



# Installation, Operation, and Maintenance Manual

## Trailblazer® Air-Cooled Chillers

Model AMZ, A-vintage  
10 to 40 Tons (35 to 140 kW)  
HFC-410A Refrigerant  
60/50 Hz

**IOM 1243-1**

Group: Chiller

Part Number: IOM1243-1

Date: October 2018



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Manufactured in an ISO 9001 & ISO 14001 certified facility



\*50 Hz option outside the scope of AHRI ACCL Certification Program



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## Pre-Start Checklist – Scroll Compressor Chillers

Must be completed, signed, and provided to Daikin Applied at least 2 weeks prior to requested start date.

<b>Job Name</b>				
<b>Installation Location</b>				
<b>Customer Order Number</b>				
<b>Model Number(s)</b>				
<b>G.O. Number(s)</b>				
<b>Chilled Water</b>	<b>Yes</b>	<b>No</b>	<b>N/A</b>	<b>Initials</b>
Piping Complete				
Water strainer installed on evaporator entering chilled water piping <b>per IM</b>				
Water System filled, flushed and vented				
Pumps installed and operational (rotation checked, strainers cleaned)				
Controls operational (3-way valves, face/bypass dampers, bypass valves, etc.)				
Water system operated and tested; flow meets unit design requirements				
Flow switch installed and wired				
Vent installed on evaporator				
Glycol at design %				
<b>Electrical</b>	<b>Yes</b>	<b>No</b>	<b>N/A</b>	<b>Initials</b>
Building controls operational				
*Power leads connected to power block or optional disconnect				
Power leads have been checked for proper phasing and voltage				
All interlock wiring complete and compliant with Daikin specifications				
Power applied at least 12 hours before startup				
Oil heaters energized at least 12 hours before startup				
Chiller components (EXV Sensors Transducers) installed and wired properly.				
*Wiring complies with National Electrical Code and local codes (See Notes)				
Remote EXV wired with shielded cable				
<b>Miscellaneous</b>	<b>Yes</b>	<b>No</b>	<b>N/A</b>	<b>Initials</b>
Unit control switches all off				
<b>Remote Evaporator / Condenser Piping</b> factory reviewed				
All refrigerant components/piping leak tested, evacuated and charged				
Thermometers, wells, gauges, control, etc., installed				
Minimum system load of 80% capacity available for testing/adjusting controls				
<b>Document Attached:</b> Technical Breakdown from Selection Software				
<b>Document Attached:</b> Final Order Acknowledgement				
<b>Document Attached:</b> Remote piping approval				
<p><b>Notes:</b> The most common problems delaying start-up and affecting unit reliability are:</p> <ol style="list-style-type: none"> <li>Field installed compressor motor power supply leads too small. Questions: Contact the local Daikin sales representative*. State size, number and type of conductors and conduits installed:             <ol style="list-style-type: none"> <li>From Power supply to chiller _____</li> </ol> </li> <li>Remote Evaporator piping incomplete or incorrect. Provide approved piping diagrams.</li> <li>Items on this list incorrectly acknowledged resulting in delayed start and possible extra expenses incurred by return trips.</li> </ol> <p>* Refer to NFPA 70-2017, Article 440.35</p>				

### Contractor Representative

Signed: \_\_\_\_\_  
 Name: \_\_\_\_\_  
 Company: \_\_\_\_\_  
 Date: \_\_\_\_\_  
 Phone/Email: \_\_\_\_\_

### Daikin Applied Sales Representative

Signed: \_\_\_\_\_  
 Name: \_\_\_\_\_  
 Company: \_\_\_\_\_  
 Date: \_\_\_\_\_  
 Phone/Email: \_\_\_\_\_

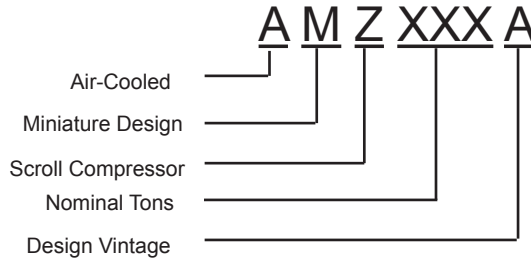


# General Description

Daikin Trailblazer® air-cooled water chillers are complete, self-contained, automatic chillers designed for outdoor installation. Packaged units are completely assembled, factory wired, charged, and tested.

The electrical control center includes all equipment protection and operating controls necessary for dependable automatic operation.

## NOMENCLATURE



**⚠ WARNING**  
Installation is to be performed by qualified personnel who are familiar with local codes and regulations.

### 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, making certain it agrees with the power supply available. Daikin Applied is not responsible for physical damage after the unit leaves the factory.

### Handling

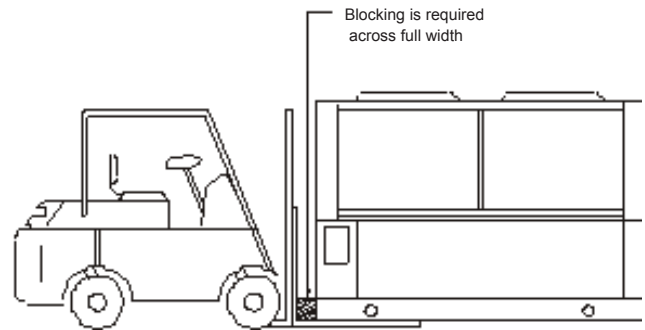
Be careful to avoid rough handling of the unit. Do not push or pull the unit from anything other than the base. Block the pushing vehicle away from the unit to prevent damage to the sheet metal cabinet and end frame (see Figure 1).

Arrange spreader bars and cables to prevent damage to condenser coils or cabinet (see Figure 2).

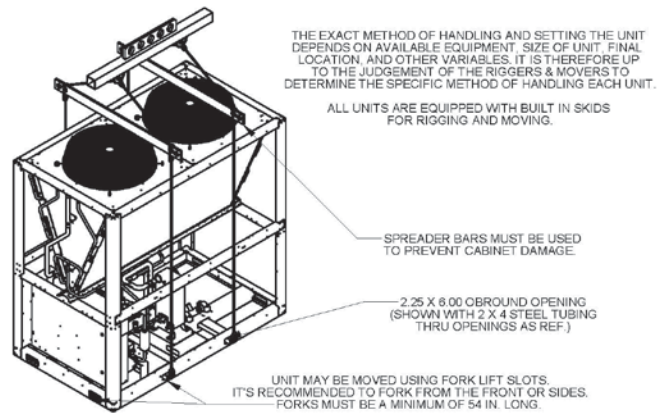
**⚠ CAUTION**  
All lifting locations must be used to prevent damage to unit.

**⚠ DANGER**  
Improper rigging, lifting, or moving of a unit can result in property damage, severe personal injury or death. Follow rigging and moving instructions carefully. Do not stand beneath the unit while it is lifted or being installed.

**Figure 1: Suggested Pushing Arrangement**



**Figure 2: Required Lifting Arrangement**



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

## Operating and Standby Limits

**Table 1: Operating Limits**

Maximum standby ambient temperature	131°F (55°C)
Maximum operating ambient temperature (standard control)	105°F (41°C)
Maximum operating ambient temperature (with optional high-ambient control)	125°F (52°C)
Minimum operating ambient temperature (standard control)	32°F (0°C)
Minimum operating ambient temperature (with optional low-ambient control)	-10°F (-23°C)
Leaving chilled water temperature	40°F to 65°F (4°C to 18°C)
Leaving chilled fluid temperatures (with anti-freeze) - Note that in cases of high ambient temperature, the lowest leaving water temperature settings may be outside of the chiller operating envelope; consult Daikin Tools to ensure chiller is capable of the required lift.	15°F to 65°F (-9°C to 18°C)
Operating chilled water delta-T range	6°F to 16°F (3.3°C to 8.9°C)
Maximum evaporator operating inlet fluid temperature	81°F (27°C)
Maximum evaporator non-operating inlet fluid temperature	100°F (38°C)

## Unit Placement

Trailblazer® units are for outdoor applications and can be mounted either on a roof or at ground level. For roof mounted applications, install the unit on a steel channel or I-beam frame to support the unit above the roof. Isolator pads or spring isolators for roof applications are recommended to reduce vibrations, noise and corrosion. For ground level applications, install the unit on a substantial base that will not settle. Use a one-piece concrete slab with footings extended below the frost line. Be sure the foundation is level within 0.5" (13 mm) over its length and width. The foundation must be strong enough to support the unit weight - See [Unit Dimensional Data on page 14](#).

## Service Clearance

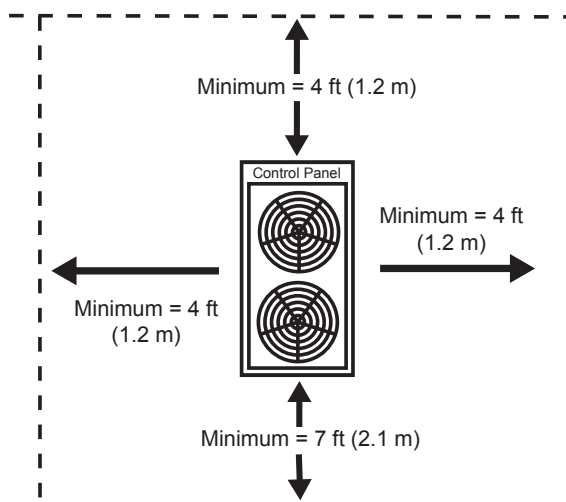
### Sides

- Minimum of 4 feet (1.2 meters)

### Control Panel End

- Minimum of 4 feet (1.2 meters)

**Figure 3: Service Clearance**



## Operational Clearance Spacing Requirements

Sufficient clearance must be maintained between the unit and adjacent walls or other units to allow the required unit air flow to reach the coils. Failure to do so will result in a capacity reduction and an increase in power consumption. Graphs on the following pages give the minimum clearance for different types of installations and also capacity reduction and power increase if closer spacing is used. The graphs are based on individual cases and should not be combined with other scenarios.

The clearance requirements shown are a general guideline, based on individual cases, and cannot account for all scenarios. Such factors as prevailing winds, additional equipment within the space, design outdoor air temperature, and numerous other factors may require more clearance than what is shown. Additional clearances may be required under certain circumstances. No obstructions are allowed above the unit at any height.

**NOTE:** Assumes a solid wall that is unit height.

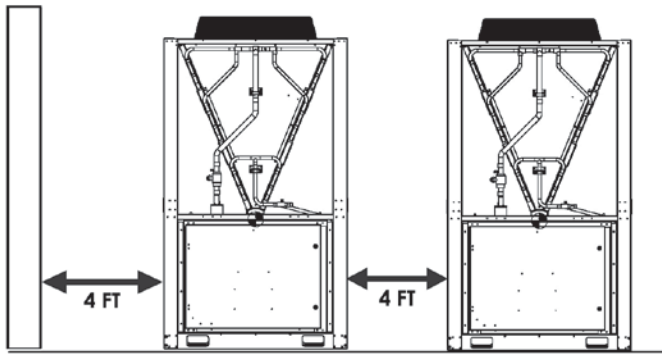
### Case 1: Wall on One Side

For AMZ010-040A: Use 4 ft. minimum clearance from any solid height wall taller than unit.

### Case 2: Two Units Side-by-Side

Units mounted with 4ft. spacing between should see no significant reduction in capacity nor increase in power consumption. (Less than 1% for both). See [Figure 4 on page 7](#).

**Figure 4: Spacing Requirements**



**Case 3: Three Units Side-by-Side**

The table below is for the center unit only. For outside units on each side of the middle unit, refer to Case 2

Distance Between 2 Units		4 Feet		5 Feet	
Unit Models	# of Fans	% -Cap. Reduct. Unit	% Power Increase Unit	% -Cap. Reduct. Unit	% Power Increase Unit
010-020A	4	0	0	0	0
025-040A	4	1.0%	1.5%	0	0

**Case 4: Open Screening Walls**

	% Open Wall Area						
	0%	10%	20%	30%	40%	50%	
010-040E	Distance from Wall Ft						
	5.0	4.4	4.0	4.0	4.0	4.0	

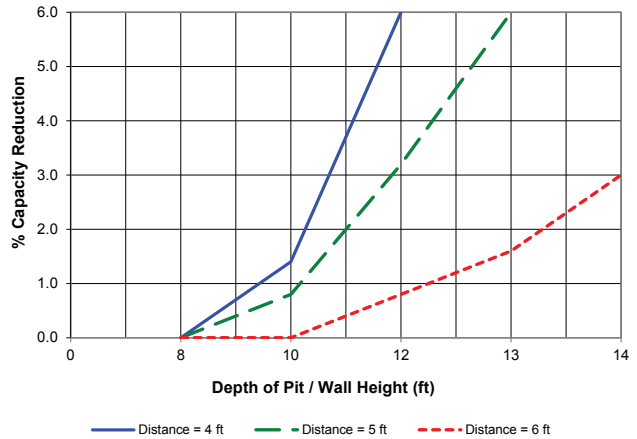
Decorative screening walls are often used to help conceal a unit either on grade or on a rooftop. When possible, design these walls such that the combination of their open area and distance from the unit do not require performance adjustment. If the wall opening percentage is less than recommended for the distance to the unit, it should be considered as a solid wall. It is assumed that the wall height is equal to or less than the unit height when mounted on its base support. If the wall height is greater than the unit height, see Case 5. The distance from the sides of the unit to the side walls must be sufficient for service, such as opening control panel doors. For uneven wall spacing, the distance from the unit to each wall can be averaged providing no distance is less than 4 feet. Values are based on walls on all four sides

**Case 5: Pit/Solid Wall Installation**

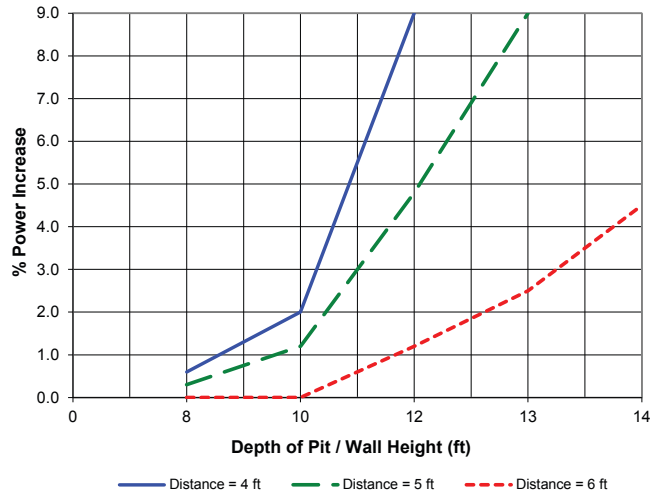
Pit installations can cause operating problems resulting from air recirculation and restriction and require care that sufficient air clearance is provided, safety requirements are met and service access is provided. Pit covers must have abundant open area at least equal to the chiller footprint. A solid wall surrounding a unit is essentially a pit and this data should be used. Derates are based on single chiller installation only. Adding multiple chillers in a pit may require more clearance.

Steel grating is sometimes used to cover a pit to prevent accidental falls or trips into the pit. The grating material and installation design must be strong enough to prevent such accidents, yet provide abundant open area to avoid recirculation problems. Have any pit installation reviewed by the Daikin Applied sales representative prior to installation to ensure it has sufficient air-flow characteristics and approved by the installation design engineer to avoid risk of accident.

**Full Load Capacity Reduction (AMZ 010-040A)**



**Power Increase (AMZ 010-040A)**



## Chilled Water Piping

### CAUTION

To prevent damage to the evaporator and potential chiller failure, a supply strainer is required in the inlet water piping which connects to this evaporator. This strainer must be installed prior to operation of the chilled liquid pumps.

Field installed water piping to the chiller **must** include:

- A cleanable strainer installed at the water inlet to the evaporator to remove debris and impurities before they reach the evaporator. Install cleanable strainer within 5 feet (1500 mm) of pipe length from the evaporator inlet connection and downstream of any welded connections (no welded connections between strainer and evaporator).
- A required strainer with perforations no larger than 0.063" (1.6 mm) diameter. See the Inlet Strainer Guidelines on [page 9](#) for more information.
- A water flow switch must be installed in the horizontal piping of the supply (evaporator outlet) water line to avoid evaporator freeze-up under low or no flow conditions. The flow switch may be ordered as a factory-installed option, a field-installed kit, or may be supplied and installed in the field. See [page 11](#) for more information.
- An expansion tank and regulating valve to maintain adequate water pressure
- Piping must have a drain and vent connection provided in the bottom of the lower connection pipe and to the top of the upper connection pipe respectively, see [Figure 5](#). These evaporators do not have drain or vent connections due to their construction. Purge air from the water system before unit start-up to provide adequate flow through the evaporator.

- Adequate piping support, independent from the unit, to eliminate weight and strain on the fittings and connections.

It is **recommended** that the field installed water piping to the chiller include:

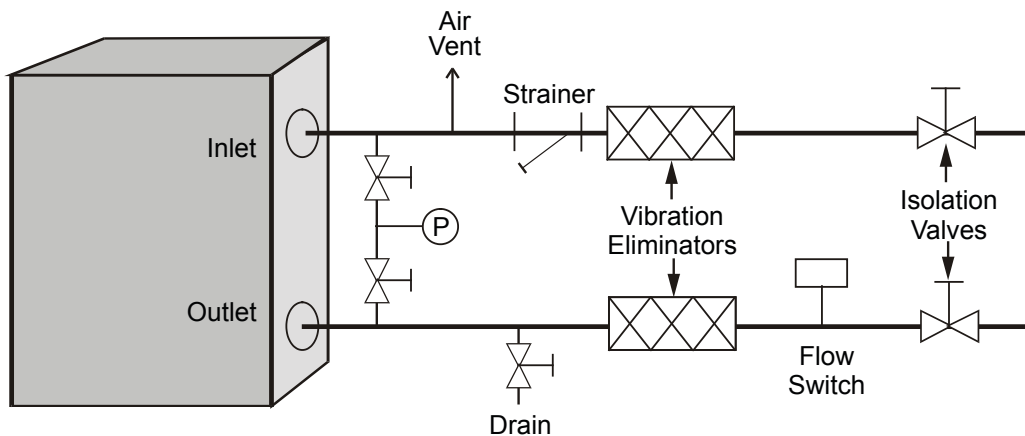
- Thermometers at the inlet and outlet connections of the evaporator.
- Water pressure gauge connection taps and gauges at the inlet and outlet connections of the evaporator for measuring water pressure drop.
- Shutoff valves are necessary to isolate the unit from the piping during unit servicing.
- Minimum bends and changes in elevation to minimize pressure drop.
- Vibration eliminators in both the supply and return water lines to reduce transmissions to the building.
- Flush the system water piping thoroughly before making connections to the unit evaporator.
- Piping insulation, including a vapor barrier, helps prevent condensation and reduces heat loss per code.
- Regular water analysis and chemical water treatment for the evaporator loop is recommended immediately at equipment start-up.

**NOTE:** Failure to follow these measures may result in performance and reliability issues.

### WARNING

Daikin Applied recommends against the use of PVC and CPVC piping for chilled water systems. In the event the pipe is exposed to POE oil used in the refrigerant system, the pipe can be chemically damaged and pipe failure can occur.

Figure 5: Typical Piping, Brazed-Plate Evaporator



WELDED PIPE CONNECTIONS ARE NOT ALLOWED BETWEEN THE STRAINER AND EVAPORATOR DUE TO THE CHANCE OF SLAG ENTERING THE EVAPORATOR



## Inlet Strainer Guidelines

An inlet water strainer kit must be installed in the chilled water piping before the evaporator inlet. Several paths are available to meet this requirement:

1. Factory installed option is available.
2. A field-installed kit shipped-loose with the unit is available for all unit sizes and consists of:
  - Y-type area strainer with 304 stainless steel perforated basket, OGS type pipe connections and strainer cap [a strainer with perforations no larger than 0.063" (1.6 mm) diameter].
  - Extension pipe with two Schrader fittings that can be used for a pressure gauge. The pipe provides sufficient clearance from the evaporator for strainer basket removal.
  - ½-inch blowdown valve
  - Two grooved clamps

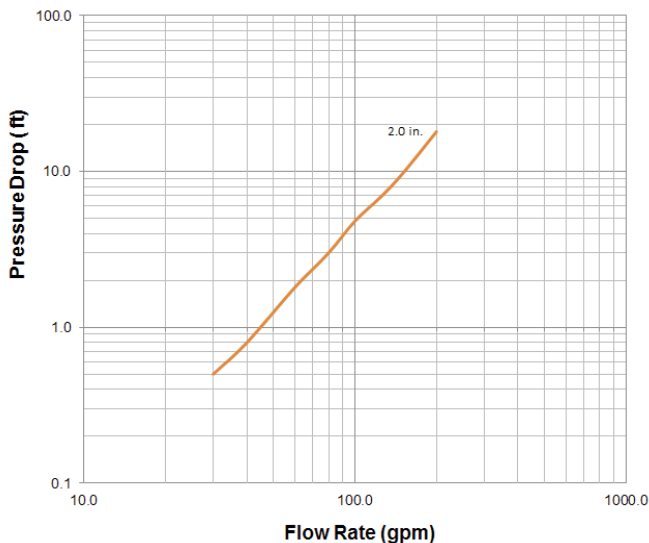
Connection sizes are given in [Table 11 on page 19](#).

