



# Installation, Operation, and Maintenance Manual

**IOM 1206-16**

Group: Chiller

Part Number: IOM1206-16

Date: September 2022

## Trailblazer® Air-Cooled Scroll Compressor Chillers With High Efficiency Variable Speed Fan Technology

Model AGZ, E Vintage  
30 to 241 Tons (100 to 840 kW)  
HFC-410A Refrigerant  
50/60 Hz



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**Manufactured in an ISO 9001 & ISO 14001 certified facility**



\* Heat Recovery option is 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 and Condenser Water for Water-cooled Chiller</b>	<b>Yes</b>	<b>No</b>	<b>N/A</b>	<b>Initials</b>
Piping Complete				
Water strainer(s) installed in piping per manual requirements				
Water System – flushed, filled, and vented; Water treatment in place				
Cooling tower flushed, filled, vented; Water treatment in place (if applicable)				
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(es) - installed, wired, and calibrated				
Vent installed on evaporator				
Glycol at design % (if applicable)				
<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 24 hours before startup				
Crankcase heaters must operate for 24+ hours before startup to maximize separation				
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				
SiteLine™ cloud-connected controls included and needs to be commissioned				
<b>Document Attached:</b> Technical Breakdown from Selection Software				
<b>Document Attached:</b> Final Order Acknowledgement				
<b>Document Attached:</b> Remote piping approval				
<b>Notes:</b> The most common problems delaying start-up and affecting unit reliability are:				
1. 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:				
a. From Power supply to chiller _____				
* Refer to NFPA 70-2017, Article 440.35				
2. Remote Evaporator piping incomplete or incorrect. Provide approved piping diagrams.				
3. Items on this list incorrectly acknowledged resulting in delayed start and possible extra expenses incurred by return trips.				

### Contractor Representative

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

### Daikin Applied Sales Representative

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

Cut Here ✂



This manual provides installation, operation, and maintenance information for Daikin Trailblazer model AGZ-E air-cooled scroll chillers with the MicroTech® III controller and using R-410A. Packaged unit configurations and optional heat recovery installations are covered in this manual. Information for units with either the pump package or remote evaporator options can be found at [www.DaikinApplied.com](http://www.DaikinApplied.com).

**NOTE:** Installation and maintenance are to be performed only by licensed, if required by local codes and regulations, or qualified personnel who are familiar with local codes and regulations and are experienced with this type of equipment.

 **DANGER**

**LOCKOUT/TAGOUT** all power sources prior to service, pressurizing, de-pressuring, or powering down the Chiller. Disconnect electrical power before servicing the equipment. More than one disconnect may be required to de-energize the unit. Failure to follow this warning exactly can result in serious injury or death. Be sure to read and understand the installation, operation, and service instructions within this manual.

 **WARNING**

Electric shock hazard. Improper handling of this equipment can cause personal injury or equipment damage. This equipment must be properly grounded. Connections to and service of the MicroTech® III control panel must be performed only by personnel that are knowledgeable in the operation of the equipment being controlled. Disconnect electrical power before servicing the equipment.

 **CAUTION**

Static sensitive components. A static discharge while handling electronic circuit boards can cause damage to the components. Use a static strap while performing any service work. Never unplug any cables, circuit board terminal blocks, or power plugs while power is applied to the panel.

 **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 chiller's grounded base (earth ground), which will safely take the charge to the ground. Damage to sensitive electronic components could occur if this procedure is not followed.

 **WARNING**

If refrigerant leaks from the unit, there is a potential danger of suffocation since refrigerant will displace the air in the immediate area. Be sure to follow all applicable industry related published standards and local, state and federal, statutes, regulations and codes if a refrigerant leak occurs. Avoid exposing refrigerant to an open flame or other ignition source.

 **WARNING**

Polyolester Oil, commonly known as POE oil is a synthetic oil used in many refrigeration systems, and may be present in this Daikin product. POE oil, if ever in contact with PVC/CPVC, will coat the inside wall of PVC/CPVC pipe causing environmental stress fractures. Although there is no PVC/CPVC piping in this product, please keep this in mind when selecting piping materials for your application, as system failure and property damage could result. Refer to the pipe manufacturer's recommendations to determine suitable applications of the pipe.

**HAZARD IDENTIFICATION INFORMATION**

 **DANGER**

Danger indicates a hazardous situation, which will result in death or serious injury if not avoided.

 **WARNING**

Warning indicates a potentially hazardous situation which can result in property damage, personal injury, or death if not avoided.

 **CAUTION**

Caution indicates a potentially hazardous situation which can result in minor injury or equipment damage if not avoided.

**NOTE:** Indicates important details or clarifying statements for information presented.

## 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. Components housed in a centrally located, weather resistant control panel with hinged and tool-locked doors.

### NOMENCLATURE



## Operating and Standby Limits

**Table 1: Operating Limits for AGZ-E Chillers**

Maximum standby ambient temperature	130°F (54°C)
Maximum operating ambient temperature	105°F (41°C)
-with optional high ambient package (see information under High Ambient Operation)	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)

## Nameplates

The unit nameplate is located on the exterior of the Unit Power Panel. Both the Model No. and Serial No. are located on the unit nameplate; the Serial No. is unique to the unit. These numbers should be used to identify the unit for service, parts, or warranty questions. This plate also has the unit refrigerant charge and electrical ratings. Evaporator data plate is under insulation and contains the serial number. Compressor nameplate is located on each compressor and gives pertinent electrical information.

### **WARNING**

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

### **CAUTION**

When around sharp edges, wear appropriate Personal Protective Equipment (PPE), such as gloves, protective clothing, foot wear, eye protection etc. to prevent personal injury.

## 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 while sitting on appropriately-sized roller dollies. To lift the unit, 2-1/2" (64mm) diameter lifting eyes are provided on the base of the unit. Arrange spreader bars and cables to prevent damage to condenser coils or cabinet (see [Figure 1](#)).

### **CAUTION**

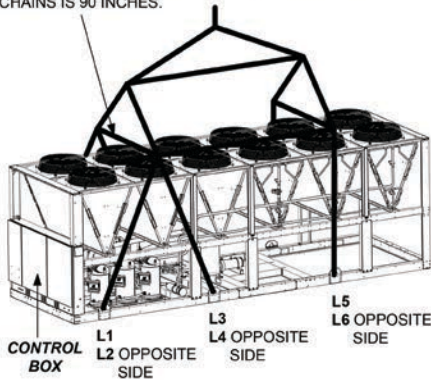
All lifting locations must be used to prevent damage to unit.

**⚠ 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: Required Lifting Arrangement**

SPREADER BARS MUST BE USED TO PREVENT CABINET DAMAGE. LOCATE BARS ABOVE UNIT TO CLEAR FAN GRILLES. MINIMUM DISTANCE ACROSS UNIT BETWEEN CABLE OR CHAINS IS 90 INCHES.



ALL RIGGING HOLES MUST BE USED. NOTE THE LOCATION OF THE CONTROL BOX.

LIFT ONLY FROM BASE POINTS AS SHOWN

NOTE: Number of fans and rigging holes may vary from this diagram. The lifting method will remain the same.

## 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. Spring isolators for roof applications are recommended. 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. Drawings, dimensional values, and other information may change depending on options or configurations selected. Refer to the as-built submittal drawings provided by a Daikin Applied sales representative for configuration-specific details.

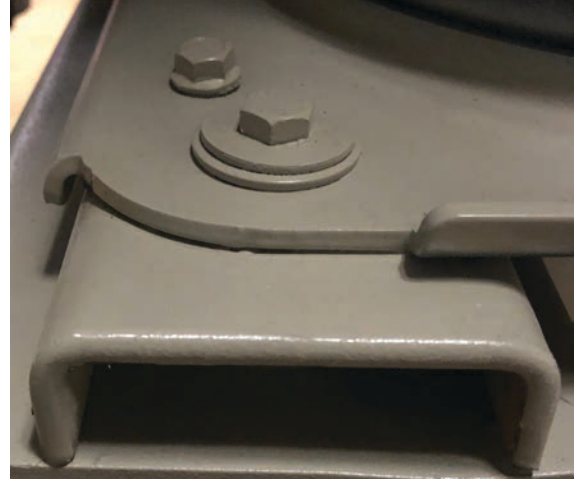
The addition of neoprene waffle pads (supplied by customer) under the unit may allow water to drain from inside the frame, which can act as a dam. Installation of optional spring or rubber-in-shear isolators can also assist with drainage, see [page 39](#) for information.

## Mounting

The inside of the base rail is open to allow access for securing mounting bolts, etc. Mounting location dimensions are given in Dimensional Drawings beginning on [page 24](#).

All compressor bolts, rubber grommets, and fasteners should be left in place on the base plate as shown in [Figure 2](#). None of these fasteners are considered to be 'temporary shipping bolts

**Figure 2: Compressor Base Plate Mounting**



## Service Clearance

The control panels are located on the end of the chiller and require a minimum of four feet of clearance in front of the panels. Compressors, filter-driers, and liquid line shutoff valves are accessible on each side or end of the unit. Do not block access to the sides or ends of the unit with piping or conduit. These areas must be open for service access. Minimum service clearance is as follows:

### Sides

- **4 Fan Models:** Minimum of 4 ft (1.2 m)
- **6 to 14 Fan Models:** It is highly recommended to provide a minimum of 8 ft (2.4 m) on one side to allow for coil replacement. Coils can be removed from the top, allowing a minimum of 4 ft (1.2 m) of side clearance; however, the unit performance may be derated.

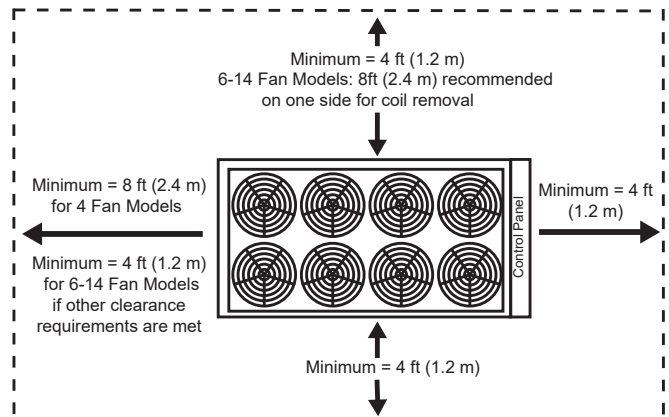
### Control Panel End

- **All Models:** Minimum of 4 feet (1.2 meters)

### Opposite Control Panel End

- **4 Fan Models:** Minimum of 8 ft (2.4 m) for coil removal.
- **6 to 14 Fan Models:** Minimum of 8 ft (2.4 m). Clearance may be reduced to 4 ft (1.2 m) if side clearance is sufficient for evaporator service and removal.

**Figure 3: Service Clearance**



## Operational 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. No solid obstructions are allowed above the unit at any height, see [page 10](#) for details.

The clearance requirements shown are a general guideline 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.

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.

**CAUTION**

Unit performance may be impacted if the operational clearance is not sufficient.

### Case 1: Building or Wall on One Side of Unit

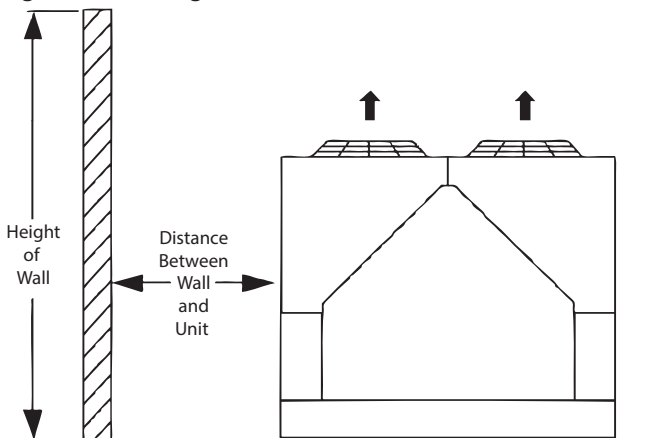
**NOTE:** Assumes a solid height wall taller than unit. Refer to Case 4 for partial wall openings.

For models AGZ030-101E, maintain a 4 feet minimum from a wall of any height.

For models AGZ110-130E, maintain a 6 feet minimum from a wall of any height.

For models AGZ140-241E, maintain a 8 feet minimum from a wall of any height.

Figure 4: Building or Wall on One Side of Unit



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

For models 030-180, there must be a minimum of 4 feet between two units placed side-by-side; however, performance may be affected at this distance. For models 191-241, the minimum is 6 feet as closing spacing may cause air recirculation and elevated condenser pressure. Assuming the requirement of one side having at least 8 feet of service clearance is met, Case 2 figures show performance adjustments as the distance between two units increases.

Figure 5: Two Units, Side-by-Side

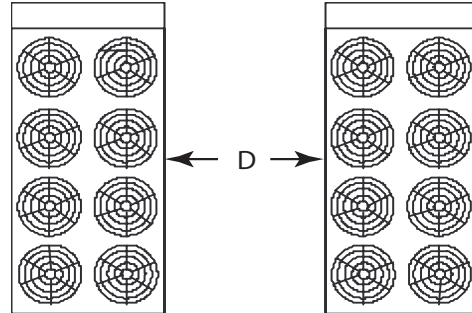


Figure 6: Case 2 - Full Load Capacity Reduction

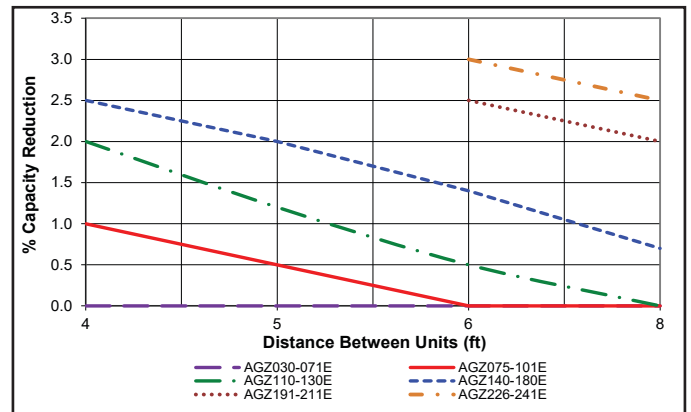
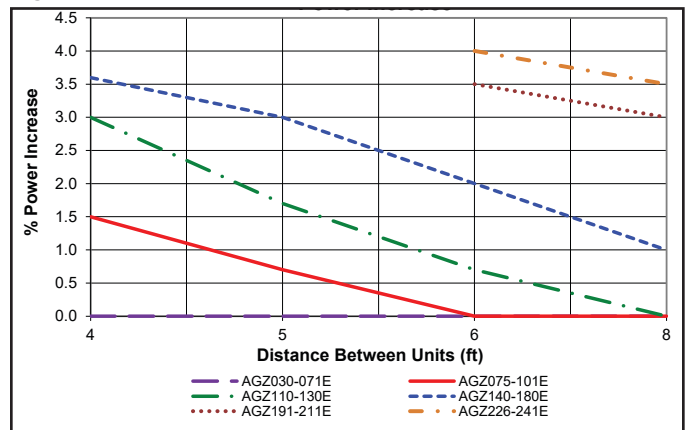


Figure 7: Case 2 - Power Increase





### Case 3: Three or More Units, Side-by-Side

For all models, there must be a minimum distance between any units placed side-by-side; however, performance may be affected at this distance. Minimum distances are: models 030 to 071 - 4 feet, models 075 to 101 - 5 feet, models 110 to 241 - 6 feet. Figure 9 and Figure 10 depict Case 3 performance adjustments as the distance between units increases.

**NOTE:** Data in Figure 9 and Figure 10 is for the middle unit with a unit on each side. See Case 2 adjustment factors for the two outside units.

Figure 8: Three or More Units, Side-by-Side

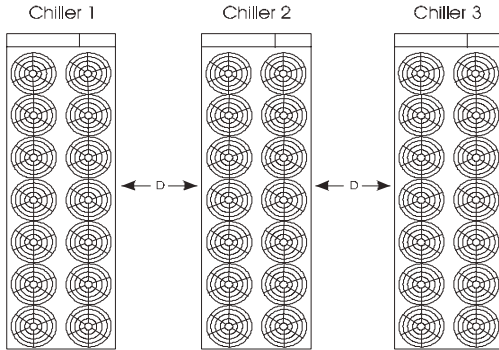


Figure 9: Case 3 - Full Load Capacity Reduction

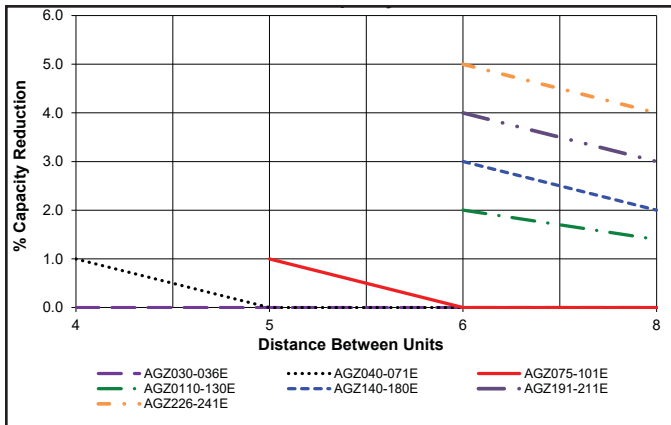
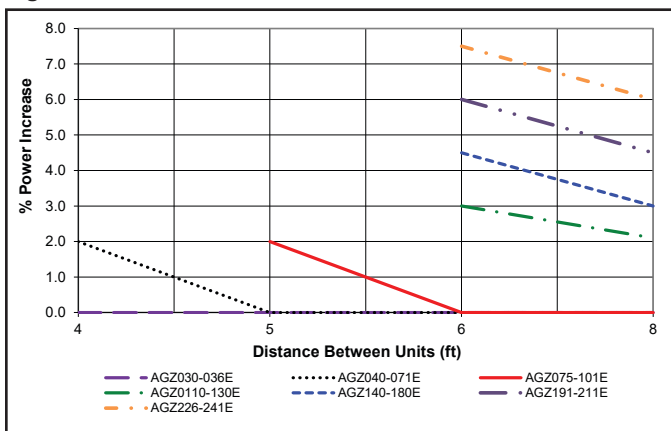


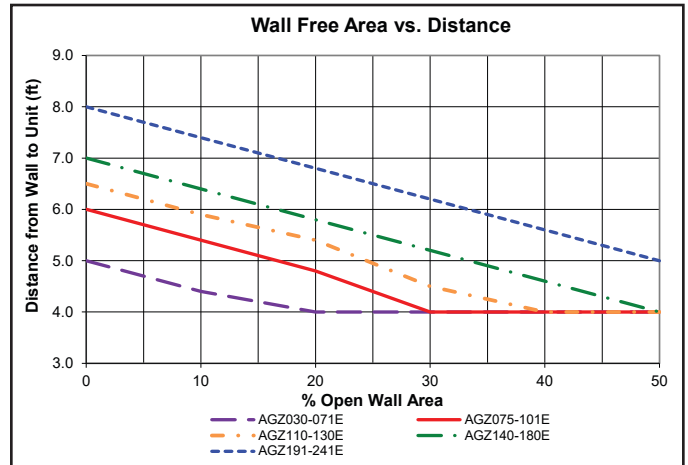
Figure 10: Case 3 - Power Increase



### Case 4: Open Screening Walls

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 (see Figure 11) 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: Pit Installation for performance adjustment factors. 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.

Figure 11: Case 4 - Allowable Wall Open Area



**Case 5: Pit Installation**

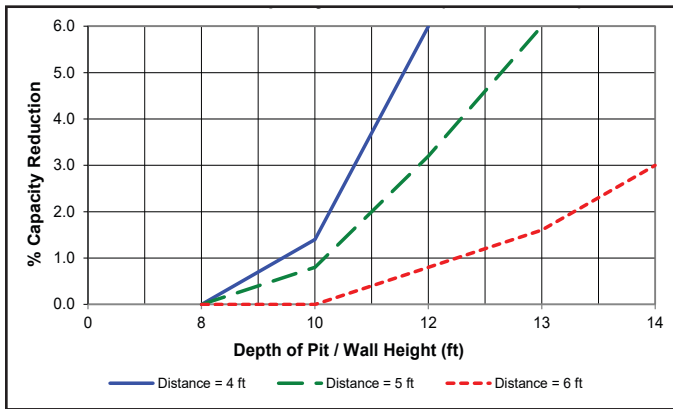
Pit installations can cause operating problems resulting from air recirculation and restriction and require care that sufficient air clearance is provided, safety requirements are met and service access is provided. A solid wall surrounding a unit is substantially a pit and this data should be used.

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.

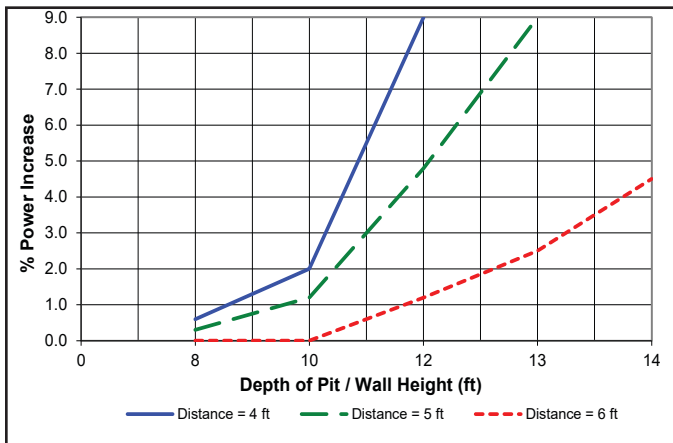
**Models AGZ030-071E:**

The Case 5 figures for models AGZ030-071E show adjustment factors for pit/wall heights of 4 feet, 5 feet, and 6 feet.

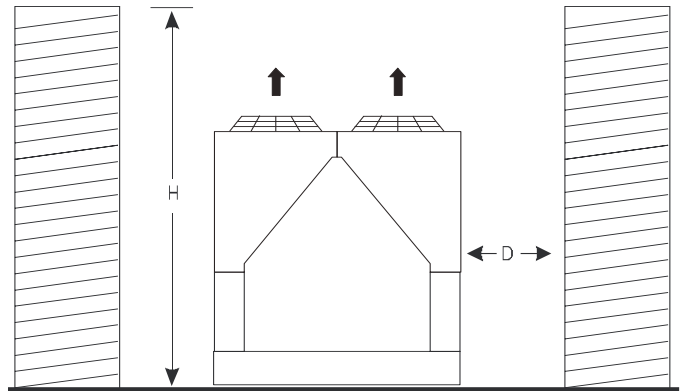
**Figure 12: Case 5 - Full Load Capacity Reduction (AGZ030E-071E)**



**Figure 13: Case 5 - Power Increase (AGZ030-071E)**



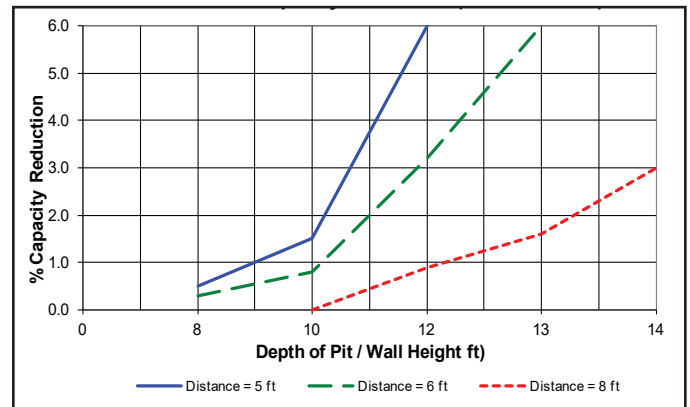
**Figure 14: Case 5 - Pit Installation**



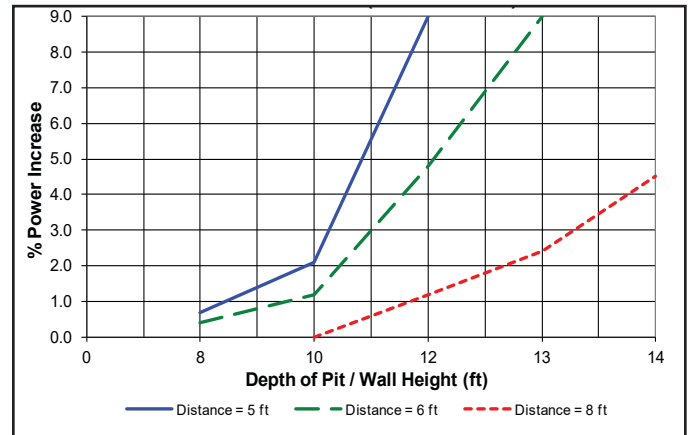
**Models AGZ075-130E:**

The Case 5 figures for models AGZ075-130E show adjustment factors for pit/wall heights of 5 feet, 6 feet, and 8 feet.

**Figure 15: Case 5 - Full Load Capacity Reduction (AGZ075-130E)**



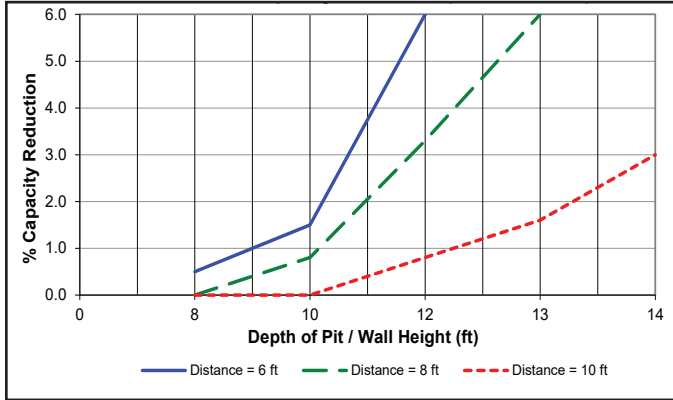
**Figure 16: Case 5 - Power Increase (AGZ075-130E)**



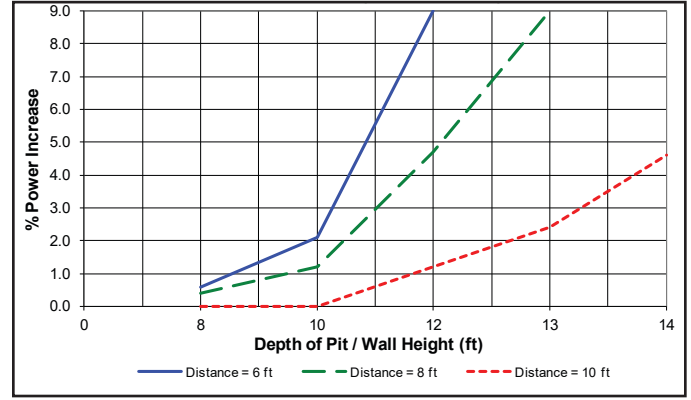
**Models AGZ140-241E:**

The Case 5 figures for models AGZ140-241E show adjustment factors for pit/wall heights of 6 feet, 8 feet, and 10 feet.

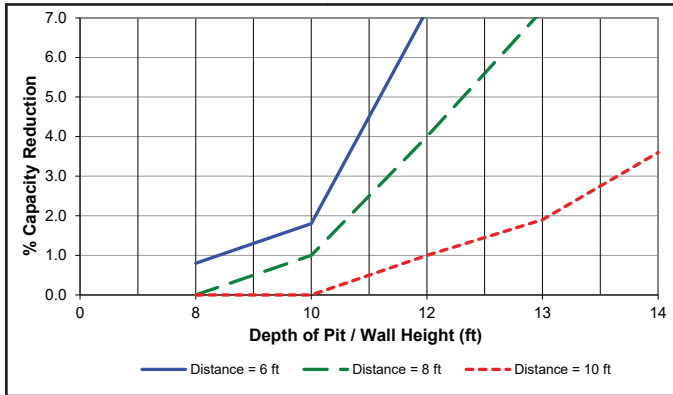
**Figure 17: Case 5 - Full Load Capacity Reduction (AGZ140-180E)**



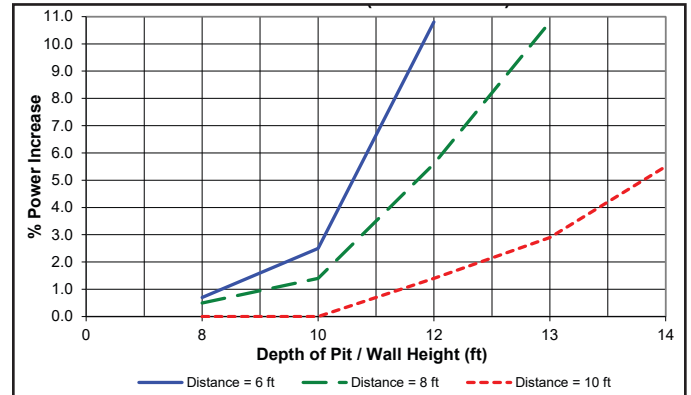
**Figure 19: Case 5 - Power Increase (AGZ140-211E)**



**Figure 18: Case 5 - Full Load Capacity Reduction (AGZ191-241E)**



**Figure 20: Case 5 - Power Increase (AGZ226-241E)**



## 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 down stream of any welded connections (no welded connections between strainer to evaporator). AGZ-E models 030-241 require a strainer with perforations no larger than 0.063" (1.6 mm) diameter. See the Inlet Strainer Guidelines on [page 13](#) 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 15](#) for more information.
- Piping for units with brazed-plate evaporators 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 21](#). 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, separate from the unit, to eliminate weight and strain on the fittings and connections.
- An expansion tank and regulating valve to maintain water pressure.
- matching mechanical connections. All evaporators have

### WARNING

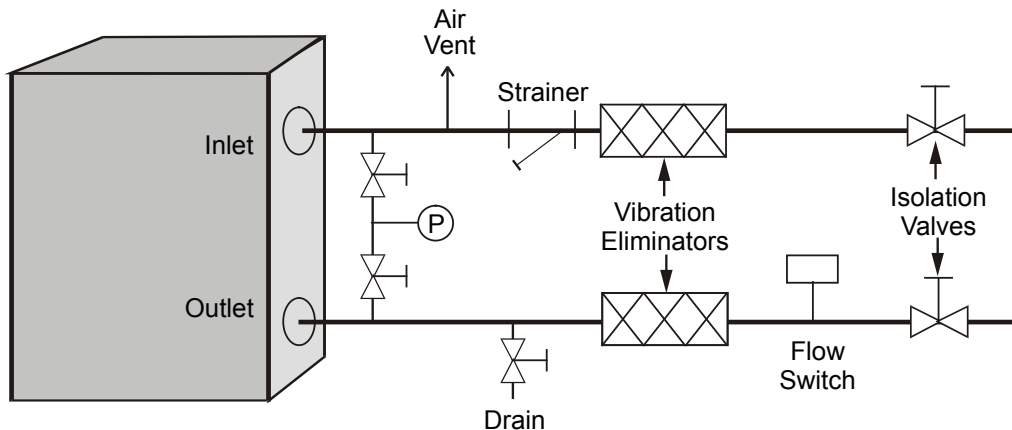
Polyolester Oil, commonly known as POE oil is a synthetic oil used in many refrigeration systems, and is present in this Daikin product. POE oil, if ever in contact with PVC/CPVC, will coat the inside wall of PVC/CPVC pipe causing environmental stress fractures. Although there is no PVC/CPVC piping in this product, please keep this in mind when selecting piping materials for your application, as system failure and property damage could result. Refer to the pipe manufacturer's recommendations to determine suitable applications of the pipe.

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

- Temperature sensors 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 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.
- 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.

Figure 21: Typical Piping for Brazed-Plate Evaporator, Models 30-241



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 - models 030 to 241.
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, grooved pipe connections and strainer cap [a strainer with perforations as listed below by model.]
  - Extension pipe with two Schrader fittings that can be used for a pressure gauge and thermal dispersion flow switch. The pipe provides sufficient clearance from the evaporator for strainer basket removal.
  - ½-inch blowdown valve
  - Two grooved clamps

Both are sized per [Table 2](#) and with the pressure drop shown in the Strainer Pressure Drop graph. Drawings, dimensional values, and other information may change depending on options or configurations selected. Refer to the as-built submittal drawings provided by a Daikin Applied sales representative for configuration-specific details.

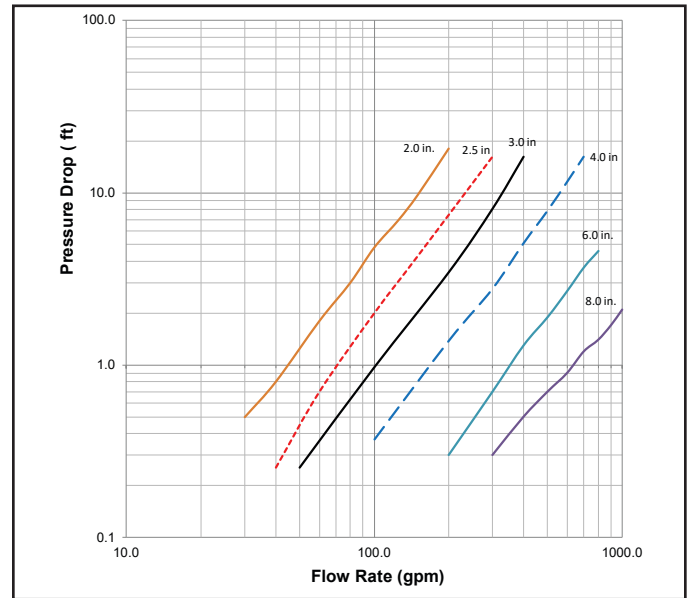
3. A field-supplied strainer that meets specification and installation requirements of this manual.

Verify total system water pressure drop including the strainer and the chiller using [Figure 22](#) and [Figure 50](#).

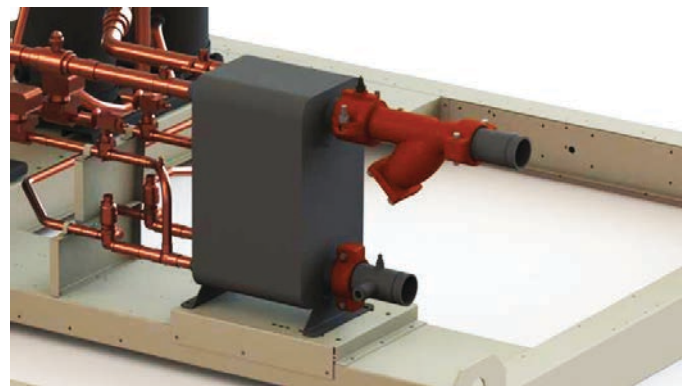
**Table 2: Strainer Data**

Trailblazer® Model	Strainer Size in (mm)	Maximum perforation size in (mm)	Factory Installed Option	Field Installed Option
030-071E	2.5 (64)	0.063 (1.6)	Y	Y
075-130E	3.0 (76)	0.063 (1.6)	Y	Y
140-180E	4.0 (102)	0.063 (1.6)	Y	Y
191-241E	6.0 (152)	0.063 (1.6)	Y	Y

**Figure 22: Strainer Pressure Drop (Data on page 46)**



**Figure 23: Factory Installed Strainer**



## Water Flow Limitations

### Constant Evaporator Flow

The evaporator flow rates and pressure drops shown on [page 44](#) 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 44](#). 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 tube erosion can occur. See [Variable Evaporator Flow on page 70](#) for set point information.

**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. Strainers must be used to protect the chiller systems from water-borne debris. Daikin will not be responsible for any water-borne debris damage or water side damage to the chiller heat exchangers due to improperly treated water.

Water systems should be cleaned and flushed prior to 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).

**⚠ 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 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 are furnished with the evaporator. Models 030 to 241 have an external plate heater and thermostat. These heaters help protect the evaporator down to -20°F (-29°C) ambient air temperature. The evaporator heater cable is factory wired to the 115 volt control circuit transformer in the control box. A 115V power source for the heater and controls may also be supplied from a separate power feed to maximize unit protection if desired. Refer to the field wiring diagram on [page 48](#) for additional information on supplying a separate 115V power feed.

Operation of the heaters is automatic through the sensing thermostat that energizes the evaporator heaters for protection against freeze-up. Unless the evaporator is drained in the winter or contains an adequate concentration of anti-freeze, the disconnect switch to the evaporator heater must not be open.

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 freeze protection:

1. If the unit will not be operated during the winter, drain the evaporator and chilled water piping and flush with glycol.
2. Add a glycol solution to the chilled water system. Burst protection should be approximately 10°F below minimum design ambient temperature.
3. Insulate the exposed piping.
4. Add thermostatically controlled heat by wrapping the lines with heat tape.
5. When glycol is added to the water system for freeze protection, the refrigerant suction pressure will be lower, cooling performance less, and water side pressure drop greater. See [“” on page 15](#) for flow rate and pressure drop adjustment factors.

**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 or automatically alternate pump selection and also has standby operation capability. The controller will energize the pump whenever at least one 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 Field Wiring Diagram beginning on [page 48](#).

**⚠ 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 or does not have adequate glycol in temperatures below freezing, catastrophic evaporator failure may occur.

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

1. If the chiller attempts to start without first starting the pump, the chiller will lock out on the No Flow alarm and require manual 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 necessary to avoid evaporator freeze-up under low or no flow conditions. A factory-included thermal dispersion flow switch will be installed on packaged models. On remote evaporator models, the flow switch may be separately field-provided, or optionally shipped loose for field installation. Terminals are provided in the unit control center for field mounting and wiring of the water flow switch. Wire from switch terminals Y and R to the unit control panel terminals shown on the field wiring diagrams, [page 48](#) to [page 51](#). Mount the flow switch in the leaving water line to shut down the unit when water flow is interrupted. A flow switch is an equipment protection control and should never be used to cycle a unit.

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 44](#). Flow switch installation and calibration is further discussed on [page 104](#).

There is also a set of paddle switch contacts on the switch that can be used for an indicator light or an alarm to indicate when a "no flow" condition exists. Freeze protect any flow switch that is installed outdoors. Differential pressure switches are not recommended for outdoor installation. They can freeze and not indicate a no-flow conditions.

**Glycol Solutions**

The use of glycol may impact system performance depending on its concentration and should be considered during initial system design. When glycol is added to the chilled water system for freeze protection, recognize that the refrigerant suction pressure will be lower, cooling performance less, and water side pressure drop will be higher. The reduction in performance depends upon the glycol concentration and temperature.

Test coolant with a clean, accurate glycol refractometer to determine the freezing point.

**⚠ CAUTION**

The installed glycol level must align with the rated glycol percentage indicated on the submitted chiller technical data sheet. Failure to adhere to the rated glycol percentage may result in unit damage and loss of unit warranty.

**⚠ CAUTION**

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

**Low Ambient Operation**

Compressor staging is adaptively determined by system load, ambient air temperature, and other inputs to the MicroTech® III control. The standard minimum ambient temperature is 32°F (0°C). A low ambient option with fan VFD allows operation down to -10°F (-23°C). The minimum ambient temperature is based on still conditions where the wind is not greater than 5 mph. Greater wind velocities will result in reduced discharge pressure, increasing the minimum operating ambient temperature. Field installed louvers are available and recommended to help allow the chiller to operate effectively down to the ambient temperature for which it was designed.

**High Ambient Operation**

Trailblazer™ units for high ambient operation (105°F to 125°F, 40°C to 52°C) require the addition of the optional high ambient package that includes a small fan with a filter in the air intake to cool the control panel. All units with the optional VFD low ambient fan control automatically include the high ambient option. Note that in cases of high ambient temperature, capacity could be reduced or the lowest leaving water temperature settings may be outside of the chiller operating envelope; consult with a Daikin Applied sales representative to ensure chiller is capable of the required lift.

## Partial Heat Recovery

Partial heat recovery for Trailblazer® chillers is achieved by adding an auxiliary heat exchanger in each unit refrigerant circuit between the compressors and the condenser coils. The heat exchangers transfer the heat from the compressor discharge gas to a separate water loop which can be used for various heating applications. The heating recovery cycle is only available when the chiller is running. The partial heat recovery auxiliary heat exchanger can return water up to 155°F; however, this value cannot be set. The amount of heat produced can be up to 50% of the nominal cooling capacity and is dependent on the requested cooling load, the operating temperatures, and the water flow rate through the auxiliary heat exchangers. Contact a local Daikin Applied sales representative for information on specific applications.

**⚠ WARNING**

Potable water cannot be used in the partial heat recovery system due to the single wall construction of the heat exchangers.

Partial heat recovery components that are factory-supplied:

- Brazed plate heat exchangers - one in each circuit with the water piped together in parallel for one inlet and one outlet water connection, see [Figure 51](#) for pressure drops.
- Insulation of heat exchangers and water piping at the unit.
- Separate temperature sensors for inlet and outlet water piping at the heat exchangers.
- Connections for air vent at the outlet water piping and drain at the inlet water piping.
- Immersion heater for each auxiliary heat exchanger for freeze protection.

**Required** partial heat recovery field piping (see next page) and connections are listed below.

- an external 3-way valve or a variable speed pump in the auxiliary heat exchanger water piping for modulation of flow through the heat exchangers by the unit controller. Heat recovery water loop pump must also be controlled by the chiller controller.
- a cleanable strainer with perforations no larger than 0.063" (1.6 mm) diameter must be installed within 5 feet (1500 mm) of pipe length from the heat exchanger inlet and downstream of any welded connections, see [Figure 22](#) for pressure drop.
- water piping and other portions of the heat recovery water loop must be insulated to prevent heat loss and possible injury due to hot surfaces.
- separate 120 volt power supply for immersion heaters. A junction box for a 120 Volt power connection is provided.

**NOTE:** If the partial heat exchanger is drained, the heater must be turned off to avoid damaging the heat exchanger. The heater should only be on when the heat recovery heat exchanger has water in it.

It is recommended that the field installed heat recovery water piping include:

- a field-installed safety or relief valve and expansion tank on the water side to prevent risks in case the water temperature thermostat should fail.
- a water tank and an additional water heater in the heat recovery piping loop for initial water temperature control and better loop stability. Typical loop sizing guidance is water volume (in gallons) be greater than or equal to approximately two to three times the heat recovery water flow rate (in gallons/minute).

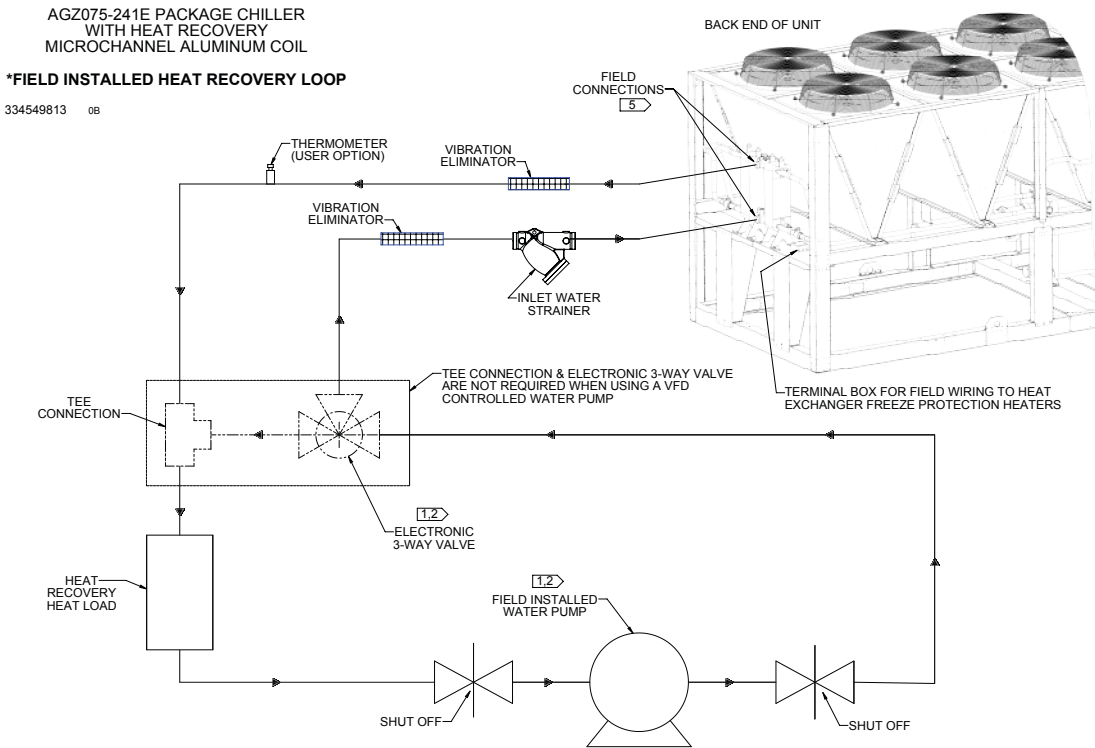
### Partial Heat Recovery Freeze Avoidance

The heat recovery condenser is insulated; a factory-installed heater will protect the heat exchanger from freezing in ambient temperatures down to -20°F (-29°C). When the ambient temperature drops to approximately 39°F (3.9°C) the thermostat energizes the heaters. The inlet and outlet piping should be protected against freezing by one of the following methods:

- Install heat tape on all field-installed water piping
- Add freeze-inhibiting fluid to the partial heat recovery water loop. If adequate amounts of glycol are supplied, it is not required to power the heater.



