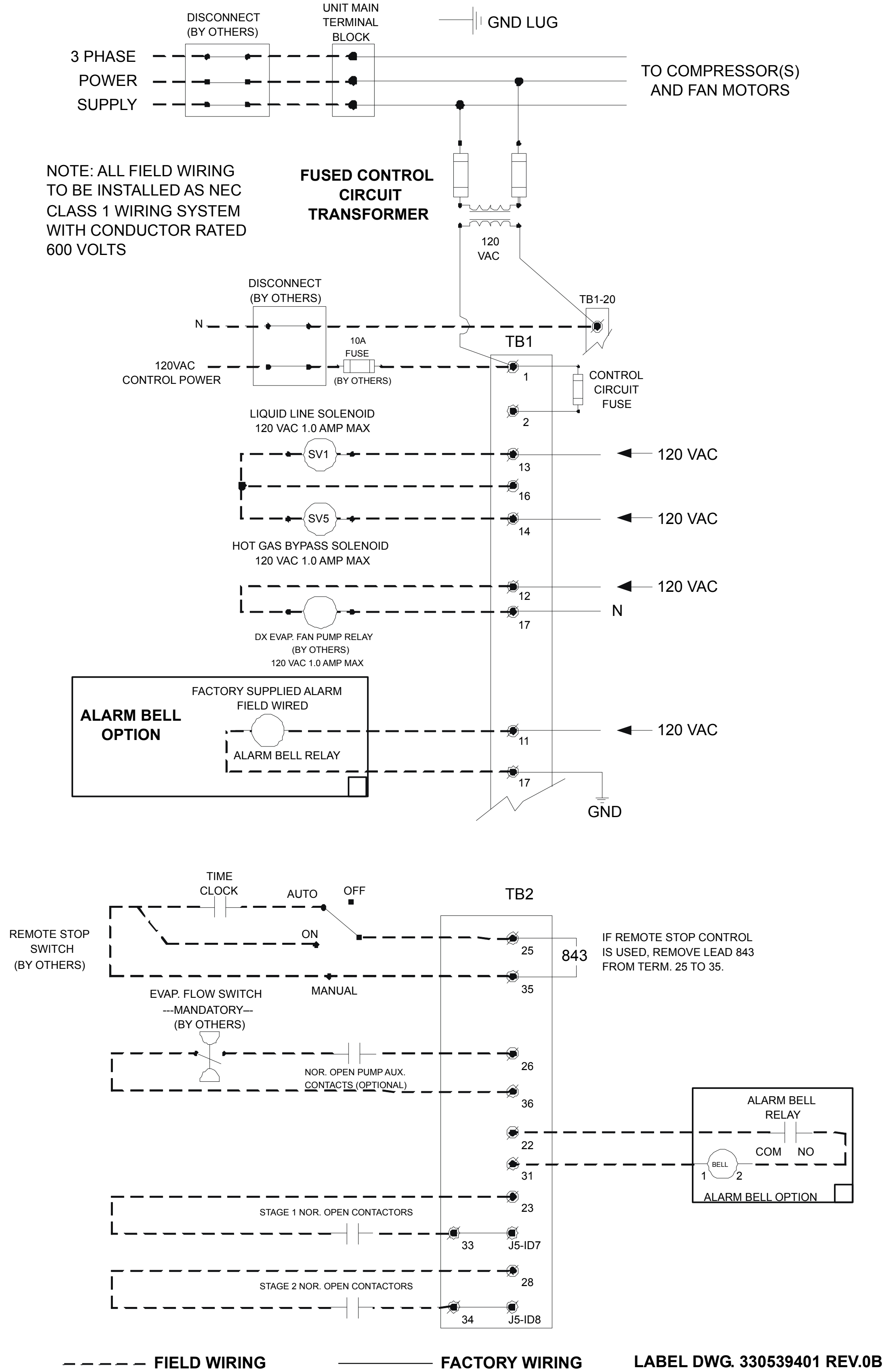
Notes for "Field Wiring Data"

1. Requires a single disconnect to supply electrical power to the unit. This power supply must either be fused or use a 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.

Standard Panel Ratings (kA)

Voltage	ACZ-B Model Size		
	ACZ 010-020	ACZ 025-033	ACZ 039
208-230	5	10	10
460	5	5	10
575	5	5	5

Figure 7, ACZ 010A through 039A, Typical Field Wiring Diagram



Dimensions & Weights

Figure 8, ACZ 010B through 020B, (See page 31 for additional dimensions and weights)

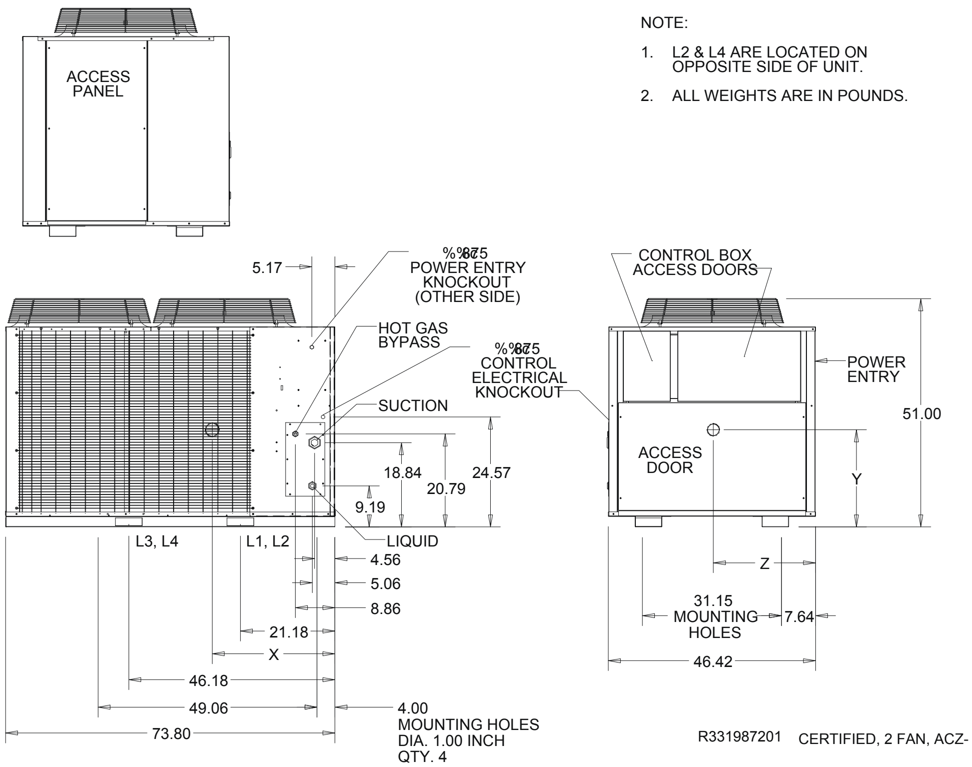


Figure 9, ACZ025BS - 039BS (See page 31 for additional dimensions and weights)