3. A field-supplied strainer that meets specification and installation requirements of this manual.

**Table 2: Strainer Data**

Trailblazer™ Model	Strainer Size in (mm)	Maximum perforation size in (mm)	Factory Installed Option	Field Installed Option
010-040E	2.0 (51)	0.063 (1.6)	Y	Y

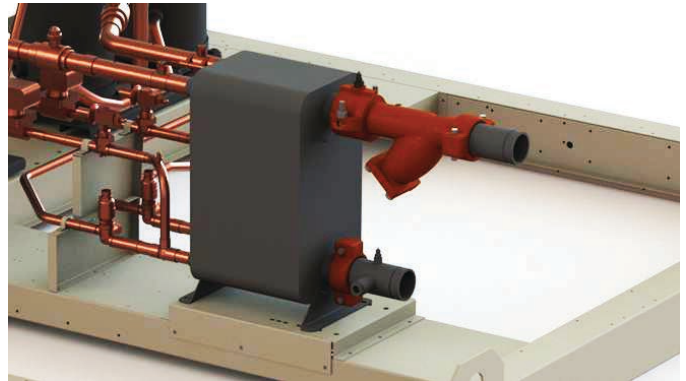
**Figure 6: Strainer Pressure Drop Data**



**Table 3: Strainer Pressure Drop Data**

FLOW (GPM)	30	40	60	80	100	125	150	200
Press. Drop (ft)	0.5	0.8	1.8	3	4.8	6.9	9.7	18

**Figure 7: Factory Installed Strainer**



## Water Flow Limitations Constant Evaporator Flow

The evaporator flow rates and pressure drops are shown on [page 18](#) for various system designs. The maximum flow rate and pressure drop are based on a 6°F temperature drop. Flow rates above the maximum values will result in unacceptable pressure drops and can cause excessive erosion, potentially leading to failure.

The minimum flow and pressure drop is based on a full load evaporator temperature drop of 16°F. Evaporator flow rates below the minimum values can result in laminar flow causing low pressure alarms, scaling, and poor temperature control.

## Variable Evaporator Flow

Reducing evaporator flow in proportion to load can reduce system power consumption. The rate of flow change should be a maximum of 10 percent of the flow per minute. For example, if the maximum design flow is 200 gpm and it will be reduced to a flow of 140 gpm, the change in flow is 60 gpm. Ten percent of 200 gpm equals 20 gpm change per minute, or a minimum of three minutes to go from maximum to desired flow. The water flow through the evaporator must remain between the minimum and maximum values listed in [Table 10 on page 18](#). If flow drops below the minimum allowable, large reductions in heat transfer can occur. If the flow exceeds the maximum rate, excessive pressure drop and erosion can occur. See unit set point information in [Table 17 on page 24](#).

## System Water Considerations

All chilled water systems need adequate time to recognize a load change, respond to the change, and stabilize to avoid undesirable short cycling of the compressors or loss of temperature control. In air conditioning systems, the potential for short cycling usually exists when the building load falls below the minimum chiller plant capacity or on close-coupled systems with very small water volumes. Some of the things the designer should consider when looking at water volume are the minimum cooling load, the minimum chiller plant capacity during the low load period and the desired cycle time for the compressors. Assuming that there are no sudden load changes and that the chiller plant has reasonable turndown, a rule of thumb of “gallons of water volume equal to two to three times the chilled water gpm flow rate” is often used. A

storage tank may have to be added to the system to reach the recommended system volume. Refer to AG 31-003 for method of calculating “Minimum Chilled Water Volume”.

The water quality provided by the owner/occupant/operator/user to a chiller system should minimize corrosion, scale buildup, erosion, and biological growth for optimum efficiency of HVAC equipment without creating a hazard to operating personnel or the environment. Water systems should be cleaned and flushed prior to the chiller installation. Water testing and treatment should be verified during initial chiller installation/commissioning and maintained on a continuous basis by water treatment professionals (see Limited Product Warranty on inside of back cover).

**CAUTION**

The improper use of detergents, chemicals, and additives in the chiller system water may adversely affect chiller performance and potentially lead to repair costs not covered by warranty. Any decision to use these products is at the discretion of the owner/occupant/operator/user, and as such they assume full liability/responsibility for any damage that may occur due to their use.

**Evaporator Freeze Protection**

Evaporator freeze-up can be a concern in the application of air-cooled water chillers in areas experiencing below freezing temperatures. To protect against freeze-up, insulation and an electric heater plate are furnished with the evaporator. This helps protect the evaporator down to -20°F (-29°C) ambient air temperature. Although the evaporator is equipped with freeze protection, it does not protect water piping external to the unit or the evaporator itself if there is a power failure or heater burnout, or if the chiller is unable to control the chilled water pumps. Use one of the following recommendations for additional protection:

- If the unit will not be operated during the winter, drain evaporator and chilled water piping and flush with glycol. Drain and vent connections are provided on the evaporator for this purpose.
- Add a year-round glycol solution to the chilled water system to provide freeze protection. Freeze point should be approximately 10°F(5.6°C) below minimum design ambient temperature or 10°F below the lowest design leaving water temperature, whichever is lower. The use of glycol anti-freeze is generally considered the safest protection against freeze-up, however, it will reduce the performance of the unit, depending on the concentration. Take this into consideration during initial system design and selection. On glycol applications, a minimum fluid concentration should be based on Burst Protection limits.
- The field addition of thermostatically controlled heat tracing and insulation to exposed piping. Factory insulation will have to be removed and replaced after installation of the tracing. (Dependent on power availability)
- The evaporator heater is factory wired to the 115-volt circuit in the control box. This power can be supplied from a separate source, or it can be supplied from the control

circuit. Operation of the heater cable is automatic through the fluid sensing thermostat that energizes the evaporator heater cable for protection against freeze-up. Unless the evaporator is drained in the winter, the disconnect switch to the evaporator heater must be closed. Conversely, do not apply heat to the evaporator if it is drained.

- An expansion water tank must be installed to accommodate water volume variations due to thermal expansion and contraction.

**Chilled Water Pump**

It is important that the chilled water pumps be wired to, and controlled by, the chiller’s microprocessor. When equipped with optional dual pump output, the chiller controller has the capability to selectively send the signal to a pump relay (by others) to start pump A or B, automatically alternate pump selection, or standby operation capability. The controller will energize the pump when the circuit on the chiller is enabled to run, whether there is a call for cooling or not. This helps ensure proper unit start-up sequence. The pump will also be turned on when the water temperature goes below the Freeze Setpoint for longer than a specified time to help prevent evaporator freeze-up. Connection points are shown in the [See Unit/Field Wiring Diagram on page 17](#).

**CAUTION**

Adding glycol or draining the system is the recommended method of freeze protection. If the chiller does not have the ability to control the pumps and the water system is not drained in temperatures below freezing, catastrophic evaporator failure may occur.

Failure to allow pump control by the chiller may cause the following problems:

1. If any device other than the chiller attempts to start the chiller without first starting the pump, the chiller will lock out on the No Flow alarm and require auto reset.
2. If the chiller evaporator water temperature drops below the “Freeze Setpoint” the chiller will attempt to start the water pumps to avoid evaporator freeze. If the chiller does not have the ability to start the pumps, the chiller will alarm due to lack of water flow.
3. If the chiller does not have the ability to control the pumps and the water system is not to be drained in temperatures below freezing or contain glycol, the chiller may be subject to catastrophic evaporator failure due to freezing. The freeze rating of the evaporator is based on the evaporator heater and pump operation. The external brazed plate heater itself may not be able to properly protect the evaporator from freezing without circulation of water.

## Flow Switch

All chillers require a chilled water flow switch to check that there is adequate water flow through the evaporator and to shut the unit down if there isn't. The option for meeting this requirement is a "paddle" type flow switch, available from Daikin Applied for field mounting and wiring.


Installation should be per manufacturer's instructions included with the switch. Flow switches should be calibrated to shut off the unit when operated below the minimum listed flow rate for the unit as listed on [page 18](#).

There is also a set of normally closed contacts on the paddle 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. Differential pressure switches are not recommended for outdoor installation, as they can freeze and not indicate a no-flow condition.

## Glycol Solutions

Test coolant with a clean, accurate glycol refractometer to determine the freezing point. Obtain percent glycol from the freezing point table below. It is recommended that a minimum of 25% solution by weight be used for protection against corrosion or that additional compatible inhibitors be added. Concentrations above 35% do not provide any additional burst protection and should be carefully considered before using.

Reset the freezestat setting to 6 °F (3.3 °C) below the leaving chilled water setpoint temperature after the glycol percentage is verified safe for the application.

 <b>CAUTION</b>	
Do not use an automotive-grade antifreeze. Industrial grade glycols must be used. Automotive antifreeze contains inhibitors which will cause plating on the copper tubes within the chiller evaporator. The type and handling of glycol used must be consistent with local codes.	

**Table 4: Freeze Protection**

Temperature °F (°C)	Percent Volume Glycol Concentration Required			
	For Freeze Protection		For Burst Protection	
	Ethylene Glycol	Propylene Glycol	Ethylene Glycol	Propylene Glycol
20 (-6.7)	16	18	11	12
10 (-12.2)	25	29	17	20
0 (-17.8)	33	36	22	24
-10 (-23.3)	39	42	26	28
-20 (-28.9)	44	46	30	30
-30 (-34.4)	48	50	30	33
-40 (-40.0)	52	54	30	35
-50 (-45.6)	56	57	30	35
-60 (-51.1)	60	60	30	35

## Condenser Coil Options and Coating Considerations

The standard coils on the Trailblazer™ chiller are an all aluminum alloy microchannel design with a series of flat tubes containing multiple, parallel flow microchannels layered between the refrigerant manifolds. The microchannel coils are designed to withstand 1000+ hour acidified synthetic sea water fog (SWAAT) test (ASTM G85-02) at 120°F (49°C) with 0% fin loss and develop no leaks.

Should the standard microchannel coil not meet the corrosion requirements for the application, additional coil options are available.

Epoxy coated coils are a water-based, extremely flexible and durable epoxy polymer coating, uniformly applied to all coil surfaces through a multi-step, submerged electrostatic coating process. Epoxy coated coils condenser coils provide a 5000+ hour salt spray resistance per ASTM B117-90, applied to both the coil and the coil frames. The Epoxy coated coils also receive a UV-resistant urethane top-coat to provide superior resistance to degradation from direct sunlight. This coil coating option provides the best overall protection against corrosive

marine, industrial, or combined atmospheric contamination.

**Table 5: Coil/Coating Selection Matrix**

Coil Option	Non-Corrosive <sup>1</sup>	Unpolluted Marine <sup>2</sup>	Industrial <sup>3</sup>	Combined Marine-Industrial <sup>4</sup>
Standard Microchannel	+++	-	-	-
Epoxy coated coils	+++	+++	+++	++

**NOTE:**

1. Non-corrosive environments may be estimated by the appearance of existing equipment in the immediate area where the chiller is to be placed.
2. Marine environments should take into consideration proximity to the shore as well as prevailing wind direction.
3. Industrial contaminants may be general or localized, based on the immediate source of contamination (i.e. diesel fumes due to proximity to a loading dock).
4. Combined marine-industrial are influenced by proximity to shore, prevailing winds, general and local sources of contamination.

## Electrical Control Center

Operating and equipment protection controls and motor starting components are separately housed in a centrally located, weather resistant control panel with hinged and tool-locked doors. Compressor motor inherent thermal and overload protection is standard. See [Unit/Field Wiring Diagram on page 17](#). In addition to the MicroTech® III controller described in the next sections, the following components are housed in the panel:

- Power terminal block
- Control, input, and output terminal block
- Control transformer
- Optional disconnect switch (through-the-door handle)
- Optional phase voltage monitor with under/over voltage and phase reversal protection
- Fan contactors with short circuit protective devices.
- Optional ground fault protection
- Fan staging head pressure control system
- Power connection per single-point standard.

A start signal can be given anytime after the stop signal since the three-minute start-to-start timer will be in effect.

## Use with On-Site Generators

Switching from site grid power to generator power and vice versa requires that the chiller must either be powered down or the power must be off for more than 5 seconds to avoid sending out of phase voltage to the chiller. A properly installed, fully synchronized Automatic Transfer Switch must be used to transfer power if the chiller is running under load.



### WARNING

Generator must be sized by an electrical engineer familiar with generator applications.

## Transfer Back to Grid Power

Proper transfer from stand-by generator power back to grid power is essential to avoid chiller damage and must be used to ensure proper function of the unit.



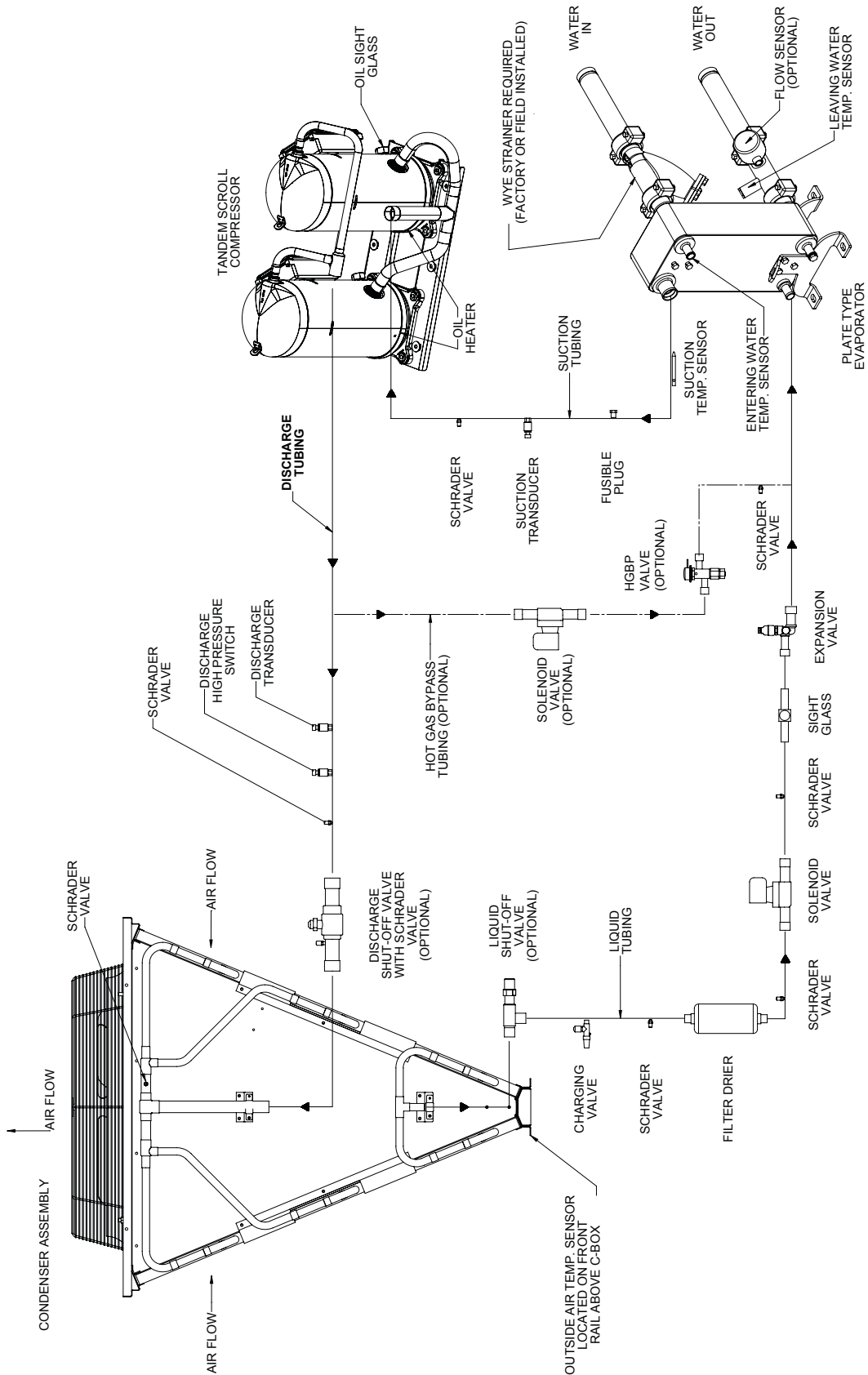
### WARNING

Stop the chiller before transferring supply power from the generator back to the utility power grid. Transferring power while the chiller is running can cause severe chiller damage.

The necessary procedure for reconnecting power from the generator back to the utility grid is as follows:

1. Set the generator to always run five minutes longer than the unit start-to-start timer while keeping the chiller powered by the generator until the fully synchronized Automatic Transfer Switch properly hands over chiller power from the site.
2. Configure the transfer switch provided with the generator to automatically shut down the chiller before transfer is made. The automatic shut-off function can be accomplished through a BAS interface or with the “remote on/off” wiring connection ([See Unit/Field Wiring Diagram on page 17.](#))

Figure 8: AMZ-A Package Chiller with Microchannel



# Unit Dimensions and Weights

Figure 9: Unit Dimensional Data

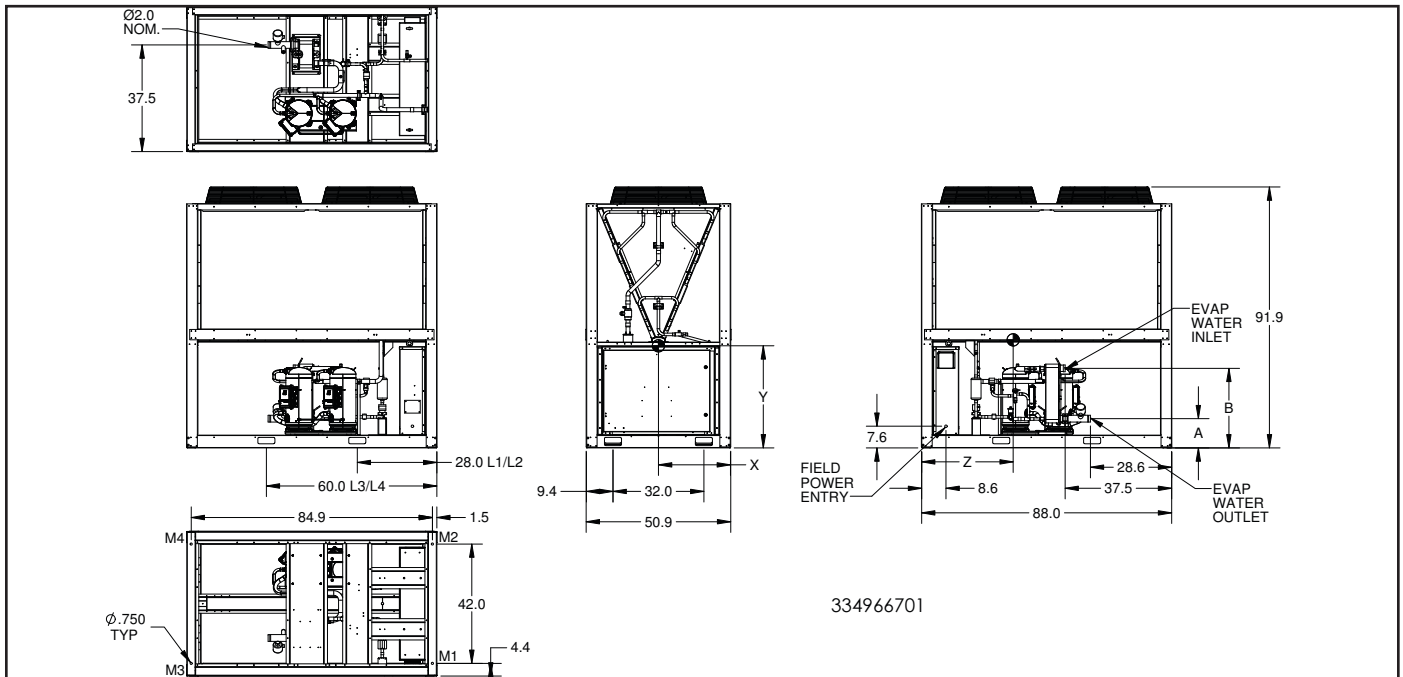


Table 6: Unit Weight Information

UNIT MODEL	SHIPPING WEIGHT LBS (KG)	OPERATING WEIGHT LBS (KG)	LOUVERS	EVAP. DIMENSIONS, IN (MM)		CG LOCATION, IN (MM)			LIFTING (SHIPPING) WEIGHT BY CORNER (LBS)				MOUNTING (OPERATING) WEIGHT (LBS)			
				A	B	X	Y	Z	L1	L3	L2	L4	M1	M3	M2	M4
AMZ010	1394 (632)	1401 (635)	N	9.9 (251)	28.4 (721)	26.2 (665)	37 (942)	35.8 (909)	515	160	559	160	401	277	431	292
	1690 (767)	1697 (770)	Y						621	194	677	198	483	335	523	356
AMZ015	1454 (660)	1461 (663)	N	9.9 (251)	28.4 (721)	26.9 (683)	36.8 (935)	35.7 (907)	520	165	584	185	406	282	456	317
	1750 (794)	1757 (797)	Y						626	199	702	223	488	340	548	381
AMZ020	1440 (653)	1447 (656)	N	10.3 (262)	28 (711)	26.4 (671)	37 (940)	35.7 (907)	527	166	568	179	402	280	451	314
	1736 (787)	1740 (789)	Y						635	200	685	216	493	342	534	371
AMZ025	1524 (691)	1532 (695)	N	10.3 (262)	28 (711)	27 (686)	36.5 (927)	35.9 (912)	540	177	608	199	423	297	477	335
	1820 (826)	1828 (829)	Y						645	211	726	238	505	355	569	399
AMZ030	1538 (698)	1547 (702)	N	10.3 (262)	28 (711)	27 (686)	36.3 (922)	36 (914)	544	180	612	202	427	301	481	338
	1834 (832)	1843 (836)	Y						649	214	730	241	509	358	573	403
AMZ035	1759 (798)	1775 (805)	N	10.3 (262)	28 (711)	28.4 (721)	33.9 (861)	34.2 (869)	628	150	792	189	477	307	603	388
	2055 (932)	2072 (940)	Y						733	175	926	221	557	359	703	453
AMZ040	1890 (857)	1908 (865)	N	10.3 (262)	28 (711)	28.4 (721)	30.8 (782)	35.9 (912)	628	207	793	262	495	348	625	440
	2186 (992)	2204 (1000)	Y						726	240	917	303	572	402	722	508

**NOTE:**

- Weights shown reflect the largest possible evaporator.
- Minimum clearances are required for unit operation and service. Refer to the AMZ Installation and Operating Manual for installation requirements.
- 3.0-inch diameter lifting holes are provided.
- The unit is shipped with a full operating charge of refrigerant.
- Installation specific drawings are available from a Daikin Applied sales representative.
- Dimensions shown in Figure 9 are in inches.