Figure 24: AGZ075-241E Heat Recovery Field Piping



- NOTES:
1. A VFD CONTROLLED WATER PUMP OR AN ELECTRONIC 3-WAY VALVE IS REQUIRED AND MUST BE CONTROLLED BY THE CHILLER.
  2. FIELD INSTALLED 3-WAY VALVE OR WATER PUMP VFD TO BE CONTROLLED BY 0-10 DCV OR 4-20 mA OUTPUT FROM THE CHILLER UNIT CONTROLLER.
  3. GALLONS OF WATER VOLUME FOR THE HEAT RECOVERY PIPING LOOP SHOULD EQUAL 2 TO 3 TIMES THE HEAT RECOVERY LOOP GPM FLOW RATE.
  4. FOR POTABLE WATER USE - A SECONDARY HEAT EXCHANGER IN A SEPARATE LOOP IS REQUIRED.
  5. WATER PIPING CONNECTIONS AT THE UNIT ARE 2.0" VICTAULIC.

## 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.

Figure 25: Epoxy Coil Coating



**Epoxy coating** is a water-based extremely flexible and durable polymer coating uniformly applied to all coil surfaces through a multi-step, submerged electrostatic coating process. Epoxy coated coils provide a 10,000+ hour salt spray resistance per ASTM B117-90, applied to both the coil and the coil headers. 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 to provide extended longevity.

Table 3: 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.

Figure 26: AGZ030-071E Package Chiller with Microchannel

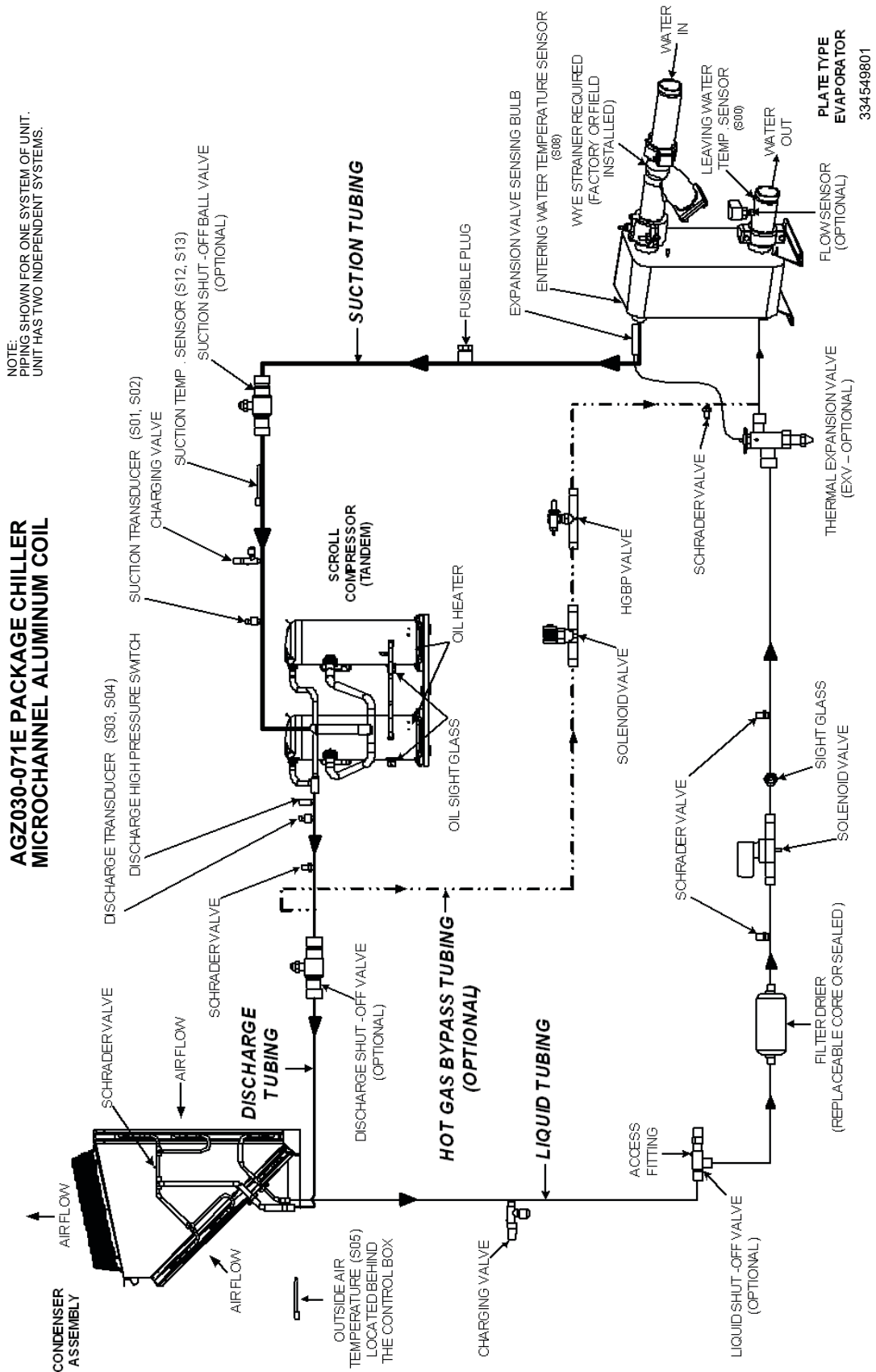
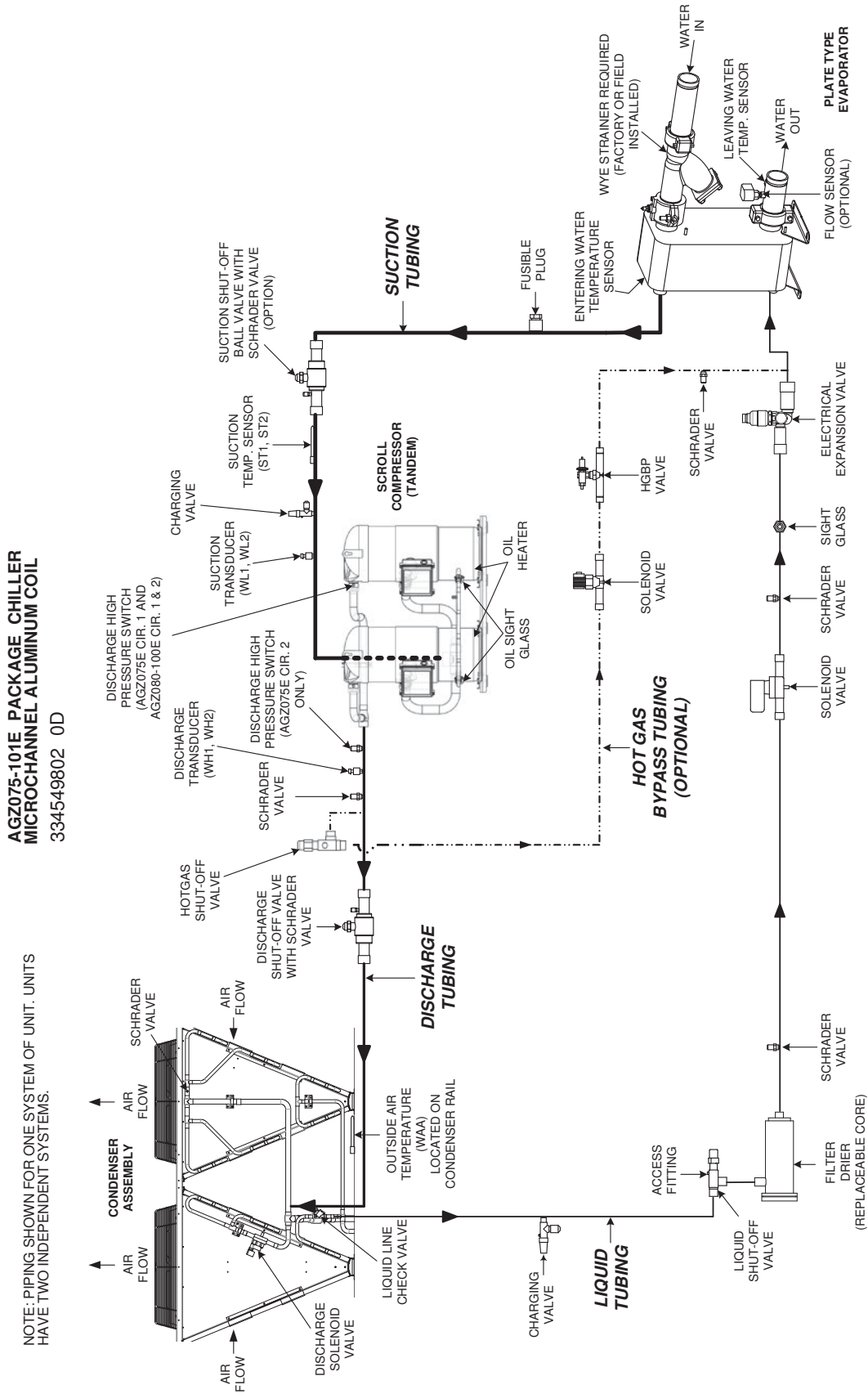
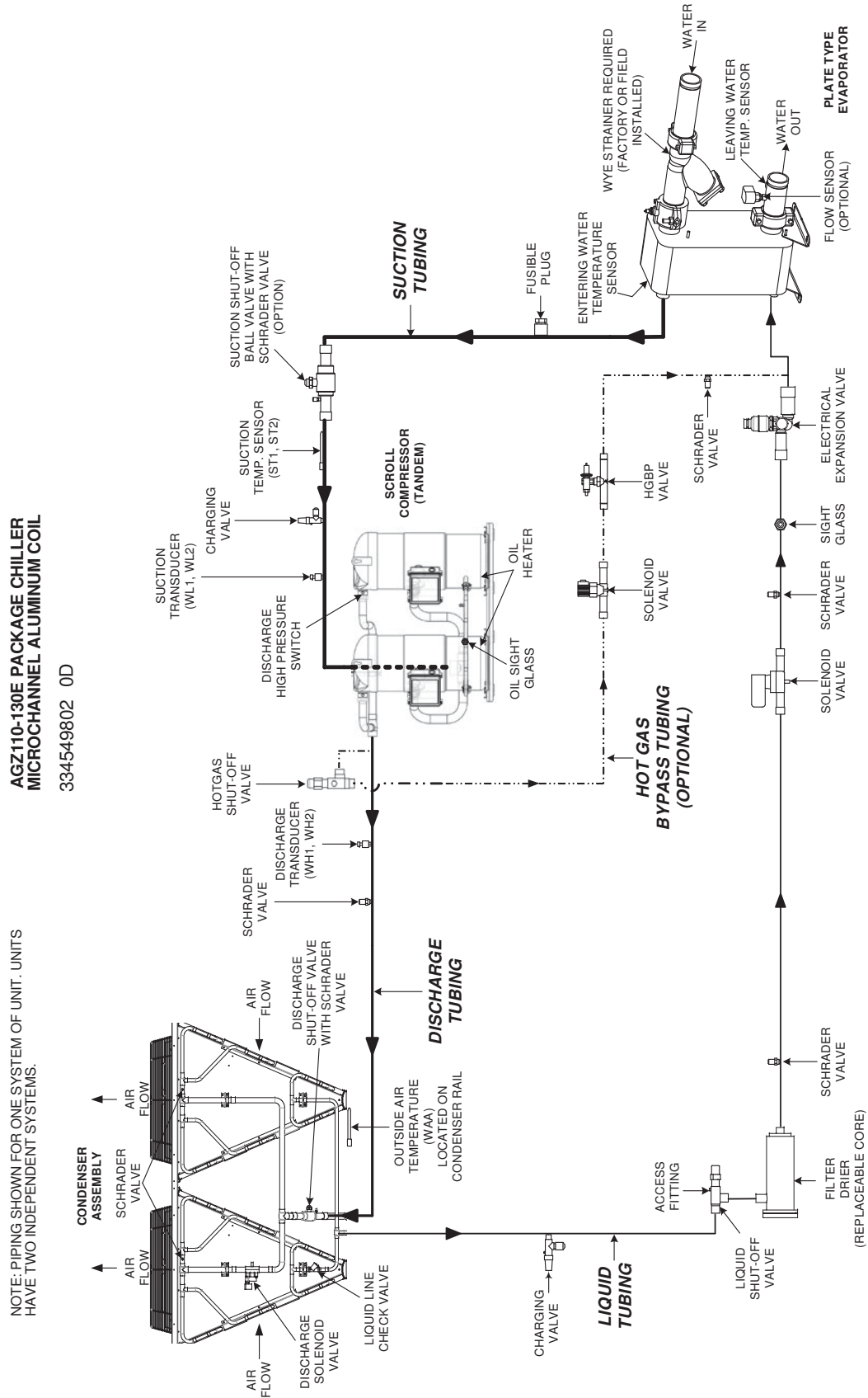


Figure 27: AGZ075-101E Package Chiller with Microchannel



**Figure 28: AGZ110-130E Package Chiller with Microchannel**



**Figure 29: AGZ140-180E Package Chiller with Microchannel**

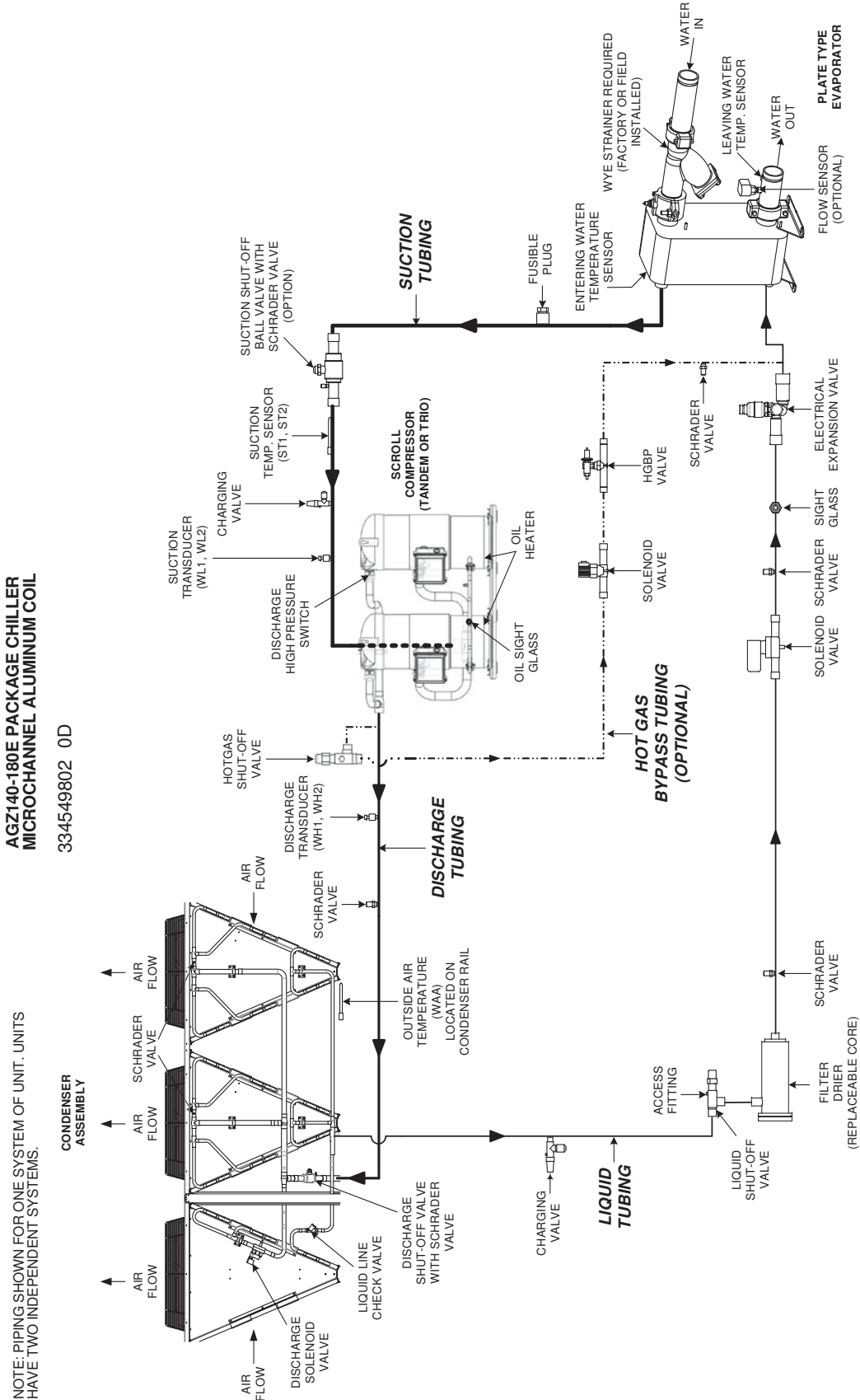


Figure 30: AGZ191-241E Package Chiller with Microchannel

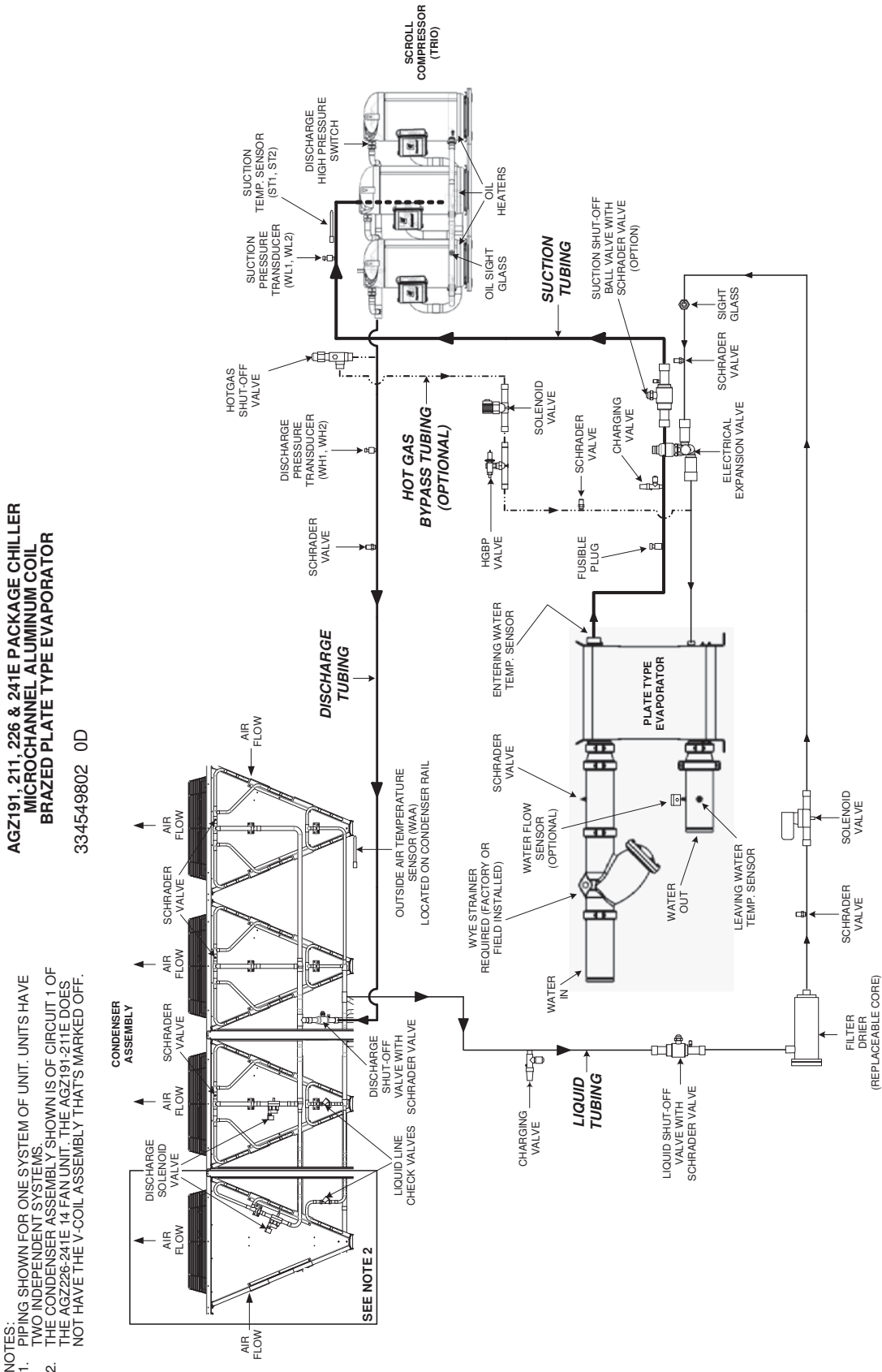
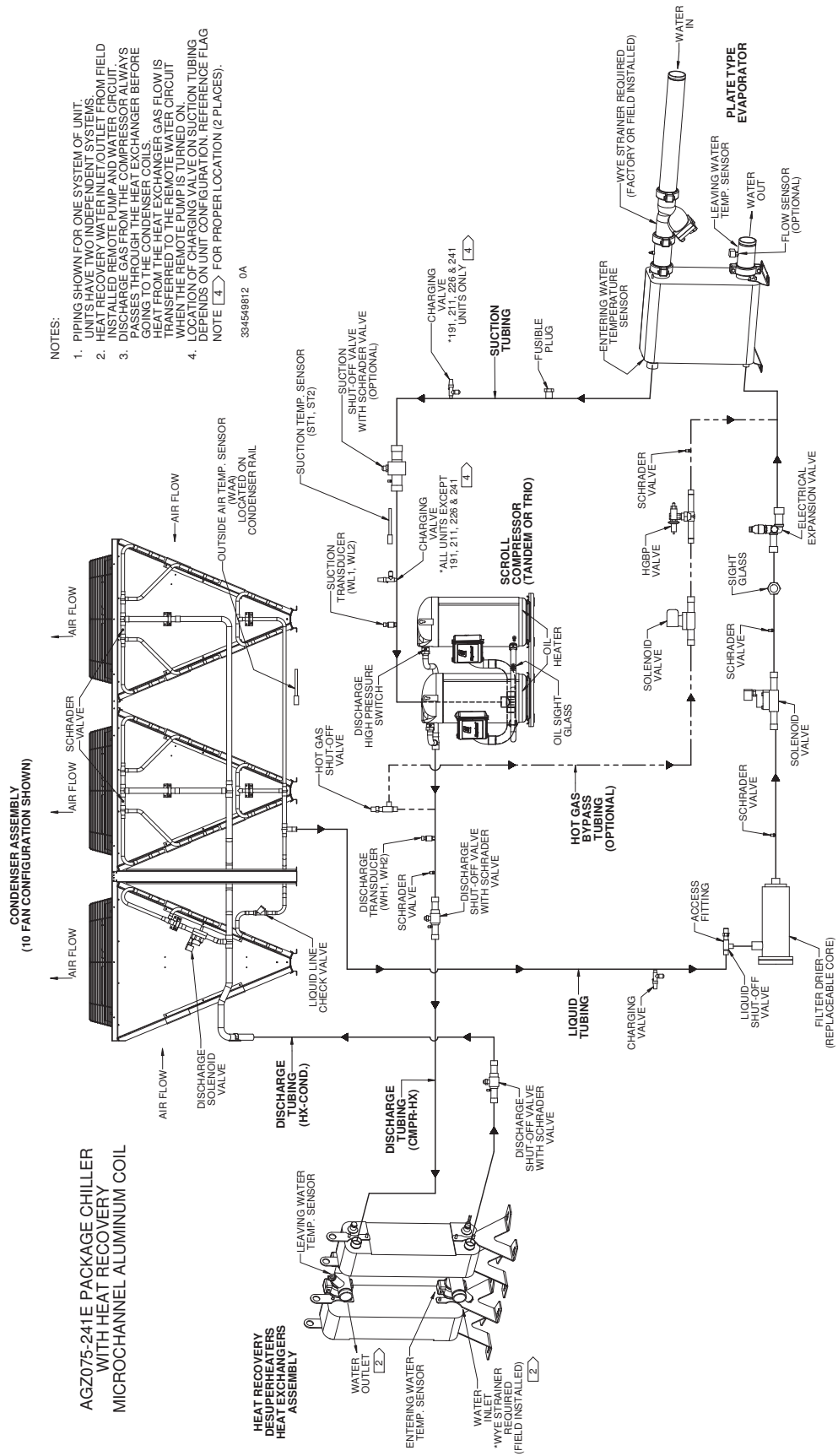
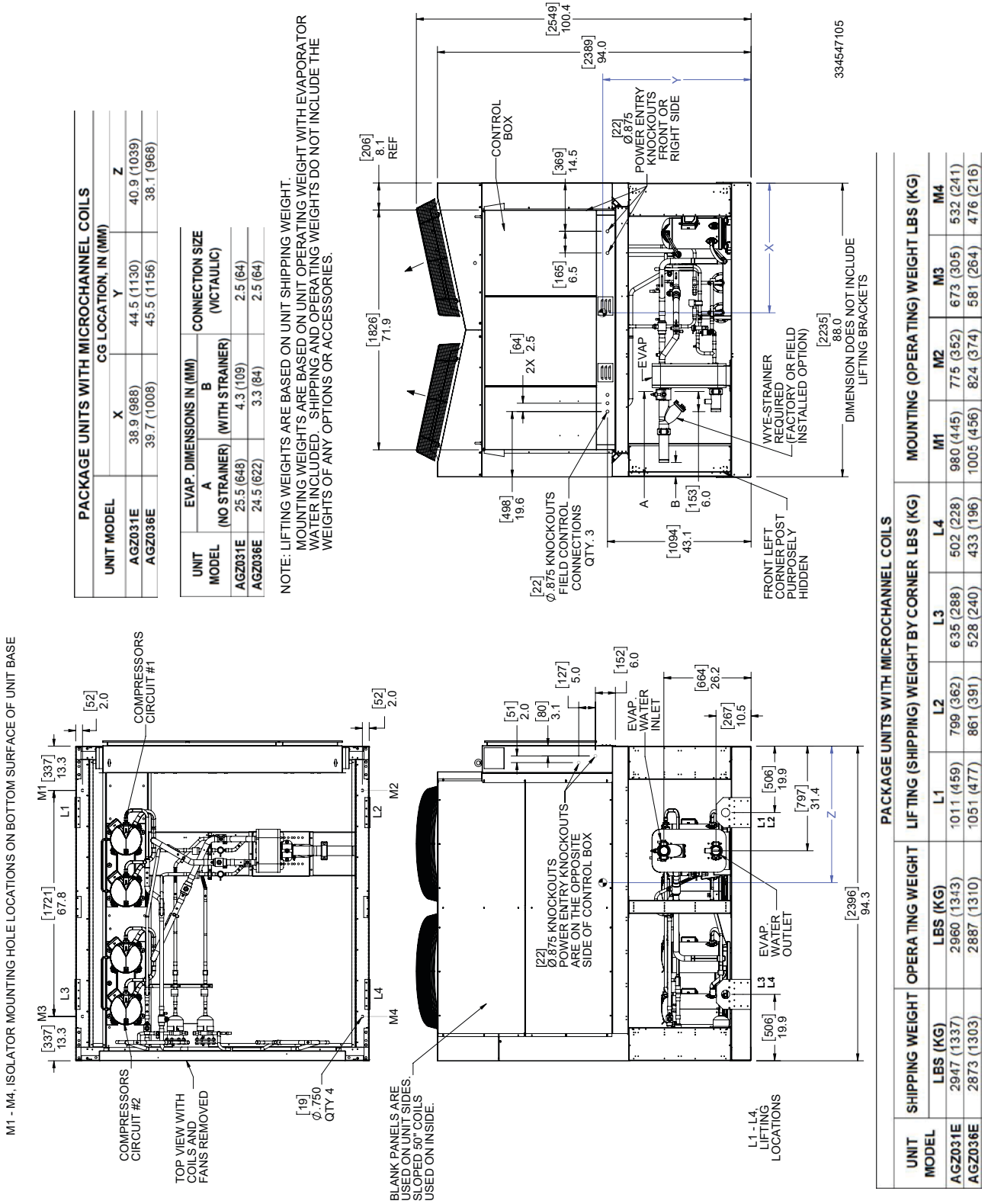


Figure 31: AGZ75-241E Package Chiller with Microchannel and Heat Recovery



**NOTE:** Drawings, dimensional values, and other information may change depending on options or configurations selected. Refer to the as-built submittal drawings provided by a Daikin Applied sales representative for configuration-specific details.

Figure 32: AGZ031E - AGZ036E, 4 Fan Models

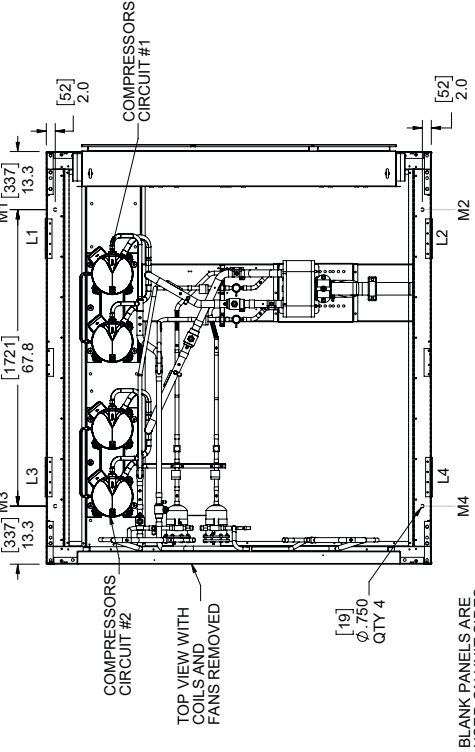


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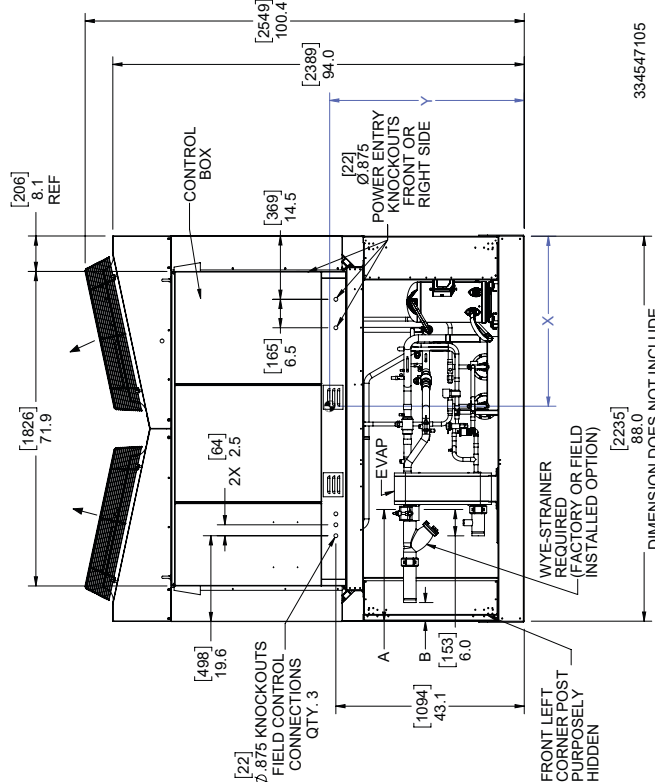
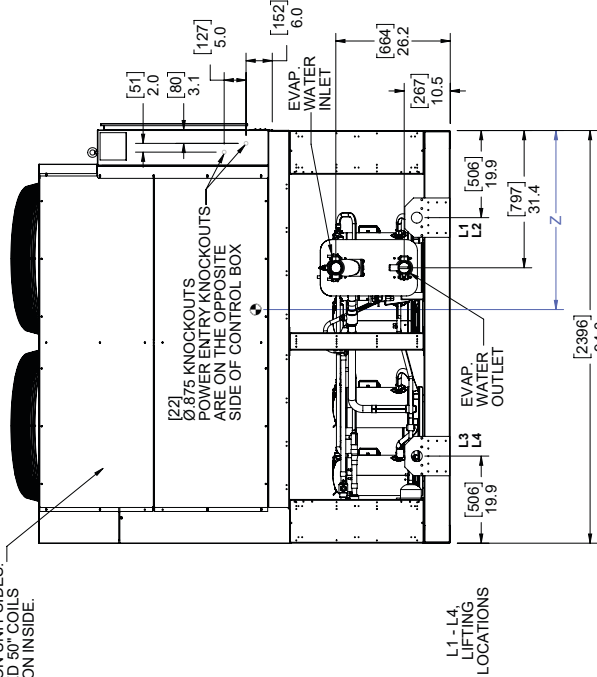
PACKAGE UNITS WITH MICROCHANNEL COILS

DIMENSION DOES NOT INCLUDE LIFTING BRACKETS

M1 - M4, ISOLATOR MOUNTING HOLE LOCATIONS ON BOTTOM SURFACE OF UNIT BASE



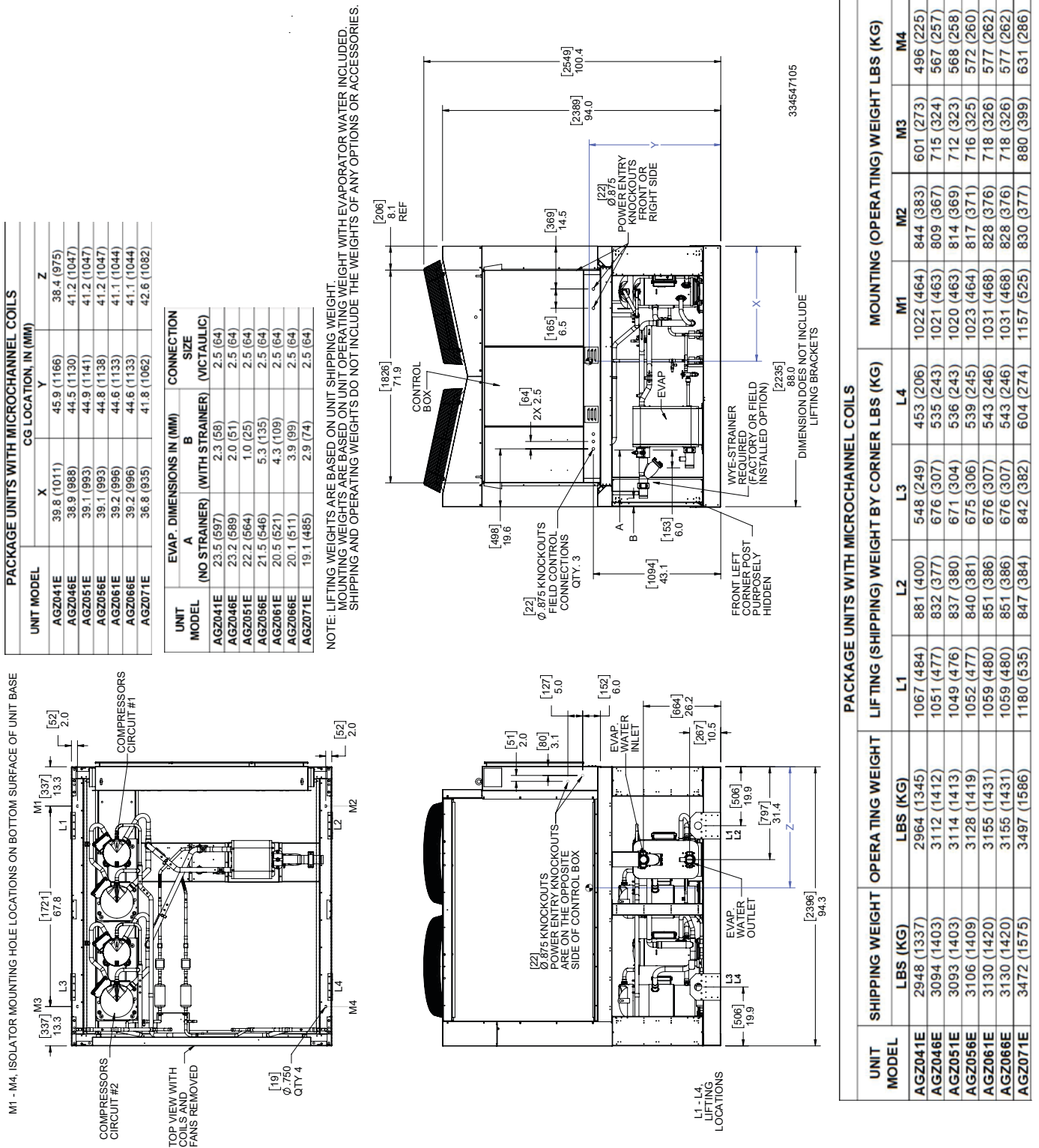
BLANK PANELS ARE USED ON UNIT SIDES. SLOPED 50° COILS USED ON INSIDE.





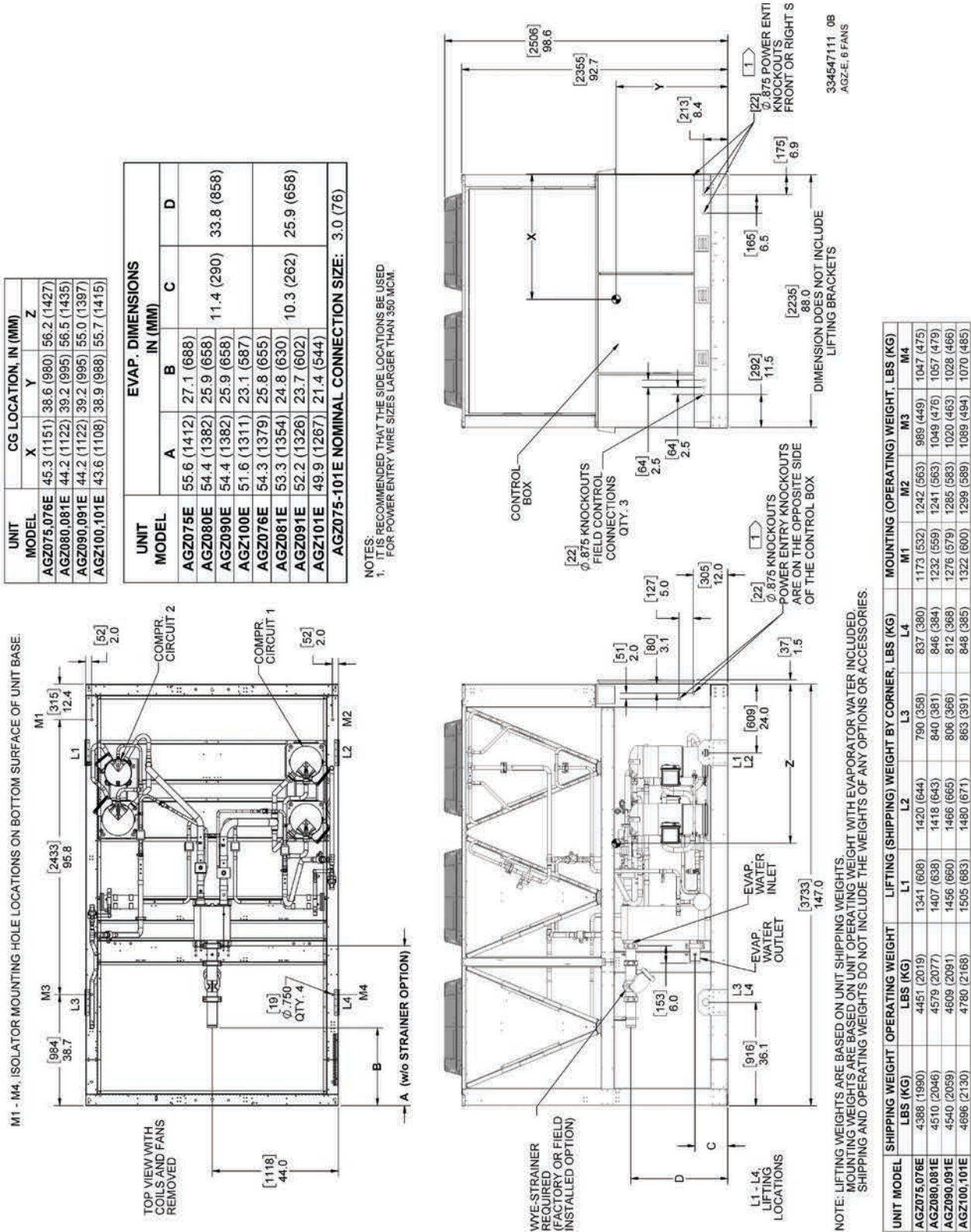
**NOTE:** Drawings, dimensional values, and other information may change depending on options or configurations selected. Refer to the as-built submittal drawings provided by a Daikin Applied sales representative for configuration-specific details.

Figure 33: AGZ041E - AGZ071E, 4 Fan Models



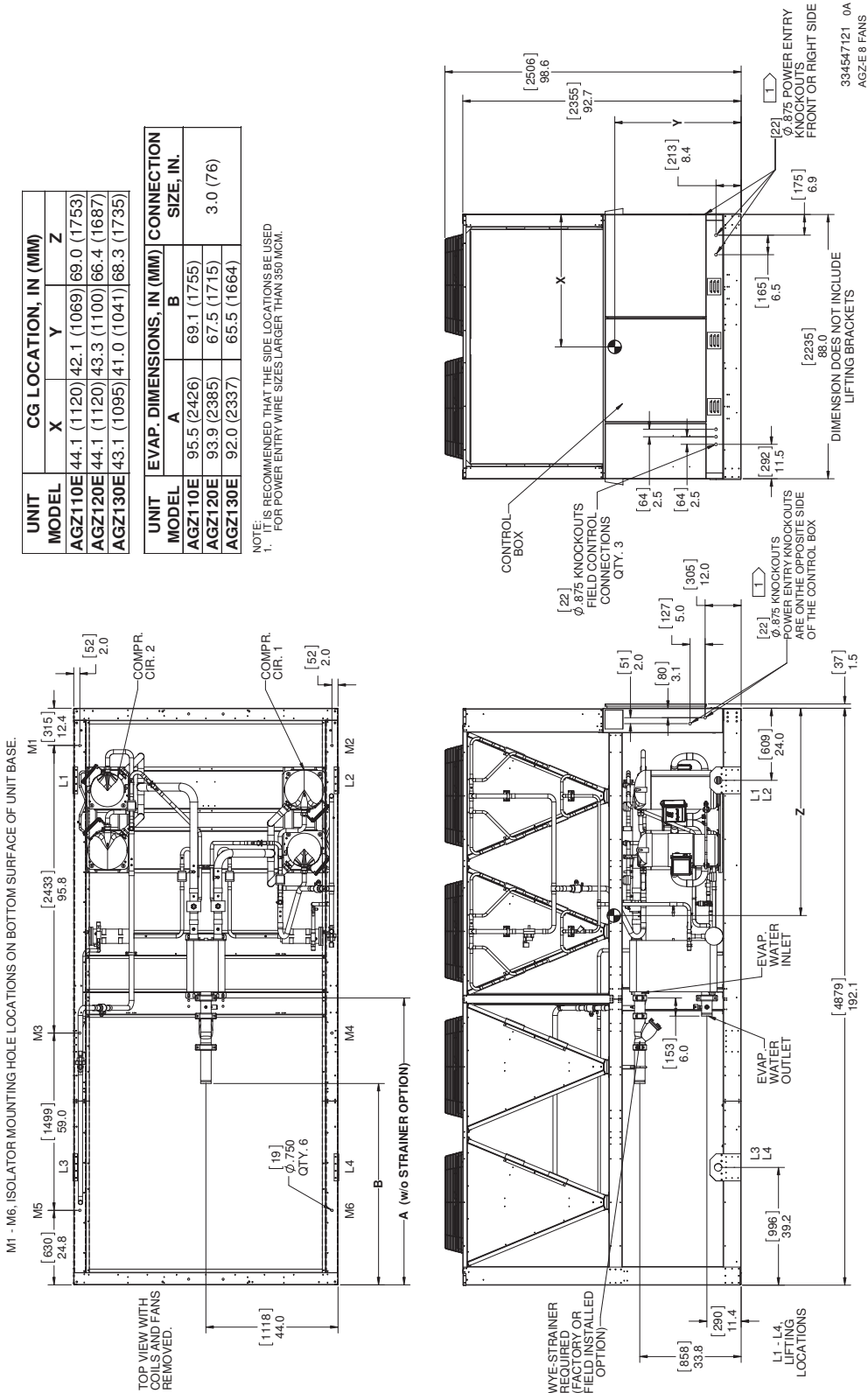
**NOTE:** Drawings, dimensional values, and other information may change depending on options or configurations selected. Refer to the as-built submittal drawings provided by a Daikin Applied sales representative for configuration-specific details.