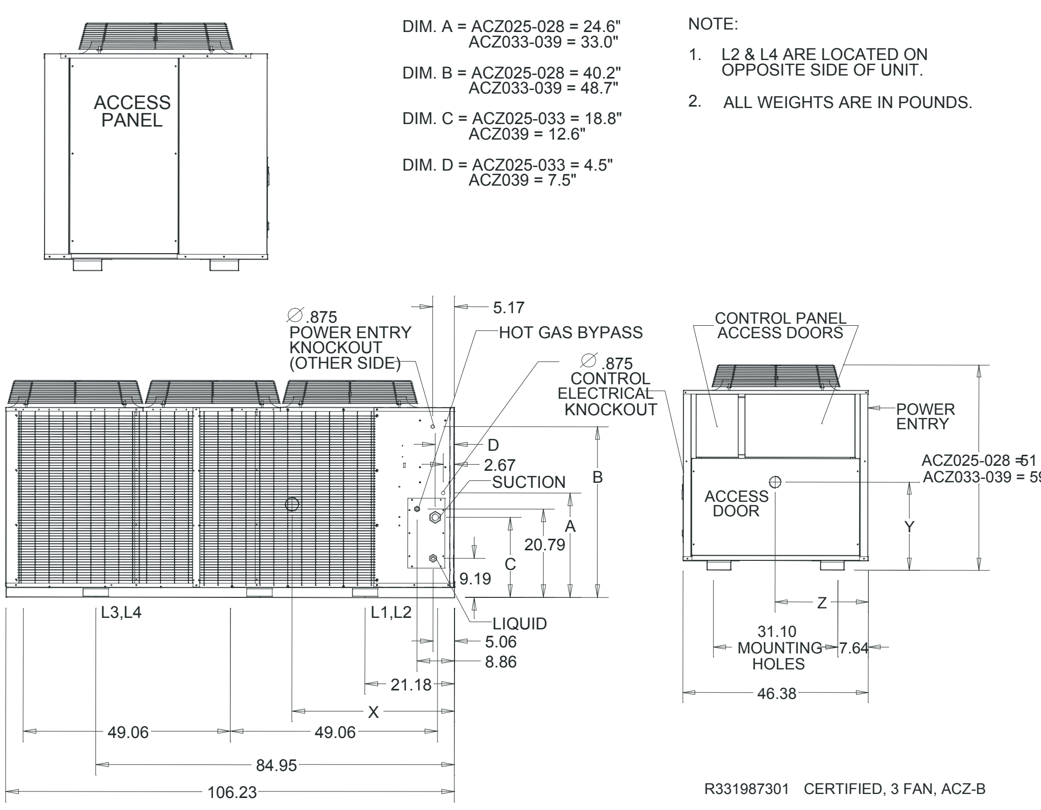


Table 15, ACZ-BS Dimensions and Weights

ACZ SIZE	CENTER OF GRAVITY			SHIP WT. (LBS)	OPN. WT. (LBS)	LIFTING WEIGHTS (LBS)				CONNECTION SIZES (IN. O.D.)		
	X	Y	Z			L1	L2	L3	L4	SUCTION	LIQUID	HOT GAS BYPASS
010-013B	27.50	21.70	22.90	1000	1015	369	379	124	128	1.125	0.875	0.625
016B	26.50	21.60	23.40	1065	1090	421	416	115	113	1.625	0.875	0.625
020B	26.60	21.80	23.30	1150	1190	454	449	124	123	1.625	0.875	0.625
025B	38.50	21.90	23.30	1370	1420	501	498	186	185	1.625	0.875	0.625
028B	38.50	19.10	23.30	1390	1445	508	505	189	188	1.625	0.875	0.625
033B	41.00	23.00	23.30	1565	1625	540	538	244	243	1.625	0.875	0.875
039B	34.60	24.00	22.40	1975	2050	753	807	201	215	2.125	0.875	0.875

Table 16, ACZ-BS Mounting Weights

ACZ SIZE	MOUNTING CORNER WEIGHTS (LBS.)			
	M1	M2	M3	M4
010-013B	257	264	236	243
016B	290	286	246	243
020B	312	309	266	263
025B	446	443	241	240
028B	453	449	245	243
033B	488	487	296	295
039B	656	703	297	318

System Maintenance

General

On initial start-up and periodically during operation, it will be necessary to perform certain routine service checks. Among these are taking electric leg readings. Some readings are readily available on the MicroTech II display.

Lubrication

No routine lubrication is required on the ACZ units. The fan motor bearings are of the permanently lubricated type and require no lubrication.

Electrical Terminals

⚠ WARNING
Electric shock hazard. Disconnect and tag-out all sources of power to the unit before continuing with following service to avoid risk of severe personal injury.

Normal heating and cooling of the wire will cause terminals to loosen. Retighten all power electrical terminals every six months.

Condensers

Condensers are air-cooled and constructed with 3/8" (9.5mm) O.D. internally finned copper tubes bonded in a staggered pattern into slit aluminum fins. No maintenance is ordinarily required except the occasional removal of dirt and debris from the outside surface of the fins. Use locally purchased foaming condenser coil cleaners for periodic cleaning of the coil. Condenser cleaners may contain harmful chemicals. Wear protective gear and read and follow manufacturer's safety instructions. Take care not to damage the fins during cleaning. All chemical cleaners should be thoroughly rinsed from the coils.

Refrigerant Sight glass

Observe the refrigerant sight glass monthly. A clear glass of liquid indicates adequate sub-cooled refrigerant charge in the system to provide proper feed through the expansion valve. Bubbling refrigerant in the sight glass indicates the system is short of refrigerant charge. Sub-cooling should be verified to prevent overcharging. Refrigerant gas flashing in the sight glass could also indicate an excessive pressure drop in the line, possibly due to a clogged filter-drier or a restriction elsewhere in the system. The sight glass indicates what moisture condition corresponds to a given element color. If the sight glass does not indicate a dry condition after about 12 hours of operation, the refrigerant and oil should be tested for moisture.

Table of Contents

Software Version: ACZSU0102B

BIOS Version: 3.56

BOOT File Version: 3.0

Overview

The MicroTech II controller's state-of-the-art design will not only permit the unit to run more efficiently but also simplifies troubleshooting if a system failure occurs. Every MicroTech II controller is programmed and tested prior to shipment to contribute to a trouble-free start-up.

Software Version

This manual is based on software version ACZSU0102B

Operator-friendly

The MicroTech II controller menu structure is separated into three distinct categories, which provide the operator or service technician with a full description of current unit status, control parameters, and alarms. Security protection deters unauthorized changing of the setpoints and control parameters.

MicroTech II control continuously performs self-diagnostic checks, monitoring system temperatures, pressures and protection devices, and will automatically shut down a compressor or the entire unit if a fault occurs. The cause of the shutdown will be retained in memory and can be easily displayed in plain English for operator review. The MicroTech II controller will also retain and display the time the fault occurred. In addition to displaying alarm diagnostics, the MicroTech II controller also provides the operator with a warning of limit (pre-alarm) conditions.

Staging

The two scroll compressors are staged on and off by contact closure of the field supplied remote two-stage staging thermostat. Lead/lag is automatic and switched every ten starts.

General Description

NOTE: When the following descriptions refer to "evaporator pressure", the pressure is actually the suction pressure within the condensing unit itself.

Compressor Motor Protection

ACZ 016 – 039: The solid-state compressor motor protector module incorporates a 30-minute (± 5 minutes) “time-off” relay utilizing the bleed-down capacitor principle. Any time the protection system opens or power to the module is interrupted, the 30-minute “time-off” delay is triggered and the module will not reset for 30 minutes. Once the 30-minute period has passed the motor protector contacts M1 and M2 reset, provided the protection system is satisfied and power is applied to the module.

Note: If the power circuit is broken once the 2-minute period is passed, the pilot circuit will reset without delay when power is reapplied.

ACZ 010 - 013: The model ACZ 010 and ACZ 013 compressors have internal line breakage with automatic reset.

FanTrol Head Pressure Control

FanTrol is the standard method of head pressure control that automatically cycles the condenser fan motors in response to condenser pressure. This function is controlled by the microprocessor, maintains head pressure and allows the unit to run at low ambient air temperatures down to 35°F (1.7°C). Fans are staged as follows:

Table 17, Fan Staging Pressures

Fan	Two-Fan Unit	Three-Fan Unit
Stage #1	On 150 psig, Off with unit	On 150 psig, Off with unit
Stage #2	On 290 psig, Off 170 psig	On 290 psig, Off 170 psig
Stage #3		On 310 psig, Off 180 psig

Note: Fan #1 is on with first compressor above 75°F (24°C).

Inputs/Outputs

Table 18, Inputs and Outputs

Analog Inputs

#	Description	Signal Source	Range
1	Open		
2	Evaporator Refrigerant Pressure	0.5 VDC to 4.5 VDC (NOTE 1)	0 to 132 psi
3	Condenser Refrigerant Pressure	0.5 VDC to 4.5 VDC (NOTE 1)	3.6to 410 psi
4	Open		
5	Outside Ambient Temperature	Thermister (10k at 77°F, 25°C)	-58 to 212°F

NOTE: Value at the converter board input. Value at the converter board output is 0.1 VDC – 0.9 VDC.

Analog Outputs

#	Description	Output Signal	Range
1-4	None		

Digital Inputs

#	Description	Signal	Signal
1	Unit OFF Switch	0 VAC (Stop)	24 VAC (Auto)
2	Remote Start/Stop	0 VAC (Stop)	24 VAC (Start)
3	Evaporator Water Flow/Air Flow Switch	0 VAC (No Flow)	24 VAC (Flow)
4	Motor Protection	0 VAC (Fault)	24 VAC (No Fault)
5	Open		
6	Phase Voltage Fault	0 VAC (Fault)	24 VAC (No Fault)
7	Stage 1 Request	0 VAC (Stop)	24 VAC (Start)
8	Stage 2 Request	0 VAC (Stop)	24 VAC (Start)

Digital Outputs

#	Description	Load	Output OFF	Output ON
1	Alarm	Alarm Indicator	Alarm OFF	Alarm ON
3	Liquid Line	Solenoid	Cooling OFF	Cooling ON
4	Motor Control Relay #1	Starter	Compressor OFF	Compressor ON
5	Motor Control Relay #2	Starter	Compressor OFF	Compressor ON
6	Condenser Fan #1	Fan Contactor	Fan OFF	Fan ON
7	Condenser Fan #2	Fan Contactor	Fan OFF	Fan ON
8	Condenser Fan #3	Fan Contactor	Fan OFF	Fan ON

Setpoints

The setpoints shown in Table 19 are held in a non-volatile memory and remembered during power off, are factory set to the Default value, and can be adjusted within the value shown in the Range column.