## Isolator Installation Information

In all cases, set the unit in place and level. If anti-skid pads are used, do not use hold down bolts. If hold down bolts are used, do not use anti-skid pads.

When spring isolators are required, install springs running under the main unit supports. Unit should be installed on blocks or shims at the listed free height. Isolator springs should not be loaded until the installation is complete, then adjust the springs to the vendor listed compression gap for the load point. When securing the isolator, do not over-tighten the mounting bolts. Over-tightening may result in cracking of the cast isolator housing and will have a negative impact on the isolation effect.

Installation of spring isolators requires flexible piping connections and at least three feet of flexible electrical conduit to avoid straining the piping and transmitting vibration and noise. Neoprene waffle pads, supplied by customers, should be mounted at the defined mounting point locations along the full rail width.

Mounting locations for each model can be found in [Figure 9 on page 14](#).

**Table 7: Isolator Kit Selections - No Louvers**

Isolator Kit Selections - No Louvers										
AMZ-A Model	Kit P/N	Rubber-In-Shear (RIS) Mounts				Kit P/N	Spring Isolator Mountings			
		M1	M2	M3	M4		M1	M2	M3	M4
AMZ010	332948111	Red	Red	Red	Red	332948120	Black	Black	Red	Red
AMZ015	332948111	Red	Red	Red	Red	332948121	Black	Dk Purple	Red	Black
AMZ020	332948111	Red	Red	Red	Red	332948121	Black	Dk Purple	Red	Black
AMZ025	332948111	Red	Red	Red	Red	332948121	Black	Dk Purple	Red	Black
AMZ030	332948111	Red	Red	Red	Red	332948121	Black	Dk Purple	Red	Black
AMZ035	332948112	Red	Green	Red	Red	332948122	Dk Purple	Dk Green	Red	Black
AMZ040	332948112	Red	Green	Red	Red	332948123	Dk Purple	Dk Green	Black	Black

**Table 8: Isolator Kit Selections - With Louvers**

Isolator Kit Selections - With Louvers										
AMZ-A Model	Kit P/N	Rubber-In-Shear (RIS) Mounts				Kit P/N	Spring Isolator Mountings			
		M1	M2	M3	M4		M1	M2	M3	M4
AMZ010	332948111	Red	Red	Red	Red	332948124	Dk Purple	Dk Purple	Black	Black
AMZ015	332948112	Red	Green	Red	Red	332948124	Dk Purple	Dk Purple	Black	Black
AMZ020	332948112	Red	Green	Red	Red	332948124	Dk Purple	Dk Purple	Black	Black
AMZ025	332948113	Green	Green	Red	Red	332948124	Dk Purple	Dk Purple	Black	Black
AMZ030	332948113	Green	Green	Red	Red	332948124	Dk Purple	Dk Purple	Black	Black
AMZ035	332948113	Green	Green	Red	Red	332948125	Dk Purple	Dk Green	Black	Dk Purple
AMZ040	332948113	Green	Green	Red	Red	332948125	Dk Purple	Dk Green	Black	Dk Purple

**Table 9: Electrical Data**

Model Size	Voltage	Single Point Field Data				
		Ratings (Amps)			Lug Range (AWG)	
		MCA	RFS	MFS	Power Block	Disconnect Switch
010A	208V	54	70	70	(1) 14-2/0	(1) 12-1/0
	230V	54	70	70	(1) 14-2/0	(1) 12-1/0
	380V	32	40	40	(1) 14-2/0	(1) 12-1/0
	460V	28	35	35	(1) 14-2/0	(1) 12-1/0
	575V	23	30	30	(1) 14-2/0	(1) 12-1/0
	400V	29	35	35	(1) 14-2/0	(1) 12-1/0
015A	208V	78	100	100	(1) 14-2/0	(1) 12-1/0
	230V	78	100	100	(1) 14-2/0	(1) 12-1/0
	380V	46	60	60	(1) 14-2/0	(1) 12-1/0
	460V	39	50	50	(1) 14-2/0	(1) 12-1/0
	575V	34	40	45	(1) 14-2/0	(1) 12-1/0
	400V	40	50	50	(1) 14-2/0	(1) 12-1/0
020A	208V	88	110	110	(1) 14-2/0	(1) 4-300MCM
	230V	88	110	110	(1) 14-2/0	(1) 4-300MCM
	380V	56	70	70	(1) 14-2/0	(1) 12-1/0
	460V	42	50	50	(1) 14-2/0	(1) 12-1/0
	575V	35	45	45	(1) 14-2/0	(1) 12-1/0
	400V	44	60	60	(1) 14-2/0	(1) 12-1/0
025A	208V	127	150	175	(1) 2-600MCM	(1) 6-350MCM
	230V	127	150	175	(1) 2-600MCM	(1) 6-350MCM
	380V	69	90	90	(1) 14-2/0	(1) 12-1/0
	460V	58	70	80	(1) 14-2/0	(1) 12-1/0
	575V	51	60	70	(1) 14-2/0	(1) 12-1/0
	400V	59	70	80	(1) 14-2/0	(1) 12-1/0
030A	208V	137	175	175	(1) 2-600MCM	(1) 6-350MCM
	230V	137	175	175	(1) 2-600MCM	(1) 6-350MCM
	380V	85	110	110	(1) 14-2/0	(1) 4-300MCM
	460V	68	80	90	(1) 14-2/0	(1) 12-1/0
	575V	59	70	80	(1) 14-2/0	(1) 12-1/0
	400V	68	80	90	(1) 14-2/0	(1) 12-1/0
035A	208V	162	200	225	(1) 2-600MCM	(1) 6-350MCM
	230V	162	200	225	(1) 2-600MCM	(1) 6-350MCM
	380V	86	110	110	(1) 14-2/0	(1) 4-300MCM
	460V	73	90	100	(1) 14-2/0	(1) 12-1/0
	575V	62	80	80	(1) 14-2/0	(1) 12-1/0
	400V	73	90	100	(1) 14-2/0	(1) 12-1/0
040A	208V	179	225	250	(1) 2-600MCM	(1) 6-350MCM
	230V	179	225	250	(1) 2-600MCM	(1) 6-350MCM
	380V	88	110	110	(1) 14-2/0	(1) 4-300MCM
	460V	77	100	100	(1) 14-2/0	(1) 12-1/0
	575V	63	80	80	(1) 14-2/0	(1) 12-1/0
	400V	77	100	100	(1) 14-2/0	(1) 12-1/0



Figure 10: Unit/Field Wiring Diagram

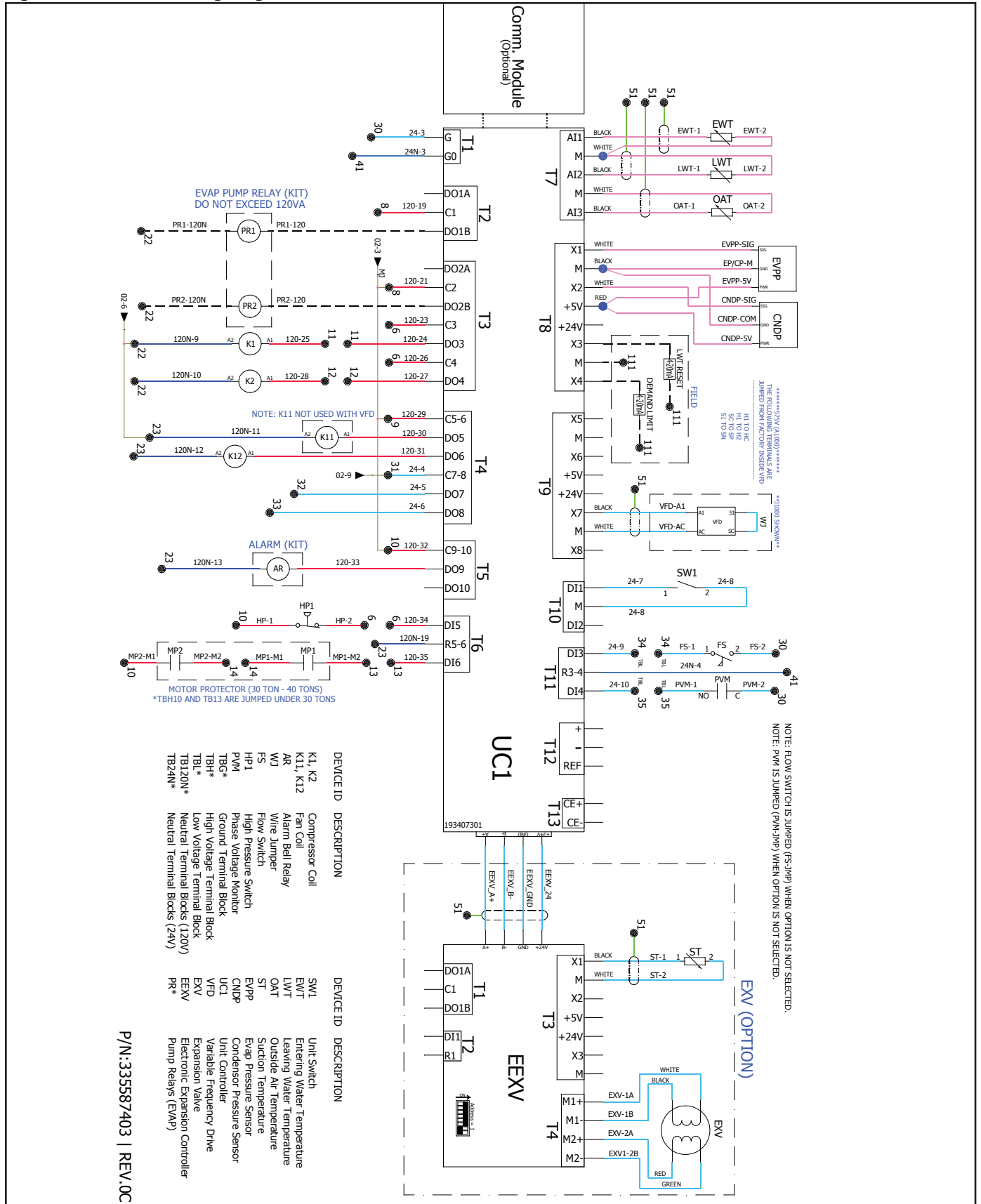


Figure 11: Pressure Drop Curves - Unit Evaporator (Reference Table 10 below)

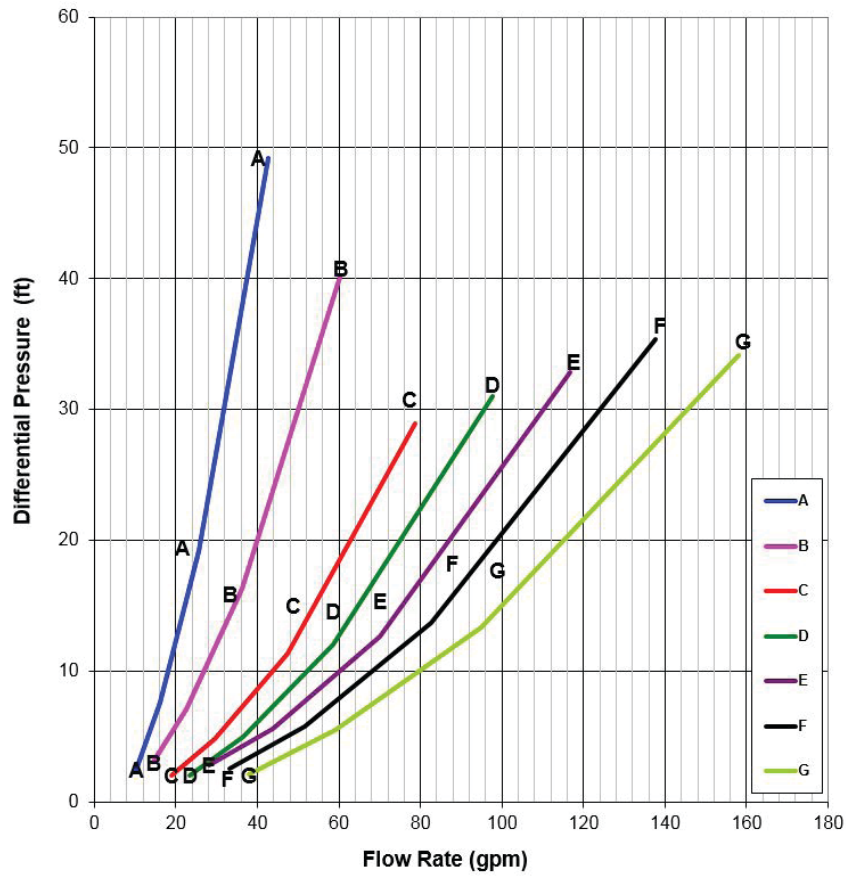


Table 10: Pressure Drop Data - Unit Evaporator

Curve Ref.	Model	Part Load Flow System Only Minimum Flow Rate <sup>2</sup>				Full Load Flow System Only Minimum Flow Rate <sup>1</sup>				Fixed and Variable Flow Systems							
		IP		SI		IP		SI		Nominal Flow Rate				Maximum Flow Rate			
		GPM	DP ft.	lps	DP kpa	GPM	DP ft.	lps	DP kpa	GPM	DP ft.	lps	DP kpa	GPM	DP ft.	lps	DP kpa
A	010A	10.3	2.5	0.6	7.5	16.1	7.6	1.0	22.8	25.7	19.2	1.6	57.5	42.8	49.3	2.7	147.3
B	015A	14.5	3.1	0.9	9.2	22.7	7.1	1.4	21.3	36.2	16.3	2.3	48.7	60.4	40.2	3.8	120.2
C	020A	18.9	2.1	1.2	6.2	29.6	4.8	1.9	14.4	47.3	11.3	3.0	33.9	78.8	29.0	5.0	86.6
D	025A	23.4	2.1	1.5	6.2	36.6	5.1	2.3	15.1	58.6	12.1	3.7	36.1	97.6	31.0	6.1	92.7
E	030A	28.0	2.8	1.8	8.4	43.8	5.6	2.8	16.8	70.1	12.7	4.4	38.0	116.8	32.8	7.4	98.2
F	035A	33.0	2.5	2.1	7.6	51.6	5.8	3.3	17.4	82.6	13.7	5.2	41.1	137.6	35.4	8.7	105.8
G	040A	37.9	2.1	2.4	6.3	59.3	5.5	3.7	16.4	94.8	13.3	6.0	39.9	158.0	34.2	10.0	102.1

**NOTE:** Pressure Drop data shown for 60 Hz models only

**Table 11: Physical Data, 60 Hz models**

Data	AMZ010A	AMZ015A	AMZ020A	AMZ025A	AMZ030A	AMZ035A	AMZ040A
<b>BASIC DATA</b>							
Unit Operating Charge lbs	18	18	18	29	29	29	29
Unit Dimensions	88.0 x 50.9 x	88.0 x 50.9 x	88.0 x 50.9 x	88.0 x 50.9 x	88.0 x 50.9 x	88.0 x 50.9 x	88.0 x 50.9 x
L x W x H, in.	91.9	91.9	91.9	91.9	91.9	91.9	91.9
Package Unit Operating Weight, lbs. (kg)	1401 (638)	1461 (664)	1447 (658)	1532 (696)	1547 (703)	1775 (807)	1908 (867)
Package Unit Shipping Weight, lbs (kg)	1394 (634)	1454 (661)	1440 (655)	1524 (693)	1538 (699)	1759 (800)	1890 (859)
Weight-Add for (Upper) Louvered Panels, lbs (kg)	183 (83)						
Weight-Add for (Lower) Louvered Panels, lbs (kg)	114 (52)						
<b>COMPRESSORS, SCROLL, HERMETIC</b>							
Nominal HP	5 / 5	7.5 / 7.5	10.0 / 10.0	13.0 / 13.0	15.0 / 15.0	15.0 / 20.0	20.0 / 20.0
Oil charge per Compressor , oz (g)	56 (1588)	85 (2410)	85 (2410)	110 (3119)	110 (3119)	110 (3119) / 152 (4495)	152 (4495)
Staging, 2 Stages	0-50-100	0-50-100	0-50-100	0-50-100	0-50-100	0-43-100 / 0-57-100	0-50-100
<b>CONDENSERS, HIGH EFFICIENCY MICROCHANNEL TYPE</b>							
Coil Inlet Face Area, sq. ft. (sq. m.)	26.5 (2.46)	26.5 (2.46)	26.5 (2.46)	53 (4.92)	53 (4.92)	53 (4.92)	53 (4.92)
Rows Deep/Fins Per Inch	1 / 21	1 / 21	1 / 21	1 / 21	1 / 21	1 / 21	1 / 21
<b>CONDENSER FANS, DIRECT DRIVE PROPELLER TYPE</b>							
# of Fans per Circuit - Fan Diameter in (mm)	2 - 30 (762)	2 - 30 (762)	2 - 30 (762)	2 - 30 (762)	2 - 30 (762)	2 - 30 (762)	2 - 30 (762)
Fan Motor, hp (kW)	1.5 (1.1)	1.5 (1.1)	1.5 (1.1)	1.5 (1.1)	1.5 (1.1)	2.0 (1.5)	2.0 (1.5)
Fan & Motor RPM	1140	1140	1140	1140	1140	1140	1140
Fan Tip Speed, fpm (m/s)	8950 (45)	8950 (45)	8950 (45)	8950 (45)	8950 (45)	8950 (45)	8950 (45)
Airflow, cfm (l/s)	17,000 (8023)	17,000 (8023)	17,000 (8023)	20,200 (9533)	20,200 (9533)	24,000 (11327)	24,000 (11327)
<b>EVAPORATOR, DIRECT EXPANSION PLATE TO PLATE</b>							
Evaporator, Model	F85x46	F85x70	F200x40	F200x48	F200x56	F200x64	F200x76
Dry Weight lbs (kg)	19.7 (8.9)	27.6 (12.5)	57.9 (26.3)	65.8	72.7	80.1	91.3
Water Volume, gallons (liters)	0.6 (2.3)	0.8 (3.0)	1.3 (4.9)	1.5 (5.7)	1.8 (6.8)	2 (7.6)	2.4 (9.1)
Groove inlet/outlet conn. in. (mm)	2 (50.8)	2 (50.8)	2 (50.8)	2 (50.8)	2 (50.8)	2 (50.8)	2 (50.8)
Max. Water Pressure, psi (kPa)	696 (48)	696 (48)	652 (48)	652 (48)	652 (48)	652 (48)	652 (48)
Max. Refrigerant Press., psi (kPa)	696 (48)	696 (48)	652 (48)	652 (48)	652 (48)	652 (48)	652 (48)

**NOTE:** Physical data shown for 60 Hz models only

## General Description

The unit only has a single refrigerant circuit with one or two condenser coils. The MicroTech® III controller's design not only permits the chiller to run more efficiently, but also can simplify troubleshooting if a system failure occurs. Every MicroTech® III controller is programmed and tested prior to shipment to facilitate start-up.

The controller menu structure is separated into three distinct categories that provide the operator or service technician with a full description of:

1. current unit status
2. control parameters
3. alarms

Security protection prevents unauthorized changing of the setpoints and control parameters.

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

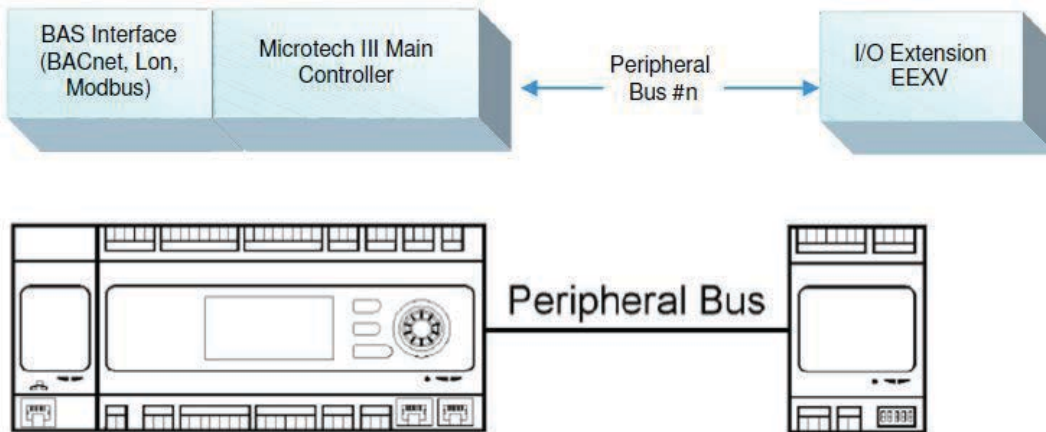
## System Architecture

The overall controls architecture uses the following:

- One MicroTech® III unit controller
- I/O EXV extension modules as needed depending on the configuration of the unit
- Communications interface(s) as needed based on installed options

Communication interface modules will connect directly to the left side of the unit controller. I/O extensions will connect via peripheral bus using the connection on the right side of the controller. All of the I/O extension modules can connect directly or using a wiring harness.