Figure 34: AGZ075E - AGZ101E, 6 Fan Models



**NOTE:** Drawings, dimensional values, and other information may change depending on options or configurations selected. Refer to the as-built submittal drawings provided by a Daikin Applied sales representative for configuration-specific details.

Figure 35: AGZ110E - AGZ130E, 8 Fan Models



UNIT MODEL	CG LOCATION, IN (MM)		
	X	Y	Z
AGZ110E	44.1 (1120)	42.1 (1069)	69.0 (1753)
AGZ120E	44.1 (1120)	43.3 (1100)	66.4 (1687)
AGZ130E	43.1 (1095)	41.0 (1041)	68.3 (1735)

UNIT MODEL	EVAP. DIMENSIONS, IN (MM)		CONNECTION SIZE, IN.
	A	B	
AGZ110E	95.5 (2426)	69.1 (1755)	3.0 (76)
AGZ120E	93.9 (2385)	67.5 (1715)	
AGZ130E	92.0 (2337)	65.5 (1664)	

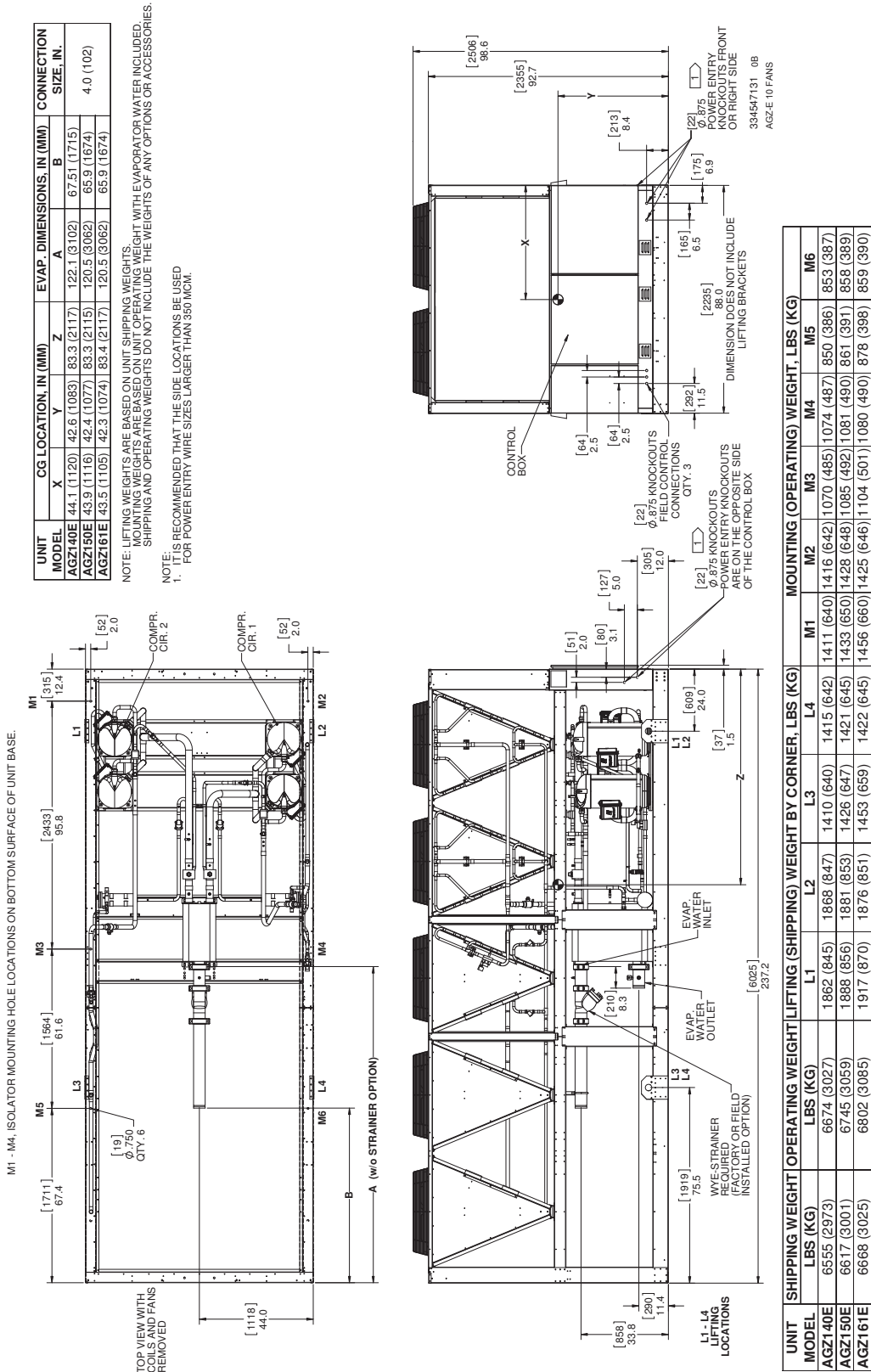
NOTE:  
1. IT IS RECOMMENDED THAT THE SIDE LOCATIONS BE USED FOR POWER ENTRY WIRE SIZES LARGER THAN 350 MCM.

UNIT MODEL	SHIPPING WEIGHT				OPERATING WEIGHT				LIFTING (SHIPPING) WEIGHT BY CORNER, LBS (KG)				MOUNTING (OPERATING) WEIGHT, LBS (KG)			
	LBS (KG)	L1	L2	L3	LBS (KG)	L1	L2	L3	L4	M1	M2	M3	M4	M5	M6	
AGZ110E	5437 (2466)	1762 (799)	1769 (802)	951 (431)	955 (433)	1424 (646)	845 (383)	849 (385)	489 (222)	491 (223)	489 (222)	489 (222)	489 (222)	489 (222)	491 (223)	
AGZ120E	5696 (2584)	1907 (865)	1915 (869)	935 (424)	939 (426)	1548 (702)	1555 (705)	1555 (705)	882 (400)	882 (400)	882 (400)	882 (400)	882 (400)	882 (400)	882 (400)	
AGZ130E	5792 (2627)	1941 (880)	1863 (845)	1015 (460)	974 (442)	1575 (714)	1511 (685)	920 (417)	883 (401)	883 (401)	883 (401)	883 (401)	883 (401)	883 (401)	883 (401)	

NOTE: LIFTING WEIGHTS ARE BASED ON UNIT SHIPPING WEIGHTS. SHIPPING WEIGHTS ARE NOT TO INCLUDE THE WEIGHTS OF ANY OPTIONS OR ACCESSORIES. SHIPPING AND OPERATING WEIGHTS DO NOT INCLUDE THE WEIGHTS OF ANY OPTIONS OR ACCESSORIES.

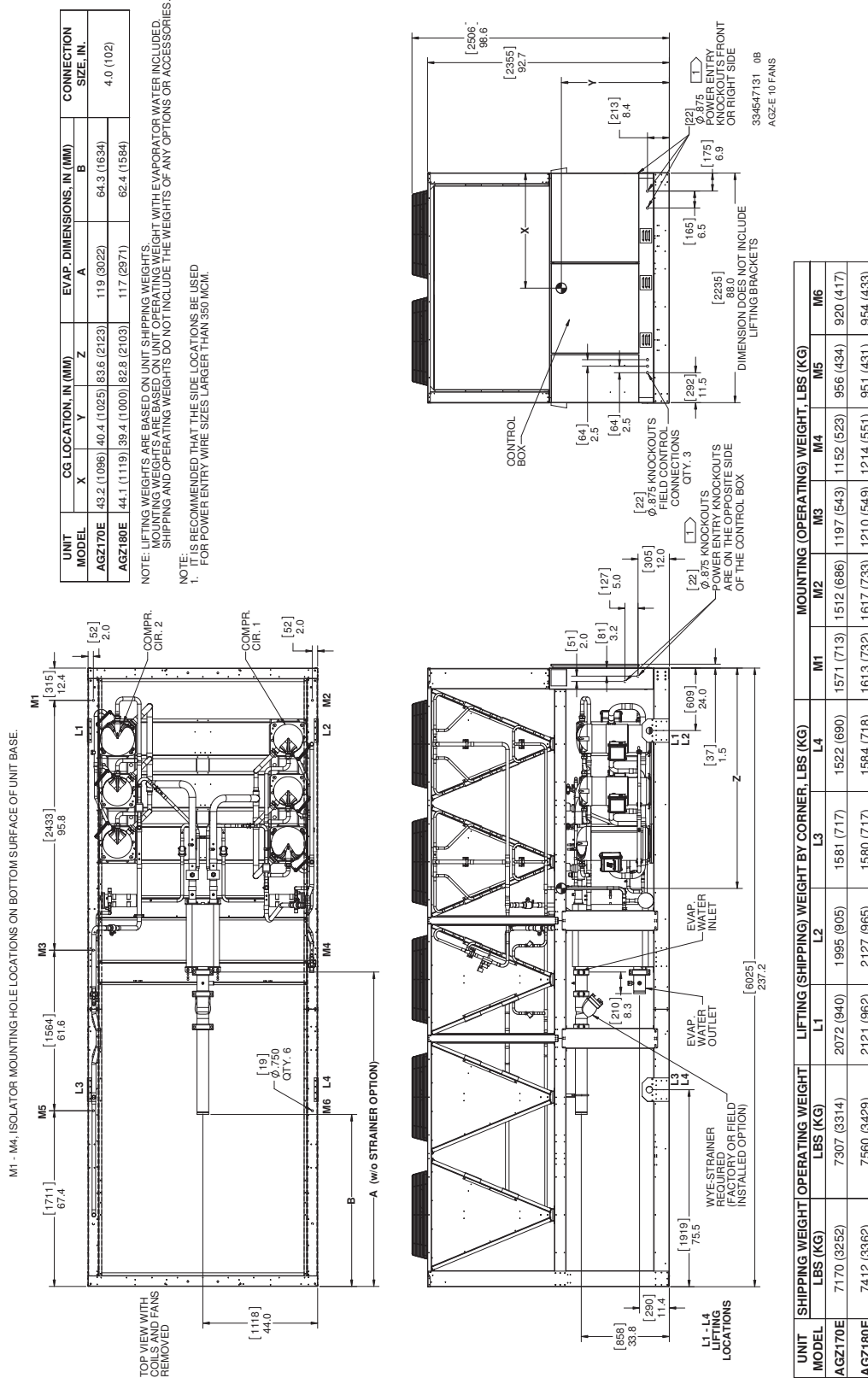
**NOTE:** Drawings, dimensional values, and other information may change depending on options or configurations selected. Refer to the as-built submittal drawings provided by a Daikin Applied sales representative for configuration-specific details.

Figure 36: AGZ140E - AGZ161E, 10 Fan Models



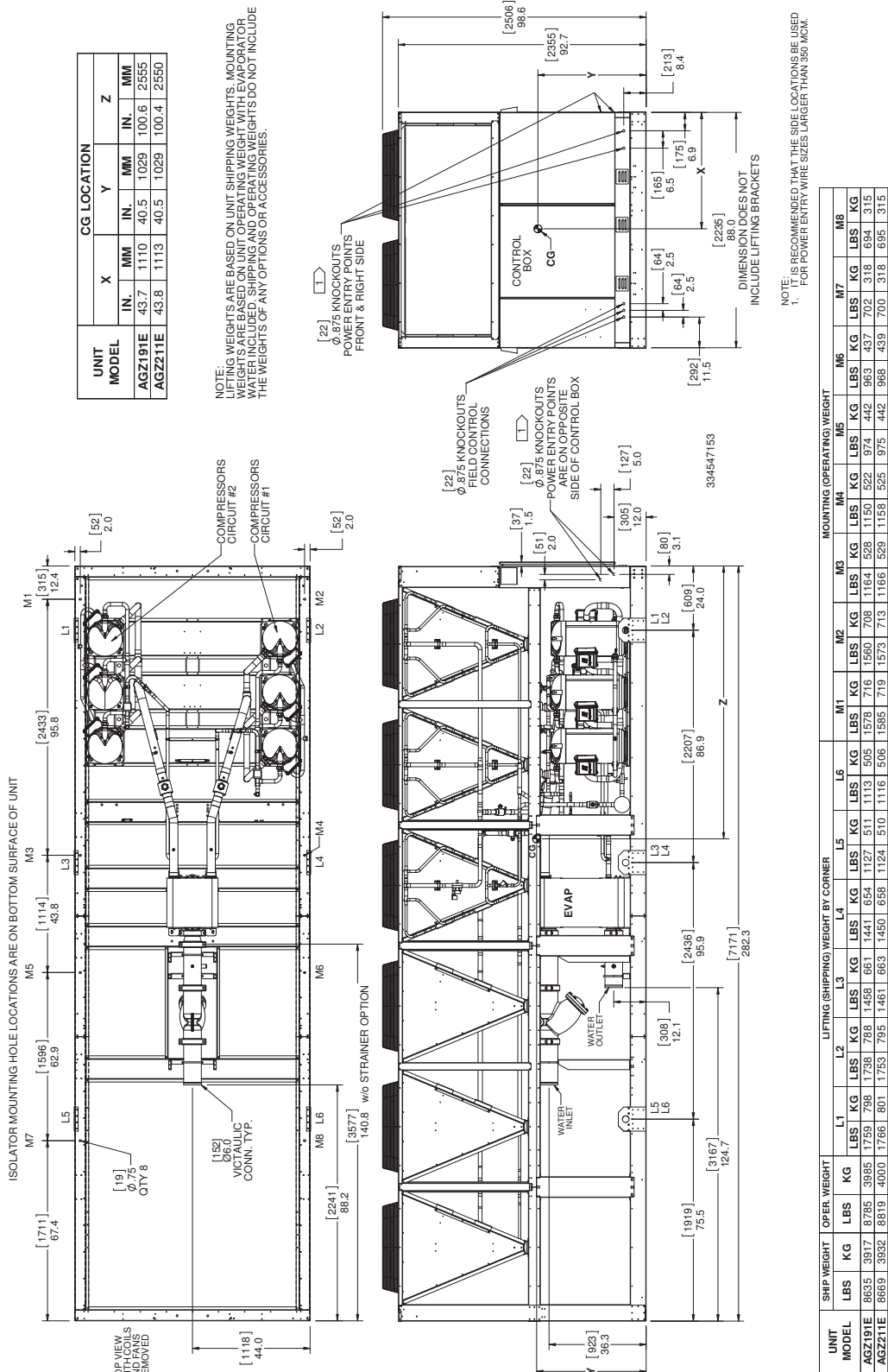
**NOTE:** Drawings, dimensional values, and other information may change depending on options or configurations selected. Refer to the as-built submittal drawings provided by a Daikin Applied sales representative for configuration-specific details.

Figure 37: AGZ170E - AGZ180E, 10 Fan Models



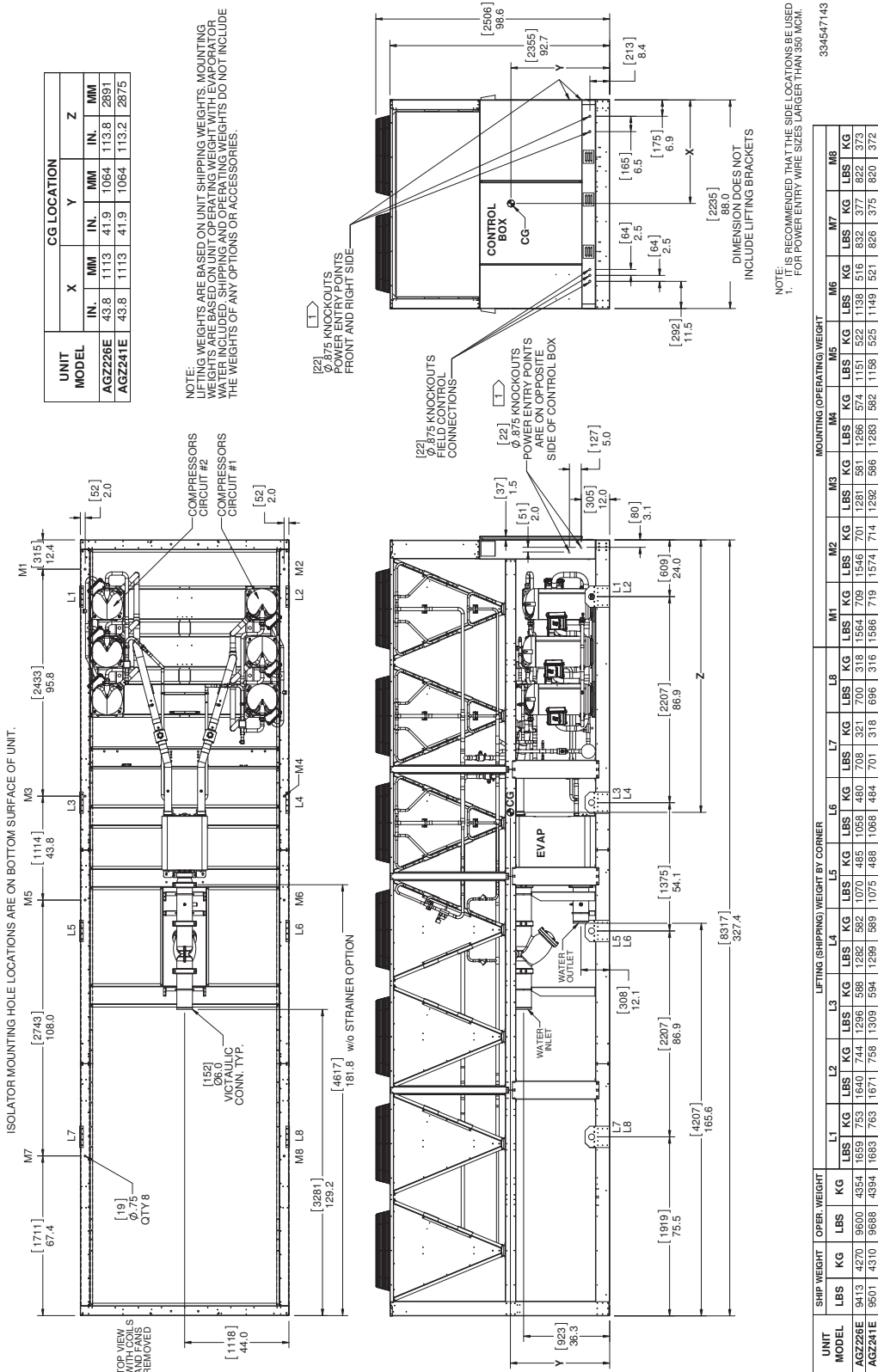
**NOTE:** Drawings, dimensional values, and other information may change depending on options or configurations selected. Refer to the as-built submittal drawings provided by a Daikin Applied sales representative for configuration-specific details.

Figure 38: AGZ191E, AGZ211E, 12 Fan Models



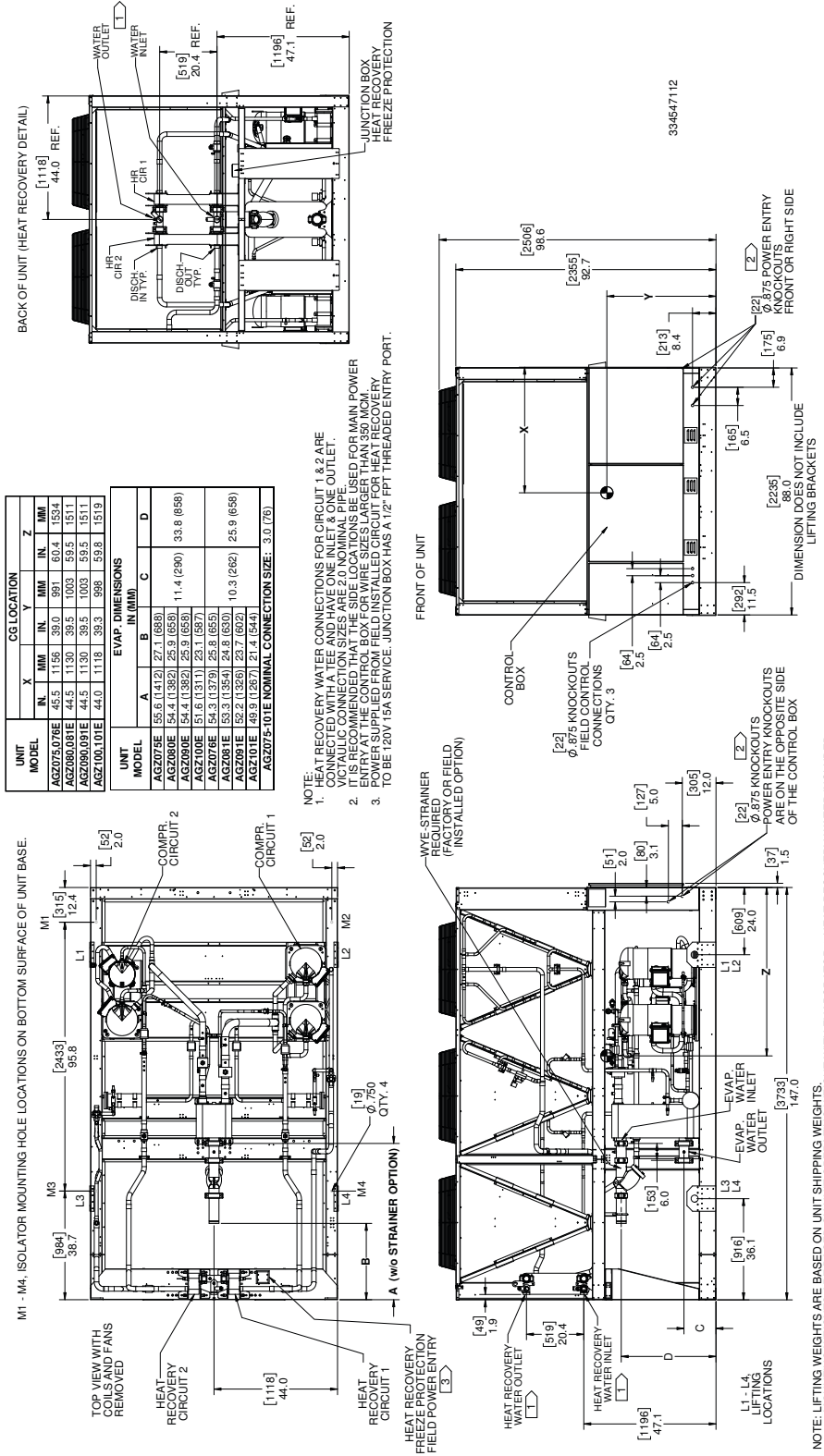
**NOTE:** Drawings, dimensional values, and other information may change depending on options or configurations selected. Refer to the as-built submittal drawings provided by a Daikin Applied sales representative for configuration-specific details.

**Figure 39: AGZ226E - AGZ241E, 14 Fan Models**



**NOTE:** Drawings, dimensional values, and other information may change depending on options or configurations selected. Refer to the as-built submittal drawings provided by a Daikin Applied sales representative for configuration-specific details.

**Figure 40: AGZ075E - AGZ101E, Heat Recovery Units, 6 Fan Models**



UNIT MODEL	CG LOCATION			EVAP. DIMENSIONS			
	X	Y	Z	A	B	C	D
AGZ075E	45.5	11.56	39.0	55.6	11.412	27.1	68.9
AGZ080E	44.5	11.30	39.5	54.4	11.382	25.9	65.9
AGZ090E	44.5	11.30	39.5	54.4	11.382	25.9	65.9
AGZ100E	44.5	11.30	39.5	54.4	11.382	25.9	65.9
AGZ101E	44.0	11.18	39.3	48.9	11.267	21.4	54.4

**NOTE:** HEAT RECOVERY WATER CONNECTIONS FOR CIRCUIT 1 & 2 ARE 1/2" NPT. VICTALIC CONNECTION SIZES ARE 2" NOMINAL PIPE VICTALIC CONNECTION SIZES ARE 2" NOMINAL PIPE ENTRY AT THE CONTROL BOX FOR WIRE SIZES LARGER THAN 350 MCM. FRONT SERVICE FIELD CONNECTIONS FOR HEAT RECOVERY TO BE 1/2" NPT. JUNCTION BOX HAS A 1/2" FPT THREADED ENTRY PORT.

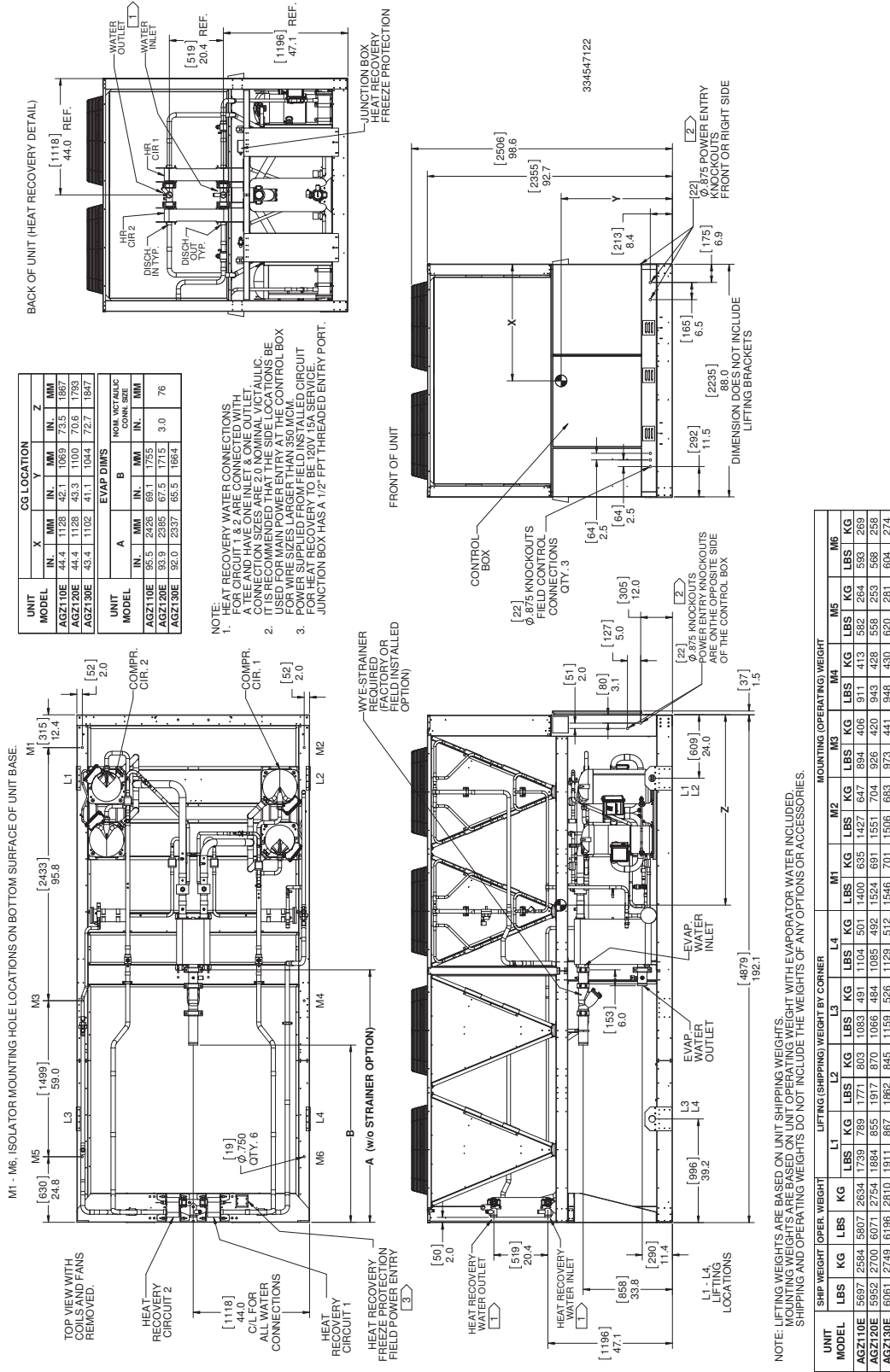
**NOTE:** LIFTING WEIGHTS ARE BASED ON UNIT SHIPPING WEIGHTS. MOUNTING WEIGHTS ARE BASED ON UNIT OPERATING WEIGHT WITH EVAPORATOR & HEAT RECOVERY WATER INCLUDED. SHIPPING AND OPERATING WEIGHTS WITH HEAT RECOVERY DO NOT INCLUDE THE WEIGHTS OF ANY OTHER OPTIONS OR ACCESSORIES.

UNIT MODEL	OPER. WEIGHT		LIFTING (SHIPPING) WEIGHT BY CORNER						MOUNTING (OPERATING) WEIGHT									
	LBS	KG	L1	L2	L3	L4	M1	M2	M3	M4	LBS	KG	LBS	KG				
AGZ075E	4613	2092	1294	597	1388	630	932	423	1000	454	1129	512	1211	549	1134	514	1216	552
AGZ080E	4734	2147	1385	628	1415	642	957	434	978	444	1210	549	1237	561	1172	532	1198	543
AGZ090E	4764	2161	1393	632	1424	646	963	437	984	446	1218	552	1245	565	1179	535	1205	547
AGZ100E	4936	2239	1452	659	1449	657	1019	462	1017	461	1273	577	1270	576	1250	567	1247	566



**NOTE:** Drawings, dimensional values, and other information may change depending on options or configurations selected. Refer to the as-built submittal drawings provided by a Daikin Applied sales representative for configuration-specific details.

Figure 41: AGZ110E - AGZ130E, Heat Recovery Units, 8 Fan Models

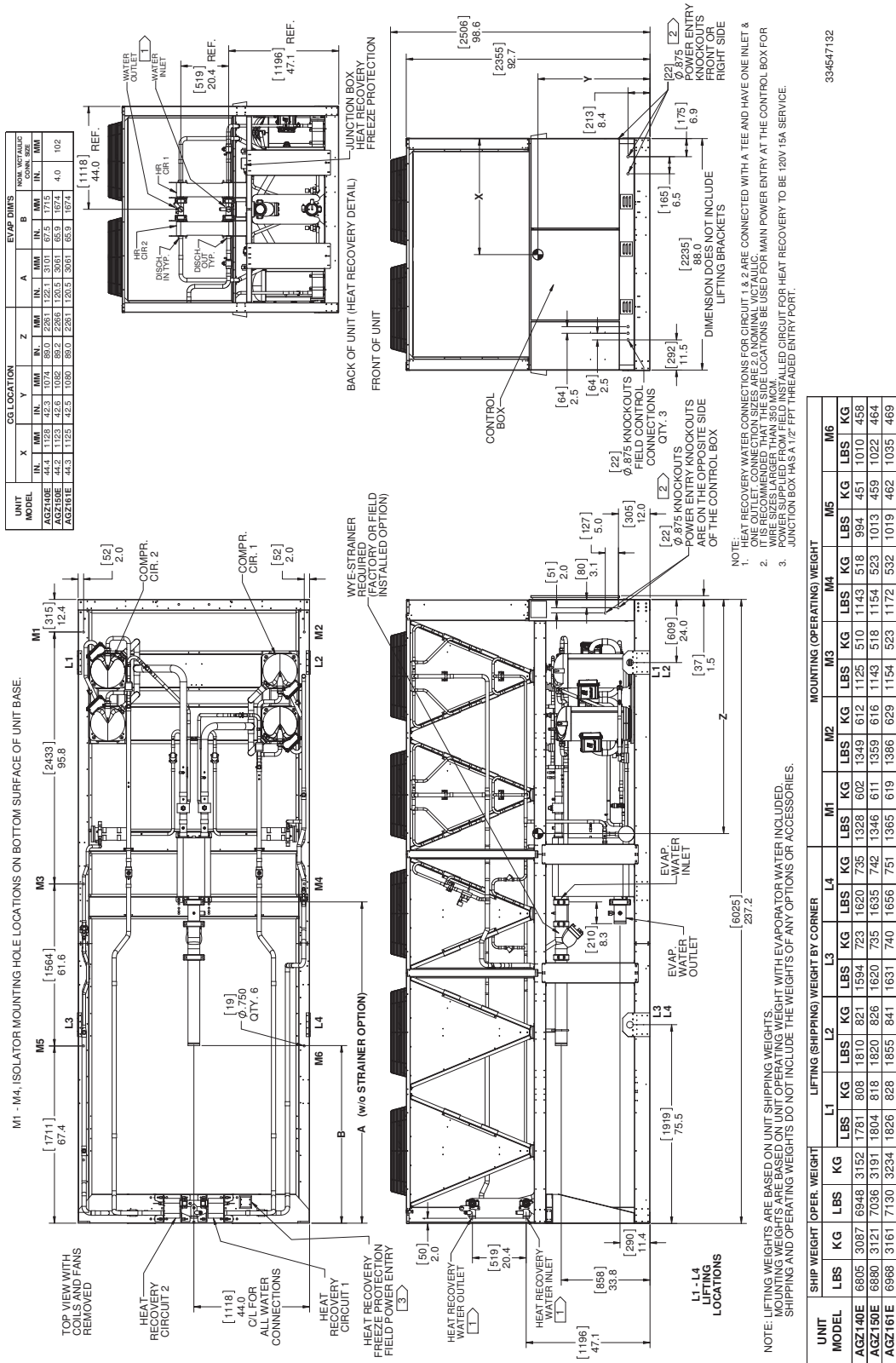


UNIT MODEL	CG LOCATION			EVAP DIMS			NOM. VICTAULIC CONN. SIZE			
	X	Y	Z	A	B		IN.	MM	IN.	MM
AGZ110E	44.4	1128	44.4	96.5	2426	69.1	17.5	3.0	76	
AGZ120E	44.4	1128	44.4	96.5	2426	69.1	17.5	3.0	76	
AGZ130E	43.4	1102	43.1	104.4	2426	69.1	17.5	3.0	76	

UNIT MODEL	SHIP WEIGHT		OPER. WEIGHT						MOUNTING (OPERATING) WEIGHT															
	LBS	KG	L1	L2	L3	L4	M1	M2	M3	M4	M5	M6	LBS	KG	LBS	KG								
AGZ110E	5897	2684	5807	2634	1739	789	1771	803	1083	491	1104	501	1400	635	1427	647	894	406	911	413	582	264	583	269
AGZ120E	5952	2700	6071	2754	1984	855	1917	870	1066	484	1085	492	1524	691	1551	704	926	420	943	428	558	253	568	258
AGZ130E	6061	2749	6196	2810	1911	867	1862	845	1159	526	1129	512	1546	701	1506	683	973	441	948	430	620	281	604	274

**NOTE:** Drawings, dimensional values, and other information may change depending on options or configurations selected. Refer to the as-built submittal drawings provided by a Daikin Applied sales representative for configuration-specific details.

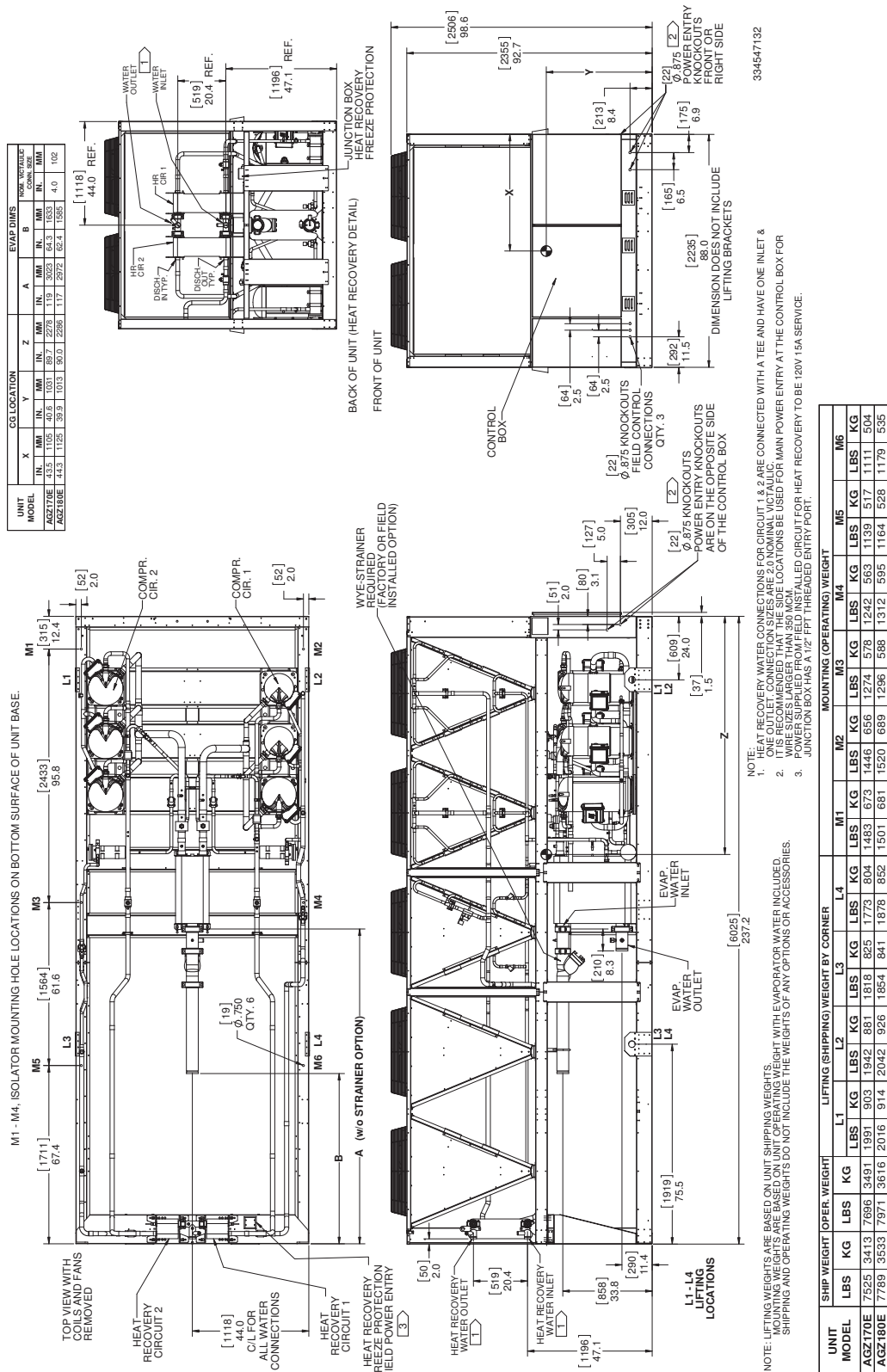
Figure 42: AGZ140E - AGZ161E, Heat Recovery Units, 10 Fan Models



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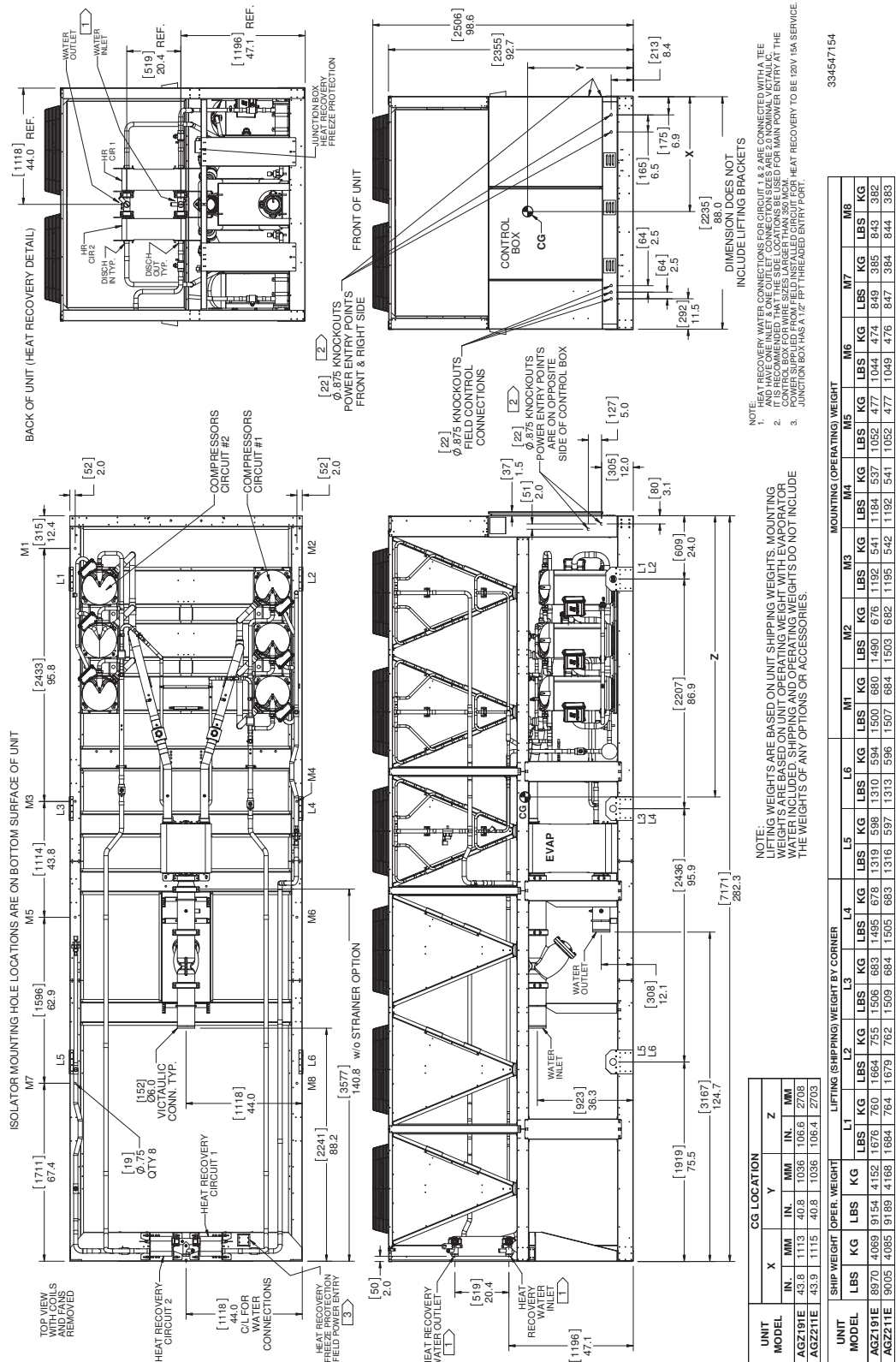
**NOTE:** Drawings, dimensional values, and other information may change depending on options or configurations selected. Refer to the as-built submittal drawings provided by a Daikin Applied sales representative for configuration-specific details.

**Figure 43: AGZ170E - AGZ180E, Heat Recovery Units, 10 Fan Models**



**NOTE:** Drawings, dimensional values, and other information may change depending on options or configurations selected. Refer to the as-built submittal drawings provided by a Daikin Applied sales representative for configuration-specific details.

