DAIKIN

Installation, Operation, and Maintenance Manual

IOM 1206-6

Group: **Chiller**

Part Number: **IOM1206-6**

Date: **December 2015**

Trailblazer™ Air-Cooled Scroll Chillers

Model AGZ, E Vintage
30 to 240 Tons (100 to 840 kW)
HFC-410A Refrigerant
50/60 Hz

People and ideas you can trust.™

Manufactured in an ISO 9001 & ISO 14001 certified facility

DAIKIN

Pre-Start Checklist – Scroll Compressor Chillers

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

Job Name	
Installation Location	
Customer Order Number	
Model Number(s)	
G.O. Number(s)	

Chilled Water	Yes	No	N/A	Initials
Piping Complete				
Water strainer : Shell & Tube Evaporators 0.125”(3.175mm) or smaller perforations				
Brazed Plate Evaporator 0.063” (1.6mm) or smaller perforations				
Water System filled, flushed and vented				
Pumps installed and operational (rotation checked, strainers cleaned)				
Controls operational (3-way valves, face/bypass dampers, bypass valves, etc.)				
Water system operated and tested; flow meets unit design requirements				
Flow switch installed and wired				
Vent installed on evaporator				
Glycol at design %				
Electrical	**Yes**	**No**	**N/A**	**Initials**
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				
Oil heaters energized at least 24 hours before startup				
Chiller components (EXV Sensors Transducers) installed and wired properly.				
*Wiring complies with National Electrical Code and local codes (See Notes)				
Remote EXV wired with shielded cable				
Miscellaneous	**Yes**	**No**	**N/A**	**Initials**
Unit control switches all off				
Remote Evaporator /Condenser Piping 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				
Document Attached: Technical Breakdown from Selection Software				
Document Attached: Final Order Acknowledgement				
Document Attached: Remote piping approval				

Notes: 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 NEC Article 430-22 (a)

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: ____________________

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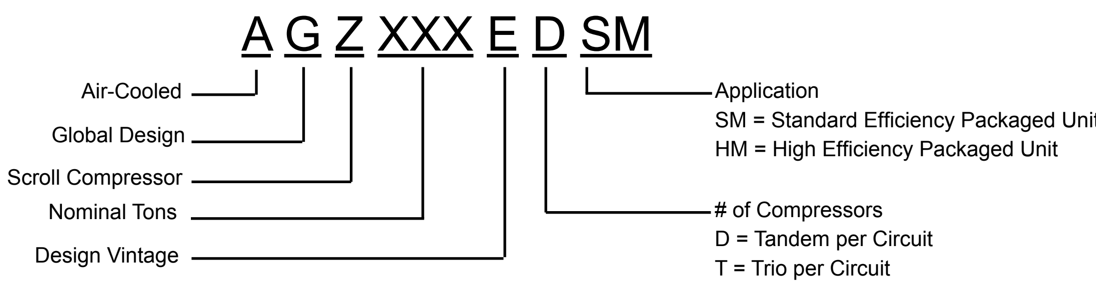
General Description

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

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

NOMENCLATURE



⚠ WARNING

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

⚠ CAUTION

Sharp edges on unit and coil surfaces are a potential hazard to personal safety. Avoid contact with them.

Additional Manual

This manual covers the installation, of dual circuit, AGZ-EH packaged, scroll compressor chillers using R-410A.

Information for units with either the pump package or remote evaporator options can be found at www.DaikinApplied.com.

Inspection

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

Handling

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

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 the condenser coils or cabinet (see Figure 2).

⚠ CAUTION

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

Figure 1: Suggested Pushing Arrangment

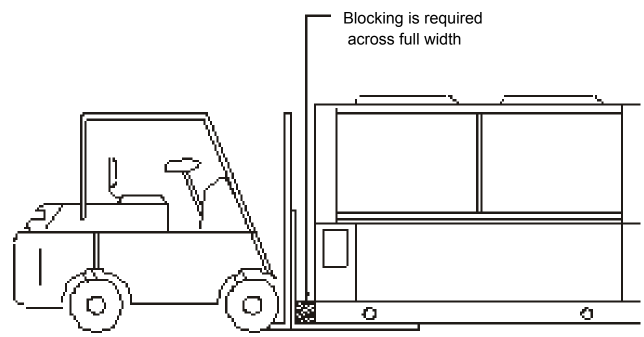
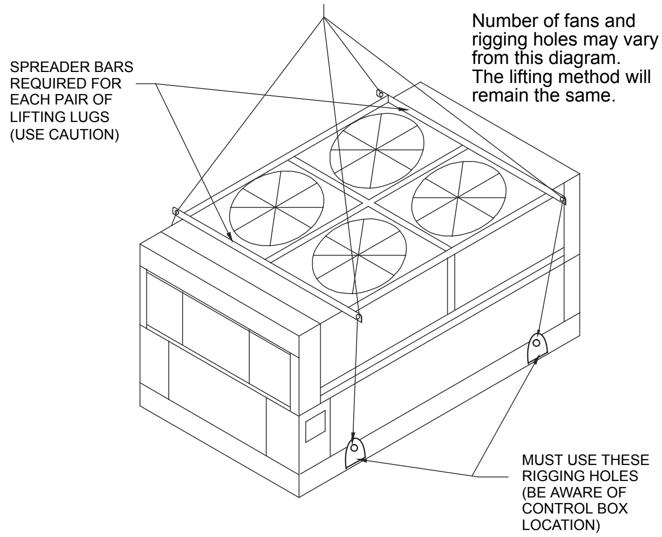


Figure 2: Required Lifting Arrangement



⚠ DANGER

Do not stand beneath the unit while it is being lifted or installed.

Operating and Standby Limits

Table 1: Operating Limits

Maximum standby ambient temperature	131°F (55°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)

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. For ground level applications, install the unit on a substantial base that will not settle. Use a one-piece concrete slab with footings extended below the frost line. Be sure the foundation is level within 0.5" (13 mm) over its length and width. The foundation must be strong enough to support the unit weight - see "Dimensions and Weights - Packaged Units" on page 15.

Service Clearance

__Sides__

- **30-70 Ton Models:** Minimum of 4 feet (1.2 meters)
- **75-240 Ton Models:** It is highly recommended to provide a minimum of 8 feet (2.4 meters) on one side to allow for coil replacement. Coils can be removed from the top, allowing a minimum of 4 feet (1.2 meters) of side clearance; however, the unit performance may be derated.

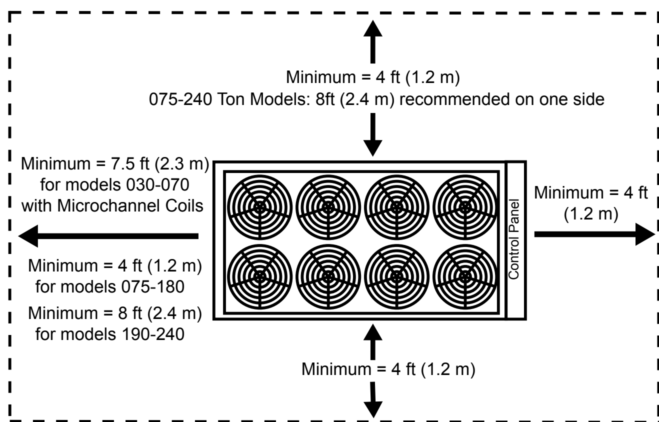
__Control Panel End__

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

__Opposite Control Panel End__

- **30-70 Ton Models with Microchannel Coils:** Minimum of 7.5 feet (2.3 meters)
- **75-180 Ton Models:** Minimum of 4 feet (1.2 meters)
- **190-240 Ton Models:** Minimum of 8 feet (2.4 meters) for evaporator removal

Figure 3: Service Clearance



Spacing Requirements

Sufficient clearance must be maintained between the unit and adjacent walls or other units to allow the required unit air flow to reach the coils. Failure to do so will result in a capacity reduction and an increase in power consumption. No solid obstructions are allowed above the unit at any height, see page 7 for details.

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 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.

Case 1: Building or Wall on One Side of Unit

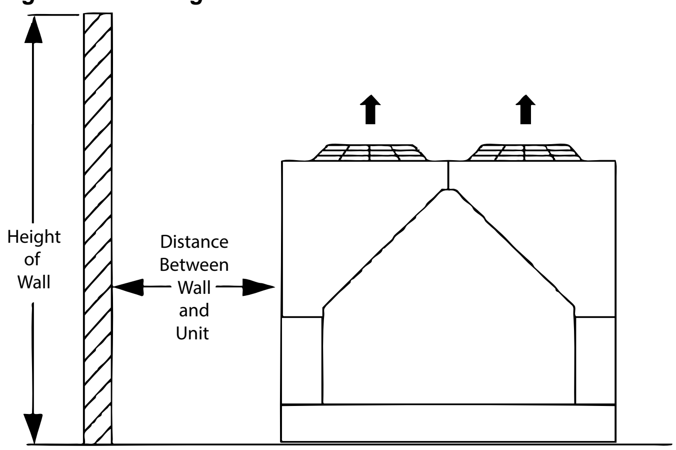
NOTE: Assumes a solid height wall taller than unit. Refer to Case 4 for partial wall openings.

For models AGZ030-100E, 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 AGZ140-240E, 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 190-210, 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

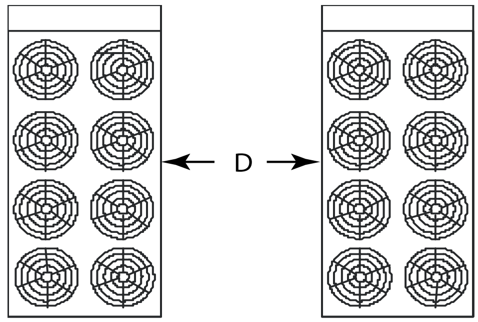


Figure 6: Case 2 - Full Load Capacity Reduction

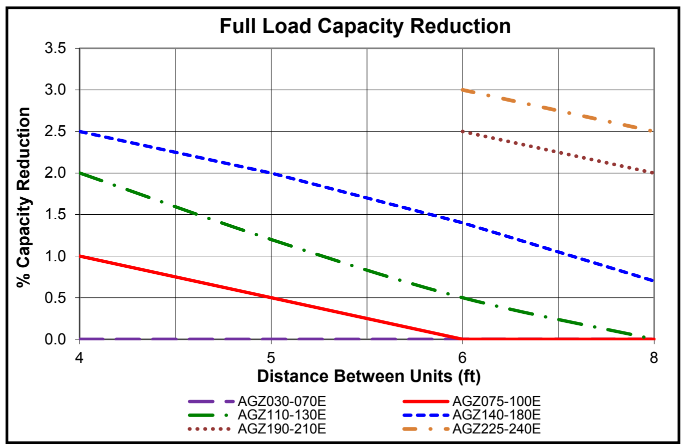
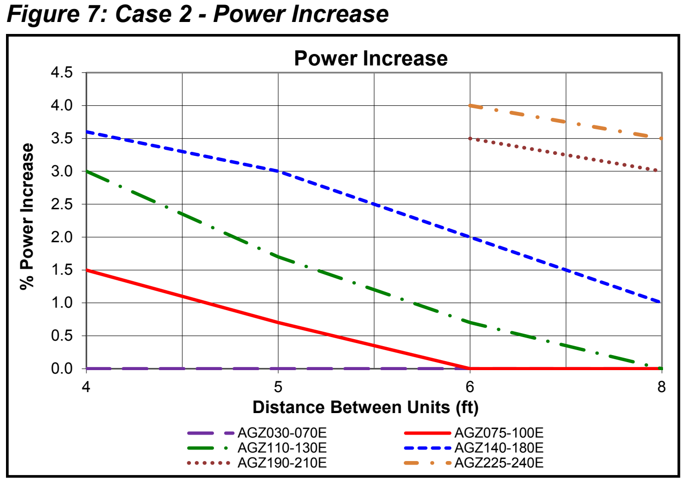


Figure 7: Case 2 - Power Increase



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 070 - 4 feet, models 075 to 100 - 5 feet, models 110 to 240 - 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

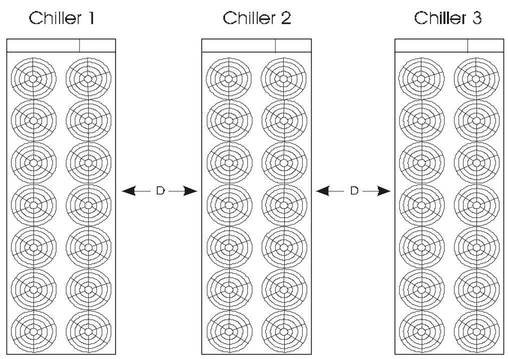


Figure 9: Case 3 - Full Load Capacity Reduction

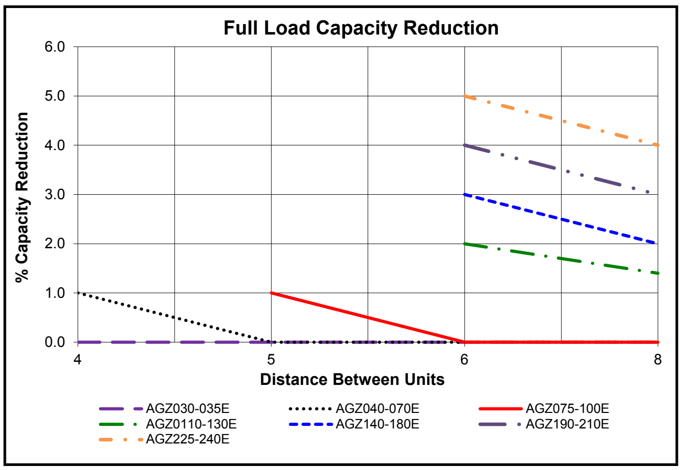
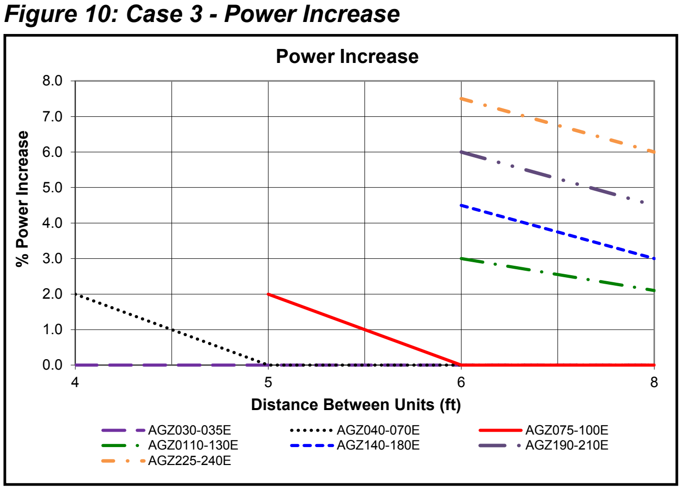


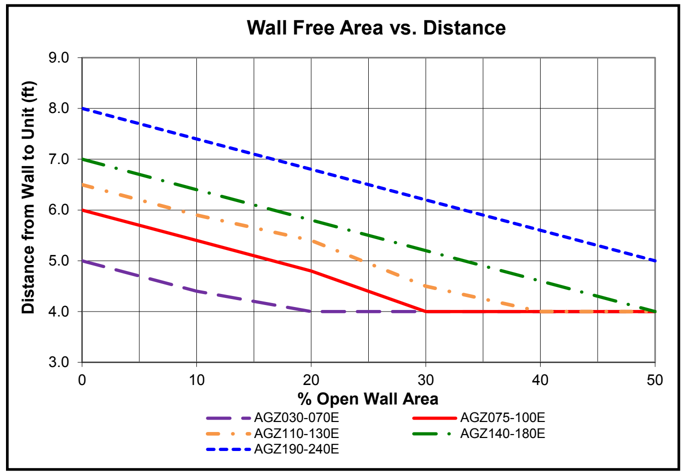
Figure 10: Case 3 - Power Increase



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 AGZ030-070E:

The Case 5 figures for models AGZ030-070E show adjustment factors for pit/wall heights of 4 feet, 5 feet, and 6 feet.

Figure 12: Case 5 - Full Load Capacity Reduction (AGZ030E-070E)

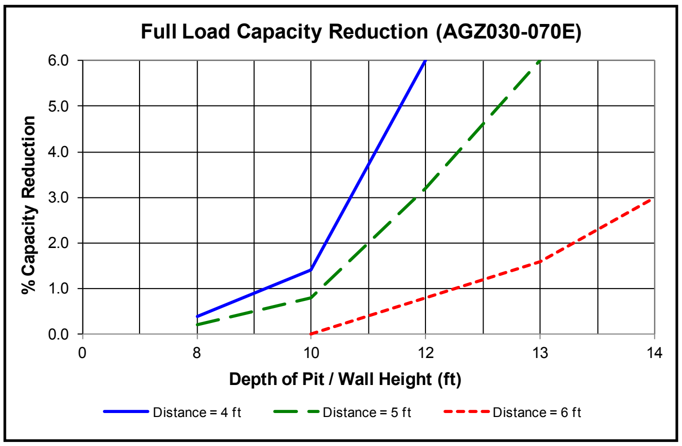


Figure 13: Case 5 - Power Increase (AGZ030-070E)

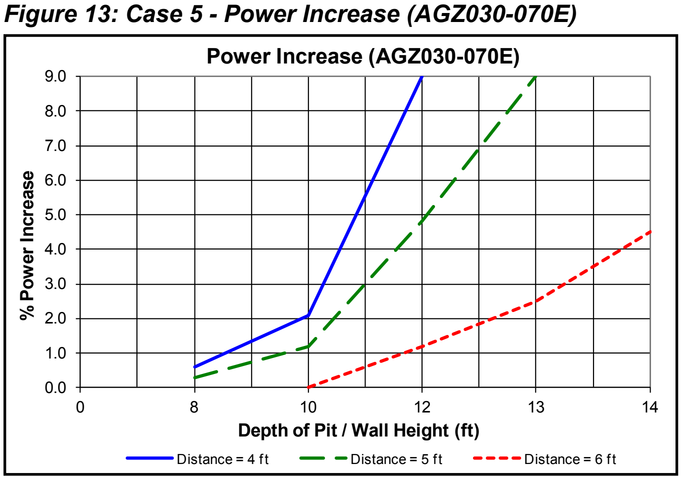
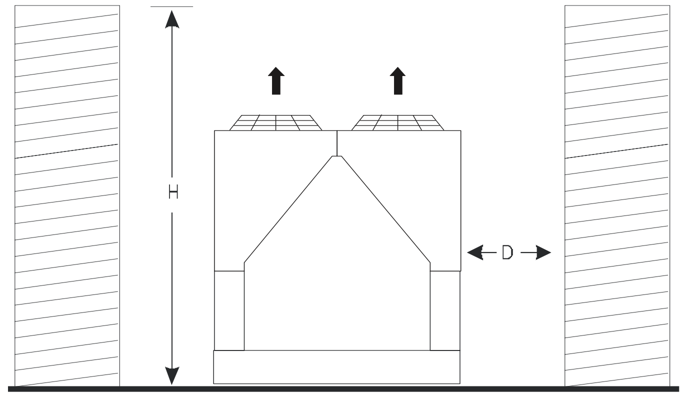


Figure 14: Case 5 - Pit Installation



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)

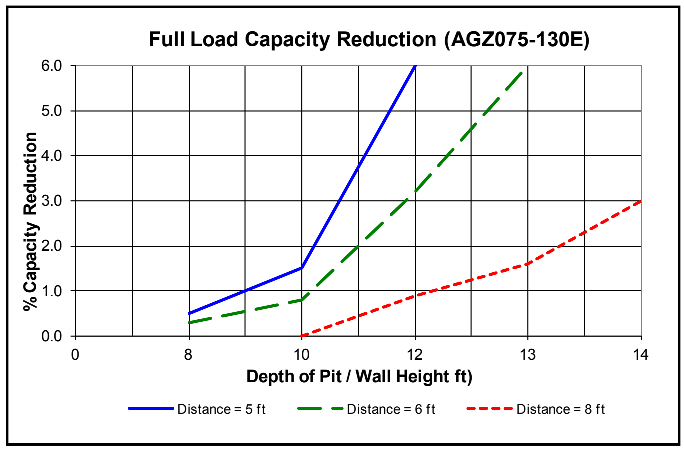
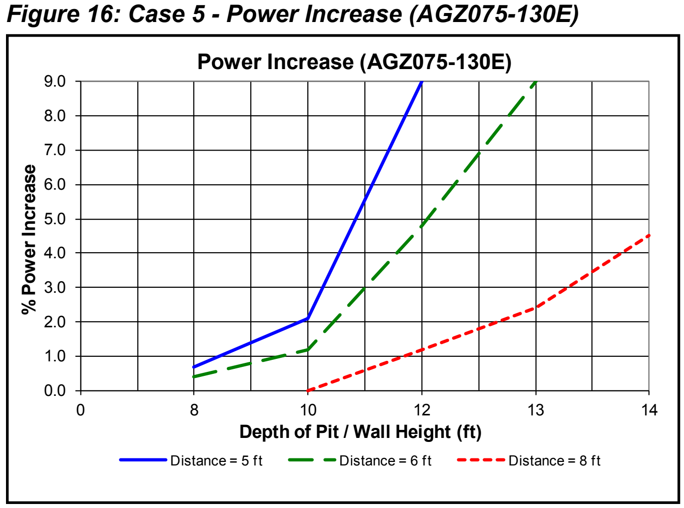


Figure 16: Case 5 - Power Increase (AGZ075-130E)



Models AGZ140-240E:

The Case 5 figures for models AGZ140-240E 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)

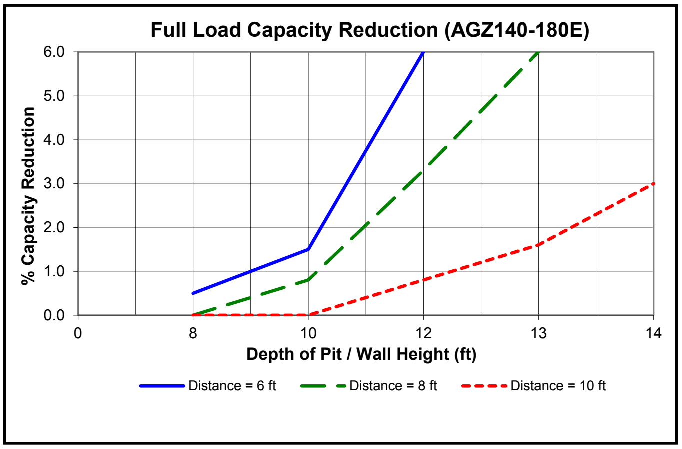


Figure 18: Case 5 - Full Load Capacity Reduction (AGZ190-240E)

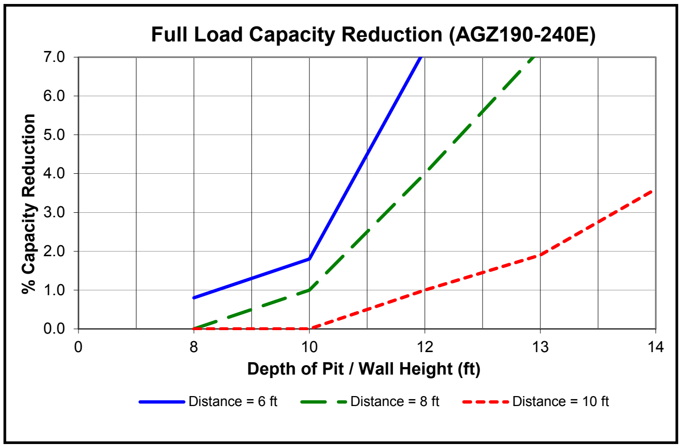


Figure 19: Case 5 - Power Increase (AGZ140-210E)

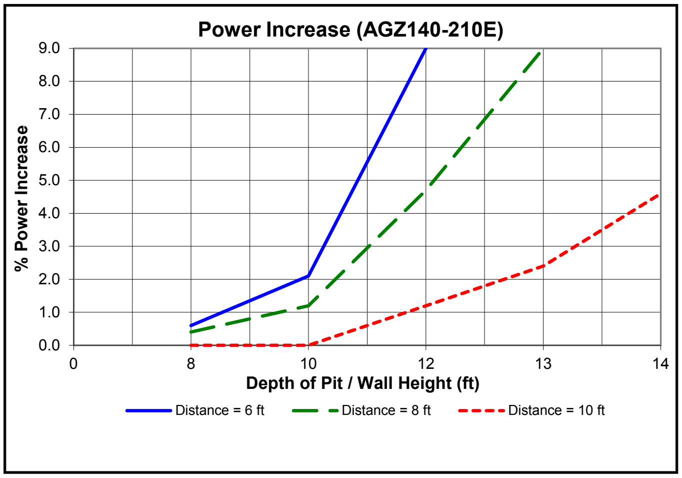
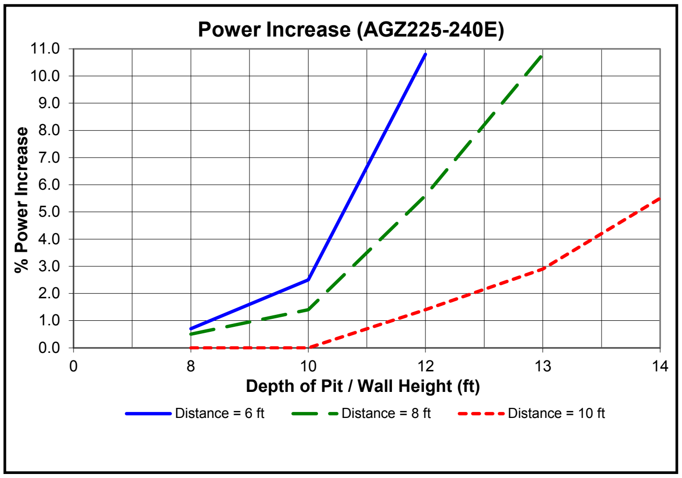


Figure 20: Case 5 - Power Increase (AGZ225-240E)



Chilled Water Piping

⚠ CAUTION

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

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

- A cleanable strainer installed at the water inlet to the evaporator to remove debris and impurities before they reach the evaporator. Install cleanable strainer within 5 feet (1500 mm) of pipe length from the evaporator inlet connection and downstream of any welded connections (no welded connections between strainer and evaporator).
- AGZ-E models 030-180 require a strainer with perforations no larger than 0.063" (1.6 mm) diameter and models 190-240 require a strainer with perforations no larger than 0.125" (3.175 mm) diameter. See the Inlet Strainer Guidelines on page 10 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 12 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, independent from the unit, to eliminate weight and strain on the fittings and connections.

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

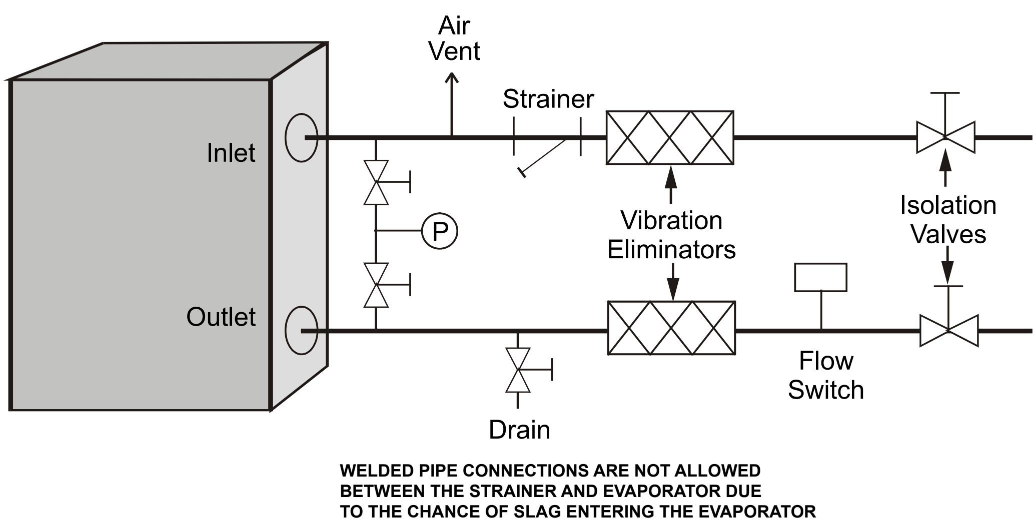
- Thermometers at the inlet and outlet connections of the evaporator.
- Water pressure gauge connection taps and gauges at the inlet and outlet connections of the evaporator for measuring water pressure drop.
- Shutoff valves are necessary to isolate the unit from the piping during unit servicing.
- Minimum bends and changes in elevation to minimize pressure drop.
- An expansion tank or regulating valve to maintain adequate water pressure
- 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.