The PW (password) column indicates the password level that must be entered in order to change the setpoint. Passwords are as follows:

O = Operator [0100]

M = Manager, [2001}

Table 19, Setpoints

Description	Default	Range	PW
Unit			
Unit Enable	Off	Off, On	O
Available mode	Cool	Cool, Test	M
Control Source	Switches	Keypad, Network, Switches	O
Air Flow Timer	30	10 to 60 seconds	M
Low Ambient Lockout	35.0 °F	–2(35) to 70 °F	M
Refrigerant Type	None	R22, R407c	M
BAS Protocol	Modbus	BACnet, LonWorks, Modbus	M
Ident number	001	001-999	M
Baud rate	9600	1200,2400,4800,9600,19200	M
Evaporator Refrig Press Sensor Offset	0 psi	-20.0 to 20.0 psi	M
Condenser Refrig Press Sensor Offset	0 psi	-20.0 to 20.0 psi	M
Outside Ambient Temperature Sensor	0 °F	-5.0 to 5.0 °F	M
Password	0000	0000 to 9999	N/a
Compressor			
Clear Cycle Timers	No	No, Yes	M
Start-Start	15 min	10 to 60 min	M
Stop-Start	5 min	3 to 20 min	M
Stage Up Delay	240	20 to 480 sec	M
Stage Down Delay	30	10 to 60 sec	M
Comp 1 Enable	Enable	Enable, Disable	M
Comp 2 Enable	Enable	Enable, Disable	M
Alarms			
Low Evap Pressure-Hold	[59,60] psi	[20, 24] to 65 psi	M
Low Evap Pressure-Unload	[58,59] psi	[20, 24] to 65 psi	M
Evap Flow Proof	5 sec	3 to 120 sec	M
High Condenser Pressure	380 psi	380 to 390 psi	M
High Condenser Stage Down	370 psi	365 to 375 psi	M
Phase Voltage Protection	N	N,Y	M
Low OAT Start Timer	165 sec	150 to 240 sec	M
Condenser Fans			
Fan Stages	2	2,3	M
Speedtrol Option	N	N,Y	M
Stage #1 On (OAT < 75°F)	200 psi	140 to 200 psi	M
Stage #2 On	290 psi	230 to 330 psi	M
Stage #3 On	300 psi	230 to 330 psi	M
Stage #1 Off	140 psi	130 to 170 psi	M
Stage #2 Off	180 psi	150 to 200 psi	M
Stage #3 Off	190 psi	150 to 200 psi	M

Automatic Adjusted Limits

The following are setpoints that will be limited based on the option selected.

Low Ambient Lockout Temperature

Speedtrol	Range
Speedtrol = N	35 – 60°F
Speedtrol = Y	-2 – 60°F

Low Evaporator Pressure Hold and Unload

Refrigerant	Range
R22	24 to 65 Psig
R407C	20 to 65 Psig

Dynamic Default Values

Some setpoints will have different default values loaded depending on the value of other setpoints.

Low Evaporator Pressure Inhibit

Refrigerant	Default Value
R22	59 psi
R407C	60 psi

Low Evaporator Pressure Unload

Refrigerant	Default Value
R22	58 psi
R407C	59 psi

Equipment Protection (Stop) Alarms

Equipment protection (stop) alarms execute rapid compressor shutdown without going through the normal shutdown cycle.

The following table identifies each of these alarms, gives the condition that causes the alarm to occur, and states the action taken because of the alarm. If the alarm is auto-clearing, the reset condition is shown below. Otherwise, the alarm is manually reset, requiring the operator to clear the alarm.

Table 20, Stop Alarms

Description	Occurs When:	Action Taken	Reset
No Evaporator (Water/Air) Flow	Any compressor is running AND Evap Flow Digital Input = No Flow for time > Evap Flow Proof SP	Rapid Stop	Evap flow switch closes OR Unit State=Off
Low Evaporator Pressure	Evaporator Press < Low Evap Pressure SP for time> Low Evap Pressure Time Delay	Rapid Stop	Manual
High Condenser Pressure	Condenser Press > High Condenser Pressure SP	Rapid Stop	Manual
Motor Protection	Digital Input = High Motor Temperature AND Delay 150 Sec. after power up has passed	Rapid Stop	Manual
Phase Voltage Protection (opt)	If Phase Voltage Protection = Y, Then Digital Input = Phase/Voltage Problem	Rapid Stop	Phase/Voltage input returns to normal
Low Ambient Restart Fault	Failed three consecutive low ambient start attempts	Rapid Stop	Manual
Evaporator Pressure Sensor Fault	Sensor shorted or open	Rapid Stop	Manual
Condenser Pressure Sensor Fault	Sensor shorted or open	Rapid Stop	Manual
Outside Ambient Temperature Sensor Fault	Sensor open or shorted	Normal Stop	Manual

Evaporator Freezestat

Freezestat logic allows the circuit to run for varying times at low pressures. The lower the pressure, the shorter the time the compressor can run. This time is calculated as follows:

Freeze error = Low Evaporator Pressure Unload – Evaporator Pressure

Freeze time = 60 – 1.6 x freeze error, limited to a range of 20-70 seconds

When the evaporator pressure goes below the Low Evaporator Pressure Unload setpoint, a timer starts. If this timer exceeds the freeze time, then a freezestat trip occurs. If the evaporator pressure rises to the unload setpoint or higher, and the freeze time has not been exceeded, the timer will reset.

Events (Limit Alarms)

The following events limit the operation of the unit in some way as described in the Action Taken column. These alarms are auto-clearing based on reaching the conditions in the reset column.

Table 21, Event (Limit) Alarms

Description	Occurs When:	Action Taken	Reset
Condenser Pressure High Unload	Pressure > High Condenser Stage Down setpoint	Shutoff Stage #2	Condenser Press drops below (SP – 100psi)
Evaporator Pressure Low – Hold	Pressure < Low Evap Pressure–Hold setpoint AND one compessor is running	Hold @ Stage 1	Evap Press rises above (SP + 8psi)
Evaporator Pressure Low – Unload	Pressure < Low Evap Pressure–Unload setpoint	Shutoff Stage 2	Evap Press rises above (SP + 10 psi)
Failed Pumpdown	Unit is pumping down for 60 seconds	Shutoff Compressors	N/A

Active Alarm List

When an alarm occurs, it appears in the active alarm list. The active alarm list holds a record of all active alarms, which includes the date and time each occurred. The active alarms can be cleared by pressing the Edit key when the end of the list has been reached by scrolling.

Active alarms may be cleared without a password being active. The condition that caused the alarm must be corrected prior to clearing the alarm to avoid filling the buffer with duplicate entries and also to avoid repeated trips from the same cause.

Alarm Logging

A separate alarm log stores the last 25 alarms to occur. When an alarm occurs, it is put into the first slot in the alarm log and all others are moved down one, dropping the last alarm. In the alarm log, the date and time the alarm occurred are stored, as well as a list of other parameters. These parameters include compressor states, evaporator pressure, condenser pressure, number of fans on, and OAT.

Event Logging

An event log similar to the alarm log holds the last 25 events to occur. When an event occurs, it is put into the first slot in the event log and all other entries are moved down one, dropping the last event. Each entry in the event log includes an event description as well as the time and date of the occurrence. No additional parameters are logged for events. A password must be active to view the event log.

Control Functions and Definitions

Refrigerant Saturated Temperature

Methods for calculating saturated refrigerant temperature differ with each refrigerant as explained below.

R22 Saturated Temperature

Evaporator saturated temperature and condenser saturated temperature are calculated from the pressures for each circuit. The pressure is fit to a curve made up of 13 straight line segments. The points used to define these segments are as follows:

Table 22, R-22 Saturated Temperatures

Pressure (psi)	Temperature (^oF)
24.0	0
34.7	12.0
47.6	24.0
62.8	36.0
80.8	48.0
101.6	60.0
126.2	72.0
153.8	84.0
185.2	96.0
220.6	108.0
260.5	120.0
305.2	132.0
355.1	144.0
430.4	160.0

R407C Saturated Temperature

Evaporator dew point and condenser mid point are calculated using 32 bit math. The equation is as follows:

If Pressure < 120 psi Then
  Saturation = [Pressure x 145/105] – [(Pressure^2)/2000] – 250

If Pressure >= 120 psi Then
  Saturation = [Pressure x 46/94] – [Pressure^2/25000] + 145

Pumpdown Pressure

The pressure to which a circuit will pumpdown is based on the Low Evaporator Pressure Unload setpoint. The equation is as follows:

Pumpdown pressure = Low Evaporator Pressure Unload Setpoint – 15 psi (with the calculated value limited to a minimum of 10 psi).