Figure 44: AGZ191E - AGZ211E with Heat Recovery, 12 Fan Models



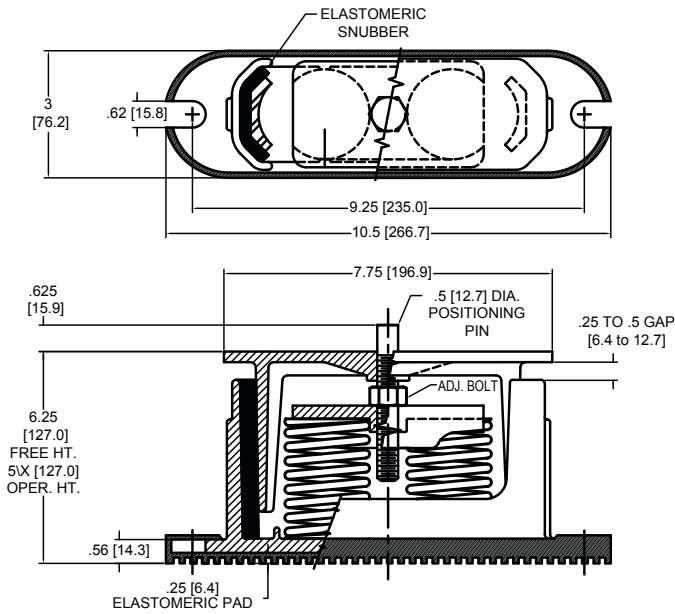


**Table 4: Refrigerant Charge - Microchannel Units**

Unit Models	Microchannel Coil Unit Operating Charge - lbs (kg)					
	Packaged Units				Heat Recovery Units	
	Replaceable Core Filter Drier		Sealed Filter Drier		Replaceable Core Filter Drier	
	Circuit 1	Circuit 2	Circuit 1	Circuit 2	Circuit 1	Circuit 2
030E/031E	17 (7.7)	17 (7.7)	15 (16.8)	15 (16.8)		
035E/036E	16 (7.3)	16 (7.3)	14 (6.4)	14 (6.4)		
040E/041E	23 (10.5)	23 (10.5)	21 (9.5)	21 (9.5)		
045E/046E	23 (10.5)	23 (10.5)	21 (9.5)	21 (9.5)		
050E/051E	23 (10.5)	23 (10.5)	21 (9.5)	21 (9.5)		
055E/056E	23 (10.5)	23 (10.5)	21 (9.5)	21 (9.5)		
060E/061E	23 (10.5)	23 (10.5)	21 (9.5)	21 (9.5)		
065E/066E	23 (10.5)	23 (10.5)	21 (9.5)	21 (9.5)		
070E/071E	23 (10.5)	23 (10.5)	21 (9.5)	21 (9.5)		
075E	46 (20.9)	46 (20.9)			49 (22)	49 (22)
076E	43 (19.6)	43 (19.6)			46 (20.9)	46 (20.9)
080E	46 (20.9)	46 (20.9)			49 (22)	49 (22)
081E	43 (19.6)	43 (19.6)			46 (20.9)	46 (20.9)
090E	48 (21.8)	48 (21.8)			51 (23)	51 (23)
091E	45 (20.5)	45 (20.5)			48 (21.8)	48 (21.8)
100E	48 (21.8)	50 (22.7)			52 (24)	52 (24)
101E	45 (20.5)	47 (21.4)			48 (21.8)	50 (22.7)
110E	64 (29.1)	64 (29.1)			69 (31)	69 (31)
120E	65 (29.5)	65 (29.5)			69 (31)	69 (31)
130E	65 (29.5)	65 (29.5)			69 (31)	69 (31)
140E	76 (34.5)	76 (34.5)			82 (37)	82 (37)
150E	76 (34.5)	76 (34.5)			82 (37)	82 (37)
161E	78 (35.4)	78 (35.4)			84 (38)	84 (38)
170E	80 (36.3)	80 (36.3)			86 (39)	86 (39)
180E	80 (36.3)	80 (36.3)			86 (39)	86 (39)
191E	87 (39.5)	87 (39.5)			95 (43)	95 (43)
211E	91 (41.3)	91 (41.3)			99 (45)	99 (45)
226E	107 (48.6)	107 (48.6)			119 (55)	119 (55)
241E	111 (50.4)	111 (50.4)			121(55)	121(55)

## Isolator Installation Information

Figure 46: Spring Isolator



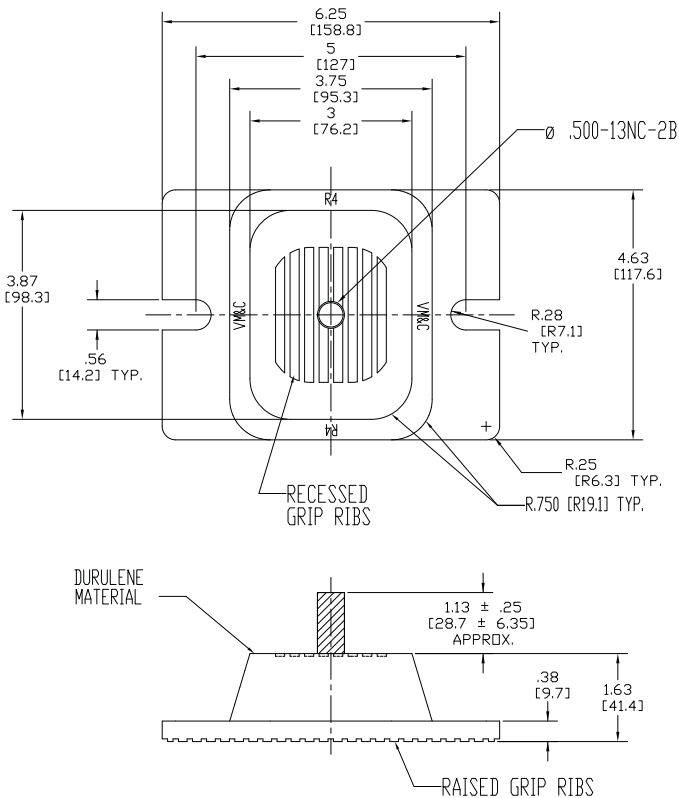
In all cases, set the unit in place and level. If antiskid pads are used do not use hold down bolts. If hold down bolts are used do not use anti-skid pads.

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.

Drawings, dimensional values, and other information may change depending on options or configurations selected. Refer to the as-built submittal drawings provided by a Daikin Applied sales representative for configuration-specific details. Optional seismic isolator information begins on [page 41](#). Contact a Daikin Applied sales representative for isolator information related to units with other fin materials.

Figure 47: Rubber-in-Shear (RIS) Isolator







**Table 6: Isolator Kits - Heat Recovery Units**

AGZ-E Model	Microchannel - Heat Recovery Units	
	Spring Isolators	RIS Isolators
075/076	332320117	332325101
080/081	332320117	332325101
090/091	332320117	332325101
100/101	332320117	332325101
110	332320123	332325113
120	332320123	332325113
130	332320123	332325113
140	332320119	332325113
150	332320119	332325113
161	332320119	332325113
170	332320119	332325113
180	332320119	332325113
191	332320126	332325114
211	332320126	332325114
226	332320134	332325114
241	332320134	332325114

**Table 7: Isolator Information - Heat Recovery Units**

AGZ-E Model	Rubber-In-Shear (RIS) Mounts								Spring Isolator Mountings							
	M1	M2	M3	M4	M5	M6	M7	M8	M1	M2	M3	M4	M5	M6	M7	M8
075/076	Brown	Brown	Brown	Brown					Dark Green	Dark Green	Dark Green	Dark Green				
080/081	Brown	Brown	Brown	Brown					Dark Green	Dark Green	Dark Green	Dark Green				
090/091	Brown	Brown	Brown	Brown					Dark Green	Dark Green	Dark Green	Dark Green				
100/101	Brown	Brown	Brown	Brown					Dark Green	Dark Green	Dark Green	Dark Green				
110	Red	Red	Brown	Brown	Brown	Brown			Dark Green	Dark Green	Dark Purple	Dark Purple	Red	Red		
120	Red	Red	Brown	Brown	Brown	Brown			Dark Green	Dark Green	Dark Purple	Dark Purple	Red	Red		
130	Red	Red	Brown	Brown	Brown	Brown			Dark Green	Dark Green	Dark Purple	Dark Purple	Red	Red		
140	Red	Red	Brown	Brown	Brown	Brown			Dark Green	Dark Green	Dark Green	Dark Green	Dark Green	Dark Green		
150	Red	Red	Brown	Brown	Brown	Brown			Dark Green	Dark Green	Dark Green	Dark Green	Dark Green	Dark Green		
161	Red	Red	Brown	Brown	Brown	Brown			Dark Green	Dark Green	Dark Green	Dark Green	Dark Green	Dark Green		
170	Red	Red	Brown	Brown	Brown	Brown			Dark Green	Dark Green	Dark Green	Dark Green	Dark Green	Dark Green		
180	Red	Red	Brown	Brown	Brown	Brown			Dark Green	Dark Green	Dark Green	Dark Green	Dark Green	Dark Green		
191	Red	Red	Brown	Brown	Brown	Brown	Brown	Brown	Dark Green	Dark Green	Dark Green	Dark Green	Dark Green	Dark Green	Dark Green	Dark Green
211	Red	Red	Brown	Brown	Brown	Brown	Brown	Brown	Dark Green	Dark Green	Dark Green	Dark Green	Dark Green	Dark Green	Dark Green	Dark Green
226	Red	Red	Brown	Brown	Brown	Brown	Brown	Brown	Dark Green	Dark Green	Dark Green	Dark Green	Dark Green	Dark Green	Dark Green	Dark Green
241	Red	Red	Brown	Brown	Brown	Brown	Brown	Brown	Dark Green	Dark Green	Dark Green	Dark Green	Dark Green	Dark Green	Dark Green	Dark Green

Figure 48: Seismic Spring Isolators

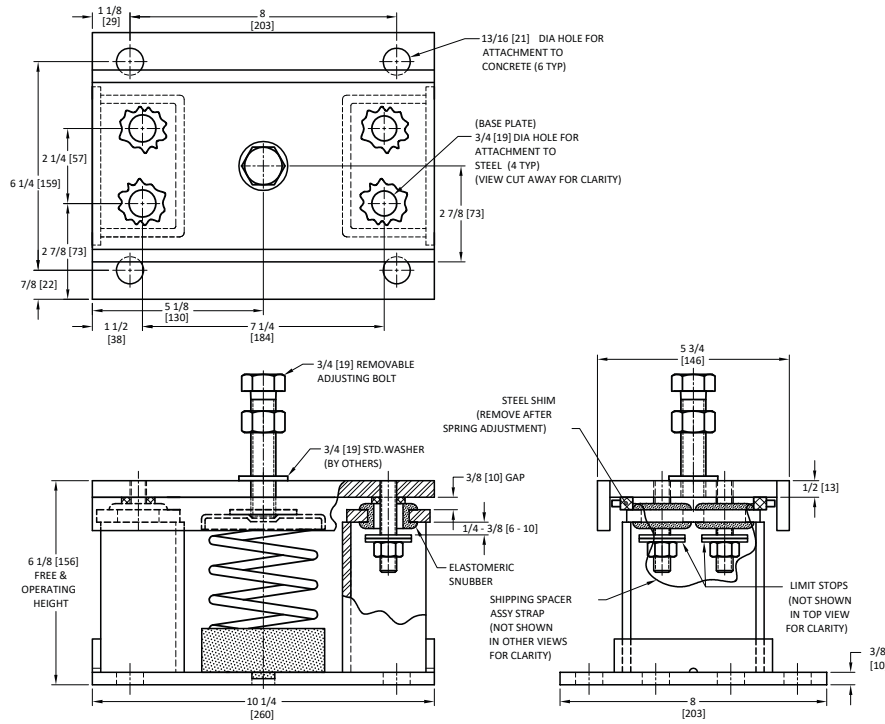


Figure 49: Seismic Neoprene Isolation Pads

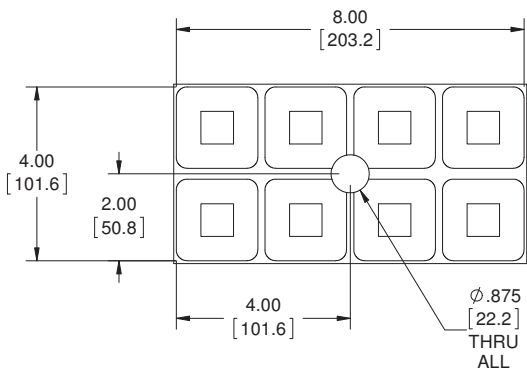


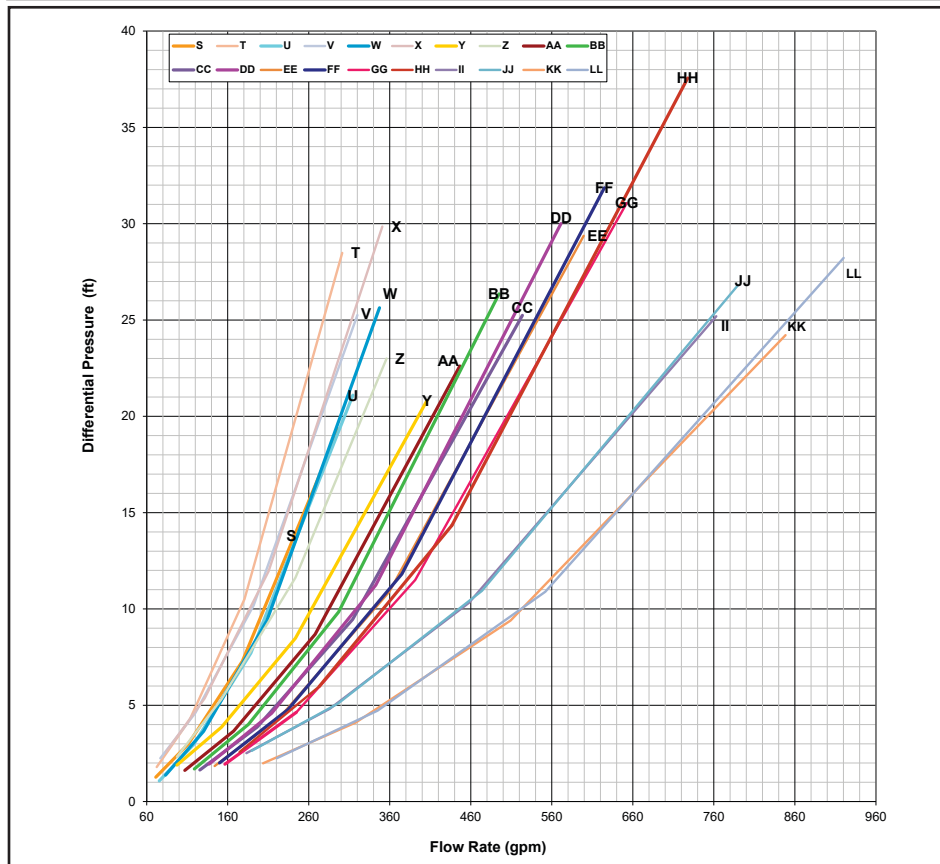
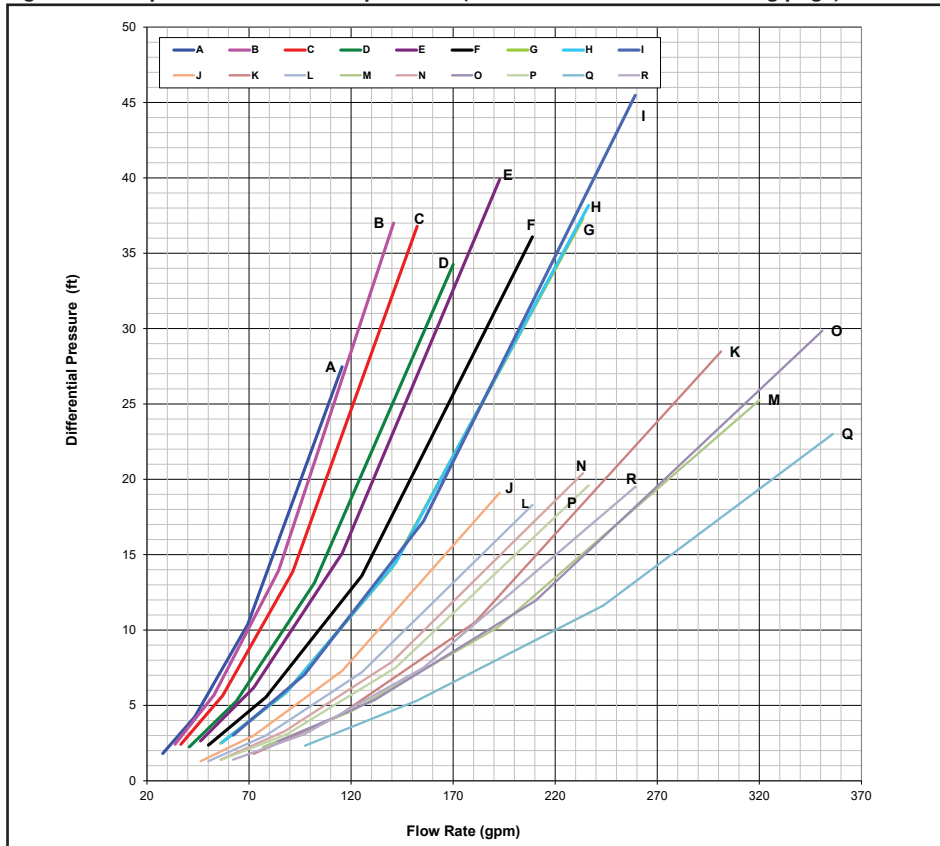
Table 8: Seismic Isolator Kit Numbers

AGZ-E Model	Packaged Unit - Microchannel Fins	
	Neoprene Pads	Spring Isolators
030-065	334549001	334548801
070	334549001	334548802
075-080	334549001	334548805
090-100	334549002	334548806
110-130	334549003	334548807
140-180	334549003	334548808
191-211	334549004	334548809
226-241	334549004	334548810

Table 9: Seismic Isolator Information

AGZ-E Model	Neoprene Pads								Spring Isolators							
	M1	M2	M3	M4	M5	M6	M7	M8	M1	M2	M3	M4	M5	M6	M7	M8
030-065	Brown	Brown	Brown	Brown					Pink	Pink	Tan	Tan				
070	Brown	Brown	Brown	Brown					Pink	Pink	Pink	Tan				
075-080	Brown	Brown	Brown	Brown					Pink	Pink	Pink	Pink				
090-100	Brown	Brown	Brown	Brown					Pink/ DkBlu	Pink/ DkBlu	Pink/ DkBlu	Pink/ DkBlu				
110-130	Red	Red	Brown	Brown	Brown	Brown			White	White	Tan/ DkBlue	Tan/ DkBlue	Red	Red		
140-180	Red	Red	Brown	Brown	Brown	Brown			White	White	Pink	Pink	Pink	Pink		
191-211	Red	Red	Red	Red	Brown	Brown	Brown	Brown	White	White	White	White	Tan/ DkBlue	Tan/ DkBlue	Tan/ DkBlue	Tan/ DkBlue
226-241	Red	Red	Red	Red	Brown	Brown	Brown	Brown	White	White	White	White	Pink	Pink	Pink	Pink

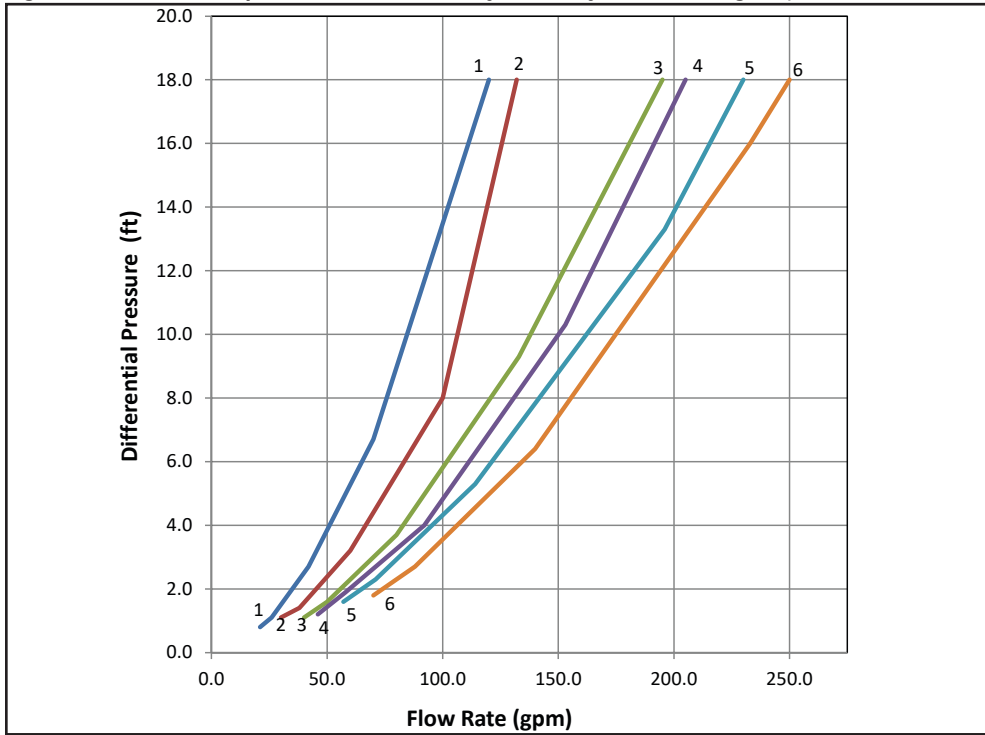
Figure 50: Evaporator Pressure Drop Curves (refer to data table on following page)





**NOTE:** 1 Full load flow minimum is the minimum allowable flow at full load conditions, and/or for a constant flow system.  
 2 Part load flow minimum is the minimum allowable flow for a partially loaded unit, which is only applicable in a variable flow system.  
 Flow may only be reduced proportionally to load, i.e. a flow reduction of 25% from the design flow rate is only allowable if the chiller load is reduced by 25%.

**Figure 51: Pressure Drop Curves- Heat Recovery Auxilliary Heat Exchangers (refer to data in Table 11)**



**Table 11: Pressure Drop Data-- Heat Recovery Auxilliary Braze Plate Heat Exchangers**

Ref.	Unit Model	Minimum Flow				Nominal Flow				Maximum Flow			
		(GPM)	Dp (ft)	l/s	DP kpa	(GPM)	Dp (ft)	l/s	DP kpa	(GPM)	Dp (ft)	l/s	DP kpa
1	AGZ075/076	21	0.8	1.3	2.3	42	2.7	2.7	8.1	120	18.0	7.6	53.8
	AGZ080/081												
	AGZ090/091												
2	AGZ100/101	30	1.1	1.9	3.2	60	3.2	3.8	9.6	132	18.0	8.3	53.8
	AGZ110												
	AGZ120												
3	AGZ130	40	1.1	2.5	3.3	80	3.7	5.0	11.1	195	18.0	12.3	53.8
	AGZ140												
4	AGZ150	46	1.2	2.9	3.7	92	4.0	5.8	12.0	205	18.0	12.9	53.8
	AGZ161												
5	AGZ170	57	1.6	3.6	4.7	114	5.3	7.2	15.8	230	18.0	14.5	53.8
	AGZ180												
	AGZ191												
	AGZ211												
6	AGZ226	70	1.8	4.4	5.3	140	6.4	8.8	19.1	250	18.0	15.8	53.8
	AGZ241												

**Table 12: Strainer Pressure Drop AGZ030-070E, 2.5" Strainer**

Flow (gpm)	Pr. Drop (ft)
40.0	0.3
60.0	0.7
100.0	2.0
150.0	4.3
300.0	16.1

**Table 13: Strainer Pressure Drop AGZ075-130E, 3" Strainer**

Flow (gpm)	Pr. Drop (ft)
50.0	0.3
100.0	1.0
200.0	3.5
300.0	8.1
400.0	16.1

**Table 14: Strainer Pressure Drop AGZ140-180E, 4" Strainer**

Flow (gpm)	Pr. Drop (ft)
100.0	0.4
200.0	1.4
300.0	2.8
400.0	5.1
500.0	7.8
600.0	11.5
700.0	16.1

**Table 15: Strainer Pressure Drop AGZ191-241E, 6" Strainer**

Flow (gpm)	Pr. Drop (ft)
200.0	0.3
300.0	0.7
400.0	1.3
500.0	1.9
600.0	2.7
700.0	3.7
800.0	4.6

**Table 16: Strainer Pressure Drop with Heat Recovery, 2" Strainer**

Flow (gpm)	Pr. Drop (ft)
30.0	0.5
40.0	0.8
60.0	1.8
80.0	3
100.0	4.8
125.0	6.9
150.0	9.7
200.0	18

**NOTE:** Refer to additional data and graph on [page 46](#).



Figure 52: Typical Packaged Unit Field Wiring Diagram (Single-Point Connection)

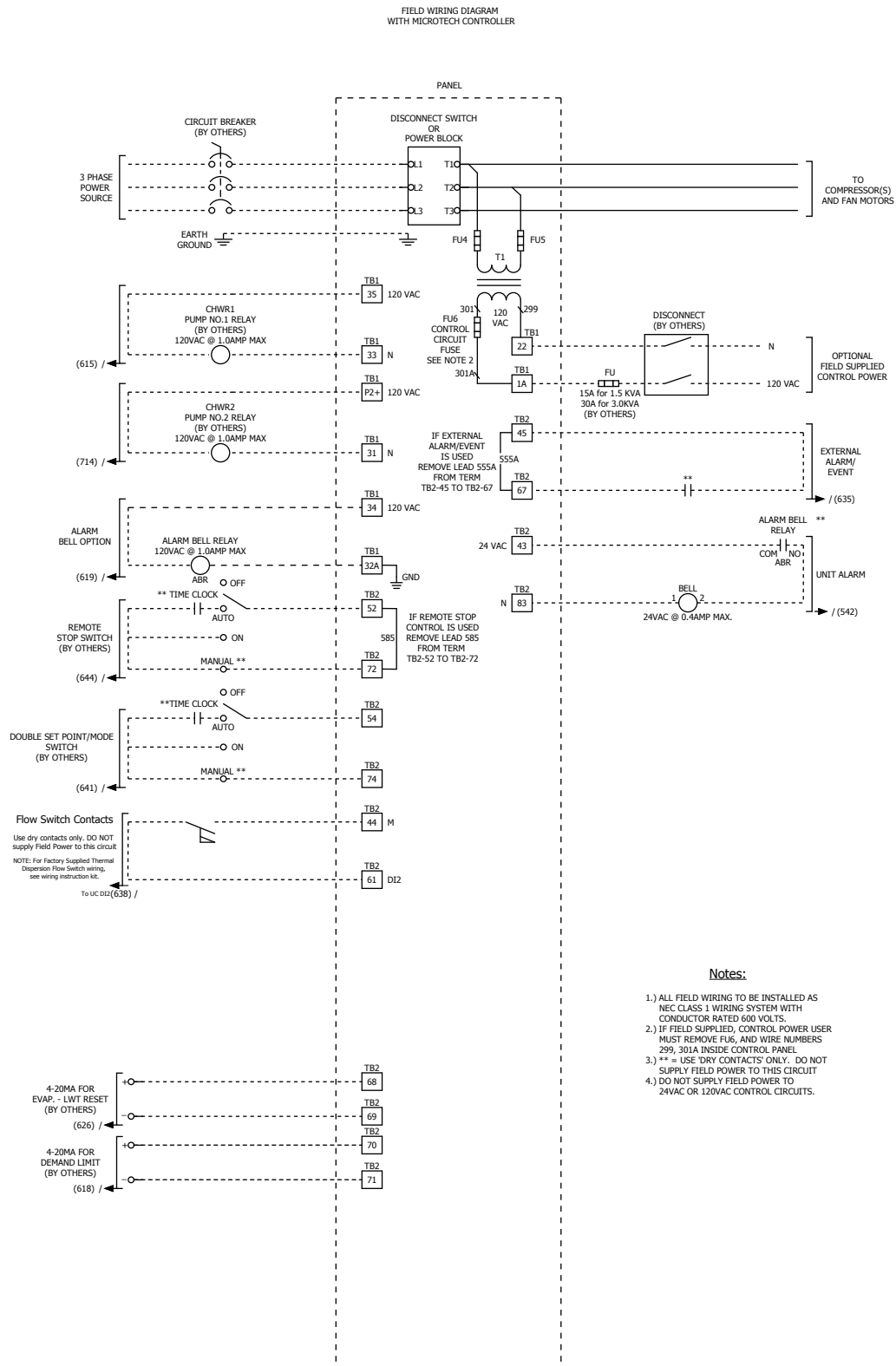




Figure 53: Typical Packaged Unit Field Wiring Diagram (Multi-Point Connection)

Note: Separate grounding is required if fed from different transformers. Otherwise a single ground is acceptable.

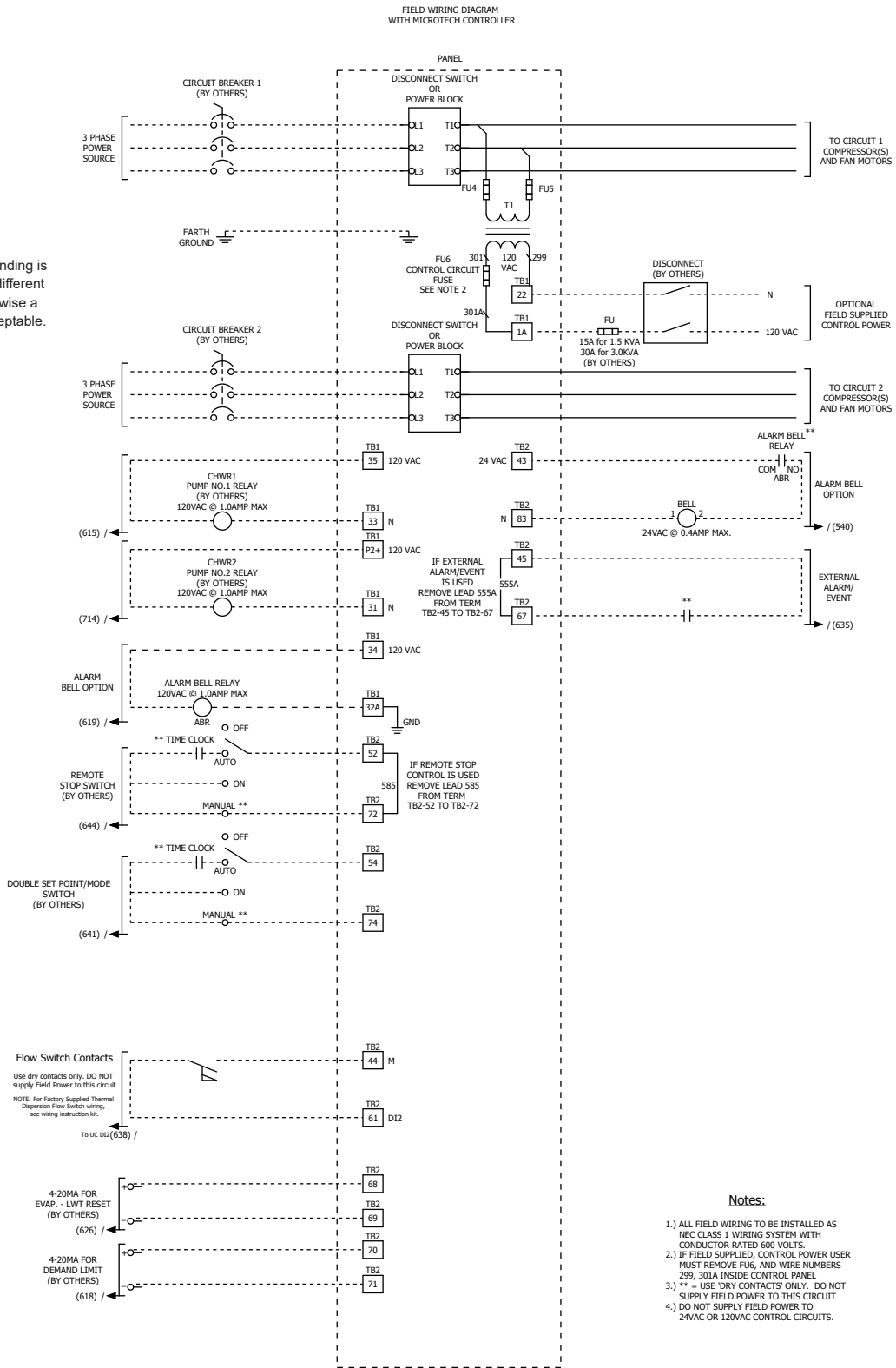


Figure 54: Typical Heat Recovery Unit Field Wiring Diagram (Single-Point Connection with all options shown)

Note: Separate grounding is required if fed from different transformers. Otherwise a single ground is acceptable.

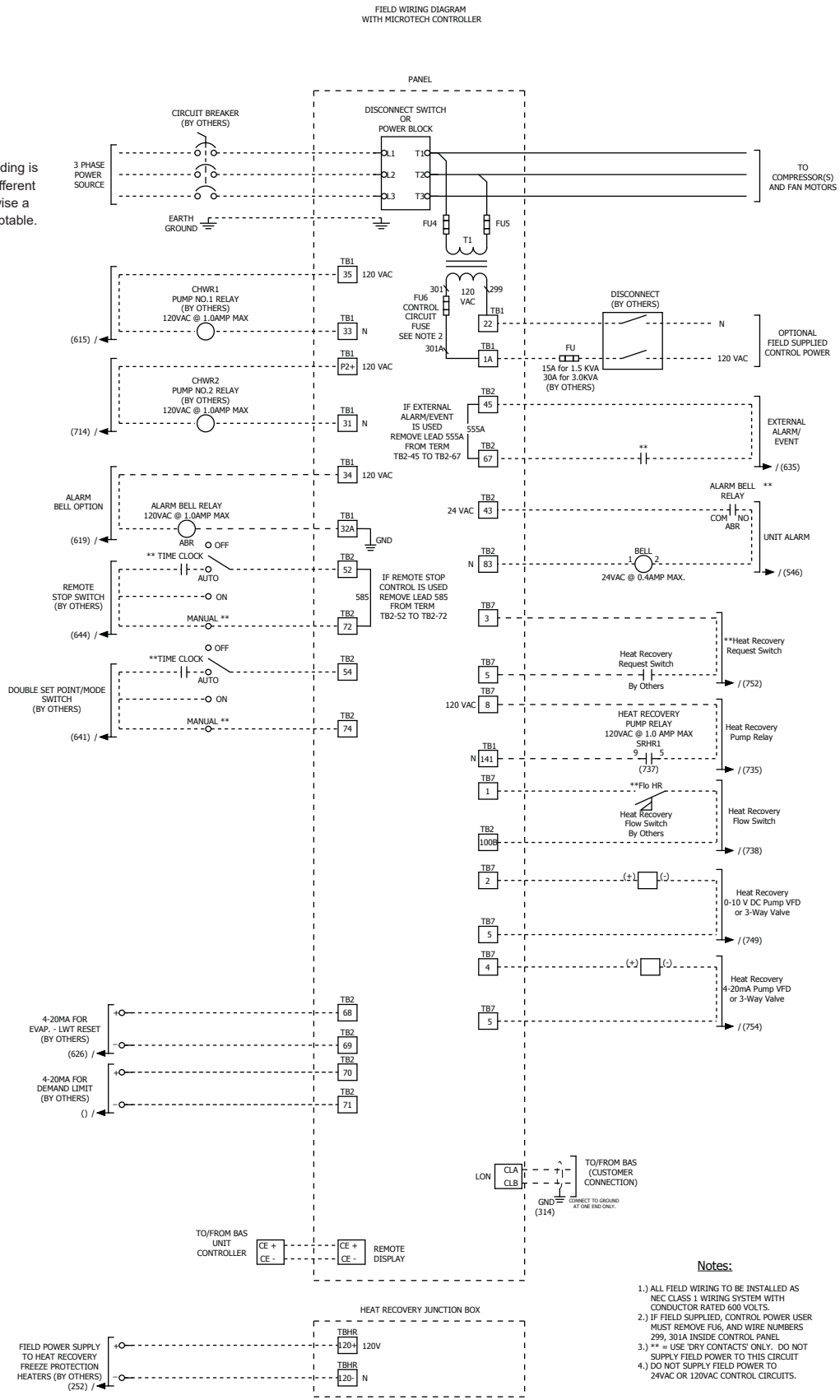
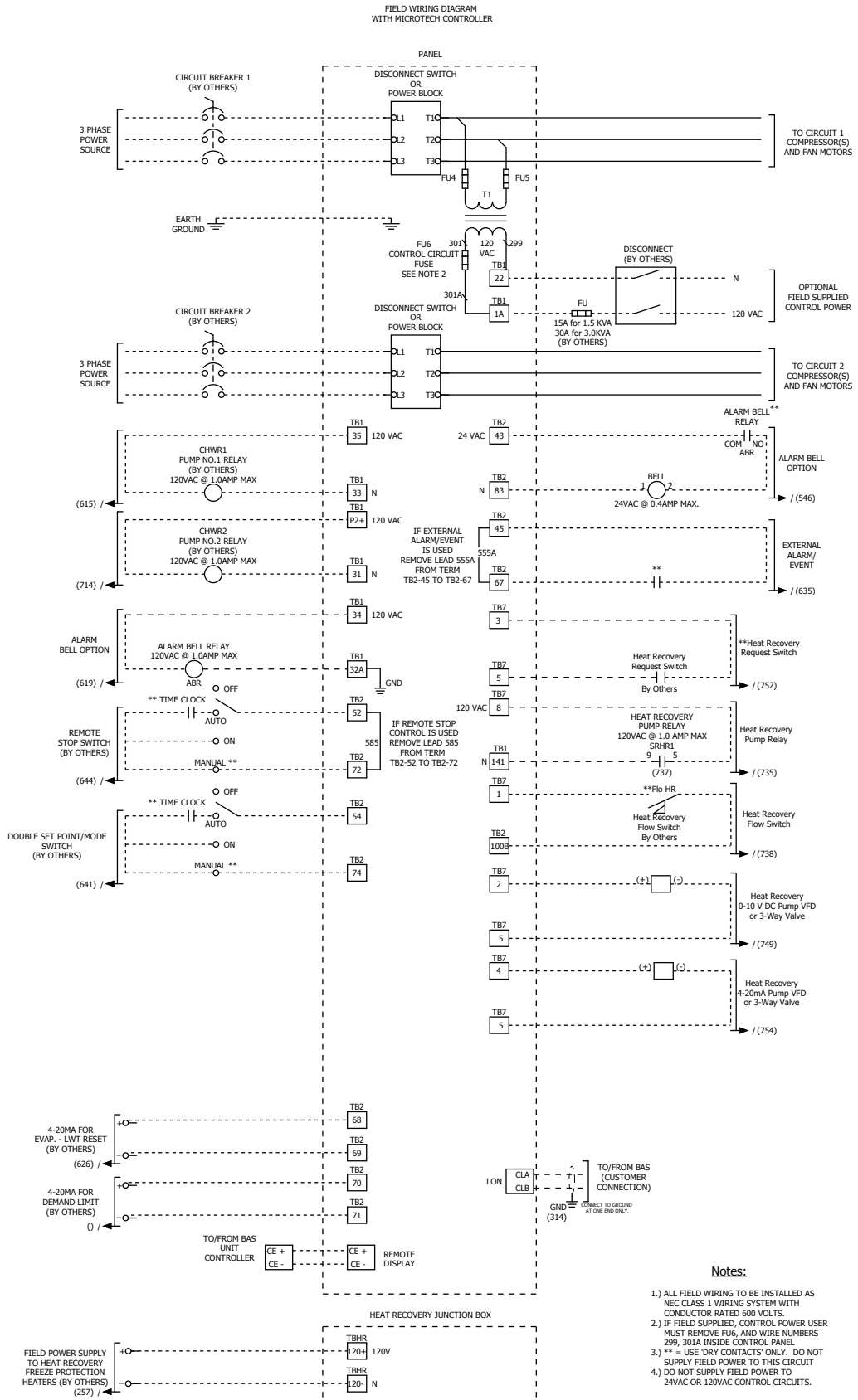


Figure 55: Typical Heat Recovery Unit Field Wiring Diagram (Multi-Point Connection)

Note: Separate grounding is required if fed from different transformers. Otherwise a single ground is acceptable.



## General Description

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.

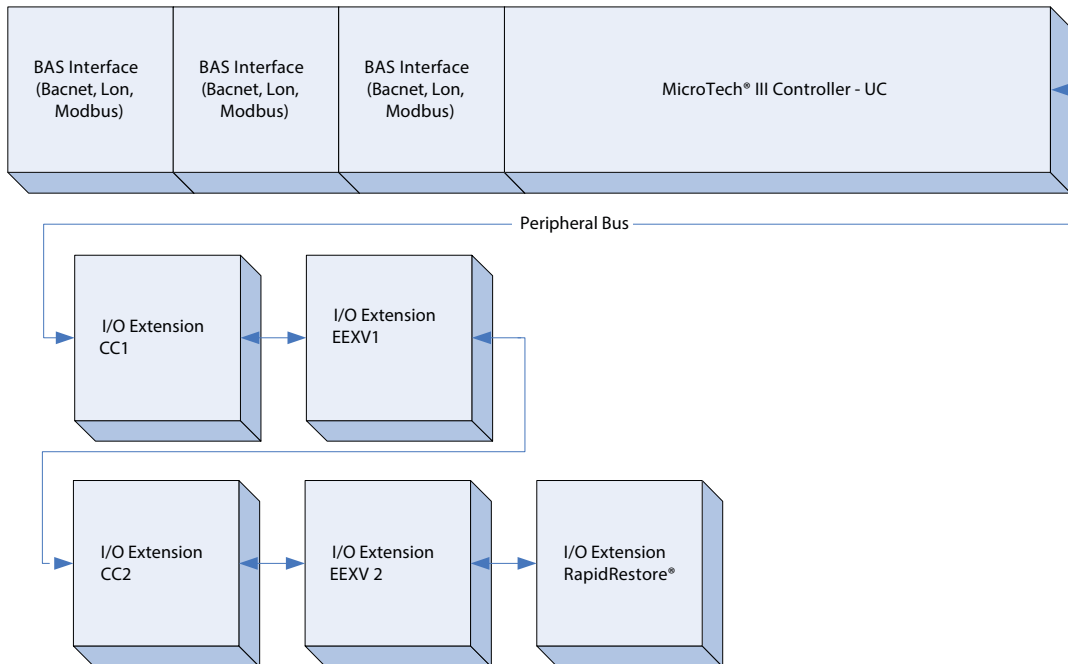
## System Architecture

The overall controls architecture uses the following:

- One MicroTech® III unit controller
- I/O 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 56: System Architecture



# Controller Inputs and Outputs

## Main Controller

**Table 19: 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	Demand Limit	4-20 mA	1 to 23 mA
X4	LWT Reset	4-20 mA	1 to 23 mA

**Table 20: Analog Outputs**

#	Description	Signal Type	Range
X2	Circuit 1 Fan VFD Speed2	Voltage	0 to 10 volts
X3	Circuit 2 Fan VFD Speed2	Voltage	0 to 10 volts
X5	Circuit 1 Fan VFD Speed1	Voltage	0 to 10 volts
X6	Circuit 2 Fan VFD Speed1	Voltage	0 to 10 volts

**Table 21: Digital Inputs**

	Description	Signal Off	Signal On
DI1	External Alarm/Event	External Fault	No Ext. Fault
DI2	Evaporator Flow Switch	No Flow	Flow
DI3	Double Set Point/ Mode Switch	See sections on Unit Mode Selection and LWT Target	
DI4	Remote Switch	Remote Disable	Remote Enable
DI5	Unit Switch	Unit Disable	Unit Enable

**Table 22: Digital Outputs**

	Description	Output Off	Output On
DO1	Evaporator Water Pump 1	Pump Off	Pump On
DO2	Alarm Indicator	Alarm Not Active	Alarm Active
DO3	Circuit 1 Fan Output 1	Fan(s) Off	Fan(s) On
DO4	Circuit 1 Fan Output 2	Fan(s) Off	Fan(s) On
DO5	Circuit 1 Fan Output 3	Fan(s) Off	Fan(s) On
DO6	Circuit 1 Fan Output 4	Fan(s) Off	Fan(s) On
DO7	Circuit 2 Fan Output 1	Fan(s) Off	Fan(s) On
DO8	Circuit 2 Fan Output 2	Fan(s) Off	Fan(s) On
DO9	Circuit 2 Fan Output 3	Fan(s) Off	Fan(s) On
DO10	Circuit 2 Fan Output 4	Fan(s) Off	Fan(s) On
X7	Circuit 1 Condenser SV 1	Solenoid Closed	Solenoid Open
X8	Circuit 2 Condenser SV 1	Solenoid Closed	Solenoid Open

## Compressor Module 1

**Table 23: Analog Inputs**

	Description	Signal Type	Expected Range
X1	Circuit 1 Suction Temp	NTC 10k	340 to 300k Ω
X2	Circuit 1 Evaporator Press	Voltage	0.4 to 4.6 volts
X4	Circuit 1 Condenser Press	Voltage	0.4 to 4.6 volts
X3	Heat Recovery EWT	NTC 10k	340 to 300k Ω
X5	Heat Recovery LWT	NTC 10k	340 to 300k Ω

**Table 24: Digital Inputs**

	Description	Signal Off	Signal On
X6	Circuit 1 Switch	Circuit Disable	Circuit Enable
X7	Circuit 1 MHP Switch	Fault	No fault
X8	Circuit 1 Motor Protection	Fault	No fault
DI1	Circuit 1 (or Unit) PVM/ GFP	Fault	No fault

**NOTE:** The Motor Protection and MHP input signal are wired in series. If Motor Protection input is open, MHP Switch input will also be open.