**Figure 12: System Architecture**



# Controller Inputs and Outputs

## Main Controller

Table 12: Analog Inputs

#	Description	Signal Type	Expected Range
AI1	Evaporator EWT	NTC 10k	340 to 300k Ω
AI2	Evaporator LWT	NTC 10k	340 to 300k Ω
AI3	Ambient Temp	NTC 10k	340 to 300k Ω
X1	Evaporator Pressure	Voltage	0.4 to 4.6 volts
X2	Condenser Pressure	Voltage	0.4 to 4.6 volts
X4	Demand Limit	4-20 mA	1 to 23 mA
X3	LWT Reset	4-20 mA	1 to 23 mA

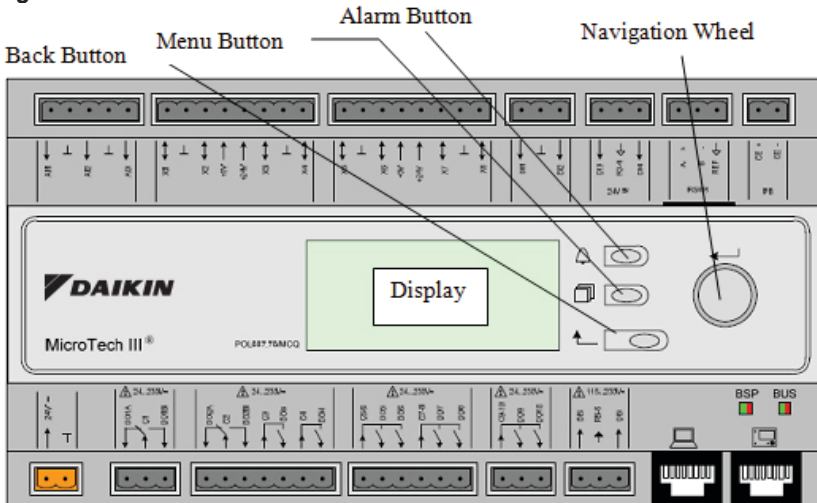
Table 13: Digital Inputs

	Description	Signal Off	Signal On
DI4	Motor Protection	Fault	No Fault
DI3	Evaporator Flow Switch	No Flow	Flow
DI5	Mechanical High Pressure Switch	Fault	No Fault
DI6	PVM/GFP	Fault	No Fault
DI1	Unit Switch	Unit Disable	Unit Enable

Table 14: Digital Outputs

	Description	Output Off	Output On
DO1	Evaporator Water Pump 1	Pump Off	Pump On
DO9	Alarm Indicator	Alarm Not Active	Alarm Active
DO5	Fan Output 1	Fan Off	Fan On
DO6	Fan Output 2	Fan Off	Fan On
DO3	Compressor #1	Compressor Off	Compressor On
DO4	Compressor #2	Compressor Off	Compressor On
DO2	Evaporator Water Pump 2	Pump Off	Pump On
DO8	Hot Gas Bypass SV	Solenoid Closed	Solenoid Open
DO7	Liquid Line SV	Solenoid Closed	Solenoid Open

Figure 13: Schematic of Unit Controller



## EEXV Module

This module will be used only when the expansion valve type is electronic.

Table 15: Digital Outputs

	Description	Signal Type	Expected Range
X1	Suction Temperature	NTC 10k	340 to 300k Ω

Table 16: Stepper Motor Output

	Description
M1+, M1-	EXV Stepper Coil 1
M2+, M2-	EXV Stepper Coil 2

## Sensor Information

### Pressure

Pressure inputs will be read using 0 to 5 volt ratiometric sensors. Nominal voltage range will be 0.5 to 4.5 volts.

### Evaporator Pressure

Will be measured using sensors that read pressures from 34.5 kPa (5 PSI) to 2448 kPa (355 PSI) in the nominal voltage range.

### Condenser Pressure

Will be measured using sensors that read pressures from 29 kPa (4.2 PSI) to 4975 kPa (721.5 PSI) in the nominal voltage range.

### EXV Actuator Information

The electronic expansion valve used has a bipolar stepper motor. The stepper driver should be configured as follows:

- Total steps: 2500 steps
- Movement speed: 200 steps/second
- Move current: 100 mA
- Dead Time Sync: 480 Minutes

The keypad/display consists of a 5-line by 22-character display, three buttons (keys) and a “push and roll” navigation wheel. There is an Alarm Button, Menu (Home) Button and a Back Button. The wheel is used to navigate between lines on a screen (page) and to increase and decrease changeable values when editing. Pushing the wheel acts as an Enter Button and will jump from a link to the next set of parameters.

**Figure 14: Typical Screen**

•6	View/Set Unit	3
Status/Settings	>	
Set Up	>	
Temperature	>	
Date/Time/Schedule	>	

Generally, each line on the display contains a menu title, a parameter (such as a value or a setpoint), or a link (which will have an arrow in the right of the line) to a further menu.

The first line visible on each display includes the menu title and the line number to which the cursor is currently “pointing.” In the above screen, Temperature is highlighted.

The left most position of the title line includes an “up” arrow ▲ to indicate there are lines (parameters) “above” the currently displayed line; and/or a “down” arrow ▼ to indicate there are lines (parameters) “below” the currently displayed items or an “up/down” arrow • to indicate there are lines “above and below” the currently displayed line. The selected line is highlighted.

Each line on a screen can contain status-only information or may be a link to further menus. This is often referred to as a jump line, meaning pushing the navigation wheel will cause a “jump” to a new menu. An arrow (>) is displayed to the far right of the line to indicate it is a “jump” line and the entire line is highlighted when the cursor is on that line.

**NOTE:** Only menus and items that are applicable to the specific unit configuration are displayed.

This manual includes information relative to the operator level of parameters; data and setpoints necessary for the every day operation of the chiller. There are more extensive menus available for the use of service technicians.

## Navigating

When power is applied to the control circuit, the controller screen will be active and display the Home screen, which can also be accessed by pressing the Menu Button. The navigating wheel is the only navigating device necessary, although the MENU, ALARM, and BACK buttons can provide shortcuts as explained later.

## Passwords

Enter passwords from the Main Menu:

- Enter Password links to the Entry screen which is an editable screen. Pressing the wheel goes to the edit mode where the password (5321 for operator access) can be entered. The first (\*) will be highlighted, rotate the

wheel clockwise to the first number and set it by pressing the wheel. Repeat for the remaining three numbers. The password will time out after 10 minutes and is cancelled if a new password is entered or the control powers down.

- Not entering a password allows access to a limited number of parameters as shown in Figure 17.

**Figure 15: Password Menu**

Main Menu	1/3
Enter Password >	
Unit Status	
Off: Unit Sw	
ACTIVE SETPT 44.6°F	

**Figure 16: Password Entry Page**

Enter Password	1/1
Enter PW ****	

Entering an invalid password has the same effect as not entering a password.

Once a valid password has been entered, the controller allows further changes and access without requiring the user to enter a password until either the password timer expires or a different password is entered. The default value for this password timer is 10 minutes.

## Navigation Mode

When the navigation wheel is turned clockwise, the cursor moves to the next line (down) on the page. When the wheel is turned counter-clockwise the cursor moves to the previous line (up) on the page. The faster the wheel is turned the faster the cursor moves. Pushing the wheel acts as an “Enter” button.

Three types of lines exist:

- Menu title, displayed in the first line as in Figure 15.
- Link (also called Jump) having an arrow (>) in the right of the line and used to link to the next menu.
- Parameters with a value or adjustable setpoint.

For example, “Time Until Restart” jumps from level 1 to level 2 and stops there.

When the Back Button is pressed the display reverts back to the previously displayed page. If the Back button is repeatedly pressed the display continues to revert one page back along the current navigation path until the “main menu” is reached.

When the Menu (Home) Button is pressed the display reverts to the “main page.”

When the Alarm Button is depressed, the Alarm Lists menu is displayed.

## Edit Mode

The Editing Mode is entered by pressing the navigation wheel while the cursor is pointing to a line containing an editable field. Once in the edit mode pressing the wheel again causes the

editable field to be highlighted. Turning the wheel clockwise while the editable field is highlighted causes the value to be increased. Turning the wheel counter-clockwise while the editable field is highlighted causes the value to be decreased. The faster the wheel is turned the faster the value is increased or decreased. Pressing the wheel again cause the new value to be saved and the keypad/display to leave the edit mode and return to the navigation mode.

A parameter with an "R" is read only; it is giving a value or description of a condition. An "R/W" indicates a read and/or write opportunity; a value can be read or changed (providing the proper password has been entered).

Link and parameter access is indicated for the various password levels with one column for each level. Column headings for the password levels are as follows.

N = No password

O = Operator level

T = Technician level

Screen navigational links:

- For each link on a screen, the linked screen is indicated in the rightmost column.
- For each screen, the screen(s) from which you can navigate to it is also shown in parentheses after the screen identifier.
- For most circuit or compressor level parameters, there is a link to a screen that shows the values for all circuits/compressors which is indicated in the 'Links to screen' column as \*.

For many of the circuit level screens, only one screen will be shown in this section. The same set of screens exists for each circuit and compressor. These screens are the ones with 'Cx' and 'Cmpx' identifiers.

## Set Points

Set points are initially set to the values in the Default column, and can be adjusted to any value in the Range column. Set points are stored in permanent memory.

Basic unit configuration set points will require the unit to be off in order to make a change and then require rebooting the controller in order to apply a change.

**Table 17: Unit Level Set Point Defaults and Ranges**

Description	Default	Range
<b>Mode/Enabling</b>		
Unit Enable	Enable	Disable, Enable
Control source	Local	Local, Network
Available Modes	Cool	Cool, Cool w/Glycol, Cool/Ice w/Glycol, Ice, Test
<b>Staging and Capacity Control</b>		
Cool LWT 1	(44.6°F) 7°C	No Glycol: 39.9 to 60 °F (4.4 to 15.56 °C) Glycol: 14.9 to 60 °F (-9.5 to 15.56 °C)
Ice LWT	(39.9°F) 4.4°C	14.9 to 39.9 °F (-9.5 to 4.4 °C)
Startup Delta T	(10.1°F) 5.6°C	1.1 to 14.9 °F (0.6 to 8.3 °C)
Shut Down Delta T	(0.5°F) 0.3°C	0.5 to 3.1 °F (0.3 to 1.7 °C)
Stage Up Delay	240 sec	120 to 480 sec
Stage Down Delay	30 sec	20 to 60 sec
Stage Delay Clear	No	No, Yes
Max Pulldown Rate	(1.1°F/min) 0.6°C/min	0.2 to 4.9°F/min (0.1 to 2.7°C/min)
Full Capacity Evap Delta T	(16°F) 8.9 °C	5.9 to 16 °F (3.3 to 8.9 °C)
Variable Evaporator Flow	No	No, Yes
Demand Limit Enable	Disable	Disable, Enable
LWT Reset Enable	Disable	Disable, Enable
<b>Configuration and Timers</b>		
Evap Pump Control Configuration	#1 Only	#1 Only, #2 Only, Auto, #1 Primary, #2 Primary
Evap Recirc Timer	90	15 to 300 seconds
Clear Cycle Timers	No	No, yes
Expansion Valve Type	Thermal	Thermal, Electronic
Fan VFD Enable	Disable	Disable, Enable
Start-Start Time Delay	15 min	10-60 minutes
Stop-Start Time Delay	5 min	3-20 minutes
Ice Cycle Delay	12 hours	1-23 hours
Clear Ice Delay	No	No, Yes
<b>Unit Sensor Offsets</b>		
Evap LWT Sensor Offset	(0°F) 0°C	-9.0 to 9.0 °F (-5.0 to 5.0 °C)
Evap EWT Sensor Offset	(0°F) 0°C	-9.0 to 9.0 °F (-5.0 to 5.0 °C)
OAT Sensor Offset	(0°F) 0°C	-9.0 to 9.0 °F (-5.0 to 5.0 °C)
<b>Alarm and Limit Settings</b>		
Evaporator Water Freeze	(36°F) 2.2°C	No Glycol: 36 to 42.1 °F (2.2 to 5.6 °C) Glycol: 12.6 to 42.1 °F (-10.8 to 5.6 °C)
Evaporator Flow Proof	5 sec	5 to 15 sec
Evaporator Recirculate Timeout	3 min	1 to 10 min
Low OAT Start Time	165 sec	150 to 240 sec
Low Ambient Lockout	(35.1°F) 1.7°C	No Fan VFD: 32 to 60.1 °F (0 to 15.6 °C) Fan VFD: -9.9 to 60.1 °F (-23.3 to 15.6 °C)
Clear Alarms	Off	Off, On
Network Clear Alarms	Off	Off, On
Low Evap Pressure Unload	689.5 KPA (100 PSI)	No Glycol: 669 to 793 kPa (97 to 115 PSI) Glycol: 317 to 793 kPa (46 to 115 PSI)
Low Evap Pressure Hold	696.4 KPA (101 PSI)	No Glycol: 669 to 793 kPa (97 to 115 PSI) Glycol: 317 to 793 kPa (46 to 115 PSI)
High Condenser Pressure	4240 KPA (615 PSI)	3310 to 4275 KPA (480 to 620 PSI)
High Condenser Pressure Unload	4137 KPA (600 PSI)	3241 to 4137 KPA (470 to 600 PSI)
<b>BAS Control Inputs</b>		
Network Unit Enable	Disable	Disable, Enable
Network Mode Command	Cool	Cool, Ice
Network Cool Set Point	(44.6°F) 7°C	No Glycol: 39.9 to 60 °F (4.4 to 15.56 °C) Glycol: 14.9 to 60 °F (-9.5 to 15.56 °C)



Network Ice Set Point	39.9°F (4.4°C)	14.9 to 39.9 °F (-9.5 to 4.4 °C)
Network Capacity Limit	100%	0 to 100%
Network Alarm Clear Command	Normal	Normal, Clear Alarm

Description	Default	Range
<b>Mode/Enabling</b>		
Compressor 1 Enable	Auto	Auto, Off
Compressor 2 Enable	Auto	Auto, Off
Network Compressor 1 Enable	Auto	Auto, Off
Network Compressor 2 Enable	Auto	Auto, Off
<b>EXV Settings</b>		
EXV control	Auto	Auto, manual
EXV position	See Special Setpoints	0% to 100%
Suction SH Target @100% (3)	10°F (5.56°C)	8 to 12 °F (4.44 to 6.67 °C)
Max Evap Pressure	1075.6 KPA (156 PSI)	979 to 1172 KPA (142 to 170 PSI)
<b>Condenser Control</b>		
Condenser Target 100%	100°F (37.78°C)	90 to 120 °F (32.22 to 48.89 °C)
Condenser Target 50%	90°F (32.22°C)	85°F to 110°F (29.44 to 43.33 °C)
VFD Max Speed	100%	90 to 110%
VFD Min Speed	25%	25 to 60%
Fan Stage Up Deadband 1	See Dynamic Set Point Ranges	See Dynamic Set Point Ranges
Fan Stage Up Deadband 2	See Dynamic Set Point Ranges	See Dynamic Set Point Ranges
<b>Sensor Offsets</b>		
Evap Pressure Offset	0 KPA (0 PSI)	-100 to 100 KPA (-14.5 to 14.5 PSI)
Cond Pressure Offset	0 KPA (0 PSI)	-100 to 100 KPA (-14.5 to 14.5 PSI)
Suction Temp Offset	0°F (0°C)	-9.0 to 9.0 °F (-5.0 to 5.0 °C)

## Special Set Point Operation

The following set points should not be changeable unless the unit switch is off:

- Unit Model
- Available Modes
- Expansion Valve Type
- Fan VFD Enable

The Compressor Enable set points should not be changeable unless the corresponding modular unit is not running.

EXV Position set point should follow the actual EXV position, while EXV Control = Auto. When EXV Control = Manual, the position set point should be changeable.

The following settings should automatically be set back to Off after being On for 1 second:

- Clear Alarms
- Network Clear Alarms
- Clear Cycle Timers
- Clear Ice Timer
- Stage Delay Clear

## Test Mode Operations

All outputs should be manually controllable in test mode via set points. For each output, there should be a set point that is changeable only when test mode is enabled.

When the unit mode is no longer Test, all test mode set points should be changed back to their 'off' values. The compressor outputs are a special case, and should be allowed to remain on for 3 seconds before being automatically set back to 'off'.

All outputs other than EXV Position and Fan VFD Speed should default to 'Off' and have a range including 'Off' and 'On'. The EXV Position and Fan VFD Speed should default to 0% and have a range of 0% to 100%. Output Set Points below:

Unit Outputs	Circuit Outputs
Unit Alarm	Compressor 1
Evaporator Pump 1	Compressor 2
Evaporator Pump 2	Liquid Line
	Hot Gas Bypass
	EXV Position
	Fan Output 1
	Fan Output 2
	Fan VFD Speed

The calculations in this section are used in unit level control logic or in control logic across all circuits.

## Water Delta T

The evaporator water delta T is calculated as entering water temperature minus leaving water temperature.

## LWT Slope

LWT slope is calculated such that the slope represents the estimated change in LWT over a time frame of one minute.

## Pulldown Rate

The slope value calculated above will be a negative value as the water temperature is dropping. A pulldown rate is calculated by inverting the slope value and limiting to a minimum value of 32°F / 0°C/min.

## LWT Error

LWT error is calculated as LWT – LWT target.

## Unit Capacity

For applying unit capacity limits, an estimate of total unit capacity is needed. Unit capacity will be based on the estimated circuit capacities.

The unit capacity is the number of compressors running (on circuits that are not pumping down) divided by the number of compressors on the unit.

## Control Band

The Control Band defines the band in which unit capacity will not be increased or decreased.

### Constant Evaporator Flow

If Variable Evaporator Flow set point is set to No, the control band is calculated as follows:

- Control Band = Full Capacity Evap Delta T Set Point \* 0.6

### Variable Evaporator Flow

When the unit set point for Variable Evaporator Flow is set to Yes, the control band increases as capacity decreases to account for the decrease in flow. It is assumed that the flow will vary to maintain the full capacity evaporator temperature delta at part load conditions. The control band is limited at each capacity step to a maximum value that corresponds to the minimum flow for that capacity step.

Since evaporator flow is represented by the set point Full Capacity Evaporator Delta T, the calculations of the control band for variable flow applications are explained in terms of delta T also. The term 'Effective Full Capacity Delta T' means the approximate temperature delta that would be observed with the unit running at full capacity for the given flow. 'Nominal flow' means the flow that is needed for a 5.56°C (10°F) delta T at full unit capacity.

**Table 18: Minimum Flows and Corresponding Maximum Effective Full Capacity Delta T with Variable Flow**

Number of Compressors	Unit Capacity	Minimum Flow (nominal %)	Max Effective Full Capacity DT
2	100%	62.5%	16 °F (8.9 °C)
1	50%	40%	25 °F (13.9 °C)

For variable evaporator flow, the Control Band is calculated as follows:

- Effective Full Capacity Delta T = (Full Capacity Evap Delta T\* 100) /Unit Capacity
- If above value is more than the Max Effective Full Capacity dT listed in the table above for the corresponding unit capacity, it is set equal to the value in the table.
- Effective Full Capacity Delta T with the limit applied is then multiplied by 0.6. This gives the total control band for the unit configuration and actual unit capacity.

## Staging Temperatures

If the unit is configured for use without glycol:

When the LWT target is more than half the Control Band above 3.9°C (39.0°F)

- Stage Up Temperature = LWT target + (Control Band\*2/3)
- Stage Down Temperature = LWT target – (Control Band/3)

If the LWT target is less than half the Control Band above 3.9°C (39.0°F)

- Stage Down Temperature = 3.9°C (39.0°F)
- Stage Up temperature = Control Band + 3.9°C (39.0°F)

If the unit is configured for use with glycol, the compressor staging temperatures are calculated as shown below:

- Stage Up Temperature = LWT target + (Control Band\*2/3)
- Stage Down Temperature = LWT target – (Control Band/3)

The Start up and Shutdown temperatures are referenced from the Control Band:

- Start Up Temperature = Stage Up Temperature + Start Up Delta set point
- Shutdown Temperature = Stage Down Temperature – Shutdown Delta set point

## Unit Enable

Enabling and disabling the chiller or system is accomplished using set points and inputs to the chiller. The enabling switch and Enable Set Point are required to be 'on' for the unit to be enabled when the control source is set to 'local'. The same is true if the control source is set to 'network', with the additional requirement that the BAS Enable set point must be 'on'.

Unit is enabled according to the following table:

Unit Switch	Control Source Set Point	Unit Enable Set Point	BAS Enable Set Point	Unit Enable
Off				Off
		Off		Off
				Off
On	Local	On		On
	Network		Off	Off
On	Network	On	On	On

## Unit Mode Selection

The operating mode of the unit is determined by setpoints and inputs to the chiller. The Available Modes Set Point determines what modes of operation can be used. This set point also determines whether the unit is configured for glycol use. The Control Source Set Point determines where a command to change modes will come from. A digital input switches between cool mode and ice mode if they are available and the control source is set to 'local.' The BAS mode request switches between cool mode and ice mode if they are both available and the control source is set to 'network.'