Unit Enable

The Unit Enable status determines whether the unit is enabled to run or not. This can be altered by the Unit Switch input, Remote input, Keypad entry, and BAS request. The Control Source Setpoint determines which sources can change the Unit Enable status with options of SWITCHES, KEYPAD or NETWORK.

Changing the Unit Enable status can be accomplished according to the following table. NOTE: An “x” indicates that the value is ignored.

Unit Switch	Control Source Setpoint	Remote Input	Keypad Entry	BAS Request	Unit Enable
OFF	x	x	x	x	OFF
x	SWITCHES	OFF	x	x	OFF
ON	SWITCHES	ON	x	x	ON
ON	KEYPAD	x	OFF	x	OFF
ON	KEYPAD	x	ON	x	ON
ON	NETWORK	x	x	OFF	OFF
ON	NETWORK	OFF	x	x	OFF
ON	NETWORK	ON	x	ON	ON

Unit Mode

The overall operating mode of the chiller is set by the Available Mode Setpoint with options of COOL and TEST.

Unit Test Mode

The unit test mode allows manual testing of controller outputs. Entering this mode requires the following conditions.

- Unit Switch = OFF
- Manager password active.
- Available Unit Mode setpoint = TEST

A test menu can then be selected to allow activation of the outputs. It is possible to switch each digital output ON or OFF and set the analog outputs to any value. In test mode, the compressors can be started, but will automatically turn off after 10 seconds. Also, if any outputs are left on in test mode, they will be automatically turned off and/or normal control logic resumed when the unit is taken out of test mode.

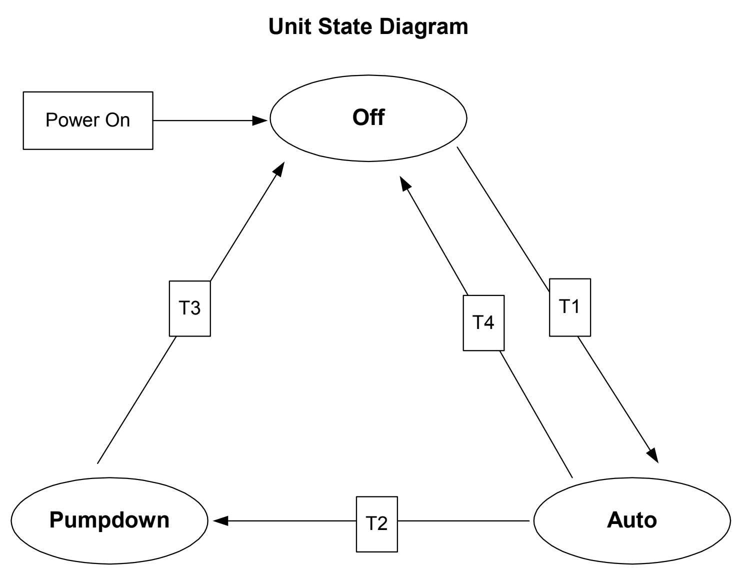
Power Up Start Delay

After powering up the unit, the motor protectors may not seem to work properly for up to 150 seconds. After the control is powered up, no compressor can start for 150 seconds. In addition, the motor protect inputs are ignored during this time so as to avoid tripping a false alarm.

Unit State

The Unit is always in one of three states. These states are Off, Auto, and Pumpdown. Transitions between these states are shown in the following diagram.

Figure 10, Unit State Diagram



T1: Transition from Off to Auto
Requires *all* of the following:

- Unit Enable = True
- No Alarm
- At least one compressor enabled via manual setpoint

T2: Transition from Auto to Pumpdown
Requires *any* of the following:

- Keypad Enable = Off OR
- BAS Enable = Off OR
- Remote Switch = Off OR
- Pumpdown Alarm Active

T3: Transition from Pumpdown to Off
Requires *any* of the following:

- Unit Alarm OR
- Unit Switch Off OR
- All compressors off

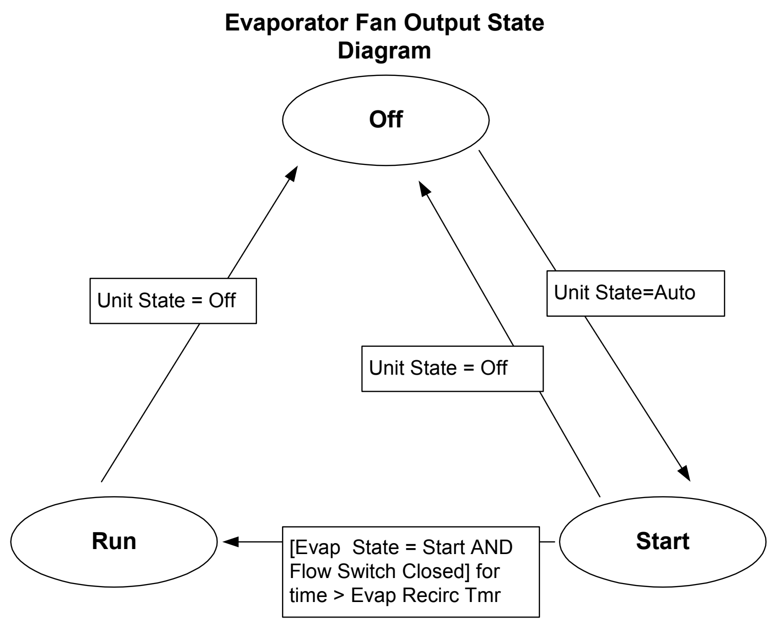
T4: Transition from Auto to Off
Requires *any* of the following:

- Unit Alarm OR
- Unit Switch Off
- Both compressors disabled via manual setpoint

Evaporator Fan State Control

Operation of the evaporator fan output is controlled by the state-transition diagram shown below.

Figure 11, Fan Output State



Condenser Fans

Condenser fans are staged up and down based on the fan stage setpoint. These setpoints define pressures at which fans should start or stop. Comments for “fan 3” apply to 3-fan units only.

fan 1 will start with the first compressor when the ambient temperature is greater than 75°F. Below 75°F, this fan starts when the condenser pressure gets up to the Stage #1 On setpoint. fan 2 will start when the condenser pressure gets up to the Stage #2 On setpoint, and fan 3 will start when the condenser pressure gets up to the Stage #3 On setpoint.

Fan 3 will stop when the condenser pressure drops to the Stage #3 Off setpoint, and fan 2 will stop when the condenser pressure drops to the Stage #2 Off setpoint. Fan 1 will stop when the pressure drops down to the Stage #1 Off setpoint.

Low OAT Start

In order to avoid low-pressure alarms at startup, low OAT start logic allows for running at low pressures for a longer time than normal as well as multiple start attempts.

A low OAT start is initiated if the condenser saturated temperature is less than 85°F when the compressor starts. Once this happens, the circuit is in this low OAT start state for a time equal to the low OAT start timer setpoint. During this time, the freezestat logic and the low pressure events are disabled. The absolute limit of 5 psi is still enforced.

At the end of the low OAT start, the evaporator pressure is checked. If the pressure is greater than or equal to the low evaporator pressure unload setpoint, the start is considered successful. If the pressure is less than the unload setpoint, the start is not successful and the compressor will stop. Three start attempts are allowed before tripping on the restart alarm; so if on the third attempt the start is not successful the restart alarm is triggered.

The restart counter will be reset when either a start is successful or the circuit is off on an alarm.

Capacity Overrides

The following conditions override the automatic capacity control when the chiller is in Cool mode only. These overrides keep the unit from entering a condition in which it is not designed to run.

Low Evaporator Pressure

If the evaporator pressure drops below the Low Evaporator Pressure Hold setpoint, the Low Evaporator Pressure Inhibit event is triggered. This can occur with either one or two compressors running. When triggered, the second compressor will not be allowed to start if only one is currently running. If both compressors are already running, no action is taken.

If the evaporator pressure drops below the Low Evaporator Pressure Unload setpoint, the Low Evaporator Pressure Unload event is triggered. This can only occur when both compressors are running. When triggered, one compressor is shut off.

These events are logged to an event log when they occur. Both remain active until the evaporator pressure rises 5 psi above the hold setpoint or both compressors are off.

High Condenser Pressure

If the discharge pressure rises above the High Condenser Pressure Unload setpoint and both compressors are running, the High Condenser Pressure Unload event is triggered. One compressor will be shut off when this occurs.

This event will also be logged to an event log when it occurs. It will remain active until the condenser pressure drops 100 psi below the unload setpoint. While active, the second compressor cannot turn back on.