**Table 25: Digital Outputs**

	Description	Output Off	Output On
DO1	Compressor #1	Compressor Off	Compressor On
DO2	Compressor #3	Compressor Off	Compressor On
DO3	Compressor #5	Compressor Off	Compressor On
DO4	Evap Water Pump 2	Pump Off	Pump On
DO5	Circuit 1 Hot Gas Bypass SV	Solenoid Closed	Solenoid Open
DO6	Circuit 1 Liquid Line SV	Solenoid Closed	Solenoid Open

## Compressor Module 2

**Table 26: Analog Inputs**

	Description	Signal Type	Expected Range
X1	Circuit 2 Suction Temp	NTC 10k	340 to 300k Ω
X2	Circuit 2 Evap Press	Voltage	0.4 to 4.6 volts
X4	Circuit 2 Cond Press	Voltage	0.4 to 4.6 volts

**Table 27: Digital Inputs**

	Description	Signal Off	Signal On
X3	Heat Recovery Flow Switch	No Flow	Flow
X6	Circuit 2 Switch	Circuit Disable	Circuit Enable
X7	Circuit 2 MHP Switch	Fault	No fault
X8	Circuit 2 Motor Protection	Fault	No fault
DI1	Circuit 2 PVM/GFP	Fault	No fault

**NOTE:** The Motor Protection and MHP input signal are wired in series. If Motor Protection input is open, MHP Switch input will also be open.

**Table 28: Digital Outputs**

	Description	Output Off	Output On
DO1	Compressor #2	Compressor Off	Compressor On
DO2	Compressor #4	Compressor Off	Compressor On
DO3	Compressor #6	Compressor Off	Compressor On
DO5	Circuit 2 Hot Gas Bypass SV	Solenoid Closed	Solenoid Open
DO6	Circuit 2 Liquid Line SV	Solenoid Closed	Solenoid Open
X5	Heat Recovery Pump Relay	Pump Off	Pump On

## EXV Module 1 and 2

These modules will be used only when the expansion valve type is electronic.

**Table 29: Digital Inputs**

	Description	Output Off	Output On
DI1	Circuit 1 or 2 MLP Switch	Fault	No Fault
X2	Heat Recovery Request Switch	No Request	Request

**Table 30: Digital Outputs**

	Description	Output Off	Output On
DO1	Circuit 1 or 2 Fan Output 5	Fan(s) Off	Fan(s) On

**Table 31: Analog Outputs**

	Description	Output Signal
X1	Heat Recovery Pump/ Valve	0-10VDC
X3	Heat Recovery Pump/ Valve	4-20 mA Current

**Table 32: Stepper Motor Output**

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

## Condenser Fan Output Labels

All condenser fan output labels, both the digital outputs and analog speed signals, will be labeled according to which fans are connected to each one. The following tables show the fans connected to each output for each configuration.

**Table 33: AGZ-E Models without VFDs**

	Output Descr.	Physical Output	Number of Fans					
			4	6	8	10	12	14
Circuit 1	Speed 1	UC X5						
	Speed 2	UC X2						
	Fan Output 1	UC DO3	Fan 11	Fan 11	Fan 11	Fan 11	Fan 11	Fan 11/13
	Fan Output 2	UC DO4	Fan 12	Fan 12	Fan 12	Fan 12	Fan 12	Fan 12
	Fan Output 3	UC DO5		Fan 13	Fan 13	Fan 13	Fan 13	Fan 14/16
	Fan Output 4	UC DO6			Fan 14	Fan 14	Fan 14/16	Fan 15
	Fan Output 5	EEXV1 DO1				Fan 15	Fan 15	Fan 17
Circuit 2	Speed 1	UC X6						
	Speed 2	UC X3						
	Fan Output 1	UC DO7	Fan 21	Fan 21	Fan 21	Fan 21	Fan 21	Fan 21/23
	Fan Output 2	UC DO8	Fan 22	Fan 22	Fan 22	Fan 22	Fan 22	Fan 22
	Fan Output 3	UC DO9		Fan 23	Fan 23	Fan 23	Fan 23	Fan 24/26
	Fan Output 4	UC DO10			Fan 24	Fan 24	Fan 24/26	Fan 25
	Fan Output 5	EEXV2 DO1				Fan 25	Fan 25	Fan 27

**Table 34: AGZ-E Models with 1 VFD per Circuit**

	Output Descr.	Physical Output	Number of Fans					
			4	6	8	10	12	14
Circuit 1	Speed 1	UC X5	Fan 11	Fan 11	Fan 11/13	Fan 11/13	Fan 11/13	Fan 11/13
	Speed 2	UC X2						
	Fan Output 1	UC DO3					Fan 12	Fan 12
	Fan Output 2	UC DO4	Fan 12	Fan 12	Fan 12	Fan 12	Fan 14	Fan 14
	Fan Output 3	UC DO5		Fan 13			Fan 15	Fan 15
	Fan Output 4	UC DO6			Fan 14	Fan 14	Fan 16	Fan 16
	Fan Output 5	EEXV1 DO1				Fan 15		Fan 17
Circuit 2	Speed 1	UC X6	Fan 21	Fan 21	Fan 21/23	Fan 21/23	Fan 21/23	Fan 21/23
	Speed 2	UC X3						
	Fan Output 1	UC DO7					Fan 22	Fan 22
	Fan Output 2	UC DO8	Fan 22	Fan 22	Fan 22	Fan 22	Fan 24	Fan 24
	Fan Output 3	UC DO9		Fan 23			Fan 25	Fan 25
	Fan Output 4	UC DO10			Fan 24	Fan 24	Fan 26	Fan 26
	Fan Output 5	EEXV2 DO1				Fan 25		Fan 27

**Table 35: AGZ-E Models with 2 VFDs per Circuit**

	Output Descr.	Physical Output	Number of Fans				
			6	8	10	12	14
Circuit 1	Speed 1	UC X5	Fan 11	Fan 11/13	Fan 11/13	Fan 11/13	Fan 11/13
	Speed 2	UC X2	Fan 12/13	Fan 12/14	Fan 12/14	Fan 12/14/15/16	Fan 12/14/15/16
	Fan Output 1	UC DO3					
	Fan Output 2	UC DO4					
	Fan Output 3	UC DO5					
	Fan Output 4	UC DO6					
	Fan Output 5	EEXV1 DO1			Fan 15		Fan 17
Circuit 2	Speed 1	UC X6	Fan 21	Fan 21/23	Fan 21/23	Fan 21/23	Fan 21/23
	Speed 2	UC X3	Fan 22/23	Fan 22/24	Fan 22/24	Fan 22/24/25/26	Fan 22/24/25/26
	Fan Output 1	UC DO7					
	Fan Output 2	UC DO8					
	Fan Output 3	UC DO9					
	Fan Output 4	UC DO10					
	Fan Output 5	EEXV2 DO1			Fan 25		Fan 27

## RapidRestore®

This module will be used only when the unit is equipped with the RapidRestore® option.

**Table 36: Digital Inputs**

	Description	Signal Off	Signal On
DI1	RapidRestore Enable	Disable	Enable
DI2	Backup Chiller Designation	Normal Chiller	Backup Chiller

## 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.

## 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. If an option is not included on the unit, the respective set point may not be visible. Data and settings that only apply to a specific operation mode will only be visible if that mode is selected.

**Table 37: Unit Level Set Point Defaults and Ranges**

Description	Default	Range
<b>Basic Unit Configuration</b>		
Unit Model	AGZ000	Based on Unit Model Configuration
Evaporator Configuration	Not Set	Not Set, Packaged, Remote
Evaporator Glycol	No	No, Yes - must be Yes for Mode to be Cool/Ice or Ice.
Available Modes	Cool	Cool, Cool w/Ice, Ice
Condenser Type	Not Set	Not Set, Microchannel
Expansion Valve Type	Not Set	Not Set, Thermal, Electronic
Condenser Fan VFD Configuration	None	None, 1/cir, 2/cir
Power Connection Configuration	Single Point	Single Point, Multi Point
RapidRestore	No	No, Yes
Heat Recovery Control Type	None	None, Valve, VFD Pump
<b>Mode/Enabling</b>		
Unit Enable	Enable	Disable, Enable
Control source	Local	Local, Network
Unit Test Mode	Off	Off, On
<b>Staging and Capacity Control</b>		
Cool LWT 1	7°C (44.6°F)	See Dynamic Set Point Ranges
Cool LWT 2	7°C (44.6°F)	See Dynamic Set Point Ranges
Ice LWT	4.4°C (39.9°F)	-9.5 to 4.4 °C (14.9 to 39.9 °F)
Startup Delta T	5.6°C (10.1°F)	0.6 to 8.3 °C (1.1 to 14.9 °F)
Shut Down Delta T	0.3°C (0.5°F)	0.3 to 1.7 °C (0.5 to 3.1 °F)
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	0.6°C/min (1.1°F/min)	0.1 to 2.7°C/min (0.2 to 4.9°F/min)
Full Capacity Evap Delta T	8.9 °C (16°F)	3.3 to 8.9 °C (5.9 to 16 °F)
Variable Evaporator Flow	No	No, Yes
Ice TimeCycle Delay	12	1-23 hours
Clear Ice Timer	No	No, Yes
RapidRestore	Disable	Disable, Enable
Rapid Restore Max Power Off Time	15 seconds	15 to 180 seconds
<b>Evaporator Pump Control</b>		
Evap Pump Control Configuration	#1 Only	#1 Only, #2 Only, Auto, #1 Primary, #2 Primary
Evap Recirc Timer	90	15 to 300 seconds
Evap Pump 1 Run Hours	0	0 to 999999 hours
Evap Pump 2 Run Hours	0	0 to 999999 hours
<b>Power Conservation and Limits</b>		
LWT Reset Enable	Disable	Disable, Enable
Demand Limit Enable	Disable	Disable, Enable
High IPLV Mode	Disable	Disable, Enable
IPLV Condensing Target	23.89°C (75°F)	21.11 to 32.22°C (70 to 90°F)
<b>Sound Reduction Mode</b>		
Sound Reduction Enable	Disable	Disable, Enable
Sound Reduction Priority	Capacity	Sound, Capacity
Sound Reduction Fan Speed Limit	50%	50%, 60%, 70%, 80%, 90%
Monday Start Time	22:00	00:00 to 23:00
Monday Duration	12 hrs	0 to 24 hrs
Tuesday Start Time	22:00	00:00 to 23:00
Tuesday Duration	12 hrs	0 to 24 hrs
Wednesday Start Time	22:00	00:00 to 23:00
Wednesday Duration	12 hrs	0 to 24 hrs
Thursday Start Time	22:00	00:00 to 23:00



**Table 38: Unit Level Set Point Defaults and Ranges (continued)**

Thursday Duration	12 hrs	0 to 24 hrs
Friday Start Time	22:00	00:00 to 23:00
Friday Duration	12 hrs	0 to 24 hrs
Saturday Start Time	22:00	00:00 to 23:00
Saturday Duration	12 hrs	0 to 24 hrs
Sunday Start Time	22:00	00:00 to 23:00
Sunday Duration	12 hrs	0 to 24 hrs
<b>Heat Recovery Mode</b>		
Heat Recovery Control Offset	2.78°C(5°F)	1.11 to 8.33 °C (2 to 15 °F)
Heat Recovery Priority	Heat	Heat, Efficiency
Heat Recovery Min Valve Position	30.0%	10.0 to 40.0 %
Heat Recovery Min Pump VFD Speed	5.0%	5.0 to 25.0 %
Heat Recovery Recirculation Time	2 minutes	1 to 7 minutes
Heat Recovery Retry Delay	5 minutes	3 to 30 minutes
Heat Recovery Control Mode	Auto	Auto, Manual
Heat Recovery Manual Valve Position		0.0 to 100.0%
Heat Recovery Manual Pump Speed		0.0 to 100.0%
Heat Recovery PID Kp Value	2.0	0.0 to 1000
Heat Recovery PID Ti Value	10.0	0.0 to 1000
Heat Recovery PID Td Value	0.0	0.0 to 1000
<b>Unit Sensor Offsets</b>		
Evap LWT Sensor Offset	0°C (0°F)	-5.0 to 5.0 °C (-9.0 to 9.0 °F)
Evap EWT Sensor Offset	0°C (0°F)	-5.0 to 5.0 °C (-9.0 to 9.0 °F)
Heat Recovery LWT sensor offset	0°C (0°F)	-5.0 to 5.0 °C (-9.0 to 9.0 °F)
Heat Recovery EWT sensor offset	0°C (0°F)	-5.0 to 5.0 °C (-9.0 to 9.0 °F)
OAT Sensor Offset	0°C (0°F)	-5.0 to 5.0 °C (-9.0 to 9.0 °F)
<b>Circuit Configuration Timers (applies to both circuits)</b>		
Compressor Start to Start Time Delay	15 min	10-60 minutes
Compressor Stop to Start Time Delay	5 min	3-20 minutes
Clear Cycle Timers	No	No, yes
<b>Alarm and Limit Settings - Units</b>		
Evaporator Water Freeze	2.2°C (36°F)	See Dynamic Set Point Ranges
Evaporator Flow Proof	5 sec	5 to 15 sec
Evaporator Recirculate Timeout	3 min	1 to 10 min
External Fault Configuration	Event	Event, Alarm
Low Ambient Lockout	1.7°C (35.1°F)	See Dynamic Set Point Ranges
Low Ambient Lockout BAS Alert	Off	Off, On
<b>Alarm and Limit Settings - Circuits</b>		
Low Evap Pressure Unload	689.5 KPA (100 PSI)	See Dynamic Set Point Ranges
Low Evap Pressure Hold	696.4 KPA (101 PSI)	See Dynamic Set Point Ranges
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)
Low OAT Start Time	165 sec	150 to 240 sec
<b>BAS Control Inputs</b>		
Network Unit Enable	Disable	Disable, Enable
Network Mode Command	Cool	Cool, Ice
Network Cool Set Point	7°C (44.6°F)	See Dynamic Set Point Ranges
Network Ice Set Point	4.4°C (39.9°F)	-9.5 to 4.4 °C (14.9 to 39.9 °F)
Network Capacity Limit	100%	0 to 100%
Network Alarm Clear Command	Normal	Normal, Clear Alarm

## Dynamic Set Point Ranges

Table 39 to Table 42 provide settings that have different ranges of adjustment based on other settings.

**Table 39: Cool LWT 1 and Cool LWT2 Set Point Ranges**

Evaporator Glycol	Unit Vintage	Range
No	E vintage	4.4 to 18.34°C (39.9 to 65°F)
Yes	E vintage	-9.5 to 18.34°C (14.9 to 65°F)

**Table 40: Evaporator Water Freeze**

Evaporator Glycol	Range
No	2.2 to 5.6°C (36 to 42.1°F)
Yes	-28.89 to 5.6°C (-20 to 42.1°F)

**Table 41: Low Ambient Lockout**

Fan VFD Configuration	Range
None	0 to 15.6°C (32 to 60.1°F)
1/cir or 2/cir	-23.3 to 15.6°C (-9.9 to 60.1°F)

**Table 42: Low Evaporator Pressure**

Available Mode Selection	Range
Hold - Without Glycol	669 to 793 KPA (97 to 115 PSI)
Hold - With Glycol	317 to 793 KPA (46 to 115 PSI)
Unhold - Without Glycol	669 to 793 KPA (97 to 115 PSI)
Unhold - With Glycol	317 to 793 KPA (46 to 115 PSI)

**Table 43: Design Conditions**

Description	Default	Range
Design Evaporator EWT	0°C (32°F)	-9.5°C to 28.34°C (14.9°F to 83°F)
Design Evaporator LWT	0°C (32°F)	-9.5°C to 18.34°C (14.9°F to 65°F)
Design Evaporator Water Flow	0 lph (0 gpm)	0 to 908399 lph (0 to 4000 gpm)
Design mes Circuit 1/2	0°C (0°F)	0°C to 10°C (0°F to 18°F)
Design Ambient Temperature	0°C (32°F)	-28.89°C to 51.67°C (-20°F to 125°F)
Design Condenser Approach Circuit 1/2	0°C (0°F)	0°C to 40°C (0°F to 72°F)
Design Full Load Efficiency	0%	0 to 100%
Design IPLV	0	0 to 100
Design Rated Capacity	0 tons	0 to 1000 tons

**NOTE:** Conditions are for reference only and not required for operation.

**Table 44: Administration and Service Support**

Description	Default	Range
Unit G.O. Number	"Enter Data"	Alphanumeric string of up to 16 characters
Unit Serial Number	"Enter Data"	Alphanumeric string of up to 20 characters
Next Maintenance Month	January	January through December
Next Maintenance Year	2009	2009 - 2100
Service Support Reference	999-999-9999	Any 10 digit phone number
Controller Time	From Controller Timeclock	00:00:00 to 23:59:59
Controller Date	From Controller Timeclock	1/1/2000 to 12/31/2050
UTC Difference	-60 minutes	-3276 to 32767 minutes
Daylight Savings Time Enable	Yes	No, Yes
Daylight Savings Time Start Month	March	January through December
Daylight Savings Time Start Week	2nd Week	1st through 5th Week
Daylight Savings Time End Month	November	January through December
Daylight Savings Time End Week	1st Week	1st through 5th Week
Operator Password Disable	Off	Off, On
Apply Changes	No	No, Yes
Active Alarm Clear	Off	Off, On
Alarm Log Clear	No	No, Yes
Power Restore Event Log - Day Selection	Current	Current, 2nd Day, 3rd Day, 4th Day, 5th Day, 6th Day, 7th Day
Display Units	English	English, Metric

**Table 45: Unit Test Mode Set Points**

Description	Default	Range
Test Unit Alarm Output	Off	Off, On
Test Evaporator Pump Output 1	Off	Off, On
Test Evaporator Pump Output 2	Off	Off, On
Test Heat Recovery Pump Output	Off	Off, On
Test Heat Recovery Position/Speed Output	0.0%	0.0 to 100.0%

**NOTE:** Unit test mode set points can be changed only when the unit mode is in Test. When the unit mode is no longer Test, all unit test mode set points will be changed back to the 'off' values.

**Table 46: Communication Configuration**

Description	Default	Range
Controller IP DHCP	On	Off, On
Controller IP Network Address	192.168.001.042	000.000.000.000 to 255.255.255.255
Controller IP Network Mask	255.255.255.000	000.000.000.000 to 255.255.255.255
Controller IP Network Gateway	192.168.001.001	000.000.000.000 to 255.255.255.255
Lon Module Maximum Send Time	0 seconds	0 to 6553.4 seconds
Lon Module Minimum Send Time	0 seconds	0 to 6553.4 seconds
Lon Module Receive Heartbeat	0 seconds	0 to 6553.4 seconds
BACnet Module Name		Alphanumeric string up to 15 characters long
BACnet Module Dev Instance	0	0 to 4194302
BACnet Module Unit Support	English	Metric, English
BACnet Module NC Dev 1	0	0 to 42949672
BACnet Module NC Dev 2	0	0 to 42949672
BACnet Module Reset Out of Service	Done	Done, False, True
BACnet IP Module UDP Port	0	0 to 65535
BACnet IP Module DHCP	Off	Off, On
BACnet IP Module Network Address		000.000.000.000 to 999.999.999.999
BACnet IP Module Network Mask		000.000.000.000 to 999.999.999.999
BACnet IP Module Network Gateway		000.000.000.000 to 999.999.999.999
BACnet MSTP Module Address	0	0 to 127
BACnet MSTP Module Baud Rate	38400	9600, 19200, 38400, 76800
BACnet MSTP Module Max Master	0	0 to 127
BACnet MSTP Module Max Info Frm	0	0 to 255
Modbus Module Address	1	1 to 247
Modbus Module Baud Rate	19200	4800, 9600, 19200, 38400
Modbus Module Parity	Even	Even, Odd, None
Modbus Module Two Stop Bits	No	No, Yes
Modbus Module Response Delay	0 milliseconds	0 to 30000 milliseconds
Modbus Module Comm LED Time Out	0 seconds	0 to 3600 seconds
AWM DHCP	Off	Off, On
AWM Network Address		000.000.000.000 to 999.999.999.999
AWM Network Mask		000.000.000.000 to 999.999.999.999
AWM Network Gateway		000.000.000.000 to 999.999.999.999

## Circuit Level Set Points

The settings in this section all exist for each individual circuit.

**Table 47: Set Points for Individual Circuits**

Description	Default	Range
<b>Mode/Enabling</b>		
Circuit mode	Enable	Disable, Enable, Test
Compressor 1 Enable	Auto	Auto, Off
Compressor 2 Enable	Auto	Auto, Off
Compressor 3 Enable	Auto	Auto, Off
<b>EXV Settings</b>		
EXV control	Auto	Auto, manual
EXV position	See Special Setpoints	0% to 100%
Suction SH Target @50% (3)	4.44°C (8°F)	4.44 to 6.12 °C (8 to 11 °F)
Suction SH Target @100% (3)	5.56°C (10°F)	4.44 to 6.67 °C (8 to 12 °F)
Suction SH Target @33% (4)	See Special Setpoints	4.44 to 6.12 °C (8 to 11 °F)
Suction SH Target @66/100% (4)	5.56°C (10°F)	4.44 to 6.67 °C (8 to 12 °F)
Max Evap Pressure	1075.6 KPA(156 PSI)	979 to 1172 KPA (142 to 170 PSI)
<b>Condenser Control</b>		
Condenser Target 100%	See Dynamic Set Point Ranges	See Dynamic Set Point Ranges
Condenser Target 67% (2)	See Dynamic Set Point Ranges	See Dynamic Set Point Ranges
Condenser Target 50% (1)	See Dynamic Set Point Ranges	See Dynamic Set Point Ranges
Condenser Target 50%, Unit 75% (1)	See Dynamic Set Point Ranges	See Dynamic Set Point Ranges
Condenser Target 50%, Unit 50% (1)	See Dynamic Set Point Ranges	See Dynamic Set Point Ranges
Condenser Target 50%, Unit 25% (1)	See Dynamic Set Point Ranges	See Dynamic Set Point Ranges
Condenser Target 33% (2)	See Dynamic Set Point Ranges	See Dynamic Set Point Ranges
Heat Recovery Cond Target 100%	40.56°C (105°F)	32.22 to 46.12°C (90 to 115°F)
Heat Recovery Cond Target 67%	37.78°C (100°F)	32.22 to 46.12°C (90 to 115°F)
Heat Recovery Cond Target 50%	40.56°C (105°F)	32.22 to 43.34°C (90 to 110°F)
Heat Recovery Cond Target 33%	37.78°C (100°F)	32.22 to 40.56°C (90 to 105°F)
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
Fan Stage Up Deadband 3	See Dynamic Set Point Ranges	See Dynamic Set Point Ranges
Fan Stage Up Deadband 4	See Dynamic Set Point Ranges	See Dynamic Set Point Ranges
Fan Stage Down Deadband 1	See Dynamic Set Point Ranges	See Dynamic Set Point Ranges
Fan Stage Down Deadband 2	See Dynamic Set Point Ranges	See Dynamic Set Point Ranges
Fan Stage Down Deadband 3	See Dynamic Set Point Ranges	See Dynamic Set Point Ranges
Fan Stage Down Deadband 4	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°C (0°F)	-5.0 to 5.0 °C (-9.0 to 9.0 °F)
<b>BAS Control Inputs</b>		
Network Compressor 1 Enable	Enable	Enable, Disable
Network Compressor 2 Enable	Enable	Enable, Disable
Network Compressor 3 Enable	Enable	Enable, Disable

- NOTE:**
1. Condenser Target 50% will be available only when the unit has 4 compressors.
  2. Condenser Targets 33% and 67% will be available only when the unit has 6 compressors.
  3. Suction SH Targets 50% and 100% will be available only when the unit has 4 compressors.
  4. Suction SH Targets 33% and 66/100% will be available only when the unit has 6 compressors.

## Special Set Point Operation

EXV settings are only visible if the unit is configured with electronic expansion valves. The EXV position set point is not changeable unless the unit switch is off.

EXV Position set point on each circuit follows the actual EXV position while EXV Control = Auto. When EXV Control = Manual, the position set point will be changeable.

**Table 48: Suction Superheat Target 33%**

Unit Model	Default
Models 75 to 180	4.44°C (8°F)
Models 191 to 241	5.56°C (10°F)

## Dynamic Set Point Ranges and Defaults

Some settings have different ranges of adjustment based on other parameters and unit configuration. The condenser settings that follow are applicable to four configuration groups:

- 1 - Models 30 to 71
- 2 - Models 75 to 241 with no fan VFDs or one VFD per circuit
- 3 - Models from 75 to 161 with 2 fan VFDs per circuit
- 4 - Models 170 to 241 with 2 fan VFDs per circuit

**Table 49: Configuration Group 1**

Description	Default	Range
Condenser Target - 100% Circuit Capacity	37.78°C (100°F)	37.78 to 46.11°C (100 to 115°F)
Condenser Target - 67% Circuit Capacity	32.22°C (90°F)	32.22 to 46.11°C (90 to 115°F)
Condenser Target - 50% Circuit Capacity	32.22°C (90°F)	32.22 to 46.11°C (90 to 115°F)
Condenser Target - 33% Circuit Capacity	32.22°C (90°F)	32.22 to 40.56°C (90 to 105°F)
Fan Stage Up Deadband 1	11.11°C (20°F)	11.11 to 13.89°C (20 to 25°F)
Fan Stage Up Deadband 2	8.33°C (15°F)	8.33 to 11.11°C (15 to 20°F)
Fan Stage Up Deadband 3	5.56°C (10°F)	5.56 to 8.33°C (10 to 15°F)
Fan Stage Up Deadband 4	5.56°C (10°F)	5.56 to 8.33°C (10 to 15°F)
Fan Stage Down Deadband 4	5.56°C (10°F)	3.33 to 5.56°C (6 to 10°F)
Fan Stage Down Deadband 3	5.56°C (10°F)	3.33 to 5.56°C (6 to 10°F)
Fan Stage Down Deadband 2	5.56°C (10°F)	5.56 to 8.33°C (10 to 15°F)
Fan Stage Down Deadband 1	11.11°C (20°F)	8.33 to 11.11°C (15 to 20°F)

**Table 50: Configuration Group 2**

Description	Default	Range
Condenser Target - 100% Circuit Capacity	37.78°C (100°F)	37.78 to 46.11°C (100 to 115°F)
Condenser Target - 67% Circuit Capacity	32.22°C (90°F)	32.22 to 43.33°C (90 to 110°F)
Condenser Target - 50% Circuit Capacity	29.44°C (85°F)	29.44 to 32.22°C (85 to 90°F)
Condenser Target - 33% Circuit Capacity	29.44°C (85°F)	29.44 to 40.56°C (85 to 105°F)
Fan Stage Up Deadband 1	11.11°C (20°F)	11.11 to 13.89°C (20 to 25°F)
Fan Stage Up Deadband 2	8.33°C (15°F)	8.33 to 11.11°C (15 to 20°F)
Fan Stage Up Deadband 3	5.56°C (10°F)	5.56 to 8.33°C (10 to 15°F)
Fan Stage Up Deadband 4	5.56°C (10°F)	5.56 to 8.33°C (10 to 15°F)
Fan Stage Down Deadband 4	5.56°C (10°F)	3.33 to 5.56°C (6 to 10°F)
Fan Stage Down Deadband 3	5.56°C (10°F)	3.33 to 5.56°C (6 to 10°F)
Fan Stage Down Deadband 2	8.33°C (15°F)	8.33 to 11.11°C (15 to 20°F)
Fan Stage Down Deadband 1	8.33°C (15°F)	8.33 to 11.11°C (15 to 20°F)

**Table 51: Configuration Group 3**

Description	Default	Range
Condenser Target - 100% Circuit Capacity	40.56°C (105°F)	40.56 to 46.11°C (105 to 115°F)
Condenser Target - 50% Circuit Capacity, 75% Unit Capacity	40.56°C (105°F)	37.78 to 43.33°C (100 to 110°F)
Condenser Target - 50% Circuit Capacity, 50% Unit Capacity	32.22°C (90°F)	31.11 to 36.67°C (88 to 98°F)
Condenser Target - 50% Circuit Capacity, 25% Unit Capacity	26.67°C (80°F)	23.89 to 29.44°C (75 to 85°F)
Fan Stage Up Deadband 1	5.56°C (10°F)	2.78 to 8.33°C (5 to 15°F)
Fan Stage Up Deadband 2	2.78°C (5°F)	2.78 to 5.56°C (5 to 10°F)
Fan Stage Down Deadband 3	2.78°C (5°F)	2.78 to 5.56°C (5 to 10°F)
Fan Stage Down Deadband 2	2.78°C (5°F)	2.78 to 5.56°C (5 to 10°F)
Fan Stage Down Deadband 1	5.56°C (10°F)	5.56 to 8.33°C (10 to 15°F)

**Table 52: Configuration Group 4**

Description	Default	Range
Condenser Target - 100% Circuit Capacity	37.78°C(100 °F)	35 to 46.11°C (95 to 115°F)
Condenser Target - 67% Circuit Capacity	37.78°C(100 °F)	35 to 40.56°C (95 to 105°F)
Condenser Target - 33% Circuit Capacity	26.67°C (80°F)	23.89 to 29.44°C (75 to 85°F)
Fan Stage Up Deadband 1	5.56°C (10°F)	2.78 to 8.33°C (5 to 15°F)
Fan Stage Up Deadband 2	2.78°C (5°F)	2.78 to 5.56°C (5 to 10°F)
Fan Stage Up Deadband 3	2.78°C (5°F)	2.78 to 5.56°C (5 to 10°F)
Fan Stage Down Deadband 4	2.78°C (5°F)	2.78 to 5.56°C (5 to 10°F)
Fan Stage Down Deadband 3	2.78°C (5°F)	2.78 to 5.56°C (5 to 10°F)
Fan Stage Down Deadband 2	2.78°C (5°F)	2.78 to 5.56°C (5 to 10°F)
Fan Stage Down Deadband 1	2.78°C (5°F)	2.78 to 5.56°C (5 to 10°F)

## Security

All set points are protected using passwords. A four-digit password provides operator access to changeable parameters. Service level passwords are reserved for authorized service personnel. See [Passwords on page 96](#) for various levels of access.

### Entering Passwords

Passwords are entered on the first screen on the unit controller.

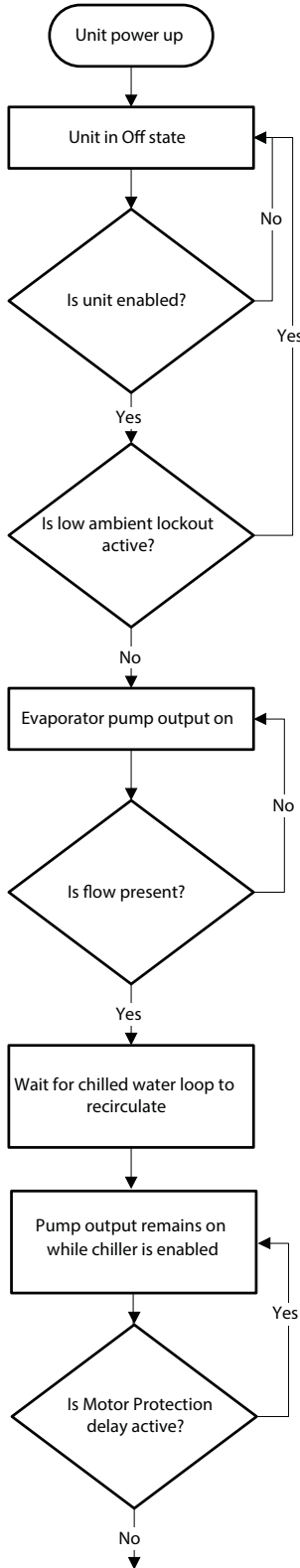
If the wrong password is entered, a message will temporarily appear stating this. If no valid password is active the active password level displays “none.”

### Editing Setpoints

After a valid password has been entered at the unit controller, set points may be changed. If the operator attempts to edit a set point for which the necessary password level is not active, no action will be taken.

Once a password has been entered, it remains valid for 10 minutes after the last key-press on the unit controller.

Figure 57: Unit Sequence of Operation - Cool Mode



The chiller may be disabled via the unit switch, the remote switch, the keypad enable setting, or the BAS network. In addition, the chiller will be disabled if all circuits are disabled, or if there is a unit alarm. If the chiller is disabled, the unit status display will reflect this and also show why it is disabled.

If the unit switch is off, the unit status will be **Off:Unit Switch**. If the chiller is disabled due to network command, the unit status will be **Off:BAS Disable**. When the remote switch is open, the unit status will be **Off:Remote Switch**. When a unit alarm is active, the unit status will be **Off:Unit Alarm**. In cases where no circuits are enabled, the unit status will be **Off:All Cir Disabled**. If the unit is disabled via the Chiller Enable set point, the unit status will be **Off:Keypad Disable**.

Low ambient lockout will prevent the chiller from starting even if it is otherwise enabled. When this lockout is disabling the chiller, the unit status will be **Off:Low OAT Lock**.

If the chiller is enabled, then the unit will be in the Auto state and the evaporator water pump output will be activated.

The chiller will then wait for the flow switch to close, during which time the unit status will be **Auto:Wait for flow**.

After establishing flow, the chiller will wait some time to allow the chilled water loop to recirculate for an accurate reading of the leaving water temperature. The unit status during this time is **Auto:Evap Recirculate**.

If the chiller is waiting on the motor protection delay after powering up, the unit status will be **Off: Motor Protection Delay**.

Figure 58: Unit Sequence of Operation - Cool Mode (continue)

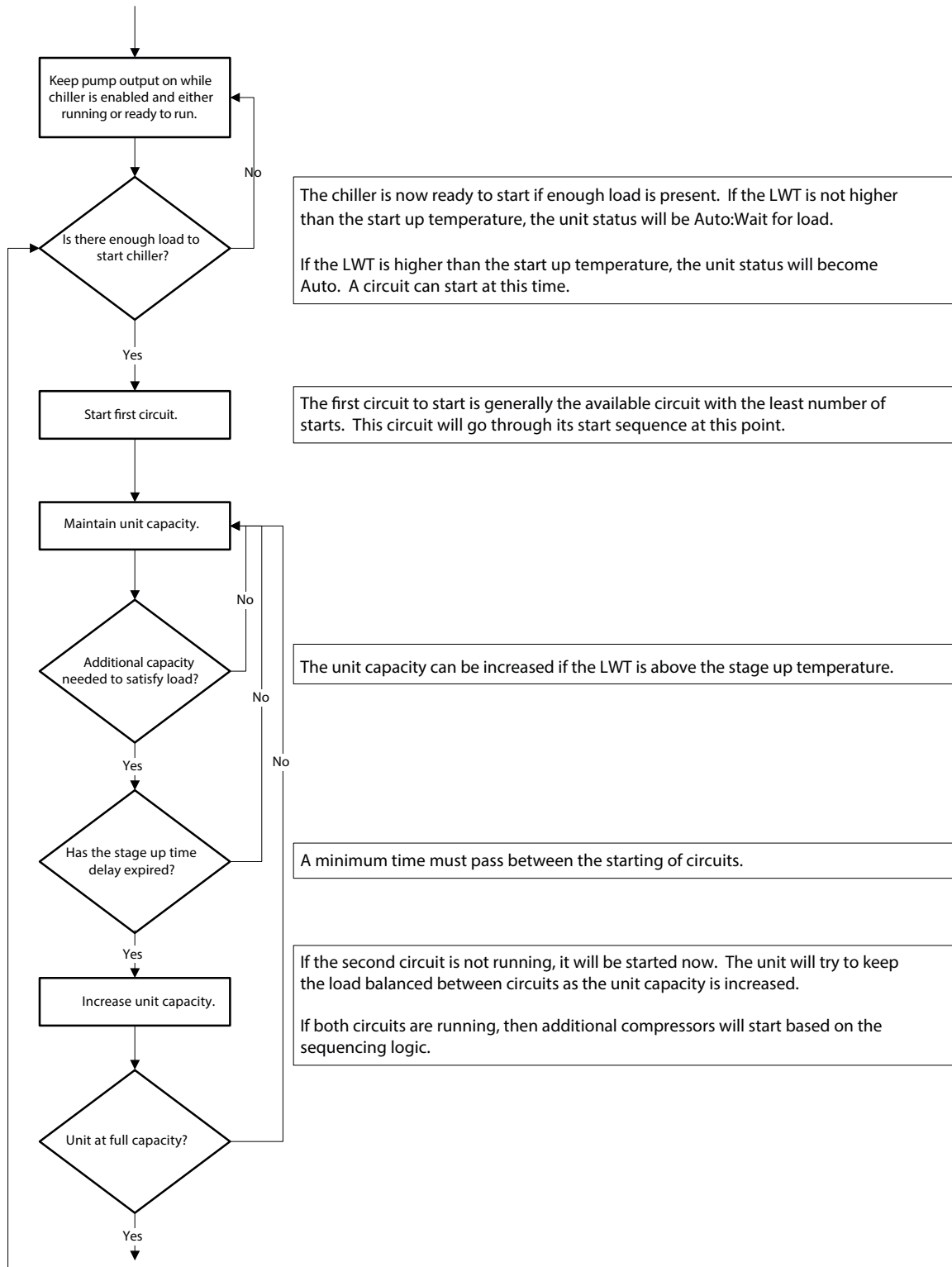




Figure 59: Unit Sequence of Operation - Cool Mode (continued)

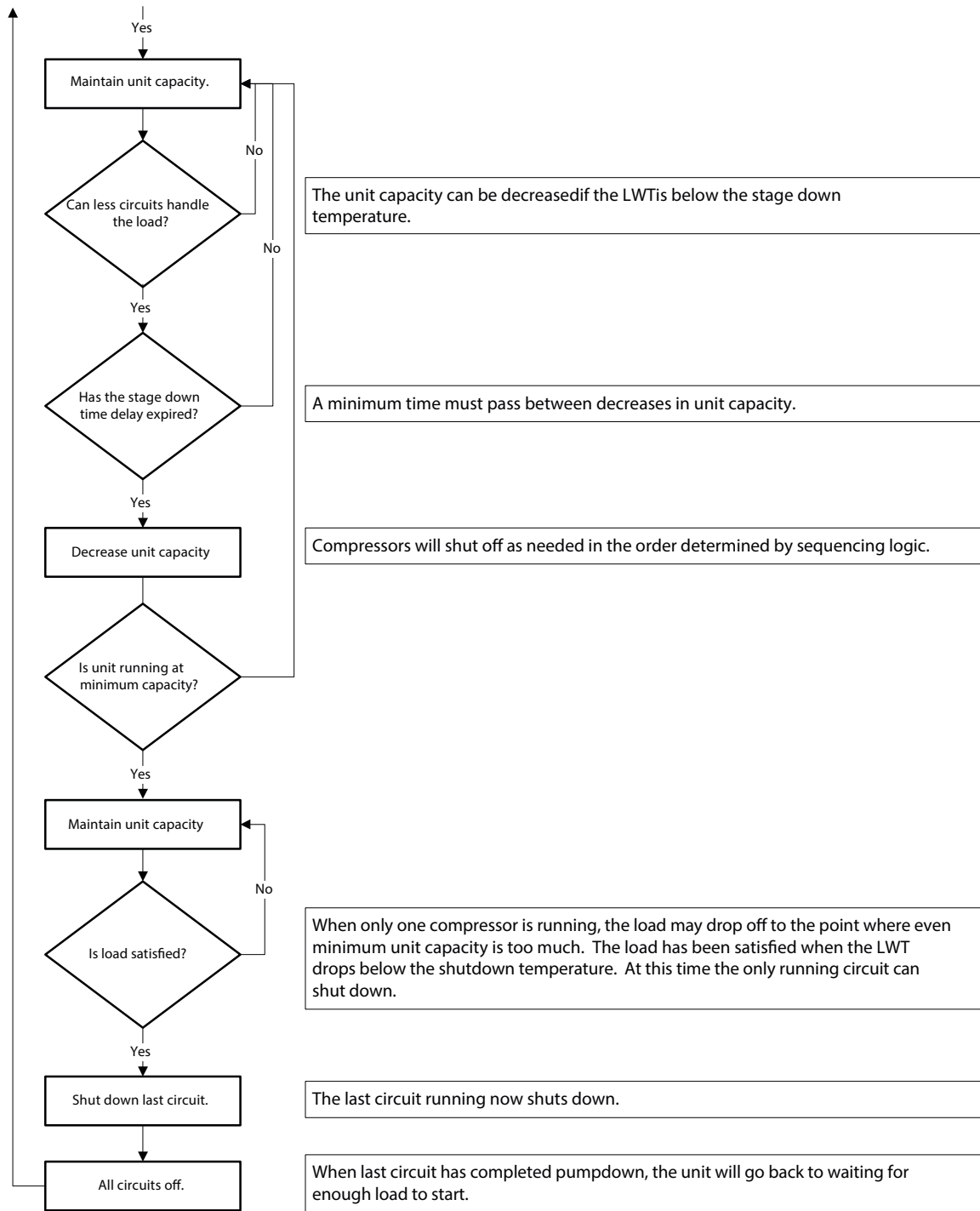
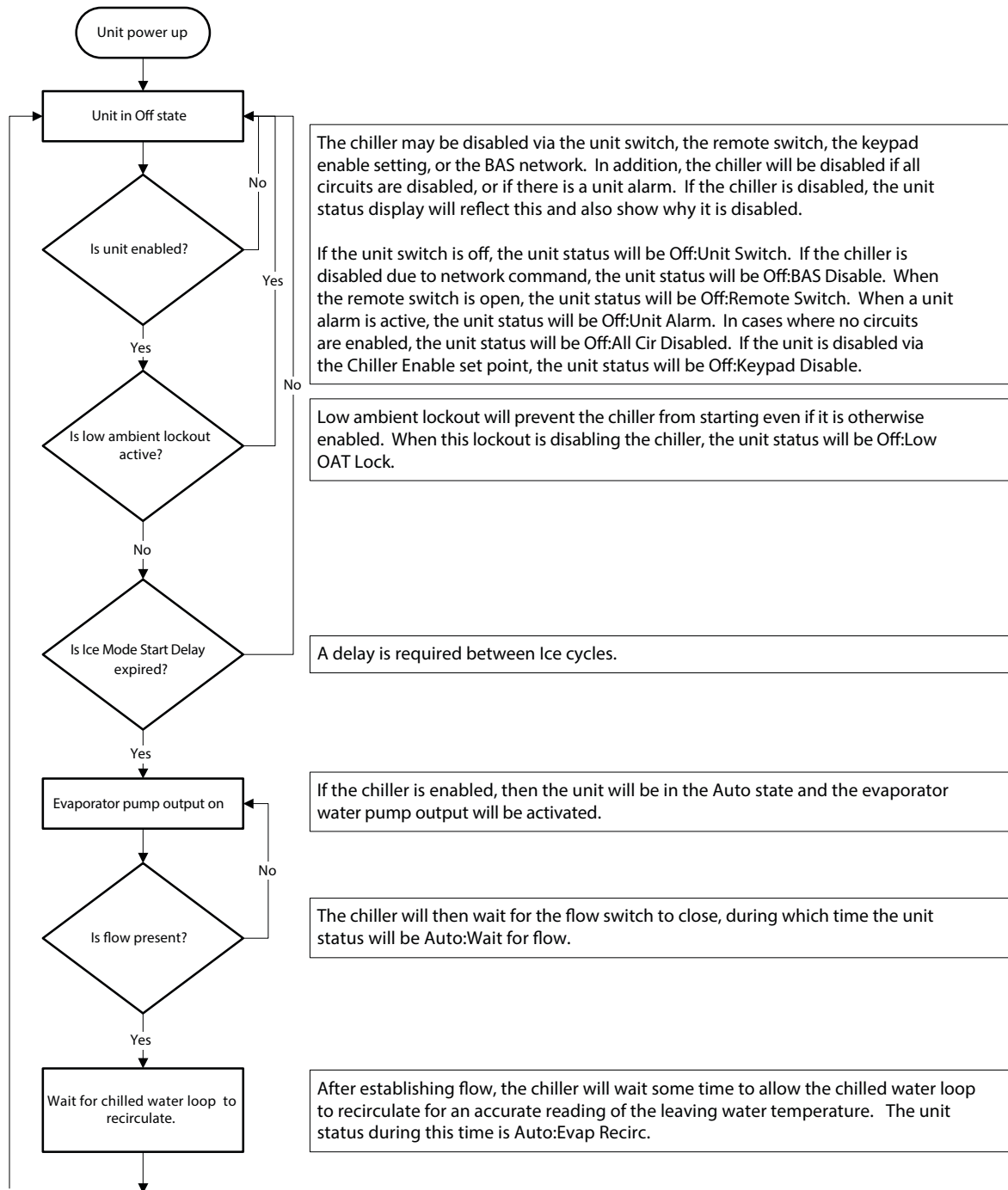


Figure 60: Unit Sequence of Operation - Ice Mode



The chiller may be disabled via the unit switch, the remote switch, the keypad enable setting, or the BAS network. In addition, the chiller will be disabled if all circuits are disabled, or if there is a unit alarm. If the chiller is disabled, the unit status display will reflect this and also show why it is disabled.