The Available Modes Set Point should only be changeable when the unit switch is off. This is to avoid changing modes of operation inadvertently while the chiller is running.

Table 19: Unit Mode Settings

Control Source Set Point	Mode Input	BAS Request	Available Modes Set Point	Unit Mode
			Cool	Cool
			Cool w/ Glycol	Cool
Local	Off		Cool/Ice w/ Glycol	Cool
Local	On		Cool/Ice w/ Glycol	Ice
Network		Cool	Cool/Ice w/ Glycol	Cool
Network		Ice	Cool/Ice w/ Glycol	Ice
			Ice w/Glycol	Ice
			Test	Test

## Glycol Configuration

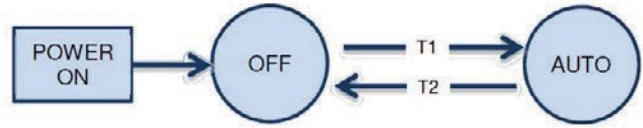
If the Available Modes Set Point is set to an option 'w/Glycol,' then glycol operation should be enabled for the unit. Glycol operation should only be disabled when the Available Modes Set Point is set to 'Cool.'

## Unit States

The unit will always be in one of three states:

- Off – Unit is not enabled to run
- Auto – Unit is enabled to run

Transitions between these states are shown in the following diagram.



### T1 - Off to Auto

All of the following are required:

- Unit Enable = On
- No Unit Alarm active
- At least one compressor is enabled to start
- If Unit Mode = Ice then Ice Delay not active
- Low Ambient Lockout is not active
- Unit configuration changed is not active
- Valid configuration is active

### T2 - Auto to Off

Any of the following are required:

- Unit alarm is active
- Low Ambient Lockout is active
- Unit Enable = Off
- Unit Mode = Ice AND LWT target is reached
- All compressors are disabled via set points

## Motor Protection Module Power Up Start Delay

After powering up the unit, the motor protection modules may not be engaged for a period of time. Therefore, 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.

## Ice Mode Start Delay

An adjustable start to start ice delay timer will limit the frequency with which the chiller may start in Ice mode. The timer starts when the first compressor starts while the unit is in ice mode. While this timer is active, the chiller cannot restart in Ice mode. The time delay is adjustable via the Ice Time Delay set point.

The ice delay timer may be manually cleared to force a restart in ice mode. A set point specifically for clearing the ice mode delay is available.

## Low Ambient Lockout

When the OAT drops below the low ambient lockout set point and the OAT sensor fault is not active, low ambient lockout is triggered. The unit should go into the Pumpdown state if any compressors are running. If no compressors are running the unit should go into the off state. This condition should

clear when OAT rises to the lockout set point plus 2.8°C (5°F).  
Lockout and Stop Operation

## Unit Status

The displayed unit status should be determined by the conditions in the following table:

#	Status	Conditions
1	Auto	Unit State = Auto
2	Auto: Motor Prot Delay	Unit State = Auto and MP start up delay is active
4	Off: Ice Mode Timer	Unit State = Off, Unit Mode = Ice, and Ice Delay = Active
5	Off: Low OAT Lockout	Unit State = Off and Low OAT Lockout is active
6	Off: All Comp Disabled	Unit State = Off and all compressors unavailable
7	Off: Unit Alarm	Unit State = Off and Unit Alarm active
8	Off: Keypad Disable	Unit State = Off and Unit Enable Set Point = Disable
9	Off: Remote Switch	Unit State = Off and Remote Switch is open
10	Off: BAS Disable	Unit State = Off, Control Source = Network, and BAS Enable = false
11	Off: Unit Switch	Unit State = Off and Unit Switch = Disable
12	Off: Test Mode	Unit State = Off and Unit Mode = Test
13	Auto: Wait for load	Unit State = Auto, no circuits running, and LWT is less than the active set point + startup delta
14	Auto: Evap Recirculate	Unit State = Auto and Evaporator State = Start
15	Auto: Wait for flow	Unit State = Auto, Evaporator State = Start, and Flow Switch is open
17	Auto: Max Pulldown Rate	Unit State = Auto, max pulldown rate has been met or exceeded
18	Auto: Unit Cap Limit	Unit State = Auto, unit capacity limit has been met or exceeded
23	Off: Invalid Config	Unit model selected not valid
24	Cfg Chg, Rst Ctr	A configuration change requiring a reboot occurred but controller has not been rebooted yet.

## Evaporator Pump Control

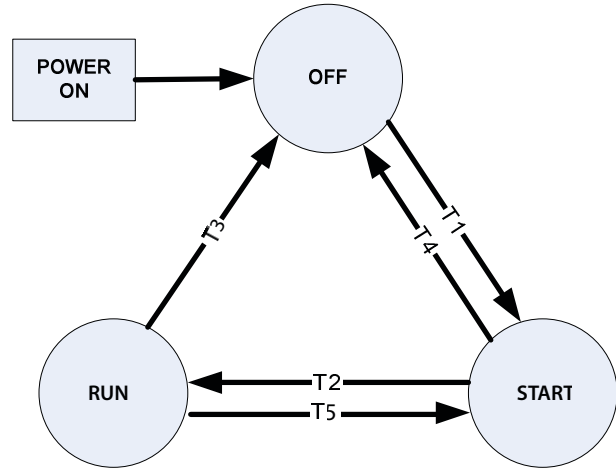
For control of the evaporator pumps, three evaporator pump control states should be used:

Off - No pump on.

Start – Pump is on, water loop is being recirculated.

Run – Pump is on, water loop has been recirculated and circuits can start if needed.

Transitions between these states are shown in the following diagram.



### T1 – Off to Start

Requires any of the following

- Unit state = Auto
- Freeze protection started

### T2 – Start to Run

Requires the following

- Flow ok for time longer than evaporator recirculate time set point

### T3 – Run to Off

Requires all of the following

- Unit state is Off
- Freeze protection not active

### T4 – Start to Off

Requires all of the following

- Unit state is Off
- Freeze protection not active

### T5 – Run to Start

This transition should occur per the requirements for pump staging and evaporator flow loss alarm.

## Freeze Protection

To protect the evaporator from freezing, the evaporator pump will start if all of the following are true:

- LWT equal to or less than the Evap Freeze set point for at least three seconds
- LWT sensor fault isn't active
- manual reset flow loss alarm is not active

Freeze protection will end when any of the following are true:

- [LWT is at least 1.11°C (2°F) above the Evap Freeze set point OR LWT sensor fault is active] and pump has been

in run state for at least 15 minutes

- manual reset flow loss alarm is active

## Pump Selection

The pump output used will be determined by the Evap Pump Control set point. This setting allows the following configurations:

- #1 only – Pump 1 will always be used
- #2 only – Pump 2 will always be used
- Auto – The primary pump is the one with the least run hours, the other is used as a backup
- #1 Primary – Pump 1 is used normally, with pump 2 as a backup
- #2 Primary – Pump 2 is used normally, with pump 1 as a backup

## Primary/Standby Pump Staging

The pump designated as primary will start first. If the evaporator state is set to start for a time greater than the recirculate timeout set point and there is no flow, then the primary pump will shut off and the standby pump will start. When the evaporator is in the run state, if flow is lost for more than half of the flow proof set point value, the primary pump will shut off and the standby pump will start. Once the standby pump is started, the flow loss alarm logic will apply if flow cannot be established in the evaporator start state, or if flow is lost in the evaporator run state.

## Auto Control

If auto pump control is selected, the primary/standby logic above is still used. When the evaporator is not in the run state, the run hours of the pumps will be compared. The pump with the least hours will be designated as the primary at this time.

## Leaving Water Temperature (LWT) Target

The LWT Target varies based on settings and inputs.

The base LWT Target is selected as follows:

Control Source Set Point	Mode Input	BAS Request	Available Modes Set Point	Base LWT Target
Local	OFF	-	COOL	Cool Set Point 1
Local	ON	-	COOL	Cool Set Point 2
Network	-	-	COOL	BAS Cool Set Point
Local	OFF	-	COOL w/ Glycol	Cool Set Point 1
Local	ON	-	COOL w/ Glycol	Cool Set Point 2
Network	-	-	COOL w/ Glycol	BAS Cool Set Point
Local	OFF	-	COOL/ICE w/Glycol	Cool Set Point 1
Local	ON	-	COOL/ICE w/Glycol	Ice Set Point
Network	-	COOL	COOL/ICE w/Glycol	BAS Cool Set Point
Network	-	ICE	COOL/ICE w/Glycol	BAS Ice Set Point
Local	-	-	ICE w/ Glycol	Ice Set Point
Network	-	-	ICE w/ Glycol	BAS Ice Set Point

## LWT Reset

The base LWT target may be reset if the unit is in Cool mode and LWT reset is enabled via the set point.

The reset amount is adjusted based on the 4 to 20 mA reset input. Reset is 0° if the reset signal is less than or equal to 4 mA. Reset is 5.56°C (10.0°F) if the reset signal equals or exceeds 20 mA. The amount of reset will vary linearly between these extremes if the reset signal is between 4 mA and 20 mA.

When the reset amount increases, the Active LWT Target is changed at a rate of 0.1°C every 10 seconds. When the active reset decreases, the Active LWT Target is changed all at once.

After the reset is applied, the LWT target can never exceed a value of 15.56°C (60°F).

## Unit Capacity Control

Unit capacity control will be performed as described in this section. All unit capacity limits described in following sections must be applied as described.

## Compressor Staging in Cool Mode

Start First Compressor when all of the following are true:

- Evaporator LWT is greater than the Startup Temperature
- Motor protect delay is not active.

Add a compressor when all of the following are true:

- Evaporator LWT is greater than the Stage Up Temperature

- Stage Up Delay is not active
- Unit capacity hold is not active
- Max pull down rate is not active

Subtract a compressor when all of the following are true:

- More than one compressor running
- Evaporator LWT is lower than the Stage Down Temperature
- Stage Down Delay is not active.

Stop the last compressor when all of the following are true:

- One compressor running
- Evaporator LWT is lower than the Shut Down Temperature

**Stage Up Delay**

A minimum amount of time, defined by the Stage Up Delay set point, should pass between increases in the capacity stage. This delay should only apply when at least one compressor is running. If the first compressor starts and quickly shuts off for some reason, another compressor may start without this minimum time passing.

**Stage Down Delay**

A minimum amount of time, defined by the Stage Down Delay set point, should pass between decreases in the capacity stage.

**Compressor Staging in Ice Mode**

The first compressor on the unit should be started when evaporator LWT is higher than the Startup Temperature.

Start second compressor when Stage Up Delay is not active.

The unit should shut down when evaporator LWT is less than the LWT target.

**Stage Up Delay**

A fixed stage up delay of one minute between compressor starts should be used in this mode.

**Staging Sequence**

This section defines which compressor is the next one to start or stop. In general, compressors with fewer starts will normally start first, and compressors with more run hours will normally stop first.

**Next To Start**

If both circuits have an equal number of compressors running or a circuit has no compressors available to start:

- the available compressor with the least starts will be next to start
- if starts are equal, the one with the least run hours will be next to start
- if run hours are equal, the lowest numbered one will be next to start

**Next to Stop**

If both circuits have an equal number of compressors running:

- the running compressor with the most run hours will be next to stop
- if run hours are equal, the one with the least starts will be next to stop
- if starts are equal, the lowest numbered one will be next to stop

**Unit Capacity Overrides**

Unit capacity limits can be used to limit total unit capacity in Cool or Cool with Glycol modes only. Multiple limits may be active at any time, and the lowest limit is always used in the unit capacity control.

**Demand Limit**

The maximum unit capacity can be limited by a 4 to 20 mA signal on the Demand Limit analog input. This function is only enabled if the Demand Limit set point is set to ON. The maximum unit capacity stage is determined as shown in the following table:

**Table 20: Stage Limits**

Demand Limit Signal (%)	Demand Limit Range (mA)	Stage
Limit ≥ 50%	Limit ≥ 12 mA	1
Limit < 50%	Limit < 12 mA	2

**Network Limit**

The maximum unit capacity can be limited by a network signal. This function is only enabled if the control source is set to network. The maximum unit capacity stage is based on the network limit value received from the BAS and is determined as shown in the following table:

**Table 21: Stage Limits - Four Compressors**

Network Limit	Stage
Limit ≥ 50%	2
Limit ≤ 50%	1

**Maximum LWT Pulldown Rate**

Only in Cool mode the maximum rate at which the leaving water temperature can drop shall be limited by the Maximum Pulldown Rate set point.

If the rate exceeds the set point, no more compressors can be started until the pulldown rate is less than the set point. Running compressors will not be stopped as a result of exceeding the maximum pulldown rate.

**Refrigerant Saturated Temperature**

Refrigerant saturated temperature shall be calculated from the pressure sensor readings. A function will provide the converted

value of temperature to match NIST values as generated by the REFPROP program:

- Within 0.1°C for pressure input ranging from 0 kPa to 2070 kPa
- Within 0.2°C for pressure input ranging from -80 kPa to 0 kPa

### Evaporator Approach

The evaporator approach shall be calculated for each circuit. The equation is as follows:

$$\text{Evaporator Approach} = \text{LWT} - \text{Evaporator Saturated Temperature}$$

### Condenser Approach

The condenser approach shall be calculated for each circuit. The equation is as follows:

$$\text{Condenser Approach} = \text{Condenser Saturated Temperature} - \text{OAT}$$

### Suction Superheat

Suction superheat shall be calculated for each circuit using the following equation:

$$\text{Suction superheat} = \text{Suction Temperature} - \text{Evaporator Saturated Temperature}$$

## Circuit Control Logic

### Circuit Enabling

A circuit should be enabled to start if the following conditions are true:

- No circuit alarms are active
- At least one compressor is enabled to start (according to enable setpoints)

### Compressor Availability

A compressor is considered available to start if all the following are true:

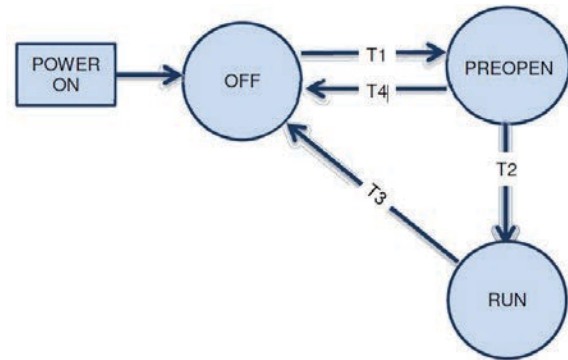
- The corresponding circuit is enabled
- The corresponding circuit is not in pumpdown
- No cycle timers are active for the compressor
- No limit events are active for the corresponding circuit
- The compressor is enabled via the enable setpoints
- The compressor is not already running

### Circuit States

The circuit will always be in one of three states:

- Off – Circuit is not running
- Preopen – Circuit is preparing to start
- Run – Circuit is running

Transitions between these states are shown in the following diagram.



#### T1 – Off to Preopen

- No compressors are running and any compressor on circuit is commanded to start (see unit capacity control)

#### T2 – Preopen to Run

- 5 seconds in Preopen state has passed

#### T3 – Run to Off

Any of the following are required:

- Last compressor is commanded to stop
- Alarm is active
- Unit State = Off
- A low ambient start attempt failed

#### T4 – Preopen to Off

Any of the following are required:

- Unit State = Off
- Alarm is active

## Low Ambient Starts

A low OAT start is initiated if the condenser refrigerant saturated temperature is less than 29.5°C (85.1° F) when the first compressor starts. Once the compressor starts the circuit is in a low OAT start state for a time equal to the Low OAT Start Time set point. During Low OAT Starts, the freeze stat logic for the low evaporator pressure alarm as well as the low evaporator pressure hold and unload alarms are disabled. The absolute limit for low evaporator pressure is enforced and the low evaporator pressure alarm should trigger if the evaporator pressure drops below that limit. In addition if the evaporator pressure is less than the Low Evap Pressure Unload set point during the low POAT start, no additional compressors can start on that circuit even though the hold and unload events are disabled at this time.

When the Low OAT Start Timer has expired, if the evaporator pressure is greater than or equal to the Low Evaporator Pressure Unload set point, the start is considered successful and normal alarm and event logic is reinstated. If the

evaporator pressure is less than the Low Evaporator Pressure Unload set point when the Low OAT Start Timer expires, the start is unsuccessful and the compressor will shutdown.

Multiple Low Ambient Start attempts are allowed. On the third failed Low Ambient Start attempt, the Restart Alarm is triggered and the circuit will not attempt to restart until the Restart alarm has been cleared.

The restart counter should be reset when either a startup is successful, the Low OAT Restart alarm is triggered, or the unit time clock shows that a new day has started.

## Circuit Status

The displayed circuit status should be determined by the conditions in the following table: If more than one status is enabled at the same time, the highest numbered status overrides the others and is displayed.

#	Status	Conditions
0	Off:Ready	Circuit is ready to start when needed.
1	Off:Cycle Timers	Circuit is off and cannot start due to active cycle timer on all compressors.
2	Off:All Comp Disable	Circuit is off and cannot start due to all compressors being disabled.
3	Off:Alarm	Circuit is off and cannot start due to active circuit alarm.
4	Off:Test Mode	Circuit is in test mode.
5	Preopen	Circuit is in preopen state.
6	Run:Normal	Circuit is in run state and running normally.
7	Run:Evap Press Low	Circuit is running and cannot load due to low evaporator pressure.
8	Run:Cond Press High	Circuit is running and cannot load due to high condenser pressure.

## Compressor Control

Compressors should run only when the unit is in a run or pumpdown state. They should not be running when the unit is in any other state.

## Compressor Availability

A compressor is considered available to start if all of the following are true:

- The circuit state is not Off
- No cycle timers are active for the compressor
- No limit events are active for the circuit
- The compressor is enabled via the enable set points
- The compressor is not already running

## Starting a Compressor

A compressor should start if it receives a start command from the unit capacity control logic.

## Stopping a Compressor

A compressor should be turned off if any of the following occur:

- Unit capacity control logic commands it off
- An unload alarm occurs and the sequencing requires this compressor to be next off

## Cycle Timers

A minimum time between starts of the compressor and a minimum time between shutdown and start of the compressor shall be enforced. The time values are determined by the Start-Start timer and Stop-Start timer setpoints.

These cycle timers should not be enforced through cycling of power to the chiller. This means that if power is cycled, the cycle timers should not be active.

These timers may be cleared via a setting on the HMI.

## Condenser Fan Control

Condenser fan control should stage fans as needed any time compressors are running on the circuit. All fans will be off when the circuit is in the off state.

## Fan Staging

The tables below show the outputs energized for each stage.

Stage	Fan Outputs On
0	0
1	1
2	12

## Condenser Target

The condenser target is selected based on circuit capacity using the condenser target set points. A minimum condenser target should be enforced. This minimum will be calculated based on the evaporator LWT. As the LWT varies from 7.2°C (45°F) to 32.2°C (90°F), the minimum condenser target will vary from 23.9°C (75°F) to 48.9°C (120°F).

## Staging Up

The first fan will not start until the evaporator pressure drop or condenser pressure rise requirement for the No Pressure Change After Start alarm is satisfied. Once that requirement is met, if there is no fan VFD then the first condenser stage should start when the saturated condenser temperature exceeds the condenser target. If there is a fan VFD, then the first stage should start when the saturated condenser temperature exceeds the condenser target less 5.56°C (10°F).

After this, the stage up dead band will be used:

When the saturated condenser temperature is above the target



plus the active deadband, stage up error is accumulated.

$$\text{Stage Up Error Step} = \text{Saturated Condenser Temperature} - (\text{Target} + \text{Stage Up dead band})$$

The Stage Up Error Step is added to Stage Up Accumulator once every 5 seconds, only if the Saturated Condenser Refrigerant Temperature is not falling. When Stage Up Error Accumulator is greater than 11°C (19.8°F) another stage is added.

When a stage up occurs or the saturated condenser temperature falls back within the stage up dead band the Stage Up Accumulator is reset to zero.

If the second compressor starts, one of the condenser fans is running and the condenser saturated temperature is higher than the target for 100% capacity, then the second condenser fan will start immediately.

If one of the condenser fans is running and the saturated condenser temperature exceeds 56.67°C (134°F), then the second condenser fan will start immediately.

## Staging Down

Two stage down dead bands shall be used.

When the saturated condenser refrigerant temperature is below the target – the active deadband, a stage down error is accumulated.

$$\text{Stage Down Error Step} = (\text{Target} - \text{Stage Down dead band}) - \text{Saturated Condenser Temperature}$$

The Stage Down Error Step is added to Stage Down Accumulator once every 5 seconds. When the Stage Down Error Accumulator is greater than 2.8°C (5°F) another stage of condenser fans is removed.

When a stage down occurs or the saturated temperature rises back above the target minus the Stage Down dead band, the Stage Down Error Accumulator is reset to zero.

## Stage Up Compensation

In order to create a smoother transition when another fan is staged on, the VFD speed compensates by slowing down initially. This is accomplished by adding the new fan stage up deadband to the VFD target. The higher target causes the VFD logic to decrease fan speed. Then, every 2 seconds, 0.1°C (0.18°F) is subtracted from the VFD target until it is equal to the saturated condenser temperature target set point.

The last fan stage will also be turned off if OAT is less than 23.89°C (75°F) and it will not be allowed to activate if OAT is less than 25.56°C (78°F).

## EXV Control

### Control States

When the circuit is in the Off state, the EXV position should be 0. The EXV control state should display that the EXV state is closed when this is the case.