Low Ambient Lockout

If the OAT drops below the low ambient lockout setpoint, the unit will do a normal stop. Once the lockout has been triggered, no compressors will start until the OAT rises to the lockout setpoint plus 5°F.

Compressor Control

Compressor Available

A compressor is available to start when the following are true:

- Unit state = auto
- Evap state = run
- Low OAT lockout is not active
- Power start delay is expired
- No limit events active
- No cycle timers active for the compressor
- Compressor enable setpoint = On

Compressor Start/Stop Timing

This section determines when to start or stop a compressor. There are two separate functions used, one for staging up and one for staging down.

Stage Up Now

The **Stage Up Now** flag is set based on the following tests:

IF Stage Request > Stages On *AND*
Stage up timer expired *THEN*
Stage Up Now = True

Stage Down Now

The **Stage Down Now** flag is set based on the following tests:

IF Stage Request < Stages On *AND*
Stage down timer expired *THEN*
Stage Down Now = True

Compressor Sequencing

Compressor staging is primarily based on compressor run-hours and starts. Compressors that have fewer starts will normally start before those with more starts. Compressors that have more run hours will normally shut off before those with fewer run hours. In the event of a tie on number of starts, the lower numbered compressor will start first. In the event of a tie on run-hours, the lower numbered compressor will shut off first. Run-hours will be compared in terms of tens of hours.

Next On = 1 if compressor 1 starts <= compressor 2 starts, or compressor 2 not available
Next On = 2 if compressor 1 starts > compressor 2 starts, or compressor 1 not available

Next Off = 1 if compressor 1 run-hours > compressor 2 run-hours
Next Off = 2 if compressor 1 run-hours <= compressor 2 run-hours

Compressor State

A compressor will start when *all* of the following are true:

- The compressor is “next on”
- Stage Up Now is set
- The compressor is available to start

A compressor will stop when *any* of the following conditions are true:

- Unit state = Off
- Evap flow alarm active
- Low Ambient start attempt failed
- Stage Down Now is set, both compressors are running, and the compressor is “next off”
- Pumpdown is complete

Normal Shutdown

If a condition arises that requires the unit to shut down, a pumpdown will be performed if it is not an emergency situation. A normal shutdown will be initiated when any of the following occur:

- Unit State = Pumpdown
- Low Ambient Lockout
- A normal stagedown occurs, and only one compressor is running

Pumpdown Procedure

- If both compressors are running, shut off the appropriate compressor based on sequencing logic
- With one compressor left running, turn off hot gas output and liquid line output
- Keep running until evaporator pressure reaches the pumpdown pressure, then stop compressor
- If evaporator pressure does not reach pumpdown pressure within two minutes, stop compressor and log pumpdown failure alarm

Rapid Shutdown

A situation may arise that requires the unit to shut down immediately, without doing a pumpdown. This rapid shutdown will be triggered by any of the following:

- Unit State = Off
- Stop Alarm
- Low ambient start attempt failed

All compressor and liquid line outputs will be turned off immediately for a rapid shutdown.

Liquid Line Solenoid

The liquid line output will be on any time a compressor is running and the unit is not performing a pumpdown. This output will be off at all other times.

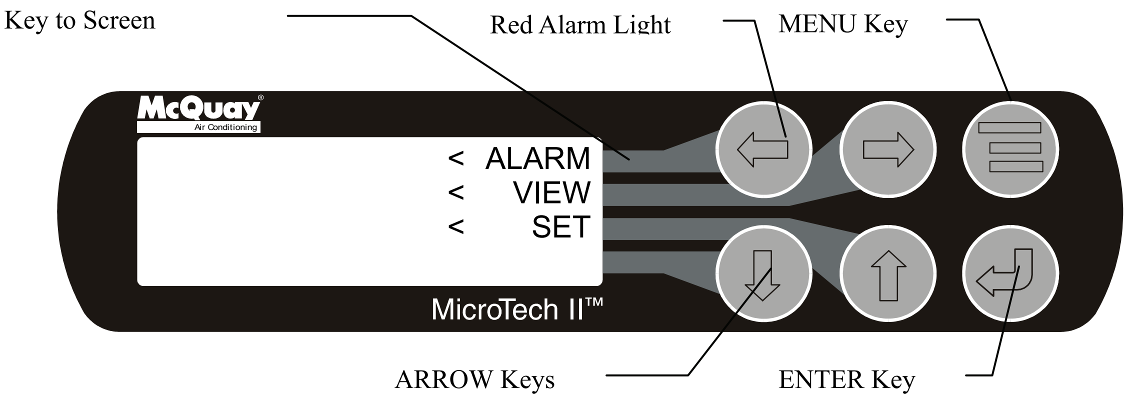
Using the Controller

4x20 Display & Keypad

Layout

The 4-line by 20-character/line liquid crystal display and 6-key keypad are shown below.

Figure 12, Display (in MENU mode) and Keypad Layout



Note that each ARROW key has a pathway to a line in the display. Pressing an ARROW key will activate the associated line when in the MENU mode.

Getting Started

There are two basic procedures to learn in order to utilize the MicroTech II controller:

1. Navigating through the menu matrix to reach a desired menu screen and knowing where a particular screen is located.
2. Knowing what is contained in a menu screen and how to read that information or how to change a setpoint contained in the menu screen.

Navigating Through the Menus

The menus are arranged in a matrix of screens across a top horizontal row. Some of these top-level screens have sub-screens located under them. The general content of each screen and its location in the matrix are shown in Figure 14. A detailed description of each menu begins on page 48.

There are two ways to navigate through the menu matrix to reach a desired menu screen.

One is to scroll through the matrix from one screen to another using the four ARROW keys.

The other way is to use shortcuts to work through the matrix hierarchy. From any menu screen, pressing the MENU key will take you to the top level of the hierarchy. The display will show ALARM, VIEW, and SET as shown in Figure 12. This corresponds to the second row of screens on Figure 14. One of these groups of screens can then be selected by pressing the key connected to it via the pathway shown in Figure 12.

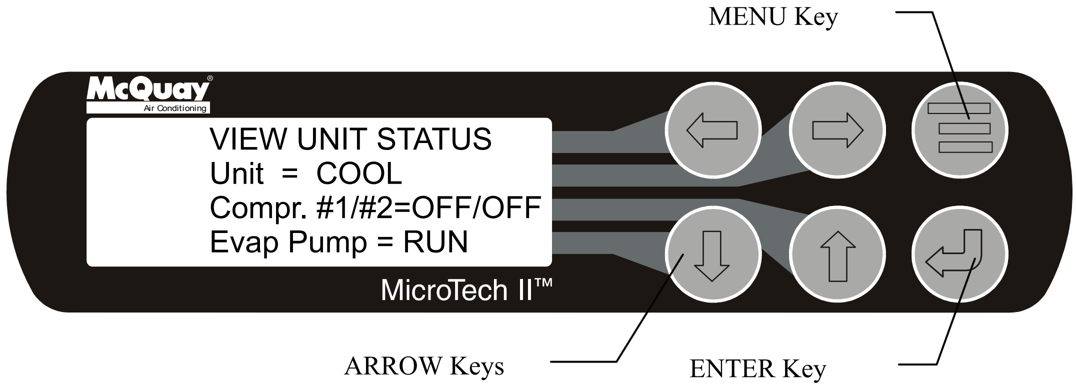
For example, selecting ALARM will go the next row of menus under ALARM (ALARM LOG or ACTIVE ALARM). Selecting VIEW will go the next level of screens under VIEW (VIEW UNIT STATUS or VIEW UNIT TEMP). Selecting SET will go to a series of screens for looking at and changing setpoints.

MENU Key

The MENU key is used to switch between the shortcut method (known as the MENU mode and as shown in Figure 12) and scrolling method (known as the SCROLL mode). The MENU mode is the shortcut to specific groups of menus used for checking ALARMS, for VIEWING information, or to SET setpoint values. The SCROLL mode allows the user to move about the matrix (from one menu to another, one at a time) by using the four ARROW keys. A typical menu screen is shown in Figure 13.

Pressing the MENU key from any menu screen will automatically return you to the MENU mode as shown in Figure 12.

Figure 13, Display in the Shortcut (SCROLL) Mode and Keypad Layout



Menu Screens

Various menus are shown in the controller display. Each menu screen shows specific information; in some cases menus are used only to *view* the status of the unit, in some cases they are used for checking and clearing *alarms*, and in some case they are used to *set* setpoint values.

The menus are arranged in a matrix of screens across a top horizontal row. Some of these top-level screens have sub-screens located under them. The general content of each screen and its location in the matrix are shown in Figure 14. A detailed description of each menu begins on page 48.

The ARROW keys on the controller are used to navigate through the menus. The keys are also used to change numerical setpoint values contained in certain menus.