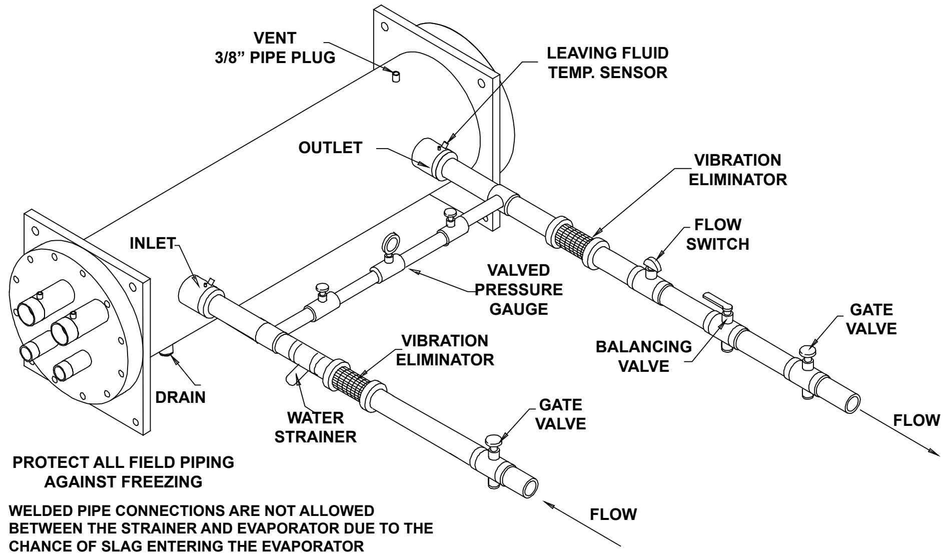
⚠ WARNING

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

Figure 21: Typical Piping, Brazed-Plate Evaporator



Typical Piping, Shell and Tube 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 180.
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, Victaulic pipe connections and strainer cap [a strainer with perforations no larger than 0.063" (1.6 mm) diameter for AGZ-E models 030-180, a strainer with perforations no larger than 0.125" (3.175 mm) diameter for AGZ-E models 190-240].
   - 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. Connection sizes are given in the Dimensions and Weights section on page 15.

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

Table 2: Strainer Data

Trailblazer™ Model	Strainer Size in (mm)	Minimum perforation size in (mm)	Factory Installed Option	Field Installed Option
030-070E	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
190-240E	8.0 (203)	0.125 (3.175)	N	Y

Figure 22: Factory Installed Strainer

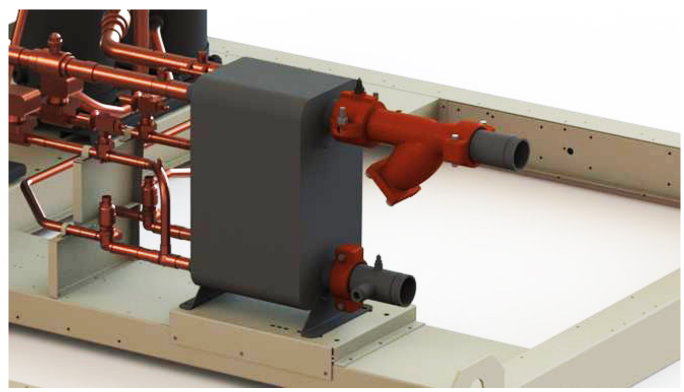
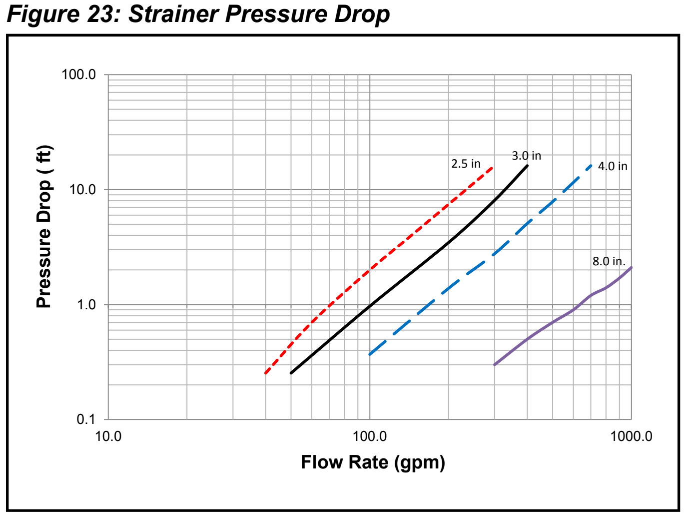


Figure 23: Strainer Pressure Drop



Water Flow Limitations

Constant Evaporator Flow

The evaporator flow rates and pressure drops shown on page 28 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 11 on page 28. 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 unit set point information in See Variable Evaporator Flow on page 56

System Water Volume 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”.

BAS should enable chiller only when there is a cooling demand.

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 through 180 have an external plate heater and thermostat. Models 190 through 240 have immersion heaters with a 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 30 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. If the percentage of glycol is high, or if propylene is used instead of ethylene glycol, the added pressure drop and loss of performance could be substantial. When Glycol or Ice are selected as Unit Mode, the MicroTech® III control will automatically reset the available range for the Leaving Water Temperature, Freezestat and Evaporator Pressure settings.

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. he 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 30.

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

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

1. If any device other than the chiller attempts to start the chiller without first starting the pump, the chiller will lock out on the No Flow alarm and require 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 or shell and tube immersion 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 ant to shut the unit down if there isn't. There are two options for meeting this requirement.

1. A factory-mounted thermal dispersion flow switch.
2. A "paddle" type flow switch is available from Daikin Applied for field mounting and wiring. Wire from switch terminals Y and R to the unit control panel terminals shown on the field wiring diagrams, page 30 and page 31. 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 28.

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

Glycol Solutions

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

$$\text{Glycol Flow Rate (gpm)} = \frac{\text{Capacity Tons}}{0.00429 \times \Delta T} \times \text{Flow Correction Factor}$$

1. **Capacity** - Multiply the capacity based on water by the Capacity correction factor from Table 3 or Table 4.
2. **Flow** - Multiply the water evaporator flow by the Flow correction factor from Table 3 or Table 4 to determine the increased evaporator flow due to glycol. If the flow is unknown, it can be calculated from the above equation.
3. **Pressure drop** - Multiply the water pressure drop from Table 11 by Pressure Drop correction factor from Table 3 or Table 4. High concentrations of propylene glycol at low temperatures may cause unacceptably high pressure drops.
4. **Power** - Multiply the water system power by Power correction factor from Table 3 or Table 4.

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

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

⚠ CAUTION

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

Table 3: Ethylene Glycol Factors

E.G.	Freeze Point		Cap	Power	Flow	PD
%	°F	°C				
10	26	-3.3	0.997	0.999	1.028	1.090
20	18	-7.8	0.993	0.997	1.059	1.216
30	7	-14	0.987	0.995	1.094	1.379
40	-7	-22	0.981	0.993	1.132	1.557
50	-28	-33	0.972	0.990	1.174	1.811

Table 4: Propylene Glycol Factors

P.G.	Freeze Point		Cap	Power	Flow	PD
%	°F	°C				
10	26	-3.3	0.995	0.998	1.011	1.025
20	19	-7.2	0.988	0.995	1.030	1.150
30	9	-13	0.979	0.992	1.056	1.375
40	-5	-21	0.968	0.988	1.090	1.701
50	-27	-33	0.955	0.983	1.131	2.128

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 Daikin Tools to ensure chiller is capable of the required lift.

Condenser Coil Options and Coating Considerations

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

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

Aluminum fin/copper tube coils consist of 3/8 inch (10 mm) seamless copper tubes mechanically bonded into plate-type aluminum fins. The fins have full drawn collars to completely cover the tubes. The aluminum fin/copper tube option is best suited for non-corrosive environments, and can be repaired onsite. This option is only available for models AGZ030-070E.

Figure 24: Aluminum Fin/Copper Tube Coils

BlackFin™ coils include aluminum fins pre-coated with a durable phenolic epoxy coating. In addition to providing a durable coating on the fin material, the BlackFin™ coils provide and epoxy barrier between the aluminum fin stock and the copper tube, to prevent the galvanic corrosion that can occur between the dissimilar metals. This option will provide a 1000+ hour salt spray rating per ASTM B117-90. The BlackFin™ option provides enhanced protection in mildly corrosive environments. This option is only available for models AGZ030-070E.

Copper-fin coils consist of 3/8 inch (10 mm) seamless copper tubes mechanically bonded into plate-type copper fins. The fins have full drawn collars to completely cover the tubes. Since the fin and the tube materials are similar, the opportunity for galvanic corrosion is eliminated. The copper fin/copper tube option may be used in marine environments; however this option is not well suited for industrial or chemical atmospheric contamination. This option is only available for models AGZ030-070E.

ElectroFin® coil coating is a water-based extremely flexible and durable epoxy polymer coating uniformly applied to all coil surfaces through a multi-step, submerged electrostatic coating process. ElectroFin® condenser coils provide a 5000+ hour salt spray resistance per ASTM B117-90, applied to both the coil and the coil frames. The ElectroFin® 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. This coating option may be applied to any of the untreated coil options offered, to provide excellent longevity and resistance to corrosion.

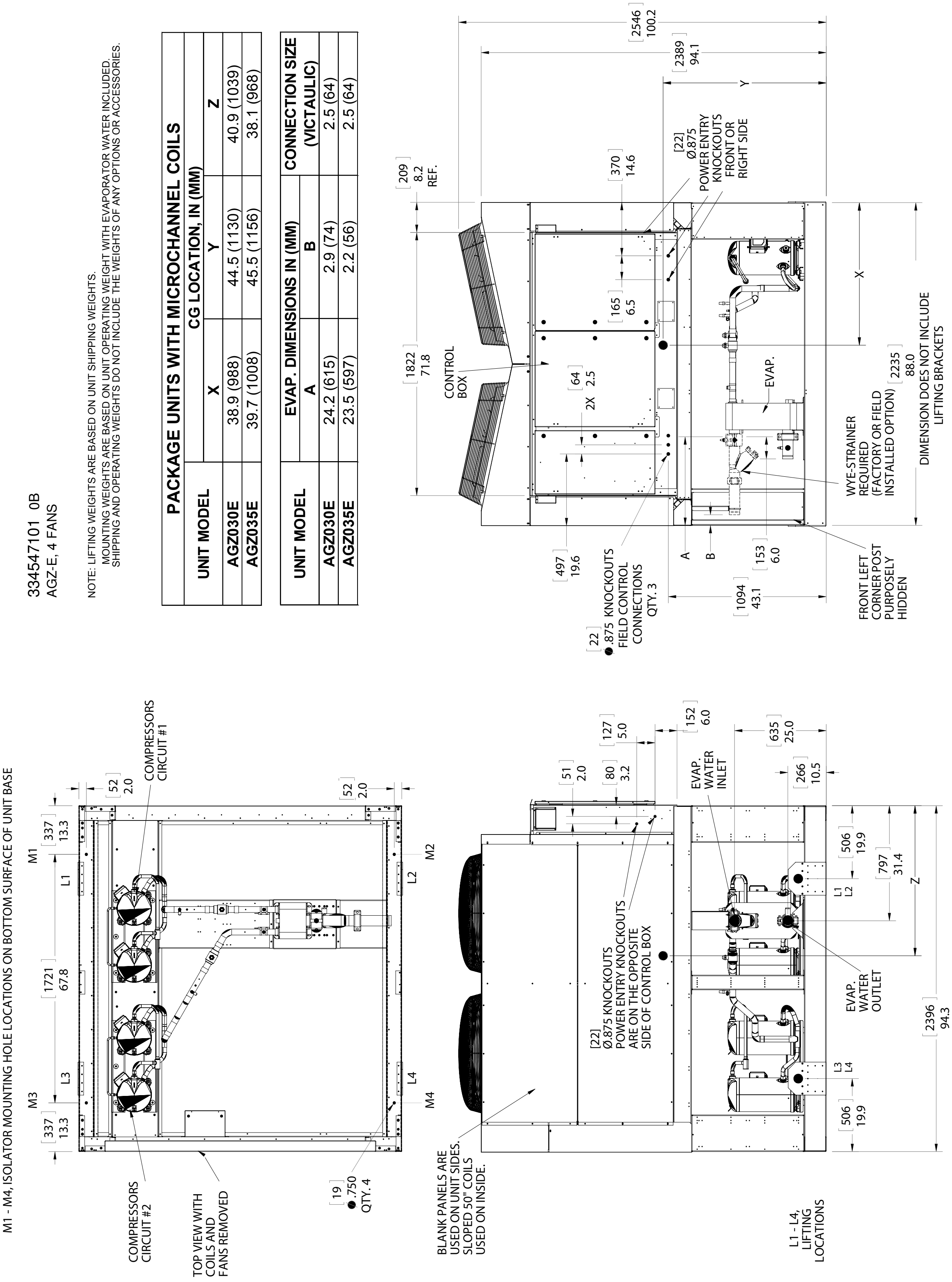
Table 5: Coil/Coating Selection Matrix

Coil Option	Non-Corrosive[1]	Unpolluted Marine[2]	Industrial[3]	Combined Marine-Industrial[4]
Standard Microchannel	+++	-	-	-
Alum. Fin/Copper Tube[5]	+++	-	-	-
Copper Fin/Copper Tube[5]	+++	+++	-	-
BlackFin™[5]	+++	+	+	-
ElectroFin®	+++	+++	+++	++

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.
5. Available for models AGZ030-070E only.

Figure 25: AGZ030E - AGZ035E



334547101 0B
AGZ-E, 4 FANS

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

PACKAGE UNITS WITH MICROCHANNEL COILS

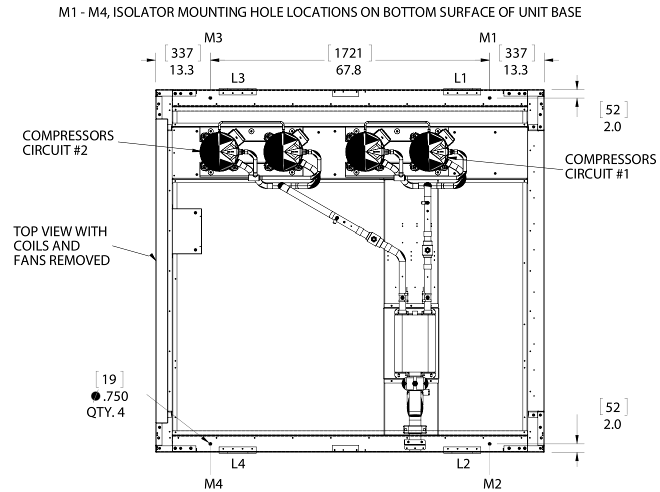
UNIT MODEL	CG LOCATION, IN (MM)		
	X	Y	Z
AGZ030E	38.9 (988)	44.5 (1130)	40.9 (1039)
AGZ035E	39.7 (1008)	45.5 (1156)	38.1 (968)

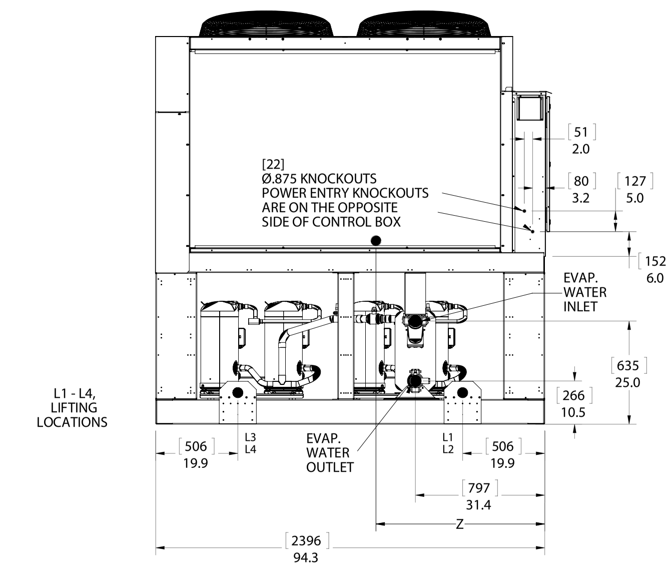
UNIT MODEL	EVAP. DIMENSIONS IN (MM)		CONNECTION SIZE (VICTAULIC)
	A	B	
AGZ030E	24.2 (615)	2.9 (74)	2.5 (64)
AGZ035E	23.5 (597)	2.2 (56)	2.5 (64)

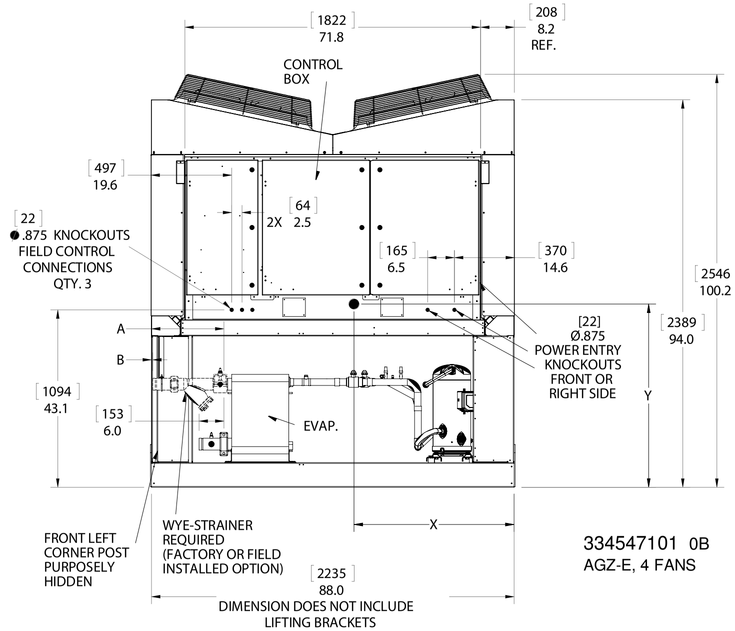
PACKAGE UNITS WITH MICROCHANNEL COILS

UNIT MODEL	SHIPPING WEIGHT	OPERATING WEIGHT	LIFTING (SHIPPING) WEIGHT BY CORNER LBS (KG)				MOUNTING (OPERATING) WEIGHT LBS (KG)			
	LBS (KG)	LBS (KG)	L1	L2	L3	L4	M1	M2	M3	M4
AGZ030E	2947 (1337)	2960 (1343)	1011 (459)	799 (362)	635 (288)	502 (228)	980 (445)	775 (352)	673 (305)	532 (241)
AGZ035E	2873 (1303)	2887 (1310)	1051 (477)	861 (391)	528 (240)	433 (196)	1005 (456)	824 (374)	581 (264)	476 (216)

Figure 26: AGZ040E - AGZ070E







PACKAGE UNITS WITH MICROCHANNEL COILS

UNIT MODEL	CG LOCATION, IN (MM)		
	X	Y	Z
AGZ040E	39.8 (1011)	45.9 (1166)	38.4 (975)
AGZ045E	38.9 (988)	44.5 (1130)	41.2 (1047)
AGZ050E	39.1 (993)	44.9 (1141)	41.2 (1047)
AGZ055E	39.1 (993)	44.8 (1138)	41.2 (1047)
AGZ060E	39.2 (996)	44.6 (1133)	41.1 (1044)
AGZ065E	39.2 (996)	44.6 (1133)	41.1 (1044)
AGZ070E	36.8 (935)	41.8 (1062)	42.6 (1082)

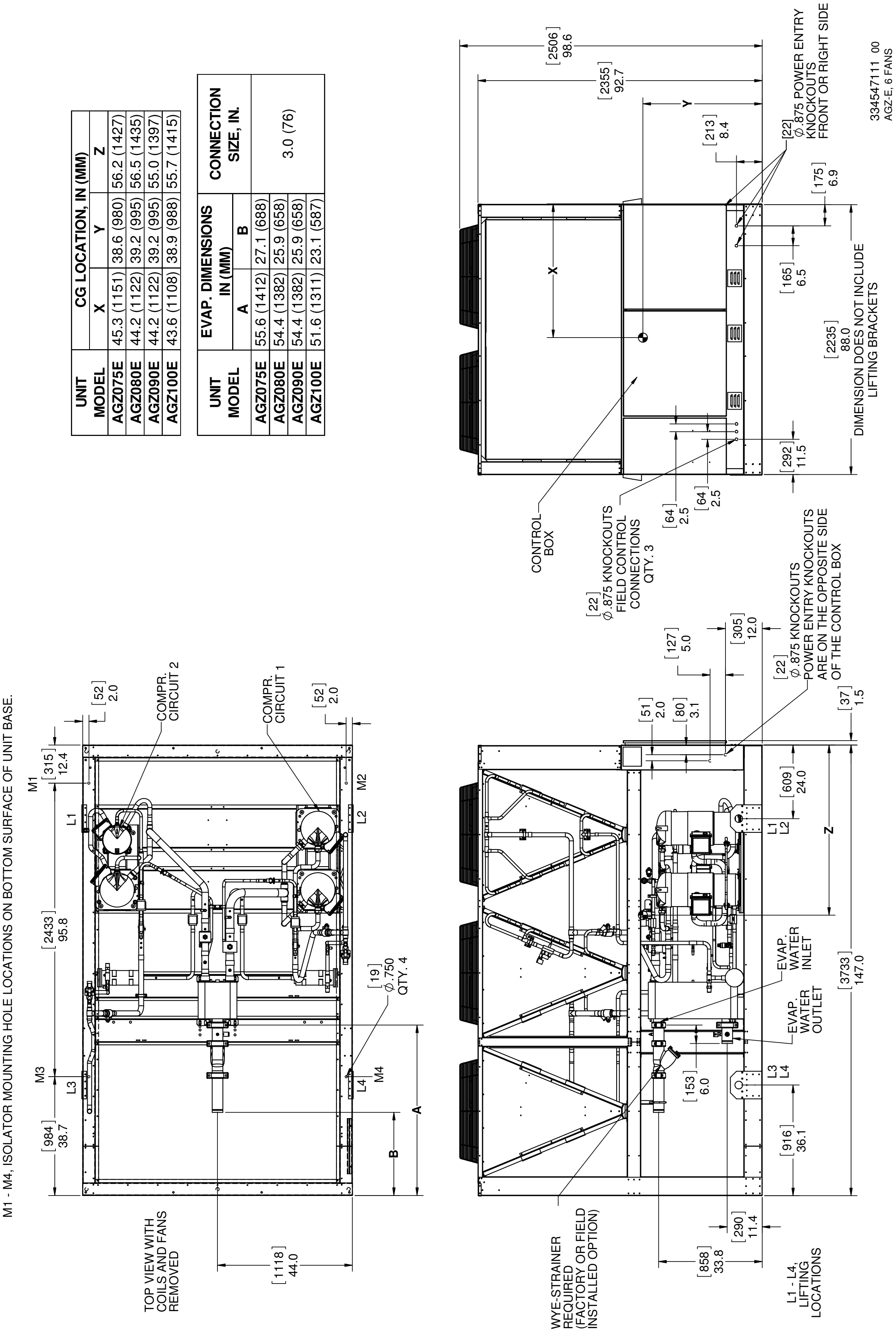
UNIT MODEL	EVAP. DIMENSIONS IN (MM)		CONNECTION SIZE
	A	B	(VICTAULIC)
AGZ040E	22.8 (579)	1.5 (38)	2.5 (64)
AGZ045E	21.4 (544)	0.11 (3)	2.5 (64)
AGZ050E	20 (508)	2.7 (69)	2.5 (64)
AGZ055E	19.3 (490)	2.0 (51)	2.5 (64)
AGZ060E	17.6 (447)	0.3 (8)	2.5 (64)
AGZ065E	17.6 (447)	0.3 (8)	2.5 (64)
AGZ070E	17.6 (447)	0.3 (8)	2.5 (64)

PACKAGE UNITS WITH MICROCHANNEL COILS

UNIT MODEL	SHIPPING WEIGHT	OPERATING WEIGHT	LIFTING (SHIPPING) WEIGHT BY CORNER LBS (KG)				MOUNTING (OPERATING) WEIGHT LBS (KG)			
	LBS (KG)	LBS (KG)	L1	L2	L3	L4	M1	M2	M3	M4
AGZ040E	2948 (1337)	2964 (1345)	1067 (484)	881 (400)	548 (249)	453 (206)	1022 (464)	844 (383)	601 (273)	496 (225)
AGZ045E	3094 (1403)	3112 (1412)	1051 (477)	832 (377)	676 (307)	535 (243)	1021 (463)	809 (367)	715 (324)	567 (257)
AGZ050E	3093 (1403)	3114 (1413)	1049 (476)	837 (380)	671 (304)	536 (243)	1020 (463)	814 (369)	712 (323)	568 (258)
AGZ055E	3106 (1409)	3128 (1419)	1052 (477)	840 (381)	675 (306)	539 (245)	1023 (464)	817 (371)	716 (325)	572 (260)
AGZ060E	3130 (1420)	3155 (1431)	1059 (480)	851 (386)	676 (307)	543 (246)	1031 (468)	828 (376)	718 (326)	577 (262)
AGZ065E	3130 (1420)	3155 (1431)	1059 (480)	851 (386)	676 (307)	543 (246)	1031 (468)	828 (376)	718 (326)	577 (262)
AGZ070E	3472 (1575)	3497 (1586)	1180 (535)	847 (384)	842 (382)	604 (274)	1157 (525)	830 (377)	880 (399)	631 (286)

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

Figure 27: AGZ075E - AGZ100E



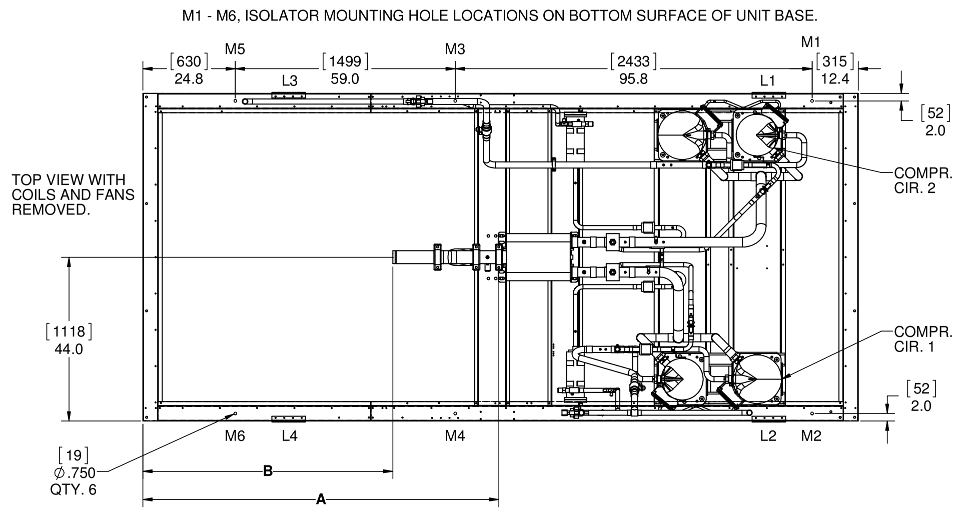
UNIT MODEL	CG LOCATION, IN (MM) X	Y	Z
AGZ075E	45.3 (1151)	38.6 (980)	56.2 (1427)
AGZ080E	44.2 (1122)	39.2 (995)	56.5 (1435)
AGZ090E	44.2 (1122)	39.2 (995)	55.0 (1397)
AGZ100E	43.6 (1108)	38.9 (988)	55.7 (1415)

UNIT MODEL	EVAP. DIMENSIONS IN (MM) A	B	CONNECTION SIZE, IN.
AGZ075E	55.6 (1412)	27.1 (688)	3.0 (76)
AGZ080E	54.4 (1382)	25.9 (658)	
AGZ090E	54.4 (1382)	25.9 (658)	
AGZ100E	51.6 (1311)	23.1 (587)	

UNIT MODEL	SHIPPING WEIGHT	OPERATING WEIGHT	LIFTING (SHIPPING) WEIGHT BY CORNER, LBS (KG)				MOUNTING (OPERATING) WEIGHT, LBS (KG)			
	LBS (KG)	LBS (KG)	L1	L2	L3	L4	M1	M2	M3	M4
AGZ075E	4388 (1990)	4451 (2019)	1341 (608)	1420 (644)	790 (358)	837 (380)	1173 (532)	1242 (563)	989 (449)	1047 (475)
AGZ080E	4510 (2046)	4579 (2077)	1407 (638)	1418 (643)	840 (381)	846 (384)	1232 (559)	1241 (563)	1049 (476)	1057 (479)
AGZ090E	4540 (2059)	4609 (2091)	1456 (660)	1466 (665)	806 (366)	812 (368)	1276 (579)	1285 (583)	1020 (463)	1028 (466)
AGZ100E	4696 (2130)	4780 (2168)	1505 (683)	1480 (671)	863 (391)	848 (385)	1322 (600)	1299 (589)	1089 (494)	1070 (485)

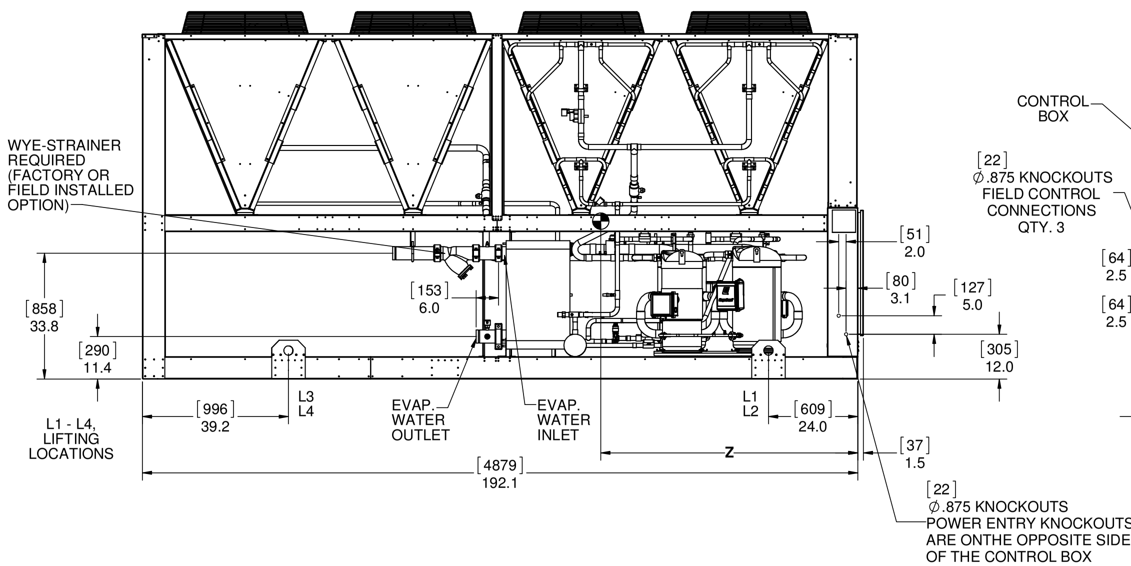
NOTE: LIFTING WEIGHTS ARE BASED ON UNIT SHIPPING WEIGHTS.
MOUNTING WEIGHTS ARE BASED ON UNIT OPERATING WEIGHT WITH EVAPORATOR WATER INCLUDED.
SHIPPING AND OPERATING WEIGHTS DO NOT INCLUDE THE WEIGHTS OF ANY OPTIONS OR ACCESSORIES.