When the circuit is in the Preopen state, the EXV should go into superheat control.

While the circuit is in the run state, the EXV should be in superheat control.

While in superheat control, the EXV controls suction superheat;

- The suction superheat target is set by a set point.
- A PID function will be used to control the superheat to the target value.
- The EXV response should be faster when the: SSH is lower than 1.67°C (3°F) Or higher than the SSH Target + 1.67°C (3°F)

The EXV should also prevent the evaporator pressure from exceeding the Maximum Evaporator Pressure set point. This is done by using another PID function to control evaporator pressure to the maximum evaporator pressure. The EXV position should be lesser position output from the two PID functions.

## Manual Control

The EXV position can be set manually. Manual control can only be selected when the circuit is in the run state. At any other time, the EXV control set point is forced to auto.

When EXV control is set to manual, the EXV position is equal to the manual EXV position setting. If set to manual when the unit state transitions from run to another state, the control setting is automatically set back to auto. When in manual control, the EXV control state displayed should reflect that it is manual control

### Position Commands

In order to improve the reliability of the EXV positioning, the position commands that are issued to the stepper driver are limited in two ways:

1. Position commands are filtered so that the minimum change in position is 0.3%. Changes of less than this are ignored. This avoids unnecessary movement of the EXV and lowers the chances of losing steps as a result.
2. The position commands are issued once per program cycle with a maximum change of 0.7% each time. This allows the stepper to move the valve to the commanded position before the next position command is issued. Issuing commands in this way may also lower the chances of losing steps.

## EXV Position Range

The table below shows the EXV range based on the number of compressors running on the unit.

**Table 22: Maximum Position Range**

Model	# Compressors Running/Circuit	
	1	2
EXV Min	5%	5%
EXV Max	75%	100%

### Operation Considerations

The expansion valve maximum position may be increased if after two minutes both the suction superheat is more than the target and the expansion valve has been within 1.0% of its current maximum position. The maximum should increase at a rate of 0.1% every six seconds up to a total of an additional

10%. This offset to the maximum position should be reset when the EXV is no longer in the Superheat Control state, or a compressor on the circuit stages up or down.

## Liquid Line Solenoid Valve

The liquid line solenoid output should be on when the circuit state is either Pre-open or Run. This output should be off at all other times.

## Hot Gas Bypass Solenoid Valve

This output will be on when circuit state is Run for at least 30 seconds and one compressor on the unit is running. The output should be off at all other times.

## Capacity Overrides – Limits of Operation

The following conditions shall override automatic capacity control as described. These overrides keep the circuit from entering a condition in which it is not designed to run.

### Low Evaporator Pressure

If the Low Evaporator Pressure Hold or Low Evaporator Pressure Unload alarms are triggered, the circuit capacity may be limited or reduced. See the Circuit Events section for details on triggering, reset, and actions taken.

### High Condenser Pressure

If the High Condenser Pressure Unload alarm is triggered, the circuit capacity may be limited or reduced. See the Circuit Events section for details on triggering, reset, and actions taken.

## Unit Fault Alarms

Situations may arise that require some action from the chiller, or that should be logged for future reference. Alarms are classified in the following sections per the Global Chiller Protocol Standard using the Fault/Problem/Warning scheme.

When any Unit Fault Alarm is active, the alarm digital output should be turned on continuously. If both circuits have a Circuit Fault Alarm active, the alarm digital output should be turned on continuously. If no Unit Fault Alarm is active and only one circuit has a Circuit Fault Alarm active, the alarm digital output should alternate five seconds on and five seconds off continuously.

All alarms appear in the active alarm list while active. All alarms are added to the alarm log when triggered and when cleared. Entries in the log representing the occurrence of an alarm will be preceded by '+' while entries representing the clearing of an alarm will be preceded by '-'.

### PVM/GFP Fault

**Trigger:** Power Configuration = Single Point and PVM/GFP Input #1 is open for longer than one second.

**Action Taken:** Rapid stop all circuits

**Reset:** Auto reset when input is closed for at least 5 seconds or if Power Configuration = Multi Point.

### Evaporator Flow Loss

**Trigger:**

1: Evaporator Pump State = Run AND Evaporator Flow Digital Input = No Flow for time > Flow Proof Set Point AND at least one compressor running

2: Evaporator Pump State = Start for time greater than Recirc Timeout Set Point and all pumps have been tried and Evaporator Flow Digital Input = No Flow

**Action Taken:** Rapid stop all circuits

**Reset:**

This alarm can be cleared at any time manually via the keypad or via the BAS clear alarm command.

If active via trigger condition 1:

When the alarm occurs due to this trigger, it can auto reset the first two times each day with the third occurrence being manual reset.

For the auto reset occurrences, the alarm will reset automatically when the evaporator state is Run again. This means the alarm stays active while the unit waits for flow, then it goes through the recirculation process after flow is detected. Once the recirculation is complete, the evaporator goes to the Run state which will clear the alarm. After three occurrences, the count of occurrences is reset and the cycle starts over if the manual reset flow loss alarm is cleared.

If active via trigger condition 2:

If the flow loss alarm has occurred due to this trigger, it is always a manual reset alarm.

### Evaporator Water Freeze Protect

**Trigger:** Evaporator LWT drops below evaporator freeze protect set point and LWT sensor fault is not active for a time longer than the evaporator recirculation time set point.

**Action Taken:** Rapid stop all circuits

**Reset:** This alarm can be cleared manually via the keypad, but only if the alarm trigger conditions no longer exist.

### Evaporator LWT Sensor Fault

**Trigger:** Sensor shorted or open for longer than one second

**Action Taken:** Normal stop all circuits

**Reset:** This alarm can be cleared manually via the keypad or BAS command, but only if the sensor is back in range.

### Outdoor Air Temperature Sensor Fault

**Trigger:** Sensor shorted or open for longer than one second

**Action Taken:** Normal stop of all circuits.

**Reset:** This alarm can be cleared manually via the keypad or via BAS command if the sensor is back in range.

### External Alarm

**Trigger:** External Alarm/Event opens for at least 5 seconds and external fault input is configured as an alarm.

**Action Taken:** Rapid stop of all circuits.

**Reset:** Auto clear when digital input is closed.

### Module Comm Failure

**Trigger:** Communication with I/O extension module has failed.

**Action Taken:** Rapid stop of circuit 1.

**Reset:** This alarm can be cleared manually via the keypad or BAS command when communication between main controller and the extension module is working for 5 seconds.

### EXV Module Comm Failure

**Trigger:** Expansion Valve Type = Electronic and communication with the I/O extension module has failed.

**Action Taken:** Rapid stop of circuit 1.

**Reset:** This alarm can be cleared manually via the keypad or BAS command when communication between main controller and the extension module is working for 5 seconds or Expansion Valve Type = Thermal.

## Unit Problem Alarms

### Evaporator Pump #1 Failure

**Trigger:** Unit is configured with primary and backup pumps, pump #1 is running, and the pump control logic switches to pump #2.

**Action Taken:** Backup pump is used.

**Reset:** This alarm can be cleared manually via the keypad or BAS command.

### Evaporator Pump #2 Failure

**Trigger:** Unit is configured with primary and backup pumps, pump #2 is running, and the pump control logic switches to pump #1.

**Action Taken:** Backup pump is used.

**Reset:** This alarm can be cleared manually via the keypad or BAS command.

## Unit Warning Alarms

### Bad Demand Limit Input

**Trigger:** Demand limit input out of range and demand limit is enabled. For this alarm out of range is considered to be a signal less than 3mA or more than 21mA.

**Action Taken:** Cannot use demand limit function.

**Reset:** Auto clear when demand limit disabled or demand limit input back in range for 5 seconds.

### Bad LWT Reset Input

**Trigger:** LWT reset input out of range and LWT reset is enabled. For this alarm out of range is considered to be a signal less than 3mA or more than 21mA.

**Action Taken:** Cannot use LWT reset function.

**Reset:** Auto clear when LWT reset is disabled or LWT reset input back in range for 5 seconds.

### Evaporator EWT Sensor Fault

**Trigger:** Sensor shorted or open for longer than one second

**Action Taken:** None.

**Reset:** Auto clear when the sensor is back in range.

## Circuit Fault Alarms

### Low Evaporator Pressure

**Trigger:**

This alarm should trigger when Freeze time is exceeded, Low Ambient Start is not active, and Circuit State = Run. It should also trigger if Evaporator Press < 137.9 KPA (20 psi) and Circuit State = Run for longer than 1 second.

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:

$$\text{Freeze error} = \text{Low Evaporator Pressure Unload} - \text{Evaporator Pressure}$$

Freeze time =

For units equipped with 10 or more condenser fans (shell and tube type evaporator):

80 – (freeze error/6.895), limited to a range of 40 to 80 seconds

For all other configurations (plate to plate type evaporator):

60 – (freeze error/6.895), limited to a range of 20 to 60 seconds

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

The alarm cannot trigger if the evaporator pressure sensor fault is active.

**Action Taken:** Rapid stop circuit.

**Reset:** This alarm can be cleared manually via the keypad if the evaporator pressure is above 137.9 KPA (20 PSI).

### High Condenser Pressure

**Trigger:** Condenser Pressure > High Condenser Pressure set point for longer than one second.

**Action Taken:** Rapid stop circuit.

**Reset:** This alarm can be cleared manually via the controller keypad.

### ***Mechanical High Pressure Switch***

**Trigger:** Mechanical High Pressure switch input is open and Motor Protection input is closed for longer than one second, and power up start delay is not active.

**Action Taken:** Rapid stop circuit.

**Reset:** This alarm can be cleared manually via the controller keypad if the MHP switch input is closed.

### ***Motor Protection Fault***

**Trigger:** Motor Protection input is open and power up start delay is not active for longer than one second.

**Action Taken:** Rapid stop circuit.

**Reset:** This alarm can be cleared manually via the controller keypad if the input is closed.

### ***Low OAT Restart Fault***

**Trigger:** Circuit has failed three low OAT start attempts.

**Action Taken:** Rapid stop circuit.

**Reset:** This alarm can be cleared manually via the keypad or via BAS command.

### ***No Pressure Change After Start***

**Trigger:** After start of compressor, at least a 7 KPA (1 PSI) drop in evaporator pressure OR 35 KPA (5.1 PSI) increase in condenser pressure has not occurred after 30 seconds. The actual alarm will not be triggered until the second occurrence. This counter should be reset every day at midnight.

**Action Taken:** Rapid stop circuit.

**Reset:** This alarm can be cleared manually via the keypad or via BAS command.

### ***Evaporator Pressure Sensor Fault***

**Trigger:** Sensor shorted or open for longer than one second

**Action Taken:** Circuit shut down.

**Reset:** This alarm can be cleared manually via the keypad or BAS command, but only if the sensor is back in range.

### ***Condenser Pressure Sensor Fault***

**Trigger:** Sensor shorted or open for longer than one second.

**Action Taken:** Rapid stop circuit.

**Reset:** This alarm can be cleared manually via the keypad or BAS command, but only if the sensor is back in range.

### ***Suction Temperature Sensor Fault***

**Trigger:** Sensor shorted or open for longer than one second and Expansion Valve Type = Electronic.

**Action Taken:** Circuit shut down.

**Reset:** This alarm can be cleared manually via the keypad or BAS command, but only if the sensor is back in range.

## **Alarm Log**

An alarm log stores the last 50 occurrences or resets that occur. When an alarm or event occurs, it is put into the first slot in the alarm log and all others are moved down one, dropping the last entry. The date and time the alarm occurred are stored in the alarm log.

## **Event Log**

An Event Log similar to the Alarm Log stores the last 50 event occurrences. Each Event Log entry includes an event description and a time and date stamp for the event occurrence plus the count of the event occurrences on the current day and for each of the last seven days. Events do not appear in the Active Alarm list.

## **Clearing Alarms**

Active alarms can be cleared through the keypad/display or a BAS network. Alarms are automatically cleared when controller power is cycled. Alarms are cleared only if the conditions required to initiate the alarm no longer exist. All alarms and groups of alarms can be cleared via the keypad or network via LON using `nviClearAlarms` and via BACnet using the `ClearAlarms` object.

To use the keypad, follow the Alarm links to the Alarms screen, which will show Active Alarms and Alarm Log. Select Active Alarm and press the wheel to view the Alarm List (list of current active alarms). They are in order of occurrence with the most recent on top. The second line on the screen shows Alm Cnt (number of alarms currently active) and the status of the alarm clear function. Off indicates that the Clear function is off and the alarm is not cleared. Press the wheel to go to the edit mode. The Alm Clr (alarm clear) parameter will be highlighted with OFF showing. To clear all alarms, rotate the wheel to select ON and enter it by pressing the wheel.

An active password is not necessary to clear alarms.

If the problem(s) causing the alarm have been corrected, the alarms will be cleared, disappear from the Active Alarm list and be posted in the Alarm Log. If not corrected, the On will immediately change back to OFF and the unit will remain in the alarm condition.

## **Events**

Situations may arise that require some action from the chiller or that should be logged for future reference, but aren't severe enough to track as alarms. These events are stored in a log separate from alarms, accessible by password. This log shows the time and date of the latest occurrence, the count of occurrences for the current day, and the count of occurrences for each of the previous 7 days.

## Unit Events

### **Unit Power Restore**

**Trigger:** Unit controller is powered up.

**Action Taken:** None

**Reset:** None

## Circuit Events

### **Low Evaporator Pressure - Hold**

**Trigger:**

This event is triggered if all of the following are true:

- circuit state = Run
- evaporator pressure  $\leq$  Low Evaporator Pressure - Hold set point
- circuit is not currently in a low OAT start
- it has been at least 30 seconds since a compressor has started on the circuit.

**Action Taken:** Inhibit starting of additional compressors on the circuit.

**Reset:** While still running, the event will reset if evaporator pressure  $>$  Low Evaporator Pressure Hold SP + 90 KPA (13 PSI). The event is also reset if the circuit is no longer in the run state.

### **Low Evaporator Pressure - Unload**

**Trigger:**

This event is triggered if all of the following are true:

- circuit state = Run
- more than one compressor is running on the circuit
- evaporator pressure  $\leq$  Low Evaporator Pressure - Unload set point for a time greater than half of the current freezestat time
- circuit is not currently in a low OAT start
- it has been at least 30 seconds since a compressor has started on the circuit.

On units equipped with 6 compressors, electronic expansion valves, and 10 or more fans, when each compressors starts, there should be a 2 minute window during which the evaporator pressure must drop an additional 27 KPA (3.9 PSI) to trigger the alarm. After this 2 minute window, the trigger

point should return to normal.

**Action Taken:** Stage off one compressor on the circuit every 10 seconds while evaporator pressure is less than the unload set point, except the last one.

**Reset:** While still running, the event will be reset if evaporator pressure  $>$  Low Evaporator Pressure Hold SP + 90 KPA(13 PSI). The event is also reset if the circuit is no longer in the run state.

### **High Condenser Pressure - Unload**

**Trigger:**

This event is triggered if all of the following are true:

- circuit state = Run
- more than one compressor is running on the circuit
- condenser pressure  $>$  High Condenser Pressure – Unload set point

**Action Taken:** Stage off one compressor on the circuit every 10 seconds while condenser pressure is higher than the unload set point, except the last one. Inhibit staging more compressors on until the condition resets.

**Reset:** While still running, the event will be reset if condenser pressure  $\leq$  High Condenser Pressure Unload SP – 862 KPA(125 PSI). The event is also reset if the circuit is no longer in the run state.

## Optional BAS Interface

The AMZ chiller controller is configured for stand-alone operation or integration with BAS through an optional communication module.

The following installation manuals for optional BAS interface modules are shipped with the chiller. They can also be found and downloaded from [www.DaikinApplied.com](http://www.DaikinApplied.com).

- IM 966, BACnet® IP Communication Module
- IM 967, BACnet® Communication Module (MS/TP)
- IM 968, LONWORKS Communication Module
- IM 969, Modbus® Communication Module
- ED 15120, Protocol Information for MicroTech® III chiller, BACnet and LONWORKS
- ED 15121, Protocol Information for MicroTech® III chiller, Modbus

Figure 17: LCD Display - Fan VFD

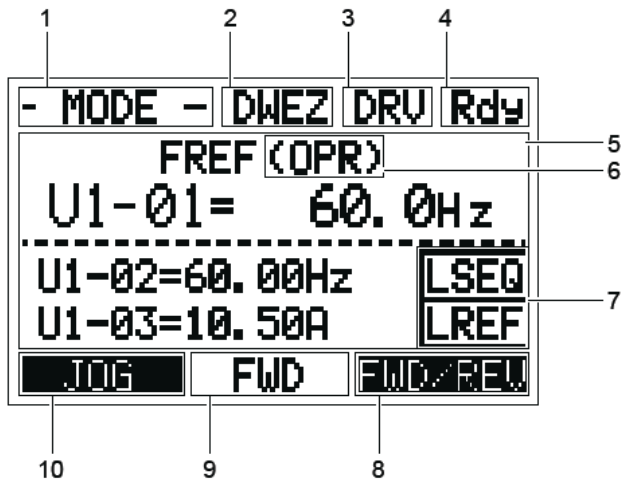


Table 23: Display Data

No	Name	Display	Content
1	Operation Mode Menus	MODE	Displayed when in Mode Selection.
		MONITR	Displayed when in Monitor Mode.
		VERIFY	Indicates the Verify Menu.
		PRMSET	Displayed when in Parameter Setting Mode.
		A.TUNE	Displayed during Auto-Tuning.
		SETUP	Displayed when in Setup Mode.
2	DriveWorksEZ Function Selection	DWEZ	Displayed when DriveWorksEZ is set to enable. (A1-07 = 1 or 2)
3	Mode Display Area	DRV	Displayed when in Drive Mode.
		PRG	Displayed when in Programming Mode.
4	Ready	Rdy	Indicates the drive is ready to run.
5	Data Display	—	Displays specific data and operation data.
6	Frequency Reference Assignment <1>	OPR	Displayed when the frequency reference is assigned to the LCD Operator Option.
		AI	Displayed when the frequency reference is assigned to the Analog Input of the drive.
		COM	Displayed when the frequency reference is assigned to the MEMOBUS/Modbus Communication Inputs of the drive.
		OP	Displayed when the frequency reference is assigned to an Option Unit of the drive.
		RP	Displayed when the frequency reference is assigned to the Pulse Train Input of the drive.
7	LO/RE Display <2>	RSEQ	Displayed when the run command is supplied from a remote source.
		LSEQ	Displayed when the run command is supplied from the operator keypad.
		RREF	Displayed when the run command is supplied from a remote source.
		LREF	Displayed when the run command is supplied from the operator keypad.
8	Function Key 1(F1)	JOG	Pressing [F1] executes the Jog function.
		HELP	Pressing [F1] displays the Help menu.
		←	Pressing [F1] scrolls the cursor to the left.
		HOME	Pressing [F1] returns to the top menu (Frequency Reference).
		ESC	Pressing [F1] returns to the previous display.
9	FWD/REV	FWD	Indicates forward motor operation.
		REV	Indicates reverse motor operation.
10	Function Key 2 (F2)	FWD/REV	Pressing [F2] switches between forward and reverse.
		DATA	Pressing [F2] scrolls to the next display.
		→	Pressing [F2] scrolls the cursor to the right.
		RESET	Pressing [F2] resets the existing drive fault error.

**Table 24: Alarm Content**

State	Content
Illuminated	When the drive detects an alarm or error
Flashing	When an alarm occurs
	When an oPE is detected
	When a fault or error occurs during Auto-Tuning
Off	Normal operation (no fault or alarm)

**Table 25: LO/RE LED and RUN LED Indictors**

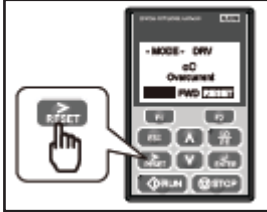
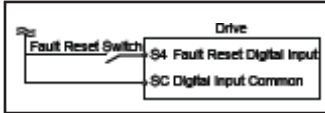
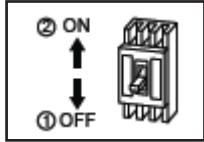
LED	Lit	Flashing Slowly	Flashing Quickly	Off
LO/RE	When the operator is selected for Run command and frequency reference control (LOCAL)	--	--	When a device other than the operator is selected for Run command and frequency reference control (REMOTE)
RUN	During run	During deceleration to stop  When a Run command is input and frequency reference is 0 Hz	While the drive was set to LOCAL, a Run command was entered to the input terminals then the drive was switched to REMOTE.	During stop
			A Run command was entered via the input terminals while the drive was not in the Drive Mode.	
			During deceleration when a Fast Stop command was entered.	
			The drive output is shut of by the Safe Disable function.	
			The STOP key was pressed while drive was running in REMOTE.	
			The drive was powered up with b1-17 = 0 (default) while the Run command was active.	