Changing Setpoints

Pressing the ENTER key changes the function of the ARROW keys to the editing function as shown below:

LEFT key Default, changes a value to the factory-set default value.
RIGHT key Cancel, cancels any change made to a value and returns to the original setting.
UP key Increment, increases the value of the setting.
DOWN key Decrement decreases the value of a setting.

These four edit functions are indicated by one-character abbreviation on the right side of the display (this mode is entered by pressing the ENTER key).

Most menus containing setpoint values have several different setpoints shown on one menu. When in a setpoint menu, the ENTER key is used to proceed from the top line to the second line and on downward. The cursor will blink at the entry point for making a change. The ARROW keys (now in the edit mode) are used to change the setpoint as described above. When the change has been made, press the ENTER key to enter it. No setting is changed until the ENTER key is pressed.

For example, to change the number of unit fans setpoint:

1. Press MENU key to go to the MENU mode (see Figure 12).
2. Press SET (the UP Key) to go to the setpoint menus.
3. Press SET FAN SP (the Right key) to go to setpoints associated with unit operation.
4. Since the first (or top) menu will be used, there is no need to press the DOWN key to scroll down through other setpoint menus.
5. Press the ENTER key to move the cursor down from the top line to the second line in order to make the change.
6. Use the ARROW keys (now in the edit mode as shown above) to change the setting.
7. When the desired value is achieved, press ENTER to enter it. The cursor will automatically move down.

At this point, the following actions can be taken:

1. Change another setpoint in this menu by scrolling to it with the ENTER key.
2. Using the ENTER key, scroll to the first line in the menu. From there the ARROW keys can be used to scroll to different menus.

Figure 14, Menu Matrix

"MENU"						
"VIEW" MENUS						
UNIT		COMP		REFRIGERANT	FANS
VIEW UNIT STATUS 1-3	VIEW UNIT TEMP	VIEW COMP #1 STATUS 1-2	VIEW COMP #2 STATUS 1-2	VIEW EVAP/COND PRESS 1-2	VIEW FANS

⇐ Continued ⇐

(Right side of matrix continued from above)

"ALARM" MENUS			**"SET"** MENUS			
ALARM LOG (LAST) TYPE, TIME	EVENT LOG (LAST) TYPE, TIME	ACTIVE ALARM (1) TYPE, TIME	SET UNIT SPs, (1) MODE	SET COMP SPs (1) STOP/START	SET LIMIT ALARMS (1) EVAP PRESS	SET FANS (1) STAGES FANTROL
ALARM LOG (NEXT TO LAST)	EVENT LOG (NEXT TO LAST)	ACTIVE ALARM (n) TYPE, TIME ADDITIONAL	SET UNIT SPs, (2) MODE = COOL	SET COMP SPs (2) INTER-STAGE	SET LIMIT ALARMS (2) FREEZE/ FLOW	SET FANS (2) STAGE ON
ALARM LOG (SECOND TO LAST)	EVENT LOG (SECOND TO LAST)	ACTIVE ALARM (3) CLEAR/VIEW	SET UNIT SPs, (3) CLOCK		SET LIMIT ALARMS (3) COND PRESS	SET FANS (3) STAGE OFF
ALARM LOG LAST 25 SHOWN ⇓	EVENT LOG LAST 25 SHOWN ⇓		SET UNIT SPs, (4) ENGLISH		SET LIMIT ALARMS (4) PHASE/VOLT LOW AMB LOCKOUT	
			SET UNIT SPs, (5) PROTOCOL		SET LIMIT ALARMS (5) LOW EVAP PR	
			SET UNIT SPs, (6) EVAP OFFSET			
			SET UNIT SPs, (7) COND OFFSET			
			SET UNIT SPs, (8) AMBIENT OFFSET			
			SET UNIT SPs, (9) ENTER PASSWORD			

Menu Structure (Hierarchical)

As discussed previously, a hierarchical menu structure can be used to access the various screens. One to twelve levels are used with two or three being typical. Optionally, the last menu selection can access one of a set of screens that can be navigated with the UP/DOWN ARROW keys (see the scrolled menu structure below).

Menu selection is initiated by pressing the MENU key that changes the display from a regular data screen to a menu screen. Menu selections are then made using the arrow keys according to labels on the right side of the display (the arrows are ignored). When the last menu item is selected, the display changes to the selected data screen. An example follows showing the selection of the "VIEW REFRIGERANT" screen.

Suppose the initial screen is as below or any other menu screen:

```
ALARM LOG
      (data)
      (data)
      (data)
```

After pressing the **MENU** key, the top level menu screen will show:

```
             < ALARM
             <  VIEW
             <   SET

```

After pressing the "**VIEW**" menu key, a menu screen will show:

```
VIEW    <       UNIT
        < COMPRESSOR
        < REFRIGRANT
        <       FANS
```

Selection of any of these will advance to the appropriate data menu. For example, after pressing the "**REFRIGERANT**" menu button, the selected data screen will show:

```
VIEW REFRIG
          PSI    °F
SAT EVAP XXX.X  XX.X
SAT COND XXX.X  XX.X
```

The ARROW keys will automatically return to the "scroll" mode at this time.

Screen Definitions VIEW

This section contains information on each screen. The menu screens are in order of the matrix in Figure 14, going from left to right and then down when there are sub-menus. Many menus are self-explanatory.

VIEW UNIT

```
VIEW UNIT STATUS (1)
Unit = AUTO
Stage=X   Request=X

```

Unit status can be OFF, AUTO, and ALARM as determined from the Unit State variable, the Unit Mode setpoint, the Unit Enable and the presence of an alarm.

```
VIEW UNIT STATUS (2)
Stg Up Delay=XXXsec
Stg Dn Delay=XXXsec

```

```
VIEW UNIT STATUS (3)
D.O        D.I.
12345678  12345678
00000000  00000000
```

View Unit Temperatures

```
VIEW UNIT TEMP °F
Outside Amb = XX.X°F
```

VIEW COMPRESSORS

```
VIEW COMP#1    (1)
State   = OFF  LEAD
Cycle Timer:  XXmin
Manual Disable
```

Cycle timer only visible when active. Manual Disable visible only when compressor is disabled via manual enable setpoint.

```
VIEW COMP#1     (2)
Hours  = XXXXX
Starts = XXXXX
```

Above two screens duplicated for Compressor #2.

VIEW REFRIGERANT

```
VIEW REFRIG      (1)
EVAP Press = XX.Xpsi
COND Press - XX.Xpsi
```

With R22 Refrigerant	With R407C Refrigerant
VIEW REFRIG (2)	VIEW REFRIG (2)
SAT EVAP = XXX.X°F	Evap Dew = XXX.X°F
SAT COND = XXX.X°F	Cond Mid = XXX.X°F
EvapApproach = XX.X°F	EvapApproach = XX.X°F

See page 38 for an explanation of saturated temperatures for R22 and R407C.

Approach is the difference between the leaving fluid temperature and the saturated evaporator temperature. It is an indication of the evaporator efficiency; an increasing approach temperature indicates decreasing heat transfer efficiency.

VIEW FANS

```
VIEW FANS
Stages ON = 2 of 3
```

Screen Definitions – ALARM

ALARM ACTIVE (X) Alarm Description hh:mm:ss dd/mmm/yyyy	ALARM ACTIVE (X) No more alarms Press ENTER to clear all active alarms

If the unit is off on a shutdown alarm or running but in a limit alarm condition, the cause and date will appear in the upper screen. If there is a simultaneous occurrence of more than one alarm, the others will appear in additional screens below this one, accessed by the DOWN ARROW. Either type alarm will light a red light in back of the LEFT-KEY. The light will go out when the fault is cleared.

To clear the fault, scroll down to the last screen and press ENTER. If other faults have appeared, they will all be cleared at the same time.

```
ALARM LOG (1)
High Condenser Press
 hh:mm:ss d/mmm/yyyy
```

The last 25 alarms, either shutdown or limit, are shown in this menu with subsequent menus stored under it. ARROW DOWN from this menu will go to the next-to-last alarm, ARROW DOWN again will go to the second from last, and so on through the last 25 occurrences. The screens are numbered (1), (2),, etc.

Screen Definitions – SET

Changing setpoints; in general, setpoints are changed as follows:

1. Select the desired menu by scrolling through SET menus with the UP and DOWN ARROWS.
2. When the desired menu is selected, select the desired entry by moving between lines using the ENTER key.
3. If a numerical value is being changed, use the INCREMENT key (UP ARROW) to increase or the DECREMENT key (DOWN ARROW) to decrease the value of the setpoint.

   If a word type setpoint (for example, YES or NO) is to be selected, the choices are loaded into the menu and selected by scrolling through the available setpoint options using the UP ARROW key.
4. Enter the desired value or word into the controller by pressing the SET key.