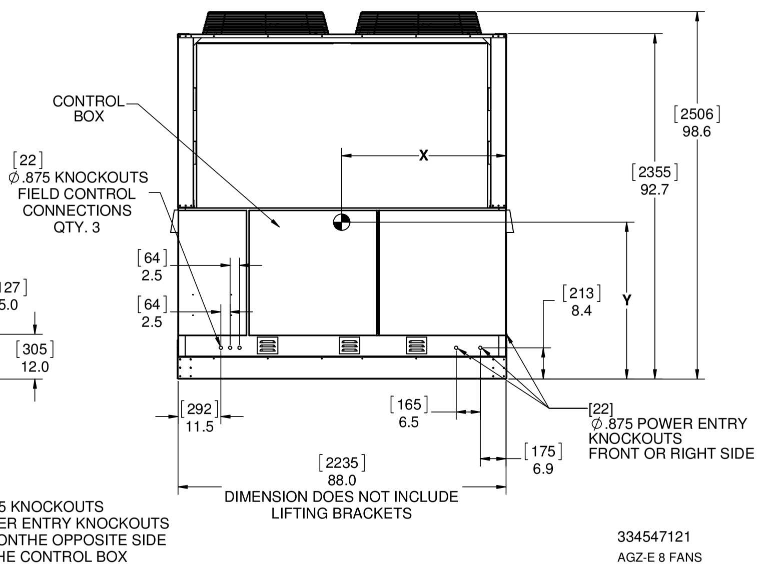
Figure 28: AGZ110E - AGZ130E



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

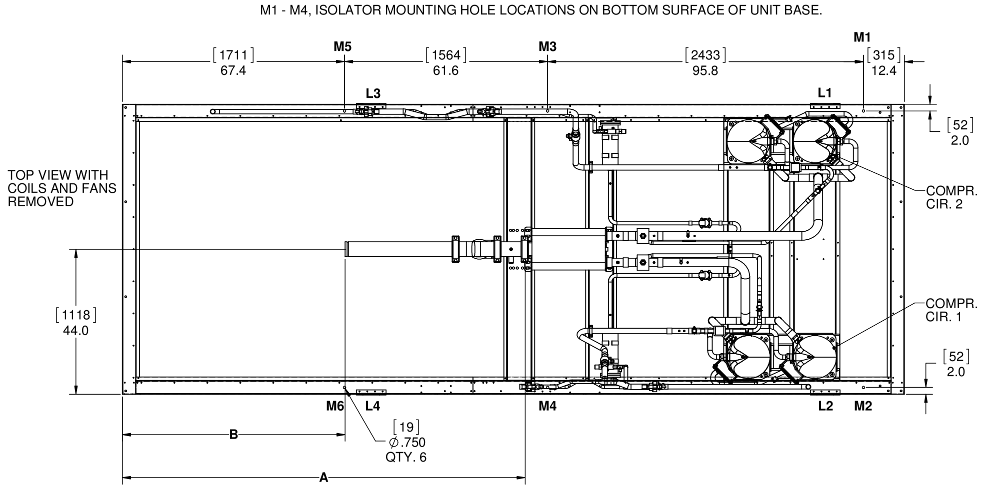


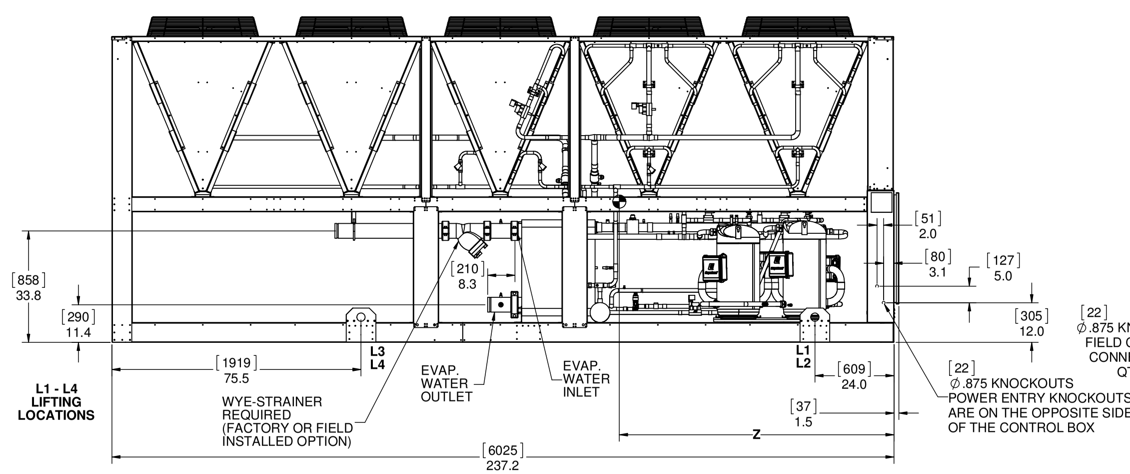


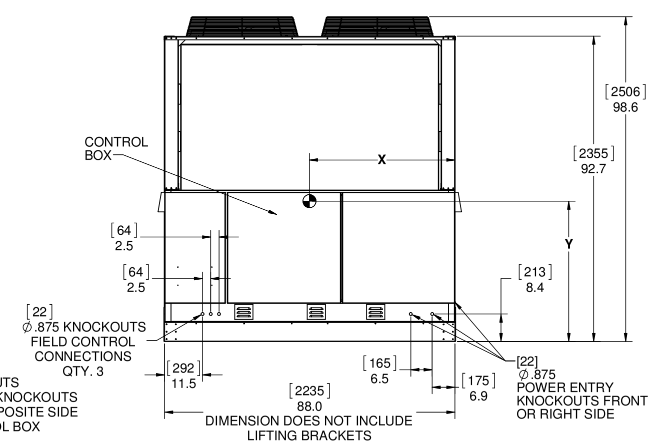
UNIT	SHIPPING WEIGHT	OPERATING WEIGHT	LIFTING (SHIPPING) WEIGHT BY CORNER, LBS (KG)				MOUNTING (OPERATING) WEIGHT, LBS (KG)					
MODEL	LBS (KG)	LBS (KG)	L1	L2	L3	L4	M1	M2	M3	M4	M5	M6
AGZ110E	5437 (2466)	5528 (2508)	1762 (799)	1769 (802)	951 (431)	955 (433)	1424 (646)	1430 (649)	845 (383)	849 (385)	489 (222)	491 (223)
AGZ120E	5696 (2584)	5796 (2629)	1907 (865)	1915 (869)	935 (424)	939 (426)	1548 (702)	1555 (705)	878 (398)	882 (400)	465 (211)	467 (212)
AGZ130E	5792 (2627)	5903 (2678)	1941 (880)	1863 (845)	1015 (460)	974 (442)	1575 (714)	1511 (685)	920 (417)	883 (401)	517 (235)	496 (225)

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

Figure 29: AGZ140E - AGZ161E







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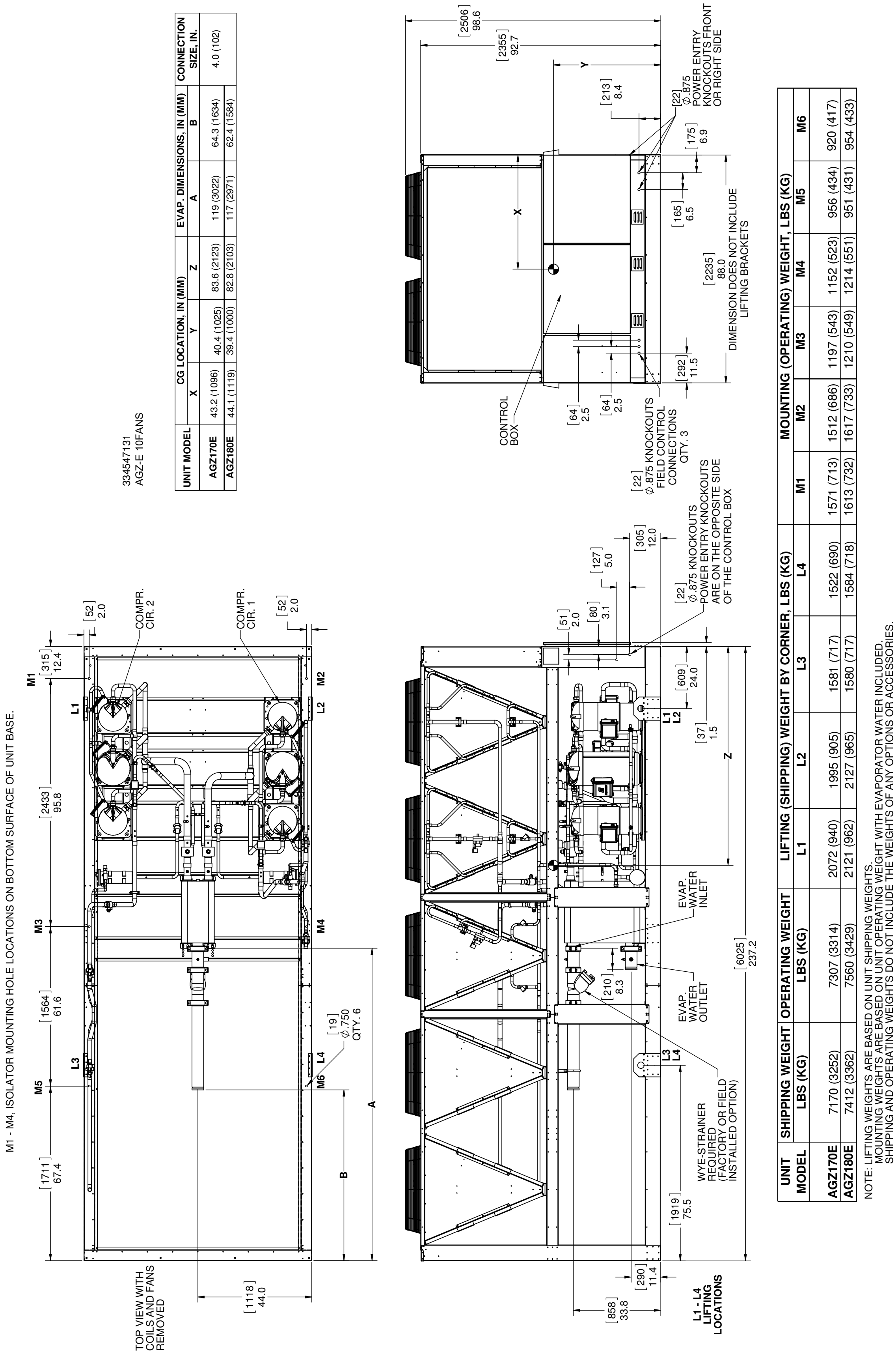
AGZ-E 10FANS

UNIT	CG LOCATION, IN (MM)			EVAP. DIMENSIONS, IN (MM)		CONNECTION
MODEL	X	Y	Z	A	B	SIZE, IN.
AGZ140E	44.1 (1120)	42.6 (1083)	83.3 (2117)	122.1 (3102)	67.51 (1715)	4.0 (102)
AGZ150E	43.9 (1116)	42.4 (1077)	83.3 (2115)	120.5 (3062)	65.9 (1674)	
AGZ161E	43.5 (1105)	42.3 (1074)	83.4 (2117)	120.5 (3062)	65.9 (1674)	

UNIT	SHIPPING WEIGHT	OPERATING WEIGHT	LIFTING (SHIPPING) WEIGHT BY CORNER, LBS (KG)				MOUNTING (OPERATING) WEIGHT, LBS (KG)					
MODEL	LBS (KG)	LBS (KG)	L1	L2	L3	L4	M1	M2	M3	M4	M5	M6
AGZ140E	6555 (2973)	6674 (3027)	1862 (845)	1868 (847)	1410 (640)	1415 (642)	1411 (640)	1416 (642)	1070 (485)	1074 (487)	850 (386)	853 (387)
AGZ150E	6617 (3001)	6745 (3059)	1888 (856)	1881 (853)	1426 (647)	1421 (645)	1433 (650)	1428 (648)	1085 (492)	1081 (490)	861 (391)	858 (389)
AGZ161E	6668 (3025)	6802 (3085)	1917 (870)	1876 (851)	1453 (659)	1422 (645)	1456 (660)	1425 (646)	1104 (501)	1080 (490)	878 (398)	859 (390)

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

Figure 30: AGZ170E - AGZ180E

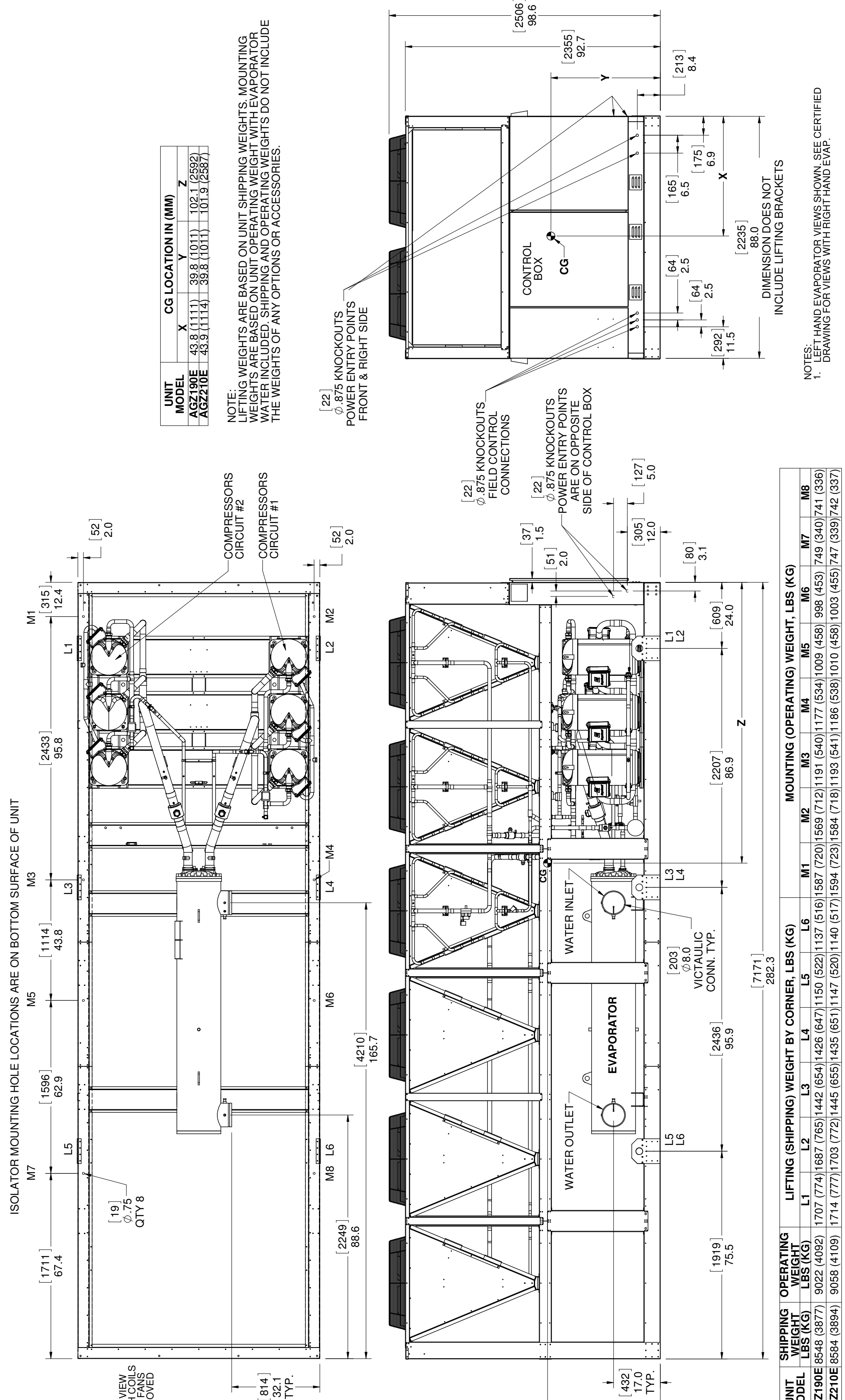


UNIT MODEL	CG LOCATION, IN (MM) X	CG LOCATION, IN (MM) Y	CG LOCATION, IN (MM) Z	EVAP. DIMENSIONS, IN (MM) A	EVAP. DIMENSIONS, IN (MM) B	CONNECTION SIZE, IN.
AGZ170E	43.2 (1096)	40.4 (1025)	83.6 (2123)	119 (3022)	64.3 (1634)	4.0 (102)
AGZ180E	44.1 (1119)	39.4 (1000)	82.8 (2103)	117 (2971)	62.4 (1584)	

UNIT MODEL	SHIPPING WEIGHT LBS (KG)	OPERATING WEIGHT LBS (KG)	LIFTING (SHIPPING) WEIGHT BY CORNER, LBS (KG) L1	L2	L3	L4	MOUNTING (OPERATING) WEIGHT, LBS (KG) M1	M2	M3	M4	M5	M6
AGZ170E	7170 (3252)	7307 (3314)	2072 (940)	1995 (905)	1581 (717)	1522 (690)	1571 (713)	1512 (686)	1197 (543)	1152 (523)	956 (434)	920 (417)
AGZ180E	7412 (3362)	7560 (3429)	2121 (962)	2127 (965)	1580 (717)	1584 (718)	1613 (732)	1617 (733)	1210 (549)	1214 (551)	951 (431)	954 (433)

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

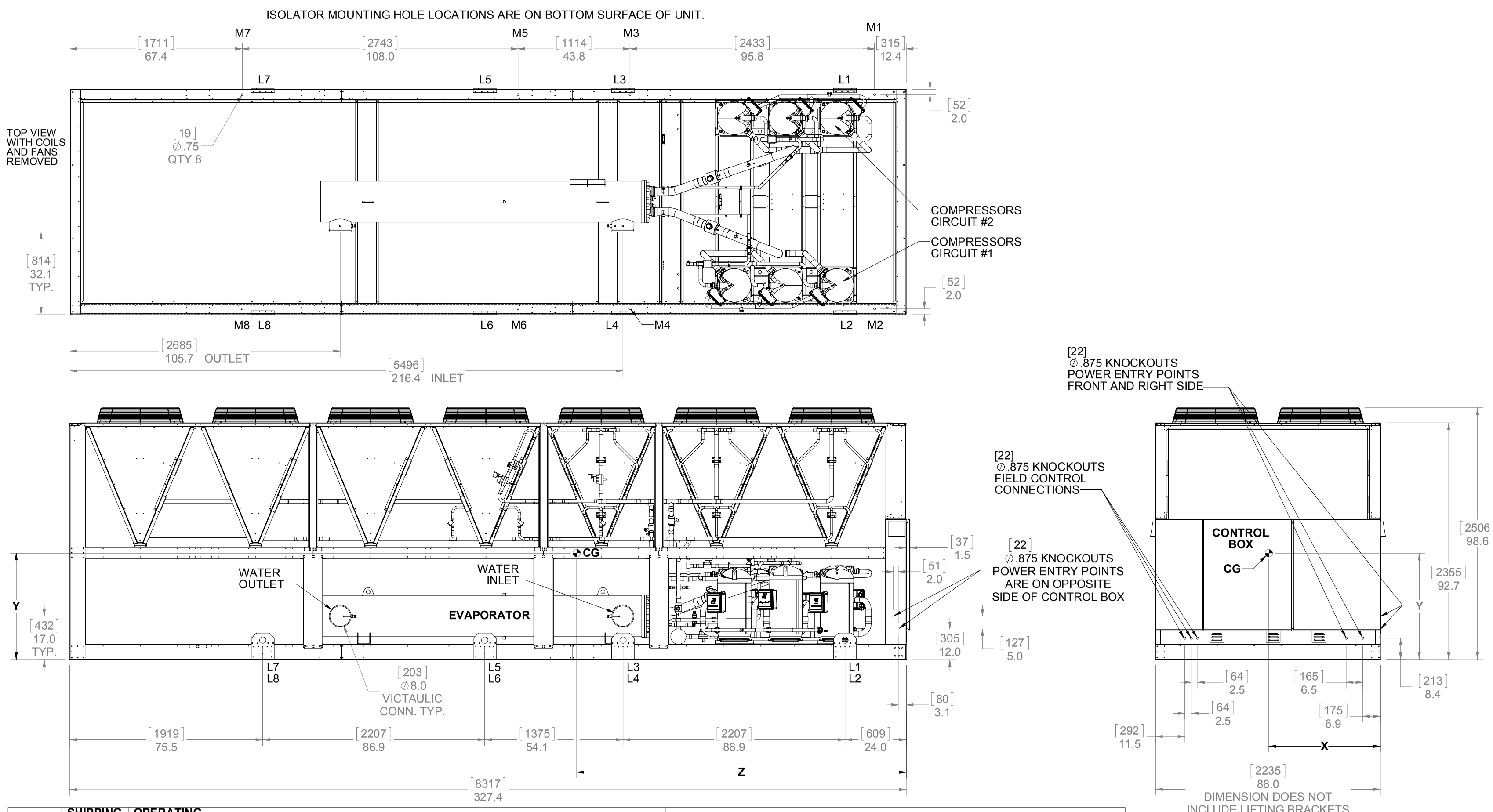
Figure 31: AGZ190E - AGZ210E



UNIT MODEL	CG LOCATION IN (MM) X	Y	Z
AGZ190E	43.8 (1111)	39.8 (1011)	102.1 (2592)
AGZ210E	43.9 (1114)	39.8 (1011)	101.9 (2587)

UNIT MODEL	SHIPPING WEIGHT LBS (KG)	OPERATING WEIGHT LBS (KG)	LIFTING (SHIPPING) WEIGHT BY CORNER, LBS (KG) L1	L2	L3	L4	L5	L6	MOUNTING (OPERATING) WEIGHT, LBS (KG) M1	M2	M3	M4	M5	M6	M7	M8
AGZ190E	8548 (3877)	9022 (4092)	1707 (774)	1687 (765)	1442 (654)	1426 (647)	1150 (522)	1137 (516)	1587 (720)	1569 (712)	1191 (540)	1177 (534)	1009 (458)	998 (453)	749 (340)	741 (336)
AGZ210E	8584 (3894)	9058 (4109)	1714 (777)	1703 (772)	1445 (655)	1435 (651)	1147 (520)	1140 (517)	1594 (723)	1584 (718)	1193 (541)	1186 (538)	1010 (458)	1003 (455)	747 (339)	742 (337)

Figure 32: AGZ225E - AGZ240E



UNIT MODEL	SHIPPING WEIGHT LBS (KG)	OPERATING WEIGHT LBS (KG)	LIFTING (SHIPPING) WEIGHT BY CORNER, LBS (KG)								MOUNTING (OPERATING) WEIGHT, LBS (KG)							
			L1	L2	L3	L4	L5	L6	L7	L8	M1	M2	M3	M4	M5	M6	M7	M8
AGZ225E	9501 (4310)	10200 (4627)	1419 (644)	1403 (636)	1248 (566)	1234 (560)	1141 (518)	1128 (512)	970 (440)	959 (435)	1410 (640)	1394 (632)	1309 (594)	1294 (587)	1262 (572)	1248 (566)	1148 (521)	1135 (515)
AGZ240E	9589 (4349)	10288 (4667)	1443 (655)	1433 (650)	1260 (572)	1251 (567)	1146 (520)	1138 (516)	963 (437)	956 (434)	1433 (650)	1422 (645)	1320 (599)	1310 (594)	1269 (576)	1259 (571)	1141 (518)	1133 (514)

UNIT MODEL	CG LOCATION IN (MM)		
	X	Y	Z
AGZ225E	43.7 (1110)	40.7 (1034)	126.6 (3216)
AGZ240E	43.8 (1113)	40.8 (1036)	125.9 (3198)

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

INSTR,CERTIFIED DWG,AGZ-E 14 FANS

PART NUMBER 334547141

NOTES:
1. LEFT HAND EVAPORATOR VIEWS SHOWN. SEE SHEET 2 FOR VIEWS WITH RIGHT HAND EVAP.