**Table 26: Types of Alarms, Faults, and Errors**

Type	Drive Response
Faults	When the drive detects a fault:
	<ul style="list-style-type: none"> <li>The digital operator displays text indicating the specific fault and the ALM indicator LED remains lit until the fault is reset.</li> </ul>
	<ul style="list-style-type: none"> <li>The fault interrupts drive output and the motor coasts to a stop. • Some faults allow the user to select the stopping method when the fault occurs.</li> </ul>
	<ul style="list-style-type: none"> <li>Fault output terminals MA-MC will close, and MB-MC will open.</li> </ul>
	The drive will remain inoperable until the fault is cleared.
Minor Faults and Alarms	When the drive detects an alarm or a minor fault:
	<ul style="list-style-type: none"> <li>The digital operator displays text indicating the specific alarm or minor fault, and the ALM indicator LED flashes.</li> </ul>
	<ul style="list-style-type: none"> <li>The drive continues running the motor, although some alarms allow the user to select a stopping method when the alarm occurs.</li> </ul>
	<ul style="list-style-type: none"> <li>A multi-function contact output set to be tripped by a minor fault closes. If the output is set to be tripped by an alarm, the contact will not close.</li> </ul>
	<ul style="list-style-type: none"> <li>The digital operator displays text indicating a specific alarm and the ALM indicator LED flashes.</li> </ul>
	Remove the cause of the problem to reset a minor fault or alarm.
Operation Errors	An operation error occurs when parameter settings conflict or do not match hardware settings (such as with an option card).When the drive detects an operation error:
	<ul style="list-style-type: none"> <li>The digital operator displays text indicating the specific error. • Multi-function contact outputs do not operate.</li> </ul>
	The drive will not operate the motor until the error has been reset. Correct the settings that caused the operation error to clear the error.
Tuning Errors	Tuning errors occur while performing Auto-Tuning. When the drive detects a tuning error:
	<ul style="list-style-type: none"> <li>The digital operator displays text indicating the specific error. • Multi-function contact outputs do not operate.</li> </ul>
	<ul style="list-style-type: none"> <li>Motor coasts to stop.</li> </ul>
	Remove the cause of the error and repeat the Auto-Tuning process.
Copy Function Errors	Copy Function Errors occur when using the digital operator or the USB Copy Unit to copy, read, or verify parameter settings.
	<ul style="list-style-type: none"> <li>The digital operator displays text indicating the specific error.</li> </ul>
	<ul style="list-style-type: none"> <li>Multi-function contact outputs do not operate.</li> </ul>
	Pressing any key on the digital operator will clear the fault. Investigate the cause of the problem (such as model incompatibility)and try again.



**Table 27: Fault Reset Methods**

After the Fault Occurs	Procedure
Fix the cause of the fault, restart the drive, and reset the fault	Press RESET on the controller. 
Resetting via Fault Reset Digital Input S4	Close then open the fault signal digital input via terminal S4. S4 is set for "Fault Reset" as default (H1-04 = 14) 
Turn off the main power supply if the above methods do not reset the fault. Reapply power after the controller display has turned off.	

**NOTE:** When a fault occurs, the cause of the fault must be removed and the drive must be restarted. The above table list the various ways to restart the drive. Remove the Run command before attempting to clear a fault. If the Run command is present, the control will disregard any attempt to reset the fault.

**Recommended Periodic Inspection**

**⚠ WARNING**

Electrical Shock Hazard. Before servicing or inspecting the equipment, disconnect power to the unit. The internal capacitor remains charged after power is turned off. Wait at least the amount of time specified on the drive before touching any components.

**Table 28: Periodic Inspection Checklist**

Inspection Area	Inspection Points	Corrective Action
General	Inspect equipment including wiring, terminals, resistors, capacitors, diode and IGBT for discoloration from overheating or deterioration.	Replace damaged components.
	Inspect for dirt or foreign particles	Use dry air to clear away.
Relays and Contactors	Inspect contactors and relays for excessive noise.	Check for over or undervoltage
	Inspect for signs of overheating such as melted or cracked insulation	Replace damaged parts.

## Pre Startup

Inspect the chiller to ensure no components became loose or damaged during shipping or installation including leak test and wiring check. Complete the pre-start checklist at the front of this manual and return to Daikin Applied prior to startup date.

### Pre-Startup Water Piping Checkout

1. Check the pump operation and vent all air from the system.
2. Check water treatment and proper glycol percent.
3. Flush System and clean all water strainers before placing the chiller into service.
4. Circulate evaporator water, checking for proper system pressure and evaporator pressure drop. Compare the pressure drop to the evaporator water pressure drop curve.
5. Leak test refrigerant circuit in order to identify leaks that may have occurred during shipping or when the unit was installed.
6. Check that all refrigerant valves are either opened or closed as required for proper operation of the chiller.
7. A thorough leak test must be done using an approved electronic leak detector. Check all valve stem packing for leaks. Replace all refrigerant valve caps and tighten.
8. Check all refrigerant lines to insure that they will not vibrate against each other or against other chiller components and are properly supported.
9. Check all connections and all refrigerant threaded connectors.
10. Look for any signs of refrigerant leaks around the condenser coils and for damage during shipping or installation.
11. Connect refrigerant service gauges to each refrigerant circuit before starting unit.

### Pre-Startup Electrical Check Out

**⚠ WARNING**

Electrical power must be applied to the compressor crankcase heaters 8 hours before starting unit to eliminate refrigerant from the oil.

1. Open all electrical disconnects and check all power wiring connections. Start at the power block and check all connections through all components to and including the compressor terminals. These should be checked again after 3 months of operation and at least yearly thereafter.
2. Check all control wiring by pulling on the wire at the terminal connections and tighten all screw connections. Check plug-in relays for proper seating and to insure retaining clips are installed.
3. Put System Switch (S1) to the Emergency Stop position.

4. Put circuit switches to the Pumpdown and Stop position.
5. Apply power to the unit. The panel Alarm Light will stay on until S1 is closed. Ignore the Alarm Light for the check out period. If you have the optional Alarm Bell, you may wish to disconnect it.
6. Check at the power block or disconnect for the proper voltage and proper voltage between phases. Check power for proper phasing using a phase sequence meter before starting unit.
7. Check for 120 Vac at the optional control transformer and at TB-2 terminal #1 and the neutral block (NB).
8. Check between TB-2 terminal #7 and NB for 120 Vac supply for transformer #2.
9. Check between TB-2 terminal #2 and NB for 120 Vac control voltage. This supplies the compressor crank case heaters.
10. Check between TB-3 terminal #17 and #27 for 24 Vac control voltage.

## Startup

Refer to the MicroTech® III Controller information beginning on [page 21](#) to become familiar with unit operation before starting the chiller.

There should be adequate building load (at least 50 percent of the unit full load capacity) to properly check the operation of the chiller refrigerant circuits.

Be prepared to record all operating parameters required by the "Compressorized Equipment Warranty Form" at the conclusion of this document. Return this information within 10 working days to Daikin Applied as instructed on the form to obtain full warranty benefits.

### Startup Steps

- Verify chilled water flow.
- Verify remote start / stop or time clock (if installed) has requested the chiller to start.
- Set the chilled water setpoint to the required temperature. (The system water temperature must be greater than the total of the leaving water temperature setpoint plus one-half the control band plus the startup delta-T before the MicroTech® III controller will stage on cooling.)
- Set the Evap Delta T based on a percent of unit nominal flow indicated in [page 26](#) and the Start Delta T as a starting point.  $\Delta T = \text{Tons} \times 24 / \text{gpm}$
- Check the controller setpoints to be sure that factory defaults are appropriate.
- Put pumpdown switch (PS1) to the ON position.
- Put system switch (S1) to ON position.

**Table 29: Pumpdown and System Switch Positions**

Switch	Switch Position	
	ON	OFF
PS1, Pumpdown Switches	Circuit will operate in the normal, automatic mode	Circuit will go through the normal pumpdown cycle and shut off.
S1, System Switch	Unit will operate in the normal automatic mode	Unit will shut off immediately without pumping down (emergency stop)

the compressor oil. This will minimize startup time when putting the unit back into service. The evaporator heater will be able to function.

8. If electrical power is off, make provisions to power the evaporator heater (if chilled water system is not drained or is filled with suitable glycol). Tag all opened electrical disconnect switches to warn against startup before the refrigerant valves are in the correct operating position.

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

## Post Startup

After the chiller has been operating for a period of time and has become stable, check the following:

- Compressor oil level. (Some scroll compressors do not have oil sight glasses).
- Refrigerant sight glass for flashing.
- Rotation of condenser fans.
- Complete and return the “Equipment Warranty Registration Form,” found at the end of this manual, within 10 days of start-up in order to comply with the terms of Daikin Limited Product Warranty.

## Shutdown

### Temporary Shutdown

1. Put circuit switch to the OFF position (Pumpdown and Stop).
2. After compressors have stopped, put System Switch (S1) to OFF (emergency stop).
3. Turn off chilled water pump. Chilled water pump to operate while compressors are pumping down.
4. To start the chiller after a temporary shutdown, follow the startup instructions.

### Extended Shutdown

1. Front seat the condenser liquid line service valve.
2. Put circuit switch to the OFF position (Pumpdown and Stop position).
3. After the compressors have stopped, put System Switch (S1) to the OFF position (emergency stop).
4. Front seat refrigerant circuit discharge valve (if applicable).
5. If chilled water system is not drained, maintain power to the evaporator heater to prevent freezing. Maintain heat tracing on the chilled water lines.
6. Drain evaporator and water piping to prevent freezing.
7. If electrical power to the unit is on, the compressor crankcase heaters will keep the liquid refrigerant out of

## Hot Gas Bypass (Optional)

This option allows the system to operate at lower loads without excessive on/off compressor cycling.

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

**NOTE:** The hot gas bypass valve should not generate a 100% false load.

The pressure regulating valve is factory set to begin opening at 110 psig with R-410A and can be changed by adjusting the pressure setting. To raise 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 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.

A solenoid valve is located ahead of the bypass valve and is controlled by the MicroTech® III controller. It is active when the first stage of cooling on a circuit is active.

### WARNING

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

## Compressor Communications

The CoreSense™ compressor communication module on model sizes 025-040 provides advanced diagnostics, protection, and communications that enhance compressor performance and reliability.

Features include motor temperature protection, scroll temperature protection, missing phase protection, reverse phase protection, low control circuit voltage protection, short cycling detection and alert, operational and fault history storage, and LED status display.

### Warnings and Alerts

A solid green LED indicates the module is powered and operation is normal.

A solid red LED indicates an internal problem with the module.

A flashing green LED communicates Warning codes. Warning codes do not result in a trip or lockout condition.

A flashing red LED communicates Alert codes. Alert codes will result in a trip condition and possibly a lockout condition

### Warning Codes (Flashing Green LED)

Code 1 – Loss of Communication: The module will flash the green Warning LED one time indicating the module has not communicated with the master controller for longer than 5 minutes.

Code 2 – Reserved For Future Use

Code 3 – Short Cycling: The module will flash the green Warning LED three times indicating the compressor has short cycled more than 48 times in 24 hours.

Code 4 – Open/Shorted Scroll Thermistor: The module will flash the green Warning LED four times indicating an open/shorted

### Alert/Lockout Codes (Flashing Red LED)

Code 1 – Motor High Temperature: The module will flash the red Alert LED one time indicating the motor is overheating. A code 1 Alert will open the M2-M1 contacts. The Alert will reset after 30 minutes. Five consecutive Code 1 Alerts will lockout the compressor. Once the module has locked out the compressor, a power cycle or Modbus reset command will be required for the lockout to be cleared.

Code 2 – Open/Shorted Motor Thermistor: The module will flash the red Alert LED two times indicating the motor PTC thermistor circuit has an open/shorted thermistor chain (see Table 2). A Code 2 Alert will open the M2-M1 contacts. The Alert will reset after 30 minutes and the M2-M1 contacts will close if the resistance of the motor PTC circuit is back in the normal range. The module will lockout the compressor and a power cycle or Modbus reset command will be required to clear the lockout.

Code 3 – Short Cycling: The module will flash the red Alert LED three times indicating the compressor is locked out due to short cycling. Once the compressor is locked out, a power cycle or Modbus reset command will be required to clear the lockout.

Code 4 – Scroll High Temperature: The module will flash the red Alert LED four times indicating the over-temperature condition. A Code 4 Alert will open the M2-M1 contacts. The Alert will reset after 30 minutes. Once the module has locked out the compressor, a power cycle or Modbus reset command will be required to clear the lockout.

Code 5 – Reserved for Future Use

Code 6 – Missing Phase: The module will flash the red Alert LED six times indicating a missing phase. The Alert will reset after 5 minutes and the module will lockout the compressor after 10 consecutive Code 6 Alerts. Once locked out, a power cycle or Modbus reset is required.

Code 7 – Reverse Phase: The module will flash the red Alert LED seven times indicating a reverse phase in two of the three compressor leads. The modules will lockout the compressor after one Code 7 Alert. A power cycle or Modbus reset command will be required to clear the lockout.

Code 8 – Reserved For Future Use

Code 9 – Module Low Voltage: The module will flash the red Alert LED nine times indicating low module voltage for more than 5 seconds. The Alert will reset after 5 minutes and the M2-M1 contacts will close if the T2-T1 voltage is above the reset value.

**NOTE:** If a compressor with CoreSense Communications fails in the field, the CoreSense module should remain with the failed compressor so the manufacturer's technicians can download the CoreSense data to assist with determining the root cause of compressor failure.

## Crankcase Heaters

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

Power must be supplied to the heaters 8 hours before starting the compressors.

## Evaporator

The evaporator is a compact, high efficiency, single circuit, brazed plate-to-plate type heat exchanger consisting of parallel stainless steel plates. The evaporator is protected with an electric resistance heater and insulated with 3/4" (19mm) thick closed-cell polyurethane insulation. This combination provides freeze protection down to -20°F (-29°C) ambient air temperature. The water side working pressure of the brazed plate type of evaporator is 653 psig (4502 kPa). Evaporators are designed and constructed according to, and listed by, Underwriters Laboratories (UL).

## General

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

## Evaporator

The evaporators are brazed plate design. Other than cleaning and testing, no service work should be required on the evaporator.

## Compressor Maintenance

The scroll compressors are fully hermetic and require no maintenance other than checking oil level and confirming proper chiller operations.

## Lubrication

No routine lubrication is required on AMZ units. The fan motor bearings are permanently lubricated and no further lubrication is required. Excessive fan motor bearing noise is an indication of motor issues.

POE type oil is used for compressor lubrication. Further details are listed in the Unit Service section on [page 49](#).

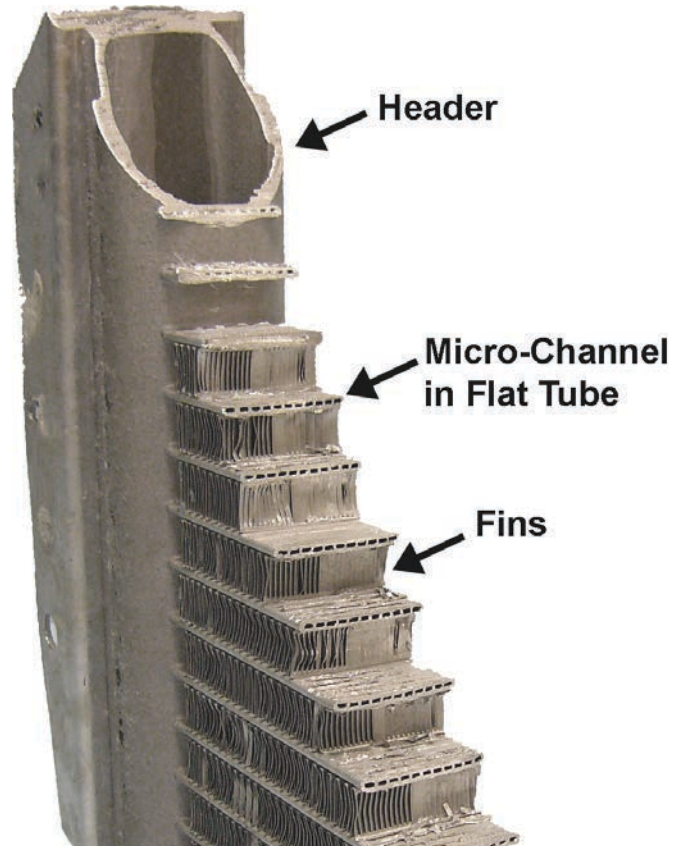
**⚠ WARNING**

POE oil must be handled carefully using proper protective equipment (gloves, eye protection, etc.) The oil must not come in contact with certain polymers (e.g. PVC), as it may absorb moisture from this material. Also, do not use oil or refrigerant additives in the system.

## All-Aluminum Condenser Coils

The condenser coils are an all-aluminum design including the connections, microchannels, fins (an oven brazing process brazes the fins to the microchannel flat tube), and headers (see “[Microchannel Coil Cross Section](#)”) which eliminates the possibility of corrosion normally found between dissimilar metals of standard coils.

Figure 18: Microchannel Coil Cross Section



During the condensing process, refrigerant in the coil passes through the microchannel flat tubes, resulting in higher efficiency heat transfer from the refrigerant to the airstream. In the unlikely occurrence of a coil leak, contact Daikin Applied to receive a replacement coil module.

## Cleaning Microchannel Aluminum Coils

Maintenance consists primarily of the routine removal of dirt and debris from the outside surface of the fins.

## Cleaning Epoxy Coated Coils

The following cleaning procedures are recommended as part of the routine maintenance activities for epoxy coated coils. Documented routine cleaning of epoxy coated coils is required to maintain warranty coverage.

**⚠ WARNING**

Prior to cleaning the unit, turn off and lock out the main power switch to the unit and open all access panels.

## Remove Surface Loaded Fibers

Surface loaded fibers or dirt should be removed prior to water rinse to prevent further restriction of airflow. If unable to back wash the side of the coil opposite that of the coils entering air side, then surface loaded fibers or dirt should be removed with a vacuum cleaner. If a vacuum cleaner is not available, a soft

non-metallic bristle brush may be used. In either case, the tool should be applied in the direction of the fins. Coil surfaces can be easily damaged (fin edges bent over) if the tool is applied across the fins.

**NOTE:** Use of a water stream, such as a garden hose, against a surface loaded coil will drive the fibers and dirt into the coil. This will make cleaning efforts more difficult. Surface loaded fibers must be completely removed prior to using low velocity clean water rinse.

### **Periodic Clean Water Rinse**

A monthly clean water rinse is recommended for coils that are applied in coastal or industrial environments to help to remove chlorides, dirt and debris. An elevated water temperature (not to exceed 130°F) will reduce surface tension, increasing the ability to remove chlorides and dirt. Pressure washer PSI must not exceed 900 psig and the nozzle should remain at least 1 foot from the coil to avoid damaging fin edges.

### **Harsh Chemical and Acid Cleaners**

Harsh chemicals, household bleach or acid cleaners should not be used to clean outdoor or indoor epoxy coated coils. These cleaners can be very difficult to rinse out of the coil and can accelerate corrosion and attack the epoxy coated coils coating. If there is dirt below the surface of the coil, use the recommended coil cleaners as described above.

### **High Velocity Water or Compressed Air**

High velocity water from a pressure washer or compressed air should only be used at a very low pressure to prevent fin and/or coil damages. The force of the water or air jet may bend the fin edges and increase airside pressure drop. Reduced unit performance or nuisance unit shutdowns may occur.



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

## **Filter-Driers**

Replace the filter-drier any time excessive pressure drop is read across the filter-drier and/or when bubbles occur in the sight glass with normal subcooling. The filter-drier should also be changed if the moisture indicating liquid line sight glass indicates excess moisture in the system.

Any residual particles from the condenser tubing, compressor and miscellaneous components are swept by the refrigerant into the liquid line and are caught by the filter-drier.

## **Battery**

The controller has a battery located behind the clear plastic bezel. It is a BR2032 with a minimum life of 2 years un-powered. The typical battery life is 10 years. .

## **Liquid Line Solenoid Valve**

The liquid line solenoid valves that shut off refrigerant flow in the event of a power failure do not normally require any maintenance. The solenoids can, however, require replacement of the solenoid coil or of the entire valve assembly.

## **System Adjustment**

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

### **Liquid Line Sight Glass**

The refrigerant sight glasses should be observed periodically. A clear glass of liquid indicates that there is subcooled refrigerant charge in the system. Bubbling refrigerant in the sight glass, during stable run conditions, may indicate that the system can be short of refrigerant charge. However, it is not unusual to see bubbles in the sight glass during changing load conditions. Refrigerant gas flashing in the sight glass could also indicate an excessive pressure drop in the liquid line, possibly due to a clogged filter-drier or a restriction elsewhere in the liquid line.

An element inside the sight glass indicates the moisture condition corresponding to a given element color. Immediately after the system has been opened for service, the element may indicate a wet condition. If the sight glass does not indicate a dry condition after about 12 hours of operation, the circuit should be pumped down and the filter-drier changed or verify moisture content by performing an acid test on the compressor oil.

### **Expansion Valve**

The expansion valve's function is to keep the evaporator supplied with the proper amount of refrigerant to satisfy the load conditions.

Before adjusting superheat, check that unit charge is correct and liquid line sight glass is full with no bubbles and that the circuit is operating under stable, full load conditions.

The suction superheat for the suction leaving the evaporator is set at the factory to 10°F.

**Table 30: Planned Maintenance Schedule**

Operation	Weekly	Monthly (Note 1)	Annual (Note 2)
<b>General</b>			
Complete unit log and review (Note 3)	X		
Visually inspect unit for loose or damaged components		X	
Inspect thermal insulation for integrity			X
Clean and paint as required			X
<b>Electrical</b>			
Check terminals for tightness, tighten as necessary			X
Clean control panel interior			X
Visually inspect components for signs of overheating		X	
Verify compressor heater operation		X	
Test and calibrate equipment protection and operating controls			X
Megger compressor motor (Note 4)			X
<b>Refrigeration</b>			
Leak test		X	
Check sight glasses for clear flow	X		
Check filter-drier pressure drop (see manual for spec)		X	
Perform compressor vibration test			X
Acid test oil sample			X
<b>Condenser (air-cooled)</b>			
Clean condenser coils (Note 5)			X
Check fan blades for tightness on shaft (Note 6)			X
Check fans for loose rivets and cracks			X
Check coil fins for damage			X

**Notes:**

1. Monthly operations include all weekly operations.
2. Annual (or spring start-up) operations includes all weekly and monthly operations.
3. Log readings can be taken daily for a higher level of unit observation.
4. Never Megger motors while they are in a vacuum to avoid damage to the motor.
5. Coil cleaning can be required more frequently in areas with a high level of airborne particles.
6. Be sure fan motors are electrically locked out.