SET UNIT SPs

```
SET UNIT SPs (1)
Unit Enable=OFF
Source=KEYPAD
```

Unit Enable is an external signal or a keypad setting that keeps the unit off when the setting is OFF and *allows* it to run if there is a call for cooling. The source for the signal is selected in the 3td line and can be:

1. KEYPAD, in which case the selection is made in line 2 and would be normally selected as ON. This is the normal setting when no external signals are controlling the unit.
2. SWITCHES, in which an external switch is wired across terminals #25 and #35.
3. NETWORK, used with BAS signal, which is wired to the three communication ports.

```
SET UNIT SPs (2)
Available Modes
  =COOL
Set w/ FP Switch Off
```

Available Modes setting is the standard COOL or TEST as selected from the available modes imbedded in the menu. The 4th line is a reminder that the ON/OFF switch on the front panel (FP) must be in the OFF position before the MODE can be changed. This prevents a mode change while the unit is operating.

```
SET UNIT SPs (3)
Air Flow Timer=XXsec
LowAmblock= XX.X°F
```

```
SET UNIT SPs (4)
       CLOCK
     dd/mmm/yyyy
       hh:mm:ss
```

```
SET UNIT SPs (5)
Units = °F/psi
Lang  = ENGLISH
Refrig=R22
```

Unit settings are only °F/psi at the present time. °C/kPa will be available later.
Lang (Language) settings can be only ENGLISH at present.
Refrig (Refrigerant) is set for the correct refrigerant in the factory prior to shipment.

```
SET UNIT SPs (6)
Protocol = NONE
Ident Number=001
Baud Rate=9600
```

Protocol selection for BAS will be available in June 2002.

```
SET UNIT SPs (7)
Evaporator Refrig
Press Sensor
Offset= 00.0 psi
```

The pressure offsets on menus 7 and 8 and the temperature offset on menu 9 correct the controller's display of the parameters. The sensors used in these units have a high degree of repeatability but may need correction (offset). An accurate pressure gauge or thermometer is used to determine the correct temperature or pressure. A positive or negative offset value is then entered to make the controller reading agree with the measured value.

```
SET UNIT SPs (8)
Condenser Refrig
Press Sensor
Offset= 00.0 psi
```

```
SET UNIT SPs (9)
Outside Ambient
Temperature Sensor
Offset= 00.0°F
```

```
SET UNIT SPs (10)
ENTER PASSWORD XXXX
Active Password
Level:None
```

Two four-digit passwords provide OPERATOR and MANAGER levels of access to changeable parameters. The passwords are preprogrammed into the controller. The Operator Password is 0100. Either password must be entered using the ENTER PASSWORD (12) screen before a protected setting can be changed.

This screen can be accessed either through the SET OTHER menu or by simply pressing the ENTER key while on one of the SET screens. The controller will automatically go from the screen with the setting change to this screen. After the correct password has been entered, the controller will automatically return to the original set screen.

Once a password has been entered, it remains valid for 15 minutes after the last key-press.

SET COMP SPs

```
SET COMP SPs (1)
Clear Cycle Tmr=No
Stop-Start  =XXmin
Start-Start =XXmin
```

This menu sets the anti-recycle timers. Stop-Start is the time required before starting a compressor after it has *stopped*. Start-Start is the time required before starting a compressor after the last time it has *started*. It is recommended that these default values not be changed.

```
SET COMP SPs (2)
InterStageUp=XXXsec
InterStageDn=XXXsec
```

InterStageUp is the time delay since the last stage change before a compressor can stage on.

InterStageDn is the time delay since the last stage change before a compressor can stage off normally (not by an alarm).

```
SET COMP SPs (3)
Manual Comp Enable
Comp 1= Enable
Comp 2= Enable
```

SET ALARM SETPOINTS

```
SET ALARM LMTS (1)
Low Evap Pressure
     Hold = 59.0 psi
   Unload = 58.0 psi
```

If two compressors are running, the LowEvPr Unld is in effect and the lag compressor will be shut off to unload the unit. If one compressor is running, the LowEvPr Hold is in effect and the lag compressor is prevented from starting, thereby holding the unit capacity.

```
SET ALARM LMTS (2)
EvapFlowProof=XXXsec
```

EvapFlowProof is the flow switch interlock. Closing the flow switch and therefore proving the existence of chilled water or air flow resets this trip.

```
SET ALARM LMTS (3)
HighCondPr = XXXpsi
HiCondStgDn = XXXpsi
```

HighCondPr (the unit high-discharge-pressure shutdown) is a stop alarm that shuts off the unit when the discharge pressure reaches the setting. The default setting is 380 psi. The HiCondStDn is a limit alarm that unloads the unit in an attempt to prevent total shutdown from the HighCondPr. The stage down is set at 370 psi.

```
SET ALARM LMTS (4)
PhaseVoltage=YES/NO
LowOATStrtTmr=XXXsec
```

LowAmbientLock prevents unit operation below the setting. If the unit is equipped with the standard FanTrol pressure-activated control, the available range is 35°F to 60°F with a default of 35°F. With the optional SpeedTrol variable speed control, the range becomes –2°F to 60°F with default of 0°F. Input to line 3 of the next screen, SET FANS SP (1), informs the controller which type of control is installed and which range of setting to allow.

SET FANS SETPOINTS

```
SET FANS SPs (1)
Fans Stages = X
Speedtrol = NO
```

The Fan Stages line tells the controller the number of fans on the unit. The UP ARROW toggles between 1, 2, and 3. 1 is not used; 2 should be used for Models ACZ 010, 013, and 017; and 3 should be used for ACZ 020, 025, 029, and 039.

SpeedTrol tells the controller whether the optional SpeedTrol is installed in the unit. The UP ARROW toggles between YES and NO. The setting changes the range available: YES = 35°F to 60°F, with 35°F being the recommended setting; NO = -2°F to 60°F, with 0°F being the recommended setting.

```
SET FANS SPs (2)
Stage ON psi
  #1    #2     #3
  XXX   XXX   XXX
```

```
SET FANS SPs (3)
Stage Off psi
  #1    #2     #3
 XXX   XXX    XXX
```

These two menus set the on and off staging pressures for the fans. The third fan is for only for three-fan units. These settings are used with both FanTrol and SpeedTrol. SpeedTrol takes effect when the last fan is running after FanTrol cycles off the others. Fan #1 is staged by condensing pressure and does not or stop start automatically when the unit does.

Screen Definitions – TEST

The test screens are only available when the unit is in TEST mode. Using these screens, any digital output can be controlled manually.

```
TEST UNIT        (1)
Alarm Signal= OFF
Evap Fan=OFF
```

```
TEST UNIT        (2)
Liquid Line Sol=OFF
Compressor #1 = OFF
Compressor #2 = OFF
```

```
TEST UNIT        (3)
Fan Motor #1 = OFF
Fan Motor #2 = OFF
Fan Motor #3 = OFF
```

Service

⚠ DANGER

Disconnect and tag-out all sources of power to the unit before doing any service inside the unit. Failure to do so can cause serious personal injury or death.

⚠ CAUTION

Service on this equipment must be performed only by trained, experienced, qualified service personnel with special regard to regulations concerning release of refrigerant to the atmosphere.

Note: Repeated tripping of equipment protection controls must be investigated and corrected.

Thermostatic Expansion Valve

The field-installed expansion valve is responsible for allowing the proper amount of refrigerant to enter the evaporator regardless of cooling load. It does this by maintaining a constant superheat. (Superheat is the difference between refrigerant temperature as it leaves the evaporator and the saturation temperature corresponding to the evaporator pressure.) Typically, superheat should run in the range of 8°F to 12°F (4.4°C to 6.6°C). Maintaining correct superheat to the compressor is an important element in extending compressor life.

Filter-Driers

In general, the pressure drop across the field-installed filter-drier should be in the 6 to 10 psi range. It should be monitored and changed when the pressure drop reaches 10 psi. After changing the filter-drier, check for leaks before recharging and returning unit to operation.

Liquid Line Solenoid

The field installed liquid line solenoid valve does not normally require any maintenance. Reliable operation of the solinoid valve is necessary for the pump-down function of the unit's control system.

Optional Controls

SpeedTrol Head Pressure Control

The SpeedTrol method of head pressure control operates in conjunction with FanTrol by modulating the motor speed on system #1 fan in response to condenser pressure. By reducing the speed of the last fan as the condensing pressure falls, the unit can operate to 0°F (-18°C) ambient air temperature.

The SpeedTrol fan motor is a single-phase, 230/460 volt, thermally protected motor specially designed for variable speed operation. The solid-state speed control is mounted in the unit control panel and is connected to a Schrader fitting on the liquid line. The control is factory-set to start modulating fan speed at 230 psig, and it will maintain a minimum condensing pressure of 170 to 180 psig. Minimum starting voltage for SpeedTrol motors is 120 volts.