Table 6: Refrigerant Charge - Microchannel Units

Unit Models	Microchannel Coil Unit Operating Charge - lbs (kg)			
	Replaceable Core Filter Drier		Sealed Filter Drier	
	Circuit 1	Circuit 2	Circuit 1	Circuit 2
030E	17 (7.7)	17 (7.7)	15 (16.8)	15 (16.8)
035E	16 (7.3)	16 (7.3)	14 (6.4)	14 (6.4)
040E	23 (10.5)	23 (10.5)	21 (9.5)	21 (9.5)
045E	23 (10.5)	23 (10.5)	21 (9.5)	21 (9.5)
050E	23 (10.5)	23 (10.5)	21 (9.5)	21 (9.5)
055E	23 (10.5)	23 (10.5)	21 (9.5)	21 (9.5)
060E	23 (10.5)	23 (10.5)	21 (9.5)	21 (9.5)
065E	23 (10.5)	23 (10.5)	21 (9.5)	21 (9.5)
070E	23 (10.5)	23 (10.5)	21 (9.5)	21 (9.5)
075E	46 (20.9)	46 (20.9)		
080E	46 (20.9)	46 (20.9)		
090E	48 (21.8)	48 (21.8)		
100E	49 (22.3)	49 (22.3)		
110E	64 (29.1)	64 (29.1)		
120E	65 (29.5)	65 (29.5)		
130E	65 (29.5)	65 (29.5)		
140E	76 (34.5)	76 (34.5)		
150E	76 (34.5)	76 (34.5)		
161E	78 (35.4)	78 (35.4)		
170E	80 (36.3)	80 (36.3)		
180E	80 (36.3)	80 (36.3)		
190E	90 (40.9)	90 (40.9)		
210E	94 (42.7)	94 (42.7)		
225E	110 (49.9)	110 (49.9)		
240E	114 (51.8)	114 (51.8)		

Figure 33: Spring Isolator

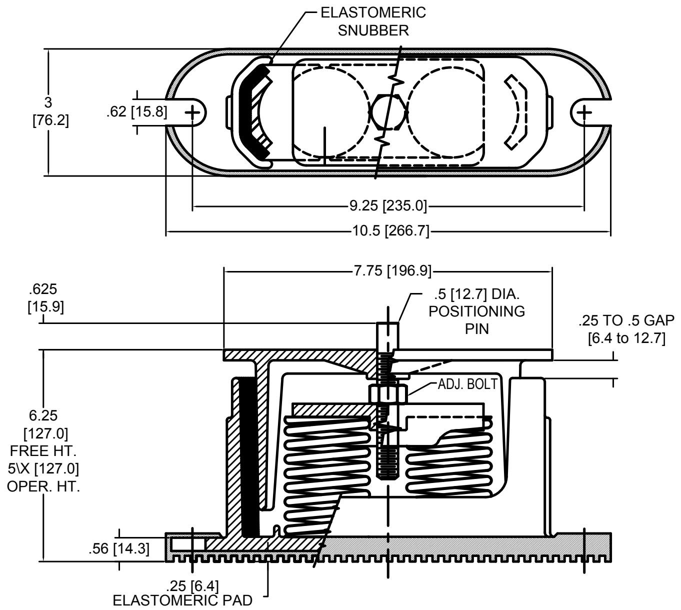
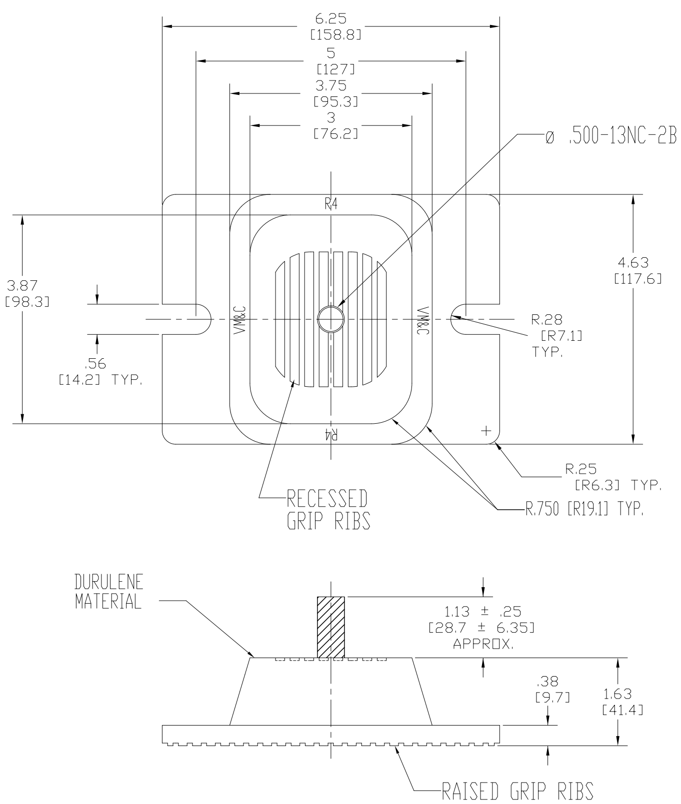


Figure 34: Rubber-in-Shear (RIS) Isolator



In all cases, set the unit in place and level. 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 for the load point.

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.

Mounting locations for each model can be found in the "Dimensions and Weights - Packaged Units" section of this document, starting on page 15.

Optional seismic isolator information begins on page 26

Contact a Daikin Applied sales representative for isolator information related to units with other fin materials.

Table 7: Isolator Kits

AGZ-E Model	Microchannel - Packaged Units	
	Spring Isolators	RIS Isolators
030	332320102	332325101
035	332320102	332325101
040	332320102	332325101
045	332320132	332325101
050	332320132	332325101
055	332320132	332325101
060	332320132	332325101
065	332320132	332325101
070	332320132	332325101
075	332320117	332325101
080	332320117	332325101
090	332320117	332325101
100	332320117	332325101
110	332320123	332325113
120	332320124	332325113
130	332320124	332325113
140	332320106	332325113
150	332320106	332325113
161	332320111	332325113
170	332320111	332325113
180	332320111	332325113
190	332320108	332325114
210	332320108	332325114
225	332320126	332325114
240	332320126	332325114

Table 8: Isolator Information - Microchannel 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
030	Brown	Brown	Brown	Brown					Dark Grn	Dk Prple	Black	Black				
035	Brown	Brown	Brown	Brown					Dark Grn	Dk Prple	Black	Black				
040	Brown	Brown	Brown	Brown					Dark Grn	Dk Prple	Black	Black				
045	Brown	Brown	Brown	Brown					Dark Grn	Dk Prple	Dk Prple	Black				
050	Brown	Brown	Brown	Brown					Dark Grn	Dk Prple	Dk Prple	Black				
055	Brown	Brown	Brown	Brown					Dark Grn	Dk Prple	Dk Prple	Black				
060	Brown	Brown	Brown	Brown					Dark Grn	Dk Prple	Dk Prple	Black				
065	Brown	Brown	Brown	Brown					Dark Grn	Dk Prple	Dk Prple	Black				
070	Brown	Brown	Brown	Brown					Dark Grn	Dk Prple	Dk Prple	Black				
075	Brown	Brown	Brown	Brown					Dark Grn	Dark Grn	Dark Grn	Dark Grn				
080	Brown	Brown	Brown	Brown					Dark Grn	Dark Grn	Dark Grn	Dark Grn				
090	Brown	Brown	Brown	Brown					Dark Grn	Dark Grn	Dark Grn	Dark Grn				
100	Brown	Brown	Brown	Brown					Dark Grn	Dark Grn	Dark Grn	Dark Grn				
110	Red	Red	Brown	Brown	Brown	Brown			Dark Grn	Dark Grn	Dk Prple	Dk Prple	Red	Red		
120	Red	Red	Brown	Brown	Brown	Brown			Gray	Gray	Dk Prple	Dk Prple	Red	Red		
130	Red	Red	Brown	Brown	Brown	Brown			Gray	Gray	Dk Prple	Dk Prple	Red	Red		
140	Red	Red	Brown	Brown	Brown	Brown			Dark Grn	Dark Grn	Dark Grn	Dark Grn	Dk Prple	Dk Prple		
150	Red	Red	Brown	Brown	Brown	Brown			Dark Grn	Dark Grn	Dark Grn	Dark Grn	Dk Prple	Dk Prple		
161	Red	Red	Brown	Brown	Brown	Brown			Gray	Gray	Dark Grn	Dark Grn	Dark Grn	Dark Grn		
170	Red	Red	Brown	Brown	Brown	Brown			Gray	Gray	Dark Grn	Dark Grn	Dark Grn	Dark Grn		
180	Red	Red	Brown	Brown	Brown	Brown			Gray	Gray	Dark Grn	Dark Grn	Dark Grn	Dark Grn		
190	Red	Red	Brown	Brown	Brown	Brown	Brown	Brown	Gray	Gray	Dark Grn	Dark Grn	Dark Grn	Dark Grn	Black	Black
210	Red	Red	Brown	Brown	Brown	Brown	Brown	Brown	Gray	Gray	Dark Grn	Dark Grn	Dark Grn	Dark Grn	Black	Black
225	Red	Red	Brown	Brown	Brown	Brown	Brown	Brown	Gray	Gray	Dark Grn	Dark Grn	Dark Grn	Dark Grn	Dark Grn	Dark Grn
240	Red	Red	Brown	Brown	Brown	Brown	Brown	Brown	Gray	Gray	Dark Grn	Dark Grn	Dark Grn	Dark Grn	Dark Grn	Dark Grn

Figure 35: Seismic Spring Isolators

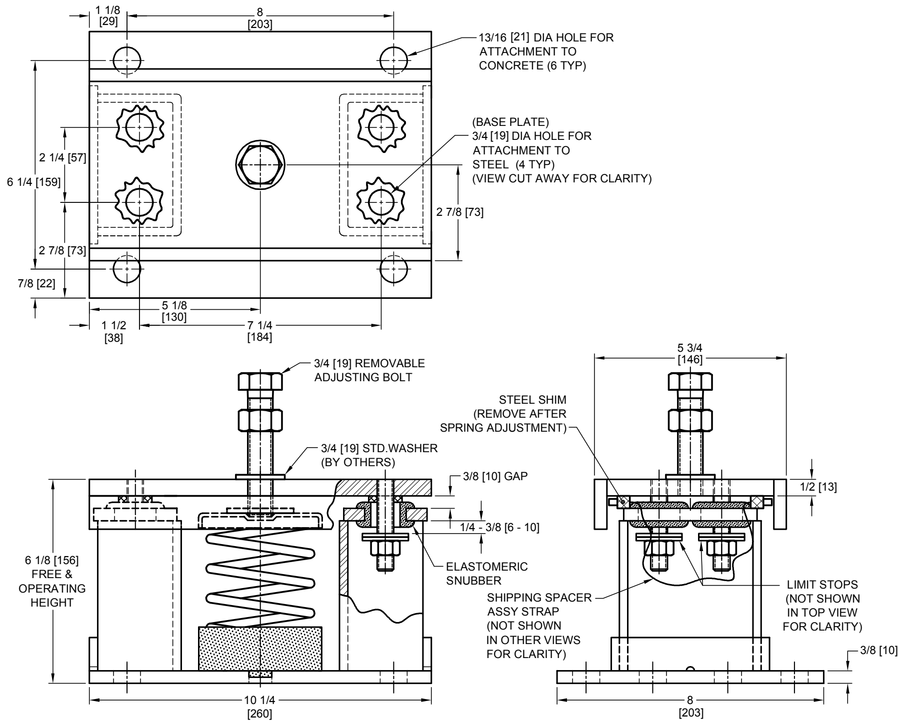


Figure 36: Seismic Neoprene Isolation Pads

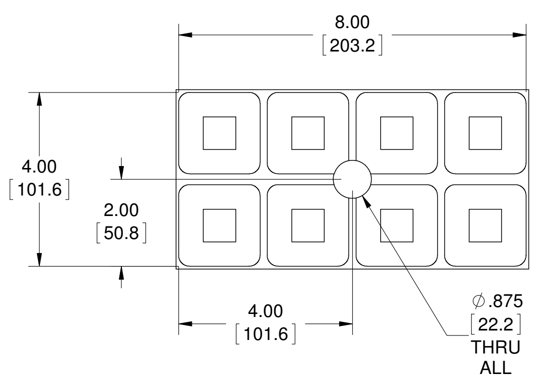


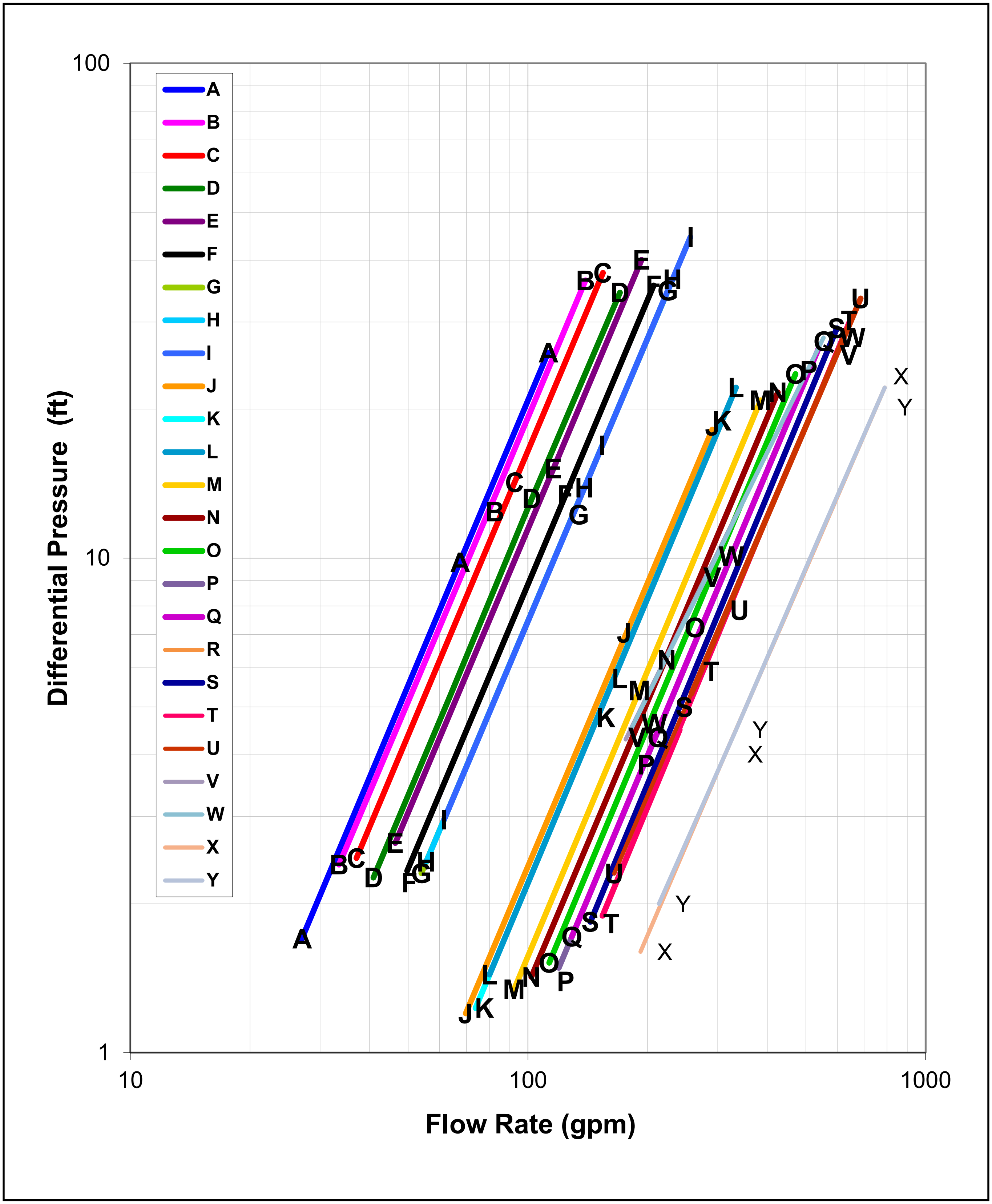
Table 9: Seismic Isolator Kit Numbers

AGZ-E Model	Packaged Unit - Aluminum Fins	
	Neoprene Pads	Spring Isolators
030	334549001	334548801
035	334549001	334548801
040	334549001	334548801
045	334549001	334548801
050	334549001	334548801
055	334549001	334548801
060	334549001	334548801
065	334549001	334548801
070	334549001	334548802

Table 10: 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	Brown	Brown	Brown	Brown					Pink	Pink	Tan	Tan				
035	Brown	Brown	Brown	Brown					Pink	Pink	Tan	Tan				
040	Brown	Brown	Brown	Brown					Pink	Pink	Tan	Tan				
045	Brown	Brown	Brown	Brown					Pink	Pink	Tan	Tan				
050	Brown	Brown	Brown	Brown					Pink	Pink	Tan	Tan				
055	Brown	Brown	Brown	Brown					Pink	Pink	Tan	Tan				
060	Brown	Brown	Brown	Brown					Pink	Pink	Tan	Tan				
065	Brown	Brown	Brown	Brown					Pink	Pink	Tan	Tan				
070	Brown	Brown	Brown	Brown					Pink	Pink	Pink	Tan				

Figure 37: Pressure Drop Curves



NOTE: Data table on next page.

Table 11: Pressure Drop Data

		Part Load Minimum Flow (Variable Flow Systems Only				Full Load Minimum Flow (Applies to Constant and Variable Flow Systems)				Fixed and Variable Flow Systems							
		Minimum Flow Rate[2]				Minimum Flow Rate[1]				Nominal Flow Rate				Maximum Flow Rate			
Curve Ref.	Model	IP		SI		IP		SI		IP		SI		IP		SI	
		GPM	DP ft.	lps	DP kpa	GPM	DP ft.	lps	DP kpa	GPM	DP ft.	lps	DP kpa	GPM	DP ft.	lps	DP kpa
A	030E	27.0	1.7	1.7	5.1	42.2	4.0	2.7	12.0	67.4	9.8	4.3	29.4	112.4	26.0	7.1	77.7
B	035E	33.5	2.4	2.1	7.1	52.4	5.6	3.3	16.7	83.8	13.7	5.3	40.9	139.6	36.4	8.8	108.7
C	040E	37.1	2.5	2.3	7.4	57.9	5.8	3.7	17.3	92.6	14.2	5.8	42.5	154.4	37.7	9.7	112.6
D	045E	40.9	2.3	2.6	6.8	63.9	5.3	4.0	15.8	102.2	13.2	6.5	39.4	170.4	34.4	10.8	102.7
E	050E	46.4	2.7	2.9	7.9	72.5	6.2	4.6	18.5	115.9	15.2	7.3	45.3	193.2	40.0	12.2	119.6
F	055E	49.7	2.3	3.1	7.0	77.7	5.5	4.9	16.3	124.3	13.4	7.8	40.0	207.2	35.6	13.1	106.2
G	060E	54.0	2.3	3.4	6.9	84.3	5.4	5.3	16.1	134.9	13.1	8.5	39.3	224.8	34.7	14.2	103.6
H	065E	55.5	2.4	3.5	7.3	86.7	5.7	5.5	17.0	138.7	13.9	8.8	41.4	231.2	36.6	14.6	109.3
I	070E	61.5	3.0	3.9	8.8	96.1	6.9	6.1	20.6	153.8	16.9	9.7	50.4	256.4	44.5	16.2	133.0
J	075E	69.8	1.2	4.4	3.6	109.1	2.8	6.9	8.4	174.5	6.9	11.0	20.5	290.8	18.2	18.3	54.3
K	080E	73.8	1.2	4.7	3.7	115.4	2.9	7.3	8.6	184.6	7.1	11.6	21.3	307.6	18.9	19.4	56.6
L	090E	80.1	1.4	5.1	4.3	125.1	3.4	7.9	10.1	200.2	8.3	12.6	24.8	333.6	22.1	21.0	66.1
M	100E	92.4	1.3	5.8	4.0	144.3	3.2	9.1	9.5	230.9	7.8	14.6	23.3	384.8	20.8	24.3	62.2
N	110E	102.0	1.4	6.4	4.2	159.5	3.3	10.1	9.9	255.1	8.2	16.1	24.4	425.2	21.6	26.8	64.6
O	120E	113.1	1.5	7.1	4.5	176.7	3.6	11.1	10.7	282.7	8.8	17.8	26.4	471.2	23.5	29.7	70.3
P	130E	119.5	1.5	7.5	4.4	186.8	3.5	11.8	10.4	298.8	8.6	18.9	25.7	498.0	22.9	31.4	68.3
Q	140E	128.9	1.7	8.1	5.1	201.5	4.0	12.7	12.1	322.3	9.9	20.3	29.7	537.2	26.4	33.9	79.0
R	150E	143.6	1.8	9.1	5.5	224.4	4.4	14.2	13.0	359.0	10.8	22.7	32.4	598.4	29.1	37.8	87.0
S	161E	143.6	1.8	9.1	5.5	224.4	4.4	14.2	13.0	359.0	10.8	22.7	32.4	598.4	29.1	37.8	87.0
T	170E	154.1	1.9	9.7	5.6	240.8	4.5	15.2	13.4	385.2	11.2	24.3	33.4	642.0	30.2	40.5	90.2
U	180E	164.8	2.3	10.4	6.9	257.6	5.3	16.2	15.9	412.1	12.8	26.0	38.3	686.8	33.5	43.3	99.9
V	190E	176.0	4.3	11.1	12.9	275.0	8.9	17.3	26.6	439.9	19.1	27.8	57.1	691.6	40.1	43.6	119.8
W	210E	181.7	4.5	11.5	13.4	284.0	9.3	17.9	27.8	454.3	20.2	28.7	60.4	691.6	40.1	43.6	119.8
X	225E	197.1	1.7	12.4	5.1	308.0	3.9	19.4	11.7	492.7	9.3	31.1	27.8	789.0	22.1	49.8	66.2
Y	240E	216.4	2.0	13.7	6.1	338.1	4.6	21.3	13.9	541.0	11.0	34.1	33.0	789.0	22.1	49.8	66.2

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 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%.

Electrical Data Notes

1. Power wiring connections to the chiller may be done with either copper or aluminum wiring. Copper wire should be sized per NEC and/or local codes. Aluminum wire should be installed in accordance with NECA/AA 10402012, Standard for Installing Aluminum Building Wire and Cable (ANSI). Wire sizing and wire count must fit in the power connection lug sizing shown in the Electrical Data tables starting on page 32.
2. Unit wire size ampacity (MCA) is equal to 125% of the largest compressor-motor RLA plus 100% of RLA of all other loads in the circuit.
3. Recommended Fuse Sizes are selected at approximately 175% of the largest compressor RLA, plus 100% of all other loads in the circuit.
4. Maximum Fuse or breaker size is equal to 225% of the largest compressor RLA, plus 100% of all other loads.
5. The control transformer is furnished and no separate 115V power is required. For both single and multi-point power connections, the control transformer is in circuit #1 with control power wired from there to circuit #2. In multi-point power, disconnecting power to circuit #1 disconnects control power to the unit.
6. Wire sizing amps is 15 amps if a separate 115V power supply is used for the control circuit.
7. Single-point power supply requires a single disconnect to supply electrical power to the unit. This power supply must either be fused or use a circuit breaker.
8. All field wire lug range values given in the Electrical Data tables starting on page 32 apply to 75°C rated wire per NEC.
9. Must be electrically grounded according to national and local electrical codes.

Circuit Breakers

Factory installed compressor circuit breakers are standard on units with single point power supply only. This option provides compressor short circuit protection and makes servicing easier

Voltage Limitations:

1. Within 10 percent of nameplate rating.
2. Voltage unbalance not to exceed 2% with a resultant current unbalance of 6 to 10 times the voltage unbalance per NEMA MG-1, 2009 Standard Rev. 1-2010.

Table 12: Standard and HSCCR Panel Ratings

Panel Type	208V / 230V	380V / 400V / 460V	575V
Standard	5kA	5kA	5kA
HSCCR	65kA	65kA	25kA

Electrical Control Center

Operating and equipment protection controls and motor starting components are separately housed in a centrally located, weather resistant control panel with hinged and tool-locked doors. In addition to the MicroTech® III controller described in the next sections, the following components are housed in the panel:

- Power terminal blocks, multi-point connection standard
- Control, input, and output terminal block
- Control transformer
- Optional disconnect switch (through-the-door handle)
- Compressor motor inherent thermal and overload protection is standard
- Optional phase voltage monitor with under/over voltage and phase reversal protection
- Fan contactors with short circuit protective devices.
- Optional ground fault protection
- FanTrol™ fan staging head pressure control system
- Power connections are per Table 13

Power Connections

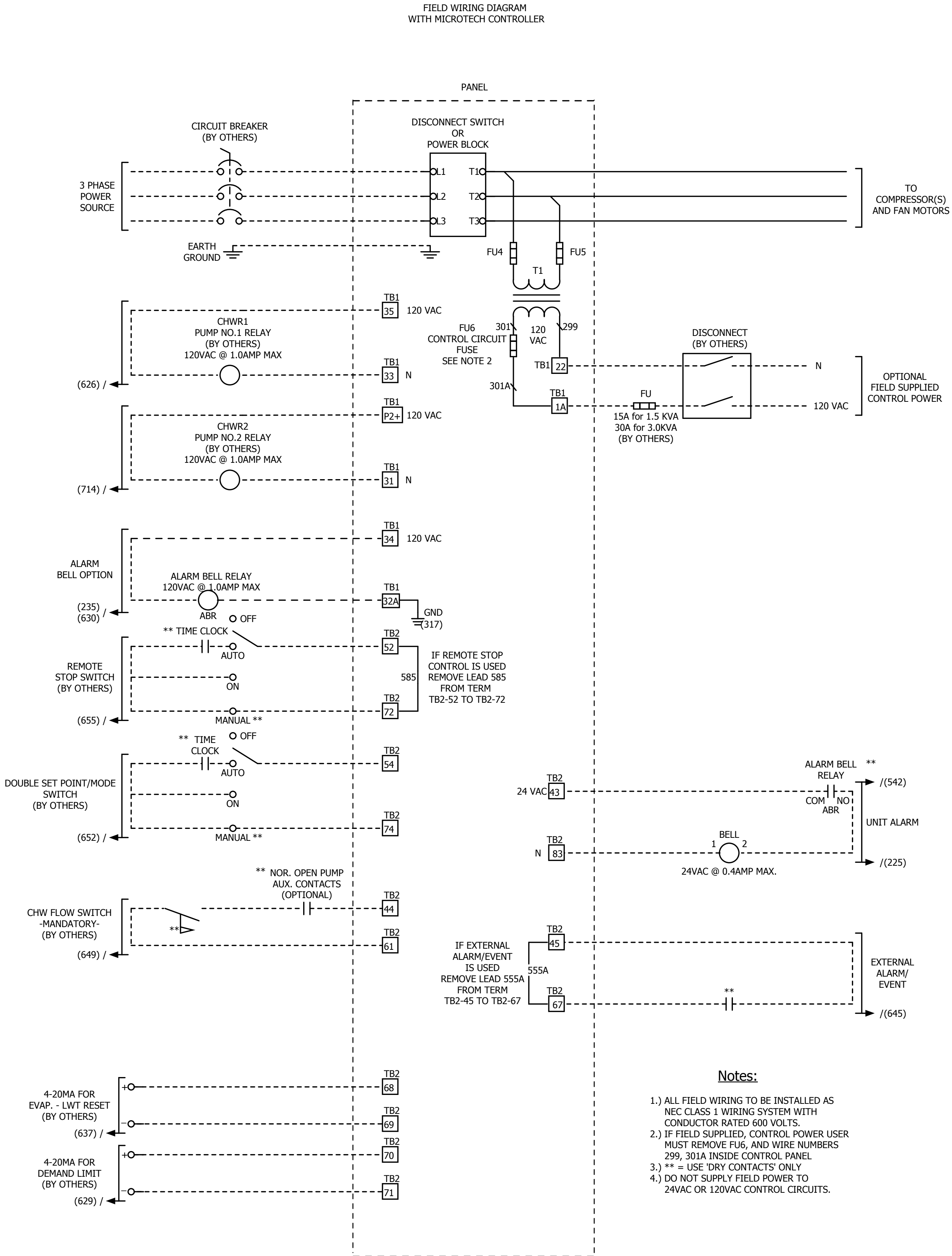
Table 13: Power Connection Availability

Power Connection	Power Block	Disc. Swt.	Comp. Circuit Breakers	Panel High Short Circuit Current Rating
Optional Single Point	Std.	Opt.	Std.	Opt.
Standard Multi-Point	Std.	Opt.	Not Avail.	Opt.

Definitions:

1. **Power Block:** An electrical device to directly accept field wiring without any disconnecting means.
2. **Disconnect Switch:** A molded case switch that accepts field wiring and disconnects main power to the entire unit or each main power supply if the multi-point power supply option is selected. This option does not provide overcurrent protection.
3. **Compressor Circuit Breakers:** A manually reset circuit breaker for each compressor, providing compressor only short circuit protection and located ahead of the contactor.
4. **Control Panel High Short Circuit Current Rating:** (Previously known as “withstand rating”). The entire control panel is designed for short circuit current rating as shown in Table 12. In the event of a short circuit, the damage is contained within the control panel enclosure.