If the unit switch is off, the unit status will be Off:Unit Switch. If the chiller is disabled due to network command, the unit status will be Off:BAS Disable. When the remote switch is open, the unit status will be Off:Remote Switch. When a unit alarm is active, the unit status will be Off:Unit Alarm. In cases where no circuits are enabled, the unit status will be Off:All Cir Disabled. If the unit is disabled via the Chiller Enable set point, the unit status will be Off:Keypad Disable.

Low ambient lockout will prevent the chiller from starting even if it is otherwise enabled. When this lockout is disabling the chiller, the unit status will be Off:Low OAT Lock.

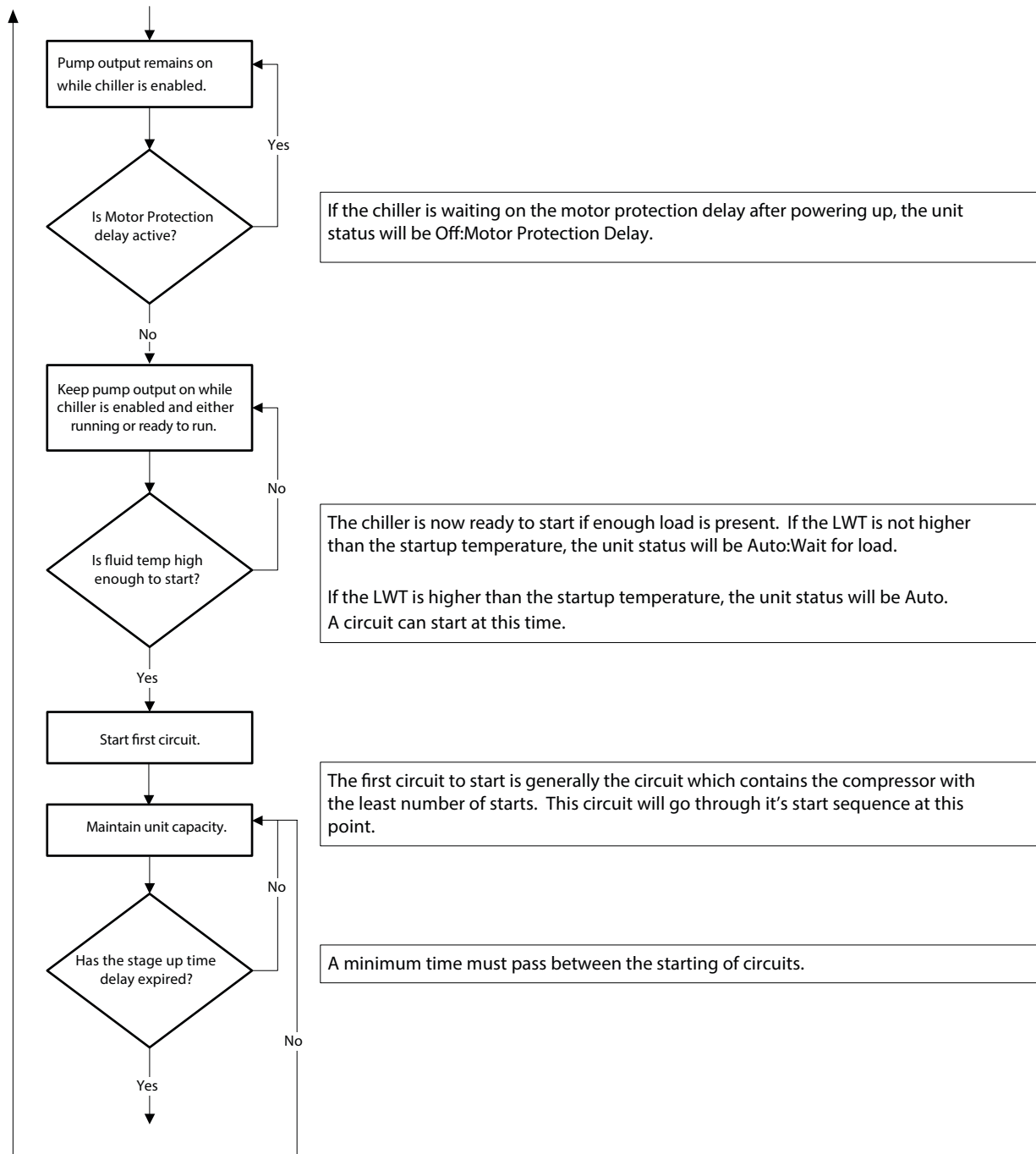
A delay is required between Ice cycles.

If the chiller is enabled, then the unit will be in the Auto state and the evaporator water pump output will be activated.

The chiller will then wait for the flow switch to close, during which time the unit status will be Auto:Wait for flow.

After establishing flow, the chiller will wait some time to allow the chilled water loop to recirculate for an accurate reading of the leaving water temperature. The unit status during this time is Auto:Evap Recirc.

Figure 61: Unit Sequence of Operation - Ice Mode (continued)



**Figure 62: Unit Sequence of Operation - Ice Mode (continued)**

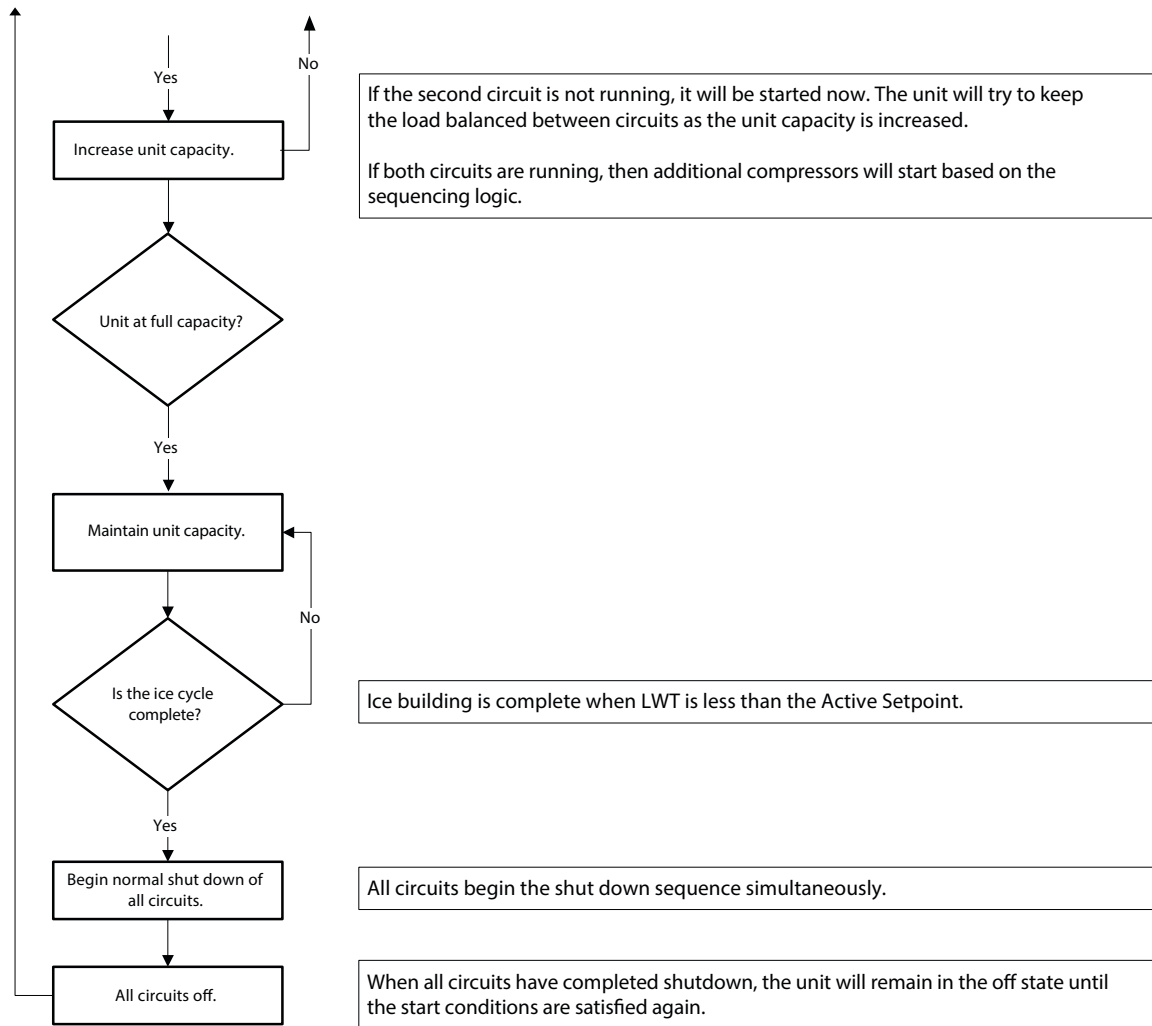
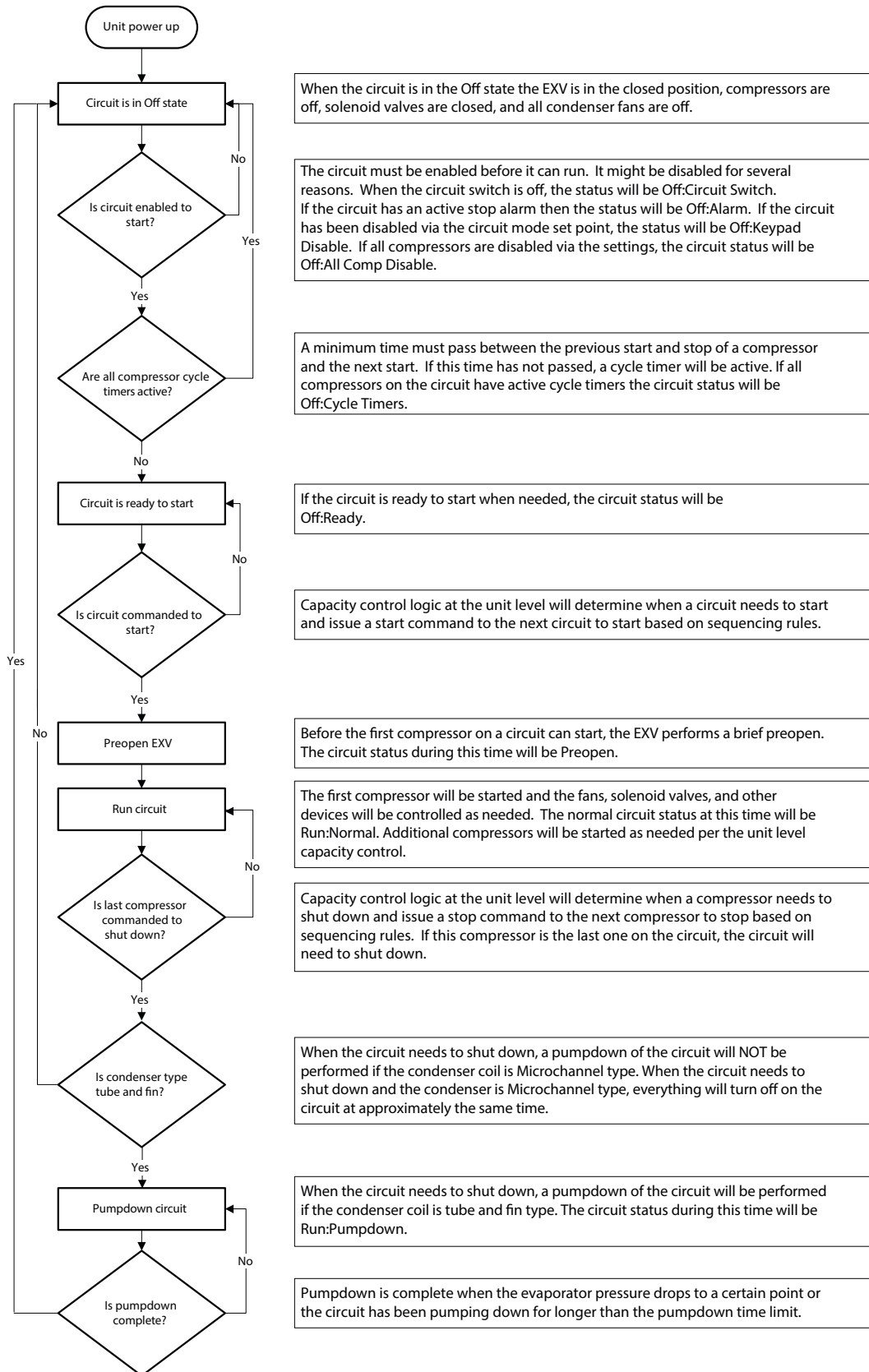


Figure 63: Circuit Sequence of Operation



When the circuit is in the Off state the EXV is in the closed position, compressors are off, solenoid valves are closed, and all condenser fans are off.

The circuit must be enabled before it can run. It might be disabled for several reasons. When the circuit switch is off, the status will be Off:Circuit Switch. If the circuit has an active stop alarm then the status will be Off:Alarm. If the circuit has been disabled via the circuit mode set point, the status will be Off:Keypad Disable. If all compressors are disabled via the settings, the circuit status will be Off:All Comp Disable.

A minimum time must pass between the previous start and stop of a compressor and the next start. If this time has not passed, a cycle timer will be active. If all compressors on the circuit have active cycle timers the circuit status will be Off:Cycle Timers.

If the circuit is ready to start when needed, the circuit status will be Off:Ready.

Capacity control logic at the unit level will determine when a circuit needs to start and issue a start command to the next circuit to start based on sequencing rules.

Before the first compressor on a circuit can start, the EXV performs a brief preopen. The circuit status during this time will be Preopen.

The first compressor will be started and the fans, solenoid valves, and other devices will be controlled as needed. The normal circuit status at this time will be Run:Normal. Additional compressors will be started as needed per the unit level capacity control.

Capacity control logic at the unit level will determine when a compressor needs to shut down and issue a stop command to the next compressor to stop based on sequencing rules. If this compressor is the last one on the circuit, the circuit will need to shut down.

When the circuit needs to shut down, a pumpdown of the circuit will NOT be performed if the condenser coil is Microchannel type. When the circuit needs to shut down and the condenser is Microchannel type, everything will turn off on the circuit at approximately the same time.

When the circuit needs to shut down, a pumpdown of the circuit will be performed if the condenser coil is tube and fin type. The circuit status during this time will be Run:Pumpdown.

Pumpdown is complete when the evaporator pressure drops to a certain point or the circuit has been pumping down for longer than the pumpdown time limit.

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

### Evaporator 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 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:

- Four compressor units: Control Band = Full Capacity Evap Delta T Set Point \* 0.35
- Six compressor units: Control Band = Full Capacity Evap Delta T Set Point \* 0.25

### 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 53: 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
4	100%	62.5%	8.9 °C (16 °F)
	75%	55%	10.1 °C (18.2 °F)
	50%	47.5%	11.7 °C (21.1 °F)
	25%	40%	13.9 °C (25 °F)
6	100%	62.5%	8.9 °C (16 °F)
	83.3%	58%	9.59 °C (17.3 °F)
	66.7%	53.5%	10.39 °C (18.7 °F)
	50%	49%	11.35 °C (20.4 °F)
	33.3%	44.5%	12.49 °C (22.5 °F)
	16.7%	40%	13.9 °C (25 °F)

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

1. Effective Full Capacity Delta T = (Full Capacity Evap Delta T\* 100) /Unit Capacity
2. 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.
3. Effective Full Capacity Delta T with the limit applied is then multiplied by 0.35 for units with four compressors and by 0.25 for units with six compressors. 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)
- Stage Down Temperature = LWT target – (Control Band/2)

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

- Stage Down Temperature = LWT target – (LWT target - 3.9°C)
- Stage Up temperature = LWT target + Control Band – (LWT target – 3.9°C)

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)
- Stage Down Temperature = LWT target – (Control Band/2)

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 is accomplished using set points and inputs to the chiller. The unit switch, remote switch input, and Unit Enable Set Point all 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 building automation system (BAS) Enable set point must be 'on'. The BAS should enable the chiller only when there is a demand for cooling.

Unit is enabled according to the following table:

Unit Switch	Control Source Set Point	Remote Switch Input	Unit Enable Set Point	BAS Enable Set Point	Unit Enable
Off					Off
			Off		Off
		Off			Off
On	Local	On	On		On
	Network			Off	Off
On	Network	On	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 54: 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

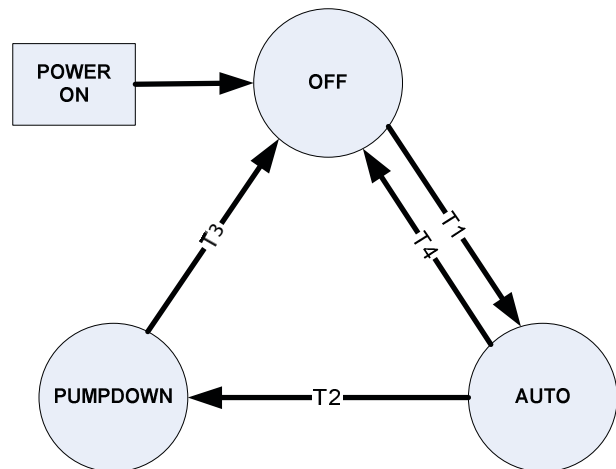
The unit will always be in one of three states:

Off – Unit is not enabled to run

Auto – Unit is enabled to run

Pumpdown – Packaged units with microchannel coils will not do a pumpdown; however, the pumpdown state will exist for units with microchannel coils and remote evaporator. So if the conditions for the Auto to Pumpdown transition occur, the unit state will transition from Auto to Pumpdown and then immediately to Off.

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
- A circuit is enabled to start
- If Unit Mode = Ice then Ice Delay not active
- Low Ambient Lockout is not active
- Unit configuration settings are valid

### **T2 - Auto to Pumpdown**

Any of the following are required:

- Unit Enable = Off and Unit Switch is closed
- Unit Mode = Ice AND LWT target is reached
- Unit Pumpdown Alarm active
- Low Ambient Lockout is active

### **T3 - Pumpdown to Off**

Any of the following are required:

- Unit rapid stop alarm active
- All circuits complete pumpdown
- Unit Switch open

### **T4 - Auto to Off**

Any of the following are required:

- Unit rapid stop alarm active
- No circuit enabled and no compressors running
- Unit Switch open

## **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. During RapidRestore® operation following power loss and restore, the delay will be 110 seconds after the controller boots up.

## **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**

The operation of the chiller in response to OAT dropping below

the Low OAT Lockout set point is configurable if the chiller has condenser fan VFD's. In that case, there are three options:

- Lockout and Stop – chiller will shut down and lockout
- Lockout only – chiller does not shut down running circuits, will lock out circuits that are off
- Disabled – chiller does not shut down or lock out

For chillers without condenser fan VFD's, there is no configuration and the chiller will always operate according to the first option shown above. Descriptions of the operation for each option are in the following sections.

## **Lockout and Stop Operation**

When the chiller is configured for lockout and stop, it will operate as described in this section.

If 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 circuits are running. If no circuits are running the unit should go into the off state. This condition should clear when OAT rises to the lockout set point plus 2.5°C (4.5°F).

## **Lockout Only Operation**

When the chiller is configured for lockout only, it will operate as described in this section.

If OAT drops below the low ambient lockout set point and any circuits are running, then those circuits will be allowed to remain running and the unit will not enter the low ambient lockout condition. Circuits that are not running will enter a circuit level lockout condition when OAT drops below the lockout set point. This condition will clear at the circuit level when OAT rises to the lockout set point plus 2.5°C (4.5°F).

If the OAT is below the low ambient lockout set point, the OAT sensor fault is not active, and neither circuit is running, low ambient lockout is triggered. The unit will go directly into the off state and will remain in the off state until the lockout has cleared. This condition will clear when OAT rises to the lockout set point plus 2.5°C (4.5°F).

## **Disabled Operation**

When the chiller is configured to disable low ambient lockout, it will operate as described in this section. Regardless of the OAT, the unit will not enter the low ambient lockout condition or shut down any running circuits.

## **BAS Annunciation**

Low Ambient Lockout is not an alarm, but it can be annunciated to the BAS as if it is one. When the Low OAT Lockout BAS Alert set point is set to On and the low ambient lockout is active, the following will occur:

- Chiller alarm status parameter will show alarm state
- Active Problem Alarm Code will be set to 16642 (assuming no higher code is active)
- Active Problem Alarm Index will be set to 65 (assuming no higher index is active)



## 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: Sound Reduction	Unit State = Auto and Sound Reduction is active
3	Off: 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 Cir Disabled	Unit State = Off and both circuits 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
16	Auto: Pumpdown	Unit State = Pumpdown
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
19	Auto: High Amb Limit	Unit State = Auto and high ambient capacity limit is active
20	Auto:RapidRestore	Unit State = Auto and unit is performing RapidRestore operation
21	Off:Cond Type Not Set	Condenser type setting is set to 'Not Set'
22	Off:ExVlv Type Not Set	Expansion valve type setting is set to 'Not Set'
23	Off:Invalid Config	Unit model selected not valid
24	Cfg Chg, Rst Ctlr	A configuration change requiring a reboot occurred but controller has not been rebooted yet.

## Evaporator Pump Control

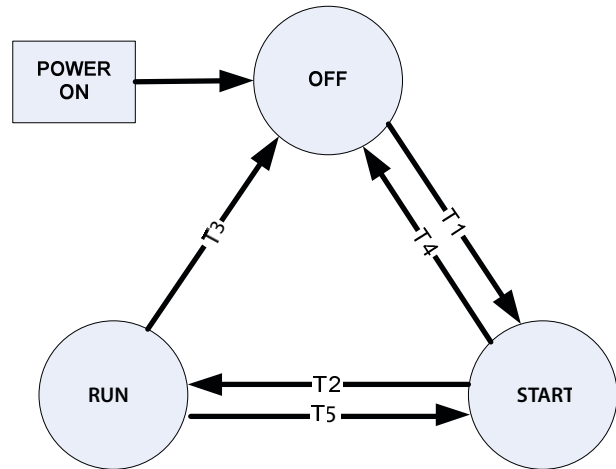
For control of the evaporator pumps, three evaporator pump control states should be used:

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

Flow switch input is low for longer than the flow proof set point.

## 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 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.

## 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

## Leaving Water Temperature (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 18.33°C (65°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

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

Additional compressors can be started when Evaporator LWT is higher than the Stage Up Temperature and the Stage Up Delay is not active.

When multiple compressors are running, one should shut down if evaporator LWT is lower than the Stage Down Temperature and the Stage Down Delay is not active.

All running compressors should shut down when the 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. This delay should not apply when the LWT drops below the Shut Down Temperature (unit should immediately shut down).

### Compressor Staging in Ice Mode

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

All compressors should be operating except during startup or shut down. Additional compressors should be started as quickly as possible with respect to the Stage Up Delay.

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.

If possible circuits will be balanced in stage. If a circuit is unavailable for any reason, the other circuit shall be allowed to stage all compressors on. When staging down, one

compressor on each circuit shall be left on until each circuit has only one compressor running.

#### 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

If the circuits have an unequal number of compressors running, the next compressor to start will be on the circuit with the least compressors running if it has at least one compressor available to start. Within that circuit:

- 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

If the circuits have an unequal number of compressors running, the next compressor to stop will be on the circuit with the most compressors running. Within that circuit:

- 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 tables:

**Table 55: Stage Limits - Four Compressors**

Demand Limit Signal (%)	Demand Limit Range (mA)	Stage
Limit ≥ 75%	Limit ≥ 16 mA	1
75% > Limit ≥ 50%	16 mA > Limit ≥ 12 mA	2
50% > Limit ≥ 25%	12 mA > Limit ≥ 8 mA	3
25% > Limit	8 mA > Limit	4

**Table 56: Stage Limits - Six Compressors**

Demand Limit Signal (%)	Demand Limit Range (mA)	Stage
Limit ≥ 83.3%	Limit ≥ 17.3 mA	1
83.3% > Limit ≥ 66.7%	17.3 mA > Limit ≥ 14.7 mA	2
66.7% > Limit ≥ 50%	14.7 mA > Limit ≥ 12 mA	3
50% > Limit ≥ 33.3%	12 mA > Limit ≥ 9.3 mA	4
33.3% > Limit ≥ 16.7%	9.3 mA > Limit ≥ 6.7 mA	5
16.7% > Limit	6.7 mA > Limit	6

## 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 tables:

**Table 57: Stage Limits - Four Compressors**

Network Limit	Stage
Limit ≥ 100%	4
100% > Limit ≥ 75%	3
75% > Limit ≥ 50%	2
50% > Limit	1

**Table 58: Stage Limits - Six Compressors**

Network Limit	Stage
Limit ≥ 100%	6
100% > Limit ≥ 83.3%	5
83.3% > Limit ≥ 66.7%	4
66.7% > Limit ≥ 50%	3
50% > Limit ≥ 33.3%	2
33.3% > Limit	1

## Maximum LWT Pulldown Rate

The maximum drop rate for the leaving water temperature shall be limited by the Maximum Pulldown Rate set point only when the unit mode is Cool or Cool with Glycol.

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.

## High Ambient Limit

On units configured with single point power connections, the maximum load amps could be exceeded at high ambient temperatures. If the power connection is single point, and the outdoor air temperature OAT is greater than 46.6°C (115.9°F), the high ambient limit becomes active. This limit will be removed when the OAT drops back down to 45.56°C (114°F). The max operating ambient temperature is 51.6°C (125°F).

When the limit is active, the unit is allowed to run all but one compressor. So it will inhibit the unit from loading if all but one compressor is on, and it will shut down a compressor if all compressors are running.

## RapidRestore® Option

RapidRestore® is an option that can be added to Trailblazer™ chillers. The general purpose of the option is to allow the capability to restart more quickly and to load faster than normal operation.

## Enabling

The RapidRestore® option is be enabled via the RapidRestore® set point on the Unit Configuration screen and requires the optional module. Doing so will require the following to be true:

- RapidRestore® module is present at address 22
- DI1 on the RapidRestore® module has a signal

If the DI1 input loses the signal or the RapidRestore® module is no longer communicating, then the option will be disabled in the chiller.

When the RapidRestore Enable input is on, RapidRestore® is enabled. When the Backup Chiller input is on, the Backup Chiller portion of the operation is enabled.

## Operation Following Power Cycle

The chiller will enter RapidRestore® upon powering up when the following conditions are met:

- RapidRestore® is enabled
- Power failure lasts less than the value of the Max Power Failure Time set point
- Power failure lasts at least one second (shorter power loss may result in unpredictable operation)
- Unit is enabled
- LWT ≥ Stage Up Temperature

When RapidRestore® is triggered, the time value used for the

evaporator recirculation time will be limited to 110 seconds or less. The evaporator recirculation time set point will not be changed. Only the value used in the evaporator state logic will be limited, and only if the set point exceeds the 110 second limit. This action will ensure that the chiller is ready to start after the motor protection module delay has expired.

RapidRestore® will end if the unit reaches full capacity, all circuits or unit become disabled for any reason, 10 minutes have passed since unit powered up, or LWT is less than Stage Up Temperature.

### Motor Protection Start Delay

The compressor manufacturer requires a minimum two minute delay after power on until a compressor should be started, which is to ensure proper operation of the motor protection modules. Unit controller boot time is about 10 seconds, so a delay of 110 seconds will start upon completing boot up. After this delay, the two minute manufacturer requirement will be satisfied.

After the 110 second delay, the first circuit to start will enter the preopen state, which takes five seconds. The end result is that the first compressor should start approximately 125 seconds after power is restored to the chiller.

A longer delay for motor protection modules will still be used for normal starts.

### Fast Loading

Fast loading will be performed while RapidRestore® is active.

### Capacity Changes

Normally the delay between compressors staging on is determined by the Stage Up Delay setting. That setting defaults to 240 seconds and has a range of 120 to 480 seconds. During fast loading, a delay of 60 seconds between compressor starts within a circuit should be used. In addition, a delay of 30 seconds between compressor starts on different circuits should be used.

This change during RapidRestore® operation will allow for a faster time to full capacity while maintaining stable operation within each circuit. Assuming both circuits are able to run, the effective unit stage up delay will be 30 to 35 seconds, so it will load about four times faster during RapidRestore® than the fastest it possibly can during normal operation.

### Max Pulldown Rate

Max pulldown rate will be ignored during fast loading so the chiller can reach full capacity as soon as possible.

### Backup Chiller Operation

If the Backup Chiller input (DI2) on the RapidRestore® module has a signal and the unit has RapidRestore® enabled, then the chiller is considered a 'backup chiller'. When a 'backup chiller' is enabled, it will use an evaporator recirculation time of 13 seconds regardless of what the evaporator recirculation time set point is. Then, fast loading will be used as outlined previously.

This backup chiller sequence is safe for the unit if it has had power applied for the minimum time stated in the operation manual. Since this sequence does not have to wait on the compressor motor protection module delay, the unit can achieve full capacity even faster than during a power loss scenario.

### Compressor Starts Per Hour

Since the compressor cycle timers are not maintained through power cycling, a limitation on the number of starts per hour will be added. Each compressor will be allowed six starts in an hour.

If a compressor start is being delayed due to this limitation, it can be cleared by using the existing Clear Cycle Timers setting.

The following table shows the approximate best case scenario for start time and loading time with the RapidRestore® operation.

**Table 59: RapidRestore® Mode Response Times**

# of compressors		Maximum Restart Time	Time to Fully Loaded
Power lost and restored	4	125 sec.	220 sec.
	6		280 sec.
Backup chiller with constant power	4	20 sec.	115 sec.
	6		175 sec.

### Sound Reduction

A special mode of operation is available for E vintage models with two fan VFD's per circuit, which reduces sound levels by limiting condenser fan speeds. This mode can be enabled and disabled via the Sound Reduction Enable setting.

### Scheduling

When enabled, sound reduction will become active based on a daily schedule. This schedule is configurable and allows a start time and duration to be selected for each day of the week. Start times can be set in one hour increments and duration can be set in hour increments.

Sound reduction will be active if the controller time is within the time block determined by the settings for the current day.

### Operation When Active

When sound reduction is active, the condenser fans will be limited to the speed selected by the fan speed limit set point.

If the Sound Reduction priority is set to 'sound', the fan speed limit is applied at all times regardless of operating conditions. If conditions are such that condenser pressure is elevated a high pressure stage down may occur, which would effectively lower

the pressure into a safe zone but capacity of the chiller would be limited.

If priority is set to 'capacity', the fan speed is allowed to exceed the limit as needed to avoid high condenser pressure stage downs, which allows the chiller to maintain a higher operating capacity.

## Heat Recovery Option

Chillers may be fitted with a Heat Recovery option. In order to utilize this option, the Heat Recovery Control Type on the Unit Configuration screen must be set to a value other than 'None'. Selecting one of the other values will enable the Heat Recovery logic and the associated parameters on the HMI.

## Heat Recovery States

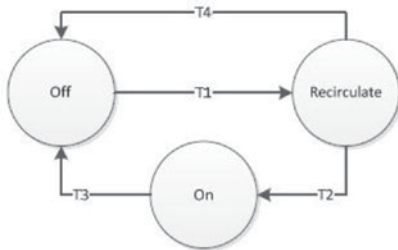
Heat Recovery operation will be controlled by a state machine with three states:

Off - Heat Recovery is completely inactive

Recirculate – Transition to Heat Recovery occurs

On – Heat Recovery is fully active

Transitions between these states are shown in the following diagram.



### T1 – Off to Recirculate

ALL of the following are required:

- Control Type set point ≠ 'none'
- HR Request input = on
- OAT > Min OAT
- Active Evaporator LWT target ≥ 4.44°C (40°F)
- At least one circuit running, sat cond temp has reached cond target, and ran for 2 more minutes
- At least two compressors running on the unit
- Heat Recovery EWT sensor fault not active
- Heat Recovery LWT sensor fault not active
- Time > Retry Time set point has passed since T3 or T4 last occurred

### T2 – Recirculate to On

ALL of the following are required:

- State = Recirculate for longer than Recirc Time set point
- Heat Recovery LWT > Cond Sat Temp + Control Offset set point on all running circuits

- 15.56°C ≤ Heat Recovery EWT ≤ 60°C
- Heat Recovery LWT ≥ Heat Recovery EWT + 1.11°C (2°F)
- At least two compressors running on the unit

### T3 – On to Off

ANY of the following are required:

- Heat Recovery Request input = off
- OAT < Min OAT for 3 minutes
- Active Evap LWT target < 4.44°C
- Heat Recovery EWT < 15.56°C or Heat Recovery EWT > 60°C
- Heat Recovery LWT ≤ Cond Sat Temp + 1.11°C on any running circuit
- Heat Recovery EWT sensor fault active
- Heat Recovery LWT sensor fault active
- Less than two compressors running on unit
- Heat Recovery LWT < Heat Recovery EWT + 1.11°C (2°F)

### T4 – Recirculate to Off

ANY of the following are required:

- Heat Recovery Request input = off
- OAT < Min OAT for 3 minutes
- Active Evap LWT target < 4.44°C
- Heat Recovery EWT sensor fault active
- Heat Recovery LWT sensor fault active
- Less than two compressors running on unit
- State = Recirculate for longer than Recirc Time set point AND any of the following:
  - Heat Recovery LWT ≤ Cond Sat Temp + Control Offset set point on any running circuit
  - Heat Recovery EWT < 15.56°C
  - Heat Recovery EWT > 60°C
  - Heat Recovery LWT < Heat Recovery EWT + 1.11°C (2°F)

Some notes about the transition conditions:

1. 2 compressors running is required as a quick way to make sure there is sufficient heat available to be claimed
2. Heat recovery EWT is expected to be in a certain range to help avoid causing operational issues with the refrigerant circuits
3. Heat recovery LWT is expected to be a minimum amount above the condenser saturated temperatures to avoid condensing refrigerant in the heat exchanger
4. Heat recovery LWT is expected to be a minimum amount above EWT to guarantee that heat is being transferred into the loop rather than out of the loop into the condenser
5. Minimum OAT is observed to help make sure there is enough heat available to heat recovery in combination with the effect of cooler OAT removing heat

6. Evaporator LWT target must be at least 4.44°C because below that the discharge temperatures are not adequate to support heat recovery operation

## Heat Recovery Operation Per State

When State = Off

- Heat Recovery Pump is off
- Heat Recovery Position/Speed signal is 0%
- Circuits use normal condenser targets

When State = Recirculate

- Heat Recovery Pump is on
- Heat Recovery Position/Speed signal is at the minimum position/speed as defined by the settings
- Circuits transition to heat recovery condenser targets

When State = On

- Heat Recovery Pump is on
- Heat Recovery Position/Speed signal is determined by PID loop
- Circuits continue to use heat recovery condenser targets

## PID Loop

A PID loop will be used for controlling valve position or pump speed. This loop should allow for a smooth transition from Recirculate to On control states, meaning that when output control is handed off to the PID there isn't a sudden large change in the position/speed from the minimum value used during Recirculate state.

In addition, there should be a smooth transition between auto and manual control modes. When changing between these modes, there should not be a sudden large change in position/speed.

The controlled parameter for the PID is a calculated value:

- Heat Recovery LWT – [maximum condenser saturated temperature of running circuits] The set point for the PID is the Heat Recovery Control Offset set point.

## Calculations By Controller

### Refrigerant Saturated Temperature

Refrigerant saturated temperature shall be calculated from the pressure sensor readings for each circuit.

### 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:

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

### Pumpdown Pressure

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

$$\text{Pumpdown pressure} = \text{Low Evap Pressure Unload set point} - 103\text{KPA (15 PSI)}$$

## Circuit Control Logic

### Circuit Enabling

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

- Circuit switch is closed
- No circuit alarms are active
- Circuit Mode set point is set to Enable
- 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:

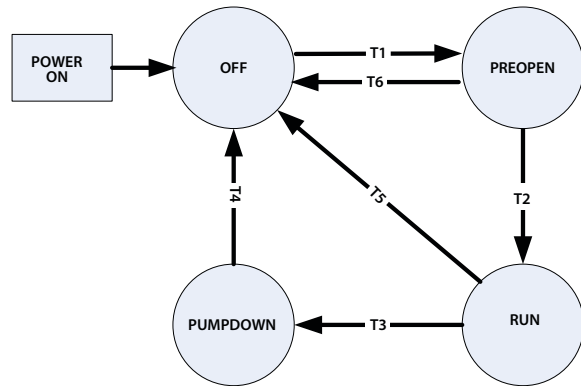
- The corresponding circuit is enabled
- The corresponding circuit is not in pumpdown
- No cycle timers are active for the compressor
- No limit events are active for the corresponding circuit
- The compressor is enabled via the enable setpoints
- The compressor is not already running

## Circuit States

The circuit will always be in one of four states:

- Off – Circuit is not running
- Preopen – Circuit is preparing to start
- Run – Circuit is running
- Pumpdown – Circuit is doing a normal shutdown

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 Pumpdown

Any of the following are required:

- Last compressor on circuit is commanded to stop
- Unit State = Pumpdown
- Circuit switch is open
- Circuit mode is disable
- Circuit Pumpdown alarm is active

### T4 – Pumpdown to Off

Any of the following are required:

- Evaporator Pressure < Pumpdown Pressure Value
- Unit State = Off
- Circuit Rapid Stop alarm is active

### T5 – Run to Off

Any of the following are required:

- Unit State = Off
- Circuit Rapid Stop alarm is active
- A low ambient start attempt failed



**T6 – Preopen to Off**

Any of the following are required:

- Unit State = Off
- Unit State = Pumpdown
- Circuit switch is open
- Circuit mode is disable
- Circuit Rapid Stop alarm is active
- Circuit Pumpdown 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 freezestat 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, OffNbrRestarts 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
1	Off:Ready	Circuit is ready to start when needed.
2	Off:Cycle Timers	Circuit is off and cannot start due to active cycle timer on all compressors.
3	Off:All Comp Disable	Circuit is off and cannot start due to all compressors being disabled.
4	Off:Keypad Disable	Circuit is off and cannot start due to circuit enable set point.
5	Off:Circuit Switch	Circuit is off and circuit switch is off.
6	Off:Alarm	Circuit is off and cannot start due to active circuit alarm.
7	Off:Test Mode	Circuit is in test mode.
8	Preopen	Circuit is in preopen state.
9	Run:Pumpdown	Circuit is in pumpdown state.
10	Run:Normal	Circuit is in run state and running normally.
11	Run:Evap Press Low	Circuit is running and cannot load due to low evaporator pressure.
12	Run:Cond Press High	Circuit is running and cannot load due to high condenser pressure.

**Compressor Control**

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

**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
- Circuit state is pumpdown and 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 controller.

## Condenser Fan Control

Condenser fan control should stage fans as needed any time compressors are running on the circuit. All fans and solenoid valves will be off when the circuit is in the off and preopen states. Condenser fan digital outputs will be turned on or off immediately for condenser stage changes. Condenser solenoid valve outputs will turn on immediately when a stage up requires the output to turn on, but will have a delay for turning off during a stage down. This delay is 20 seconds. If the circuit shuts off then the condenser solenoid valve outputs will turn off without a delay.

## Condenser Staging

Condenser staging will use up to 5 digital outputs for control of condenser fans and a digital output for control of a condenser solenoid valve. When equipped with condenser fan VFDs, the speed signal(s) also starts and stops the fan that is connected to the VFD. The total number of fans on shall be adjusted with changes of one fan at a time. The tables below show the outputs energized for each stage.