A low ambient timer function is included in the microprocessor. When the solenoid valve and lead compressor are energized by the controller, the low pressure cutout control is bypassed and the compressor is allowed to start with the low pressure control open.

After about 2-3/4 minutes, the time delay will open and the low pressure cutout function is again operable. If the system has not built up enough evaporator pressure to close the low pressure setting, the compressor will stop.

Due to the vertical condenser design, it is recommended that the unit be oriented so that prevailing winds blow parallel to the unit length, thus minimizing effects on minimum ambient operation. If it is not practical to orient the unit in this manner, a wind deflector should be constructed.

Hot Gas Bypass

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

The field installed hot gas solenoid valve should be as shown on Figure 7, ACZ 010A through 039A, Typical Field Wiring Diagram. This can be accomplished by wiring the hot gas solenoid (SV5) to terminals 14 and 16. The pressure-regulating valve is factory-set to begin opening at 58 PSIG (32°F for R-22) when the air-charged bulb is in an 80°F ambient temperature. The bulb can be mounted anywhere as long as it senses a fairly constant temperature at various load conditions. The compressor suction line is one such mounting location. It is generally in the 50°F to 60°F range.

The chart below (Figure 16) indicates that when the bulb is sensing 50°F to 60°F temperatures, the valve will begin opening at 54 PSIG. This setting can be changed as indicated above, by changing the pressure setting, remove the cap on the bulb and turn the adjustment screw clockwise. To lower the setting, turn the screw counterclockwise. Do not force the adjustment beyond the range it is designed for, as this will damage the adjustment assembly.

The regulating valve opening point can be determined by slowly reducing the system load (or increasing the required evaporator temperature setting indicated on the unit thermostat), while observing the suction pressure. When the bypass valve starts to open, the refrigerant line on the evaporator side of the valve will begin to feel warm to the touch.

⚠ WARNING

The hot gas line can become hot enough to cause injury in a very short time. Do not allow prolonged contact during valve checkout.

On installations where the condensing unit is remote from the evaporator, it is recommended that the hot gas bypass valve be mounted near the condensing unit to minimize the amount of refrigerant that will condense in the hot gas line during periods when hot gas bypass is not required.

Figure 15, Hot Gas Bypass Piping

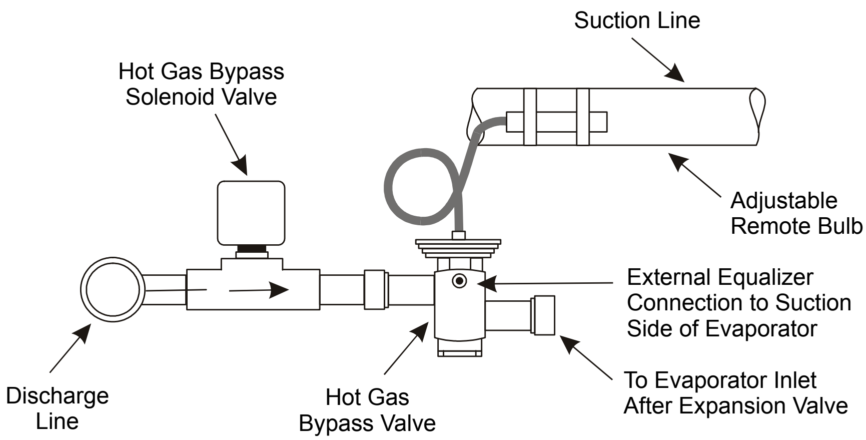
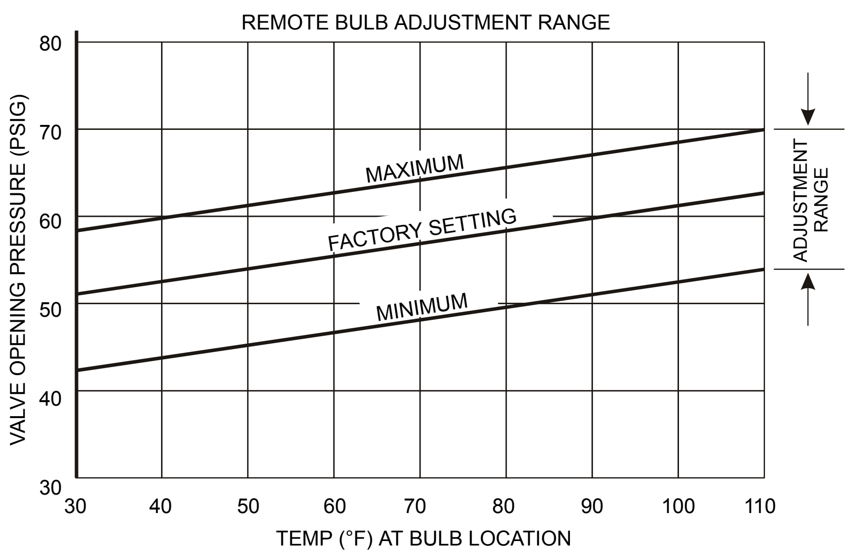


Figure 16, Hot Gas Bypass Adjustment



Troubleshooting Chart

⚠ WARNING

Troubleshooting must be done only by trained, experienced technicians. Troubleshooting presents risks of severe personal injury and death from cuts, burns, electrocution and suffocation.

Table 23, Troubleshooting Chart

PROBLEM	POSSIBLE CAUSES	POSSIBLE CORRECTIVE STEPS
COMPRESSOR WILL NOT RUN	1. Main switch open 2. Fuse blown, breakers open 3. Thermal overloads tripped 4. Defective contactor or coil 5. System off by protection device 6. No cooling required 7. Liquid line solenoid will not open 8. Motor electrical problem 9. Loose wiring	1. Close switch 2. Check electrical circuits and motor windings for shorts. Check for overloads and loose connections. Replace fuse or reset breaker. 3. Check unit when back on line, auto reset 4. Repair or replace 5. Determine cause and correct 6. None, should start on call for cooling 7. Repair or replace coil 8. Check motor for open or short circuit, or burnout 9. Check all wire junctions. Tighten all terminals.
COMPRESSOR NOISY OR VIBRATING	1. Refrigerant flooding compressor 2. Improper line support 3. Worn compressor	1. Check expansion valve setting 2. Relocate or add supports 3. Replace
HIGH DISCHARGE PRESSURE	1. Noncondensables in system 2. Refrigerant overcharge 3. Fan not running 4. Dirty condenser coils 5. FanTrol out of adjustment	1. Remove with authorized procedures 2. Remove excess 3. Check electrical circuit 4. Clean coil 5. Adjust FanTrol setting
LOW DISCHARGE PRESSURE	1. Faulty condenser control 2. Low refrigerant charge 3. Low suction pressure	1. Check condenser control operation 2. Check for leaks. Add refrigerant 3. See low suction pressure steps below
HIGH SUCTION PRESSURE	1. Excessive load 2. Expansion valve overfeeding	1. Reduce load or add capacity 2. Check remote bulb. Regulate superheat
LOW SUCTION PRESSURE	1. Lack of refrigerant 2. Evaporator dirty 3. Clogged filter-drier 4. Expansion valve malfunctioning 5. Low condensing temperature	1. Check for leaks. Repair and replace refrigerant. 2. Clean chemically 3. Replace 4. Check and adjust for proper superheat 5. Check discharge pressure control settings
UNIT WILL NOT LOAD OR UNLOAD	1 Faulty controller sensor/broken wire 2. Stages not set for application	1. Replace 2. Adjust thermostat setting
LOAD/UNLOAD INTERVAL TOO SHORT	1. Erratic thermostat 2. Insufficient water flow	1. Replace 2. Adjust flow
COMPRESSOR LOSES OIL	1. Lack of refrigerant 2. Suction superheat too high 3. Crankcase heater burned out	1. Check for leaks and repair 2. Adjust superheat 3. Replace crankcase heater
MOTOR OVERLOAD RELAYS OPEN OR BLOWN FUSES	1. Low voltage during high loads 2. Defective or grounded motor wiring 3. Loose power wiring 4. High condensing temperature 5. Unbalanced voltage	1. Check supply voltage 2. Replace compressor 3. Check all connections and tighten 4. See steps for high discharge pressure 5. Check voltage. Contact power company.
COMPRESSOR THERMAL SWITCH OPEN	1. Operating beyond design conditions	1. Add facilities so conditions are within allowable limits

All McQuay equipment is sold pursuant to McQuay's Standard Terms and Conditions of Sale and Limited Product Warranty. Consult your local McQuay Representative for warranty details. Refer to form 933-430285Y-00-A (09/08). To find your local representative, go to www.mcquay.com

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