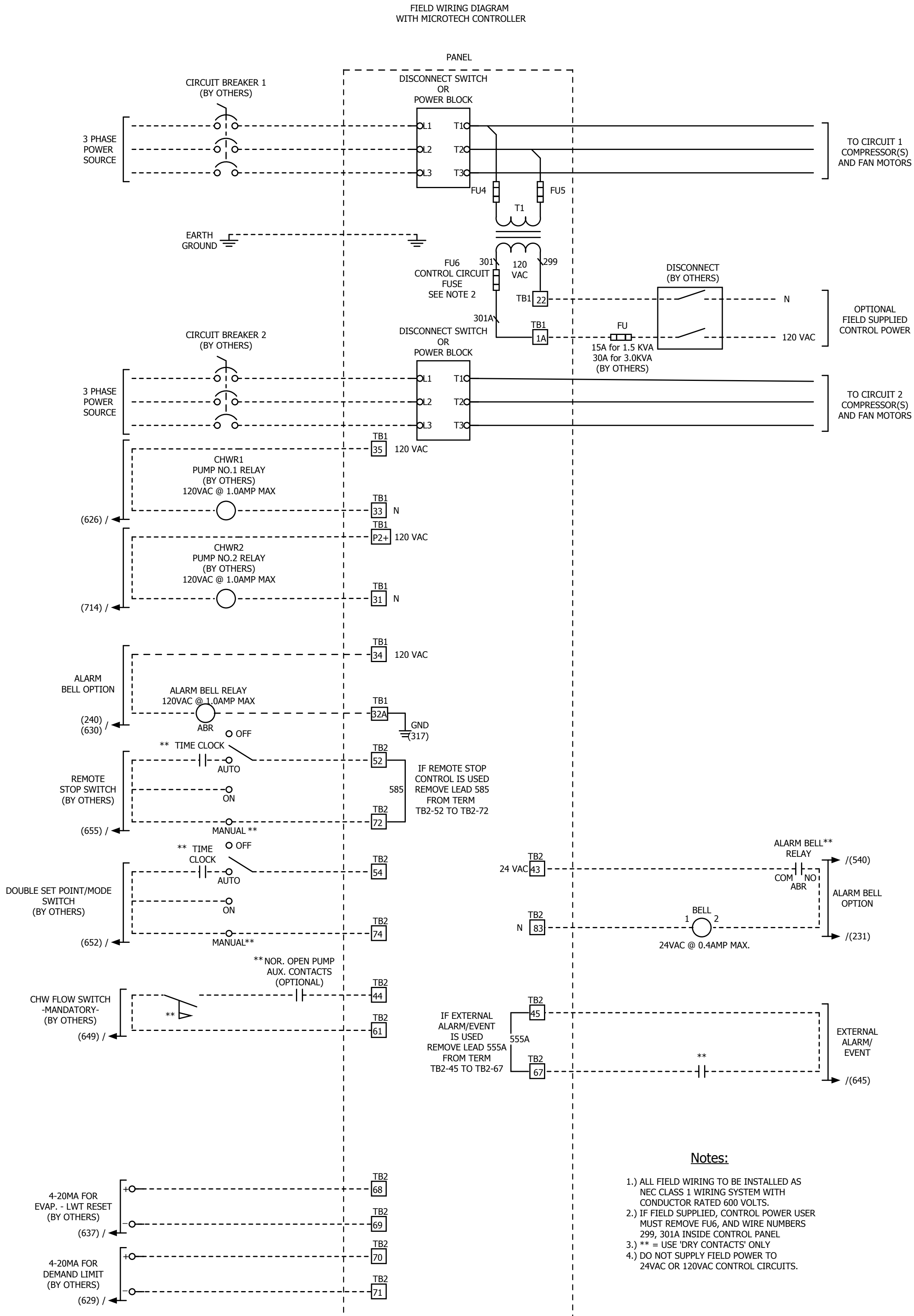
Figure 38: Typical Field Wiring Diagram (Single-Point Connection)



<u>Notes:</u>

1.) ALL FIELD WIRING TO BE INSTALLED AS NEC CLASS 1 WIRING SYSTEM WITH CONDUCTOR RATED 600 VOLTS.
2.) IF FIELD SUPPLIED, CONTROL POWER USER MUST REMOVE FU6, AND WIRE NUMBERS 299, 301A INSIDE CONTROL PANEL
3.) ** = USE 'DRY CONTACTS' ONLY
4.) DO NOT SUPPLY FIELD POWER TO 24VAC OR 120VAC CONTROL CIRCUITS.

Figure 39: Typical Field Wiring Diagram (Multi-Point Connection)



Notes:

1.) ALL FIELD WIRING TO BE INSTALLED AS NEC CLASS 1 WIRING SYSTEM WITH CONDUCTOR RATED 600 VOLTS.
2.) IF FIELD SUPPLIED, CONTROL POWER USER MUST REMOVE FU6, AND WIRE NUMBERS 299, 301A INSIDE CONTROL PANEL
3.) ** = USE 'DRY CONTACTS' ONLY
4.) DO NOT SUPPLY FIELD POWER TO 24VAC OR 120VAC CONTROL CIRCUITS.

Table 14: Electrical Data - Single Point (60/50 Hz)

Model Size	Voltage / Freq.	Single Point Field Data				
		Ratings			Lug Range	
		MCA	RFS	MFS	Power Block	Disconnect Switch
030E	208V/60	149	175	175	(1) 2-600MCM	(1) 6-350MCM
	230V/60	149	175	175	(1) 2-600MCM	(1) 6-350MCM
	380V/60	87	100	100	(1) 2-600MCM	(1) 12-1/0
	460V/60	74	80	80	(1) 14-2/0	(1) 12-1/0
	575V/60	64	70	70	(1) 14-2/0	(1) 12-1/0
	400V/50	77	90	90	(1) 14-2/0	(1) 12-1/0
035E	208V/60	163	175	175	(1) 2-600MCM	(1) 6-350MCM
	230V/60	163	175	175	(1) 2-600MCM	(1) 6-350MCM
	380V/60	96	110	110	(1) 2-600MCM	(1) 4-300MCM
	460V/60	77	90	90	(1) 14-2/0	(1) 12-1/0
	575V/60	64	70	70	(1) 14-2/0	(1) 12-1/0
	400V/50	80	90	90	(1) 14-2/0	(1) 12-1/0
040E	208V/60	168	200	200	(1) 2-600MCM	(1) 6-350MCM
	230V/60	168	200	200	(1) 2-600MCM	(1) 6-350MCM
	380V/60	107	125	125	(1) 2-600MCM	(1) 4-300MCM
	460V/60	80	90	90	(1) 14-2/0	(1) 12-1/0
	575V/60	67	80	80	(1) 14-2/0	(1) 12-1/0
	400V/50	83	100	100	(1) 14-2/0	(1) 12-1/0
045E	208V/60	228	250	250	(1) 2-600MCM	(1) 6-350MCM
	230V/60	228	250	250	(1) 2-600MCM	(1) 6-350MCM
	380V/60	117	125	125	(1) 2-600MCM	(1) 4-300MCM
	460V/60	90	100	100	(1) 2-600MCM	(1) 12-1/0
	575V/60	75	90	90	(1) 14-2/0	(1) 12-1/0
	400V/50	94	110	110	(1) 2-600MCM	(1) 4-300MCM
050E	208V/60	241	250	250	(1) 2-600MCM	(2) 3/0-500MCM
	230V/60	241	250	250	(1) 2-600MCM	(2) 3/0-500MCM
	380V/60	131	150	150	(1) 2-600MCM	(1) 4-300MCM
	460V/60	109	125	125	(1) 2-600MCM	(1) 4-300MCM
	575V/60	97	110	110	(1) 2-600MCM	(1) 4-300MCM
	400V/50	107	125	125	(1) 2-600MCM	(1) 4-300MCM
055E	208V/60	251	300	300	(1) 2-600MCM	(2) 3/0-500MCM
	230V/60	251	300	300	(1) 2-600MCM	(2) 3/0-500MCM
	380V/60	147	175	175	(1) 2-600MCM	(1) 6-350MCM
	460V/60	118	125	125	(1) 2-600MCM	(1) 4-300MCM
	575V/60	105	125	125	(1) 2-600MCM	(1) 4-300MCM
	400V/50	119	125	125	(1) 2-600MCM	(1) 4-300MCM
060E	208V/60	260	300	300	(1) 2-600MCM	(2) 3/0-500MCM
	230V/60	260	300	300	(1) 2-600MCM	(2) 3/0-500MCM
	380V/60	161	175	175	(1) 2-600MCM	(1) 6-350MCM
	460V/60	126	150	150	(1) 2-600MCM	(1) 4-300MCM
	575V/60	113	125	125	(1) 2-600MCM	(1) 4-300MCM
	400V/50	129	150	150	(1) 2-600MCM	(1) 4-300MCM

Table 15: Electrical Data - Single Point (60/50 Hz)

Model Size	Voltage / Freq.	Single Point Field Data				
		Ratings			Lug Range	
		MCA	RFS	MFS	Power Block	Disconnect Switch
065E	208V/60	268	300	300	(1) 2-600MCM	(2) 3/0-500MCM
	230V/60	268	300	300	(1) 2-600MCM	(2) 3/0-500MCM
	380V/60	161	175	175	(1) 2-600MCM	(1) 6-350MCM
	460V/60	129	150	150	(1) 2-600MCM	(1) 4-300MCM
	575V/60	113	125	125	(1) 2-600MCM	(1) 4-300MCM
	400V/50	129	150	150	(1) 2-600MCM	(1) 4-300MCM
070E	208V/60	306	350	350	(1) 2-600MCM	(2) 3/0-500MCM
	230V/60	306	350	350	(1) 2-600MCM	(2) 3/0-500MCM
	380V/60	164	200	200	(1) 2-600MCM	(1) 6-350MCM
	460V/60	138	150	150	(1) 2-600MCM	(1) 4-300MCM
	575V/60	117	125	125	(1) 2-600MCM	(1) 4-300MCM
	400V/50	138	150	150	(1) 2-600MCM	(1) 4-300MCM
075E	208V/60	338	400	400	(1) 2-600MCM	(2) 3/0-500MCM
	230V/60	338	400	400	(1) 2-600MCM	(2) 3/0-500MCM
	380V/60	173	200	200	(1) 14-2/0	(1) 6-350MCM
	460V/60	149	175	175	(1) 14-2/0	(1) 6-350MCM
	575V/60	125	150	150	(1) 14-2/0	(1) 4-300MCM
	400V/50	149	175	175	(1) 14-2/0	(1) 6-350MCM
080E	208V/60	355	400	400	(1) 2-600MCM	(2) 3/0-500MCM
	230V/60	355	400	400	(1) 2-600MCM	(2) 3/0-500MCM
	380V/60	187	225	225	(1) 2-600MCM	(1) 6-350MCM
	460V/60	153	175	175	(1) 14-2/0	(1) 6-350MCM
	575V/60	126	150	150	(1) 14-2/0	(1) 4-300MCM
	400V/50	153	175	175	(1) 14-2/0	(1) 6-350MCM
090E	208V/60	384	450	450	(1) 2-600MCM	(2) 3/0-500MCM
	230V/60	384	450	450	(1) 2-600MCM	(2) 3/0-500MCM
	380V/60	218	250	250	(1) 2-600MCM	(1) 6-350MCM
	460V/60	168	200	200	(1) 14-2/0	(1) 6-350MCM
	575V/60	147	175	175	(1) 14-2/0	(1) 6-350MCM
	400V/50	168	200	200	(1) 14-2/0	(1) 6-350MCM
100E	208V/60	442	500	500	(2) 6-500MCM	(2) 3/0-500MCM
	230V/60	442	500	500	(2) 6-500MCM	(2) 3/0-500MCM
	380V/60	268	300	300	(1) 2-600MCM	(2) 3/0-500MCM
	460V/60	203	250	250	(1) 2-600MCM	(1) 6-350MCM
	575V/60	184	225	225	(1) 2-600MCM	(1) 6-350MCM
	400V/50	203	250	250	(1) 2-600MCM	(1) 6-350MCM
110E	208V/60	490	600	600	(2) 6-500MCM	(2) 3/0-500MCM
	230V/60	490	600	600	(2) 6-500MCM	(2) 3/0-500MCM
	380V/60	294	350	350	(1) 2-600MCM	(2) 3/0-500MCM
	460V/60	227	250	250	(1) 2-600MCM	(1) 6-350MCM
	575V/60	204	250	250	(1) 2-600MCM	(1) 6-350MCM
	400V/50	227	250	250	(1) 2-600MCM	(1) 6-350MCM

NOTE: MCA = Minimum Current Ampacity, RFS = Recommended Fuse Size, MFS = Maximum Fuse Size.
For RFS, use the given values for intended standard ambient operation. If the operating ambient is intended to be above 105°F, MFS must be used.

Table 16: Electrical Data - Single Point (60/50 Hz)

Model Size	Voltage / Freq.	Single Point Field Data				
		Ratings			Lug Range	
		MCA	RFS	MFS	Power Block	Disconnect Switch
120E	208V/60	534	600	600	(2) 6-500MCM	(2) 3/0-500MCM
	230V/60	534	600	600	(2) 6-500MCM	(2) 3/0-500MCM
	380V/60	330	400	400	(1) 2-600MCM	(2) 3/0-500MCM
	460V/60	261	300	300	(1) 2-600MCM	(2) 3/0-500MCM
	575V/60	234	250	250	(1) 2-600MCM	(2) 3/0-500MCM
	400V/50	261	300	300	(1) 2-600MCM	(2) 3/0-500MCM
130E	208V/60	569	700	700	(2) 6-500MCM	(3) 2/0-400MCM
	230V/60	569	700	700	(2) 6-500MCM	(3) 2/0-400MCM
	380V/60	358	400	450	(1) 2-600MCM	(2) 3/0-500MCM
	460V/60	284	350	350	(1) 2-600MCM	(2) 3/0-500MCM
	575V/60	239	250	250	(1) 2-600MCM	(2) 3/0-500MCM
	400V/50	284	350	350	(1) 2-600MCM	(2) 3/0-500MCM
140E	208V/60	612	700	700	(2) 6-500MCM	(3) 2/0-400MCM
	230V/60	612	700	700	(2) 6-500MCM	(3) 2/0-400MCM
	380V/60	388	450	450	(1) 2-600MCM	(2) 3/0-500MCM
	460V/60	309	350	350	(1) 2-600MCM	(2) 3/0-500MCM
	575V/60	248	300	300	(1) 2-600MCM	(2) 3/0-500MCM
	400V/50	309	350	350	(1) 2-600MCM	(2) 3/0-500MCM
150E	208V/60	640	700	700	(2) 6-500MCM	(3) 2/0-400MCM
	230V/60	640	700	700	(2) 6-500MCM	(3) 2/0-400MCM
	380V/60	410	500	500	(1) 2-600MCM	(2) 3/0-500MCM
	460V/60	328	400	400	(1) 2-600MCM	(2) 3/0-500MCM
	575V/60	252	300	300	(1) 2-600MCM	(2) 3/0-500MCM
	400V/50	328	400	400	(1) 2-600MCM	(2) 3/0-500MCM
161E	208V/60	668	800	800	(2) 6-500MCM	(3) 2/0-400MCM
	230V/60	668	800	800	(2) 6-500MCM	(3) 2/0-400MCM
	380V/60	432	500	500	(1) 2-600MCM	(2) 3/0-500MCM
	460V/60	346	400	400	(1) 2-600MCM	(2) 3/0-500MCM
	575V/60	255	300	300	(1) 2-600MCM	(2) 3/0-500MCM
	400V/50	346	400	400	(1) 2-600MCM	(2) 3/0-500MCM
170E	208V/60	734	800	800	(2) 6-500MCM	(4) 4/0-500MCM
	230V/60	734	800	800	(2) 6-500MCM	(4) 4/0-500MCM
	380V/60	442	500	500	(2) 6-500MCM	(2) 3/0-500MCM
	460V/60	355	400	400	(1) 2-600MCM	(2) 3/0-500MCM
	575V/60	309	350	350	(1) 2-600MCM	(2) 3/0-500MCM
	400V/50	355	400	400	(1) 2-600MCM	(2) 3/0-500MCM
180E	208V/60	875	1000	1000	--	(4) 4/0-500MCM
	230V/60	875	1000	1000	--	(4) 4/0-500MCM
	380V/60	479	500	500	(2) 6-500MCM	(2) 3/0-500MCM
	460V/60	394	450	450	(1) 2-600MCM	(2) 3/0-500MCM
	575V/60	339	350	350	(1) 2-600MCM	(2) 3/0-500MCM
	400V/50	394	450	450	(1) 2-600MCM	(2) 3/0-500MCM

Table 17: Electrical Data - Single Point (60/50 Hz)

Model Size	Voltage / Freq.	Single Point Field Data				
		Ratings			Lug Range	
		MCA	RFS	MFS	Power Block	Disconnect Switch
190E	**208V/60**	848	1000	1000	(4) 2-600MCM	(4) 4/0-500MCM
	230V/60	848	1000	1000	(4) 2-600MCM	(4) 4/0-500MCM
	380V/60	508	600	600	(2) 6-500MCM	(2) 3/0-500MCM
	460V/60	424	500	500	(2) 6-500MCM	(2) 3/0-500MCM
	575V/60	348	400	400	(2) 6-500MCM	(2) 3/0-500MCM
	400V/50	424	500	500	(1) 2-600MCM	(2) 3/0-500MCM
210E	**208V/60**	890	1000	1000	(4) 2-600MCM	(4) 4/0-500MCM
	230V/60	890	1000	1000	(4) 2-600MCM	(4) 4/0-500MCM
	380V/60	525	600	600	(2) 6-500MCM	(2) 3/0-500MCM
	460V/60	443	500	500	(2) 6-500MCM	(2) 3/0-500MCM
	575V/60	351	400	400	(2) 6-500MCM	(2) 3/0-500MCM
	400V/50	443	500	500	(1) 2-600MCM	(2) 3/0-500MCM
225E	**208V/60**	943	1000	1000	(4) 2-600MCM	(4) 4/0-500MCM
	230V/60	943	1000	1000	(4) 2-600MCM	(4) 4/0-500MCM
	380V/60	551	600	600	(2) 6-500MCM	(3) 2/0-400MCM
	460V/60	469	500	500	(2) 6-500MCM	(2) 3/0-500MCM
	575V/60	359	400	400	(2) 6-500MCM	(2) 3/0-500MCM
	400V/50	469	500	500	(1) 2-600MCM	(2) 3/0-500MCM
240E	**208V/60**	1071	1200	1200	(4) 2-600MCM	(4) 4/0-500MCM
	230V/60	1071	1200	1200	(4) 2-600MCM	(4) 4/0-500MCM
	380V/60	602	700	700	(2) 6-500MCM	(3) 2/0-400MCM
	460V/60	525	600	600	(2) 6-500MCM	(2) 3/0-500MCM
	575V/60	367	400	400	(2) 6-500MCM	(2) 3/0-500MCM
	400V/50	525	600	600	(1) 2-600MCM	(2) 3/0-500MCM

NOTE: MCA = Minimum Current Ampacity, RFS = Recommended Fuse Size, MFS = Maximum Fuse Size.
For RFS, use the given values for intended standard ambient operation. If the operating ambient is intended to be above 105°F, MFS must be used.

Table 18: Electrical Data - Multiple Point (60/50 Hz)

Model Size	Voltage / Frequency	Multiple Point Field Data - Circuit #1					Multiple Point Field Data - Circuit #2				
		Ratings			Lug Range		Ratings			Lug Range	
		MCA	RFS	MFS	Power Block	Disconnect Switch	MCA	RFS	MFS	Power Block	Disconnect Switch
030E	208V/60	78	100	100	(1) 14-2/0	(1) 12-1/0	78	100	100	(1) 14-2/0	(1) 4-300MCM
	230V/60	78	100	100	(1) 14-2/0	(1) 12-1/0	78	100	100	(1) 14-2/0	(1) 4-300MCM
	380V/60	46	60	60	(1) 14-2/0	(1) 12-1/0	46	60	60	(1) 14-2/0	(1) 12-1/0
	460V/60	39	50	50	(1) 14-2/0	(1) 12-1/0	39	50	50	(1) 14-2/0	(1) 12-1/0
	575V/60	34	40	45	(1) 14-2/0	(1) 12-1/0	34	40	45	(1) 14-2/0	(1) 12-1/0
	400V/50	40	50	50	(1) 14-2/0	(1) 12-1/0	40	50	50	(1) 14-2/0	(1) 12-1/0
035E	208V/60	82	100	110	(1) 14-2/0	(1) 4-300MCM	88	110	110	(1) 14-2/0	(1) 4-300MCM
	230V/60	82	100	110	(1) 14-2/0	(1) 4-300MCM	88	110	110	(1) 14-2/0	(1) 4-300MCM
	380V/60	44	60	60	(1) 14-2/0	(1) 12-1/0	56	70	70	(1) 14-2/0	(1) 12-1/0
	460V/60	39	50	50	(1) 14-2/0	(1) 12-1/0	42	50	50	(1) 14-2/0	(1) 12-1/0
	575V/60	32	40	40	(1) 14-2/0	(1) 12-1/0	35	45	45	(1) 14-2/0	(1) 12-1/0
	400V/50	40	50	50	(1) 14-2/0	(1) 12-1/0	44	60	60	(1) 14-2/0	(1) 12-1/0
040E	208V/60	88	110	110	(1) 14-2/0	(1) 4-300MCM	88	110	110	(1) 14-2/0	(1) 4-300MCM
	230V/60	88	110	110	(1) 14-2/0	(1) 4-300MCM	88	110	110	(1) 14-2/0	(1) 4-300MCM
	380V/60	56	70	70	(1) 14-2/0	(1) 12-1/0	56	70	70	(1) 14-2/0	(1) 12-1/0
	460V/60	42	50	50	(1) 14-2/0	(1) 12-1/0	42	50	50	(1) 14-2/0	(1) 12-1/0
	575V/60	35	45	45	(1) 14-2/0	(1) 12-1/0	35	45	45	(1) 14-2/0	(1) 12-1/0
	400V/50	44	60	60	(1) 14-2/0	(1) 12-1/0	44	60	60	(1) 14-2/0	(1) 12-1/0
045E	208V/60	120	150	150	(1) 14-2/0	(1) 4-300MCM	120	150	150	(1) 14-2/0	(1) 6-350MCM
	230V/60	120	150	150	(1) 14-2/0	(1) 4-300MCM	120	150	150	(1) 14-2/0	(1) 6-350MCM
	380V/60	62	80	80	(1) 14-2/0	(1) 12-1/0	62	80	80	(1) 14-2/0	(1) 12-1/0
	460V/60	48	60	60	(1) 14-2/0	(1) 12-1/0	48	60	60	(1) 14-2/0	(1) 12-1/0
	575V/60	39	50	50	(1) 14-2/0	(1) 12-1/0	39	50	50	(1) 14-2/0	(1) 12-1/0
	400V/50	49	60	60	(1) 14-2/0	(1) 12-1/0	49	60	60	(1) 14-2/0	(1) 12-1/0
050E	208V/60	127	150	175	(1) 14-2/0	(1) 6-350MCM	127	150	175	(1) 14-2/0	(1) 6-350MCM
	230V/60	127	150	175	(1) 14-2/0	(1) 6-350MCM	127	150	175	(1) 14-2/0	(1) 6-350MCM
	380V/60	69	90	90	(1) 14-2/0	(1) 12-1/0	69	90	90	(1) 14-2/0	(1) 12-1/0
	460V/60	58	70	80	(1) 14-2/0	(1) 12-1/0	58	70	80	(1) 14-2/0	(1) 12-1/0
	575V/60	51	60	70	(1) 14-2/0	(1) 12-1/0	51	60	70	(1) 14-2/0	(1) 12-1/0
	400V/50	56	70	70	(1) 14-2/0	(1) 12-1/0	56	70	70	(1) 14-2/0	(1) 12-1/0
055E	208V/60	127	150	175	(1) 14-2/0	(1) 6-350MCM	137	175	175	(1) 14-2/0	(1) 6-350MCM
	230V/60	127	150	175	(1) 14-2/0	(1) 6-350MCM	137	175	175	(1) 14-2/0	(1) 6-350MCM
	380V/60	69	90	90	(1) 14-2/0	(1) 12-1/0	85	110	110	(1) 14-2/0	(1) 4-300MCM
	460V/60	58	70	80	(1) 14-2/0	(1) 12-1/0	66	80	90	(1) 14-2/0	(1) 12-1/0
	575V/60	51	60	70	(1) 14-2/0	(1) 12-1/0	59	70	80	(1) 14-2/0	(1) 12-1/0
	400V/50	56	70	70	(1) 14-2/0	(1) 12-1/0	68	80	90	(1) 14-2/0	(1) 12-1/0
060E	208V/60	137	175	175	(1) 14-2/0	(1) 6-350MCM	137	175	175	(1) 14-2/0	(1) 6-350MCM
	230V/60	137	175	175	(1) 14-2/0	(1) 6-350MCM	137	175	175	(1) 14-2/0	(1) 6-350MCM
	380V/60	85	110	110	(1) 14-2/0	(1) 4-300MCM	85	110	110	(1) 14-2/0	(1) 4-300MCM
	460V/60	66	80	90	(1) 14-2/0	(1) 12-1/0	66	80	90	(1) 14-2/0	(1) 12-1/0
	575V/60	59	70	80	(1) 14-2/0	(1) 12-1/0	59	70	80	(1) 14-2/0	(1) 12-1/0
	400V/50	68	80	90	(1) 14-2/0	(1) 12-1/0	68	80	90	(1) 14-2/0	(1) 12-1/0

NOTE: MCA = Minimum Current Ampacity, RFS = Recommended Fuse Size, MFS = Maximum Fuse Size.
For RFS, use the given values for intended standard ambient operation. If the operating ambient is intended to be above 105°F, MFS must be used.