## R-410A Refrigerant

### Terminology

**Bubble Point:** The temperature/pressure where bubbles first appear when heat is added to a liquid refrigerant. Used to measure sub-cooling.

**Dew Point:** The temperature/pressure where droplets first appear when heat is removed from a refrigerant gas. Used to measure superheat.

**Fractionalization:** A change in refrigerant composition due to the tendency of the higher pressure refrigerant to leak at a faster rate, should a system have leakage from a static two-phase region.

**Glide:** The total difference of Dew and Bubble Point at a specific condition. Mid-Point or Mean: Measurement half way between Dew and Bubble Points.

**Miscibility:** The ability of a refrigerant and oil to mix and flow together.

**Solubility:** The effect of refrigerant on the viscosity of a lubricant.

### Safety

- ANSI/ASHRAE safety group A1.
- Always carry and be familiar with SDS information for R-410A.
- Store refrigerant in clean, dry area out of direct sunlight.
- Never heat or store cylinders above 125° F. Note vehicle precautions!
- Never tamper with cylinder valves or pressure relief valves. (Typical relief for R-410A is 525 psig).
- Never refill disposable cylinders.
- Verify cylinder hook-up.
- Verify cylinder label and color code match. R-410A is rose/light maroon. Must be DOT approved, R-410A with 400 psig rating. Open cylinders slowly.
- Avoid rough handling of cylinders and secure as appropriate. Cap when not in use.
- Do not overfill recovery cylinders or overcharge units.
- Check gauge calibration before every use and manifold set for leaks regularly.
- Be aware of pneumatic and possible hydrostatic pressure potentials.
- Never pressurize systems with oxygen or ref/air mix. R-410A, R-407C, & R-134a are flammable with low air mix.
- Wear protective clothing. Impervious gloves and splash goggles should be worn.
- Avoid contact with liquid refrigerant (R-410A -60.8°F @ atm.) due to corrosion and freezing hazards.
- Avoid exposure to vapors. 1000 ppm/8 hr.
- Evacuate areas in cases of large releases. R-410A is heavier than air and can cause asphyxiation, narcotic and



cardiac sensation effects.

- Evacuate systems and break vacuum (0 psig) with nitrogen before welding or brazing.
- Always ventilate work areas before using open flames. Exposure to open flames or glowing metal will form toxic hydrofluoric acid & carbonyl fluoride. No smoking!
- Make sure all tools, equipment, and replacement components are rated for the refrigerant used.

## POE Lubricants

### **WARNING**

POE oil must be handled carefully using proper protective equipment (gloves, eye protection, etc.) The oil must not come in contact with certain polymers (e.g. PVC), as it may absorb moisture from this material. Daikin Applied recommends against the use of PVC and CPVC piping for chilled water systems. In the event the pipe is exposed to POE oil used in the refrigerant system, the pipe can be chemically damaged and pipe failure can occur. Also, do not use oil or refrigerant additives in the system.

Polyolester (POE) oil is used for compressor lubrication. This type of oil is extremely hydroscopic which means it will quickly absorb moisture if exposed to air and may form acids that can be harmful to the chiller. Avoid prolonged exposure of POE oil to the atmosphere to prevent this problem.

It is important that only the manufacturer's recommended oils be used. Acceptable POE oil types are:

- CPI/Lubrizol Emkarate RL32-3 MAF
- Copeland Ultra 32-3 MAF
- Parker Emkarate RL32-3MAF
- Virginia LE323MAF
- Nu Calgon 4314-66

### **Procedure Notes**

- Use only new sealed metal containers of oil to insure quality.
- Buy smaller containers to prevent waste and contamination.
- Use only filter driers designed for POE and check pressure drops frequently.
- Test for acid and color at least annually. Change filter driers if acid or high moisture (> 200 ppm) is indicated (< 100 ppm typical).
- Evacuate to 500 microns and hold test to insure systems are dry.

## Refrigerant Charging

### **CAUTION**

When moving refrigerant to/from the chiller using an auxiliary tank, a grounding strap must be used. An electrical charge builds when halo-carbon refrigerant travels in a rubber hose. A grounding strap must be used between the auxiliary refrigerant tank and the end sheet of the chiller (earth ground), which will safely take the charge to the ground. Damage to sensitive electronic components could occur if this procedure is not followed.

If a unit is low on refrigerant, you must first determine the cause before attempting to recharge the unit. Locate and repair any refrigerant leaks. Soap works well to show bubbles at medium size leaks but electronic leak detectors are needed to locate small leaks.

Charging or check valves should always be used on charging hoses to limit refrigerant loss and prevent frostbite. Ball valve type recommended. Charge to 80-85% of normal charge before starting the compressors.

### **Charging procedure**

The units are factory-charged with R-410A. Use the following procedure if recharging in the field is necessary:

To prevent fractionalization, liquid must be charged from the refrigerant cylinder, unless charging the entire cylinder contents.

The charge can be added at any load condition between 25 to 100 percent load per circuit, but at least two fans per refrigerant circuit should be operating if possible.

- Start the system and observe operation.
- Trim the charge to the recommended liquid line sub-cooling (approximately 18-20°F typical).
- Verify the suction superheat (10 degrees F for EEVs and 10 – 12 degrees F for TXVs) at full load conditions.
- Use standard charging procedures (liquid only) to top off the charge.
- Check the sight glass to be sure there is no refrigerant flashing.

If the unit is at steady full load operation and bubbles are visible in the sight glass, then check liquid subcooling. Liquid line subcooling at the liquid shut-off valve should be between 18 and 20°F at full load. The AMZ units have a condenser coil design with approximately 15% of the coil tubes located in a subcooler section of the coil to achieve liquid cooling to within 5-10°F (2.8-5.6°C) of the outdoor air temperature when all condenser fans are operating. Subcooling should be checked at full load with 70°F (21.1°C) ambient temperature or higher, stable conditions, and all fans running.

If subcooling is low, add charge to clear the sight glass. Once the subcooler is filled, extra charge will not lower the liquid temperature and does not help system capacity or efficiency. If head pressure becomes too high, nuisance trips may occur.

If subcooling is normal (18 to 20°F at full load) and flashing is visible in the sight glass, check the pressure drop across the filter-drier. The maximum allowable pressure drop is 10psi.

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 by using a flow restrictor. 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.

Overcharging of refrigerant will raise the compressor discharge pressure due to filling of the condenser tubes with excess refrigerant.

## Service

With R-410A, fractionalization, if due to leaks and recharge has a minimal effect on performance or operation.

Special tools will be required due to higher refrigerant pressures with R-410A. Oil-less/hp recovery units, hp recovery cylinders (DOT approved w/525# relief), gauge manifold 30"-250 psi low/0-800 psi high, hoses w/800 psi working & 4,000 psi burst.

All filter driers and replacement components must be rated POE oils and for the refrigerant pressure (R-410A 600psig typical).

R-410A compressor internal relief is 600-650 psid.

Brazed connections only. No StayBrite or solder connections (solder should never be used with any refrigerant). K or L type refrigeration tubing only. Use nitrogen purge. Higher R-410A pressures and smaller molecule size make workmanship more critical.

R-410A must be charged from cylinder as a liquid unless entire cylinder is used. Use a Refrigerant flow restrictor if charging liquid to suction or to a system at pressure below a saturated temperature of 32° F.

Follow EPA recovery and handling requirements for R-410A.

Cooling the recovery cylinder will speed recovery and lessen stress on recovery equipment.

### WARNING

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

Daikin P.O Box 2510 Staunton, VA 24402-2510 Email Address: STN.Wty_Startup_Registration@daikinapplied.com	This form must be completely filled out and returned to the Staunton Warranty Department within <b>ten (10) days</b> of start-up in order to comply with the terms of "Daikin Limited Product Warranty".
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**Check, Test and Commissioning for  
Scroll Product (AGZ, AMZ, WGZ, TGZ)**

Job Name: \_\_\_\_\_ Startup Date: \_\_\_\_\_

Daikin G.O. No.: \_\_\_\_\_ Daikin S.O. No.: \_\_\_\_\_

Installation Address: \_\_\_\_\_ City/State/Zip: \_\_\_\_\_

Purchasing Contractor: \_\_\_\_\_ Phone: \_\_\_\_\_

City/State/Zip: \_\_\_\_\_ No. of units at site: \_\_\_\_\_

Unit Model No.: \_\_\_\_\_ Serial No.: \_\_\_\_\_

Compressor # 1 Serial #: \_\_\_\_\_ Compressor # 4 Serial No.: \_\_\_\_\_

Compressor # 2 Serial #: \_\_\_\_\_ Compressor # 5 Serial No.: \_\_\_\_\_

Compressor # 3 Serial #: \_\_\_\_\_ Compressor # 6 Serial No.: \_\_\_\_\_

Benshaw/DRC Control Box M/M #: \_\_\_\_\_ Benshaw/DRC Control Box S/N #: \_\_\_\_\_

**I. PRE START-UP PROCEDURE**

**II. Pre Start-Up Checklist**

**Pre Start-Up Checklist, All NO checks require an explanation under "Description". Please check yes or no.**

	YES	NO
A. Is the unit free of visible shipping damage, corrosion or paint problems?	<input type="checkbox"/>	<input type="checkbox"/>
B. Is unit installed level?	<input type="checkbox"/>	<input type="checkbox"/>
C. Does the unit meet all location, installation and service clearances per IM Bulletin?	<input type="checkbox"/>	<input type="checkbox"/>
D. Has sensor bulb been properly installed in the well?	<input type="checkbox"/>	<input type="checkbox"/>
E. Are all set screws on all fans tight?	<input type="checkbox"/>	<input type="checkbox"/>
F. Does electrical service correspond to unit nameplate? Nameplate: Volts _____ Hertz _____ Phase _____	<input type="checkbox"/>	<input type="checkbox"/>
G. Has electrical service been checked for proper phasing at each circuit power terminal block?	<input type="checkbox"/>	<input type="checkbox"/>
H. Has unit been properly grounded?	<input type="checkbox"/>	<input type="checkbox"/>
I. Has a fused disconnect and fuses or breaker been sized per product manual and installed per local code? Number of conduits _____ Number of Wires _____ Wire Size _____	<input type="checkbox"/>	<input type="checkbox"/>
J. Are all electrical power connections tight?	<input type="checkbox"/>	<input type="checkbox"/>
K. been operating for 24 hours prior to start-up?	<input type="checkbox"/>	<input type="checkbox"/>

- L. Does all field wiring conform to unit electrical specifications?
- M. Are all service and liquid line valves in correct position?
- N. Water Strainer installed? Brazed Plate Evaporator 0.063" (1.6mm) or smaller perforations
- O. Has a flow switch been installed per the IM manual?
- P. Has the chill water circuit been cleaned, flushed, and water treatment confirmed?
- Q. Does the chiller and condenser water piping conform to the IM manual?
- R. Are fans properly aligned and turn freely?
- S. Is wind impingement against the air cooled condenser a consideration?
- T. Description of unit location with respect to building structures. Include measured distances.

**Description:** \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

**III. REFRIGERATION SYSTEM**

- |  | N/A                      | YES                      | NO                       |
|--|--------------------------|--------------------------|--------------------------|
| A. Has all field piping been leak tested at 150 psig (690 kPa)?                                  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B. Has system been properly evacuated and charged?   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| C. Refrigerant R-_____ Circuit 1 _____ lbs (kg) Circuit 2 _____ lbs. (kg)                        |                          | <input type="checkbox"/> | <input type="checkbox"/> |
| D. Does piping to unit appear to be adequately sized and installed according to the IM bulletin? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| E. Is a liquid line filter-drier installed in each circuit?                                      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| F. Is level of oil in sightglass visible but not more than 1/2 glass with compressors running?   |                          | <input type="checkbox"/> | <input type="checkbox"/> |
| G. Is a liquid line solenoid installed correctly in each circuit?                                | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| H. Is expansion valve bulb or suction sensor properly installed and insulated?                   |                          | <input type="checkbox"/> | <input type="checkbox"/> |

**IV. DESIGN CONTROLS**

- A. CHILLER  
 Water Pressure Drop: \_\_\_\_\_ psig(kPa) \_\_\_\_\_ Ft. (kPa) \_\_\_\_\_ gpm (lps)  
 Water Temperatures: Entering \_\_\_\_\_ °F (°C) Leaving \_\_\_\_\_ °F (°C)
- B. CONDENSER  
 Water Pressure Drop: \_\_\_\_\_ psig(kPa) \_\_\_\_\_ Ft. (kPa) \_\_\_\_\_ gpm (lps)  
 Water Temperatures: Entering \_\_\_\_\_ °F (°C) Leaving \_\_\_\_\_ °F (°C)

**V. START-UP**

- |  | YES                      | NO                       |
|--|--------------------------|--------------------------|
| A. Does unit start and perform per sequence of operation as stated in the IM Manual? | <input type="checkbox"/> | <input type="checkbox"/> |
| B. Do condenser fans rotate in the proper directions?                                | <input type="checkbox"/> | <input type="checkbox"/> |

**MICROTECH STATUS CHECK-Each Reading Must be Verified with Field Provided Instruments of Known Accuracy?**

		<b>MicroTech</b>	<b>Verification</b>
C. Water Temperatures:	Leaving Evaporator .....	_____ °F (°C)	_____ °F (°C)
	Entering Evaporator .....	_____ °F (°C)	_____ °F (°C)
	Entering Condenser .....	_____ °F (°C)	_____ °F (°C)
	Leaving Condenser .....	_____ °F (°C)	_____ °F (°C)
D. Circuit #1 Refrigerant Pressures:	Evaporator .....	_____ psig (kPa)	_____ psig (kPa)
	Liquid Line pressure .....	_____ psig (kPa)	_____ psig (kPa)
	Condenser Pressure .....	_____ psig (kPa)	_____ psig (kPa)
E. Circuit #2 Refrigerant Pressures:	Evaporator .....	_____ psig (kPa)	_____ psig (kPa)
	Liquid Line Pressure .....	_____ psig (kPa)	_____ psig (kPa)
	Condenser Pressure .....	_____ psig (kPa)	_____ psig (kPa)
F. Circuit #1 Refrigerant Temperatures:	Saturated Evaporator Temperature .....	_____ °F (°C)	_____ °F (°C)
	Suction Line Temperature .....	_____ °F (°C)	_____ °F (°C)
	Suction Superheat .....	_____ °F (°C)	_____ °F (°C)
	Saturated Condenser Temperature .....	_____ °F (°C)	_____ °F (°C)
	Liquid Line Temperature .....	_____ °F (°C)	_____ °F (°C)
	Subcooling .....	_____ °F (°C)	_____ °F (°C)
	Discharge Temperature .....	_____ °F (°C)	_____ °F (°C)
G. Circuit #2 Refrigerant Temperatures:	Saturated Evaporator Temperature .....	_____ °F (°C)	_____ °F (°C)
	Suction Line Temperature .....	_____ °F (°C)	_____ °F (°C)
	Suction Superheat .....	_____ °F (°C)	_____ °F (°C)
	Saturated Condenser Temperature .....	_____ °F (°C)	_____ °F (°C)
	Liquid Line Temperature .....	_____ °F (°C)	_____ °F (°C)
	Subcooling .....	_____ °F (°C)	_____ °F (°C)
	Discharge Temperature .....	_____ °F (°C)	_____ °F (°C)
H. Outdoor Air Temperature: .....	_____ °F (°C)	_____ °F (°C)	

**NON-MICROTECH READINGS**

- I. Does the system contain glycol?  Yes  No  
 Percentage by weight \_\_\_\_\_ or by volume \_\_\_\_\_ Glycol Type \_\_\_\_\_
- J. If the chilled water system include glycol, have the freezstats been adjusted lower to meet acutal job requirements?  
**Note: See operation manual for low temperature on ice bank applications.**  Yes  No
- K. Chiller: \_\_\_\_\_ psig (kPa) \_\_\_\_\_ Ft. (kPa) \_\_\_\_\_ gpm (lps)  
 Condenser: \_\_\_\_\_ psig (kPa) \_\_\_\_\_ Ft. (kPa) \_\_\_\_\_ gpm (lps)
- L. Unit Voltage Across Each Phase: L1-L2 \_\_\_\_\_ V L2-L3 \_\_\_\_\_ V L1-L3 \_\_\_\_\_ V
- M. Unit Current Per Phase: L1 amps \_\_\_\_\_ L2 amps \_\_\_\_\_ L3 amps \_\_\_\_\_
- N. Compressor Current Per Phase: Compressor #1: \_\_\_\_\_ L1 Amps \_\_\_\_\_ L2 Amps \_\_\_\_\_ L3 Amps  
 Compressor #2: \_\_\_\_\_ L1 Amps \_\_\_\_\_ L2 Amps \_\_\_\_\_ L3 Amps  
 Compressor #3: \_\_\_\_\_ L1 Amps \_\_\_\_\_ L2 Amps \_\_\_\_\_ L3 Amps  
 Compressor #4: \_\_\_\_\_ L1 Amps \_\_\_\_\_ L2 Amps \_\_\_\_\_ L3 Amps  
 Compressor #5: \_\_\_\_\_ L1 Amps \_\_\_\_\_ L2 Amps \_\_\_\_\_ L3 Amps  
 Compressor #6: \_\_\_\_\_ L1 Amps \_\_\_\_\_ L2 Amps \_\_\_\_\_ L3 Amps

**VI. MICROTECH SETPOINTS**

	MICROTECH Setting
A. Leaving Evaporator .....	_____ °F (°C)
B. Reset Leaving .....	_____ °F (°C)
C. Reset Signal .....	_____ ma
D. Reset Option .....	_____
E. Maximum Chilled Water Reset .....	_____ °F (°C)
F. Return Setpoint .....	_____ °F (°C)
G. Maximum Pulldown .....	_____ °F (°C)
H. Evaporator Full Load Delta T .....	_____ °F (°C)
I. Evap Recirc Timer .....	_____ sec.
J. Start-to-Stop Delay .....	_____ min.
K. Stop-to-Stop Delay .....	_____ min.
L. Stage Up Delay .....	_____ sec.
M. Stage Down Delay .....	_____ sec.

**ALARM SETPOINTS MUST BE VERIFIED WITH INSTRUMENTS OF KNOWN ACCURACY**

N. Low Pressure Hold .....	_____ psig (kPa)
O. Low Pressure Unload.....	_____ psig (kPa)
P. Evaporator Water Freeze.....	_____ psig (kPa)
Q. High Pressure Cut-Out.....	_____ psig (kPa)
R. Unit Type = _____	
S. Number of Compressors = _____	
T. Number of Stages = _____	
U. Number of Fan Stages = _____	
V. Software Version = _____	

**VII. FOR TGZ Templifier CHILLERS ONLY (Must Be Taken At Full Load)**

A. Place Unit in heat recovery mode.			
B. Condenser Pressure Drop:	_____ psig (kPa)	_____ Ft. (kPa)	_____ gpm (lps)
C. Condenser Temperatures:	_____ Inlet	_____ Outlet	
D. Head Pressure: Circuit #1	_____ psig (kPa)	Circuit #2:	_____ psig (kPa)
E. Evaporator Pressure Drop:	_____ psig (kPa)	_____ Ft. (kPa)	_____ gpm (lps)
F. Evaporator Temperatures:	_____ Inlet	_____ Outlet	
G. Suction Pressure: Circuit #1	_____ psig (kPa)	Circuit #2:	_____ psig (kPa)
F. Compressor Current Per Phase			
Compressor #1	_____ L1 AMPS	_____ L2 AMPS	_____ L3 AMPS
Compressor #2	_____ L1 AMPS	_____ L2 AMPS	_____ L3 AMPS
Compressor #3	_____ L1 AMPS	_____ L2 AMPS	_____ L3 AMPS
Compressor #4	_____ L1 AMPS	_____ L2 AMPS	_____ L3 AMPS
Compressor #5	_____ L1 AMPS	_____ L2 AMPS	_____ L3 AMPS
Compressor #6	_____ L1 AMPS	_____ L2 AMPS	_____ L3 AMPS

**VIII. GENERAL**

	YES	NO
A. Are all control lines secure to prevent excess vibration and wear? .....	<input type="checkbox"/>	<input type="checkbox"/>
B. Are all gauges shut off, valve caps, and packings tight after startup? .....	<input type="checkbox"/>	<input type="checkbox"/>

Refrigerant Leaks: \_\_\_\_\_

Repairs Made \_\_\_\_\_  
\_\_\_\_\_

Items not installed per IM Manual and/or recommended corrective actions \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Performed By: \_\_\_\_\_ Title: \_\_\_\_\_

Company Name: \_\_\_\_\_

Address: \_\_\_\_\_

City/State/Zip Code: \_\_\_\_\_ Telephone: \_\_\_\_\_

Modem Number: \_\_\_\_\_

Signature: \_\_\_\_\_ Date: \_\_\_\_\_

Contractor's Signature \_\_\_\_\_

**RETURN COMPLETED FORM TO: DAIKIN, WARRANTY DEPT., PO BOX 2510, STAUNTON, VA 24402**



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