Figure 64: 2 Fans per Circuit - Unit Numbering Schematic

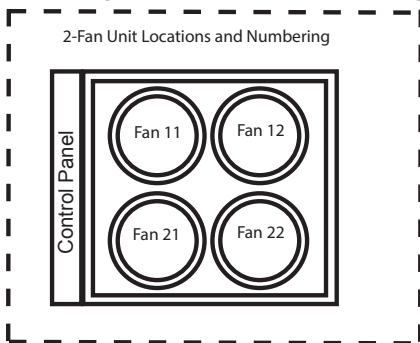


Table 60: 2 Fans per Circuit - Without Fan VFD

Circuit 1								
Description	Output	Fans	Stage					
			1	2	3	4	5	6
Fan Output 1	UC DO3	Fan 11	On	On	--	--	--	--
Fan Output 2	UC DO4	Fan 12		On	--	--	--	--
Circuit 2								
Description	Output	Fans	Stage					
			1	2	3	4	5	6
Fan Output 1	UC DO7	Fan 21	On	On	--	--	--	--
Fan Output 2	UC DO8	Fan 22		On	--	--	--	--

Table 61: 2 Fans per Circuit - With 1 Fan VFD per Circuit

Circuit 1								
Description	Output	Fans	Stage					
			1	2	3	4	5	6
Speed Signal 1	UC X5	Fan 11	On	On	--	--	--	--
Fan Output 2	UC DO4	Fan 12		On	--	--	--	--
Circuit 2								
Description	Output	Fans	Stage					
			1	2	3	4	5	6
Speed Signal 1	UC X6	Fan 21	On	On	--	--	--	--
Fan Output 2	UC DO8	Fan 22		On	--	--	--	--

Figure 65: 3 Fans per Circuit - Unit Numbering Schematic

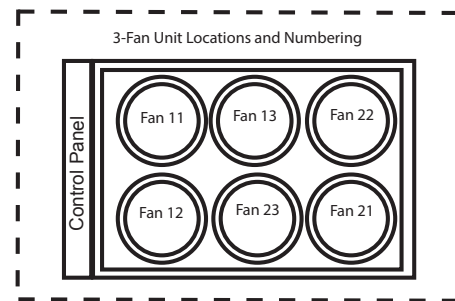


Table 62: 3 Fans per Circuit - Without Fan VFD

Circuit 1								
Description	Output	Fans	Stage					
			1	2	3	4	5	6
Fan Output 1	UC DO3	Fan 11	On	On	On	--	--	--
Fan Output 2	UC DO4	Fan 12		On	On	--	--	--
Fan Output 3	UC DO5	Fan 13			On			
Condenser SV	UC X7	SV 11			On			
Circuit 2								
Description	Output	Fans	Stage					
			1	2	3	4	5	6
Fan Output 1	UC DO7	Fan 21	On	On	On	--	--	--
Fan Output 2	UC DO8	Fan 22		On	On	--	--	--
Fan Output 3	UC DO9	Fan 23			On	--	--	--
Condenser SV	UC X8	SV 21			On	--	--	--

**Table 63: 3 Fans per Circuit - With 1 Fan VFD per Circuit**

Circuit 1								
Description	Output	Fans	Stage					
			1	2	3	4	5	6
Speed Signal 1	UC X5	Fan 11	On	On	On	--	--	--
Fan Output 2	UC DO4	Fan 12		On	On	--	--	--
Fan Output 3	UC DO5	Fan 13			On			
Condenser SV	UC X7	SV 11			On			

Circuit 2								
Description	Output	Fans	Stage					
			1	2	3	4	5	6
Speed Signal 1	UC X6	Fan 21	On	On	On	--	--	--
Fan Output 2	UC DO8	Fan 22		On	On	--	--	--
Fan Output 3	UC DO9	Fan 23			On	--	--	--
Condenser SV	UC X8	SV 21			On	--	--	--

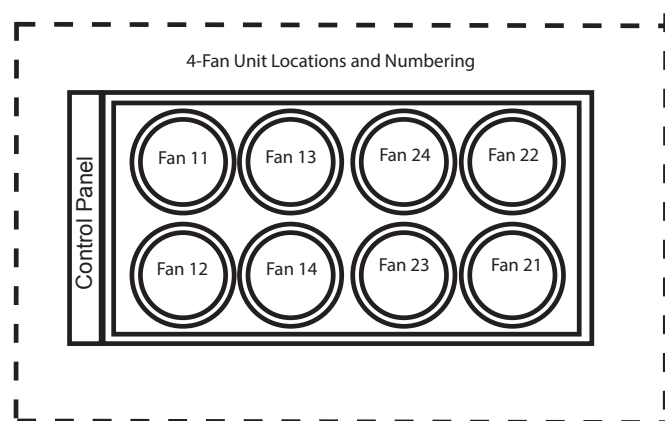
**Table 64: 3 Fans per Circuit - With 2 Fan VFDs per Circuit**

Circuit 1								
Description	Output	Fans	Stage					
			1	2	3	4	5	6
Speed Signal 1	UC X5	Fan 11	On		On	--	--	--
Speed Signal 2	UC X2	Fan 12/13		On	On	--	--	--
Condenser SV	UC X7	SV 11		On	On			

Circuit 2								
Description	Output	Fans	Stage					
			1	2	3	4	5	6
Speed Signal 1	UC X6	Fan 21	On		On	--	--	--
Speed Signal 2	UC X3	Fan 22/23		On	On	--	--	--
Condenser SV	UC X8	SV 21		On	On			--

**Figure 66: 4 Fans per Circuit - Unit Numbering Schematic**



**Table 65: 4 Fans per Circuit - Without Fan VFD**

Circuit 1								
Description	Output	Fans	Stage					
			1	2	3	4	5	6
Fan Output 1	UC DO3	Fan 11	On	On	On	On	--	--
Fan Output 2	UC DO4	Fan 12			On	On	--	--
Fan Output 3	UC DO5	Fan 13		On	On	On	--	--
Fan Output 4	UC DO6	Fan 14				On	--	--
Condenser SV	UC X7	SV 11		On	On	On	--	--

Circuit 2								
Description	Output	Fans	Stage					
			1	2	3	4	5	6
Fan Output 1	UC DO7	Fan 21	On	On	On	On	--	--
Fan Output 2	UC DO8	Fan 22			On	On	--	--
Fan Output 3	UC DO9	Fan 23		On	On	On	--	--
Fan Output 4	UC DO10	Fan 24				On	--	--
Condenser SV	UC X8	SV 21		On	On	On	--	--

**Table 66: 4 Fans per Circuit - With 1 Fan VFD per Circuit**

Circuit 1								
Description	Output	Fans	Stage					
			1	2	3	4	5	6
Speed Signal 1	UC X5	Fan 11/13	On	On	On	On	--	--
Fan Output 2	UC DO4	Fan 12			On	On	--	--
Fan Output 4	UC DO6	Fan 14				On	--	--
Condenser SV	UC X7	SV 11		On	On	On	--	--

Circuit 2								
Description	Output	Fans	Stage					
			1	2	3	4	5	6
Speed Signal 1	UC X6	Fan 21/23	On	On	On	On	--	--
Fan Output 2	UC DO8	Fan 22			On	On	--	--
Fan Output 4	UC DO10	Fan 24				On	--	--
Condenser SV	UC X8	SV 21		On	On	On	--	--

**Table 67: 4 Fans per Circuit - With 2 Fan VFDs per Circuit**

Circuit 1								
Description	Output	Fans	Stage					
			1	2	3	4	5	6
Speed Signal 1	UC X5	Fan 11/13	On	On	On	--	--	--
Speed Signal 2	UC X2	Fan 12/14			On	--	--	--
Condenser SV	UC X7	SV 11		On	On			

Circuit 2								
Description	Output	Fans	Stage					
			1	2	3	4	5	6
Speed Signal 1	UC X6	Fan 21/23	On	On	On	--	--	--
Speed Signal 2	UC X3	Fan 22/24			On	--	--	--
Condenser SV	UC X8	SV 21		On	On			--

Figure 67: 5 Fans per Circuit - Unit Numbering Schematic

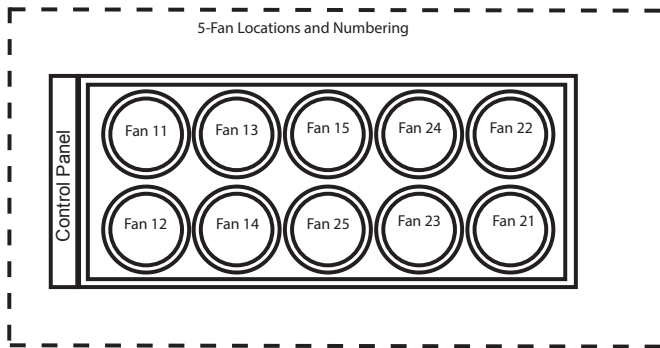


Table 68: 5 Fans per Circuit - Without Fan VFD

Circuit 1								
Description	Output	Fans	Stage					
			1	2	3	4	5	6
Fan Output 1	UC DO3	Fan 11	On	On	On	On	On	--
Fan Output 2	UC DO4	Fan 12			On	On	On	--
Fan Output 3	UC DO5	Fan 13		On	On	On	On	--
Fan Output 4	UC DO6	Fan 14				On	On	--
Fan Output 5	EEXV1 DO1	Fan 15					On	--
Condenser SV	UC X7	SV 11					On	--
Circuit 2								
Description	Output	Fans	Stage					
			1	2	3	4	5	6
Fan Output 1	UC DO7	Fan 21	On	On	On	On	On	--
Fan Output 2	UC DO8	Fan 22			On	On	On	--
Fan Output 3	UC DO9	Fan 23		On	On	On	On	--
Fan Output 4	UC DO10	Fan 24				On	On	--
Fan Output 5	EEXV2 DO1	Fan 25					On	--
Condenser SV	UC X8	SV 21					On	--

Table 69: 5 Fans per Circuit - With 1 Fan VFD per Circuit

Circuit 1								
Description	Output	Fans	Stage					
			1	2	3	4	5	6
Speed Signal 1	UC X5	Fan 11/13	On	On	On	On	--	--
Fan Output 2	UC DO4	Fan 12		On	On	On	--	--
Fan Output 4	UC DO6	Fan 14			On	On	--	--
Fan Output 5	EEXV1 DO1	Fan 15					On	--
Condenser SV	UC X7	SV 11					On	--
Circuit 2								
Description	Output	Fans	Stage					
			1	2	3	4	5	6
Speed Signal 1	UC X6	Fan 21/23	On	On	On	On	--	--
Fan Output 2	UC DO8	Fan 22		On	On	On	--	--
Fan Output 4	UC DO10	Fan 24			On	On	--	--
Fan Output 5	EEXV2 DO1	Fan 25					On	--
Condenser SV	UC X8	SV 21					On	--

Table 70: 5 Fans per Circuit - With 2 Fan VFDs per Circuit

Circuit 1								
Description	Output	Fans	Stage					
			1	2	3	4	5	6
Speed Signal 1	UC X5	Fan 11/13	On	On	On	--	--	--
Speed Signal 2	UC X2	Fan 12/14		On	On	--	--	--
Fan Output 5	EEXV1 DO1	Fan 15			On			
Condenser SV	UC X7	SV 11			On			
Circuit 2								
Description	Output	Fans	Stage					
			1	2	3	4	5	6
Speed Signal 1	UC X6	Fan 21/23	On	On	On	--	--	--
Speed Signal 2	UC X3	Fan 22/24		On	On	--	--	--
Fan Output 5	EEXV2 DO1	Fan 25			On	--	--	--
Condenser SV	UC X8	SV 21			On			--

Figure 68: 6 Fans per Circuit - Unit Numbering Schematic

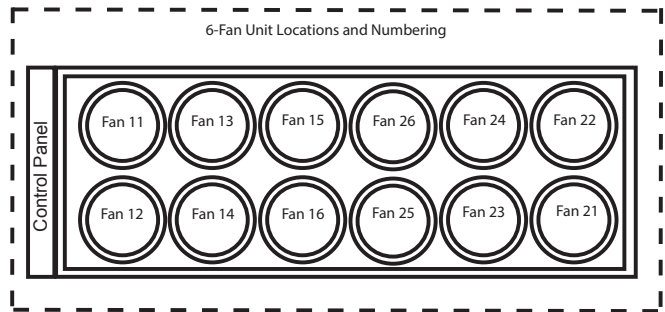


Table 71: 6 Fans per Circuit - Without Fan VFD

Circuit 1								
Description	Output	Fans	Stage					
			1	2	3	4	5	6
Fan Output 1	UC DO3	Fan 11	On	On	On	On	On	On
Fan Output 2	UC DO4	Fan 12				On		On
Fan Output 3	UC DO5	Fan 13		On	On	On	On	On
Fan Output 4	UC DO6	Fan 14/16					On	On
Fan Output 5	EEXV1 DO1	Fan 15			On	On	On	On
Condenser SV	UC X7	SV 11			On	On	On	On
Circuit 2								
Description	Output	Fans	Stage					
			1	2	3	4	5	6
Fan Output 1	UC DO7	Fan 21	On	On	On	On	On	On
Fan Output 2	UC DO8	Fan 22				On		On
Fan Output 3	UC DO9	Fan 23		On	On	On	On	On
Fan Output 4	UC DO10	Fan 24/26					On	On
Fan Output 5	EEXV2 DO1	Fan 25			On	On	On	On
Condenser SV	UC X8	SV 21			On	On	On	On

**Table 72: 6 Fans per Circuit - With 1 Fan VFD per Circuit**

Circuit 1								
Description	Output	Fans	Stage					
			1	2	3	4	5	6
Speed Signal 1	UC X5	Fan 11/13	On	On	On	On	On	--
Fan Output 1	UC DO3	Fan 12			On	On	On	--
Fan Output 2	UC DO4	Fan 14				On	On	--
Fan Output 3	UC DO5	Fan 15		On	On	On	On	--
Fan Output 4	UC DO6	Fan 16					On	--
Condenser SV	UC X7	SV 11		On	On	On	On	--

Circuit 2								
Description	Output	Fans	Stage					
			1	2	3	4	5	6
Speed Signal 1	UC X6	Fan 21/23	On	On	On	On	On	--
Fan Output 1	UC DO7	Fan 22			On	On	On	--
Fan Output 2	UC DO8	Fan 24				On	On	--
Fan Output 3	UC DO9	Fan 25		On	On	On	On	--
Fan Output 4	UC DO10	Fan 26					On	--
Condenser SV	UC X8	SV 21		On	On	On	On	--

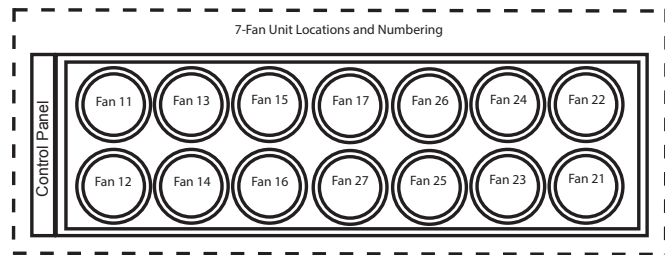
**Table 73: 6 Fans per Circuit - With 2 Fan VFDs per Circuit**

Circuit 1								
Description	Output	Fans	Stage					
			1	2	3	4	5	6
Speed Signal 1	UC X5	Fan 11/13	On		On	--	--	--
Speed Signal 2	UC X2	Fan 12/14/15/16		On	On	--	--	--
Condenser SV	UC X7	SV 11		On	On			

Circuit 2								
Description	Output	Fans	Stage					
			1	2	3	4	5	6
Speed Signal 1	UC X6	Fan 21/23	On		On	--	--	--
Speed Signal 2	UC X3	Fan 22/24/25/26		On	On	--	--	--
Condenser SV	UC X8	SV 21		On	On			--

**Figure 69: 7 Fans per Circuit - Unit Numbering Schematic**



**Table 74: 7 Fans per Circuit - Without Fan VFD**

Circuit 1								
Description	Output	Fans	Stage					
			1	2	3	4	5	6
Fan Output 1	UC DO3	Fan 11/13	On	On	On	On	On	On
Fan Output 2	UC DO4	Fan 12			On		On	On
Fan Output 3	UC DO5	Fan 14/16				On	On	On
Fan Output 4	UC DO6	Fan 15		On	On	On	On	On
Fan Output 5	EEXV1 DO1	Fan 17						On
Condenser SV	UC X7	SV 11						On

Circuit 2								
Description	Output	Fans	Stage					
			1	2	3	4	5	6
Fan Output 1	UC DO7	Fan 21/23	On	On	On	On	On	On
Fan Output 2	UC DO8	Fan 22			On		On	On
Fan Output 3	UC DO9	Fan 24/26				On	On	On
Fan Output 4	UC DO10	Fan 25		On	On	On	On	On
Fan Output 5	EEXV2 DO1	Fan 27						On
Condenser SV	UC X8	SV 21						On

**Table 75: 7 Fans per Circuit - With 1 Fan VFD per Circuit**

Circuit 1								
Description	Output	Fans	Stage					
			1	2	3	4	5	6
Speed Signal 1	UC X5	Fan 11/13	On	On	On	On	On	On
Fan Output 1	UC DO3	Fan 12			On	On	On	On
Fan Output 2	UC DO4	Fan 14				On	On	On
Fan Output 3	UC DO5	Fan 15		On	On	On	On	On
Fan Output 4	UC DO6	Fan 16					On	On
Fan Output 5	EEXV1 DO1	Fan 17						On
Condenser SV	UC X7	SV 11						On

Circuit 2								
Description	Output	Fans	Stage					
			1	2	3	4	5	6
Speed Signal 1	UC X6	Fan 21/23	On	On	On	On	On	On
Fan Output 1	UC DO7	Fan 22			On	On	On	On
Fan Output 2	UC DO8	Fan 24				On	On	On
Fan Output 3	UC DO9	Fan 25		On	On	On	On	On
Fan Output 4	UC DO10	Fan 26					On	On
Fan Output 5	EEXV2 DO1	Fan 27						On
Condenser SV	UC X8	SV 21						On

**Table 76: 7 Fans per Circuit - With 2 Fan VFDs per Circuit**

Circuit 1								
Description	Output	Fans	Stage					
			1	2	3	4	5	6
Speed Signal 1	UC X5	Fan 11/13	On		On	On	--	--
Speed Signal 2	UC X2	Fan 12/14/15/16		On	On	On	--	--
Fan Output 5	EEXV1 DO1	Fan 17				On		
Condenser SV	UC X7	SV 11				On		

Circuit 2								
Description	Output	Fans	Stage					
			1	2	3	4	5	6
Speed Signal 1	UC X6	Fan 21/23	On		On	On	--	--
Speed Signal 2	UC X3	Fan 22/24/25/26		On	On	On	--	--
Fan Output 5	EEXV2 DO1	Fan 27				On		
Condenser SV	UC X8	SV 21				On		--

## Condenser Target

The condenser target is selected based on circuit capacity using the condenser target set points. There are set points that establish the condenser target for 33%, 50%, 67%, and 100% capacity. If the circuit has two compressors the set points for 50% and 100% will be used. If the circuit has three compressors then the set points for 33%, 67%, and 100% will be used.

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 four stage up dead band settings will be used:

- Stage Up Deadband 1 – used when active condenser stage is 1
- Stage Up Deadband 2 – used when active condenser stage is 2
- Stage Up Deadband 3 – used when active condenser stage is 3
- Stage Up Deadband 4 – used when active condenser stage is 4, 5, or 6

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.

## Additional Conditions for Staging Up

If circuit has two compressors, the second compressor on a circuit starts, the circuit is not already at the maximum condenser stage, and the condenser saturated temperature is higher than 37.78°C (100°F), then a condenser stage will be added immediately.

If the condenser stage is not already at the maximum, the saturated condenser temperature exceeds 56.67°C (134°F), it has been at least 5 seconds since adding a condenser stage, and the saturated condenser temperature is not dropping, then a condenser stage will be added immediately.

## Skipping First Stage

There are circumstances where the first condenser stage will be skipped, so condenser stage would go from 0 to 2:

If the circuit has 4 fans, or it has 6 fans and no fan VFD's, then the first condenser stage may be skipped at startup. This happens if the OAT is at least 21.11°C (70°F) when the first condenser stage would normally be started.

If the circuit has two fan VFDs and OAT is at least 10°C (50°F) when the first condenser stage would normally be started.

## Staging Down

Four stage down dead bands shall be used.

- Stage Down Deadband 1 – used when active condenser stage is 1
- Stage Down Deadband 2 – used when active condenser stage is 2
- Stage Down Deadband 3 – used when active condenser stage is 3
- Stage Down Deadband 4 – used when active condenser stage is 4, 5, or 6

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.

## Limiting Last Stage

For AGZ-E models with either 5 or 7 fans per circuit and two fan VFD's per circuit, the last fan stage on those configurations is a fixed speed fan. The last fan stage will be turned off and will not be allowed to activate when noise reduction is active.

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).

## VFD Control

Configurations can include a VFD on the first one or two fans on the circuit, or two VFD's on the circuit with either all fans connected to those VFD's or all except one (leaving one fixed speed fan). The VFD's will vary fan speed to drive the saturated condenser temperature to a target value. The target value is normally the same as the saturated condenser temperature target.

Note that when there are two VFD's per circuit, there are two separate speed signals on each circuit. Staging logic will determine when each speed signal output should be something other than 0vdc (meaning the connected fans should run), but any time both VFD's are to be running the speed signals will be the same (there is no independent speed control on the two

VFD's within a circuit). The speed will normally be controlled between the minimum and maximum speed set points using a PID loop.

The optional VFD fan control is used for unit operation below 32°F (0°C) down to a minimum of -10°F (-23°C). For a discussion of the VFD controller and operation, see "Fan VFD Controller" on page 98.

**VFD State**

The VFD speed signals should always be 0 when the fan stage is 0.

When the condenser fan staging requires the fans connected to a VFD to run, the VFD speed signal should be enabled and control the speed as needed.

**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.

**Sound Reduction Operation**

When Sound Reduction is active, the maximum speed of the VFD's will be limited to the Sound Reduction fan speed limit set point value. When Sound Reduction priority is set to 'sound', the fan speed limit is applied at all times regardless of operating conditions.

When priority is set to 'capacity', the fan speed limit is in effect unless saturated condenser temperature rises to a certain value. That value is the high condenser pressure unload set point converted to saturated temperature, less 5.56° (10°F). Once the condenser saturated temperature starts to exceed that value, the fans will speed up beyond the speed limit as needed to control the saturated temperature to that value.

**High IPLV Mode**

When the High IPLV Mode setting is 'On' and one compressor is running on the unit, the condenser target setting for the running circuit may be overridden. In this case, rather than use the condenser target setting for 33% or 50% (depending on number of compressors), the condenser target will be forced to the value of the IPLV Condenser Target set point.

In addition, when high IPLV mode is active the calculation for the minimum allowed condenser target (based on LWT) will be changed. The minimum value will be changed from 23.9°C (75°F) to the value of the IPLV Condenser Target set point. No other changes to the operation are made when High IPLV mode is on.

**Special Operation During Heat Recovery**

When the Heat Recovery state is either Recirculate or On, the circuit should use the heat recovery settings to determine the condenser target. There are settings for each circuit capacity

which are to be used during this time, so it should select the value from the setting corresponding to the current circuit capacity.

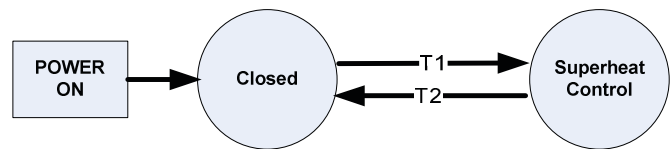
If Heat Recovery Priority = Efficiency, the condenser target settings should be used as is. If Heat Recovery Priority = Heat, then the condenser target should have an additional 5.56°C (10°F) added to the current selected target. In addition, when Heat Recovery state is either Recirculate or On the condenser target should be filtered when the circuit is running. Whenever the target is changing, it should only be allowed to change 0.1°C every two seconds.

**EXV Control Control States**

EXV control will always be in one of two states: Closed or Superheat Control.

Transitions between these states are shown in Figure 70.

**Figure 70: EXV Control Transitions**



**T1 – Closed to Superheat Control**

- Circuit state is preopen

**T2 – Superheat Control to Closed**

- Circuit state is off or pumpdown

**Closed State Operation**

When the EXV is in the Closed state the position command will be 0 and the EXV control state display will show 'Closed'.

**Superheat Control State Operation**

While in superheat control, the EXV controls suction superheat. A PID loop will be used to control the suction superheat to the target value. The EXV response is faster when the SSH is lower than 1.67°C (3°F) or higher than the SSH Target + 1.67°C (3°F). Normally during superheat control the EXV control state display will show 'Superheat'.

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 the lesser position output from the two PID functions. If the EXV position is being limited due to exceeding the maximum evaporator pressure, then the EXV control state display will show 'MaxEvapPr'.

**Superheat Target**

The suction superheat target is selected per the set points depending on what capacity the circuit is running at.

- If the circuit has two compressors and one is running, the value used is the SSH Target at 50% set point. If both compressors are running the SSH Target at 100% set point is used.
- If the circuit has three compressors and one is running, the value used is the SSH Target at 33% set point. If either two or three are running the SSH Target at 66/100% set point is used.

If no compressors are running the target is set to set point used when one compressor is running (applies to EXV preopen).

**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 minimum EXV position while the circuit is running will always be 8%. The maximum position will change as the number of compressors running on the circuit changes. These values are shown for each unit model in [Table 77](#).

**Operation Considerations**

For all units - the expansion valve maximum position may be increased if both the suction superheat is higher than the target and the expansion valve has been within 1% of its current maximum position for a minute. The maximum should increase at a rate of 0.1% every six seconds up to a total of an additional 10%. This addition 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.

**Table 77: Maximum Position Range**

Model	# Compressors Running/Circuit		
	1	2	3
AGZ030E / 031E	50	100	n/a
AGZ035E / 036E	50	100	n/a
AGZ040E / 041E	50	100	n/a
AGZ045E / 046E	50	100	n/a
AGZ050E / 051E	50	100	n/a
AGZ055E / 056E	50	100	n/a
AGZ060E / 061E	50	100	n/a
AGZ065E / 066E	50	100	n/a
AGZ070E / 071E	50	100	n/a
AGZ075E / 076E	60	100	n/a
AGZ080E / 081E	60	100	n/a
AGZ090E / 091E	60	100	n/a
AGZ100E / 101E	60	100	n/a
AGZ110E	50	80	n/a
AGZ120E	50	80	n/a
AGZ130E	50	80	n/a
AGZ140E	70	100	n/a
AGZ150E	70	100	n/a
AGZ161E	80	100	n/a
AGZ170E	60	80	100
AGZ180E	60	80	100
AGZ191E	60	80	100
AGZ211E	60	80	100
AGZ226E	60	80	100
AGZ241E	60	80	100

**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 circuit 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 will be 'Manual'.

**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 unless the unit is a model 191-241. For these models, the hot gas bypass will also be activated for 10 minutes when a second or third compressor is started on the circuit.



## 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.

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 as Faults, Problems, or Warnings.

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 is 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 '-'.

## Unit Fault Alarms

### PVM/GFP Fault

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

**Action Taken:** Rapid shutdown all circuits and lockout unit from running.

**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

- if an auto reset occurrence has triggered, keep unit enabled and allow the evaporator recirculation sequence to proceed

- if a manu reset occurrence has been triggered, lock out unit from running

**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 shutdown all circuits and lockout unit from running.

**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.

- Resistance value is less than 340  $\Omega$  or more than 300 k $\Omega$
- Reliability value reported for input is anything other than 'No Fault'.

**Action Taken:** Normal stop all circuits and lock out unit from running.

**Reset:** This alarm can be cleared manually via the keypad or BAS command, but only if the sensor is back in range and reliability value reported for input is 'No Fault' for at least five seconds.

**Evaporator EWT Sensor Fault**

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

- Resistance value is less than 340 Ω or more than 300 kΩ
- Reliability value reported for input is anything other than 'No Fault'.

**Action Taken:** None

**Reset:** This alarm should be cleared automatically if the sensor is back in range and reliability value reported for input is 'No Fault' for at least five seconds.

**Outdoor Air Temperature Sensor Fault**

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

- Resistance value is less than 340 Ω or more than 300 kΩ
- Reliability value reported for input is anything other than 'No Fault'.

**Action Taken:** Normal stop all circuits and lock out unit from running.

**Reset:** This alarm can be cleared manually via the keypad or BAS command, but only if the sensor is back in range and reliability value reported for input is 'No Fault' for at least five seconds.

**External Alarm**

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

**Action Taken:** Rapid shutdown all circuits and lockout unit from running.

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

**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.

**External Event**

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

**Action Taken:** None.

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

**Bad Demand Limit Input**

**Trigger:** Demand limit input out of range and Demand Limit set point is set to On. For this alarm, out of range is considered to be a signal less than 3mA or more than 21mA.

**Action Taken:** Demand limit function and signal are ignored.

**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:** LWT reset signal and function are ignored.

**Reset:** Auto clear when LWT Reset Type set point is not 4-20 mA or LWT reset input back in range for 5 seconds.

**Heat Recovery LWT and EWT Sensor Fault**

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

- Resistance value is less than 340 Ω or more than 300 kΩ
- Reliability value reported for input is anything other than 'No Fault'.

Also, alarm can only trigger if Heat Recovery Control Type ≠ None and communication with CC1 is ok.

**Action Taken:** Heat Recovery is forced off.

**Reset:** This alarm should clear automatically if the sensor is back in range and reliability value reported for input is 'No Fault' for at least five seconds.

**RapidRestore Module Comm Failure**

**Trigger:** RapidRestore set point is set to 'Yes' and communication with the RapidRestore module has failed. This means the reliability value reported for the module is anything other than 0 for at least 3 seconds.

**Action Taken:** RapidRestore® functionality will be disabled while the module is not communicating since an input on the module is required in order to enable the functionality.

**Reset:** This alarm will automatically clear after communication is restored for at least 5 seconds.

**Circuit Fault Alarms**

**PVM/GFP Fault**

**Trigger:** Power Configuration = Multi Point and circuit PVM/GFP input is off for longer than one second

**Action Taken:** Rapid stop circuit.

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

### **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 all 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 shutdown of circuit and lock out from running.

**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 shutdown of circuit and lock out from running.

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

### **Mechanical Low Pressure Switch**

**Trigger:** The alarm is triggered if all of the following are true for at least 40 seconds:

- Circuit State is Run
- MLP Switch input is off

The alarm also requires Evaporator Configuration = Remote and Condenser Type = Microchannel to trigger.

**Action Taken:** Rapid stop circuit.

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

### **Mechanical High Pressure Switch**

**Trigger:** Power up start delay is not active and [Mechanical High Pressure switch input is off and Motor Protection input is on] for longer than one second.

**Action Taken:** Rapid stop circuit.

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

### **Motor Protection Fault**

**Trigger:** Motor Protection input is off 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 on.

### **Low OAT Restart Fault (displayed as “OffNbrRestarts”)**

**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:** Trigger any time sensor input voltage is less than 400mv and UC communication with CC module is OK, for at least one second.

Trigger when sensor input voltage is more than 4600mv and UC communication with CC module is OK, for at least one second. However, this trigger should only occur after circuit state is run or pumpdown for at least 90 seconds or the OAT is less than 40.56°C (105°F).

Trigger if the evaporator approach is less than -9.44°C (-17°F) for more than 30 seconds. This trigger should only be enabled after the circuit state is Run for 30 seconds. The purpose of this trigger condition is to prevent operation if the sensor is reading high but not out of range.

**Action Taken:** Rapid shutdown of circuit and lock out from running.

**Reset:** This alarm can be cleared manually via the controller HMI or BAS command if either of the following are true for at least 5 seconds:

- OAT ≥ 40.56°C (105°F) and sensor input voltage is at

least 400mv OR

- OAT < 40.56°C (105°F) and sensor input voltage is from 400mv to 4600mv.

### Condenser Pressure Sensor Fault

**Trigger:** Trigger any time sensor input voltage is less than 400mv or more than 4600mv and UC communication with CC module is OK, for at least one second.

**Action Taken:** Rapid shutdown of circuit and lock out from running.

**Reset:** This alarm can be cleared manually via the keypad or BAS command, but only if the sensor is back in range for at least 5 seconds.

### Suction Temperature Sensor Fault

**Trigger:** In order to trigger, Expansion Valve Type must be Electronic. Trigger if any of the following are true for at least 1 second:

- Sensor input value is less than 340  $\Omega$  or greater than 300 k $\Omega$
- Sensor reliability reported by control system  $\neq$  'No Fault'

**Action Taken:** Normal shutdown of circuit and lock out from running.

**Reset:** This alarm should be cleared manually if the sensor is back in range and reliability value reported for input is 'No Fault' for at least five seconds.

### Compressor CC Module Comm Failure

**Trigger:** Communication with the module has failed. Specifically, this means the reliability value reported for the module is anything other than 0 for at least 3 seconds.

**Action Taken:** Rapid shutdown of circuit and lock out from running.

**Reset:** This alarm can be cleared manually via the keypad or BAS command after reliability value reported for the module is 0 for at least 5 seconds.

### EEXV Module Comm Failure

**Trigger:** Communication with the module has failed. Specifically, this means the reliability value reported for the module is anything other than 0 for at least 3 seconds.

**Action Taken:** Rapid shutdown of circuit and lock out from running.

**Reset:** This alarm can be cleared manually via the keypad or BAS command after reliability value reported for the module is 0 for at least 5 seconds.

### Failed Pumpdown

**Trigger:** Circuit state = pumpdown for longer than 2 minutes.

**Action Taken:** Shut down circuit.

**Reset:** N/A.

## Alarm Logs

Press the alarm button on the controller to go to the alarm section. Three alarm sub-sections will appear. Turn the navigating wheel to highlight among them and press the wheel to select. Reference [Figure 71](#) for controller components.

### Active Alarms

When an alarm or event occurs, it appears in the active alarm list. The active alarm list holds a record of all active alarms not yet cleared and includes the date and time each occurred. When cleared, the alarm transfers to the Alarm Log that contains an alarm history with time/date stamp. A (+) before an alarm indicates that it is active, a (-) indicates a cleared alarm. The Active Alarm list is only limited by the number of alarms since any given alarm cannot appear twice.

### 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.

**CAUTION**

Repeated manual clearing of alarms without resolving the cause of the alarm may damage the chiller, impact the unit's operational performance, and may affect the chiller's warranty.

## 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. 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.

**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.

## Compressor Communications

The compressor communication module 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 locked out the compressor, 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.

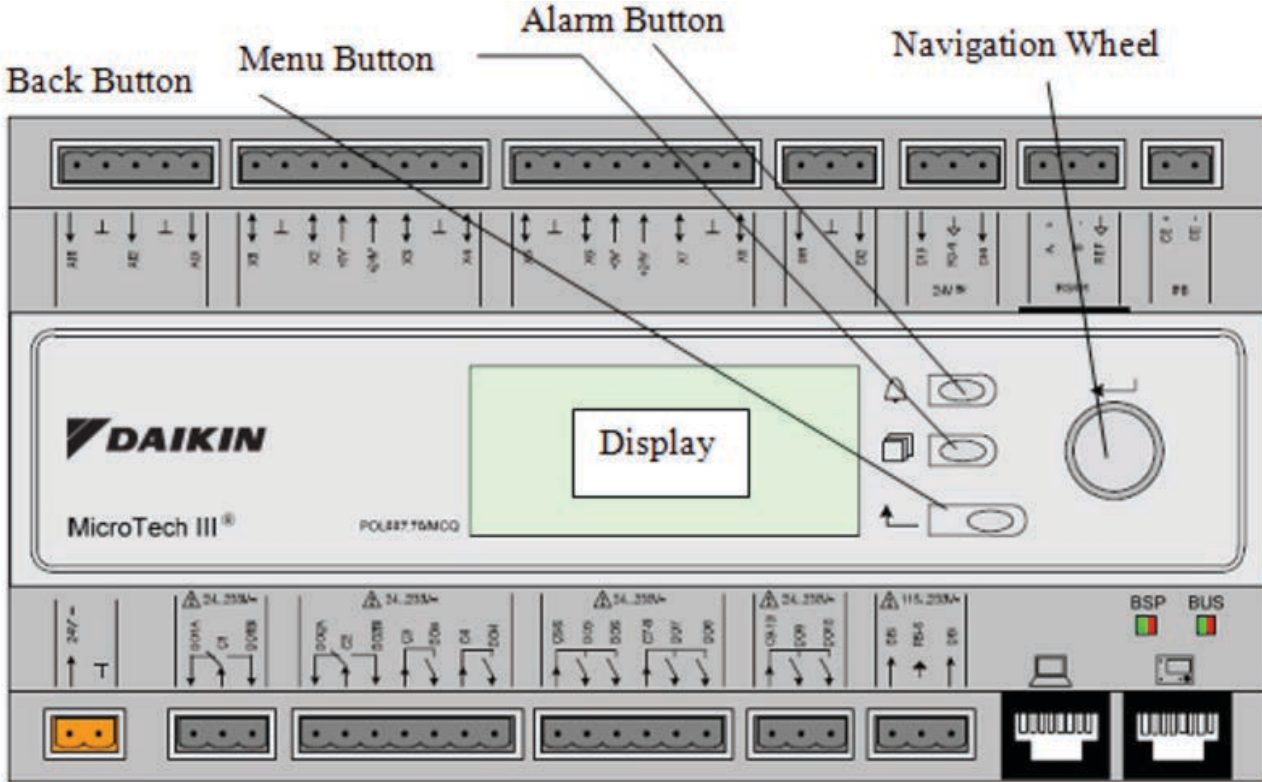
Code 7 – Reverse Phase: The module will flash the red Alert LED seven times indicating a reverse phase in two of the three compressor leads. The modules will lockout the compressor after one Code 7 Alert. A power cycle or Modbus reset command will be required to clear the lockout.

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.

Figure 71: Schematic of Unit Controller



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 72: 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

include changeable data fields (setpoints).

When the cursor is on a line the highlights will look like this:

Evaporator Delta T= 10.0F

If line contains a changeable value-

Unit Status= Run

If the line contains status-only information-

Or a line in a menu 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

There are 4 levels of access for the user interface:

- No password
- Operator level - 5321
- Technician/Manager level - 2526
- Daikin Applied service technician level

Enter passwords from the Main Menu:

- Enter Password links to the Entry screen which is an editable screen. So pressing the wheel goes to the edit mode where the password 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 76.

Figure 73: Password Menu

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

Figure 74: 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 73.
- 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 and shown in Figure 75:

- N = No password
- O = Operator level
- T = Technican/Manager level
- D = Daikin Applied factory service 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.

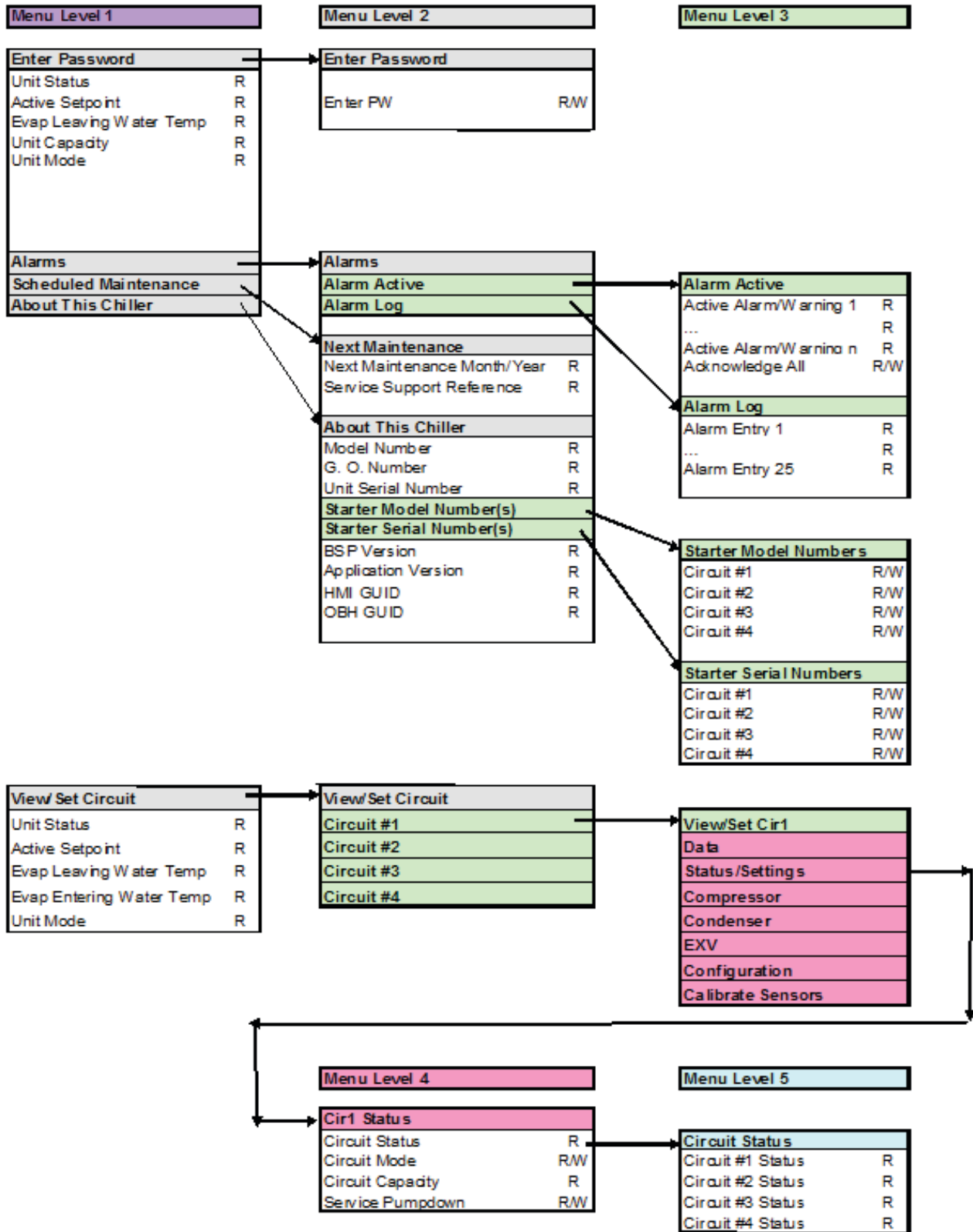
Figure 75: Example of Screen Menu With Access Levels

U-1					
	N	O	T	D	To Screen
Main Menu					
Enter Password	R	R	R	R	U-2
Quick Menu		R	R	R	U-3
View/Set Unit			R	R	U-4
View/Set Circuit			R	R	U-5
Unit Status	R	R	R	R	
Active Setpoint	R	R	R	R	



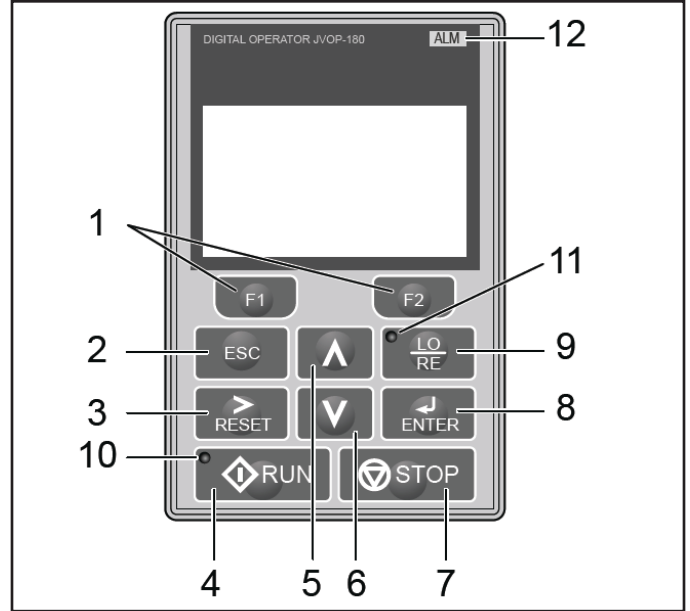
Figure 76: Controller Keypad Sample Navigation

Visible (w/o Password)



## VFD Interface

The VFD controller is located in the lower left-hand corner of the unit control panel. It is used to view data including fault and alarm information. No operator intervention on this control is required for normal unit operation.



**Table 78: Display Key Functions**

No.	Display Name	Function
1	Function Key (F1, F2)	The functions assigned to F1 and F2 vary depending on the currently displayed menu. The name of each function appears in the lower half of the display window.
2, 3	ESC Key, RESET Key	<ul style="list-style-type: none"> <li>• Returns to the previous display.</li> <li>• Moves the cursor one space to the left</li> <li>• Pressing and holding this button will return to the Frequency Reference display.</li> </ul>
3	RESET Key	<ul style="list-style-type: none"> <li>• Moves the cursor to the right.</li> <li>• Resets the drive to clear a fault situation</li> </ul>
4	RUN Key	Starts the drive in LOCAL mode.
5	Up Arrow Key	Scrolls up to display the next item, select parameter numbers, and increment setting values.
6	Down Arrow Key.	Scrolls down to display the next item, select parameter numbers, and increment setting values
7	STOP Key	Stops drive operation.
8	ENTER Key	<ul style="list-style-type: none"> <li>• Enters parameter values and settings.</li> <li>• Selects a menu item to move between displays</li> </ul>
9	LO/RE Selection Key	Switches drive control between the operator (LOCAL) and an external source (REMOTE) for the Run command and frequency reference.
10	RUN Light	Lit while the drive is operating the motor.
11	LO/RE Ligh	Lit while the operator is selected to run the drive (LOCAL mode).
12	ALM LED Light	Refer to ALARM (ALM) LED Displays in <a href="#">Table 80</a>

Figure 77: LCD Display

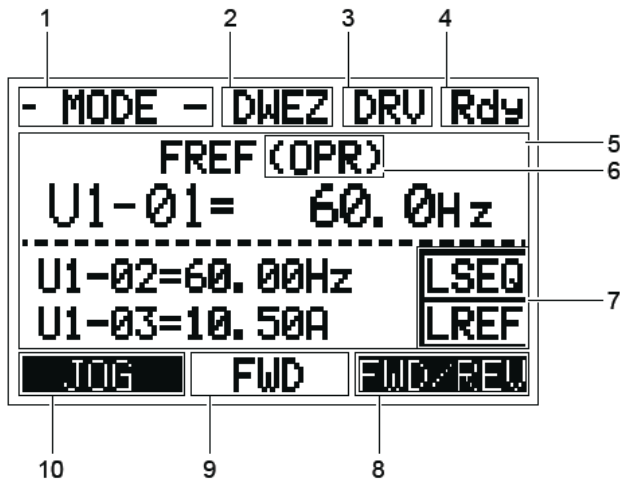


Table 79: Display Data

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 80: 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)

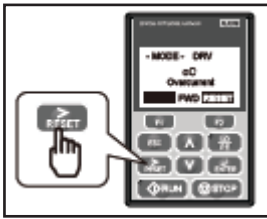
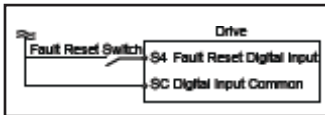
**Table 81: LO/RE LED and RUN LED Indictors**

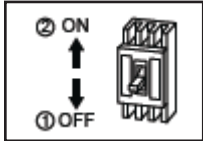
LED	Lit	Flashing Slowly	Flashing Quickly	Off
LO/RE	When the operator is selected for Run command and frequency reference control (LOCAL)	--	--	When a device other than the operator is selected for Run command and frequency reference control (REMOTE)
RUN	During run	During deceleration to stop  When a 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 82: Types of Alarms, Faults, and Errors**

Type	Drive Response
Faults	When the drive detects a fault:
	• The digital operator displays text indicating the specific fault and the ALM indicator LED remains lit until the fault is reset.
	• 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.
	• Fault output terminals MA-MC will close, and MB-MC will open.
	The drive will remain inoperable until the fault is cleared.
Minor Faults and Alarms	When the drive detects an alarm or a minor fault:
	• The digital operator displays text indicating the specific alarm or minor fault, and the ALM indicator LED flashes.
	• The drive continues running the motor, although some alarms allow the user to select a stopping method when the alarm occurs.
	• 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.
	• The digital operator displays text indicating a specific alarm and the ALM indicator LED flashes.
	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:
	• The digital operator displays text indicating the specific error. • Multi-function contact outputs do not operate.
	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:
	• The digital operator displays text indicating the specific error. • Multi-function contact outputs do not operate.
	• Motor coasts to stop.
	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.
	• The digital operator displays text indicating the specific error.
	• Multi-function contact outputs do not operate.
	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 83: Fault Reset Methods**

After the Fault Occurs	Procedure
Fix the cause of the fault, restart the drive, and reset the fault	<p>Press RESET on the controller.</p> 
Resetting via Fault Reset Digital Input S4	<p>Close then open the fault signal digital input via terminal S4. S4 is set for "Fault Reset" as default (H1-04 = 14)</p> 

<p>Turn off the main power supply if the above methods do not reset the fault. Reapply power after the controller display has turned off.</p>	
---	---

**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.

## Optional BAS Interface

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

The appropriate installation manual for optional BAS interface modules are shipped with the chiller. The current version of each document 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

## 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 84: 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.

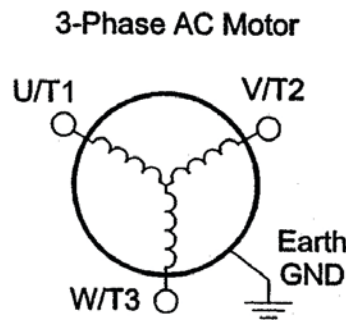
## Inverter Output to the Motor

**⚠ WARNING**

Avoid swapping any 2 of the 3 motor lead connections which will cause reversal of the motor direction. In applications where reversed rotation could cause equipment damage or personnel injury, be sure to verify direction of rotation before attempting full-speed operation. For safety to personnel, the motor chassis ground must be connected to the ground connection at the bottom of the inverter housing.