Table 19: Electrical Data - Multiple Point (60/50 Hz)

Model Size	Voltage / Frequency	Multiple Point Field Data - Circuit #1					Multiple Point Field Data - Circuit #2				
		Ratings			Lug Range		Ratings			Lug Range	
		MCA	RFS	MFS	Power Block	Disconnect Switch	MCA	RFS	MFS	Power Block	Disconnect Switch
065E	208V/60	141	175	175	(1) 14-2/0	(1) 6-350MCM	141	175	175	(1) 14-2/0	(1) 6-350MCM
	230V/60	141	175	175	(1) 14-2/0	(1) 6-350MCM	141	175	175	(1) 14-2/0	(1) 6-350MCM
	380V/60	85	110	110	(1) 14-2/0	(1) 4-300MCM	85	110	110	(1) 14-2/0	(1) 4-300MCM
	460V/60	68	80	90	(1) 14-2/0	(1) 12-1/0	68	80	90	(1) 14-2/0	(1) 12-1/0
	575V/60	59	70	80	(1) 14-2/0	(1) 12-1/0	59	70	80	(1) 14-2/0	(1) 12-1/0
	400V/50	68	80	90	(1) 14-2/0	(1) 12-1/0	68	80	90	(1) 14-2/0	(1) 12-1/0
070E	208V/60	162	200	225	(1) 2-600MCM	(1) 6-350MCM	162	200	225	(1) 2-600MCM	(1) 6-350MCM
	230V/60	162	200	225	(1) 2-600MCM	(1) 6-350MCM	162	200	225	(1) 2-600MCM	(1) 6-350MCM
	380V/60	86	110	110	(1) 14-2/0	(1) 4-300MCM	86	110	110	(1) 14-2/0	(1) 4-300MCM
	460V/60	73	90	100	(1) 14-2/0	(1) 12-1/0	73	90	100	(1) 14-2/0	(1) 4-300MCM
	575V/60	62	80	80	(1) 14-2/0	(1) 12-1/0	62	80	80	(1) 14-2/0	(1) 12-1/0
	400V/50	73	90	100	(1) 14-2/0	(1) 12-1/0	73	90	100	(1) 14-2/0	(1) 4-300MCM
075E	208V/60	186	225	250	(1) 2-600MCM	(1) 6-350MCM	170	225	225	(1) 14-2/0	(1) 6-350MCM
	230V/60	186	225	250	(1) 2-600MCM	(1) 6-350MCM	170	225	225	(1) 14-2/0	(1) 6-350MCM
	380V/60	92	110	125	(1) 14-2/0	(1) 4-300MCM	91	110	125	(1) 14-2/0	(1) 4-300MCM
	460V/60	80	100	110	(1) 14-2/0	(1) 4-300MCM	76	100	100	(1) 14-2/0	(1) 4-300MCM
	575V/60	66	80	90	(1) 14-2/0	(1) 12-1/0	65	80	90	(1) 14-2/0	(1) 12-1/0
	400V/50	80	100	110	(1) 14-2/0	(1) 4-300MCM	76	100	100	(1) 14-2/0	(1) 4-300MCM
080E	208V/60	186	225	250	(1) 2-600MCM	(1) 6-350MCM	186	225	250	(1) 2-600MCM	(2) 3/0-500MCM
	230V/60	186	225	250	(1) 2-600MCM	(1) 6-350MCM	186	225	250	(1) 2-600MCM	(2) 3/0-500MCM
	380V/60	98	125	125	(1) 14-2/0	(1) 4-300MCM	98	125	125	(1) 14-2/0	(1) 6-350MCM
	460V/60	80	100	110	(1) 14-2/0	(1) 4-300MCM	80	100	110	(1) 14-2/0	(1) 4-300MCM
	575V/60	66	80	90	(1) 14-2/0	(1) 12-1/0	66	80	90	(1) 14-2/0	(1) 4-300MCM
	400V/50	80	100	110	(1) 14-2/0	(1) 4-300MCM	80	100	110	(1) 14-2/0	(1) 4-300MCM
090E	208V/60	203	250	250	(1) 2-600MCM	(1) 6-350MCM	203	250	250	(1) 2-600MCM	(2) 3/0-500MCM
	230V/60	203	250	250	(1) 2-600MCM	(1) 6-350MCM	203	250	250	(1) 2-600MCM	(2) 3/0-500MCM
	380V/60	115	150	150	(1) 14-2/0	(1) 4-300MCM	115	150	150	(1) 14-2/0	(1) 6-350MCM
	460V/60	89	110	125	(1) 14-2/0	(1) 4-300MCM	89	110	125	(1) 14-2/0	(1) 4-300MCM
	575V/60	78	100	110	(1) 14-2/0	(1) 4-300MCM	78	100	110	(1) 14-2/0	(1) 4-300MCM
	400V/50	89	110	125	(1) 14-2/0	(1) 4-300MCM	89	110	125	(1) 14-2/0	(1) 4-300MCM
100E	208V/60	215	300	300	(1) 2-600MCM	(2) 3/0-500MCM	248	300	350	(1) 2-600MCM	(2) 3/0-500MCM
	230V/60	215	300	300	(1) 2-600MCM	(2) 3/0-500MCM	248	300	350	(1) 2-600MCM	(2) 3/0-500MCM
	380V/60	129	175	175	(1) 14-2/0	(1) 6-350MCM	152	200	200	(1) 14-2/0	(2) 3/0-500MCM
	460V/60	96	125	125	(1) 14-2/0	(1) 4-300MCM	117	150	150	(1) 14-2/0	(1) 6-350MCM
	575V/60	87	110	110	(1) 14-2/0	(1) 4-300MCM	105	150	150	(1) 14-2/0	(1) 6-350MCM
	400V/50	96	125	125	(1) 14-2/0	(1) 4-300MCM	117	150	150	(1) 14-2/0	(1) 6-350MCM
110E	208V/60	259	350	350	(1) 2-600MCM	(2) 3/0-500MCM	259	350	350	(1) 2-600MCM	(2) 3/0-500MCM
	230V/60	259	350	350	(1) 2-600MCM	(2) 3/0-500MCM	259	350	350	(1) 2-600MCM	(2) 3/0-500MCM
	380V/60	156	200	225	(1) 14-2/0	(1) 6-350MCM	156	200	225	(1) 14-2/0	(2) 3/0-500MCM
	460V/60	120	150	175	(1) 14-2/0	(1) 6-350MCM	120	150	175	(1) 14-2/0	(1) 6-350MCM
	575V/60	108	150	150	(1) 14-2/0	(1) 4-300MCM	108	150	150	(1) 14-2/0	(1) 6-350MCM
	400V/50	120	150	175	(1) 14-2/0	(1) 6-350MCM	120	150	175	(1) 14-2/0	(1) 6-350MCM

NOTE: MCA = Minimum Current Ampacity, RFS = Recommended Fuse Size, MFS = Maximum Fuse Size.
For RFS, use the given values for intended standard ambient operation. If the operating ambient is intended to be above 105°F, MFS must be used.

Table 20: Electrical Data - Multiple Point (60/50 Hz)

Model Size	Voltage / Frequency	Multiple Point Field Data - Circuit #1					Multiple Point Field Data - Circuit #2				
		Ratings			Lug Range		Ratings			Lug Range	
		MCA	RFS	MFS	Power Block	Disconnect Switch	MCA	RFS	MFS	Power Block	Disconnect Switch
120E	208V/60	281	350	350	(1) 2-600MCM	(2) 3/0-500MCM	281	350	350	(1) 2-600MCM	(2) 3/0-500MCM
	230V/60	281	350	350	(1) 2-600MCM	(2) 3/0-500MCM	281	350	350	(1) 2-600MCM	(2) 3/0-500MCM
	380V/60	174	225	225	(1) 14-2/0	(1) 6-350MCM	174	225	225	(1) 14-2/0	(2) 3/0-500MCM
	460V/60	137	175	175	(1) 14-2/0	(1) 6-350MCM	137	175	175	(1) 14-2/0	(1) 6-350MCM
	575V/60	123	150	150	(1) 14-2/0	(1) 4-300MCM	123	150	150	(1) 14-2/0	(1) 6-350MCM
	400V/50	137	175	175	(1) 14-2/0	(1) 6-350MCM	137	175	175	(1) 14-2/0	(1) 6-350MCM
130E	208V/60	281	350	350	(1) 2-600MCM	(2) 3/0-500MCM	316	400	450	(1) 2-600MCM	(2) 3/0-500MCM
	230V/60	281	350	350	(1) 2-600MCM	(2) 3/0-500MCM	316	400	450	(1) 2-600MCM	(2) 3/0-500MCM
	380V/60	174	225	225	(1) 14-2/0	(1) 6-350MCM	201	250	250	(1) 2-600MCM	(2) 3/0-500MCM
	460V/60	137	175	175	(1) 14-2/0	(1) 6-350MCM	160	200	225	(1) 14-2/0	(2) 3/0-500MCM
	575V/60	123	150	150	(1) 14-2/0	(1) 4-300MCM	128	175	175	(1) 14-2/0	(1) 6-350MCM
	400V/50	137	175	175	(1) 14-2/0	(1) 6-350MCM	160	200	225	(1) 14-2/0	(2) 3/0-500MCM
140E	208V/60	324	400	450	(1) 2-600MCM	(2) 3/0-500MCM	324	400	450	(1) 2-600MCM	(2) 3/0-500MCM
	230V/60	324	400	450	(1) 2-600MCM	(2) 3/0-500MCM	324	400	450	(1) 2-600MCM	(2) 3/0-500MCM
	380V/60	206	250	250	(1) 2-600MCM	(1) 6-350MCM	206	250	250	(1) 2-600MCM	(2) 3/0-500MCM
	460V/60	164	200	225	(1) 14-2/0	(1) 6-350MCM	164	200	225	(1) 14-2/0	(2) 3/0-500MCM
	575V/60	131	175	175	(1) 14-2/0	(1) 6-350MCM	131	175	175	(1) 14-2/0	(1) 6-350MCM
	400V/50	164	200	225	(1) 14-2/0	(1) 6-350MCM	164	200	225	(1) 14-2/0	(2) 3/0-500MCM
150E	208V/60	324	400	450	(1) 2-600MCM	(2) 3/0-500MCM	351	450	450	(1) 2-600MCM	(2) 3/0-500MCM
	230V/60	324	400	450	(1) 2-600MCM	(2) 3/0-500MCM	351	450	450	(1) 2-600MCM	(2) 3/0-500MCM
	380V/60	206	250	250	(1) 2-600MCM	(1) 6-350MCM	228	300	300	(1) 2-600MCM	(2) 3/0-500MCM
	460V/60	164	200	225	(1) 14-2/0	(1) 6-350MCM	182	225	250	(1) 2-600MCM	(2) 3/0-500MCM
	575V/60	131	175	175	(1) 14-2/0	(1) 6-350MCM	134	175	175	(1) 14-2/0	(1) 6-350MCM
	400V/50	164	200	225	(1) 14-2/0	(1) 6-350MCM	182	225	250	(1) 2-600MCM	(2) 3/0-500MCM
161E	208V/60	358	450	450	(1) 2-600MCM	(2) 3/0-500MCM	358	450	450	(1) 2-600MCM	(2) 3/0-500MCM
	230V/60	358	450	450	(1) 2-600MCM	(2) 3/0-500MCM	358	450	450	(1) 2-600MCM	(2) 3/0-500MCM
	380V/60	212	250	250	(1) 2-600MCM	(1) 6-350MCM	212	250	250	(1) 2-600MCM	(2) 3/0-500MCM
	460V/60	165	200	200	(1) 14-2/0	(1) 6-350MCM	165	200	200	(1) 14-2/0	(2) 3/0-500MCM
	575V/60	146	175	175	(1) 14-2/0	(1) 6-350MCM	146	175	175	(1) 14-2/0	(1) 6-350MCM
	400V/50	165	200	200	(1) 14-2/0	(1) 6-350MCM	165	200	200	(1) 14-2/0	(2) 3/0-500MCM
170E	208V/60	358	450	450	(1) 2-600MCM	(2) 3/0-500MCM	405	500	500	(1) 2-600MCM	(2) 3/0-500MCM
	230V/60	358	450	450	(1) 2-600MCM	(2) 3/0-500MCM	405	500	500	(1) 2-600MCM	(2) 3/0-500MCM
	380V/60	212	250	250	(1) 2-600MCM	(1) 6-350MCM	248	300	300	(1) 2-600MCM	(2) 3/0-500MCM
	460V/60	165	200	200	(1) 14-2/0	(1) 6-350MCM	204	250	250	(1) 2-600MCM	(2) 3/0-500MCM
	575V/60	146	175	175	(1) 14-2/0	(1) 6-350MCM	176	200	225	(1) 2-600MCM	(1) 6-350MCM
	400V/50	165	200	200	(1) 14-2/0	(1) 6-350MCM	204	250	250	(1) 2-600MCM	(2) 3/0-500MCM
180E	208V/60	453	500	500	(2) 6-500MCM	(2) 3/0-500MCM	453	500	500	(2) 6-500MCM	(2) 3/0-500MCM
	230V/60	453	500	500	(2) 6-500MCM	(2) 3/0-500MCM	453	500	500	(2) 6-500MCM	(2) 3/0-500MCM
	380V/60	248	300	300	(1) 2-600MCM	(2) 3/0-500MCM	248	300	300	(1) 2-600MCM	(2) 3/0-500MCM
	460V/60	204	250	250	(1) 2-600MCM	(1) 6-350MCM	204	250	250	(1) 2-600MCM	(2) 3/0-500MCM
	575V/60	176	200	225	(1) 2-600MCM	(1) 6-350MCM	176	200	225	(1) 2-600MCM	(2) 3/0-500MCM
	400V/50	204	250	250	(1) 2-600MCM	(1) 6-350MCM	204	250	250	(1) 2-600MCM	(2) 3/0-500MCM

NOTE: MCA = Minimum Current Ampacity, RFS = Recommended Fuse Size, MFS = Maximum Fuse Size.
For RFS, use the given values for intended standard ambient operation. If the operating ambient is intended to be above 105°F, MFS must be used.

Table 21: Electrical Data - Multiple Point (60/50 Hz)

Model Size	Voltage / Frequency	Multiple Point Field Data - Circuit #1					Multiple Point Field Data - Circuit #2				
		Ratings			Lug Range		Ratings			Lug Range	
		MCA	RFS	MFS	Power Block	Disconnect Switch	MCA	RFS	MFS	Power Block	Disconnect Switch
190E	208V/60	413	500	500	(1) 2-600MCM	(2) 3/0-500MCM	464	600	600	(2) 6-500MCM	(3) 2/0-400MCM
	230V/60	413	500	500	(1) 2-600MCM	(2) 3/0-500MCM	464	600	600	(2) 6-500MCM	(3) 2/0-400MCM
	380V/60	252	300	300	(1) 2-600MCM	(2) 3/0-500MCM	274	350	350	(1) 2-600MCM	(2) 3/0-500MCM
	460V/60	208	250	250	(1) 2-600MCM	(1) 6-350MCM	231	300	300	(1) 2-600MCM	(2) 3/0-500MCM
	575V/60	179	225	225	(1) 2-600MCM	(1) 6-350MCM	182	225	225	(1) 2-600MCM	(2) 3/0-500MCM
	400V/50	208	250	250	(1) 2-600MCM	(1) 6-350MCM	231	300	300	(1) 2-600MCM	(2) 3/0-500MCM
210E	208V/60	464	600	600	(2) 6-500MCM	(2) 3/0-500MCM	464	600	600	(2) 6-500MCM	(3) 2/0-400MCM
	230V/60	464	600	600	(2) 6-500MCM	(2) 3/0-500MCM	464	600	600	(2) 6-500MCM	(3) 2/0-400MCM
	380V/60	274	350	350	(1) 2-600MCM	(2) 3/0-500MCM	274	350	350	(1) 2-600MCM	(2) 3/0-500MCM
	460V/60	231	300	300	(1) 2-600MCM	(2) 3/0-500MCM	231	300	300	(1) 2-600MCM	(2) 3/0-500MCM
	575V/60	182	225	225	(1) 2-600MCM	(2) 3/0-500MCM	182	225	225	(1) 2-600MCM	(2) 3/0-500MCM
	400V/50	231	300	300	(1) 2-600MCM	(1) 6-350MCM	231	300	300	(1) 2-600MCM	(2) 3/0-500MCM
225E	208V/60	483	600	600	(2) 6-500MCM	(2) 3/0-500MCM	494	600	600	(2) 6-500MCM	(3) 2/0-400MCM
	230V/60	483	600	600	(2) 6-500MCM	(2) 3/0-500MCM	494	600	600	(2) 6-500MCM	(3) 2/0-400MCM
	380V/60	278	350	350	(1) 2-600MCM	(2) 3/0-500MCM	295	350	350	(1) 2-600MCM	(2) 3/0-500MCM
	460V/60	235	300	300	(1) 2-600MCM	(2) 3/0-500MCM	253	300	300	(1) 2-600MCM	(2) 3/0-500MCM
	575V/60	185	225	225	(1) 2-600MCM	(2) 3/0-500MCM	187	225	225	(1) 2-600MCM	(2) 3/0-500MCM
	400V/50	235	300	300	(1) 2-600MCM	(1) 6-350MCM	253	300	300	(1) 2-600MCM	(2) 3/0-500MCM
240E	208V/60	555	700	700	(2) 6-500MCM	(3) 2/0-400MCM	555	700	700	(2) 6-500MCM	(3) 2/0-400MCM
	230V/60	555	700	700	(2) 6-500MCM	(3) 2/0-400MCM	555	700	700	(2) 6-500MCM	(3) 2/0-400MCM
	380V/60	312	400	400	(1) 2-600MCM	(2) 3/0-500MCM	312	400	400	(1) 2-600MCM	(2) 3/0-500MCM
	460V/60	272	300	300	(1) 2-600MCM	(2) 3/0-500MCM	272	300	300	(1) 2-600MCM	(2) 3/0-500MCM
	575V/60	190	225	225	(1) 2-600MCM	(2) 3/0-500MCM	190	225	225	(1) 2-600MCM	(2) 3/0-500MCM
	400V/50	272	300	300	(1) 2-600MCM	(1) 6-350MCM	272	300	300	(1) 2-600MCM	(2) 3/0-500MCM

NOTE: MCA = Minimum Current Ampacity, RFS = Recommended Fuse Size, MFS = Maximum Fuse Size.
For RFS, use the given values for intended standard ambient operation. If the operating ambient is intended to be above 105°F, MFS must be used.

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® IIII 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.

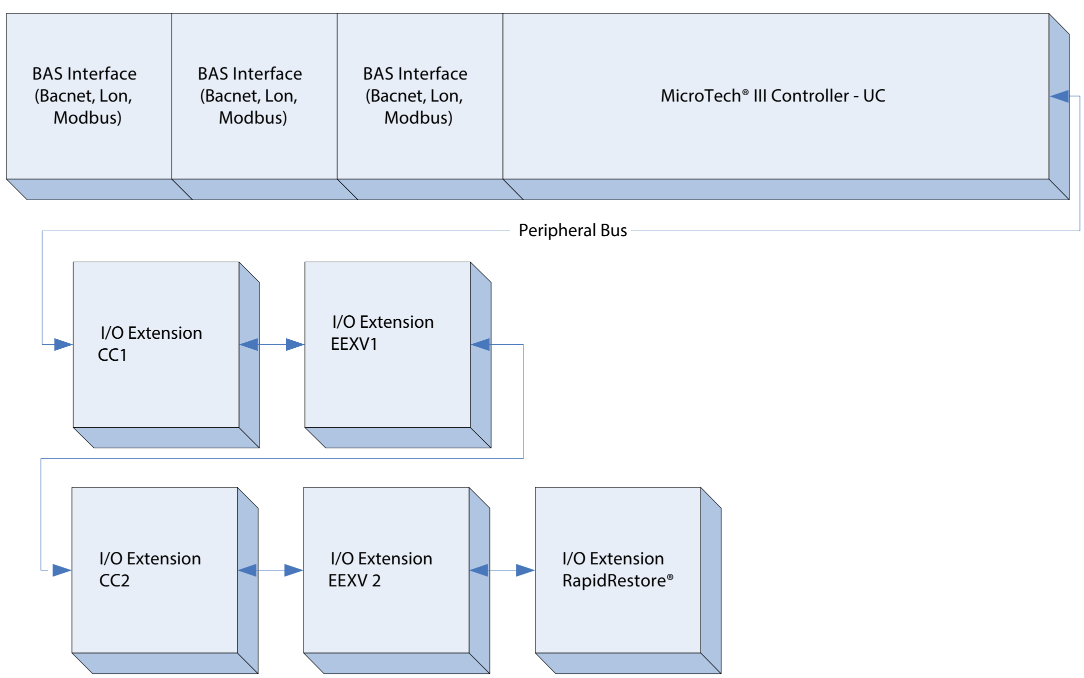
System Architecture

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 40: System Architecture



Controller Inputs and Outputs

Main Controller

Table 22: 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 23: 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 24: Digital Inputs

	Description	Signal Off	Signal On
DI1	External Alarm/Event	Ext. 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 25: 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 26: 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

Table 27: 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 28: 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	Evaporator 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 29: Analog Inputs

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

Table 30: Digital Inputs

	Description	Signal Off	Signal On
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 (not applicable to 030 and 045E models).

Table 31: 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

EXV Module 1 and 2

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

Table 32: Digital Outputs

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

Table 33: 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 34: 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 35: 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 36: 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 37: Digital Inputs

	Description	Signal Off	Signal On
DI1	RapidRestore Enable	Disable RapidRestore	Allow RapidRestore Enabling
DI2	Backup Chiller Designation	Not Backup 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. If an option is not available on a specific model size, the respective set point will not be needed and therefore not be visible.

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

Table 38: Unit Level Set Point Defaults and Ranges

Description	**Default**	**Range**
Basic Unit Configuration		
Unit Model	AGZ000???	Based on Unit Model Configuration
Condenser Type	Not Set	Not Set Tube and Fin, 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
Mode/Enabling		
Unit Enable	Enable	Disable, Enable
Control source	Local	Local, Network
Available Modes	Cool	Cool, Cool w/Glycol, Cool/Ice w/Glycol, Ice, Test
Staging and Capacity Control		
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 TimCycle Delay	12	1-23 hours
Clear Ice Timer	No	No,Yes
RapidRestore	Disable	Disable, Enable
Rapid Restore Max Power Off	15 seconds	15 ro 180 seconds
Evaporator Pump Control		
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
Power Conservation and Limits		
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)
Sound Reduction Mode		
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
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

Table 39: Unit Level Set Point Defaults and Ranges (continued)

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
Unit Sensor Offsets		
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)
OAT Sensor Offset	0°C (0°F)	-5.0 to 5.0 °C (-9.0 to 9.0 °F)
Circuit Configuration Timers (applies to both circuits)		
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
Alarm and Limit Settings - Units		
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
Alarm and Limit Settings - Circuits		
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
BAS Control Inputs		
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

The following settings have different ranges of adjustment based on other settings.

Table 40: Cool LWT 1 and Cool LWT2 Set Point Ranges

Available Mode Selection	Unit Vintage	Range
Without Glycol	E vintage	4.4 to 18.34°C (39.9 to 65°F)
With Glycol	E vintage	-9.5 to 18.34°C (14.9 to 65°F)

Table 41: Evaporator Water Freeze

Available Mode Selection	Range
Without Glycol	2.2 to 5.6°C (36 to 42.1°F)
With Glycol	-10.8 to 5.6°C (12.6 to 42.1°F)

Table 42: Low Ambient Lockout

Fan VFD	Range
Disable	0 to 15.6°C (32 to 60.1°F)
Enable	-23.3 to 15.6°C (-9.9 to 60.1°F)

Table 43: 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 44: 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 Evaporator Approach 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

Table 45: 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 46: 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

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 47: Commincation 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 48: Set Points for Individual Circuits

Description	Default	Range
Mode/Enabling		
Circuit mode	Enable	Disable, Enable, Test
Compressor 1 Enable	Auto	Auto, Off
Compressor 2 Enable	Auto	Auto, Off
Compressor 3 Enable	Auto	Auto, Off
EXV Settings		
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)
Condenser Control		
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
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
Sensor Offsets		
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)
BAS Control Inputs		
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.

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 70
2 - Models 75 to 240 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 240 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)

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 53: Suction Superheat Target 33%

Unit Model	Default
Models 75 to 180	4.44°C (8°F)
Models 190 to 240	5.56°C (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 79 for various levels of access.

Entering Passwords

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

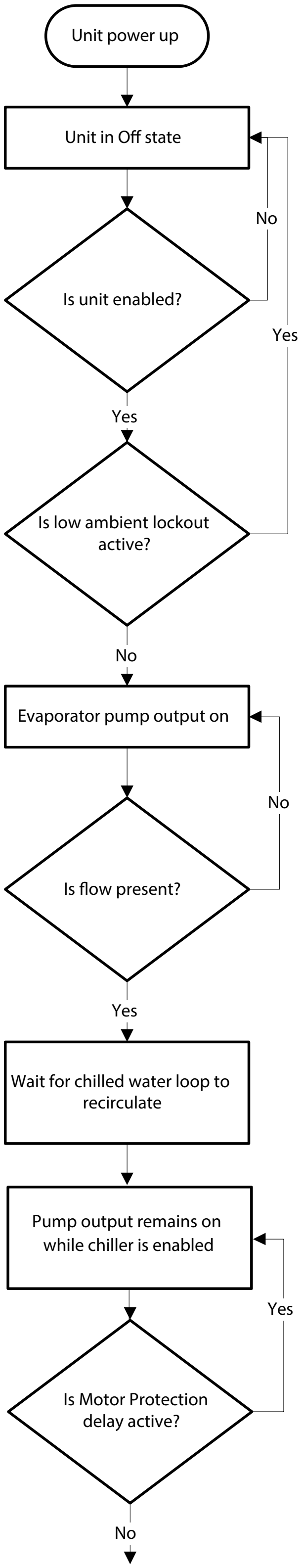
If the wrong password is entered, a message will temporarily appear stating this. If no valid password is active the active password level displays "none."

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 41: 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**.

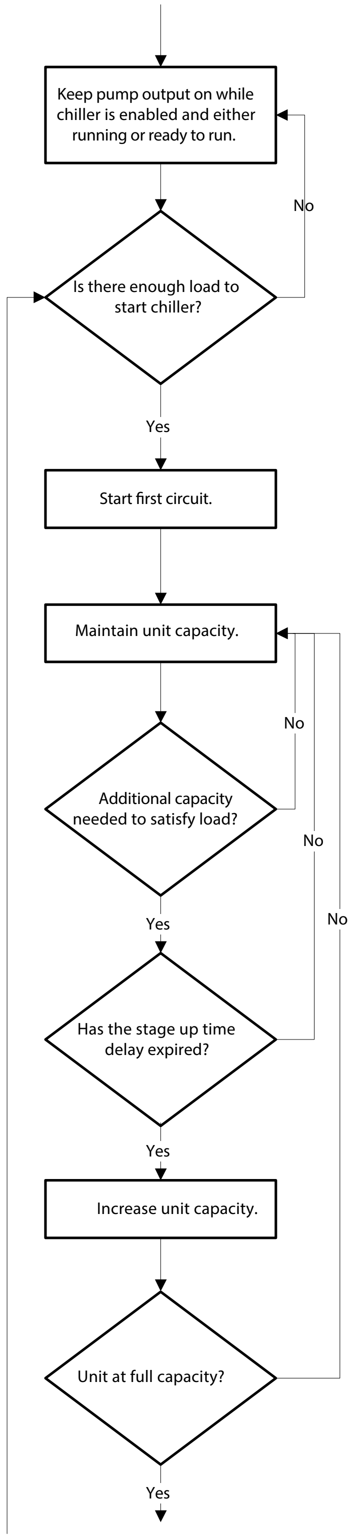
If the chiller is enabled, then the unit will be in the Auto state and the evaporator water pump output will be activated.

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 42: Unit Sequence of Operation - Cool Mode (continue)



The chiller is now ready to start if enough load is present. If the LWT is not higher than the start up temperature, the unit status will be Auto:Wait for load.

If the LWT is higher than the start up temperature, the unit status will become Auto. A circuit can start at this time.

The first circuit to start is generally the available circuit with the least number of starts. This circuit will go through its start sequence at this point.

The unit capacity can be increased if the LWT is above the stage up temperature.

A minimum time must pass between the starting of circuits.

If the second circuit is not running, it will be started now. The unit will try to keep the load balanced between circuits as the unit capacity is increased.

If both circuits are running, then additional compressors will start based on the sequencing logic.

Figure 43: Unit Sequence of Operation - Cool Mode (continued)

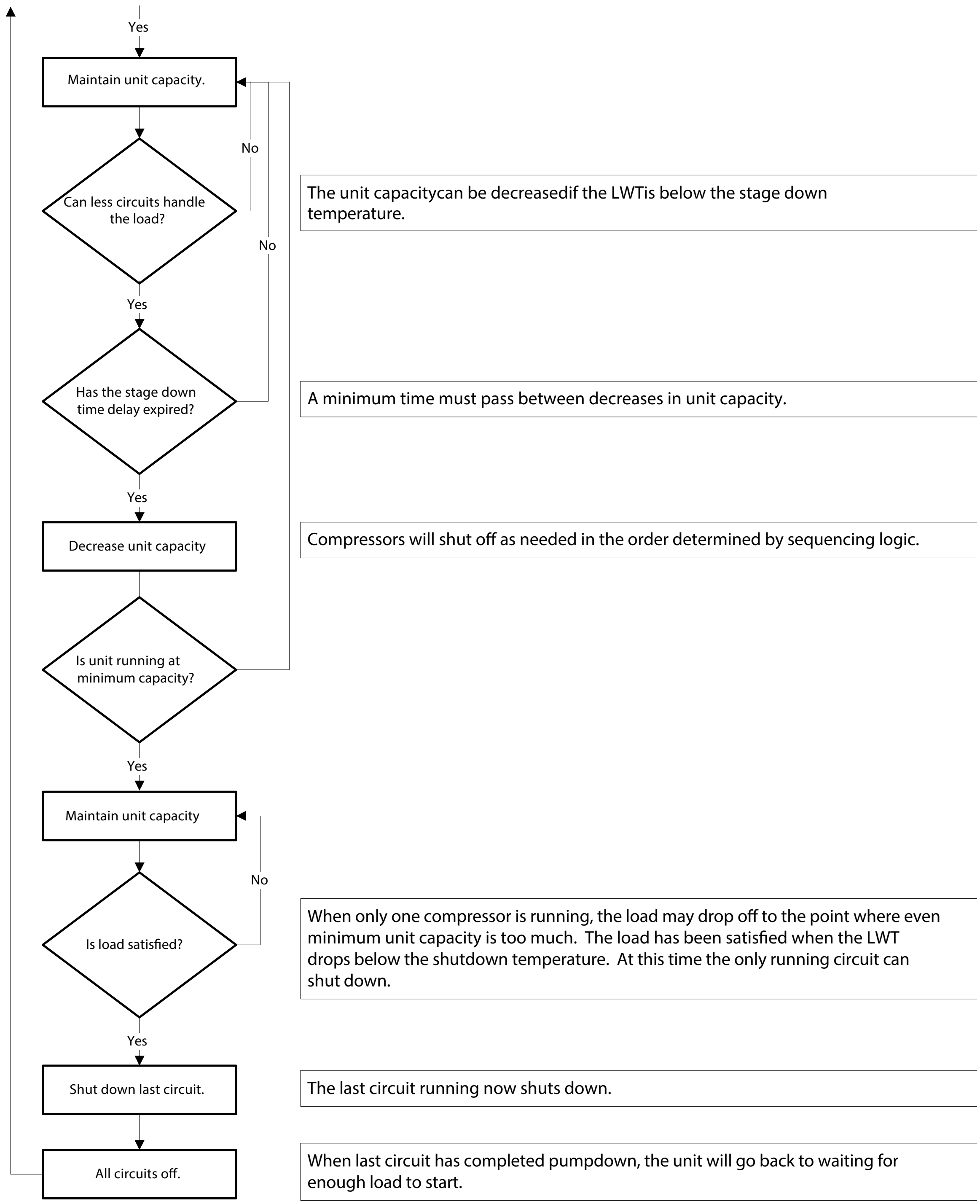
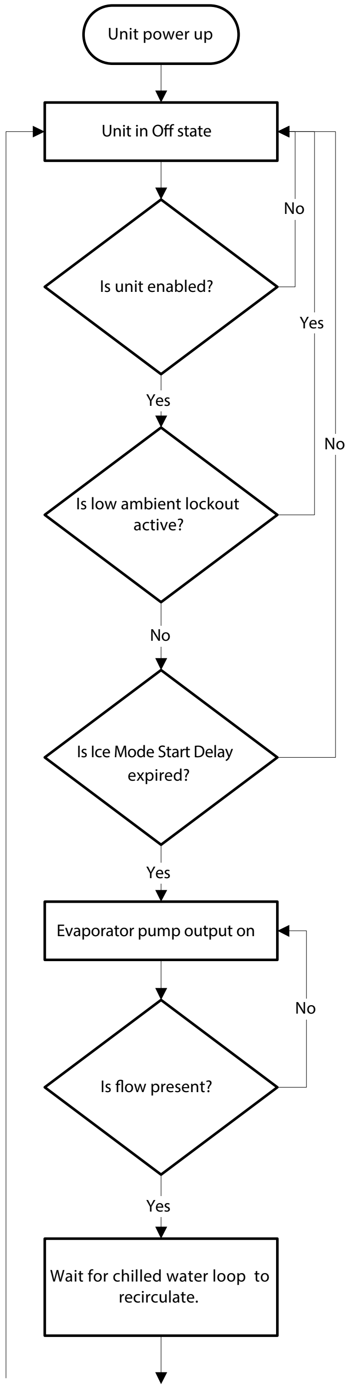


Figure 44: Unit Sequence of Operation - Ice Mode



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.

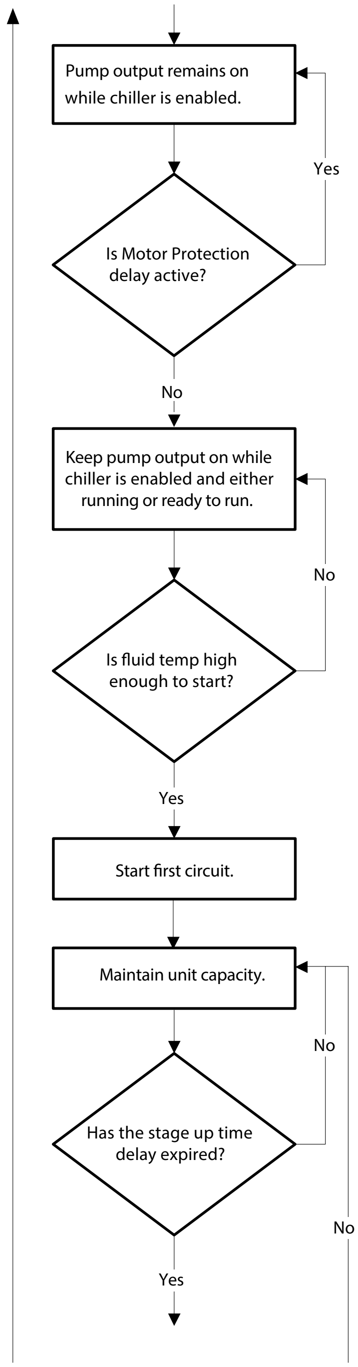
A delay is required between Ice cycles.

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 45: Unit Sequence of Operation - Ice Mode (continued)



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

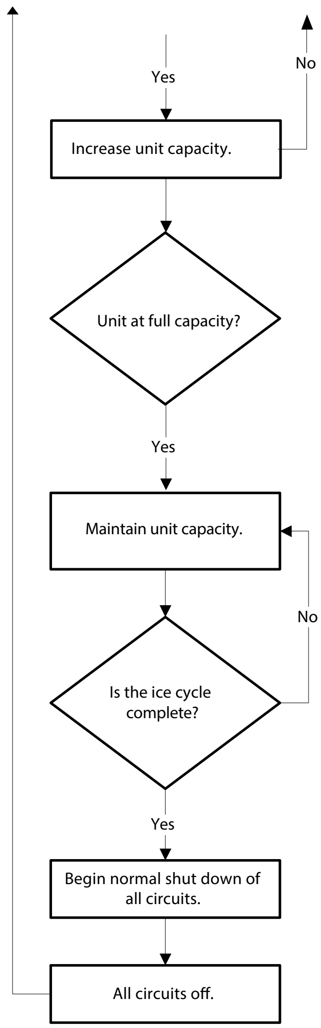
The chiller is now ready to start if enough load is present. If the LWT is not higher than the startup temperature, the unit status will be Auto:Wait for load.

If the LWT is higher than the startup temperature, the unit status will be Auto. A circuit can start at this time.

The first circuit to start is generally the circuit which contains the compressor with the least number of starts. This circuit will go through it's start sequence at this point.

A minimum time must pass between the starting of circuits.

Figure 46: Unit Sequence of Operation - Ice Mode (continued)



If the second circuit is not running, it will be started now. The unit will try to keep the load balanced between circuits as the unit capacity is increased.

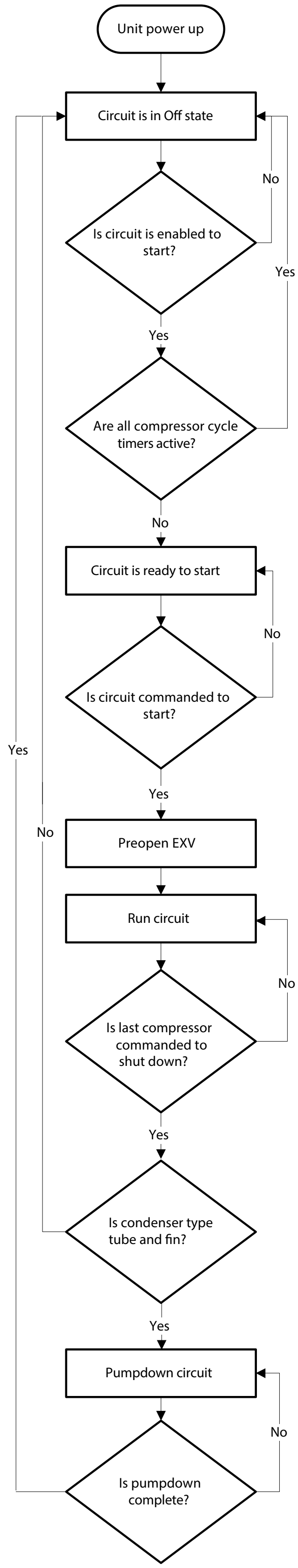
If both circuits are running, then additional compressors will start based on the sequencing logic.

Ice building is complete when LWT is less than the Active Setpoint.

All circuits begin the shut down sequence simultaneously.

When all circuits have completed shutdown, the unit will remain in the off state until the start conditions are satisfied again.

Figure 47: 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 54: 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 55: 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

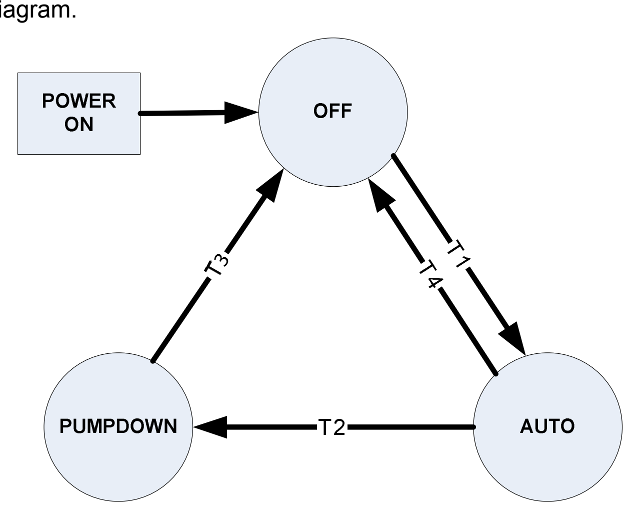
The unit will always be in one of three states:

Off – Unit is not enabled to run

Auto – Unit is enabled to run

Pumpdown – Unit is doing a normal shutdown (tube and fin condenser coils only). If a unit has microchannel coils, the individual refrigerant circuits will never do a pumpdown. 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.

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:Rapid Restore	Unit State = Auto and unit is performing Rapid Restore 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

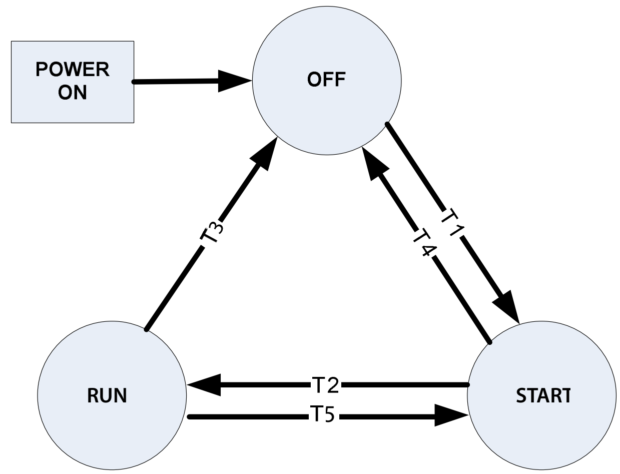
For control of the evaporator pumps, three evaporator pump control states should be used:

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 ackup
- #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.

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 mode 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 56: 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 57: 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 58: Stage Limits - Four Compressors

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

Table 59: 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.

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 shall be enabled via the RapidRestore® set point 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.

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

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.

Time to Start

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.

Current software has a delay of 150 seconds after bootup is complete before the first circuit can start. The software will be changed to use the 110 second delay discussed above only when the chiller is performing the RapidRestore operation.

Fast Loading

Fast loading will be performed when the following conditions are met after the unit power up:

- Chiller enters RapidRestore® operation
- Current LWT > Start Up Temperature

For reference, Start Up Temperature is Stage Up Temperature + Start Up Delta T. Stage Up Temperature is calculated based on the Full Capacity Evaporator Delta T set point and the number of compressors on the chiller.

Fast loading should end if any of the following conditions occur:

- LWT < Stage Up Temperature
- Unit capacity = 100%
- All circuits become disabled for any reason
- Unit becomes disabled for any reason
- 10 minutes have passed since unit powered up

When fast loading ends, the RapidRestore® operation is considered complete.

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 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 in the fast loading section.

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 60: 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.

Calculations

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:

Evaporator Approach = LWT – Evaporator Saturated Temperature

Condenser Approach

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

Condenser Approach = Condenser Saturated Temperature - OAT

Suction Superheat

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

Suction superheat = Suction Temperature – 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:

Pumpdown pressure = Low Evap Pressure Unload set point – 103KPA (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:

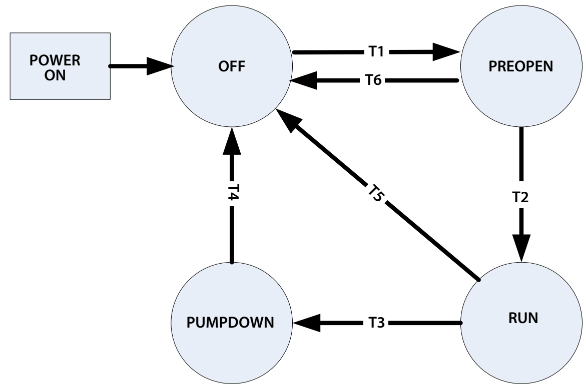
Off – Circuit is not running

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

Pumpdown Procedure

Pumpdown is performed as follows:

- If multiple compressors are running, shut off the appropriate compressors based on sequencing logic and leave only one running
- Turn off hot gas output and liquid line output
- Keep running until evaporator pressure reaches the pumpdown pressure, then stop compressor
- If evaporator pressure does not reach pumpdown pressure within two minutes, stop compressor

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 addition al compressors can start on that circuit even though the hold and unlaod events are disabled at this time.

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

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

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

Circuit Status

The displayed circuit status should be determined by the conditions in the following table:If more than one status is enabled at the same time, the hightest 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 48: 2 Fans per Circuit - Unit Numbering Schematic

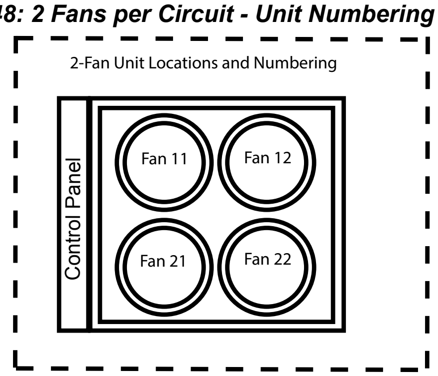


Table 61: 2 Fans per Circuit - Without Fan VFD

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 62: 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 49: 3 Fans per Circuit - Unit Numbering Schematic

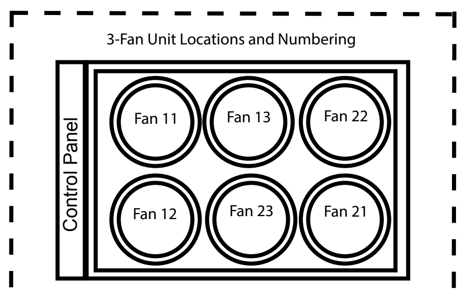


Table 63: 3 Fans per Circuit - Without Fan VFD

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 64: 3 Fans per Circuit - With 1 Fan VFD per Circuit

Description	Output	Fans	Stage					
			1	2	3	4	5	6
Circuit 1								
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								
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 65: 3 Fans per Circuit - With 2 Fan VFDs per Circuit

Description	Output	Fans	Stage					
			1	2	3	4	5	6
Circuit 1								
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								
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 50: 4 Fans per Circuit - Unit Numbering Schematic

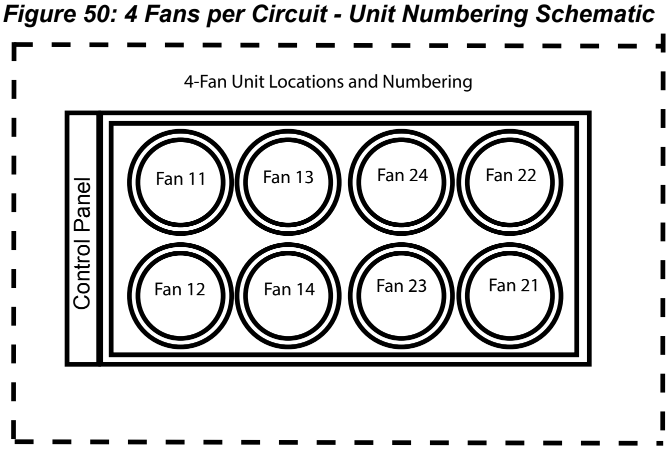


Table 66: 4 Fans per Circuit - Without Fan VFD

Description	Output	Fans	Stage					
			1	2	3	4	5	6
Circuit 1								
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								
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 67: 4 Fans per Circuit - With 1 Fan VFD per Circuit

Description	Output	Fans	Stage					
			1	2	3	4	5	6
Circuit 1								
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								
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 68: 4 Fans per Circuit - With 2 Fan VFDs per Circuit

Description	Output	Fans	Stage					
			1	2	3	4	5	6
Circuit 1								
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								
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 51: 5 Fans per Circuit - Unit Numbering Schematic

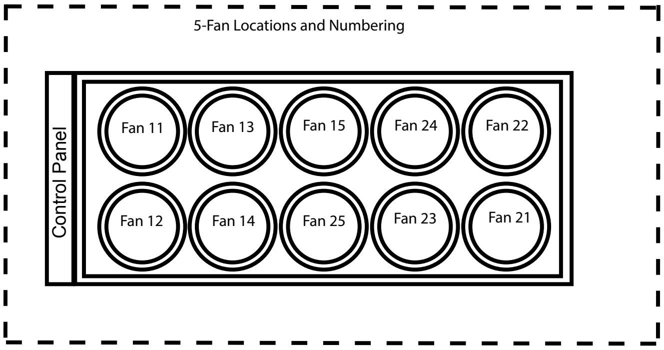


Table 69: 5 Fans per Circuit - Without Fan VFD

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 70: 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 71: 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 52: 6 Fans per Circuit - Unit Numbering Schematic

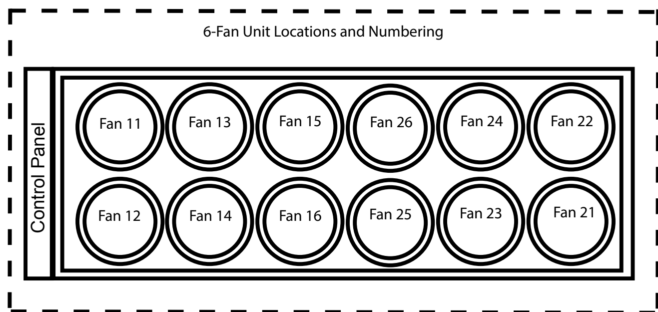


Table 72: 6 Fans per Circuit - Without Fan VFD

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 73: 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 74: 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 53: 7 Fans per Circuit - Unit Numbering Schematic

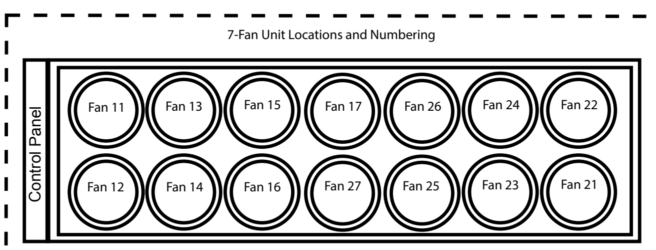


Table 75: 7 Fans per Circuit - Without Fan VFD

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 76: 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 77: 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.

Stage Up Error Step = Saturated Condenser Temperature – (Target + 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.

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.

Stage Down Error Step = (Target - Stage Down dead band) - 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.

VFD Control

Configurations can include a VFD on the first fan 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.

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.

Additional Conditions For Microchannel Coils

For units configured with microchannel condenser coils, the fan staging is the same as for a tube and fin coil except there are additional conditions which may cause the fan stage to increase:

- 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.

In addition, 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, in which case it will go directly to the second stage.

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.

Both of these additions are in place to deal with spikes in condenser pressure resulting from the lower volume of the microchannel coils.

Limiting Last Stage

For E vintage 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).

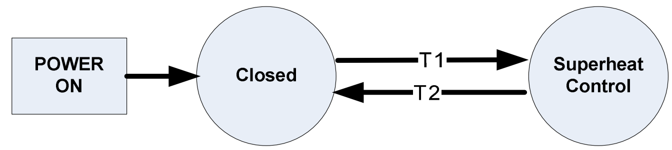
EXV Control

Control States

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

Transitions between these states are shown in Figure 54.

Figure 54: 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 the set point used when one compressor is running (this applies during 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 78.

Table 78: Maximum Position Range

Model	# Compressors Running/Circuit		
	1	2	3
AGZ030E	50	100	n/a
AGZ035E	50	100	n/a
AGZ040E	50	100	n/a
AGZ045E	50	100	n/a
AGZ050E	50	100	n/a
AGZ055E	50	100	n/a
AGZ060E	50	100	n/a
AGZ065E	50	100	n/a
AGZ070E	50	100	n/a
AGZ075E	60	100	n/a
AGZ080E	60	100	n/a
AGZ090E	60	100	n/a
AGZ100E	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
AGZ190E	60	80	100
AGZ210E	60	80	100
AGZ225E	60	80	100
AGZ240E	60	80	100

Operation Considerations

For units equipped with shell and tube evaporators, when staging down a compressor the maximum position is reduced by 10% for one minute to prevent liquid refrigerant from getting to the compressors. After this initial one minute delay, the maximum valve position is allowed to return to its normal value at a rate of 0.1% every six seconds. This offset to the manximum position should not occur if the stage down is due to a low pressure unload.

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.

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 190-240. 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 stop all circuits

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

Evaporator Flow Loss

Trigger:

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

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

Action Taken: Rapid stop all circuits

Reset:

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

If active via trigger condition 1:

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

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

If active via trigger condition 2:

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

Evaporator Water Freeze Protect

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

Action Taken: Rapid stop all circuits

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

Evaporator LWT Sensor Fault

Trigger: Sensor shorted or open for longer than one second

Action Taken: Normal stop all circuits

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

Outdoor Air Temperature Sensor Fault

Trigger: Sensor shorted or open for longer than one second

Action Taken: Normal stop of all circuits.

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

External Alarm

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

Action Taken: Rapid stop of all circuits.

Reset: Auto clear when digital input is closed.

Compressor Module 1 Comm Failure

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

Action Taken: Rapid stop of circuit 1.

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

Compressor Module 2 Comm Failure

Trigger: Communication with I/O extension module failed.

Action Taken: Rapid stop of circuit 2.

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

EXV Module 1 Comm Failure

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

Action Taken: Rapid stop of circuit 1.

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

EXV Module 2 Comm Failure

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

Action Taken: Rapid stop of circuit 2.

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

Unit Problem Alarms

Evaporator Pump #1 Failure

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

Action Taken: Backup pump is used.

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

Evaporator Pump #2 Failure

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

Action Taken: Backup pump is used.

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

Unit Warning Alarms

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 is enabled. For this alarm out of range is considered to be a signal less than 3mA or more than 21mA.

Action Taken: Cannot use demand limit function.

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

Bad LWT Reset Input

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

Action Taken: Cannot use LWT reset function.

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

Evaporator EWT Sensor Fault

Trigger: Sensor shorted or open for longer than one second

Action Taken: None.

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

Circuit Fault Alarms

PVM/GFP Fault

Trigger: Power Configuration = Multi Point and circuit PVM/GFP input is open 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:

Freeze error = Low Evaporator Pressure Unload – Evaporator Pressure

Freeze time =

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

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

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

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

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

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

Action Taken: Rapid stop circuit.

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

High Condenser Pressure

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

Action Taken: Rapid stop circuit.

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

Mechanical High Pressure Switch

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

Action Taken: Rapid stop circuit.

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

Motor Protection Fault

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

Action Taken: Rapid stop circuit.

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

Low OAT Restart Fault

Trigger: Circuit has failed three low OAT start attempts.

Action Taken: Rapid stop circuit.

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

No Pressure Change After Start

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

Action Taken: Rapid stop circuit.

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

Evaporator Pressure Sensor Fault

Trigger: Triggered when sensor is shorted or open for longer than one second. However the fault should not be triggered due to the input signal reading too high unless the circuit has been running for longer than 90 seconds or the OAT is less than 40.56°C (105°F).

Action Taken: Rapid stop circuit.

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

Condenser Pressure Sensor Fault

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

Action Taken: Rapid stop circuit.

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

Suction Temperature Sensor Fault

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

Action Taken: Normal shutdown of circuit.

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

Circuit Warning Alarm

Failed Pumpdown

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

Action Taken: Rapid stop 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 55 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.

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 <= 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 <= Low Evaporator Pressure - Unload set point for a time greater than half of the current freezestat time
- circuit is not currently in a low OAT start
- it has been at least 30 seconds since a compressor has started on the circuit.

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

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

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

High Condenser Pressure - Unload

Trigger:

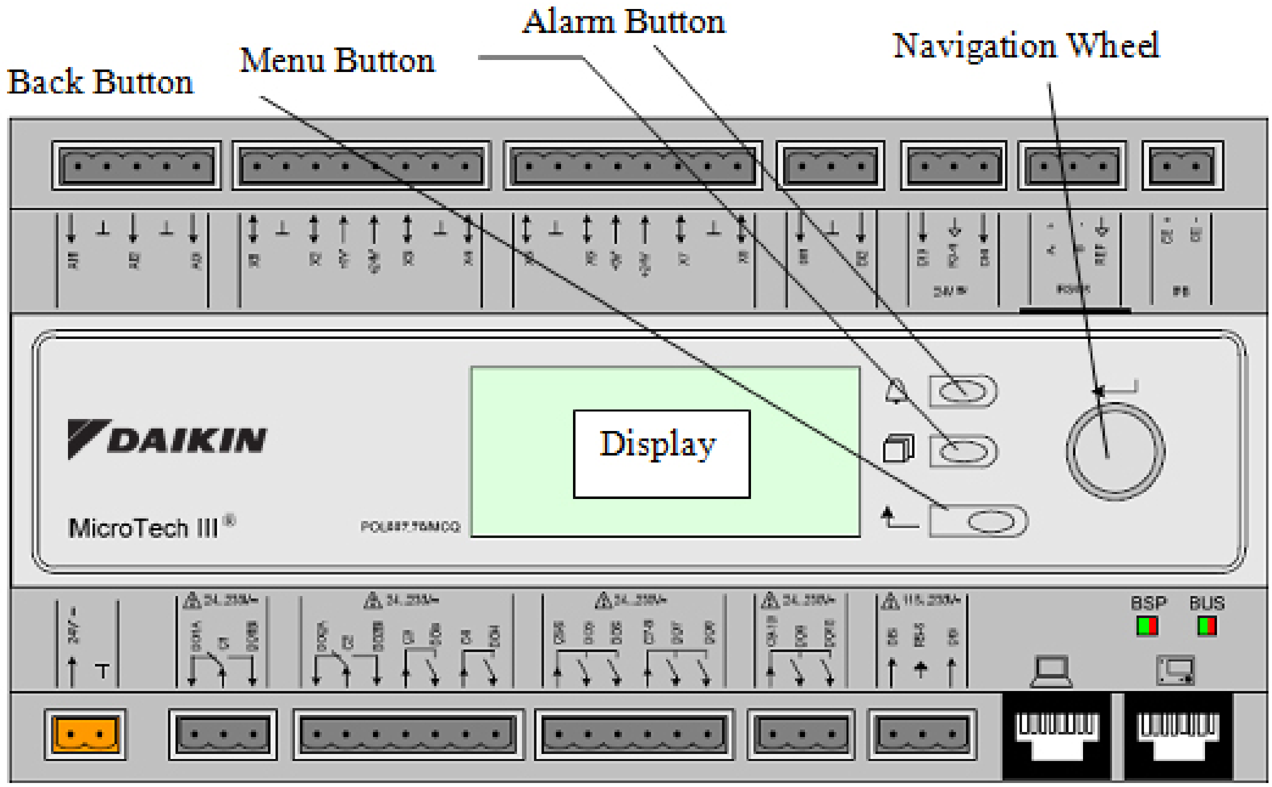
This event is triggered if all of the following are true:

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

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

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

Figure 55: 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 56: 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

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 (6363 for start-up access, 2526 for technician access, 5321 for operator access) can be entered. The first (*) will be highlighted, rotate the wheel clockwise to the first number and set it by pressing the wheel. Repeat for the remaining three numbers. The password will time out after 10 minutes and is cancelled if a new password is entered or the control powers down.
- Not entering a password allows access to a limited number of parameters as shown in Figure 60.

Figure 57: Password Menu

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

Figure 58: 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 57.
- 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 59:

N = No password

O = Operator level

T = Technician 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 *.