The AC motor must be connected only to the inverter's output terminals. The output terminals are uniquely labeled (to differentiate them from the input terminals) with the designations U/T1, V/T2, and W/T3.

This corresponds to typical motor lead connection designations T1, T2, and T3. The consequence of swapping any two of the three connections is the reversal of the motor direction. This must not be done. In applications where reversed rotation could cause equipment damage or personnel injury, be sure to verify direction of rotation before attempting full-speed operation. For safety to personnel, the motor chassis ground must be connected to the ground connection at the bottom of the inverter housing.



Notice the three connections to the motor do not include one marked "Neutral" or "Return." The motor represents a balanced "Y" impedance to the inverter, so there is no need for a separate return. In other words, each of the three "Hot" connections serves also as a return for the other connections because of their phase relationship.

Do not to switch off power to the inverter while the motor is running (unless it is an emergency stop) to avoid equipment damage. Also, do not install or use disconnect switches in the wiring from the inverter to the motor (except thermal disconnect).

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

**⚠ DANGER**

**LOCKOUT/TAGOUT** all power sources prior to servicing the unit. Disconnect all power before performing any service inside the unit. The panel is always energized to ground even when the system switch is off. To de-energize the complete panel, including crankcase heaters, pull the main unit disconnect. Failure to follow this warning exactly can result in serious personal injury or death. Be sure to read and understand the installation, operation, and service instructions within this manual.

## 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.

**⚠ CAUTION**

Dyes used for refrigerant leak detection are not tested or recommended for use in Daikin chillers. Use of these products may damage and/or degrade the performance of the equipment and will void the manufacturer warranty.

## Pre-Startup Checkout

1. Verify chilled water piping requirements from [page 12](#) are met.
2. Check the pump operation and vent all air from the system.
3. Circulate evaporator water, checking for proper system pressure and evaporator pressure drop. Compare the pressure drop to the evaporator water pressure drop curve.
4. Flush System and clean all water strainers before placing the chiller into service.
5. Check water treatment and proper glycol percent, if used.
6. Check all exposed brazed joints for evidence of leaks. Joints may have been damaged during shipping or when the unit was installed.
7. Check that all refrigerant valves are either opened or closed as required for proper operation of the chiller.
8. A thorough leak test must be done using an electronic leak detector. Check all valve stem packing for leaks. Replace all refrigerant valve caps and tighten.
9. Check all refrigerant lines to insure that they will not vibrate against each other or against other chiller components and are properly supported.
10. Check all connections and all refrigerant threaded connectors.

11. Look for any signs of refrigerant leaks around the condenser coils and for damage during shipping or installation.
12. 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 24 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 connections and tighten all screw connections. Check plug-in relays for proper seating and to insure retaining clips are installed.
3. Put System Switch (S1) to the Emergency Stop position.
4. Put both circuit #1 & #2 switches to the Pumpdown and Stop position.
5. Apply power to the unit. The panel Alarm Light will stay on until S1 is closed. Ignore the Alarm Light for the check out period. If you have the optional Alarm Bell, you may wish to disconnect it.
6. Check at the power block or disconnect for the proper voltage and proper voltage between phases. Check power for proper phasing using a phase sequence meter before starting unit.
7. Check for 120 Vac at the 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 on [page 52](#) 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) and stable conditions to properly check the operation of the chiller refrigerant circuits.

Be prepared to record all operating parameters required by the "Compressorized Equipment Warranty Form". 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 rate.
- Calibrate thermal dispersion flow switch, see instructions on [page 104](#)
- 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 44](#) 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 both pumpdown switches (PS1 and PS2) to the ON position.
- Put system switch (S1) to ON position.

**Table 85: Pumpdown and System Switch Positions**

Switch	Switch Position	
	ON	OFF
PS1, PS2, Pumpdown Switches	Circuits 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)

## Post Startup

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

- Compressor oil level.
- Refrigerant sight glass for flashing.
- Rotation of condenser fans.
- Complete 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 both circuit switches 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 both condenser liquid line service valves.
2. Put both circuit switches 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 both refrigerant circuit discharge valves (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 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.

## Flow Switch Installation and Calibration

A thermal dispersion flow switch uses heat to determine flow and therefore must be calibrated during system startup. A thermal dispersion flow switch can be an acceptable replacement for paddle type flow switches and differential pressure switches but care must be taken regarding wiring.

The thermal dispersion flow switch supplied by Daikin Applied, shown in [Figure 78](#), comes as a 2 part unit consisting of a flow switch and an adapter labeled E40242 by the supplier.

**Figure 78: Thermal Dispersion Flow Switch and Adapter**



**IMPORTANT:** Flow switch MUST be calibrated before chiller operation. Failure to properly calibrate the switch may result in severe chiller damage and/or void warranty.

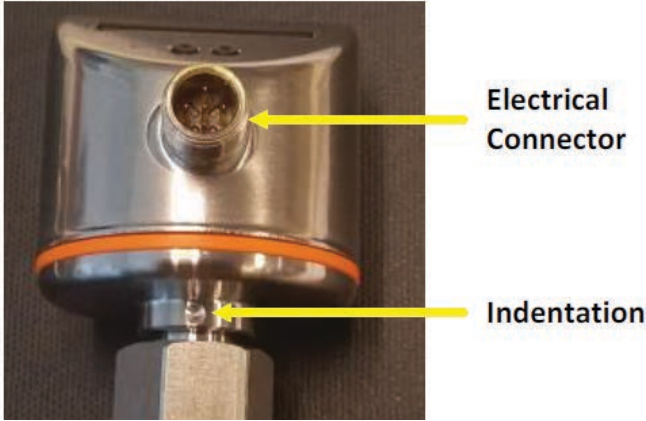




**Mounting**

Figure 79 highlights the position of the electrical connector and indentation 'mark' on flow switch.

**Figure 79: Flow Switch Details**



It is commended, if possible, that the flow switch be mounted such that the electrical connection and indentation 'mark' are pointed in the direction of flow as shown in Figure 80. It is important that the flow switch be mounted so that the probe is sufficiently inserted into the fluid stream. It may not be mounted directly on top or directly on the bottom of a horizontal pipe.

If the flow sensor is to be mounted away from the unit, the sensor should be mounted on the wall of the outlet pipe of evaporator and condenser, or in a run of straight pipe that allows 5 to 10 pipe diameters prior to the sensor and 3 to 5 pipe diameters of straight pipe after the sensor. Flow switch is placed in outlet pipe to reflect flow leaving the barrel. If installation on the inlet pipe is necessary, contact Chiller Technical Response at TechResponse@DaikinApplied.com to review the jobsite details.

**NOTE:** DO NOT alter or relocate factory installed flow switch. If issues exist, contact Chiller Technical Response at TechResponse@DaikinApplied.com.

**Figure 80: Remote Mounting Guidelines for Flow Switch**

<p><b>General</b></p> <ul style="list-style-type: none"> <li>• The sensor tip is to be completely surrounded by the medium.</li> <li>• Insertion depth of the sensor: minimum .47" in.</li> </ul>		
<p><b>Recommended</b></p> <ul style="list-style-type: none"> <li>• For horizontal pipes: mounting from the side.</li> <li>• For vertical pipes: mounting in the rising pipe.</li> </ul>		
<p><b>To avoid</b></p> <ul style="list-style-type: none"> <li>• The sensor tip must not be in contact with the pipe wall.</li> <li>• Do not mount in downpipes that are open at the bottom!</li> </ul>		

If needed, the adapter is threaded into the pipe using pipe sealant appropriate for the application. The flow sensor is mounted onto the adapter using silicone grease. Carefully apply lubricant to the inside threads and o-ring so temperature probe does not become coated with lubricant. Torque the adapter/sensor connection to 18.5 ft/lbs.

**Wiring**

Refer to wiring diagram in the unit control panel.

Either AC or DC is used to power the flow switch. The unit controller's digital input is a DC signal which is supplied through the switch output of the flow switch for flow indication. It is required that the AC and DC commons of power be separated. Contact Chiller Technical Response for alternate wiring scenarios.

**Flow Switch Setup**

The flow switch comes from the factory set at a default velocity of 20cm/s. This value is typically well below the minimum water flow specified for the unit's evaporator and condenser so field adjustment is required for adequate low flow protection. Table 86 are the calculated gallons per minute (gpm) for Schedule 40 steel pipe for various fluid velocities from 15 cm/s to 60 cm/s. The flow switch has a range of adjustment from 3 cm/s to 300 cm/s.

**Step 1:** Adjust flow through the evaporator to the minimum desired operating gpm. Maintain this flow throughout the setup procedure.

**Step 2:** Once steady state minimum desired operating flow is obtained, perform the 'Teach' function on the flow switch. The 'Teach' function is initiated by holding down the minus '-' button on the face of the flow switch for 15 seconds. During this 15 second period, LEDs '0' and '9' will be lit green. Once the 'Teach' function is completed, the outer LEDs will flash green as shown in Figure 81.

**Figure 81: Automatic Teach of Setpoint**

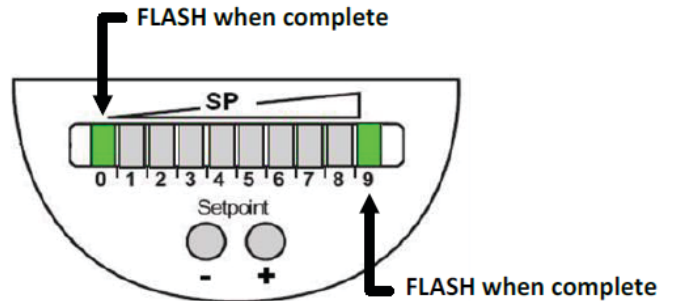
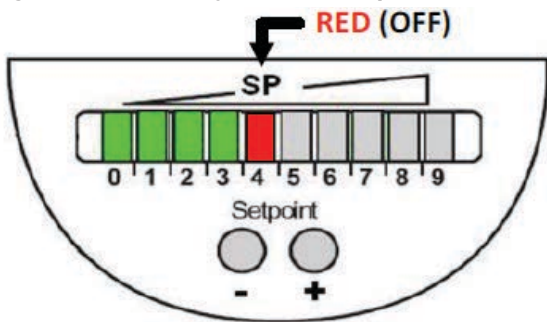


Table 86: Flow Volume Calculation

Pipe Size (inch)	Inside Pipe Diameter (inch)	US GPM at the velocities indicated below									GPM adjustment per '+' or '-' key input
		Default									
		20 cm/sec	30 cm/sec	50 cm/sec	75 cm/sec	100 cm/sec	150 cm/sec	200 cm/sec	250 cm/sec	300cm/sec	
2	2.06	6.86	10.3	17.2	25.7	34.3	51.5	68.6	85.8	102.9	1.72
2.5	2.46	9.79	14.7	24.5	36.7	49.0	73.4	97.9	122.4	146.9	2.42
3	3.07	15.1	22.7	37.8	56.7	75.6	113.4	151.2	189.0	226.8	3.78
3.5	3.55	20.2	30.3	50.6	75.8	101.1	151.7	202.2	252.8	303.3	5.06
4	4.03	26.0	39.1	65.1	97.7	130.2	195.3	260.4	325.5	390.5	6.51
5	5.05	40.9	61.4	102.3	153.5	204.6	306.9	409.2	511.5	613.7	10.2
6	6.07	59.1	88.6	147.7	221.6	295.5	443.2	590.9	738.7	886.3	14.8
8	7.98	102.3	153.5	255.8	383.7	511.6	767.5	1023.3	1279.1	1534.7	25.6
10	10.02	161.3	241.9	403.2	604.8	806.5	1209.7	1612.9	2016.2	2419.1	39.0
12	11.94	229.0	343.4	572.4	858.6	1144.7	1717.1	2289.5	2861.9	3433.8	57.2
14	13.13	276.8	415.2	692.0	1037.9	1383.9	2075.9	2767.8	3459.8	4151.3	69.2
16	15.00	361.5	542.2	903.6	1355.5	1807.3	2710.9	3614.6	4518.2	5421.2	90.4
18	16.88	457.5	686.3	1143.8	1715.7	2287.6	3431.4	4575.2	5719.0	6862.1	114.4
20	18.81	572.4	853.0	1421.6	2132.4	2843.2	4264.8	5686.4	7108.0	8528.6	142.2

**Step 3:** After the 'Teach' function is completed and the outer LEDs flashed, the flow switch will indicate a new set point based upon the current flow which should still be at the steady state minimum desired operating flow. Figure 82 shows a typical display for this condition. All LEDs to the left of the SP LED are lit green. The SP LED is lit RED (or may toggle amber) which indicates that the flow switch is OPEN. Typically, an increase in fluid flow is between 15% to 30% above the 'Teach' function flow is required for the SP LED to turn AMBER and the flow switch to CLOSE indicating acceptable flow.

Figure 82: Teach Adjustment Complete

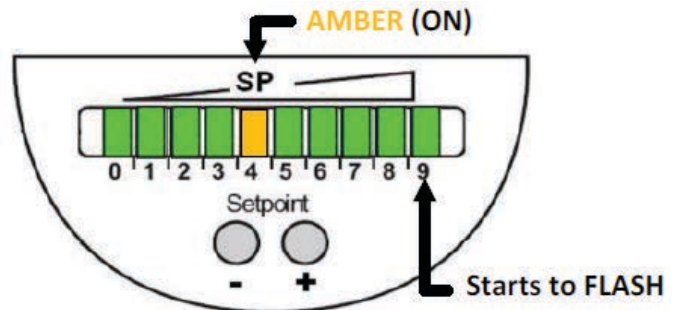


In Step 3, the 'Teach' function re-adjusted the flow switch set point (SP) while flow was at the minimum desired operating flow. The chiller will not operate at this flow because the flow switch is OPEN after performing the 'Teach' function. The benefit of the 'Teach' function is to quickly set the set point within the desired operating range. Additional 'manual' adjustment of set point is required in order to allow for chiller operation at this minimum flow. The '+' and '-' buttons on the face of the flow switch allow for the manual adjustment of the SP. Pressing the '+' button reduces the flow set point while

pressing the '-' button increases the flow set point. Each button press, '+' or '-', changes the flow set point by 2.5 cm/s.

**Step 4:** Press the '+' button until LED '9' begins to flash, as shown in Figure 83. Opening of flow switch should now occur at approximately 80% to 90% of minimum flow.

Figure 83: Upper Range of Minimum Flow



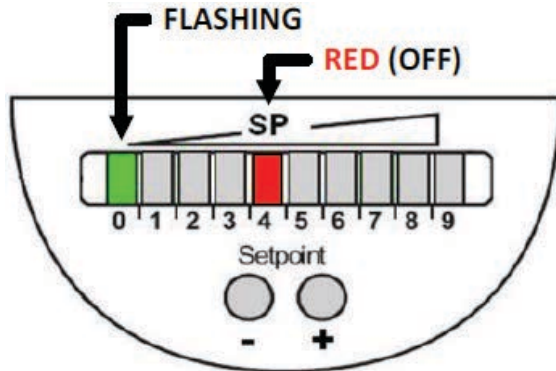
**Step 5:** Once the SP is set, it is recommended that the sensor be locked to avoid inadvertent readjustment. This can be performed by pressing both the '+' and '-' buttons simultaneously for 10 seconds. The indication goes out momentarily indicating the unit is locked. To unlock, the same procedure is performed to toggle to unlocked.

**NOTE:** 1. The LED window display on flow switch represents a velocity range of 50 cm/s. The window centers on the set point (SP). For example, if the SP was set to 200 cm/s, then the LED labeled '0' would represent a velocity of 180 cm/s when lit and the LED labeled 9 would represent a velocity of 230 cm/s when lit.  
2. Each LED represents 5 cm/s, or two presses of the '+' or '-' buttons.

3. When power is initially applied to the flow switch, all green LEDs light and go out step by step. During this time, the output is closed. The unit is in the operating mode.
4. When making manual adjustments to the set point (SP), if no button is pressed for 2 seconds, the unit returns to the operating mode with the newly set value.

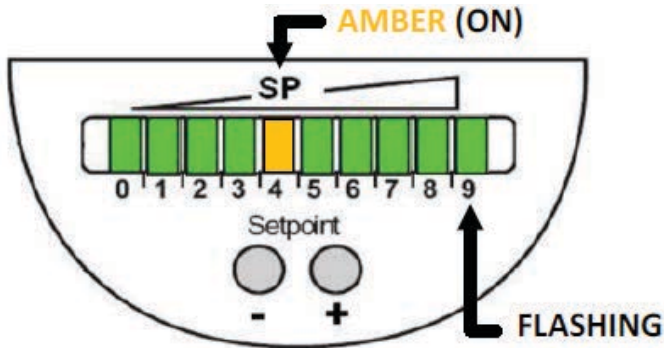
**Flow below display range:** The SP LED will be lit red and the leftmost LED will be flashing green. For example, if the SP was set to 200 cm/s, the flashing labeled '0' would indicate that the flow was below 180 cm/s. This would be shown if no flow through chiller or lowered than desired flow.

**Figure 84: Display for Flow Below Range**



**Flow above display range:** The SP LED will be lit amber, all LEDs to the left and right of the SP LED will be green with the rightmost LED flashing green. For example, if the SP was set to 200 cm/s, the flashing LED labeled '9' would indicate that the flow was above 230 cm/s. This may be a normal display depending on range by which flow varies through chiller.

**Figure 85: Display for Flow Above Range**



## General

On initial start-up and periodically during operation, it will be necessary to perform certain routine service checks. Among these are checking the liquid line 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.

## Electrical Terminals

Prior to attempting any service on the control center, study the wiring diagram furnished with the unit so that you understand the operation of the unit.

**⚠ DANGER**

**LOCKOUT/TAGOUT** all power sources prior to starting, pressurizing, de-pressuring, or powering down the Chiller. Disconnect electrical power before servicing the equipment. Failure to follow this warning exactly can result in serious injury or death.

**⚠ DANGER**

The panel is always energized even if the system switch is off. If it is necessary to de-energize the complete panel, including crankcase heaters, pull the main unit disconnect. More than one disconnect may be required to de-energize the unit. Failure to do so may result in serious injury or death.

**⚠ WARNING**

Warranty may be affected if wiring is not in accordance with specifications. A blown fuse or tripped protector may indicate a short, ground fault, or overload. Before replacing fuse or restarting compressor, the trouble must be found and corrected. It is important to have a qualified control panel electrician service this panel. Unqualified tampering with the controls can cause serious damage to equipment and void the warranty.

**⚠ CAUTION**

Periodically check electrical terminals for tightness and tighten as required. Always use a back-up wrench when tightening electrical terminals.

## Compressor Maintenance

The scroll compressors are fully hermetic and require standard maintenance practices:

- Check oil level monthly
- Inspect electrical connections annually
- Test oil annually

### Crankcase Heaters

The scroll compressors are equipped with externally mounted band heaters located at the oil sump level. The function of

the heater is to keep the temperature in the crankcase high enough to prevent refrigerant from migrating to the crankcase and condensing in the oil during off-cycle.

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

## Lubrication

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

POE type oil is used for compressor lubrication. Further details and warnings are listed on [page 112](#).

**⚠ WARNING**

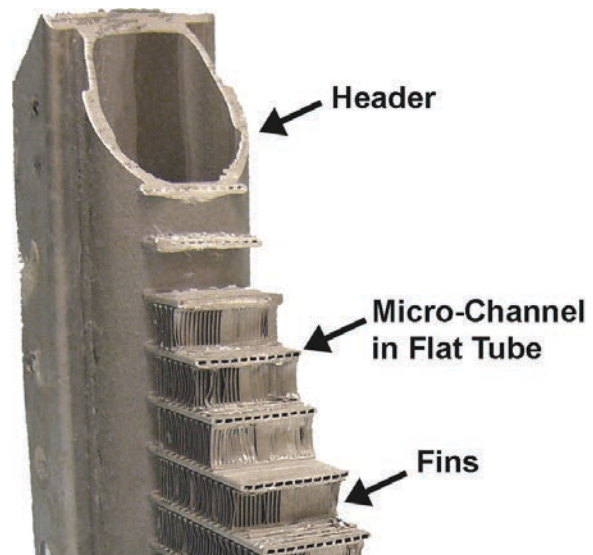
POE oil must be handled carefully using proper protective equipment (gloves, eye protection, etc.). The oil must not come in contact with certain polymers (e.g. PVC), as it may absorb moisture from this material. Daikin Applied recommends against the use of PVC and CPVC piping for chilled water systems. 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, microchannel, 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.

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.

**Figure 86: Microchannel Coil Cross Section**



## Cleaning Microchannel Aluminum Coils

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

**WARNING**

Prior to cleaning the coils, 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 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 all coils according to [Table 87](#). Coils should be rinsed with water at a lower pressure such as from a hose. Pressure washers are not recommended as the higher pressure may damage the fins.

Regular water rinsing of epoxy coated coils that are applied in coastal or industrial environments will 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.

**Table 87: Coil Cleaning Guidelines**

Coating Option	Recommended Rinsing	Required Cleaning
Aluminum Coil Only	Monthly with low pressure water only	N/A
Epoxy Coated Coil	Monthly with low pressure water only - max 130°F	Quarterly with approved cleaner, Chloride Remover is required - max 130°F

## 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.

### Routine Quarterly Cleaning of Epoxy Coated Coil Surfaces

Quarterly cleaning is essential to extend the life of an epoxy coated coil and shall be part of the unit's regularly scheduled maintenance procedures. Failure to clean epoxy coated coils will void the warranty and may result in reduced efficiency and

durability in the environment.

For routine quarterly cleaning, first clean the coil with a coil cleaner (see [Table 88](#)). After cleaning the coils with a cleaning agent, use the chloride remover to remove soluble salts and revitalize the unit.

### Recommended Coil Cleaning Agents

The following cleaning agents, used in accordance with the manufacturer's directions on the container for proper mixing and cleaning, has been approved for use on epoxy coated coils to remove mold, mildew, dust, soot, greasy residue, lint and other particulates:

**Table 88: Epoxy Coated Coil Recommended Cleaning Agents**

Chemical Type	Cleaning Agent
Coil Cleaner	Enviro-Coil Concentrate
Coil Cleaner	GulfCoat™
Chloride Remover	CHLOR*RID®

Chloride remover should be used to remove soluble salts from epoxy coated coils, but the directions must be followed closely. This product is intended to remove chlorides and sulfates and not intended for use as a degreaser. Any grease or oil film should first be removed with the approved cleaning agent.

1. Remove Barrier - Soluble salts adhere themselves to the substrate. For the effective use of this product, the product must be able to come in contact with the salts. These salts may be beneath any soils, grease or dirt; therefore, these barriers must be removed prior to application of this product. As in all surface preparation, the best work yields the best results.
2. Apply chloride remove directly onto the substrate. Sufficient product must be applied uniformly across the substrate to thoroughly wet out surface with no areas missed. This may be accomplished by use of a pump-up sprayer. The method does not matter, as long as the entire area to be cleaned is wetted. After the substrate has been thoroughly wetted, the salts will be soluble and is now only necessary to rinse them off.
3. Rinse - It is highly recommended that a hose be used as a pressure washer will damage the fins. The water to be used for the rinse is recommended to be of potable quality, though a lesser quality of water may be used if a small amount of chloride remover is added.

### 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 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 or compressed air may damage the coil fins and must only be used at a pressure lower than 100 psig and 130°F to prevent fin and/or coil damage. Nozzles must have a diffuse pattern, as a concentrated jet may damage the fins. Never use a pressure washer for coil cleaning. 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.

## Evaporator

On AGZ-E models, the evaporator is a compact, high efficiency, dual 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. Evaporators are designed and constructed according to, and listed by, Underwriters Laboratories (UL). Other than cleaning and testing, no service work should be required on the evaporator.

## 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.

## Battery

The controller has included with it a battery (BR2032) with a ~2 year life; therefore, it is recommended to include battery replacement every 2 years in your maintenance plan.

## High Ambient Control Panel

This option consists of an exhaust fan with rain hood, two inlet screens with filters, necessary controls and wiring to allow operation to 125°F (52°C). The components can be factory or field installed as a kit.

- It must be supplied on units operating at ambient temperatures of 105°F (40.6°C) and above.
- It is automatically included on units with fan VFD (low ambient option).
- Check inlet filters periodically and clean as required. Verify that the fan is operational.

## 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 and Subcooling

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.

If the unit is at steady full load operation and bubbles are visible in the sight glass, then check liquid subcooling. If subcooling is low, add charge to clear the sight glass - see ["Refrigerant Charging" on page 113](#). Once the subcooler is filled, extra charge will not lower the liquid temperature and does not help system capacity or efficiency. If subcooling is normal (15 to 20 degrees F at full load) and flashing is visible in the sight glass, check the pressure drop across the filter-drier.

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 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.

**Thermal Expansion Valve** - The suction superheat for the suction leaving the evaporator is set at the factory to 10 degrees F.

**Electronic Expansion Valve** - For suction superheat targets, see ["Circuit Level Set Points" on page 60](#)

## 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.

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

For units with replaceable core filter driers, the core assembly of the replaceable core drier consists of a filter core held tightly in the shell in a manner that allows full flow without bypass.

## Hot Gas Bypass (Optional)

The hot gas bypass (HGBP) option allows the system to operate at lower loads without excessive on/off compressor cycling. HGBP is required to be on both refrigerant circuits because of the lead / lag feature of the controller. HGBP 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 or air handler load.

**NOTE:** The hot gas bypass valve should not generate a 100% false load. For glycol applications, HGBP may not have full range of setting or turn down.

The pressure regulating valve is factory set to begin opening at 110 psig with R-410a and can be changed by changing the pressure setting. To raise the pressure setting, remove the cap 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 only the first stage of cooling on a circuit is active.

### WARNING

When performing valve checkout procedure, the hot gas line may become hot enough in a short period of time to cause personal injury. Be sure to read and understand the installation, operation, and service instructions within this manual.

A field installed HGBP kit can be added to units already installed. If a 120-V version of the kit is ordered, the solenoid valve comes with a DIN connector and has to be wired directly back to the control box. The wiring should be two 14 AWG wires, one red and one white to be run in conduit. Field to wire:

- Circuit #1: Red to TB2 95 and White to TB1-30.
- Circuit #2: Red to TB2 96 and White to TB1-30

DIN connection size is 1/2 in. NPTF for conduit fitting. Required wire, conduit fittings, and conduit to be supplied by the field.

Figure 87: HGBP Portion of Refrigerant Schematic

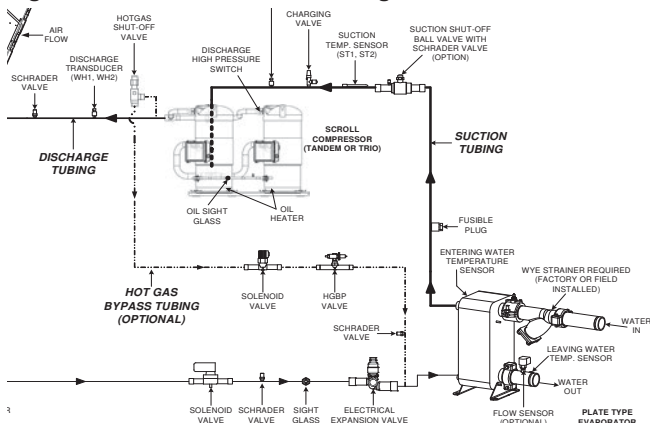


Table 89: Planned Maintenance Schedule

Operation	Weekly	Monthly (Note 1)	Quarterly	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
Verify solenoid plug(s) tightness and gasket integrity				X
<b>Refrigeration</b>				
Leak test		X		
Check sight glasses for clear flow	X			
Check filter-drier pressure drop		X		
Perform compressor vibration test				X
Acid test oil sample				X
<b>Condenser (air-cooled)</b>				
Rinse condenser coils (Note 5)		X		
Clean epoxy coated 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 rinsing and 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 MSDS 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, suitable for use with 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, & R-22 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 @ atms.) 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


Polyolester (POE) oil is used for compressor lubrication. This type of oil is extremely hygroscopic 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

 **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. Also, do not use oil or refrigerant additives in the system.

 **WARNING**

Polyolester Oil, commonly known as POE oil is a synthetic oil used in many refrigeration systems, and is present in this Daikin product. POE oil, if ever in contact with PVC/CPVC, will coat the inside wall of PVC/CPVC pipe causing environmental stress fractures. Although there is no PVC/CPVC piping in this product, please keep this in mind when selecting piping materials for your application, as system failure and property damage could result. Refer to the pipe manufacturer's recommendations to determine suitable applications of the pipe.

## 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.

## Control and Alarm Settings

The software that controls the operation of the unit is factory-set for operation with R-410A.

## 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 subcooling (approximately 15-20°F typical at full load).
- 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.

With outdoor temperatures above 60°F (15.6°C), all condenser fans should be operating and the liquid line temperature should be within 15°F to 20°F (8.3°C to 11.1°C) of the outdoor air temperature. At 25-50% load, the liquid line temperature should be within 5°F (2.8°C) of outdoor air temperature with all fans on. At 75-100% load the liquid line temperature should be within 10°F (5.6°C) of outdoor air temperature with all fans on.

If the unit is at steady full load operation and bubbles are visible in the sight glass, then check liquid subcooling. The AGZ 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 15 to 20°F (8.3 to 11.1°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. Liquid line subcooling at the liquid shut-off valve should be between 15 and 20°F at full load.

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 subcooling is normal (15 to 20° F at full load) and flashing is visible in the sight glass, check the pressure drop across the filter-drier.

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 for POE oils and for the refrigerant pressure (R-410A 600 psig 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.

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. If refrigerant leaks from the unit, there is a potential danger of suffocation since refrigerant will displace the air in the immediate area. Servicing this equipment must comply with the requirements of all applicable industry related published standards and local, state and federal, statutes, regulations and codes in regards to refrigerant reclamation and venting. Avoid exposing refrigerant to an open flame or other ignition source.

PROBLEM	POSSIBLE CAUSES	POSSIBLE CORRECTIVE STEPS
Compressor Will Not Run	1. Main or compressor disconnect switch open.	1. Close switch.
	2. Fuse blown. circuit breakers open	2. Check electrical circuits and motor windings for shorts or grounds. Investigate for possible overloading. Check for loose or corroded connections. Replace fuse or reset breakers after fault cause is corrected.
	3. Thermal overloads tripped	3. Overloads are auto-reset. Check voltages, cycle times and mechanical operations. Allow time for auto-reset.
	4. Defective contactor or coil.	4. Replace.
	5. System shutdown by equipment protection devices	5. Determine type and cause of shutdown and correct it before restarting equipment.
	6. No cooling required	6. None. Wait until unit calls for cooling.
	7. Liquid line solenoid will not open	7. Repair or replace solenoid. Check wiring.
	8. Motor electrical trouble	8. Check motor for opens, shorts, or burnout.
	9. Loose wiring	9. Check all wire junctions. Tighten all terminal screws.
Compressor Noisy Or Vibrating	1. Low lift, inverted start	1. Control issues or condenser fan VFDs needed.
	2. Compressor running in reverse	2. Check unit and compressor for correct phasing.
	3. Improper piping or support on suction or discharge	3. Relocate, add, or remove hangers.
	4. Worn compressor isolator bushing	4. Replace.
	5. Compressor mechanical failure	5. Replace.
High Discharge Pressure	1. Noncondensables in system	1. Extract noncondensables with approved procedures or replace charge.
	2. Circuit overcharged with refrigerant	2. Remove excess, check liquid subcooling.
	3. Optional discharge shutoff valve not open	3. Open valve.
	4. Condenser fan control wiring not correct	4. Correct wiring.
	5. Fan not running	5. Check electrical circuit and fan motor.
	6. Dirty condenser coil	6. Clean coil.
	7. Air recirculation	7. Correct.
Low Suction Pressure	1. Rapid load swings	1. Stabilize load.
	2. Lack of refrigerant	2. Check for leaks, repair, add charge. Check liquid sight glass.
	3. Fouled liquid line filter drier	3. Check pressure drop across filter drier. Replace.
	4. Expansion valve malfunctioning	4. Repair or replace and adjust for proper superheat.
	5. Condensing temperature too low	5. Check means for regulating condenser temperature.
	6. Compressors not staging properly	6. See corrective steps - Compressor Staging Intervals Too Low.
	7. Insufficient water flow	7. Correct flow.
	8. Excess or wrong oil used	8. Recover or change oil
	9. Evaporator dirty	9. Back flush or clean chemically.

<b>PROBLEM</b>	<b>POSSIBLE CAUSES</b>	<b>POSSIBLE CORRECTIVE STEPS</b>
Compressor Will Not Stage Up	1. Defective capacity control	1. Replace.
	2. Faulty sensor or wiring	2. Replace.
	3. Stages not set for application	3. Adjust controller setting for application.
Compressor Staging Intervals Too Short	1. Control band not set properly	1. Adjust controller settings for application.
	2. Faulty water temperature sensor	2. Replace.
	3. Insufficient water flow	3. Correct flow.
	4. Rapid temperature or flow swings	4. Stabilize load.
	5. Oversized equipment	5. Evaluate equipment selection
	6. Chiller enabled with no load	6. Evaluate BAS sequence and settings
	7. Light loads	7. Evaluate need for HGBP or thermal inertia
Compressor Oil Level Too High Or Too Low	1. Oil hang-up in remote piping	1. Review refrigerant piping and correct.
	2. Low oil level	2. Verify superheat, add oil.
	3. Loose fitting on oil line	3. Repair.
	4. Level too high with compressor operating	4. Confirm correct superheat, remove oil.
	5. Insufficient water flow - Level too high	5. Correct flow, verify superheat.
	6. Excessive liquid in crankcase - Level too high	6. Check crankcase heater. Check liquid line solenoid valve operation.
	7. Short cycling	7. Stabilize load or correct control settings for application.
	8. HGBP valve oversize or improperly set-up	8. replace or adjust HGBP valve
	9. Expansion valve operation or selection	9. Confirm superheat at minimum and maximum load conditions
	10. Compressor mechanical issues	10. Replace compressor
	11. Wrong oil for application	11. Verify
Motor Overload Relays or Circuit Breakers Open	1. Voltage imbalance or out of range	1. Correct power supply.
	2. Defective or grounded wiring in motor	2. Replace compressor.
	3. Loose power wiring or burnt contactors	3. Check all connections and tighten, replace contactors.
	4. High condenser temperature	4. See corrective steps for High Discharge Pressure.
Compressor Thermal Protection Switch Open	1. Operating beyond design conditions	1. Correct so conditions are within allowable limits.
	2. Discharge valve not open	2. Open valve.
	3. Short cycling	3. Stabilize load or correct control settings for application
	4. Voltage range or imbalance	4. Check and correct.
	5. High superheat	5. Adjust to correct superheat.
	6. Compressor mechanical failure	6. Replace compressor.



**New Chiller Start-Up Form - Air-Cooled Scroll Compressor Equipment  
AGZ and AMZ**

This form must be completely filled out and returned to Daikin Applied (Warranty Department)  
within ten (10) days of start-up in order to comply with the terms of the Daikin **Limited Product Warranty**.  
Complete and mail to: Daikin Applied, Attn: Warranty Department, PO Box 2510, Staunton, VA 20042-2510  
Or email to: [stn.wty\\_startup\\_regi@DaikinApplied.com](mailto:stn.wty_startup_regi@DaikinApplied.com)

**JOB INFORMATION**

Job Name: _____  Start-Up Date: _____ No. of units at site: _____  Installation Address: _____	Daikin G.O.: _____  Daikin S.O.: _____  Purchasing Contractor Information: _____
--	--

**UNIT INFORMATION**

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

Component	Model Number	Serial Number
Compressor # 1:	_____	_____
Compressor # 2:	_____	_____
Compressor # 3:	_____	_____
Compressor # 4:	_____	_____
Compressor # 5:	_____	_____
Compressor # 6:	_____	_____

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

Before beginning, confirm that items on the Pre-Start Checklist have been completed and initial: \_\_\_\_\_  
*Note Discrepancies here or on Page 6.*

**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 level and isolators installed?	<input type="checkbox"/>	<input type="checkbox"/>
C. Does the unit meet all location, installation and service clearances per IOM Bulletin?	<input type="checkbox"/>	<input type="checkbox"/>
D. Are all fan fastener nuts on the fans tight?	<input type="checkbox"/>	<input type="checkbox"/>
E. Does electrical service correspond to unit nameplate?	<input type="checkbox"/>	<input type="checkbox"/>
Nameplate: Volts _____ Hertz _____ Phase _____		
F. Has electrical service been checked for proper phasing at each circuit power terminal block?	<input type="checkbox"/>	<input type="checkbox"/>
G. Has unit been properly grounded and all field wiring confirmed to unit electrical specifications?	<input type="checkbox"/>	<input type="checkbox"/>
H. Has a fused disconnect and fuses or breaker been sized per product manual and installed per local code?	<input type="checkbox"/>	<input type="checkbox"/>
Number of conduits _____ Number of Wires _____ Wire Size _____		
I. Are all electrical power connections tight?	<input type="checkbox"/>	<input type="checkbox"/>
J. Have compressor crankcase heaters been operating for 24 hours prior to start-up?	<input type="checkbox"/>	<input type="checkbox"/>
K. Does all field wiring conform to unit electrical specifications?	<input type="checkbox"/>	<input type="checkbox"/>
L. Are all service and liquid line valves per the IOMM in correct position?	<input type="checkbox"/>	<input type="checkbox"/>
M. Water Strainer installed? Braze Plate Evaporator 0.063" (1.6mm) or smaller perforations	<input type="checkbox"/>	<input type="checkbox"/>
N. Has a flow switch been installed per the IOM manual?	<input type="checkbox"/>	<input type="checkbox"/>
O. Has the chill water circuit been cleaned, flushed, and water treatment confirmed?	<input type="checkbox"/>	<input type="checkbox"/>
P. Does the chiller water piping conform to the IOM manual?	<input type="checkbox"/>	<input type="checkbox"/>
Q. Are fans properly aligned and turn freely?	<input type="checkbox"/>	<input type="checkbox"/>
R. Is wind impingement against the air-cooled condenser a consideration?	<input type="checkbox"/>	<input type="checkbox"/>
S. Are the condenser coils coated?	<input type="checkbox"/>	<input type="checkbox"/>

Description of unit location with respect to building structures. Include measured distances.

**Description:**

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**REFRIGERANT PIPING FOR REMOTE EVAPORATOR APPLICATIONS**

	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. Reviewed and confirmed piping is per the approved SF-99006 form submitted to the factory?	<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 a liquid line solenoid installed correctly in each circuit?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
G. Is Expansion Valve and associated sensors installed, insulated and wired correctly? (Including Entering water and Leaving water sensors)		<input type="checkbox"/>	<input type="checkbox"/>

**DESIGN CONTROLS**

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

B. CONDENSER  
 Design Ambient Temperatures: Entering \_\_\_\_\_ °F (°C)    Leaving \_\_\_\_\_ °F (°C)  
 Minimum Ambient Temperatures: Entering \_\_\_\_\_ °F (°C)    Leaving \_\_\_\_\_ °F (°C)

**START-UP**

	Yes	No
A. Does unit start and perform per sequence of operation as stated in the IOM 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?**

	MicroTech	Verification
C. Water Temperatures: Leaving Evaporator .....	_____ °F (°C)	_____ °F (°C)
Entering Evaporator .....	_____ °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)  
 Subcooling ..... °F (°C)  
 Discharge Temperature ..... °F (°C)

H. Ambient 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 freeze protection, low pressure devices and settings  Yes  No  
 been adjusted for the actual job requirements? **Detail these settings on page 6 - Remarks section**

**Note: See operation manual for low temperature on ice bank applications.**

K. Unit Voltage Across Each Phase: L1-L2 \_\_\_\_\_ V L2-L3 \_\_\_\_\_ V L1-L3 \_\_\_\_\_ V

L. Unit Current Per Phase: L1 amps \_\_\_\_\_ L2 amps \_\_\_\_\_ L3 amps \_\_\_\_\_

M. 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..... \_\_\_\_\_ °F (°C)
- 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 = \_\_\_\_\_

**VIII. GENERAL**

- |   | <b>YES</b>               | <b>NO</b>                |
|---|--------------------------|--------------------------|
| 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"/> |
| C. Has the chiller been leak tested? Detail refrigerant leaks and repairs below ..... | <input type="checkbox"/> | <input type="checkbox"/> |

Refrigerant Leaks:

Repairs Made

Items not installed per IOM 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**





**DAIKIN APPLIED AMERICAS INC.  
LIMITED PRODUCT WARRANTY  
(North America)**

Daikin Applied Americas Inc. dba Daikin Applied (“Company”) warrants to contractor, purchaser and any owner of the product (collectively “Owner”) that Company, at its option, will repair or replace defective parts in the event any product manufactured by Company, including products sold under the brand name Daikin and used in the United States or Canada, proves defective in material or workmanship within twelve (12) months from initial startup or eighteen (18) months from the date shipped by Company, whichever occurs first. Authorized replaced parts are warranted for the duration of the original warranty. All shipments of such parts will be made FOB factory, freight prepaid and allowed. Company reserves the right to select carrier and method of shipment.

In addition, labor to repair or replace warranty parts is provided during Company normal working hours on products with rotary screw compressors and centrifugal compressors. Warranty labor is not provided for any other products.

Company’s liability to Owner under this warranty shall not exceed the lesser of the cost of correcting defects in the products sold or the original purchase price of the products.

PRODUCT STARTUP ON CENTRIFUGAL AND SCREW COMPRESSOR PRODUCTS IS MANDATORY and must be performed by a Daikin Applied or a Company authorized service representative.

It is Owner’s responsibility to complete and return the Registration and Startup Forms accompanying the product to Company within ten (10) days of original startup. If this is not done, the ship date and the startup date will be deemed the same for warranty period determination, and this warranty shall expire twelve (12) months from that date.

**EXCEPTIONS**

1. If free warranty labor is available as set forth above, such free labor does not include diagnostic visits, inspections, travel time and related expenses, or unusual access time or costs required by product location.
2. Refrigerants, fluids, oils and expendable items such as filters are not covered by this warranty.
3. This warranty shall not apply to products or parts which (a) have been opened, disassembled, repaired, or altered by anyone other than Company or its authorized service representative; or (b) have been subjected to misuse, negligence, accidents, damage, or abnormal use or service; or (c) have been operated, installed, or startup has been provided in a manner contrary to Company’s printed instructions, or (d) were manufactured or furnished by others and which are not an integral part of a product manufactured by Company; (e) have been exposed to contaminants, or corrosive agents, chemicals, or minerals, from the water supply source, or (f) have not been fully paid for by Owner.

**ASSISTANCE**

To obtain assistance or information regarding this warranty, please contact your local sales representative or a Daikin Applied office.

**SOLE REMEDY**

**THIS WARRANTY CONSTITUTES THE OWNER’S SOLE REMEDY. IT IS GIVEN IN LIEU OF ALL OTHER WARRANTIES. THERE IS NO IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. IN NO EVENT AND UNDER NO CIRCUMSTANCE SHALL COMPANY BE LIABLE FOR INCIDENTAL, INDIRECT, SPECIAL, CONTINGENT OR CONSEQUENTIAL DAMAGES, WHETHER THE THEORY BE BREACH OF THIS OR ANY OTHER WARRANTY, NEGLIGENCE OR STRICT LIABILITY IN TORT.**

No person (including any agent, sales representative, dealer or distributor) has the authority to expand the Company’s obligation beyond the terms of this express warranty or to state that the performance of the product is other than that published by Company.

For additional consideration, Company will provide an extended warranty(ies) on certain products or components thereof. The terms of the extended warranty(ies) are shown on a separate extended warranty statement.







### ***Daikin Applied Training and Development***

Now that you have made an investment in modern, efficient Daikin Applied equipment, its care should be a high priority. For training information on all Daikin Applied HVAC products, please visit us at [www.DaikinApplied.com](http://www.DaikinApplied.com) and click on Training, or call 540-248-9646 and ask for the Training Department.

### ***Warranty***

All Daikin Applied equipment is sold pursuant to its standard terms and conditions of sale, including Limited Product Warranty. Consult your local Daikin Applied representative for warranty details. To find your local Daikin Applied representative, go to [www.DaikinApplied.com](http://www.DaikinApplied.com).

### ***Aftermarket Services***

To find your local parts office, visit [www.DaikinApplied.com](http://www.DaikinApplied.com) or call 800-37PARTS (800-377-2787). To find your local service office, visit [www.DaikinApplied.com](http://www.DaikinApplied.com) or call 800-432-1342.

This document contains the most current product information as of this printing. For the most up-to-date product information, please go to [www.DaikinApplied.com](http://www.DaikinApplied.com).

Products manufactured in an ISO Certified Facility.