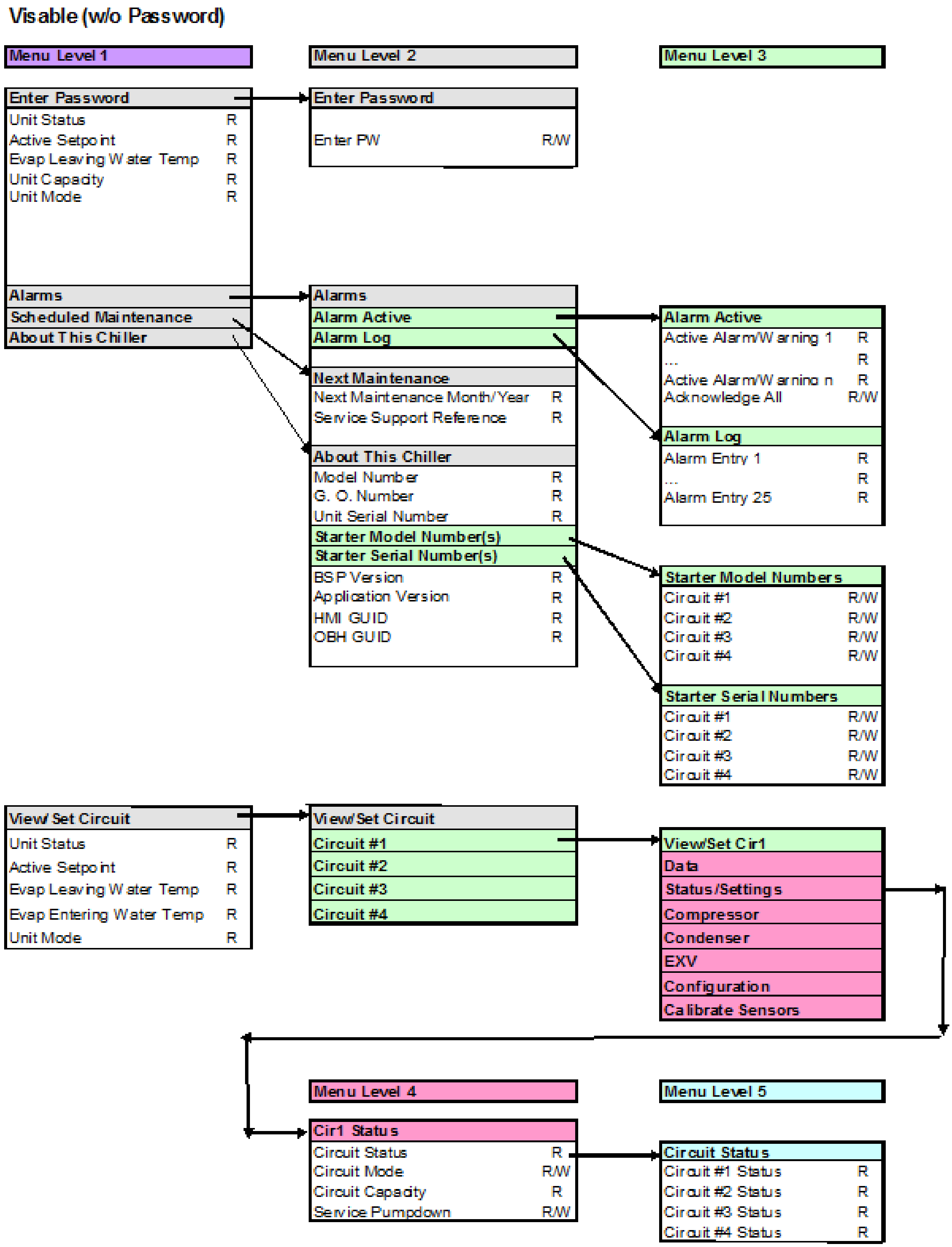
For many of the circuit level screens, only one screen will be shown in this section. The same set of screens exists for each circuit and compressor. These screens are the ones with 'Cx' and Cmpx' identifiers.

Figure 59: Example of Screen Menu With Access Levels

U-1

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

Figure 60: Controller Keypad Sample Navigation



The optional VFD fan control is used for unit operation below 32°F (0°C) down to a minimum of -10°F (-23°C). The control looks at the saturated discharge temperature and varies the fan speed to hold the temperature (pressure) at the "target" temperature.

Low ambient air temperature control is accomplished by using the Optional Low Ambient VFD to control the speed of the first fan on each circuit. This VFD control uses a proportional integral function to drive the saturated condenser temperature to a target value by changing the fan speed. The target value is normally the same as the saturated condenser temperature target setpoint.

The fan VFD always starts when the saturated condenser temperature rises higher than the target.

What is an Inverter?

The term inverter and variable-frequency drive are related and somewhat interchangeable. An electronic motor drive, for an AC motor, controls the motor's speed by varying the frequency of the power sent to the motor.

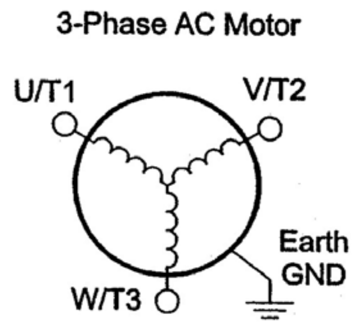
In general, an inverter is a device that converts DC power to AC power. The figure below shows how the variable-frequency drive employs an internal inverter. The drive first converts incoming AC power to DC through a rectifier bridge, creating an internal DC bus voltage. Then the inverter circuit converts the DC back to AC again to power the motor. The special inverter can vary its output frequency and voltage according to the desired motor speed.

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).

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.

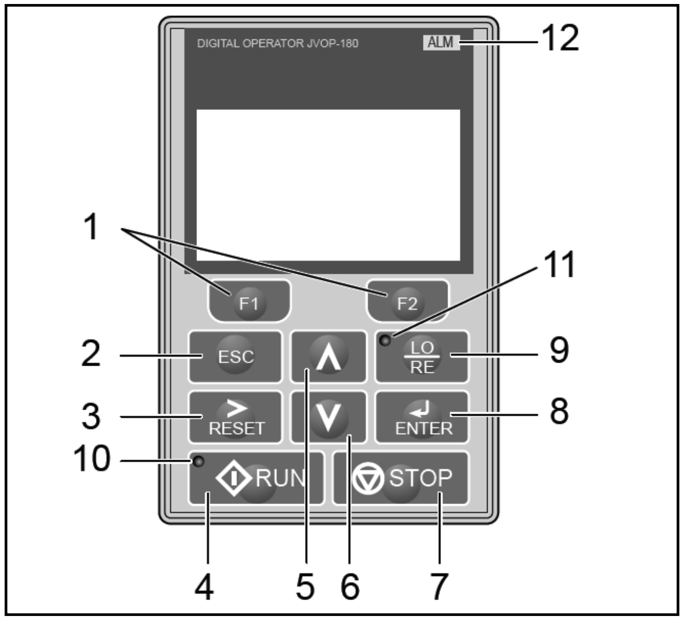


Table 79: Display Key Functions

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	• Returns to the previous display. • Moves the cursor one space to the left • Pressing and holding this button will return to the Frequency Reference display.
3	RESET Key	• Moves the cursor to the right. • Resets the drive to clear a fault situation
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	• Enters parameter values and settings. • Selects a menu item to move between displays
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 Table 81

Figure 61: LCD Display

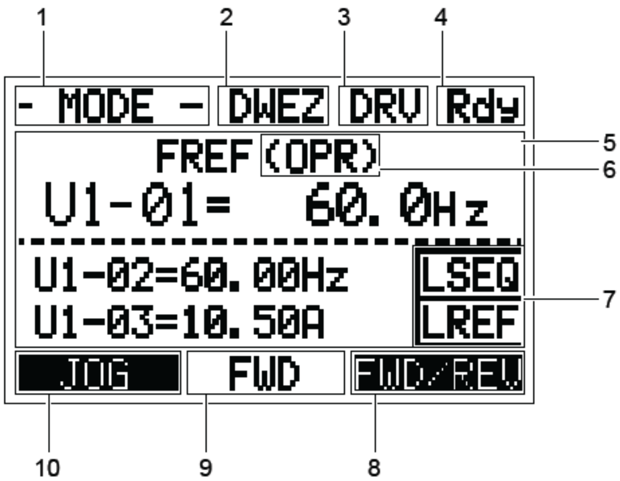


Table 80: Display Data

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 81: 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 82: LO/RE LED and RUN LED Indictors

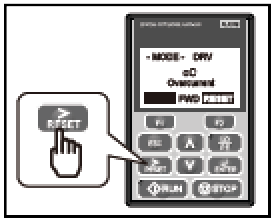
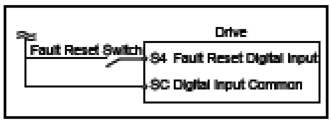
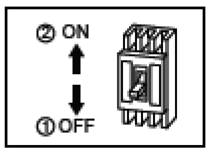
<table>
<tr><th>LED</th><th>Lit</th><th>Flashing Slowly</th><th>Flashing Quickly</th><th>Off</th></tr>
<tr><td>LO/RE</td><td>When the operator is selected for Run command and frequency reference control (LOCAL)</td><td>--</td><td>--</td><td>When a device other than the operator is selected for Run command and frequency reference control (REMOTE)</td></tr>
<tr><td rowspan="6">RUN</td><td rowspan="6">During run</td><td rowspan="6">During deceleration to stop

When a Run command is input and frequency reference is 0 Hz</td><td>While the drive was set to LOCAL, a Run command was entered to the input terminals then the drive was switched to REMOTE.</td><td rowspan="6">During stop</td></tr>
<tr><td>A Run command was entered via the input terminals while the drive was not in the Drive Mode.</td></tr>
<tr><td>During deceleration when a Fast Stop command was entered.</td></tr>
<tr><td>The drive output is shut of by the Safe Disable function.</td></tr>
<tr><td>The STOP key was pressed while drive was running in REMOTE.</td></tr>
<tr><td>The drive was powered up with b1-17 = 0 (default) while the Run command was active.</td></tr>
</table>

Table 83: 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 84: Fault Reset Methods

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

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

Recommended Periodic Inspection

⚠ WARNING

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

Table 85: 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.

Optional BAS Interface

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

The following installation manuals for optional BAS interface modules are shipped with the chiller. They can also be found and downloaded from www.DaikinApplied.com.

- IM 966-1, BACnet® IP Communication Module
- IM 967-1, BACnet® Communication Module (MS/TP)
- IM 968-1, LONWORKS Communication Module
- IM 969-2, Modbus® Communication Module
- ED 15120, Protocol Information for MicroTech® III chiller, BACnet and LONWORKS
- ED 15121, Protocol Information for MicroTech® III chiller, Modbus

Pre Startup

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

Pre-Startup Water Piping Checkout

1. Check the pump operation and vent all air from the system.
2. Circulate evaporator water, checking for proper system pressure and evaporator pressure drop. Compare the pressure drop to the evaporator water pressure drop curve.
3. Flush System and clean all water strainers before placing the chiller into service.
4. Check water treatment and proper glycol percent.
5. Pre-Startup Refrigerant Piping Checkout
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 approved 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 8 hours before starting unit to eliminate refrigerant from the oil.

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

Startup

Refer to the MicroTech® III Controller information on page 38 to become familiar with unit operation before starting the chiller.

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

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

Startup Steps

- Verify chilled water flow.
- Verify remote start / stop or time clock (if installed) has requested the chiller to start.
- Set the chilled water setpoint to the required temperature. (The system water temperature must be greater than the total of the leaving water temperature setpoint plus one-half the control band plus the startup delta-T before the MicroTech® III controller will stage on cooling.)
- Set the Evap Delta T based on a percent of unit nominal flow indicated in page 28 and the Start Delta T as a starting point. Delta-T=Tons x 24 / 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 86: 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. (Some scroll compressors do not have oil sight glasses).
- 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 prestartup and startup instructions.

Hot Gas Bypass (Optional)

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

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

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

The pressure regulating valve is factory set to begin opening at 110 psig with R-410a and can be changed by changing the pressure setting. The adjustment range is 75 to 150 psig. To raise the pressure setting, remove the cap on the bulb and turn the adjustment screw clockwise. To lower the setting, turn the screw counterclockwise. Do not force the adjustment beyond the range it is designed for as this will damage the adjustment assembly. The regulating valve opening point can be determined by slowly reducing the system load while observing the suction pressure. When the bypass valve starts to open, the refrigerant line on the evaporator side of the valve will begin to feel warm to the touch.

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

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

VFD Low Ambient Control (Optional)

The optional VFD fan control is used for unit operation below 32°F (0°C) down to a minimum of -10°F (-23.3°C). The control looks at the saturated discharge temperature and varies (pressure) at the “target” temperature. This temperature is established as an input to a setpoint screen labeled “Sat Condenser Temp Target.”

Compressor Communications

The CoreSense™ compressor communication module on model sizes 070-240 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 onerheating . 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.

Replaceable Core Filter-Driers

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.

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.

Crankcase Heaters

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

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

Evaporator

On AGZ-E models 030 through 180, 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. The water side working pressure of the brazed plate type of evaporator is 653 psig (4502 kPa). Evaporators are designed and constructed according to, and listed by, Underwriters Laboratories (UL).

On AGZ-E models 190 through 240, the evaporator is a direct-expansion, shell-and-U-tube type with water flowing in the baffled shell side, and refrigerant flowing through the tubes. The evaporator has an insertion heater and is insulated with 3/4" (19 mm) thick vinyl nitrate polymer sheet insulation, protecting against water freeze-up at ambient air temperatures to -20° F (29° C). An water thermostat controls the heater cable. The fitted and glued-in-place insulation has a K factor of 0.28 Btu in/hr ft2 ºF at 75°F. The water side working pressure of the shell-and-tube type of evaporator is 152 psig (1048 kPa). Each evaporator is designed, constructed, inspected, and stamped according to the requirements of the ASME Boiler and Pressure Vessel Code. Double thickness insulation is available as an option.

Phase Voltage Monitor (Optional)

Factory settings are as follows:

- Trip Delay Time: 2 seconds.
- Voltage Setting: set at nameplate voltage.
- Restart Delay Time: 60 seconds.

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.

Evaporator

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

Compressor Maintenance

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

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 are listed in the Unit Service section on page 95.

⚠ WARNING

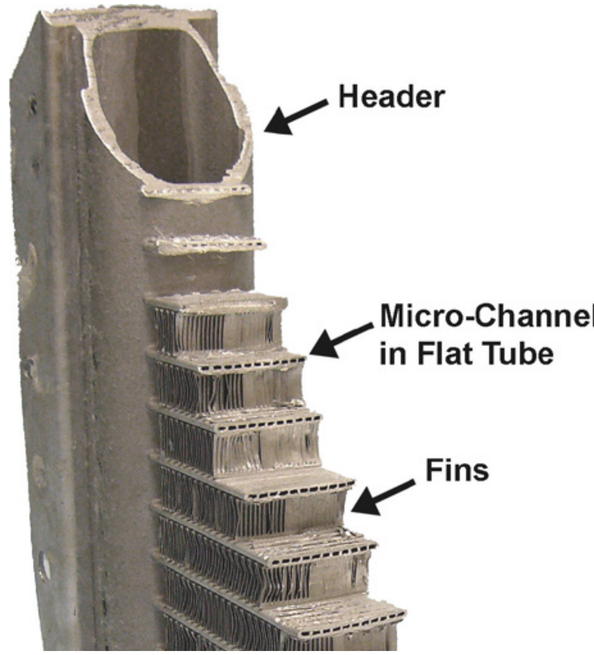
POE oil must be handled carefully using proper protective equipment (gloves, eye protection, etc.) The oil must not come in contact with certain polymers (e.g. PVC), as it may absorb moisture from this material. Also, do not use oil or refrigerant additives in the system.

All-Aluminum Condenser Coils

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

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 occurence of a coil leak, contact Daikin Applied to receive a replacement coil module.

Figure 62: 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.

Cleaning ElectroFin® Coated Coils

The following cleaning procedures are recommended as part of the routine maintenance activities for ElectroFin Coated Coils. Documented routine cleaning of ElectroFin Coated Coils is required to maintain warranty coverage. The cleaning procedure can be downloaded from the ElectroFin web site www.luvata.com/electrofin, click on Procedures for Cleaning.

⚠ WARNING

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

Remove Surface Loaded Fibers

Surface loaded fibers or dirt should be removed prior to water rinse to prevent further restriction of airflow. If unable to back wash the side of the coil opposite that of the coils entering air side, then surface loaded fibers or dirt should be removed with a vacuum cleaner. If a vacuum cleaner is not available, a soft non-metallic bristle brush may be used. In either case, the tool should be applied in the direction of the fins. Coil surfaces can be easily damaged (fin edges bent over) if the tool is applied across the fins.

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

Periodic Clean Water Rinse

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

Routine Quarterly Cleaning of ElectroFin Coated Coil Surfaces

Quarterly cleaning is essential to extend the life of an ElectroFin Coated Coil and is required to maintain warranty coverage. Coil cleaning shall be part of the unit's regularly scheduled maintenance procedures. Failure to clean an ElectroFin Coated Coil will void the warranty and may result in reduced efficiency and durability in the environment.

For routine quarterly cleaning, first clean the coil with an approved coil cleaner (see approved products list in Table 87). After cleaning the coils with the approved cleaning agent, use the approved chloride remover to remove soluble salts and revitalize the unit.

Recommended Coil Cleaner

The following cleaning agent, assuming it is used in accordance with the manufacturer's directions on the container for proper mixing and cleaning, has been approved for use on ElectroFin Coated Coils to remove mold, mildew, dust, soot, greasy residue, lint and other particulate:

Table 87: ElectroFin Coated Coil Recommended Cleaning Agents

Cleaning Agent	Reseller	Part Number
Enviro-Coil Concentrate	Hydro-Balance Corp P.O. Box 730 Prosper, TX 75078 800-527-5166	H-EC01
Enviro-Coil Concentrate	Home Depot	H-EC01
Chloride Remover	Chlor*Rid Int'l, Inc. P.O. Box 908 Chandler, AZ 85244 800-422-3217	Chlor*Rid DTS

CHLOR*RID DTS™ should be used to remove soluble salts from the ElectroFin Coated Coil, but the directions must be followed closely. This product is 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 CHLOR*RID DTS - Apply CHLOR*RID DTS 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 or conventional spray gun. 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 CHLOR*RID DTS is added. Check with CHLOR*RID International, Inc. for recommendations on lesser quality rinse water.

Harsh Chemical and Acid Cleaners

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

High Velocity Water or Compressed Air

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

Electrical Terminals

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

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.

Filter-Driers

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

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

Battery

The controller has a battery located behind the clear plastic bezel. It is a BR2032 with a minimum life of 2 years unpowered. It would be prudent to replace it on a 2-year cycle. There is no indication of an eminent failure.

Liquid Line Solenoid Valve

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

System Adjustment

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

Liquid Line Sight Glass 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 indicates 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. 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 5-10°F (2.8-5.6°C) of the outdoor air temperature when all condenser fans are operating. Subcooling should be checked at full load with 70°F (21.1°C) ambient temperature or higher, stable conditions, and all fans running. Liquid line subcooling at the liquid shut-off valve should be between 15 and 20 degrees 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 degrees F at full load) and flashing is visible in the sight glass, check the pressure drop across the filter-drier. See page 92 for maximum allowable pressure drops.

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

Expansion Valve

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

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

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

Table 88: Planned Maintenance Schedule

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

Notes:

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

R-410A Refrigerant

Terminology

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

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

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

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

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

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

Safety

- ANSI/ASHRAE safety group A1.
- Always carry and be familiar with 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, 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

⚠ WARNING

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

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

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

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

Procedure Notes

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

Control and Alarm Settings

The software that controls the operation of the unit is factory-set for operation with R-410A taking into account that the pressure/temperature relationship differs from R-22. The software functionality is the same for either refrigerant.

Refrigerant Charging

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

Charging or check valves should always be used on charging hoses to limit refrigerant loss and prevent frostbite. Ball valve type recommended.

Charge to 80-85% of normal charge before starting the compressors.

Charging procedure

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

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

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

- Start the system and observe operation.
- Trim the charge to the recommended liquid line sub-cooling (approximately 15-20°F typical).
- Verify the suction superheat (10 degrees F for EEVs and 10 – 12 degrees F for TXVs) at full load conditions.
- Use standard charging procedures (liquid only) to top off the charge.
- Check the sight glass to be sure there is no refrigerant flashing.

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

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

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

Service

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

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

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

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

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

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

EPA recovery and handling requirements for R-410A are the same as R-22.

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

⚠ WARNING

Service on this equipment is to be performed by qualified refrigeration personnel familiar with equipment operation, maintenance, correct servicing procedures, and the safety hazards inherent in this work. Causes for repeated tripping of equipment protection controls must be investigated and corrected.

Disconnect all power before doing any service inside the unit.

Servicing this equipment must comply with the requirements set forth by the EPA in regards to refrigerant reclamation and venting.

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.

PROBLEM	POSSIBLE CAUSES	POSSIBLE CORRECTIVE STEPS
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.

Attention: Warranty Department	**Scroll Compressor Equipment Warranty Registration Form**
Daikin	This form must be completely filled out and returned to the
P.O Box 2510	Staunton Warranty Department within **ten (10) days** of start-up in order to comply
Staunton, VA 24402-2510	with the terms of "Daikin Limited Product Warranty".
Email Address: STN.Wty_Startup_Registration@daikinapplied.com	

Check, Test and Commissioning for
Scroll Product (AGZ, ACZ, WGZ, TGZ)

Job Name: ______________________ **Startup Date:** ______________________

Daikin G.O. No.: ______________________ **Daikin S.O. No.:** ______________________

Installation Address: ______________________ **City/State/Zip:** ______________________

Purchasing Contractor: ______________________ **Phone:** ______________________

City/State/Zip: ______________________ **No. of units at site:** ______________________

Unit Model No.: ______________________ **Serial No.:** ______________________

Compressor # 1 Serial #: ______________________ **Compressor # 4 Serial No.:** ______________________

Compressor # 2 Serial. #: ______________________ **Compressor # 5 Serial No.:** ______________________

Compressor # 3 Serial #: ______________________ **Compressor # 6 Serial No.:** ______________________

Benshaw/DRC Control Box M/M #: ______________________ **Benshaw/DRC Control Box S/N #:** ______________________

I. PRE START-UP PROCEDURE

II. Pre Start-Up Checklist

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

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

L. Does all field wiring conform to unit electrical specifications?	☐	☐
M. Are all service and liquid line valves in correct position?	☐	☐
N. Water Strainer installed? Shell & Tube Evaporators 0.125”(3.175mm) or smaller perforations Brazed Plate Evaporator 0.063” (1.6mm) or smaller perforations	☐	☐
O. Has a flow switch been installed per the IM manual?	☐	☐
P. Has the chill water circuit been cleaned, flushed, and water treatment confirmed?	☐	☐
Q. Does the chiller and condenser water piping conform to the IM manual?	☐	☐
R. Are fans properly aligned and turn freely?	☐	☐
S. Is wind impingement against the air cooled condenser a consideration?	☐	☐

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

Description:____

____

____

III. REFRIGERATION SYSTEM

	N/A	YES	NO
A. Has all field piping been leak tested at 150 psig (690 kPA)?	☐	☐	☐
B. Has system been properly evacuated and charged?	☐	☐	☐
C. Refrigerant R-_____ Circuit 1 _____ lbs (kg) Circuit 2 _____ lbs. (kg)		☐	☐
D. Does piping to unit appear to be adequately sized and installed according to the IM bulletin?	☐	☐	☐
E. Is a liquid line filter-drier installed in each circuit?	☐	☐	☐
F. Is level of oil in sightglass visible butnot more than 1/2 glass with compressors running?		☐	☐
G. Is a liquid line solenoid installed correctly in each circuit?	☐	☐	☐
H. Is expansion valve bulb or suction sensor properly installed and insulated?		☐	☐

IV. DESIGN CONTROLS

A. CHILLER
Water Pressure Drop: ________ psig(kPa)________ Ft. (kPa) ________ gpm (lps)
Water Temperatures: Entering________ °F (°C) Leaving________ °F (°C)

B. CONDENSER
Water Pressure Drop: ________ psig(kPa)________ Ft. (kPa) ________ gpm (lps)
Water Temperatures: Entering________ °F (°C) Leaving________ °F (°C)

V. START-UP

	YES	NO
A. Does unit start and perform per sequence of operation as stated in the IM Manual?	☐	☐
B. Do condenser fans rotate in the proper directions?	☐	☐

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)
	Entering Condenser	_____ °F (°C)	_____ °F (°C)
	Leaving Condenser	_____ °F (°C)	_____ °F (°C)
D. Circuit #1 Refrigerant Pressures:			
	Evaporator	_____ psig (kPa)	_____ psig (kPa)
	Liquid Line pressure		_____ psig (kPa)
	Condenser Pressure	_____ psig (kPa)	_____ psig (kPa)
E. Circuit #2 Refrigerant Pressures:			
	Evaporator	_____ psig (kPa)	_____ psig (kPa)
	Liquid Line Pressure		_____ 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)	
	Liquid Line Temperature		_____ °F (°C)
	Subcooling		_____ °F (°C)
	Discharge Temperature		_____ °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)	
	Liquid Line Temperature		_____ °F (°C)
	Subcooling		_____ °F (°C)
	Discharge Temperature		_____ °F (°C)
H. Outdoor Air Temperature:		_____ °F (°C)	_____ °F (°C)

NON-MICROTECH READINGS

I. Does the system contain glycol? ☐ Yes ☐ No
Percentage by weight _____ or by volume ________ Glycol Type ______________

J. If the chilled water system include glycol, have the freezstats been adjusted lower to meet acutal job requirements?
Note: See operation manual for low temperature on ice bank applications. ☐ Yes ☐ No

K. Chiller: ________ psig (kPa) ________ Ft. (kPa) ________ gpm (lps)
Condenser: ________ psig (kPa) ________ Ft. (kPa) ________ gpm (lps)

L. Unit Voltage Across Each Phase: L1-L2 ________ V **L2-L3** ________ V L1-L3 ________ V
M. Unit Current Per Phase: L1 amps ________ L2 amps ________ L3 amps ________
N. Compressor Current Per Phase:

Comrpessor #1:	________ L1 Amps	________ L2 Amps	________ L3 Amps
Compressor #2:	________ L1 Amps	________ L2 Amps	________ L3 Amps
Compressor #3:	________ L1 Amps	________ L2 Amps	________ L3 Amps
Compressor #4:	________ L1 Amps	________ L2 Amps	________ L3 Amps
Compressor #5:	________ L1 Amps	________ L2 Amps	________ L3 Amps
Compressor #6:	________ L1 Amps	________ L2 Amps	________ L3 Amps

VI. MICROTECH SETPOINTS — MICROTECH Setting

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

ALARM SETPOINTS MUST BE VERIFIED WITH INSTRUMENTS OF KNOWN ACCURACY

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

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

A. Place Unit in heat recovery mode.
B. Condenser Pressure Drop: ________ psig (kPa) ________ Ft. (kPa) ________ gpm (lps)
C. Condenser Temperatures: ______ Inlet ______ Outlet
D. Head Pressure: Circuit #1 ________ psig (kPa) Circuit #2: ________ psig (kPa)
E: Evaporator Pressure Drop: ________ psig (kPa) ________ Ft. (kPa) ________ gpm (lps)
F: Evaporator Temperatures: ______ Inlet ______ Outlet
G. Suction Pressure: Circuit #1 ________ psig (kPa) Circuit #2: ________ psig (kPa)
F. Compressor Current Per Phase

Compressor #1	________ L1 AMPS	________ L2 AMPS	________ L3 AMPS
Compressor #2	________ L1 AMPS	________ L2 AMPS	________ L3 AMPS
Compressor #3	________ L1 AMPS	________ L2 AMPS	________ L3 AMPS
Compressor #4	________ L1 AMPS	________ L2 AMPS	________ L3 AMPS
Compressor #5	________ L1 AMPS	________ L2 AMPS	________ L3 AMPS
Compressor #6	________ L1 AMPS	________ L2 AMPS	________ L3 AMPS

VIII. GENERAL

	YES	NO
A. Are all control lines secure to prevent excess vibration and wear? ……	☐	☐
B. Are all gauges shut off, valve caps, and packings tight after startup? ……	☐	☐

Refrigerant Leaks: ____

____

Repairs Made ______________________________

____

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

____

____

Performed By: ______________________________ Title: ______________________________

Company Name: ______________________________

Address: ______________________________

City/State/Zip Code: ______________________________ Telephone: ______________________________

Modem Number: ______________________________

Signature: ______________________________ Date: ______________________________

Contractor's Signature ______________________________

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

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